



Mass Flow Meters For Gas Applications

Model 50 Series Thermal Mass FLO-SENSORS[®] & FLO-METERS[®]



STANDARD GAS

APPLICATION IDEAS

- Compressor or pump output monitoring
- Rotameter replacement or upgrade
- Verification of sample gas streams in analytical equipment
- Precision gas injection and dosing



PRODUCT DESCRIPTION

McMillan Model 50 Series Mass FLO-SENSORS® & FLO-METERS® are capable of measuring virtually any clean, dry gas as low as 0-20 sccm or as high as 0-500 Lpm! Repeatable results are achieved using a patented thermal mass flow sensor design. This proven design minimizes zero drift while maintaining fast response and linear outputs.

Because of the compact size and economical cost of these products, the Model 50 Series FLO-SENSORS & FLO-METERS are suitable for a wide variety of industrial, commercial, laboratory and O.E.M. applications.

PRINCIPLE OF OPERATION

Thermal mass flow meters feature fast response, virtually zero maintenance, and precise measurement. These are all very important qualities among today's variety of applications.

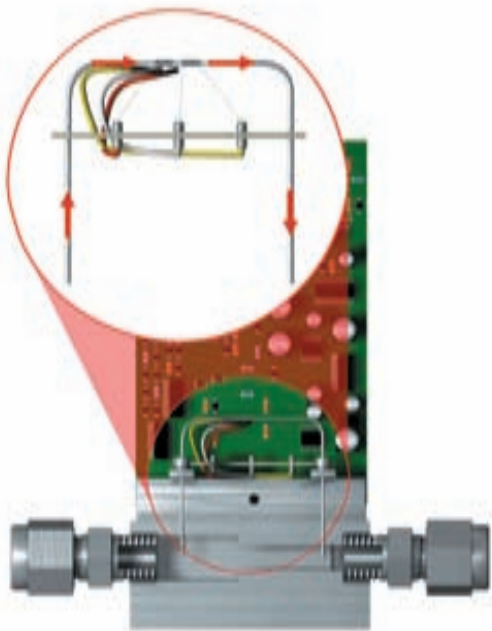


Figure 1. Cutaway of sensor technology.

The McMillan Company Model 50 Series Mass FLO-SENSORS & FLO-METERS utilize this thermal sensing technology. Flow enters the unit, and a portion of the flow is redirected into a small tube. This tube has two coils, one downstream from the other. The first coil introduces a small amount of heat into the gas stream. As the gas passes through the tube, the smart electronics sense the amount of heat transferred from one coil to the other. McMillan's patented* system insures that the zero remains stable and the sensor is extremely repeatable.

The output of the thermal mass flow sensor is directly related to the specific heat characteristic of the gas being measured. Therefore, if a unit is calibrated for air, it is a relatively simple calculation to figure the calibration for nitrogen or some other similar gas. This advantage offers flexibility not found on many other types of flow sensors.



*US Patents 6,038,921 & 6,240,776. Other patents pending.

FEATURES AND OPTIONS

FLOW RANGES

Flow ranges from 0-20 sccm up to 0-500 Lpm are available. Consult the factory for custom requirements.

POWER

Units may be ordered to operate with either 12 VDC or 24 VDC power. Various power adapters are available for use with 12 VDC versions.

SIGNAL INPUTS & OUTPUTS

All integrated output signals are 0-5 VDC. An external module may be ordered to provide 4-20 mA output in addition to the integrated 0-5 VDC output.

ACCURACY/LINEARITY

All models have a standard accuracy specification of $\pm 1.5\%$ F.S. accuracy (including linearity). NIST traceable calibration certificates are optional on all models.

FLUID CONNECTIONS

All units have compression-type tube fittings as standard. Consult Fitting Chart for available materials and sizes.

ELECTRICAL CONNECTIONS

All units have a 36" (92 cm) output cable, terminated with either a 9-pin "D" connector, 15-pin "D" connector, or 6-pin PS/2 style connector. An optional mating cable assembly, terminated with pigtail leads, is recommended to facilitate wiring.

WETTED MATERIALS

All units feature metal construction. See specifications for detailed materials in gas path. Units with S suffix feature stainless steel construction; other models constructed from aluminum.

DISPLAYS

For units with integrated displays, choose the D suffix. Units without integrated displays may be used with McMillan's line of external remote displays. Please request additional information from factory on remote displays available.

CALIBRATION GASES

Units may be calibrated for virtually any clean, dry gas. Several standard gas selections are available as indicated in Ordering Information. Contact factory for calibration information on non-standard gases.



