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

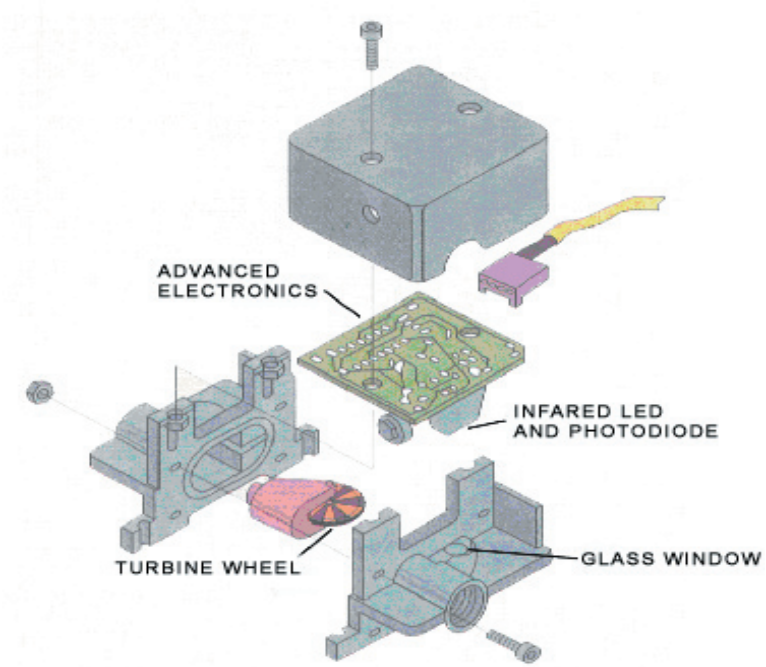
McMillan Model 101/102/104/107 FLO-SENSORS® are capable of measuring extremely low liquid flow rates from 13 mLpm up to 10 Lpm with a full scale accuracy of ±1.0% or better!

A wide variety of fluids may be measured. Repeatable results are achieved using a patented Pelton-type microturbine 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

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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 ±1% F.S. (including linearity). An improved accuracy specification of ±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

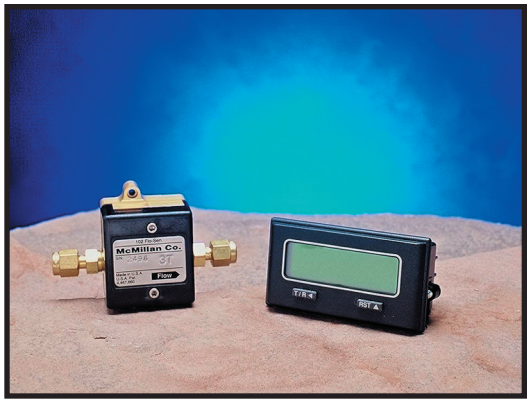
Most units have an integrated 4-pin male connector. To complete connections, either a cable assembly or power adapter should be ordered. Units where the circuit board has been epoxy potted for increased chemical resistance feature an integrated cable with pigtail leads.

