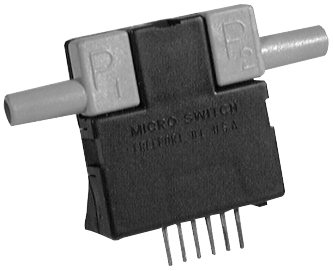
Microbridge Mass Airflow/Unamplified



FEATURES
- Bidirectional sensing capability
- Actual mass air flow sensing
- Low differential pressure sensing

The AWM2000 Series microbridge mass airflow sensor is a passive device comprised of two Wheatstone bridges. The heater control circuit in Figure 1 is required for operation per specifications. The sensing bridge supply circuit in Figure 2 is also required for operation per specifications. These two circuits are **not on board** the package and must be supplied in the application. The differential amplifier in Figure 3 is a useful interface for the sensing bridge. It can be used to introduce the gain and to introduce voltage offsets to the sensor output as referenced in Equation 1.

Note: For applications sensing hydrogen or helium, see Application Note 3, page 131.

Figure 1
Heater Control Circuit

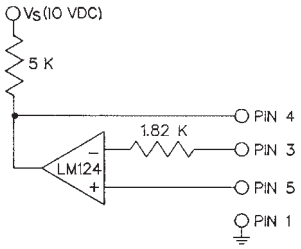


Figure 2
Sensing Bridge Supply Circuit

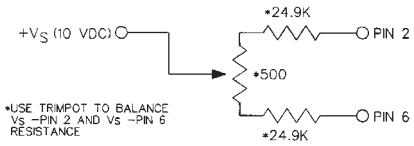
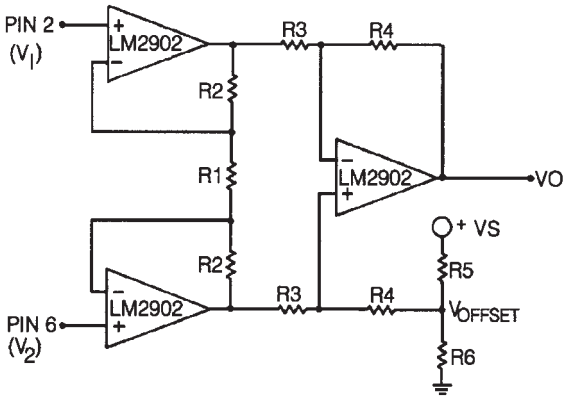


Figure 3
Differential Instrumentation Amplifier Circuit



Equation 1:

$$V_o = \left(\frac{2R_2+R_1}{R_1}\right)\left(\frac{R_4}{R_3}\right)\left(V_2-V_1\right)+V\ \text{offset}$$

