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# User's Guide

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# FPD2000 Series
## Positive Displacement Flow Meters

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# FPD2000 Series - Positive Displacement Flowmeters

# FPD2000 Series Positive Displacement Flow Meters

## General Description:

Omega's positive displacement gear flow meters are similar in design to a gear pump. The principle of operation is reversed; instead of the gears driving the medium, the medium drives the gears. A non-intrusive hall-effect sensor detects the movement of the gear and as each gear tooth passes the sensor a square wave pulse is produced and a discrete volume of liquid is measured. The resulting pulse train is proportional to the actual flow rate and provides a highly accurate representation of the fluid flow. All meters are designed with highly wear resistant moving parts to provide exceptionally long service life.

### Filtration:
Depends upon model

**Fluid Compatibility:**
The materials of construction are stainless steel or high strength aluminum housing, stainless steel gears and stainless steel bearings. The fluids should be compatible with these materials.

## Installation Instructions:

**The preferred flow direction** is etched or marked by an arrow on the meter as this is the flow direction in which the meter was calibrated however; the flow meters have bi-directional flow capabilities. Damage will not occur from reverse flow.

**The preferred orientation is to mount the meter vertically** although horizontal mounting is acceptable if conditions deter vertical orientation. There is no need for straight run piping upstream or downstream of the flow meter.

**Install the meter upstream from control valves and fluid regulators if possible** - see Fig.1. Back pressure is necessary for stable running.

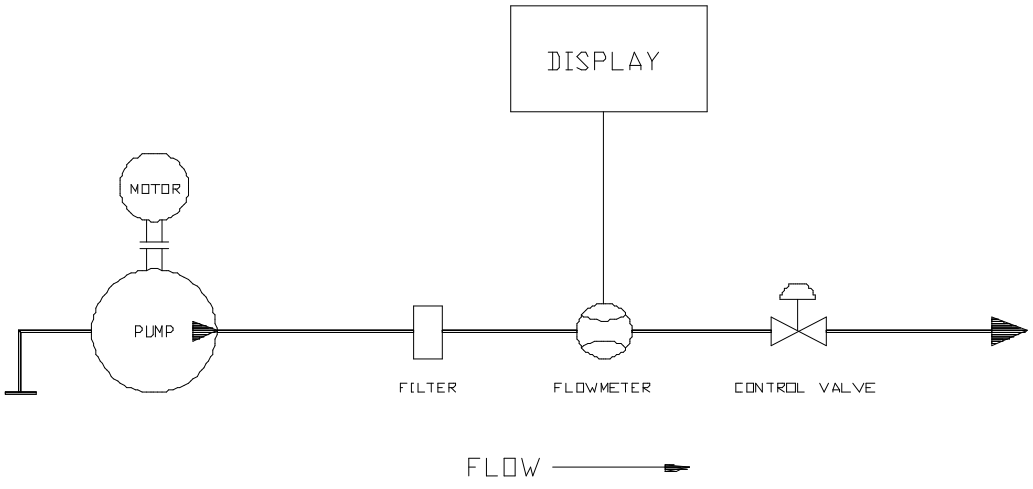
**Eliminate all dirt, debris and metal shavings from the piping** as the liquid must be free from any particles larger than allowed by the manufacturer's specifications. Any recommended filtration should be installed before operation as potential plugging most often occurs at startup.

**If possible install a bypass** around the meter and flush existing piping with the appropriate solvent before first use - see Fig.1.

**Review the pickup instructional guide prior to installation**. Locate the pickup & wiring away from A/C motors, actuators, heaters, relays etc. Use only shielded cable and do not take power from the same circuits as other devices. Ensure clean power supplies which utilize a true earth ground. Intrinsic Safety Barriers must be installed if the circuit is intended to be intrinsically safe.

**The pickup sensor should only be installed hand tight**… do not use wrenches or channel locks. Over tightening may cause a dimple to protrude into the meter chamber beneath the pickup and interfere with the free gear rotation.

*Figure 1*



## Operation & Maintenance Instructions:

**Maintenance Guides** are provided with the meter - these should always be reviewed by personnel prior to attempting any maintenance work. The overwhelming majority of down time & repairs are the result of breakages due to improper maintenance actions, lack of training or rough handling.

**Never run the meter dry or spin with air only** - Gear flow meters are precision engineered flow devices - they should always be maintained in a clean, lubricated condition with the internals wet at all times. Air and water should not be allowed in contact with the internal parts except in short (1-2 second) cycles as part of an automated flush.

**Don't use water for flow testing** - the viscosity of water is too low to produce accurate results unless the flow rate is elevated and the internals would then have to be dried and lubricated to avoid corrosion or scaling. Using a fluid with a viscosity of approximately 30 cSt such as mineral oil or thinned glycerin is recommended if calibration of the system is necessary - the preferred calibration fluid would be the actual fluid to be metered.

**Don't ramp-up flow to a full flow condition instantaneously** - Gear flow meters are rugged yet precise instruments which will respond almost instantaneously to changes in fluid flow. Normal pulsating flows will not damage the meter and will merely cause the output to be unsteady however, if flow is repeatedly cycled from zero to full flow instantaneously, fluid shock forces may be significant and may produce premature damage or wear over time. To avoid damage to the system ramp-up to max flow over a few seconds rather than instantaneously & do not inject high flow speeds into an empty meter.

**Filtration** is recommended to prevent contaminants from entering the meter. **Should the meter become plugged,** a reduced flow may still be observed from the outlet as fluid pressure will squeeze fluid through the meter - visual flow does not necessarily mean that the meter's gears are turning. If plugging is caused by contaminants then filtering should be installed….if plugging is repeatedly caused by particle build up then review the cleaning and maintenance procedures in the following section. Because of the vast differences in fluid types and in-plant procedures there may be some trial and error involved in determining the ideal flushing or cleaning regimen.

**A calibration factor** (K Factor) is established at the factory on a preferred calibrating fluid - this number is usually accurate for a wide variety of fluids and should not usually be changed - it is provided with the meter either on a Calibration Data Sheet or on a tag attached to the meter. Should it be lost, a copy can be obtained from the factory. A calibration verification procedure is detailed later in this document.

**Storage** - when the flow meter is idle or stored for any extended period of time the internals should be thoroughly cleaned with the appropriate solvent, lubricated with a light oil and the ports capped or plugged to prevent drying.

## Flow Meter Guidelines:

**DO:** **Leave flushing solvent in the lines overnight or during extended off-times.**
This keeps internals wet, preventing residual paint from drying, helping start ups.

