



McMillan
C•O•M•P•A•N•Y

Liquid Flow Rate Meters for Precision Applications

MODEL 101, 102, 104 & 107 MICROTURBINE LIQUID FLO-SENSORS®



APPLICATION IDEAS

Precision flow measurement of samples in laboratories

Fuel cell liquid monitoring

OEM for liquid analyzers, test stands, etc.

Totalizing chemical injection streams



PRODUCT DESCRIPTION

McMillan Model 101/102/104/107 FLO-SENSORS[®] are capable of measuring extremely low liquid flow rates from 13 mLpm up to 10 Lpm with a full scale accuracy of $\pm 1.0\%$ or better!

A wide variety of fluids may be measured. Repeatable results are achieved using a patented Pelton-type micro-turbine wheel. This proven design has been providing precision results since 1988 and has developed a well-deserved reputation for continuous operational service for many years without failure.

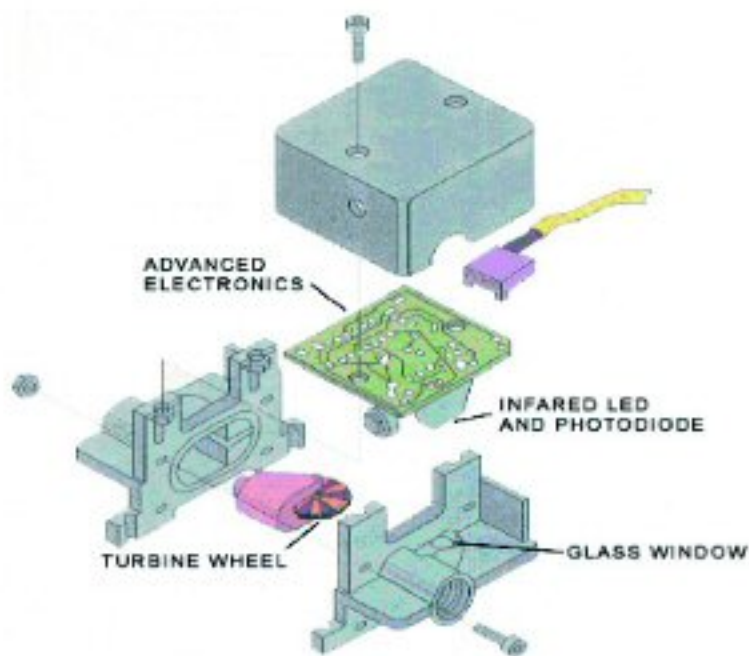
Because of the compact size and economical cost of these products, the Model 101/102/104/107 FLO-SENSORS are suitable for a wide variety of industrial, commercial, laboratory and O.E.M. applications. Some sample applications include measurement of hydrocarbon fluids, fuels, light oils, solvents, coolant, pesticides, mild acids, alkalis, and deionized water. Several power and output configurations are available, including both pulse and analog outputs. NIST Traceable certificates are available on all models.

PRINCIPLE OF OPERATION

McMillan's patented* microturbine wheel technology utilizes the Pelton turbine wheel concept. This design allows for use of a miniature turbine wheel similar in size to a U.S. dime (16 mm diameter, 0.75 mm thick). The wheel is supported on a very small sapphire shaft, held in position by two sapphire bearings. Due to the light weight of both the wheel and the shaft, the microturbine wheel virtually floats in the liquid. This flotation effect relieves force on the shaft and bearings, virtually eliminating wear.

As flow passes through the FLO-SENSOR, it is directed onto the very small teeth of the wheel using a precision-machined nozzle. This nozzle is sized according to the flow range of the unit. The rotational speed of the turbine wheel increases proportionally to the volumetric flow rate.