$$\text{where } V\ \text{offset} = V_s\left(\frac{R_6}{R_6+R_5}\right)$$

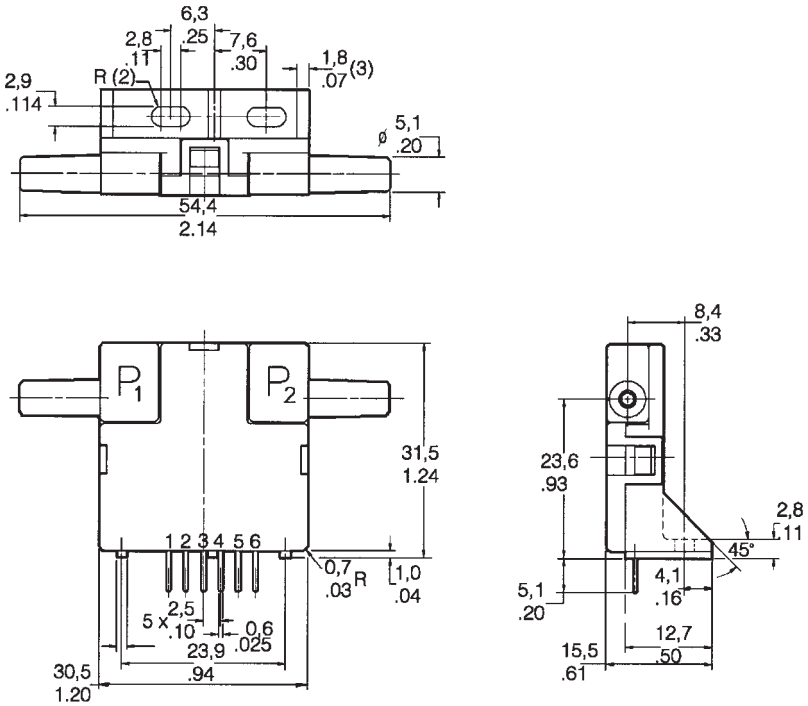
Microbridge Mass Airflow/Unamplified

AWM2000 SERIES ORDER GUIDE (Performance Characteristics @ 10.01 ±0.01 VDC, 25°C)

Catalog Listings	AWM2100V	AWM2150V	AWM2200V	AWM2300V
Flow Range (Full Scale)	±200 sccm	±30 sccm		±1000 sccm
Pressure Range (See Application Note #1)			±4.0″ H_2O (10 mBar)	
Output Voltage @ Trim Point	30 mV @ 100 sccm	11.8 mV @ 25 sccm	20 mV @ 2″ H_2O	50 mV @ 650 sccm
Null Voltage Shift, Typ. +25° to −25°C, +25° to 85°C	±0.20 mV	±0.20 mV	±0.20 mV	±0.20 mV
Output Voltage Shift, Max. +25° to −25°C +25° to +85°C	+2.5% Reading −2.5% Reading	+5% Reading −5% Reading	+22% Reading (Note 2) −22% Reading	+5% Reading −5% Reading
Repeatability & Hysteresis, Max.	±0.35% Reading	±0.35% Reading	±0.35% Reading	±1% Reading
	Min.	**Typ.**	**Max.**	
Excitation (VDC) (Note 1)	8.0	10±0.01	15	
Power Consumption (mW)	—	30	50	
Null Voltage (mV)	−1.0	0.0	+1.0	
Response Time (msec)	—	1.0	3.0	
Common Mode Pressure (psi)	—	—	25	
Sensor Resistance (kΩ) Pin 2-Pin 1, Pin 6-Pin 1	—	5	—	
Sensor Current (mA) Pin 2-Pin 1, Pin 6-Pin 1	—	—	0.6	
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. Output Voltage is ratiometric to supply voltage.
2. Temperature shifts when sensing differential pressure correlates to the density change of the gas over temperature. See Application Note 1.
3. Maximum allowable rate of flow change to prevent damage: 5.0 SLPM/1.0 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 (Pin 6 > Pin 2). Negative flow direction is defined conversely and results in negative output (Pin 6 < Pin 2). Do not exert a force greater than 4.54 kg (10 lbs.) in any direction.