**DO:** **Follow the Maintenance Guide instructions when opening and cleaning a meter.**
During cleaning separate the gears from the shafts. On carbide bearings, clean inside the center of the gear bearing and on the outer surface of the shafts at the point where the gear rotates on the shaft. Apply a suitable lubricating fluid before closing the meter. After tightening the bolts, a short squirt of shop air will briefly spin the gears which should be easily audible.

**DO:** **Install and maintain filters.**
The recommended filter should be installed to eliminate potential plugging. Should plugging occur, the meter will still pass fluid but with no signal output.

**DO:** **Check electrical compatibility between the meter's output signal and the input of the PLC.**
If signals are not being detected at start up, first check wiring and electrical compatibility.

**DO:** **Verify reliable grounding of electrical parts, as per installation guidelines, and a dedicated power supply is recommended.**
Voltage spikes on shared power lines, negligent grounding and sloppy wiring will likely produce erratic readings and chronic maintenance
The control valve will provide back pressure which is beneficial to stable flow control.

**DO:** **Install the meter immediately upstream of the regulator or control valve.**
The control valve provides back pressure which stabilizes the flow.

**DON'T:** **Allow air into the flow meter.**
Always keep the meter internally wet.

**DON'T:** **Dry paint lines using pressurized air.**
Flow meters are designed to flow liquids. Meters should be closed to air except when air is part of an automated purge cycle. Do not dry lines after purging.

**DON'T:** **Allow materials to dry inside the meter.**
When a meter is removed from the line during maintenance the internals should be cleaned immediately, lubricated and the fluid ports capped.

**DON'T:** **Over tighten the pickup sensor beyond hand tight.**
When installing the pickup sensor turn it in lightly to a hand tight torque. Do not use a wrench on the pickup as over tightening may cause a dimple of metal under the sensor nose to protrude into the gear cavity & interfere with the gear's rotation.

**DON'T:** **Use water or solvent for calibration or test purposes.**
Water or solvent may not turn the gears at low flow and may leave the impression that the meter is not functioning. A calibration factor (k-factor) is issued with the flow meter which is valid for most fluids except water or equivalent viscosities.

## Calibrations

Each flow meter is calibrated and given a 'K Factor' using a standard calibrating fluid at the factory. This number is accurate for all fluids, with most viscosities, except the most water-like. There should be no need to change this except for the very lowest viscosities close to 1.0 cP.

**If flow readings are too high:**
If the display shows significantly more than the volume actually dispensed or shows flow when there is definitely no flow - this most likely indicates an electrical noise problem. In such cases turn off nearby motors or heaters or relays, check cable shielding and establish a clean ground independent of other electrical devices before repeating accuracy tests. If the problem continues it may be necessary to relocate the offending device

**If flow readings are too low:**
If the display shows significantly less than the volume actually dispensed then most likely the meter has a high slippage factor and the fluid is by-passing the gears and the k-factor may require adjustment.

**If it is necessary to adjust the existing k-factor:**
Trigger at least 500ml of your sample fluid, in a steady stream, at approximately the desired flow rate, into a graduated beaker. Compare the volume in the beaker to the volume on the display. Do not time the operation merely measure the volume dispensed. Repeat the sample 3 times and take an average. If the result is outside an acceptable margin, adjust the K Factor by the % difference between the average beaker sample and the average displayed total. If the error is not corrected clean the meter thoroughly and repeat the procedure. **Do not use water for this test**.

**If it is necessary to re-calculate a new k-factor:**
You will first need a data collecting instrument to count pulses produced by the meter. An Omega display may be used in totalizer mode provided the KFT is set to count each pulse (KFT = 10000). Trigger at least 500ml of your sample fluid, in a steady stream, at approximately the desired flow rate, into a graduated beaker. Divide the number of pulses by the volume dispensed and the result is your new k-factor in the units of your sample…in the example above the k-factor units would be impulses/ml.

## Trouble Shooting Guide:

| TROUBLE | POSSIBLE CAUSE | SOLUTION |
|---|---|---|
| Meter indicates lower than actual | Viscosity of fluid is <30cst. | Decrease the K-factor by percent error. |
| | Excessive pressure differential across meter causing gears to bind. | Reduce flow rate, reduce fluid viscosity. |
| | Debris in measuring chamber. | Clean meter, change or add filter. |
| | Upper housing has dimple from over tightening sensor. | Replace upper housing. |
| Meter indicates higher than actual. | Air in lines. | Add air eliminator. |
| | Electro-magnetic interference. | Ground flow meter and all electronics. |
| | Reverse fluid flow. | Add check valve. |
| Indicator shows flow when there is no flow. | Fluid oscillates. | Check pump, add check valve, increase back pressure. |
| | Electro-magnetic interference. | Ground flow meter and all electronics. Use shielded cable and relocate away from electrical noise. |
| No flow indication. | No fluid flow. | Check pump. |
| | Debris in measuring chamber or gears. | Clean meter, change or add filter. |
| | Sensor not installed properly. | Check sensor is installed to hand tight. Review sensor guide. |
| | Faulty wiring. | Check sensor connection and readout connection. |
| | Faulty sensor. | Replace sensor. |
| | Upper housing has dimple from over-tightening sensor. | Replace upper housing. |
| Erratic system indication. | Ground loop in shielding. | Ground shield one place only. Re-route cables from electrical noise. |
| | Pulsating fluid flow. | Add pulse dampener. |

# FPD20x1 to FPD20x4 Dual Hall Effect Pickup

Installation and Technical Data Guide

## Description:

The Dual Hall Effect Pickups are microprocessor-based sensors for use with the FPD2000 series of positive displacement flow meters. The DH sensors can detect both uni- and bi-directional flow. The sensors' mode of operation is determined by an output selection switch located inside the housing. The DH detects the rotation of the flow meter's gears and emits a frequency signal proportional to flow. The output signal is a square wave pulse which has a duty cycle of approximately 50%.

DH signal outputs are protected with a self-resetting fuse. This fuse has a 50mA nominal trip point. When a trip occurs, turn off power to the sensor and remove output load to reset fuse. The sensor has two different output configurations: sinking output and sourcing output.

The DH sensor circuit board is equipped with a red and green LED. The red LED is a status LED which, when the sensor is operating properly, will flash once every 6 seconds, a fast flash will indicate a failure of one or both of the pick-ups. The green LED indicates the pulse of the input signal. Note that signals above 20Hz will look as solid green.

## Installation:

- Ensure that the flowmeter sensor cavity is free of debris prior to installing pickup
- Make sure the sensor mounting screws line up with the sensor mounting holes. If they do not, remove and rotate the sensor 180°
- Sensor is equipped with an output test feature for readouts before initial running of your system

**TEST FEATURE:** ***Note: Power must be cycled for new setting to take effect***

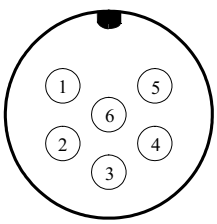
- Switch setting 8 will cause the pick-up to output a 10 Hz (+/- 20%) Phase = +90 deg pulse output, simulating low flow conditions without flow through your meter.
- Switch setting 9 will cause the pick-up to output a 250 Hz (+/- 20%) Phase = -90 deg pulse output, simulating medium flow conditions without flow through your meter.