The microturbine wheel has alternating white and black sections evenly spaced on one surface of the wheel. As the wheel rotates, an infrared beam is reflected off each white section and is directed to a phototransistor which detects each reflected beam and converts them into pulses. As the wheel spins faster, pulse rate increases. When the wheel stops (under zero flow conditions), no pulses are generated. Consequently, zero drift is not possible and zero adjustments are never required. Processing circuitry provides analog and/or pulse outputs that are linearly proportional to the flow rate.



* US Patents 4,467,660; DE 19680105 T1; GB 2302175B; GB 2332064B; Japan 1770103; other patents pending



FEATURES AND OPTIONS

FLOW RANGES

Flow ranges from 13-100 mLpm up to 1.0-10.0 Lpm are available. Consult the factory for custom requirements.

POWER

Most units may be specified to operate with either 12VDC or 24VDC power. The Model 107 FLO-SENSOR will only work with 24VDC. Various power adapters are also available for use with 12VDC versions.

SIGNAL OUTPUTS

Most units may be ordered with a 0-5VDC output or with both 0-5VDC and pulse outputs. The Model 107 is only available with a 4-20mA output.

ACCURACY/LINEARITY

All models have a standard accuracy specification of $\pm 1\%$ F.S. (including linearity). An improved accuracy specification of $\pm 0.5\%$ is available. NIST traceable calibration certificates are standard for improved accuracy ("H") models and optional for standard units.

FLUID CONNECTIONS

All units have compression type tube fittings as standard. Many alternate fitting types and sizes may be selected as noted in the Fitting Codes Chart.

ELECTRICAL CONNECTIONS

Most units have an integrated 4-pin male connector. To complete connections, either a cable assembly or power adapter should be ordered. Units where the circuit board has been epoxy potted for increased chemical resistance feature an integrated cable with pigtail leads.

WETTED MATERIALS

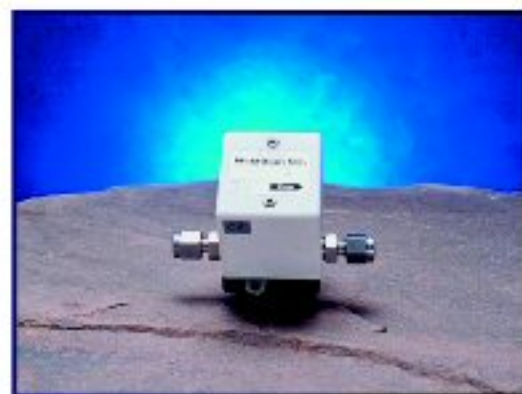
The wetted materials vary depending on the model number. See the specifications for further details. Viton[®] O-Rings are fitted as standard but may be replaced with EPDM for improved compatibility.

DISPLAYS

McMillan has a comprehensive range of FLO-METERS[®] with integrated displays. A number of remote displays are also available for use with any FLO-SENSOR or FLO-METER. Please request further information from the factory.