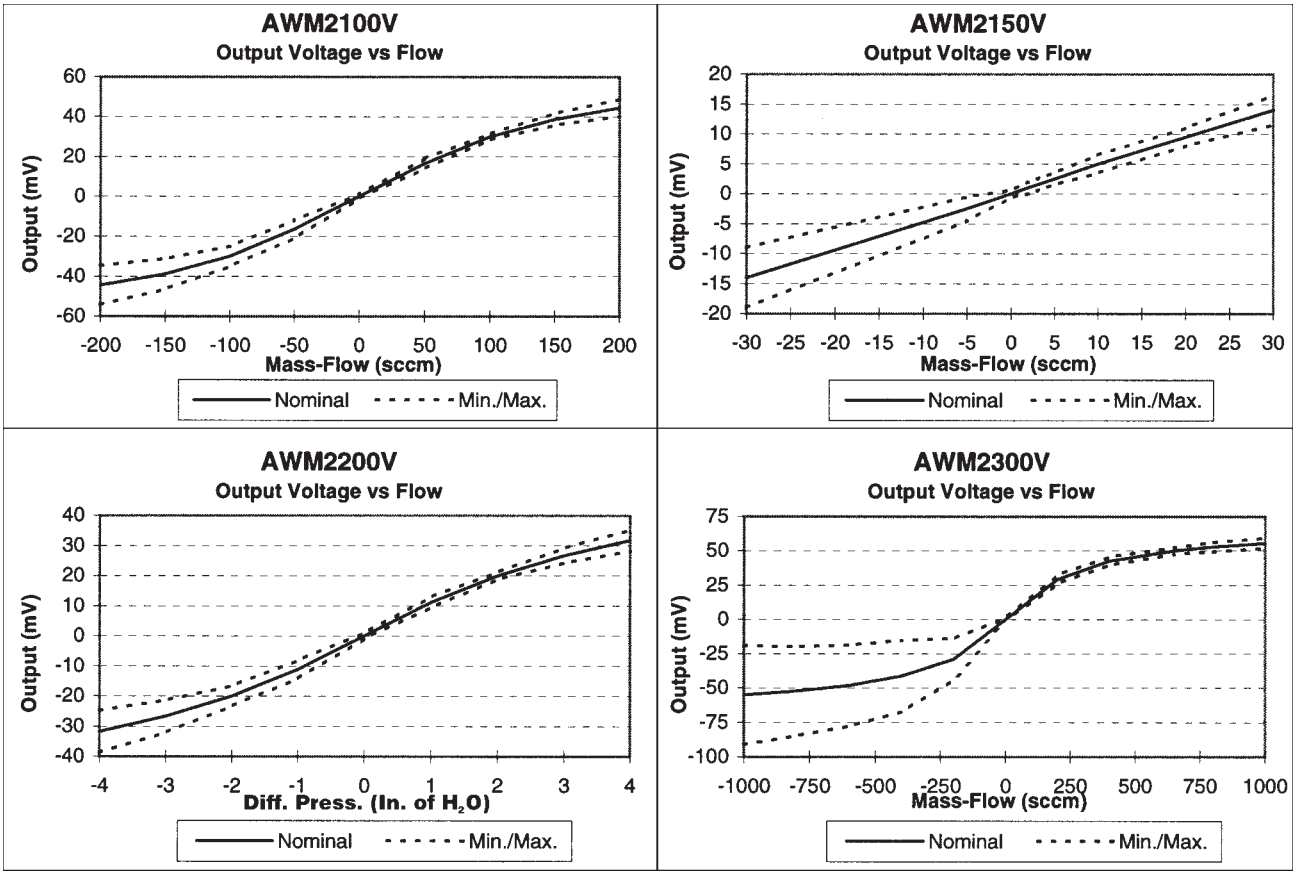
Microbridge Mass Airflow/Unamplified

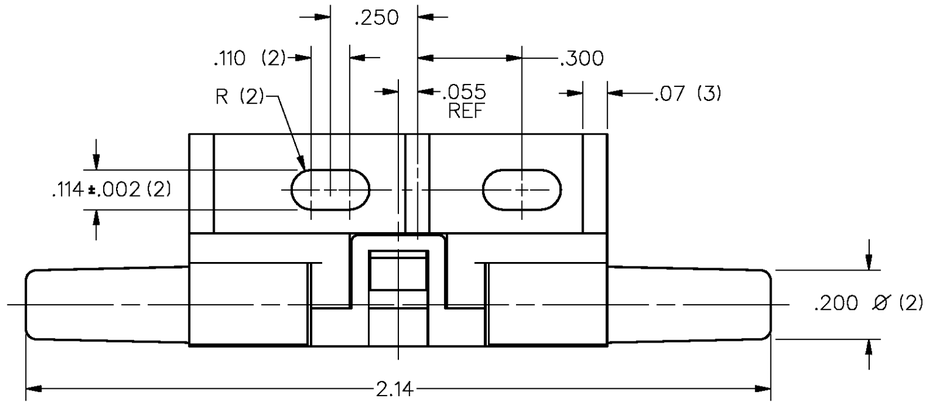
OUTPUT FLOW VS INTERCHANGEABILITY (Note 1) **Performance Characteristics @ 10.0 ±0.01 VDC, 25°C**

