



- ✓ Advanced microturbine design for repeatable results - with no particle shedding & no zero drift
- ✓ Compatible with solvents, deionized water, acids, CMP slurries, etc.
- ✓ Extremely compact size

DESCRIPTION

The Model 106F Flo-Sensor will precisely measure flow rates of virtually any low-viscosity fluid, as low as 15 mL/minute or as high as 50 L/minute (13 GPM). Repeatable results are achieved by utilizing a patented* Pelton-type microturbine wheel, designed for use with ultrapure applications. This proven design does not generate any particles to contaminate your processes, but continues to provide precise results even after many years of service.

Machined flare-type fittings provide easy connection and eliminate all threads from the fluid stream. Electrical connections are made via the included 6 foot cable. Several power and signal configurations are available for a wide range of applications.

The superior design of the microturbine technology used in the Model 106F is shown in its compact size. For most of the flow rates, the footprint of the unit is nearly ¼th the size of a comparable differential pressure flow sensor.

By limiting the wetted surfaces of the 106F to Teflon®, Kal-Rez®, and sapphire, it can be used to measure almost any low-viscosity fluid, including hydrofluoric and other acids, CMP slurries, solvents, deionized water, and photodevelopers.

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COMMON APPLICATIONS

1. Flow rate monitoring to improve yield management
2. Chemical delivery monitoring for CMP polish tools
3. High & low flow rate alarm systems
4. Injection & dispensing systems

*US Patents 4,467,660; 5,542,302; 5,728,949; Other patents: DE 19680105 T1; GB 0163785; GB 2302175B; GB2332064B; Japan 1770103.
Teflon and Kalrez -- Reg TM E.I. duPont de Nemours Co.

PRINCIPLE OF OPERATION

McMillan's microturbine wheel technology utilizes the Pelton turbine wheel concept. This type of design allows usage of a sub-miniature microturbine wheel about the size of a quarter in both diameter and thickness. The turbine wheel is then supported on a very small sapphire shaft held in position by two sapphire bearings. Because of the very light weight of both the wheel and the shaft, the microturbine wheel virtually floats in the liquid. This flotation effect causes the turbine wheel to be suspended in the middle of the bearings and thus eliminates shaft and bearing wear.

As flow passes through the flow sensor, it is directed onto the teeth of the wheel using a precision-machined orifice, which is sized according to flow range. The flow is projected onto the wheel, spinning the wheel faster as flow increases. This speed increase is directly proportional to the increase in flow rate.

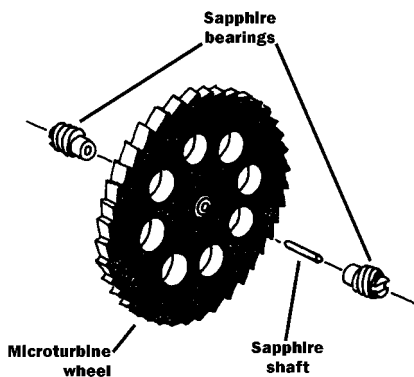


Figure 2. Assembly of microturbine wheel.

The microturbine wheel features 8 small holes, spaced evenly around the center of the wheel. As the wheel spins, an infrared beam is projected through a Teflon® window and onto the wheel. A sensor on the other side of the wheel detects each hole and translates those signals into pulses. Thus, as the wheel spins faster, more pulses are generated. When the wheel stops, no pulses are generated.

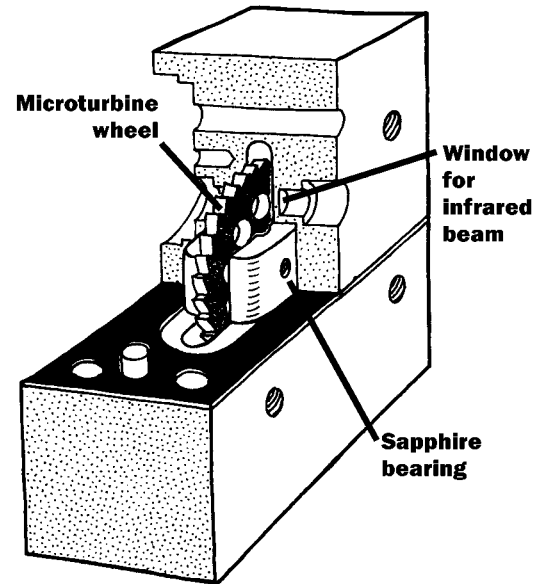


Figure 1. Cutaway of 106F sensor technology.