Model 102 FLO-SENSOR shown with 220 Display



Model 107 FLO-SENSOR



Model 101 FLO-SENSOR shown with 220 Display



ORDERING INFORMATION

| Form part number: (Model Code) - (Flow Range) (Power/Signal Output) (Seal) (Bearing Support) - (Fittings) (Options) For standard options, no specification is necessary | Code | 101 | 102 | 104 | 107 |
|---|---|---|---|---|---|
| 101 Nylon® Liquid FLO-SENSOR® 102 Brass Liquid FLO-SENSOR® 104 Stainless Steel Liquid FLO-SENSOR® 107 Stainless Steel Liquid FLO-SENSOR® | 101 102 104 107 | ✓ | ✓ | ✓ | ✓ |
| Flow Range (mLpm of H ₂ O) Code 13-100 20-200 50-500 100-1000 200-2000 500-5000 1000-10000 | 3 4 5 6 7 8 9 | ✓ ✓ ✓ ✓ ✓ ✓ ✓ | ✓ ✓ ✓ ✓ ✓ ✓ ✓ | ✓ ✓ ✓ ✓ ✓ ✓ ✓ | ✓ ✓ ✓ ✓ ✓ ✓ ✓ |
| Power / Signal Output Code 11.5-15.0 VDC Power / 0-5 VDC Output 18.0-25.0 VDC Power / 0-5 VDC Output 11.5-15.0 VDC Power / 0-5 VDC & Pulse Output 18.0-25.0 VDC Power / 4-20 mA Output | Standard E T Standard | ✓ ✓ ✓ ✓ | ✓ ✓ ✓ ✓ | ✓ ✓ ✓ ✓ | ✓ ✓ ✓ ✓ |
| Seal Codes Viton® EPDM | Standard Q | ✓ ✓ | ✓ ✓ | ✓ ✓ | ✓ ✓ |
| Bearing Support Codes Stainless Steel KEL-F Impact Resistant (Stainless Steel) | Standard K N | ✓ ✓ ✓ | ✓ ✓ ✓ | ✓ ✓ ✓ | ✓ ✓ ✓ |
| Fitting Codes (see fitting codes chart on next page for details) 1/8" Acetal Compression Tube 1/4" Acetal Compression Tube 3/8" Acetal Compression Tube 1/4" PVDF Compression Tube 3/8" PVDF Compression Tube 1/8" Brass Compression Tube 1/4" Brass Compression Tube 3/8" Brass Compression Tube 1/8" Stainless Steel Compression Tube 1/4" Stainless Steel Compression Tube 3/8" Stainless Steel Compression Tube 3 mm Stainless Steel Compression Tube 6 mm Stainless Steel Compression Tube 10 mm Stainless Steel Compression Tube 1/4" Acetal Barb (up to 25 psig) 1/4" Stainless Steel Barb (up to 25 psig) | A2 A4 A6 K4 K6 B2 B4 B6 S2 S4 S6 M3 M6 M10 A5 S5 | ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ | ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ | ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ | ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ |
| Option Codes Improved ±0.5% F.S. Accuracy Epoxy-Potted PC Board NIST-Traceable Calibration Certificate | H Y NIST | ✓ ✓ ✓ | ✓ ✓ ✓ | ✓ ✓ ✓ | ✓ ✓ ✓ |
| ACCESSORIES Cables and Power Adapters (Order Separately - Required For Operation) Cable with Pigtail Leads 36" (92 cm) length, 12/24VDC Power Required 110VAC Power Adapter (for 12 VDC Models only) 230VAC Power Adapter (for 12VDC Models only) | 100-17T 110-004-08T 110-003-18T | ✓ ✓ ✓ | ✓ ✓ ✓ | ✓ ✓ ✓ | ✓ ✓ ✓ |
| Displays (Order Separately - More Information Available) 210R Ratio Display, 3½ digit, 5-30 VDC Power 220 Pulse/Total Display, 8 digit, battery powered* 250 Multi-Function Display, 11.5 VAC Power 250E Multi-Function Display, 230 VAC Power | 210R 220 250 250E | ✓ ✓ ✓ ✓ | ✓ ✓ ✓ ✓ | ✓ ✓ ✓ ✓ | ✓ ✓ ✓ ✓ |

* Use only with T models

Example #1:

102-7E-B4-HY would give you a 102 FLO-SENSOR rated for 02-20 Lpm. The full scale accuracy would be ±0.5%. The power would be 24VDC, and the output would be 0-5VDC. The electronic PC board would be potted in epoxy for extra protection. 1/8" brass compression tube fittings would be installed. An NIST-Traceable calibration certificate would be included due to the H suffix.

Example #2:

107-5Q-M10-NIST would give you a 107 FLO-SENSOR rated for 50-500 mLpm. The full scale accuracy would be ±1.0%. The power would be 24VDC, and the output would be 4-20 mA. The standard Viton® O-rings would be replaced with EPDM O-rings. 10mm Stainless Steel compression tube fittings would be installed. An NIST-Traceable calibration certificate would be included.



