



Liquid Flow Meters for Precision Applications

S Series Microturbine Liquid FLO-METERS®



APPLICATION IDEAS

- Monitoring input flow to an analyzer
- Verifying flow in a coolant loop
- Checking fuel consumption on a furnace or engine
- Dispensing chemicals in a laboratory



PRODUCT DESCRIPTION

McMillan S Series FLO-METERS® 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 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.

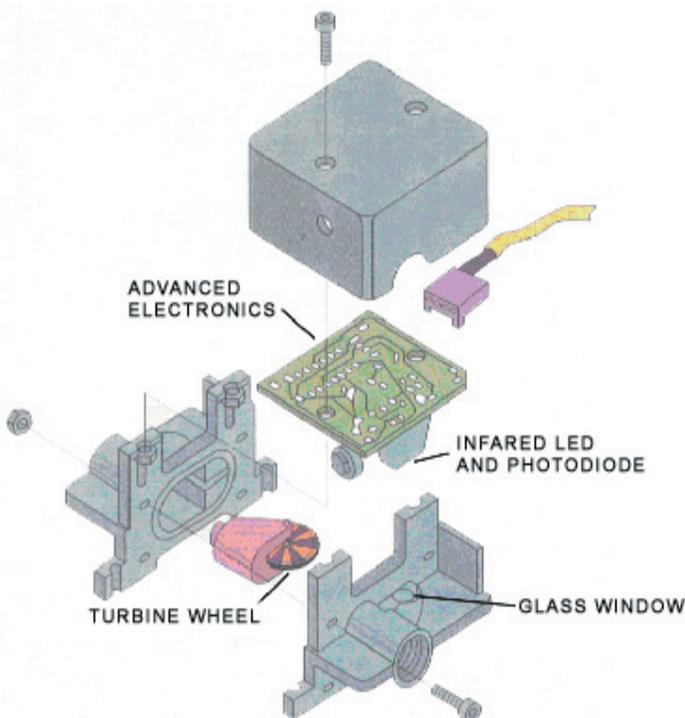
Because of the compact size and economical cost of these products, the S Series FLO-METERS are suitable for a wide variety of industrial, commercial, laboratory and O.E.M. applications. Some sample applications include measurement of hydrocarbon fluids, fuels, light oils, solvents, coolant, pesticides, acids, alkalis, and deionized water.

Several body types are available, including both plastic and metal. NIST Traceable certificates are available on all models. A 3½ digit flow rate display is integrated into each unit and is programmed to read in milliliters per minute (liters per minute for flow ranges 7-10).

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-METER, 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 an analog output that are linearly proportional to the flow rate, and the flow rate in engineering units is shown on the integrated display.



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. Various power adapters are also available for use with 12VDC versions.

SIGNAL OUTPUTS

An analog 0-5VDC output is provided on all units.

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

Units have an integrated 4-pin male connector. To complete connections, either a cable assembly or power adapter should be ordered.

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.

INTEGRATED DISPLAY

A 3½ digit flow rate display is integrated into each unit and is programmed to read in milliliters per minute (mLpm) for ranges 3-6, and liters per minute (Lpm) for flow ranges 7-10.



Model S-111



Model S-112



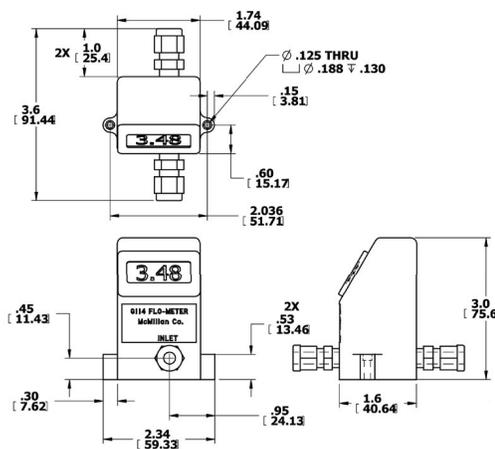
Model S-114

SPECIFICATIONS

	Model S-111	Model S-112	Model S-114
Accuracy (including linearity)	Standard: $\pm 1.0\%$ Full Scale "H" suffix: $\pm 0.5\%$ Full Scale		
Repeatability	$\pm 0.2\%$ Full Scale		
Pressure Rating	100 psig	500 psig	
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® "Q" Suffix: EPDM		
Fitting Material	Standard: Acetal Optional: Brass, Stainless Steel	Standard: Brass Optional: Acetal, Stainless Steel	Standard: Stainless Steel Optional: 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		
Integrated Display	3½ digit non-backlit LCD		
Power	Standard: 12 VDC @ 75 mA (11.5-15 VDC) "E" Suffix: 24 VDC @ 40 mA (18-25 VDC)		
Response Time	Typically <1 second for 97% of final value		
Reliability	100,000 Hours MTBF (testing ongoing)		
Certifications	CE Approved 89/336/EEC (EN 55011 & EN 50082-1) 73/23/EEC Low Voltage Directive		
Ratings	IP10 (NEMA 1)		