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

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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 Ryton® Liquid FLO-SENSOR®	101	✓			
102 Brass Liquid FLO-SENSOR®	102		✓		
104 Stainless Steel Liquid FLO-SENSOR®	104			✓	
107 Stainless Steel Liquid FLO-SENSOR®	107				✓
Flow Range (mLpm of H_2O) Code					
13-100	3	✓	✓	✓	✓
20-200	4	✓	✓	✓	✓
50-500	5	✓	✓	✓	✓
100-1000	6	✓	✓	✓	✓
200-2000	7	✓	✓	✓	✓
500-5000	8	✓	✓	✓	✓
1000-10000	9	✓	✓	✓	✓
Power / Signal Output Code					
11.5-15.0 VDC Power / 0-5 VDC Output	Standard	✓	✓	✓	
18.0-25.0 VDC Power / 0-5 VDC Output	E	✓	✓	✓	
11.5-15.0 VDC Power / 0-5 VDC & Pulse Output	T	✓	✓	✓	
18.0-25.0 VDC Power / 4-20 mA Output	Standard				✓
Seal Codes					
Viton®	Standard	✓	✓	✓	✓
EPDM	Q	✓	✓	✓	✓
Bearing Support Codes					
Stainless Steel	Standard	✓	✓	✓	✓
KEL-F	K	✓			
Impact Resistant (Stainless Steel)	N	✓	✓	✓	✓
Fitting Codes (see fitting codes chart on next page for details)					
1/8" Acetal Compression Tube	A2	✓	✓	✓	✓
1/4" Acetal Compression Tube	A4	✓	✓	✓	✓
3/8" Acetal Compression Tube	A6	✓	✓	✓	✓
1/4" PVDF Compression Tube	K4	✓	✓	✓	✓
3/8" PVDF Compression Tube	K6	✓	✓	✓	✓
1/8" Brass Compression Tube	B2	✓	✓	✓	✓
1/4" Brass Compression Tube	B4	✓	✓	✓	✓
3/8" Brass Compression Tube	B6	✓	✓	✓	✓
1/8" Stainless Steel Compression Tube	S2	✓	✓	✓	✓
1/4" Stainless Steel Compression Tube	S4	✓	✓	✓	✓
3/8" Stainless Steel Compression Tube	S6	✓	✓	✓	✓
3 mm Stainless Steel Compression Tube	M3	✓	✓	✓	✓
6 mm Stainless Steel Compression Tube	M6	✓	✓	✓	✓
10 mm Stainless Steel Compression Tube	M10	✓	✓	✓	✓
1/4" Acetal Barb (up to 25 psig)	AB	✓	✓	✓	✓
1/4" Stainless Steel Barb (up to 25 psig)	SB	✓	✓	✓	✓
Option Codes					
Improved ±0.5% F.S. Accuracy	H	✓	✓	✓	✓
Epoxy-Potted PC Board	Y	✓	✓	✓	✓
NIST-Traceable Calibration Certificate	NIST	✓	✓	✓	✓
ACCESSORIES					
Cables and Power Adapters (Order Separately, Required For Operation)		✓	✓	✓	✓
Cable with Pigtail Leads, 36" (92 cm) length, 12/24VDC Power Required	100-17T				
110VAC Power Adapter (for 12 VDC Models only)	110-00-08T	✓	✓	✓	
230VAC Power Adapter (for 12VDC Models only)	110-00-18T	✓	✓	✓	
Displays (Order Separately, More Information Available)					
210R Rate Display, 3½ digit, 5-30 VDC Power	210R	✓	✓	✓	
220 Rate/Total Display, 8 digit, battery powered*	220	✓	✓	✓	
250 Multi-Function Display, 115 VAC Power	250	✓	✓	✓	✓
250E Multi-Function Display, 230 VAC Power	250E	✓	✓	✓	✓

* Use only with T models

Example #1:

102-7E-B4-HY would give you a 102 FLO-SENSOR rated for 0.2-2.0 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. ¼" 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.

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FITTING CODES

101

RANGE	A2	A4	A6	K4	K6	B2	B4	B6	S2	S4	S6	M3	M6	M10	AB	SB
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

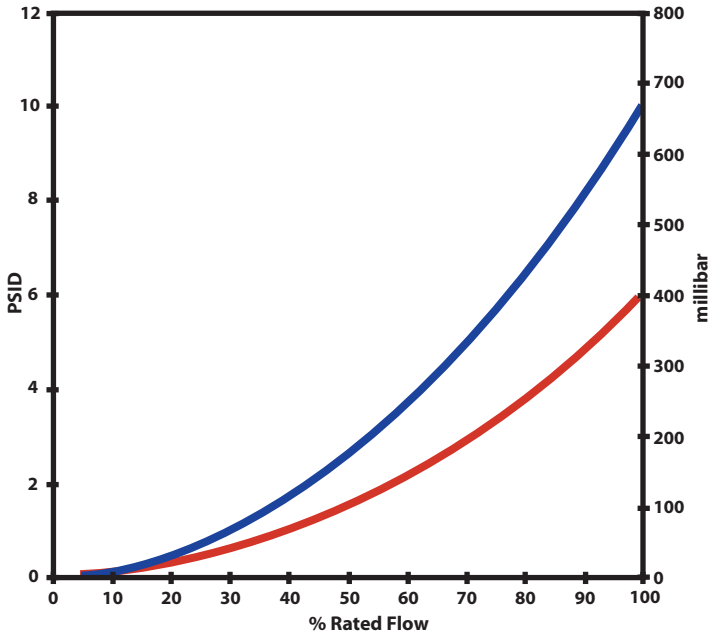
RANGE	A2	A4	A6	K4	K6	B2	B4	B6	S2	S4	S6	M3	M6	M10	AB	SB
3	O	O	O	O	O	**S**	O	O	O	O	O	O	O	O	O	O
4		O	O	O	O		**S**	O		O	O		O	O	O	O
5		O	O	O	O		**S**	O		O	O		O	O	O	O
6		O	O	O	O		**S**	O		O	O		O	O	O	O
7		O	O	O	O		**S**	O		O	O		O	O	O	O
8			O		O			**S**			O			O		
9			O		O			**S**			O			O		