FITTING CODES

101

| RANGE | A2 | A4 | A6 | K4 | K6 | S2 | S4 | S6 | S2 | S4 | S6 | M3 | M6 | M10 | A5 | S5 |
|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|----|----|
| 3 | S | O | O | O | O | O | O | O | O | O | O | O | O | O | O | O |
| 4 | | S | O | O | O | | O | O | | O | O | | O | O | O | O |
| 5 | | S | O | O | O | | O | O | | O | O | | O | O | O | O |
| 6 | | S | O | O | O | | O | O | | O | O | | O | O | O | O |
| 7 | | S | O | O | O | | O | O | | O | O | | O | O | O | O |
| 8 | | | S | | O | | | O | | | O | | | O | | |
| 9 | | | S | | O | | | O | | | O | | | O | | |

102

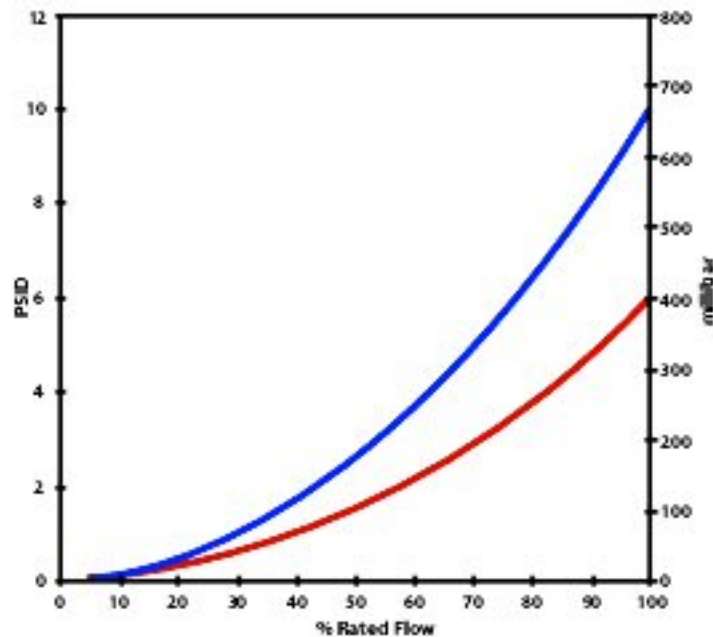
| RANGE | A2 | A4 | A6 | K4 | K6 | S2 | S4 | S6 | S2 | S4 | S6 | M3 | M6 | M10 | A5 | S5 |
|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|----|----|
| 3 | O | O | O | O | O | S | O | O | O | O | O | O | O | O | O | O |
| 4 | | O | O | O | O | | S | O | | O | O | | O | O | O | O |
| 5 | | O | O | O | O | | S | O | | O | O | | O | O | O | O |
| 6 | | O | O | O | O | | S | O | | O | O | | O | O | O | O |
| 7 | | O | O | O | O | | S | O | | O | O | | O | O | O | O |
| 8 | | | O | | O | | | S | | | O | | | O | | |
| 9 | | | O | | O | | | S | | | O | | | O | | |

104/107

| RANGE | A2 | A4 | A6 | K4 | K6 | S2 | S4 | S6 | S2 | S4 | S6 | M3 | M6 | M10 | A5 | S5 |
|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|----|----|
| 3 | O | O | O | O | O | O | O | O | S | O | O | O | O | O | O | O |
| 4 | | O | O | O | O | | O | O | | S | O | | O | O | O | O |
| 5 | | O | O | O | O | | O | O | | S | O | | O | O | O | O |
| 6 | | O | O | O | O | | O | O | | S | O | | O | O | O | O |
| 7 | | O | O | O | O | | O | O | | S | O | | O | O | O | O |
| 8 | | | O | | O | | | O | | | S | | | O | | |
| 9 | | | O | | O | | | O | | | S | | | O | | |

