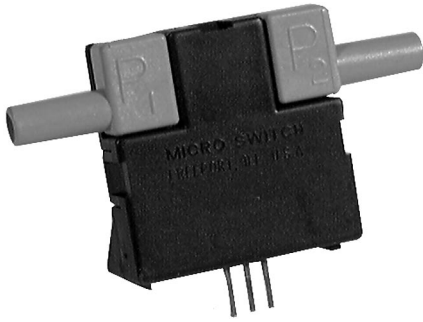


Airflow Sensors

Microbridge Mass Airflow/Amplified

AWM3000 Series



FEATURES

- Laser trimmed for improved sensor interchangeability
- Flow sensing up to 1.0 SLPM
- Low differential pressure sensing

Like the AWM2000 Series, the dual Wheatstone bridges control airflow measurement. The AWM3000 Series is amplified; therefore, it can be used to increase the gain and to introduce voltage offsets to the sensor output. The schematic in Figure 3 depicts the amplification circuitry on board the sensor. Also, the heater control circuit (see Figure 1) and the sensing bridge supply circuit (see Figure 2) are on board the package.

Figure 1
Heater control circuit

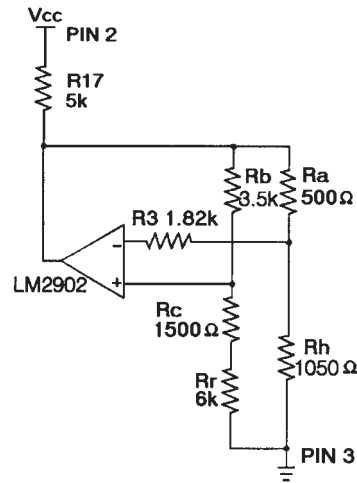


Figure 2
Sensing bridge supply circuit

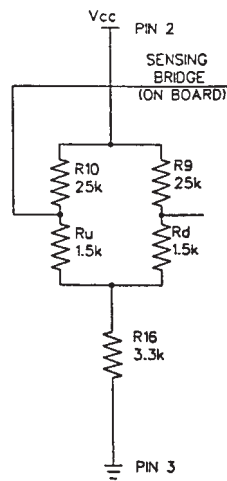
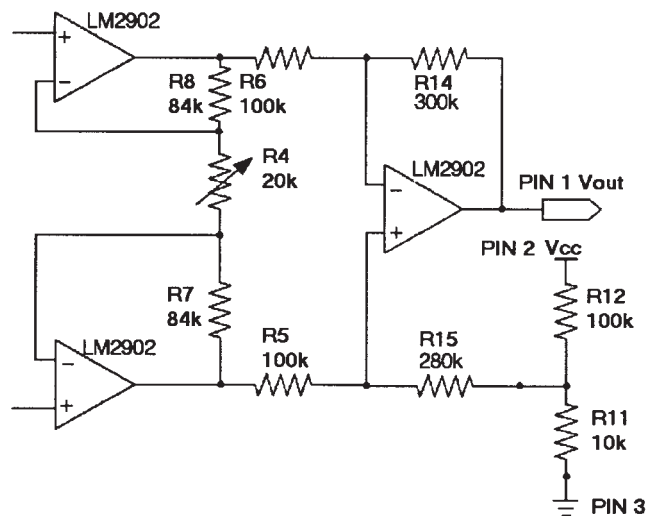


Figure 3
Differential instrumentation amplifier circuit



Airflow

Airflow Sensors

Microbridge Mass Airflow/Amplified

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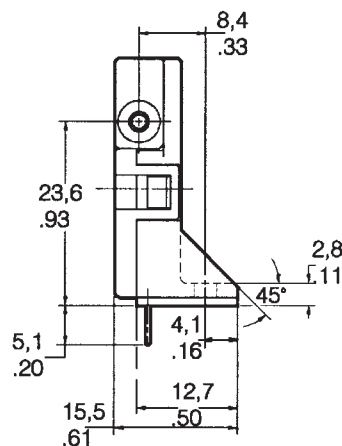
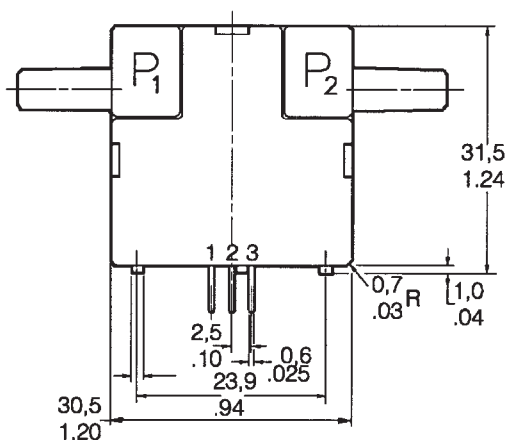
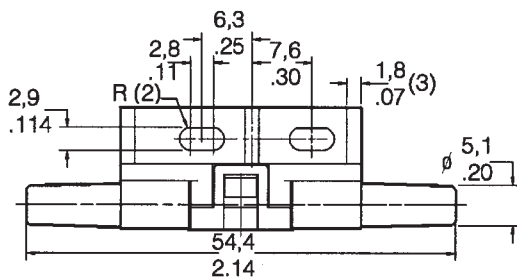
AWM3000 SERIES ORDER GUIDE (Performance Characteristics @ 10.01 ±0.01 VDC, 25°C)