50K & 50S FLO-SENSORS



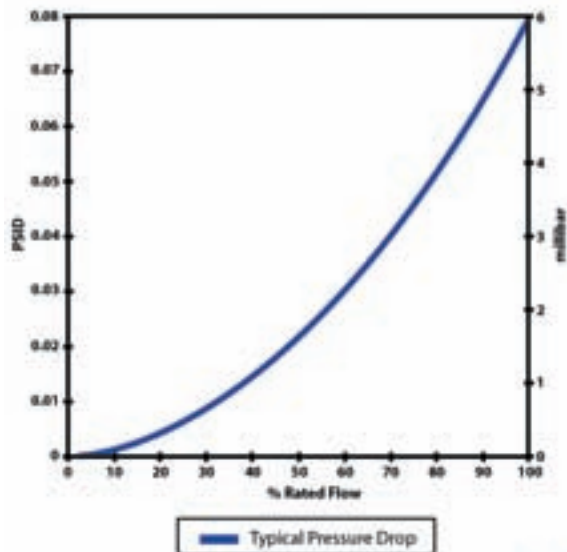
50D & 50SD FLO-METERS

SPECIFICATIONS

	Model 50K	Model 50D	Model 50S	Model 50SD
Accuracy (including linearity)	±1.5% Full Scale*			
Repeatability	±0.25% Full Scale*			
Pressure Rating	150 psig (10.3 bar)		500 psig (34.5 bar)	
Pressure Sensitivity	±0.02% Full Scale* per psi (per 69 mbar)			
Temperature Rating	Operating Range: 5 to 55°C Storage Range: 0 to 70°C			
Temperature Sensitivity	±0.15% F.S.* or less per °C			
Body Leak Integrity (not including fittings)	1 x 10 ⁻⁷ sccs of He			
Wetted Materials	Aluminum 304 Stainless Steel 316 Stainless Steel		303 Stainless Steel 304 Stainless Steel 316 Stainless Steel Epoxy	
O-Ring Material	Viton®		n/a	
Fitting Material	Choose from acetal, brass, or stainless steel			
Recommended Filtration	20 microns or less Optional inline filters available			
Compatible gases	Clean, dry gases compatible with wetted materials			
0-5 VDC Output Signal	Minimum 2.5 Kohm load			
Warm-Up Time	Less than 5 minutes			
Integrated Display	n/a	3½ digit flow rate	n/a	3½ digit flow rate
Typical Power Consumption	Standard: 12 VDC @ 150 mA (12.5-15 VDC) "E" Suffix: 24 VDC @ 80 mA (22-25 VDC)			
Peak Power Consumption	Standard: 12 VDC @ 300 mA (12.5-15 VDC) "E" Suffix: 24 VDC @ 160 mA (22-25 VDC)			
Electrical Connections	Integrated 36" (92 cm) cable, terminated with: Standard: 6-pin Mini-DIN (PS/2 Style) D1 Option: 9-pin D-Sub male D2 Option: 15-pin D-Sub male			
Settling Time	Typically <1 second for 97% of final value			
Reliability	100,000 Hours MTBF (testing ongoing)			

*Specifications from 10-100% of rated flow. Linearity is best fit straight line. All calibrations performed with air unless otherwise stated on calibration certificate