POWER AND SIGNAL CONFIGURATIONS

All 106F Flo-Sensors come standard with an integrated 6-foot long, 4 conductor, PVC-jacketed cable. This cable provides both power and signal connections. Seven configurations are available - see the ordering information chart on page 5 for your options. See specifications on page 3 for details on the various outputs. Select your output when ordering by adding the appropriate configuration suffix (i.e., 106F-3B, or 106F-30K).

Output must be selected when ordering; outputs are not field selectable. A calibration certificate is included with each unit showing actual indicated outputs vs. several flow rates.

By combining the A configuration suffix (pulse output, 12-15VDC) with the optional Model 251 Multi-Function Display, full scale accuracies of $\pm 0.5\%$ or better are possible. Since all Model 106F sensors feature $\pm 0.2\%$ Full Scale repeatability, the precision of a 106F/251 system is ideal for your critical flow measurement applications. The Model 251 plugs into a standard wall outlet (order the 251 for USA applications and the 251E for Europe) and provides 12-15 VDC power for the 106F.

Other displays and output options are available - contact McMillan for more information.

DETAILED SPECIFICATIONS

Accuracy/Linearity: For $\pm 0.5\%$ Full Scale accuracy/linearity, use the Model 106F (A suffix) with the optional Model 251 Multi-Function Display.

106F with pulse output (A, E suffix): $\pm 3\%$ Full Scale*, typical.

106F with analog output (B, C, D, J or K suffix): $\pm 1\%$ Full Scale*, typical.

Repeatability: $\pm 0.2\%$ Full Scale*

Power Requirements: 106F (A suffix): 12-15 VDC, 50 mA

106F (B, D, J suffix): 22-25VDC, 55 mA

106F (C suffix): 22-25VDC, 75 mA

106F (E suffix): 22-25VDC, 50 mA

106F (K suffix): 12-15VDC, 55 mA

Pressure Rating: Normal working pressure should not exceed 80 psig (5.4 bar)

Over pressure limit is 100 psig (6.8 bar)

Temperature Rating: Operating range: 5 to 55°C

Storage range: 0 to 70°C

Temperature Sensitivity: $\pm 0.2\%$ Full Scale* or less per °C

Wetted Materials: PTFE Teflon®, sapphire, Kal-Rez®

Non-wetted Materials: PTFE Teflon®, Ryton®, Viton®, polypropylene, PVC-jacketed cable

Recommended Filtration: 25 microns or less

Compatible Fluids: Most low viscosity liquids - best performance with liquids < 10 centistokes

Outputs: 106F with pulse output (A, E suffix): Opto-isolated passive pulse -- bidirectional BOSFET. Isolation is 2500 volts. Pulse rate is proportional to flow rate (zero pulses at zero flow). Lowest flow range (15-100 mL/minute) produces typically 0-200 Hz, while higher flow ranges typically produce 0-500 Hz. Pulse height selectable using external voltage source.

106F with 0-5VDC output (B, D suffix): Analog voltage output -- 0-5VDC. Voltage level is proportional to flow rate (zero VDC at zero flow). Load connected to output should not be less than 2500 ohms. Output not isolated from ground.

106F with 4-20 mA output (C suffix): Analog current output -- 4-20 mA. Current level is proportional to flow rate (4 mA at zero flow). Current loop should not exceed 500 ohms. Output is not isolated from ground.

106F with 0-10 VDC output (J, K suffix): Analog voltage output -- 0-10 VDC. Voltage level is proportional to flow rate (zero VDC at zero flow). Load connected to output should not be less than 5000 ohms. Output not isolated from ground.

Flow Connections: Male-flare type tubing connections. PVDF nuts optional - order P/N

106F-NS38 for a pair of 3/8" PVDF flare nuts, or P/N 106-NS34 for 3/4" (pair).