Catalog Listings	AWM3100V	AWM3150V	AWM3200V	AWM3300V
Flow Range (Full Scale)	+200 sccm	+30 sccm		+1000 sccm
Pressure Range (See Application Note 1)			+2.0" H ₂ O (5 mBar)	
Output Voltage @ Trim Point	5 VDC @ 200 sccm	3.4 VDC @ 25 sccm	5 VDC @ 2" H ₂ O	5 VDC @ 1000 sccm
Null Voltage	1.00 ±0.05 VDC	1.00 ±0.10 VDC	1.00 ±0.08 VDC	1.00 ±0.10 VDC
Null Voltage Shift, Typ. +25° to -25°C, 25° to +85°C	±25 mV	±100 mV	±25 mV	±25 mV
Output Voltage Shift, Max. +25° to -25°C +25° to +85°C	-4% Reading +4% Reading	±5% Reading ±5% Reading	+24% Reading (Note 3) -24% Reading	-5% Reading +5% Reading
Repeatability & Hysteresis, Max.	±0.50% Reading	±1% Reading	±0.50% Reading	±1% Reading
	Min.	Typ.	Max.	
Excitation VDC (Note 2)	8.0	10±0.01	15	
Power Consumption (mW)	—	50	60	
Response Time (msec) (Note 1)	—	1.0	3.0	
Common Mode Pressure (psi)	—	—	25	
Temperature Range	Operating: -25° to +85°C (-13° to +185°F); Storage: -40° to +90°C (-40° to +194°F)			
Termination	2,54 mm (.100") centers, 0,635 mm (0.025") square			
Weight (grams)	10.8			
Shock Rating	100 g peak (5 drops, 6 axes)			

Notes:

1. Initial warm-up time for signal conditioned circuitry is 1 minute max.
2. Output Voltage is ratiometric to supply voltage.
3. Temperature shifts when sensing differential pressure correlates to the density change of the gas over temperature. (See Application Note 1.)
4. Maximum allowable rate of flow change to prevent damage: 5 SLPM/1 sec.

MOUNTING DIMENSIONS (for reference only)



Note: Positive flow direction is defined as proceeding from Port 1 (P1) to Port 2 (P2) and results in positive output. Do not exert a force greater than 4.54kg (10 lbs.) in any direction.

Airflow Sensors

Microbridge Mass Airflow/Amplified

AWM3000 Series

OUTPUT FLOW VS INTERCHANGEABILITY (Note 1)