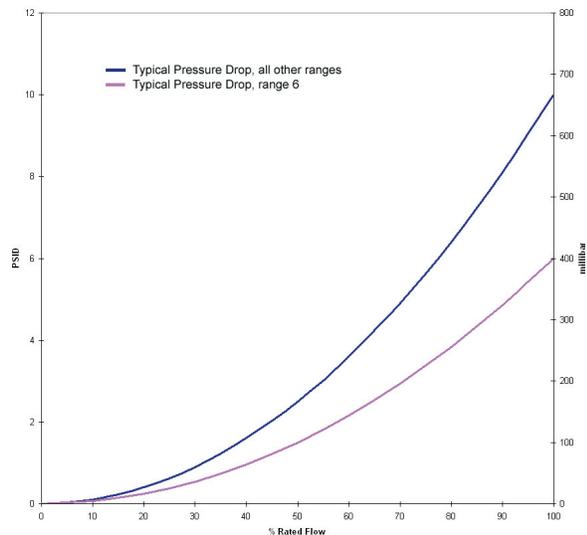
*316 Stainless replaced by KEL-F on units with "K" suffix

DIMENSIONS



Dimensions shown for S-114 with S4 fittings. Other models similar in dimensions – request specific model dimensional drawings from factory.

PRESSURE DROP



ORDERING INFORMATION

Form part number: (Model Code) - (Flow Range)(Power)(Seal)(Bearing Support) – (Fittings)-(Options). For standard options, no specification is necessary.	Code	S-111	S-112	S-114
S-111 Ryton® Liquid FLO-METER® S-112 Brass Liquid FLO-METER® S-114 Stainless Steel Liquid FLO-METER®	S-111 S-112 S-114	✓	✓	✓
Flow Range (mLpm of H ₂ O) Code				
13-100	3	✓	✓	✓
20-200	4	✓	✓	✓
50-500	5	✓	✓	✓
100-1,000	6	✓	✓	✓
200-2,000	7	✓	✓	✓
500-5,000	8	✓	✓	✓
1,000-10,000	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	✓	✓	✓
Seal Code				
Viton®	Standard	✓	✓	✓
EPDM	Q	✓	✓	✓
Bearing Support Code				
Stainless Steel	Standard	✓	✓	✓
KEL-F	K	✓	✓	✓
Impact Resistant (Stainless Steel)	N	✓	✓	✓
Fitting Code (see fitting chart for details)				
1/8" Acetal Compression Tube	A2	✓	✓	✓
1/4" Acetal Compression Tube	A4	✓	✓	✓
3/8" Acetal Compression Tube	A6	✓	✓	✓
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 Code				
Improved ±0.5% F.S. Accuracy	H	✓	✓	✓
NIST-Traceable Calibration Certificate	NIST	✓	✓	✓

ACCESSORIES

Cables and Power Adapters				
Cable with pigtail leads, 36" (92 cm) length, 12/24 VDC Power Required	100-17T	✓	✓	✓
110VAC Power Adapter (for 12 VDC Models only)	110-00-08T	✓	✓	✓
230VAC Power Adapter (for 12 VDC Models only)	110-00-18T	✓	✓	✓
Base Plate				
Allows S-111 FLO-METER to stand on bench or table	110-00-17	✓		

EXAMPLES

#1. S-112-7E-B4-H would give you an S-112 FLO-METER 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. 1/4" Brass compression tube fittings would be installed. An NIST-Traceable calibration certificate would be included due to the H suffix.

#2. S-114-5Q-M10-NIST would give you a S-114 FLO-METER rated for 50-500 mLpm. The full scale accuracy would be ±1.0%. The power would be 24VDC, and the output would be 0-5 VDC. 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 CHART

S-111

RANGE	A2	A4	A6	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
4		S	O		O	O		O	O		O	O	O	O
5		S	O		O	O		O	O		O	O	O	O
6		S	O		O	O		O	O		O	O	O	O
7		S	O		O	O		O	O		O	O	O	O
8			S			O			O			O		
9			S			O			O			O		

S-112

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

S-114

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

S=Standard; O=Optional.



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

Bulletin SSERIES-S002

Specifications subject to change without notice.

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