AWM2100V				AWM2150V				AWM2200V (Note 2)				AWM2300V			
Press. mBar	**Flow sccm**	**Nom. mV**	**Tol. ±mV**	Press. µBar	**Flow sccm**	**Nom. mV**	**Tol. ±mV**	Flow sccm	**Press. ″ H_2O**	**Nom. mV**	**Tol. ±mV**	Press. mBar	**Flow sccm**	**Nom. mV**	**Tol. ±mV**
0.49	**200**	44.50	4.25	53	**30**	14.0	2.5	120	**4.00**	31.75	3.50	3.4	**1000**	55.50	3.70
0.35	**150**	38.75	3.00	36	**20**	9.5	1.5	90	**3.00**	26.75	2.50	2.4	**800**	52.90	3.50
0.21	**100**	30.00	1.50	17	**10**	5.0	1.5	60	**2.00**	20.00	1.20	1.8	**650**	50.00	2.50
0.09	**50**	16.50	2.50	9.8	**5**	2.5	1.0	30	**1.00**	11.20	1.80	0.83	**400**	42.50	3.00
0.00	**0**	0.00	1.00	7.4	**4**	2.0	1.0	0	**0.00**	0.00	1.00	0.31	**200**	29.20	3.20
−0.09	**−50**	−16.50	4.50	6.2	**3**	1.5	1.0	−30	**−1.00**	−11.20	3.00	0	**0**	0.00	1.00
−0.21	**−100**	−30.00	5.00	5	**2**	1.0	1.0	−60	**−2.00**	−20.00	3.30	−0.31	**−200**	−28.90	15.00
−0.35	**−150**	−38.80	7.65	2.5	**1**	0.5	0.8	−90	**−3.00**	−26.75	5.30	−0.83	**−400**	−41.20	26.00
−0.49	**−200**	−44.50	9.75	0	**0**	0.0	0.6	−120	**−4.00**	−31.75	7.00	−1.6	**−600**	−48.20	29.50
				−9.8	**−5**	−2.5	2.0					−2.4	**−800**	−52.20	32.50
				−53	**−30**	−14.0	5.0					−3.4	**−1000**	−55.00	36.00