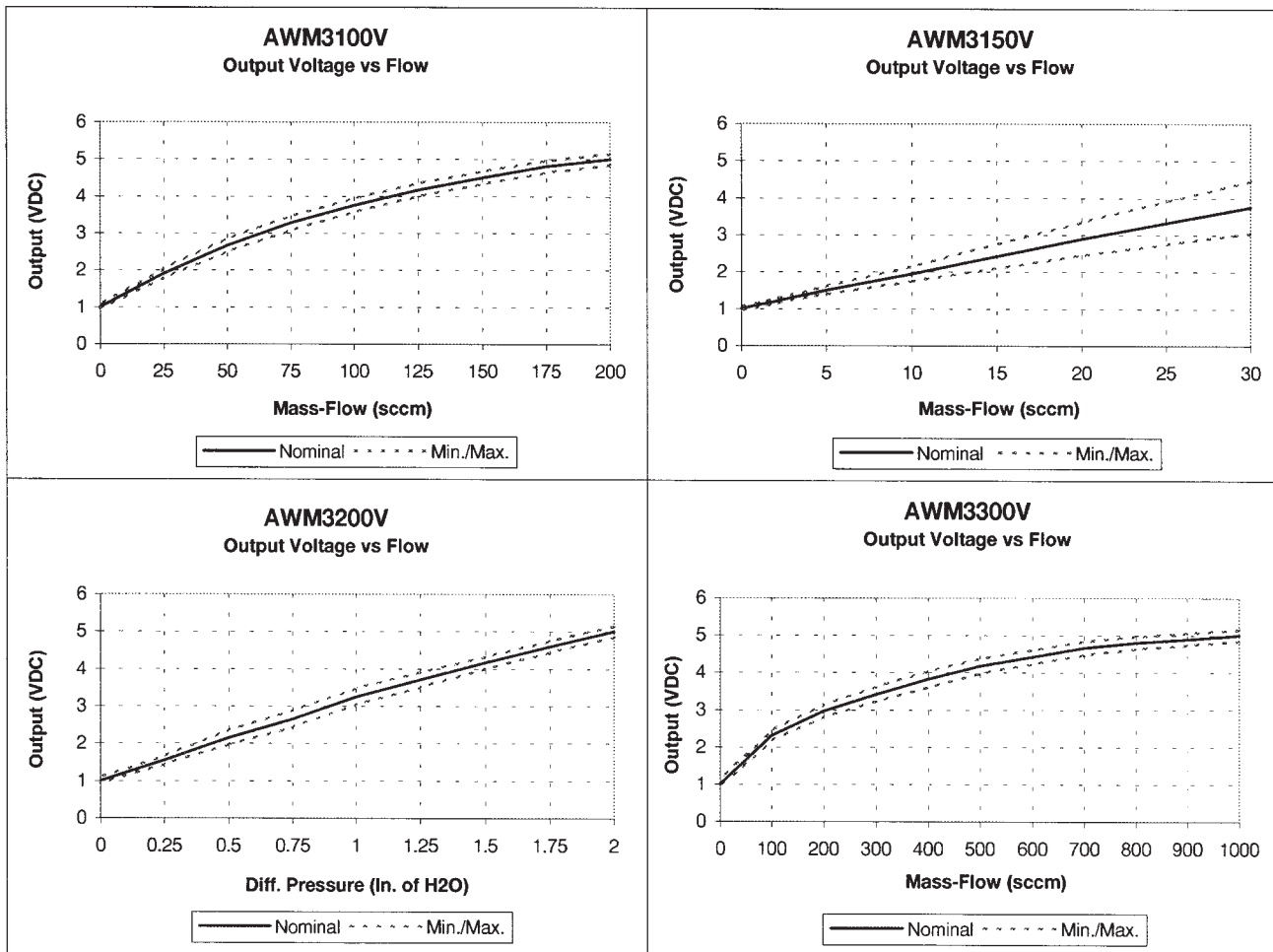
Performance Characteristics @ 10.0 ±0.01 VDC, 25 C

AWM3100V				AWM3150V				AWM3200V (Note 2)				AWM3300V			
Press. mBar	Flow sccm	Nom. VDC	Tol. ± VDC	Press. mBar	Flow sccm	Nom. VDC	Tol. ± VDC	Flow sccm	Press. " H ₂ O	Nom. VDC	Tol. ± VDC	Press. mBar	Flow sccm	Nom. VDC	Tol. ± VDC
0.49	200	5.00	0.15	2.50	30	3.75	0.70	60.0	2.00	5.00	0.15	3.40	1000	5.00	0.15
0.42	175	4.80	0.16	1.70	20	2.90	0.45	53.0	1.75	4.59	0.15	2.90	900	4.90	0.16
0.35	150	4.50	0.17	0.84	10	1.95	0.20	46.0	1.50	4.16	0.16	2.40	800	4.80	0.17
0.28	125	4.17	0.18	0.42	5	1.50	0.10	38.0	1.25	3.70	0.20	2.00	700	4.66	0.18
0.21	100	3.75	0.19	0.34	4	1.40	0.08	30.0	1.00	3.25	0.22	1.60	600	4.42	0.19
0.14	75	3.27	0.19	0.26	3	1.30	0.08	23.0	0.75	2.65	0.22	1.20	500	4.18	0.20
0.09	50	2.67	0.17	0.17	2	1.20	0.07	16.0	0.50	2.15	0.19	0.80	400	3.82	0.21
0.04	20	1.90	0.13	0.08	1	1.10	0.06	8.0	0.25	1.55	0.11	0.54	300	3.41	0.19
0.00	0	1.00	0.05	0.00	0	1.00	0.05	0.0	0.00	1.00	0.08	0.31	200	2.96	0.17
												0.12	100	2.30	0.14
												0.00	0	1.00	0.10

Notes:

- Numbers in **BOLD** type indicate calibration type, mass flow or differential pressure. Tolerance values apply to calibration type only.
- Differential pressure calibrated devices are not recommended for flow measurement. Use flow calibrated devices for flow measurement.