PRESSURE DROP



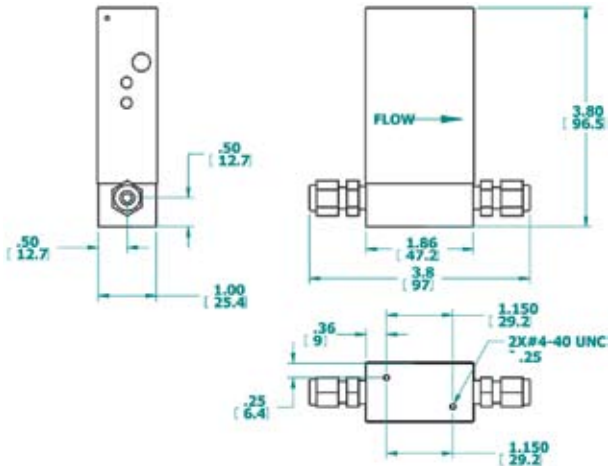
ORDERING INFORMATION

Form part number: (Model Code) - (Flow Range) - (Power) - (Fittings) - (Connector) - (Gas) - (Options). For standard options, no specification is necessary.	Code
50K Aluminum Mass FLO-SENSOR® 50D Aluminum Mass FLO-METER® with integrated display 50S Stainless Steel Mass FLO-SENSOR® 50SD Stainless Steel Mass FLO-METER® with integrated display	50 50D 50S 50SD
Flow Range (sccm of air) 0-50 0-100 0-200 0-500 0-1000 0-2000 0-5000	3 4 5 6 7 8 9
Flow Range (Lpm of air) 0-10 0-20 0-50 0-100 0-200 0-500	10 11 12 13 14 15
Power 12.5-15.0 VDC 22.0-25.0 VDC	Standard E
Fittings (see Fitting Chart for available sizes based on flow range) 1/8" acetal 1/4" acetal 3/8" acetal 1/8" brass 1/4" brass 3/8" brass 1/8" stainless steel 1/4" stainless steel 3/8" stainless steel 1/2" stainless steel 3/4" stainless steel 3 mm stainless steel 6 mm stainless steel 8 mm stainless steel 12 mm stainless steel 1/4" VCR (utilizing 1/8" NPT threaded ports) 1/4" acetal barb (25 psig max) 1/4" stainless steel barb (25 psig max)	A2 A4 A6 B2 B4 B6 S2 S4 S6 S7 S8 M3 M6 M8 M12 V4 AB SB
Connector 6-pin Mini-DIN (PS/2 type) 9-pin D-Sub 15-pin D-Sub	Standard D1 D2
Gas Air Nitrogen Oxygen Hydrogen Helium Argon CO2 Other Single Gas (specify in item description) Other Gas Blend (specify gases and percentages in item description)	Standard G1 G2 G3 G4 G5 G6 G7 G8
Options NIST-Traceable Calibration Certificate	NIST
ACCESSORIES: Cables and Power Adapters (Order Separately, Required For Operation) 6-pin Mating Cable with Pigtail Leads, 36" (92 cm) length, VDC Power Required 9-pin Mating Cable with Pigtail Leads, 36" (92 cm) length, VDC Power Required 15-pin Mating Cable with Pigtail Leads, 36" (92 cm) length, VDC Power Required 0-5 VDC Output 115VAC Power Adapter Package, Not for E Models, Requires Standard 6-pin Mini-DIN Connector 0-5 VDC Output 230VAC Power Adapter Package, Not for E Models, Requires Standard 6-pin Mini-DIN Connector 4-20 mA Output Module, 24 VDC Power, Not for E Models, Requires Standard 6-pin Mini-DIN Connector 4-20 mA Output 115VAC Power Adapter Package, Not for E Models, Requires Standard 6-pin Mini-DIN Connector 4-20 mA Output 230VAC Power Adapter Package, Not for E Models, Requires Standard 6-pin Mini-DIN Connector	50-C-X 50-C-X1 50-C-X2 A-115VAC A-230VAC 50-20-H B-115VAC B-230VAC
ACCESSORIES: Displays (Order Separately, More Information Available) 210R Rate Display, 3½ digit, 5-30 VDC Power 250 Multi-Function Display, 115 VAC Power 250E Multi-Function Display, 230 VAC Power	210R 250 250E
ACCESSORIES: Filters (Order Separately) Aluminum Filter, Screws into Inlet Port (Ranges 3-8) Aluminum Filter, Screws into Inlet Port (Ranges 9-10)	90 91

FITTING CHART

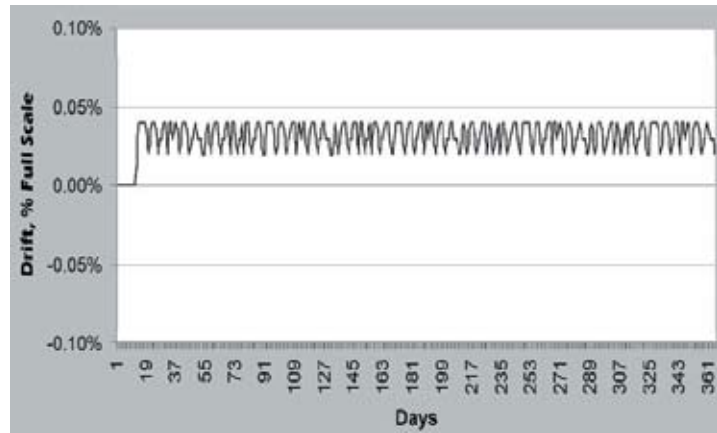
RANGE	A2	A4	A6	B2	B4	B6	S2	S4	S6	S7	S8	M3	M6	M8	M12	V4	AB	SB
3 (0-50 sccm)	✓	✓		✓	✓		✓	✓				✓				✓	✓	✓
4 (0-100 sccm)	✓	✓		✓	✓		✓	✓				✓				✓	✓	✓
5 (0-200 sccm)	✓	✓		✓	✓		✓	✓				✓				✓	✓	✓
6 (0-500 sccm)	✓	✓		✓	✓		✓	✓				✓	✓			✓	✓	✓
7 (0-1000 sccm)		✓	✓		✓	✓		✓	✓				✓			✓	✓	✓
8 (0-2000 sccm)		✓	✓		✓	✓		✓	✓				✓			✓	✓	✓
9 (0-5000 sccm)		✓	✓		✓	✓		✓	✓				✓			✓		
10 (0-10000 sccm)			✓			✓			✓				✓					
11 (0-20 Lpm)										✓	✓			✓				
12 (0-50 Lpm)										✓	✓			✓	✓			
13 (0-100 Lpm)										✓	✓				✓			
14 (0-200 Lpm)										✓	✓				✓			
15 (0-500 Lpm)										✓	✓				✓			

DIMENSIONS



Dimensions shown for Model 50S unit with 1/4" stainless steel (S4) fittings and are similar for other models. Specific model dimensional drawings may be requested from the factory.

ZERO STABILITY



Tests run on a new, randomly chosen McMillan thermal mass FLO-METER. Temperature controlled at 22°C (±2°C) during testing.



Viton – Reg TM E.I. DuPont Dow Elastomers LLC
FLO-SENSOR & FLO-METER – Reg TM McMillan Company

Bulletin 50-S003

Specifications subject to change without notice.

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