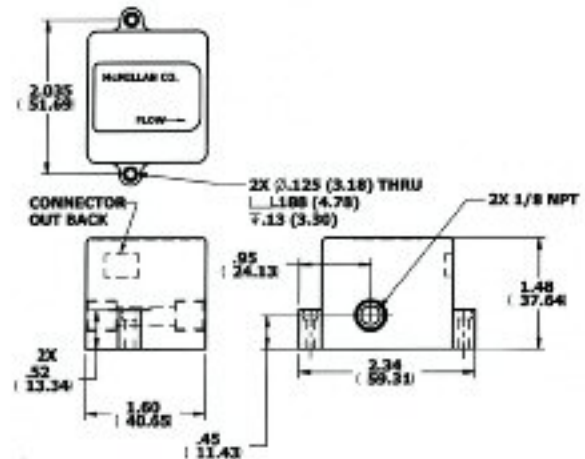
S=Standard, O=Optional.

PRESSURE DROP



— Typical Pressure Drop, all other ranges
— Typical Pressure Drop, range 6

DIMENSIONS



Dimensions shown are in inches (mm) and do not reflect included fittings. Dimensions shown are for the Model 104 and are similar for other models. Specific dimensional drawings for each model may be requested from the factory.



SPECIFICATIONS

| | Model 101 | Model 102 | Model 104 | Model 107 |
|--|---|--|---|--|
| Accuracy (including linearity, best fit straight line) | Standard: $\pm 1.0\%$ Full Scale "H" suffix: $\pm 0.5\%$ Full Scale | | | |
| Repeatability | Standard: $\pm 0.2\%$ Full Scale "H" Suffix: $\pm 0.5\%$ Full Scale | | | |
| Pressure Rating | 100 psig (6.8 bar) | 500 psig (34 bar) | | |
| Temperature Rating | Operating Range: 5 to 55°C Storage Range: 0 to 70°C | | | |
| Temperature Sensitivity | $\pm 0.2\%$ F.S. or less per °C | | | |
| Wetted Materials | Ryton® 316 Stainless* Epoxy Glass Sapphire | Brass Ryton® 316 Stainless Epoxy Glass Sapphire | 316 Stainless Ryton® Epoxy Glass Sapphire | |
| O-Ring Material | Standard: Viton® "C" Suffix: EPDM | | | |
| Fitting Material (Standard) | Acetal | Brass | Stainless Steel | |
| Fitting Material (Optional) | Brass Stainless Steel | Acetal Stainless Steel | Acetal Brass | |
| Recommended Filtration | 25 micron or less | | | |
| Compatible Liquids | Low viscosity (<10 cS) Translucent or Transparent Minimum amount of entrained air | | | |
| 0-5 VDC Output Signal | Standard Non-Isolated, 2500 ohm minimum load | | | Not Available |
| Pulse Output Signal | Optional (with suffix "T") 7.5 VDC peak buffered square wave $\pm 3.0\%$ full scale linearity 0-100 Hz typical | | | Not Available |
| 4-20 mA Output Signal | Not Available | | | Standard Non-Isolated Current Loop should not exceed 500 ohms |
| Power | Standard: 12 VDC @ 35 mA (11.5-15 VDC) "H" Suffix: 24 VDC @ 35 mA (18-25 VDC) | | | 24 VDC @ 85 mA |
| Response Time | Typically <1 second for 63% of final value | | | |
| Reliability | 100,000 Hours MTBF | | | |
| Certifications | CE Approved 80/336/EEC (EN 590 11 & EN 50082-1) 73/23/EEC Low Voltage Directive | | | None |
| Ratings | Standard: IP10 (NEMA 1) "H" Suffix: IP67 (NEMA 6) | | | |
| Warranty | 1 Year Limited | | | |

*16 Stainless required by NCEP for units with "H" suffix

Viton® - Reg TM C. DuPont Co. or DuPont LLC

Ryton® - Reg TM Phillips Petroleum Co.

FLUORON® - Reg TM McMillan Co.

FLUORON® - Reg TM McMillan Co.

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