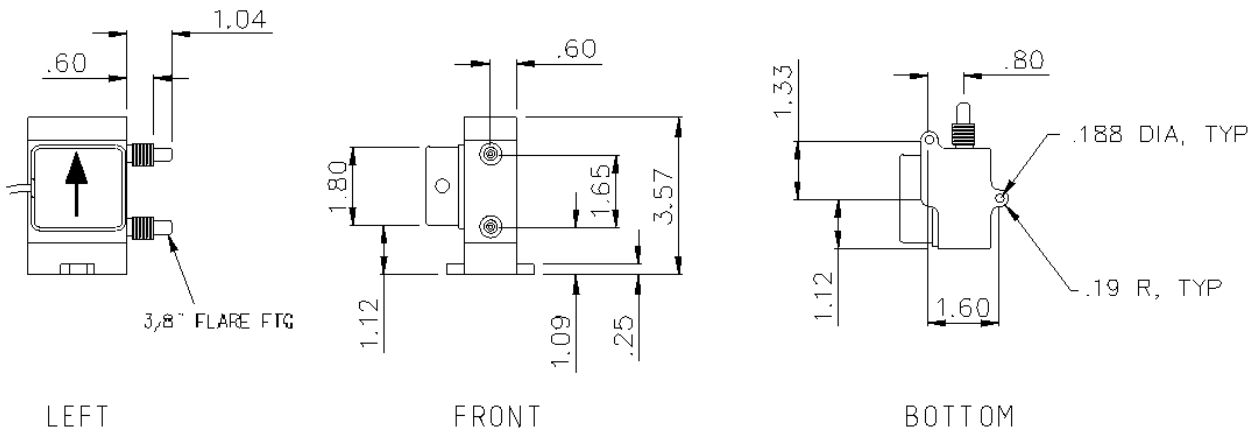
Electrical Connections: Integrated, shielded 6-ft, 4-conductor cable (PVC jacket), terminated with tinned pigtail leads. Other lengths & connection options available.

Reliability: Units installed as recommended by the manufacturer can be expected to remain in service at least 5 years (43,800 hours) before maintenance. Longer MTBF may be experienced in many applications.

*Full Scale is from 10% to 100% of rated flow (20 to 100% of rated flow for range 3). Linearity is best fit straight line. All calibrations performed with deionized water.

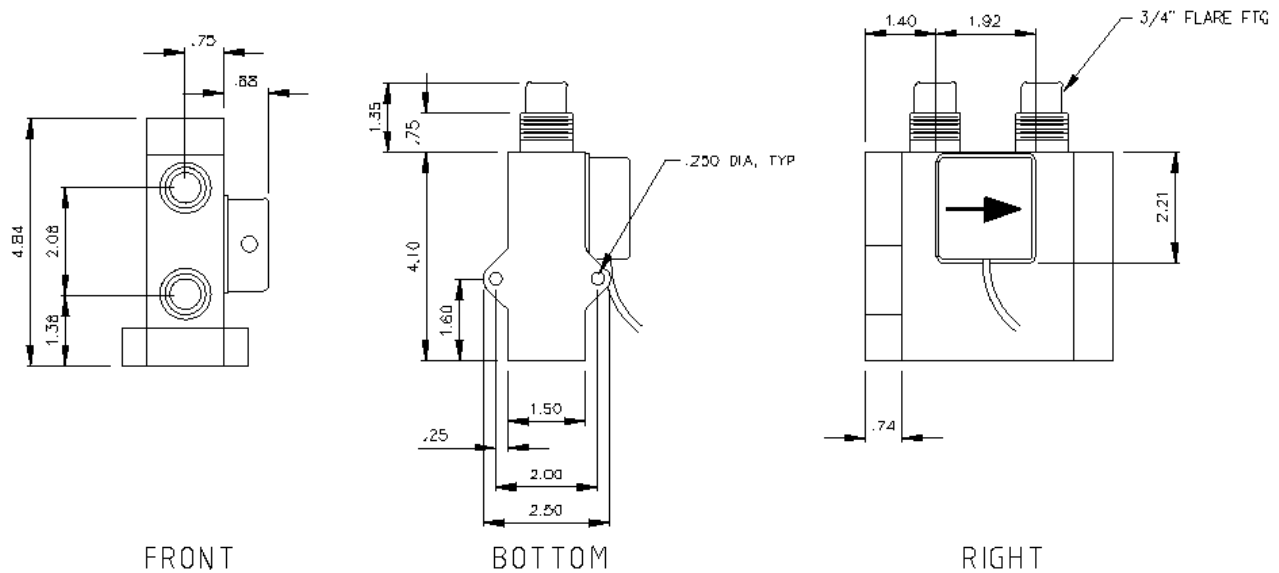
DIMENSIONS

For units with 3/8" flare fittings (flow ranges 10 L/minute and less):



Flare nuts also available - order P/N 106-NS38 for a pair of 3/8" PVDF nuts.

