

Liquid Flow Switches for Precision Applications

Model 501 Microturbine Liquid FLO-SWITCH®



APPLICATION IDEAS

Low- or no-flow alarms for cooling loops

Pump flow verification

Filter load detection

Verification of sample fluid flow rates in analytical instrumentation



PRODUCT DESCRIPTION

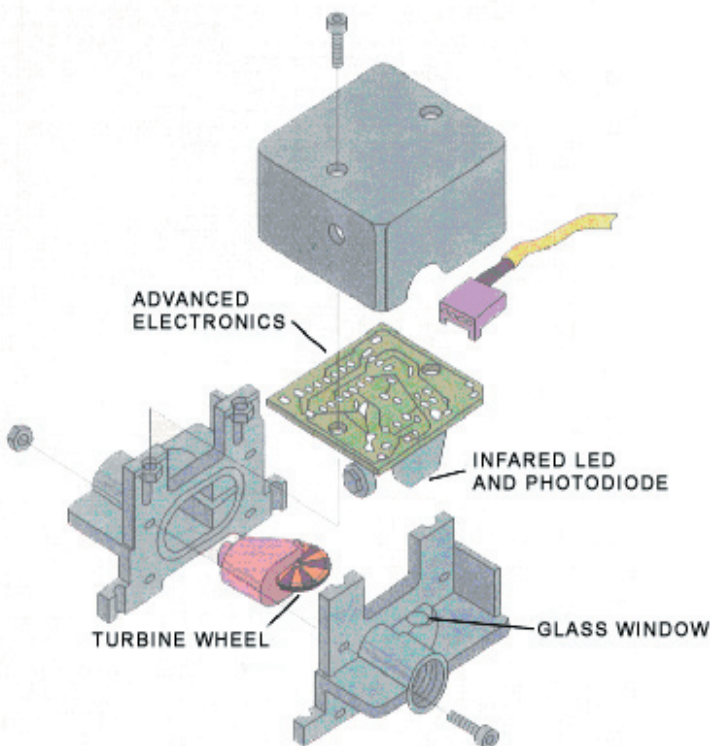
McMillan Model 501 FLO-SWITCHES® are capable of measuring extremely low liquid flow rates from 13 mLpm up to 10 Lpm with a full scale accuracy of $\pm 1.0\%$ or better!

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 501 FLO-SWITCHES are suitable for a wide variety of industrial, commercial, laboratory and O.E.M. applications. Some sample applications include high/low alarms for hydrocarbon fluids, fuels, light oils, solvents, coolant, pesticides, mild acids, alkalis, and deionized water. Either plastic or metal construction may be selected.

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-SWITCH, 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 solid-state relay outputs based on configuration and set points.



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

Choose from 12 VDC Power or 24 VDC Power.

RELAY OUTPUTS

All units may be ordered with either a normally closed (NC) or normally open (NO) solid state relay configuration. For NC units, contacts are closed below setpoint. For NO units, contacts are open below setpoint.

SET POINT ADJUSTMENT

Units may be ordered with a preset setpoint (set at the factory) or field-adjustable setpoints. Units with field adjustable setpoints may be adjusted using the integrated potentiometer. Units preset at the factory may not be adjusted in the field.

REPEATABILITY & HYSTERESIS

All models feature a standard $\pm 0.50\%$ F.S. repeatability specification. Switching hysteresis is $\pm 2.0\%$ or better.

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

All units provide an integrated cable terminated with pigtail leads.

WETTED MATERIALS

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

INDICATORS

Integrated LEDs provide basic flow rate and power indication.