**NOTE: WIRING SHOULD BE INSTALLED BY A QUALIFIED INSTRUMENTATION TECHNICIAN**

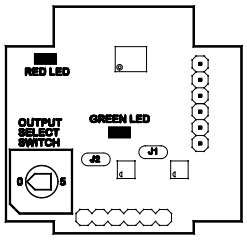
## Electrical Connection for Pin Connector

| Pin Number | Function |
|---|---|
| 1 | NC |
| 2 | Output 2 |
| 3 | NC |
| 4 | Output 1 |
| 5 | Ground |
| **6** | **Supply** |

Pinout looking at male connector on sensor




Top view of circuit board with view of LED's and switch




## Wiring Color Code:

| | Pin Number | Wire Color |
|---|---|---|
| Signal 2: | 2 | Green |
| Signal 1: | 4 | White |
| Ground: | 5 | Black |
| **Supply Voltage:** | **6** | **Red** |

## Operating Modes

| Switch | Output 1 | Output 2 |
|---|---|---|
| 0 | Direction | Signal 2 |
| 1 | Signal 1 | Signal 2 |
| 2 | Direction | Signal 1 + 2 (2x frequency) |
| 3 | Signal 1 | Signal 1 + 2 (2x frequency) |
| 4 | Signal 1 (both outputs in phase) | |
| 5 | Signal 2 (both outputs in phase) | |
| 6 | Signal 1 + 2 (both 2x frequency & both outputs in phase) | |
| 7 | Reserved | |
| 8 | Test: S1 & S2 == 10 Hz (+/- 20%) Phase = +90 deg. | |
| 9 | Test: S1 & S2 == 250 Hz (+/- 20%) Phase = -90 deg. | |

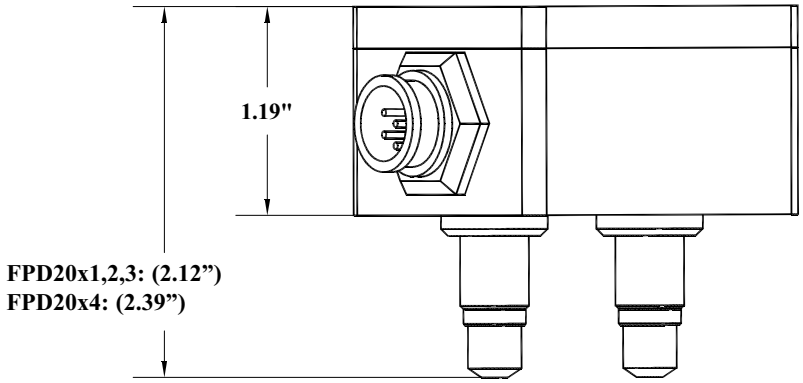
**Note: Power must be cycled for new setting to take effect**

# FPD20x1 to 20x4 Dual Hall Effect Pickup

Installation and Technical Data Guide

## Technical Data:

| | |
|---|---|
| Supply Voltage: | +10 to 27 Volt DC |
| Supply Current: | 18 mA @ 12 VDC, 25 mA @ 24 VDC |
| Duty Signal: | 50% ± 15% |
| Minimum Signal: | 0.5 Hz |
| Frequency Output: | Flow dependent, up to 2,000 Hz |
| Driving Capacity: | 50 mA Max resistive load |
| Output Impedance: | ~ 40 Ohm - analog switch and self-resetting fuse |
| Temperature Range: | -40° F to 185° F (-40° C to 85° C) |




**Part number configuration:**

DH Sensors can be used with all Aluminum, 303 Stainless Steel and 316 Stainless Steel body flow meters

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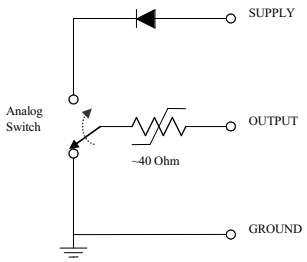
### Sourcing Output Circuit




- Signal output square wave :
  $V_{high}$ = Supply -1V @ no output load
  $V_{low}$ = 0.1V
- Max sourced output voltage: Supply -0.5V
- Max current sourcing capabilities: 50mA

# FPD2005 and 2015 Hall Effect Pickup

Installation and Technical Data Guide

## Description:

The 4-Hall Effect Pickups are microprocessor-based sensors for use with the FPD2000 series of positive displacement flow meters. The sensor can detect both uni- and bi-directional flow, and sensors' mode of operation is determined by an output selection switch located inside the housing. The sensor detects the rotation of the flow meter gears and emits a frequency signal proportional to flow. The output signal is a square wave pulse which has a duty cycle of approximately 50%.

Signal outputs are protected with a self-resetting fuse. This fuse has a 50mA nominal trip point. When a trip occurs, turn off power to the sensor and remove output load to reset fuse. The sensor has two different output configurations: sinking output when jumpers JP1 & JP2 are removed and sourcing when jumpers JP1 & JP2 are shorting pins.

Sensor circuit board is equipped with a red and green LED. The red LED is a status LED which, when the sensor is operating properly, will flash once every 4 seconds, a fast flash will indicate a failure of one or more of the pick-ups. The green LED indicates the pulse of the input signal. Note that signals above 20Hz will look as solid green.

## Installation:

- Ensure that the flowmeter sensor cavity is free of debris prior to installing pickup
- Install flow meter and sensor - **CYCLE POWER - or sensor will not function properly!!**
- Sensor is equipped with an output test feature for readouts before initial running of your system

**TEST FEATURE:** ***Note: Power must be cycled for new setting to take effect***

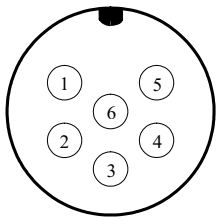
- Switch setting 8 will cause the pick-up to output a 10 Hz (+/- 20%) Phase = +90 deg pulse output, simulating low flow conditions without flow through the meter.
- For sourcing outputs remove shorting block from JP1 & JP2
  For sinking outputs place shorting block across JP1 & JP2 (factory default)
- Switch setting 9 will cause the pick-up to output a 250 Hz (+/- 20%) Phase = -90 deg pulse output, simulating medium flow conditions without flow through the meter.