OUTPUT CURVES

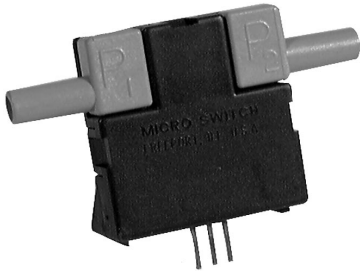


Airflow

Airflow Sensors

Microbridge Mass Airflow

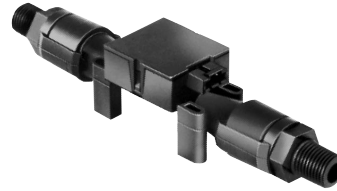
AWM Series



AWM 1000/2000/3000 Series



AWM 40000 Series



AWM 5000 Series

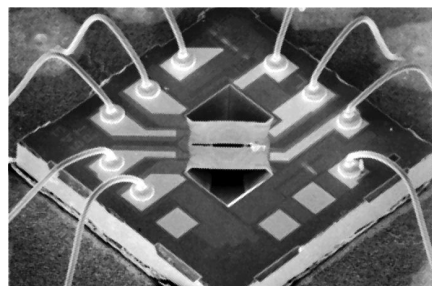
FEATURES

- State-of-the-art silicon micromachining
- Sensitive to low flows – 0.1 sccm to 20 SLPM
- Adaptable for use with higher flows (See Application Note 2 page 128.)
- Fast response time
- Analog output
- Low power consumption

OPERATION

The microbridge mass airflow sensor operates on the theory of heat transfer. Mass airflow is directed across the surface of the sensing elements. Output voltage varies in proportion to the mass air or other gas flow through the inlet and outlet ports of the package. The specially designed housing precisely directs and controls the airflow across the microstructure sense element. Mechanical design of the package allows it to be easily mounted to printed circuit boards.

The microbridge mass airflow sensor has a unique silicon chip based on advanced microstructure technology. It consists of a thin-film, thermally isolated bridge structure containing heater and temperature sensing elements. The bridge structure provides a sensitive and fast response to the flow of air or other gas over the chip. Dual sensing elements positioned on both sides of a central heating element indicate flow direction as well as flow rate. Laser trimmed thick film and thin film resistors provide consistent interchangeability from one device to the next.



- Repeatable response
- Laser-trimmed interchangeability
- Accurate, cost effective flow sensing
- In-line printed circuit board terminals
- Standard 0.100" (2,54mm) mounting centers
- Accurate sensing of low pressure 0.001" to 4.0" H₂O (.003 to 10mBar)

The microbridge mass airflow sensor uses temperature-sensitive resistors deposited within a thin film of silicon nitride. They are suspended in the form of two bridges over an etched cavity in the silicon, shown below. The chip is located in a precisely dimensioned airflow channel to provide a repeatable flow response. Highly effective thermal isolation for the heater and sensing resistors is attained by etching the cavity space beneath the flow sensor bridges. The small size and thermal isolation of the microbridge mass airflow sensor are responsible for the extremely fast response and high sensitivity to flows.

Dual Wheatstone bridges control airflow measurement — one provides closed loop heater control, the other contains the dual sensing elements. The heater circuit minimizes shift due to ambient temperature changes by providing an output proportional to mass flow. The circuit keeps the heater temperature at a constant differential (160°C) above ambient air temperature which is sensed by a heat-sunk resistor on the chip. The ratio-metric voltage output of the device corresponds to the differential voltage across the Wheatstone bridge circuit.

APPLICATIONS

- Damper control for heating, ventilation, and air conditioning systems
- Gas analyzers
- Low vacuum control
- Process control
- Medical respirators and ventilators
- Oxygen concentrators
- Leak detection equipment
- Vent hoods
- Anesthesia control
- Gas metering
- Gas chromatography

NOTICE

Dust contamination may be possible in some applications, the effects of which can be minimized. By design, dust particles that may be present in the air stream will flow past the chip parallel to the chip surface. In addition, the microstructure chip produces a thermophoretic effect, which repels micrometer-sized dust particles away from the bridge structure.

Dust adherence to chip edges and channel surfaces can be prevented using a simple filter. A disposable five-micron filter used in series on the upstream side of the airflow device will provide adequate filtering in most applications. For a list of possible filter sources, see Filter Manufacturers, page 126.

CAUTION

PRODUCT DAMAGE

AWM Series Microbridge Mass Airflow Sensors are **NOT** designed to sense liquid flow and will be damaged by liquid flow through the sensor.