104/107

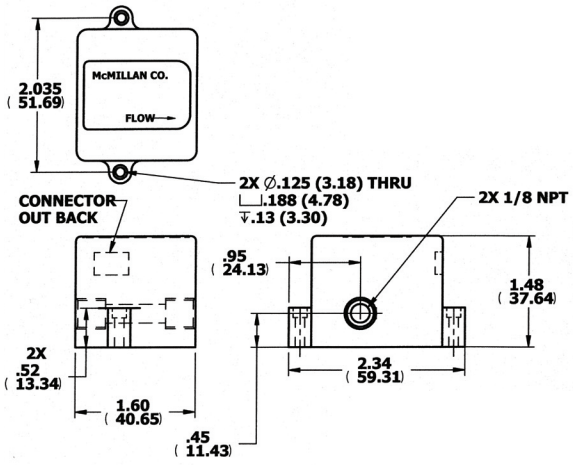
RANGE	A2	A4	A6	K4	K6	B2	B4	B6	S2	S4	S6	M3	M6	M10	AB	SB
3	O	O	O	O	O	O	O	O	**S**	O	O	O	O	O	O	O
4		O	O	O	O		O	O		**S**	O		O	O	O	O
5		O	O	O	O		O	O		**S**	O		O	O	O	O
6		O	O	O	O		O	O		**S**	O		O	O	O	O
7		O	O	O	O		O	O		**S**	O		O	O	O	O
8			O		O			O			**S**			O		
9			O		O			O			**S**			O		

S=Standard; O=Optional.

PRESSURE DROP



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.

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SPECIFICATIONS

	Model 101	Model 102	Model 104	Model 107
Accuracy (including linearity, best fit straight line)	Standard: ±1.0% Full Scale "H" suffix: ±0.5% Full Scale			
Repeatability	Standard: ±0.2% Full Scale "N" Suffix: ±0.5% Full Scale			
Pressure Rating	100 psig (6.8 bar)	500 psig (34 bar)		
Temperature Rating	Operating Range: 5 to 55ºC Storage Range: 0 to 70ºC			
Temperature Sensitivity	±0.2% F.S. or less per ºC			
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® "Q" Suffix: EPDM			
Fitting Material (Standard)	Acetal	Brass	Stainless Steel	
Fitting Material (Optional)	Brass Stainless Steel	Acetal Stainless Steel	Acetal Brass	
Recommended Filtration	25 microns 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 ±3.0% full scale linearity 0-400 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) "E" Suffix: 24 VDC @ 35 mA (18-25 VDC)			24 VDC @ 65 mA
Response Time	Typically <1 second for 63% of final value			
Reliability	100,000 Hours MTBF			
Certifications	CE Approved 89/336/EEC (EN 55011 & EN 50082-1) 73/23/EEC Low Voltage Directive			None
Ratings	Standard: IP10 (NEMA 1) "Y" Suffix: IP67 (NEMA 6)			
Warranty	1 Year Limited			

*316 Stainless replaced by KEL-F on units with "K" suffix

Viton® – Reg TM E.I. DuPont Dow Elastomers LLC
Ryton® – Reg TM Phillips Petroleum Co
FLO-SENSOR® -- Reg TM McMillan Co
FLO-METER® -- Reg TM McMillan Co

Brochure 101-S001

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