**NOTE: WIRING SHOULD BE INSTALLED BY A QUALIFIED INSTRUMENTATION TECHNICIAN**

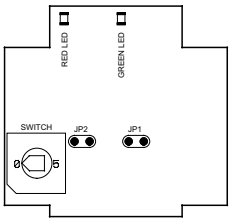
## Electrical Connection for Pin Connector

| Pin Number | Function |
|---|---|
| 1 | NC |
| 2 | Output 2 |
| 3 | NC |
| 4 | Output 1 |
| 5 | Ground |
| **6** | **Supply** |

Pinout looking at male connector on sensor




Top view of circuit board with view of LED's and switch




## Wiring Color Code:

| | Pin Number | Wire Color |
|---|---|---|
| Signal 2: | 2 | Green |
| Signal 1: | 4 | White |
| Ground: | 5 | Black |
| **Supply Voltage:** | **6** | **Red** |

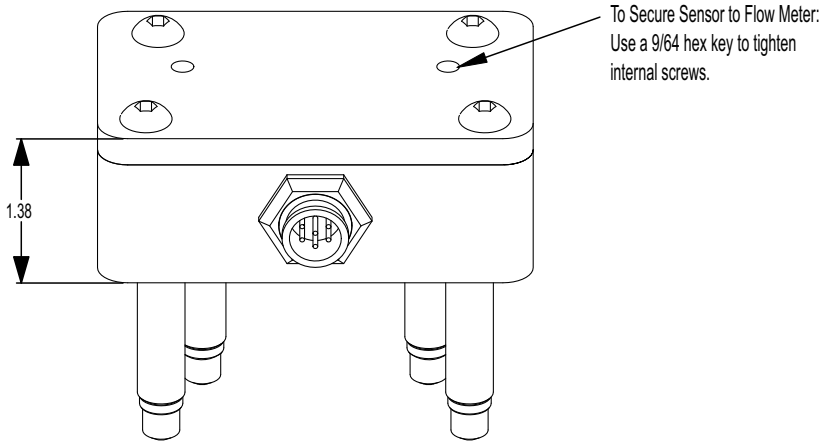
## Operating Modes

| Switch | Output 1 | Output 2 |
|---|---|---|
| 0 | Flow Direction | Signal 2 |
| 1 | 1x frequency +90 deg phase | |
| 2 | Flow Direction | 2x frequency |
| 3 | 2x frequency +90 deg phase | |
| 4 | Flow Direction | 4x frequency |
| 5 | Both outputs 4x frequency in phase | |
| 6 | Reserved | |
| 7 | Forward pulses | Reverse pulses |
| 8 | Test: S1 & S2 == 10 Hz (+/- 20%) Phase = +90 deg. | |
| 9 | Test: S1 & S2 == 250 Hz (+/- 20%) Phase = -90 deg. | |

**Note: Power must be cycled for new setting to take effect**

# FPD2005 and 2015 Dual Hall Effect Pickup

Installation and Technical Data Guide




## Technical Data:

| | |
|---|---|
| Supply Voltage: | +10 to 27 Volt DC |
| Supply Current: | 75 mA @ 24 VDC |
| Duty Signal: | 50% ± 15% |
| Minimum Signal: | 0.5 Hz |
| Maximum Signal: | 1,000 Hz |
| Frequency Output: | Flow dependent, up to 2,000 Hz |
| Driving Capacity: | 50 mA Max resistive load |
| Output Impedance: | ~ 40 Ohm - analog switch and self-resetting fuse |
| Temperature Range: | -40° F to 185° F (-40° C to 85° C) |

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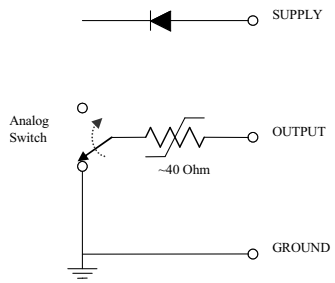
### Sinking Output Circuit




- Output selection jumper off: remove shorting block from JP1 & JP2
- User may need to add external components to interface to displays or other instructions
- User must limit output voltage to Supply -1V
- Max current sinking capability: 50mA

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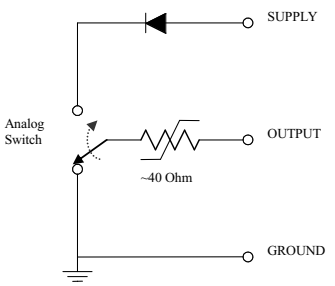
### Sourcing Output Circuit - Default from Factory

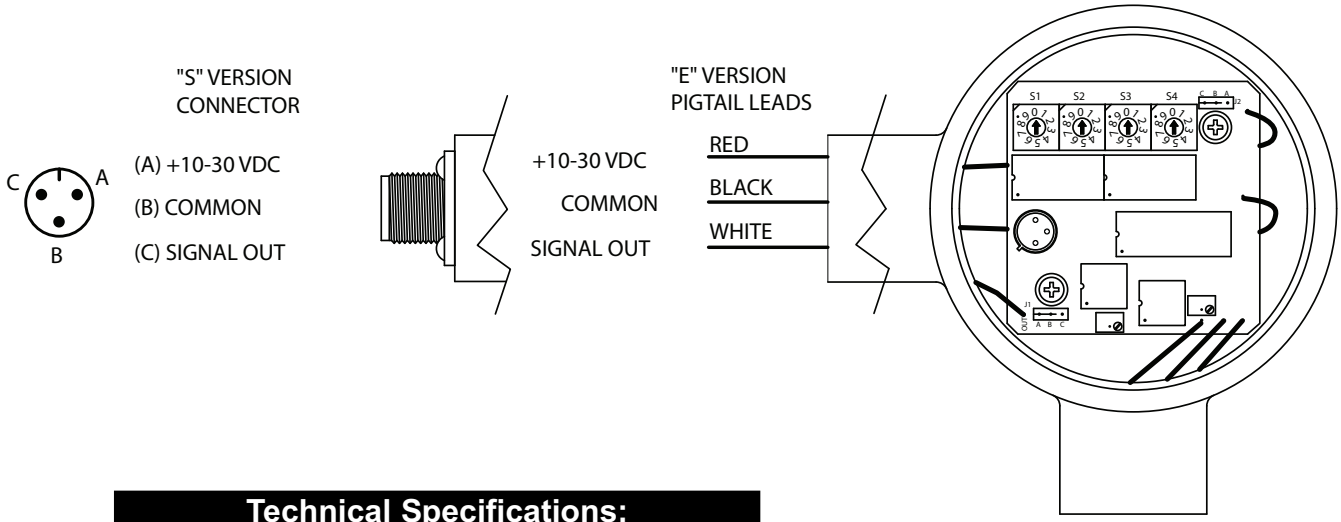



- Output selection jumper on: place shorting block across JP1 & JP2
- Signal output square wave :
  $V_{high}$ = Supply -1V @ no output load
  $V_{low}$ = 0.1V
- Max sourced output voltage: Supply -0.5V
- Max current sourcing capabilities: 50mA

# FPD20xx-A Analog Output Sensor

The FPD20xx-A is a microprocessor based, meter mounted, analog output sensor. Each unit has a sensor, amplifier and converter module built into an Ex housing. The FIP is designed to handle frequencies up to 5,000 Hz. The operational frequency range is user defined via four BCD rotary switches, where the high flow rate in frequency is set to 20 mA and the output signal is automatically scaled. End connection is a 3-pin male connector.