Model 501

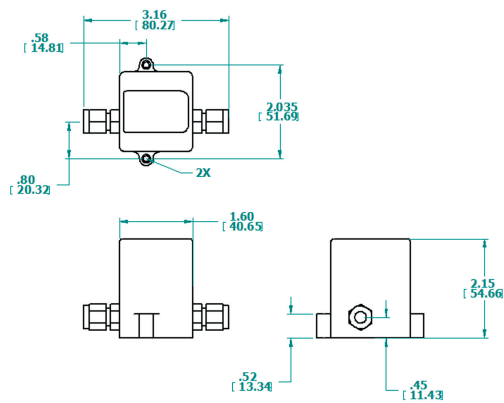


Model 501

SPECIFICATIONS

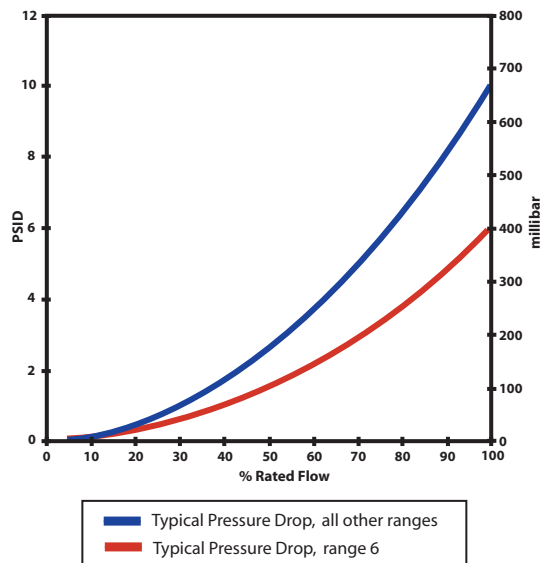
	Model 501
Accuracy (including linearity)	Standard: $\pm 1.0\%$ Full Scale
Repeatability	$\pm 0.5\%$ Full Scale
Switching Hysteresis	$\pm 2.0\%$ Full Scale
Pressure Rating	Ryton body: 100 psig (6.9 bar) Stainless steel body: 500 psig (34.5 bar)
Temperature Rating	Operating Range: 5 to 55°C Storage Range: 0 to 70°C
Temperature Sensitivity	$\pm 0.2\%$ F.S. or less per °C
Wetted Materials	Ryton® 316 Stainless Epoxy Glass Sapphire
O-Ring Material	Standard: Viton® "Q" Suffix: EPDM
Fitting Material	Acetal or stainless steel
Recommended Filtration	25 microns or less
Compatible liquids	Low viscosity (<10 cS) Translucent or Transparent Minimum amount of entrained air
Relay Output Type	Electronic FET switch Normally open or normally closed configuration
Relay Ratings (Maximum)	Voltage: 24 VDC Current: 250 mA
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	Standard: IP10 (NEMA 1) "Y" Suffix: IP67 (NEMA 6)

DIMENSIONS



Dimensions shown for Model 501 stainless steel unit with 1/4" stainless steel fittings (S4). Ryton model similar in dimensions.

PRESSURE DROP



ORDERING INFORMATION

Form part number: 501 - (Flow Range)(Body)(Relay Configuration) - (Fittings) - (Cable Length) - (Options).	Code
501 Liquid FLO-SWITCH®	501
Flow Range (mLpm of H ₂ O) 13-100 20-200 50-500 100-1,000 200-2,000 500-5,000 1,000-10,000	3 4 5 6 7 8 9
Body Material Ryton® Stainless Steel	R S
Relay Configuration Normally open below setpoint (NO) Normally closed below setpoint (NC)	O C
Fittings (see fitting chart for details) 1/8" Acetal Compression Tube 1/4" Acetal Compression Tube 3/8" Acetal 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 S2 S4 S6 M3 M6 M10 AB SB
Cable Length 1 foot (0.3 m) 3 feet (0.9 m) 6 feet (1.8 m) 12 feet (3.6 m) 25 feet (7.6 m)	C1 C3 C6 C12 C25
Options 24 VDC Power (12 VDC standard) Epoxy-Potted PC Board EPDM O-Rings (to replace standard Viton®) Factory preset setpoint (where "xxxx" is setpoint in mLpm)	E Y Q Fxxxx

EXAMPLES

#1: 501-3RO-A2-C6-F50 would provide a 501 FLO-SWITCH with Ryton construction. The working flow range would be 13-100 mLpm, and the normally open (NO) relay would close if flow rates exceed 50 mLpm (preset by the factory). 1/8" acetal compression tube fittings would be installed. The cable would be 6 feet (1.8m) long. 12VDC power would be required. Viton O-rings would be installed.

#2: 501-9SC-M10-C25-EYQ would provide a 501 FLO-SWITCH with stainless steel construction. The working flow range would be 1,000-10,000 mLpm, and the normally closed (NC) relay output would open if the flow rate exceeds the setpoint. The setpoint would be adjustable in the field by the user by turning the integrated potentiometer. 10 mm stainless steel compression fittings would be installed, and the cable length would be 25 feet (7.6 m). 24VDC power would be required. EPDM O-rings would be installed. The PC board would be epoxy coated to provide an IP67 rating.



FITTING CHART

501 (Ryton)

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

501 (stainless)

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

S=Standard; O=Optional.

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

Bulletin 501-S002

Specifications subject to change without notice.

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