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

OUTPUT CURVES



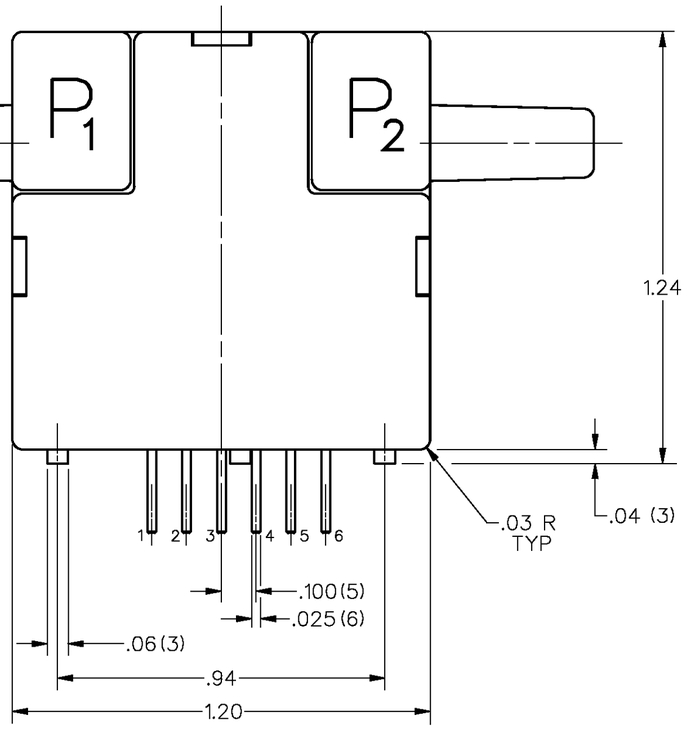


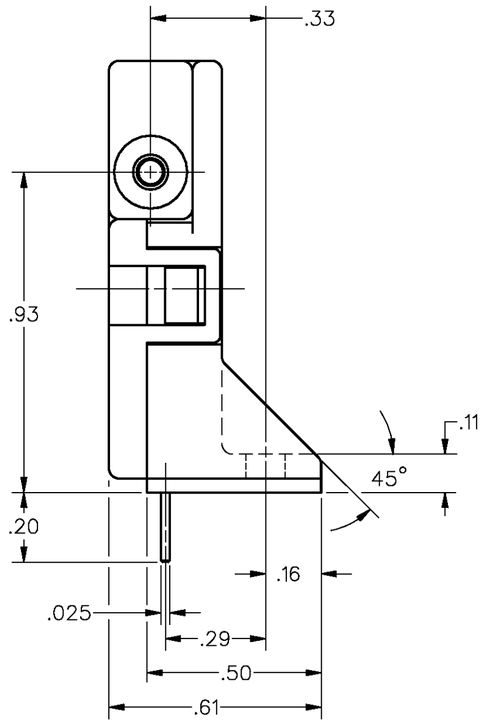
SPECIFICATIONS:	AWM2300V
RECOMMENDED EXCITATION (USING TEST CIRCUIT) **8VDC MIN**	10.00±.01VDC (15.00 VDC MAX)
POWER CONSUMPTION	30mW TYP
OUTPUT VOLTAGE TRIM POINT	50mV @ 650 sccm
NULL VOLTAGE	0.0±1.0mV
NULL VOLTAGE SHIFT (−25°C TO +85°C)	±.14mV **TYP**
OUTPUT VOLTAGE SHIFT (+25°C TO −25°C) (+25°C TO +85°C)	+5% READING MAX −5% READING MAX
REPEATABILITY & HYSTERESIS	±1.0% READING MAX
RESPONSE TIME	3.0 msec MAX
OPERATING TEMPERATURE RANGE	−25°C TO +85°C
STORAGE TEMPERATURE RANGE	−40°C TO +90°C
TERMINATION (ON .100 CENTERS)	0.025 SQ. IN.
WEIGHT	10.8 GRAMS
SHOCK RATING (5 DROPS, EACH OF 6 AXES)	100G PEAK
OVERPRESSURE	25 psi MAX
SENSOR RESISTANCE (PIN 2−PIN 1, PIN 6−PIN 1)	5 K−OHMS (TYP)
SENSOR CURRENT (PIN 2−PIN 1, PIN 6−PIN 1)	0.6 mA (MAX)

AWM2300V
OUTPUT FLOW VS. INTERCHANGEABILITY

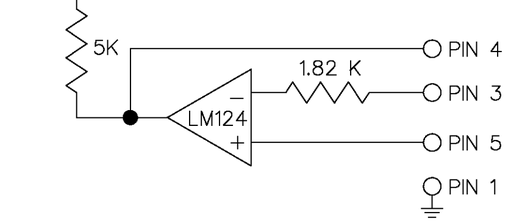
FLOW sccm	NOMINAL (mV)	TOL. (±mV)
1000	55.50	3.70
800	52.90	3.5
650	50.00	2.50
400	40.50	3.00
200	29.20	3.20
0	0.00	1.0
−200	−28.90	15.00
−400	−41.20	26.00
−600	−48.20	29.50
−800	−52.50	32.50
−1000	−55.00	36.00

NOTES
1 − POSITIVE FLOW DIRECTION IS DEFINED AS PROCEEDING FROM P1 TO P2 AND RESULTS IN POSITIVE OUTPUT (PIN 6 > PIN 2). NEGATIVE FLOW DIRECTION IS DEFINED CONVERSELY AND RESULTS IN NEGATIVE OUTPUT (PIN 6 < PIN 2)
2 − LASER TRIMMED FOR 50.00mV AT 650 Sccm