For units with 3/4" flare fittings (flow ranges over 10 L/minute):



Flare nuts also available - order P/N 106-NS34 for a pair of 3/4" PVDF nuts.

ORDERING INFORMATION

1. Select a range:

Model Number	Flow Range*	Max. Pressure Drop**	Standard Fittings
106F-3	15-100 mL/minute	12 psi	3/8" male flare
106F-4	20-200 mL/minute	10 psi	3/8" male flare
106F-5	50-500 mL/minute	10 psi	3/8" male flare
106F-6	100-1000 mL/minute	6 psi	3/8" male flare
106F-7	200-2000 mL/minute	10 psi	3/8" male flare
106F-8	400-5000 mL/minute	10 psi	3/8" male flare
106F-9	1.0-10.0 L/minute	10 psi	3/8" male flare
106F-20	3.0-20.0 L/minute	3 psi	3/4" male flare
106F-30	4.0-30.0 L/minute	4 psi	3/4" male flare
106F-50	7.0-50.0 L/minute	10 psi	3/4" male flare
106F-5G	1.0-10.0 GPH	12 psi	3/8" male flare
106F-8G	10-100 GPH	12 psi	3/8" male flare

2. Select a signal and power configuration:

Configuration Suffix	Power Requirement	Output
A	12-15 VDC	Pulse (Passive BOSFET)
B	22-25 VDC	Non-isolated 0-5 VDC
C	15-25 VDC	Non-isolated 4-20 mA
D	12-15 VDC	Non-isolated 0-5VDC
E	22-25 VDC	Pulse (Passive BOSFET)
J	22-25 VDC	Non-isolated 0-10 VDC
K	12-15 VDC	Non-isolated 0-10 VDC

3. Create your part number:

Add the configuration suffix from step #2 to your model number from step #1.

Example #1: To order a flow sensor that measures from 400-5000 mL/minute, uses 24VDC power, and provides a pulse output, order a **106F-8E** (Model 106F-8 + E suffix).

Example #2: To order a flow sensor that measures from 1-10 GPH, uses 12VDC power, and provides a 0-10 VDC output, order a **106F-5GK** (Model 106F-5G + K suffix).

4. Order options & accessories:

3/8" Flare Nuts: Order P/N 106F-NS38 for a pair of PVDF 3/8" flare nuts (use with ranges 10 L/minute and below).

3/4" Flare Nuts: Order P/N 106F-NS34 for a pair of PVDF 3/4" flare nuts (use with ranges 20 L/minute and above).

Custom Cable Lengths: Custom cable lengths (6 feet standard) & connector options are available. Call for details.

Model 251 Multi-Function Display: 8-digit "smart" display that allows 9-point linearization of flow sensor signal to achieve ±0.5% full scale or better linearity/accuracy. Alarm and setpoint relay options. Use with suffix A.

MSB-5 Output Device: Provides isolated 4-20 mA output. Requires 24VDC power. Use with suffix A.

*All units calibrated using deionized water. Ranges shown indicate recommended measurement range for deionized water applications.

** Maximum pressure drop occurs at maximum (100%) rated flow. At 50% of rated flow, the actual pressure drop will only be 25% of maximum pressure drop. At 25% of rated flow, the actual pressure drop will only be 6.25% of maximum pressure drop.

OTHER RELATED PRODUCTS

**Model 251
Multi-Function Display**

Check out our website
for more information!



- **Completely programmable flow rate and total flow display, perfect for use with the Model 106F**
- **Program up to 9 calibration points to achieve precise linearization!**
- **Option cards add alarm & analog outputs, more**
- **Achieve $\pm 0.5\%$ full scale linearity/accuracy when combined with the Model 106F (A suffix)**

**Model 401 Teflon®
Liquid Flow Controller**

Call for details today!



Valve Unit

Control Unit

- **The world's first automatic microprocessor-controlled Teflon® liquid flow controller**
- **A flow sensor and automatic needle valve combined**
- **Improve processes by maintaining steady flow rates**