NOTE: This is a 3 wire hookup and is not suitable for a 2 wire installation.

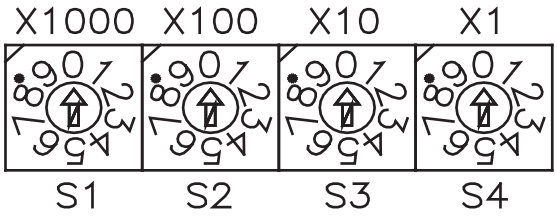



| Technical Specifications: | |
|---|---|
| Supply Voltage: | 10-30 VDC |
| Supply Current: | 60 mA max |
| Signal Output: | 4-20mA or |
| Maximum Load Impedance (Vcc/0.02): | 275 ohm (for mA out) |
| Temperature Range: | 0-185° F |

| Jumper Settings: | |
|---|---|
| J1 | AB: Analog Output<br>BC: Frequency Output |
| J2 | AB: Housing Ground |
| CB: | Signal ground |
| Response Time: | 1/F + 25 msec |
| Frequency Input: | 5 KHz max |
| Diagnostics: | A glowing LED indicates the unit is working. The LED will blink to show an active frequency. |

## Scaling Analog Output:

On the front panel there are four rotary switches which are adjustable with a small screwdriver. It is not necessary to power the unit down to change the settings. The switches are read from left to right in order of decreasing value as shown in the figure to the right.




**If the maximum frequency is known at which the resulting output should be 20mA, set the switches to this frequency. The output will automatically scale itself.** If the maximum frequency is not known, the correct switch settings can be determined in 2 ways.

The following equation can be used to determine what the switch setting should be for any particular meter and flow rate.

$$\text{Switch Setting} = \frac{\text{K Factor} * \text{Max Flow Rate}}{60}$$

**Where: K Factor** is the flow meter scaling factor in pulses / volume (found on calibration sheet)
**Max. Flow Rate** is the flow rate at which the analog output should be at it's max.
**Note:** K-Factor and Max flow rate MUST have same units, ie: gallon/GPM, liter/LPM
**60** is the scaling factor when max. flow rate is in volume/minute. Use 3600 for volume/hour

Ex: K Factor = 89,100 pulses/gallon (for a FPD2001-A), Max flow rate = 0.2 GPM

$$\text{Switch Setting} = \frac{89{,}100 * 0.2}{60} = 297$$

**If the numerical flow rate is not known, the unit can be calibrated in systems with the following:**

1) Adjust system flow to the rate at which analog output should read 20 mA.
2) Set scaling switches to a value known to be above the maximum frequency (ex. 9, 49, 799, 2999) if unsure, use 4999
3) If S1 is 0, go to step 4. Decrease S1 until output shows 20 mA. Then increase its setting by one unless value is 4, in which case value should remain 4. If the switch value is 0 and the output is below 20 mA, leave switch at 0 and go to next switch.
4) If S2 is 0, go to step 5. Decrease S2 until output shows 20 mA. Then increase its setting by one unless value is 9, in which case value should remain 9. If the switch value is 0 and the output is below 20 mA, leave switch at 0 and go to next switch.
5) If S3 is 0, go to step 6. Decrease S3 until output shows 20 mA. Then increase its setting by one unless value is 9, in which case value should remain 9. If the switch value is 0 and the output is below 20 mA, leave switch at 0 and go to next switch.
6) Decrease S4 until output shows 20 mA and leave setting. DO NOT increase this setting by one. The switches are now set at the frequency which will result in a 20 mA output.

When setting switches in step 1, try to use numbers ending in 9 for example: 9, 39, 299 and 2999. Any switch setting above 5000 Hz is read as 4999 Hz.

**Example:** Actual maximum input frequency is 538 Hz. Switches are set to 0999 Hz, a value known to be above actual maximum input frequency. The output shows 12.64 mA.

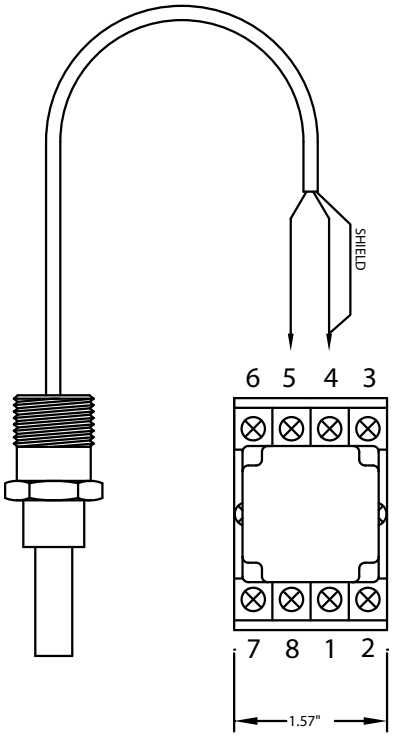
Starting with the switch of highest order, in this case S2 since S1 is 0, its value is decreased until the output shows 20 mA **(S2 shows 4)**. The switch is then increased by 1 **(S2 is set to 5)**. S3 is then decreased until the output shows 20 mA **(S3 shows 2)**. The switch is then increased by 1 **(S3 is set to 3)**. Finally, S4 is decreased until the output shows 20 mA and left as such **(S4 set at 8)** the switches are now set to 538 Hz, the frequency which will cause maximum output current / voltage.

# FPD20xx-HT High Temperature Pickup System

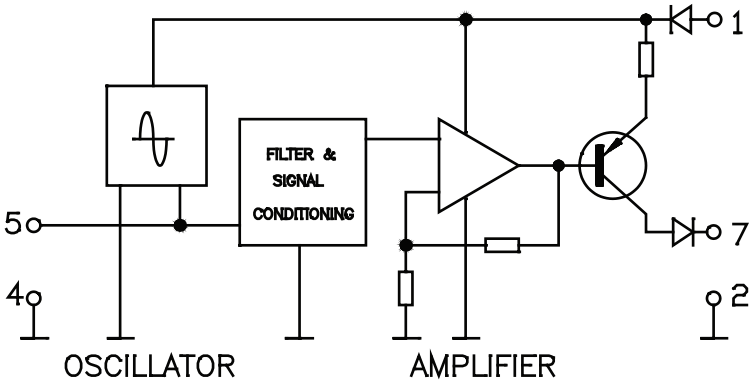
**Description:**
The High Temperature Pickup System consists of a signal amplifier module and A high temperature carrier frequency pickup. The amplifier will work on a supply voltage between 10 Volt DC and 30 Volt DC. The module is protected against reversed polarity on the voltage supply. The length of wire between the pickup and the amplifier module should not be extended over 20 feet. The pickup is supplied with a 7-foot cable only.

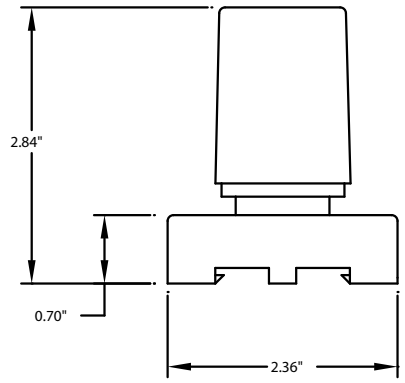
**Technical Data:**

| | |
|---|---|
| Supply Voltage .....: | 10 to 30 Volt DC |
| Supply Current .....: | 9 mA @ 15 Volt, max 18mA |
| Signal Output .....: | Square wave, Supply minus 2-3 V, peak-to-peak |
| Frequency Output : | Flow dependent, up to 2000 Hz |
| Temperature range: | Amplifier.....: Up to 160°F/70°C |
| | Pickup.....: Up to 400°F/205°C |




**Connections:**
1 - +10 to 30 Volt DC supply voltage
2 - Ground for supply and signals
3 - Not used
4 - Signal from pickup & shield wire
5 - Signal from pickup
6 - Not used
7 - Frequency signal output
8 - Not used

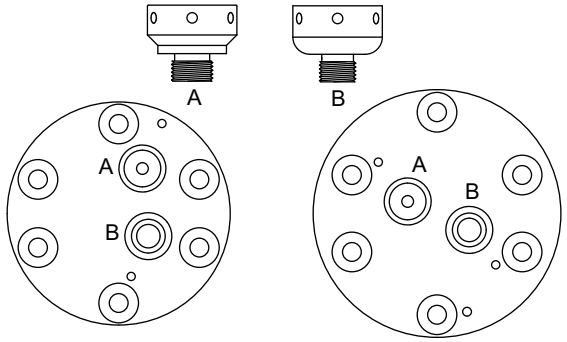



**OUTPUT:**
13V. peak-peak
(4.2VRMS) @ 15V SUPPLY

**Note: If signal does not go to ground, connect external resistor, 5 K-10 Kohm, between input and ground of monitoring equipment.**

# Swivel Fitting Guide

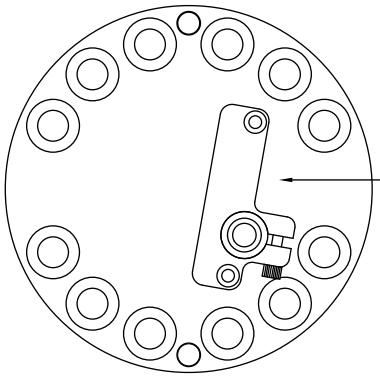



FPD-20x1-x-x

FPD-20x2-x-x
&
FPD-20x3-x-x

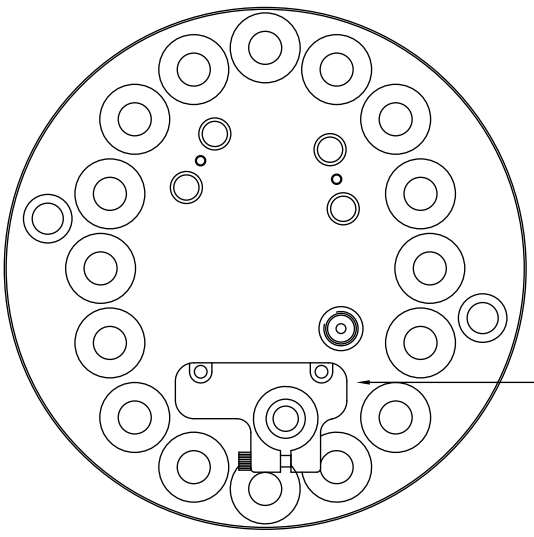
SMALLER SIZE METERS USE THREADED SWIVEL FITTINGS FOR THE ELECTRONIC SENSORS. THE SIDE VIEW IDENTIFIES THE 2 TYPES. TYPE **A** HAS A METRIC M14 THREAD AND TYPE **B** HAS A STANDARD 1/2-20 THREAD.
LOOKING AT METER TOP VIEW TO THE LEFT, DETERMINE WHICH OF THE TWO METER SENSOR HOLES SHOULD BE USED WITH THE SUPPLIED SWIVEL FITTING.

NOTE: BECAUSE TYPE **B** THREAD IS SMALLER THAN TYPE **A**, IT WILL FIT INTO THE TYPE A SENSOR HOLE, BUT WILL NOT FASTEN PROPERLY.



FPD-20x4-x-x

LARGER METER SIZES USE A CLAMP STYLE SWIVEL FITTING. THESE ARE MOUNTED TO THE METER USING 2 SOCKET HEAD CAP SCREWS, ORIENTED AS SHOWN TO THE LEFT. WHEN TIGHTENING THE CLAMP SCREW, ONLY DO SO UNTIL THE SENSOR CAN NO LONGER MOVE OR ROTATE. OVERTIGHTENING THE SCREW COULD DAMAGE THE SCREW OR THE CLAMP ITSELF.



FPD-20x5-x-x

**NOTE: ALL METERS SHOWN WITH FORWARD FLOW DIRECTION FROM LEFT TO RIGHT**

# Maintenance Guide

For Flow Meter Series: FPD20x1-x-x, FPD20x2-x-x, FPD20x3-x-x

**Cleaning, inspecting or repairing a gear flow meter is easily accomplished by following the procedures below.**

1. Remove the Sensor (1) from the flow meter body Upper Housing (4). Using a 3mm hex key, loosen the 2 mounting screws inside the sensor.

2. Remove the hex bolts using a 5mm hex key. Keep the 2 opposing bolts near the Locating Pins (7) engaged by a few threads to avoid stress on the shafts and the locating pins during housing separation. **Please note the orientation of the Upper and Lower housings with respect to each other so that the meter is reassembled the same way.**

3. Holding the Upper Housing (4), gently tap on the top of the 2 opposing bolt heads to separate the Upper Housing (4) from the Lower Housing (9). **Do NOT use chisels or screwdrivers to split and pry apart the housings. This can cause damage to the meter bodies and meter internal parts.**

4. After separation, remove, clean and inspect the gear assemblies (6) and shafts (5). Clean out the o-ring groove, shaft holes and meter cavity.

   **IMPORTANT: The gear assembly consists of two bearings (6a), the Gear (6b), and a Bearing Spacer (6c. These parts are loosely fitted and can fall out. These parts are matched together and careful attention MUST be made to their orientation and location as they MUST be replaced the exact way they were.**

5. After cleaning all parts completely, the Gear Assemblies (6), Shafts (5) and Locating Pins (7) can be reinserted. Check for free and easy rotation of the gears.

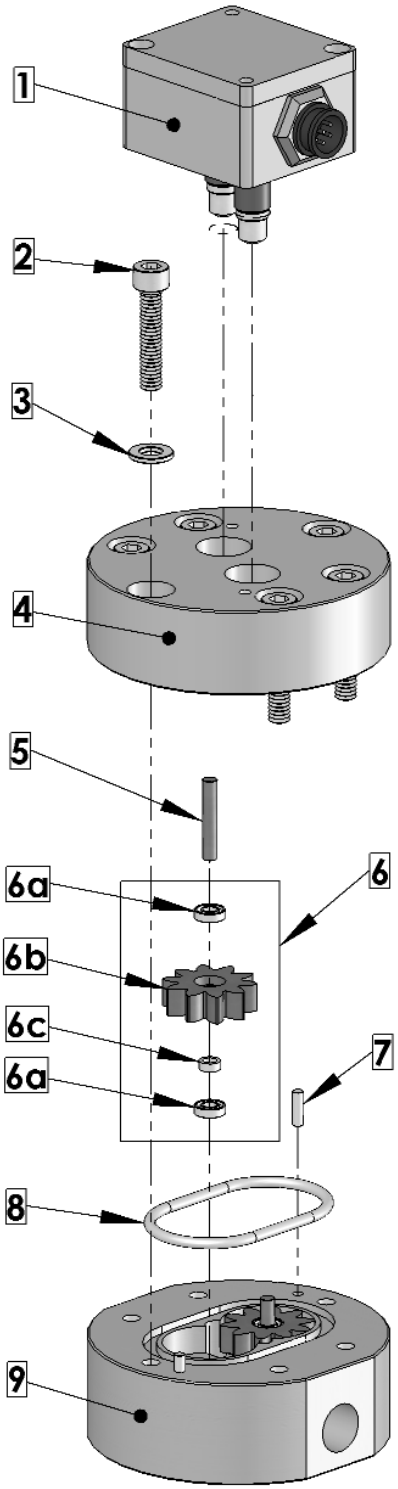
6. Replace the O-Ring (8).

7. During reassembly keep the meter housings as parallel as possible. Make sure the housings are orientated the same way they were prior to disassembly.

8. Replace the Washers (3) and the Bolts (2). Torque the bolts to 10 ft/lbs. Do not force the meter housings together. Do NOT use a hammer or other such device. Over tightening will not cause damage to the meter, but may fatigue the bolts and/or restrict the operation if internal surfaces are not completely clean.

9. After reassembly, gently blow air through the meter so the gears spin. This should be clearly audible given a moderate background noise level.

10. Clean any debris from the pickup holes before remounting the sensor (1) to the Upper Housing (4). Use a 3mm hex key to tighten the mounting screws in the sensor to mount the sensor on the housing. **Note that there is a correct and incorrect orientation for the sensor to be mounted on the flow meter.** Please see the Omega website for documentation if you do not have it. The orientation is noted by the sensor's connector with respect to the outlet port of the flow meter.



# Maintenance Guide

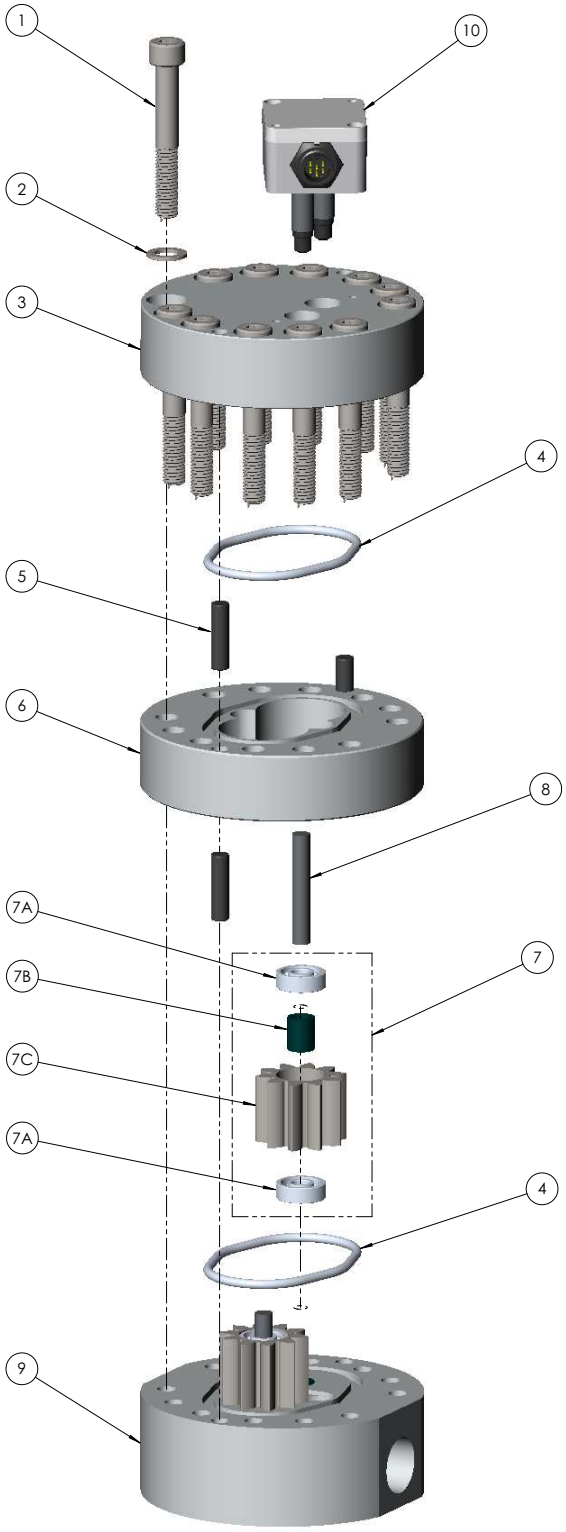
## For Flow Meter Series: FPD20x4-x-x

**Cleaning, inspecting or repairing a FPD20x4 Series gear flow meter is easily accomplished by following the procedures below.**

1. Remove the Sensor (10) from the flow meter body Upper Housing (3). Using a 3mm hex key, loosen the 2 mounting screws inside the sensor.
2. The FPD20x4-x-x flow meter uses M10 Bolts (1), loosen them using an 8mm hex key. Keep the 2 opposing bolts near the Locating Pins (5) engaged by a few threads to avoid stress on the shafts and the locating pins during housing separation. Please note the orientation of the Upper, Middle and Lower housings with respect to each other so that the meter is reassembled the same way.
3. Holding the Upper Housing (3), gently tap on the top of the 2 opposing bolt heads to separate the Upper Housing (3) from the Middle Housing (6) and Lower Housing (9). Do NOT use chisels or screwdrivers to split and pry apart the housings. This can cause damage to the meter bodies and meter internal parts.
4. After separation, remove, clean and inspect the gears (7C) and shafts (8). Clean out the o-ring groove, shaft holes and meter cavity.
5. After cleaning all parts completely, the Gears (7C), Shafts (8) and Locating Pins (5) can be reinserted. Check for free and easy rotation of the gears.
6. Replace the O-Rings (4).

Note: JVM-60KG Flow meters have 2 o-rings per meter.

7. During reassembly keep the meter housings as parallel as possible. Make sure the housings are orientated the same way they were prior to disassembly.
8. Replace the Washers (2) and the Bolts (1). Torque the bolts to 30 ft/lbs. Do not force the meter housings together. Do NOT use a hammer or other such device. Over tightening will not cause damage to the meter, but may fatigue the bolts and/or restrict the operation if internal surfaces are not completely clean.
9. After reassembly, gently blow air through the meter so the gears spin. This should be clearly audible given a moderate background noise level.
10. Clean any debris from the pickup holes before remounting the sensor (10) to the Upper Housing (3). Use a 3mm hex key to tighten the mounting screws in the sensor to mount the sensor on the housing. Note that there is a correct and incorrect orientation for the sensor to be mounted on the flow meter. Please see the Omega website for documentation if you do not have it. The orientation is noted by the sensor's connector with respect to the outlet port of the flow meter.

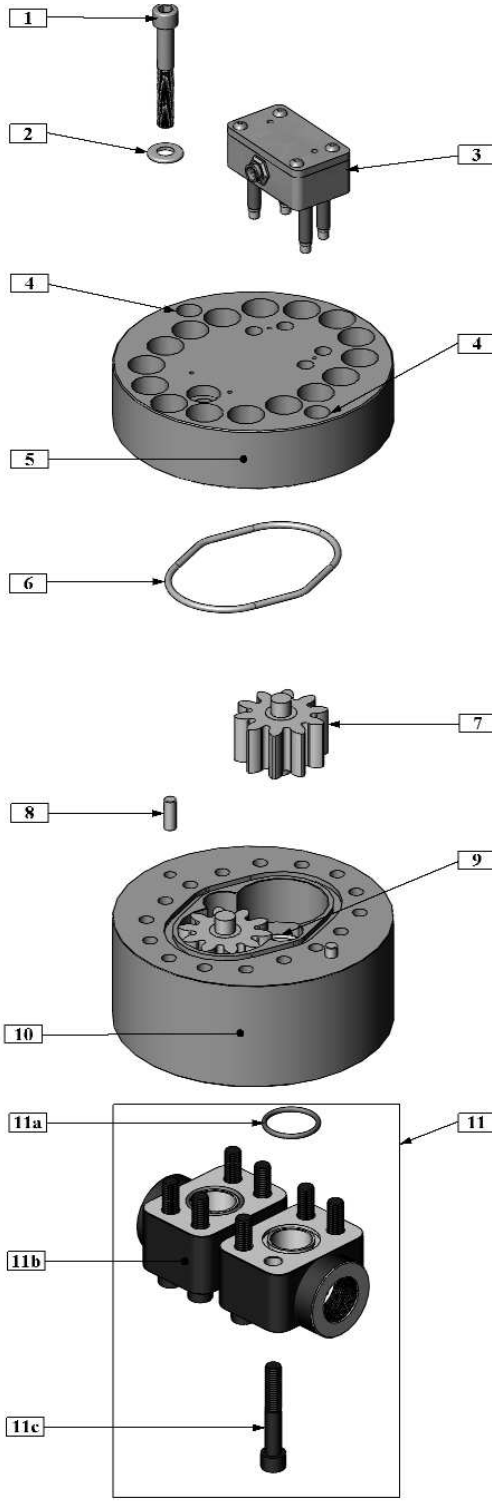


# Maintenance Guide

For Flow Meter Series: FPD20x5-x-x

**Cleaning, inspecting or repairing a FPD20x5 Series gear flow meter is easily accomplished by following the procedures below.**

1. Remove the Sensor (3) from the flow meter body Upper Housing (5). Using a 9/64 hex key, loosen the 2 mounting screws inside the sensor.
2. Remove the hex bolts (1) with a 3/8 hex key.
3. Turn 2 of the hex bolts into the extraction bolt holes (4) until they make contact with the lower housing (10). Using these bolts for separating the housings helps to reduce any stress on the locating pins and gear shafts.
4. With the extraction bolts turned down to the lower housing, give each bolt a half-turn, alternating them, until the housings have separated enough to where you can lift the upper housing (5) straight off the locating pins. **CAUTION: When lifting the top housing off, make sure the gears stay in the lower housing. If they come out with the upper housing, they may fall off and damage the lower housing or the gears themselves.**
5. After separation, inspect the gears (7) and bearings (9). Carefully remove the gears and thoroughly clean them with solvent. Special care must be observed when cleaning or flushing either the upper (5) or lower housing (10) as the bearing could dislodge from the housing. **NOTE: Do not remove the bearings. For bearing repairs the meter should be returned to the factory.**
6. After cleaning, add lubrication if possible. The gears can be reinserted into their previous positions. Check for free and easy rotation of the gears.
7. Replace the O-ring (6).
8. Keep the meter housings parallel during reassembly and align the index marks on the housings so they are on the same side. **NOTE: Do not force the housings together using a hammer or other similar device. Make sure to turn out the bolts from the extraction holes.**
9. Replace the hex bolts and torque all the bolts to 50 ft/lbs, once one bolt is torqued, move to the bolt that is opposite it and repeat until all bolts have been torqued. Over tightening will not cause damage, but may restrict operation if surfaces are not completely clean.
10. After reassembly, gently blow air into the meter so the gears spin. This should be clearly audible given a moderate background noise level.
11. **The bearings should be lubricated prior to storage. Never allow contact with water without immediately drying and lubricating after use.**



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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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