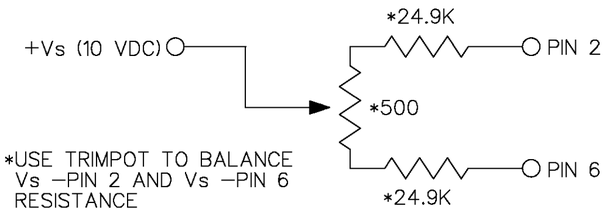




HEATER CONTROL CIRCUIT



SENSING BRIDGE SUPPLY CIRCUIT



*USE TRIMPOT TO BALANCE Vs −PIN 2 AND Vs −PIN 6 RESISTANCE

DRAWING NUMBER AWM2300V
ISSUE 7 M PAGE 1 OF 1
RELEASE NO. PR−17967 REPLACES X87416−AW
RASTER DRAWN J A S 12 OCT 88 CHECK J A S 11 JAN 90 CHECK

REVISIONS

A	PR17967	K A G 9 JAN 90	
B	C074438	J A F 6 JUL 93	
C	C083279	G J W 9 SEP 96	
D	C083694	J A K 29 APR 97	CHECK
E	C094375	TSM 23 MAR 99	
F	201366	C S L 22 SEP 00	

MASTER REDUCED

MICRO SWITCH a Honeywell Division
FED. MFG. CODE 81829

MASS AIRFLOW SENSOR (1000 Sccm)

CATALOG LISTING
AWM2300V

THIRD ANGLE PROJECTION
SCALE 3 : 1
DO NOT SCALE PRINT

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE

ONE PLACE	(.0)	±.030
TWO PLACES	(.00)	±.015
THREE PLACES	(.000)	±.005
ANGLES		±

WEIGHT

Installation Instructions for the **AWM2000 Series**

ISSUE 3
PK 88544

⚠WARNING
PERSONAL INJURY
DO NOT USE these products as safety or emergency stop devices or in any other application where failure of the product could result in personal injury.
Failure to comply with these instructions could result in death or serious injury.

GENERAL INFORMATION

The AWM2000 Series Microbridge Mass Airflow Sensor is a passive device consisting of two Wheatstone bridges: one for closed loop heater control and one for the twin sensing elements. The heater control in Figure 1 is required for operation per specification. The sensing bridge supply circuit in Figure 2 is also required. The differential instrumentation amplifier in Figure 3 can be used to increase gain and introduce voltage offsets to sensor output.

MEDIA CONTAMINATION

Dust has the effect of clogging the porous metal flow restrictor (AWM2200V only). Dust accumulation causes the pressure drop across the sensor to increase for any given flow rate.

Clogging can be prevented by use of an inexpensive 5 micron filter upstream of the sensing element.

Figure 1. Heater Control Circuit

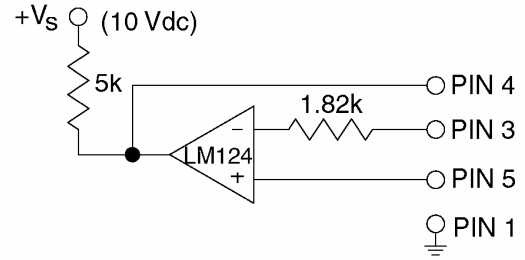


Figure 2. Sensing Bridge Supply Circuit

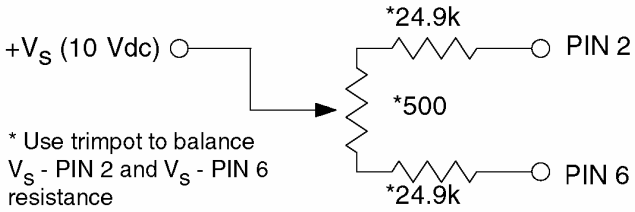
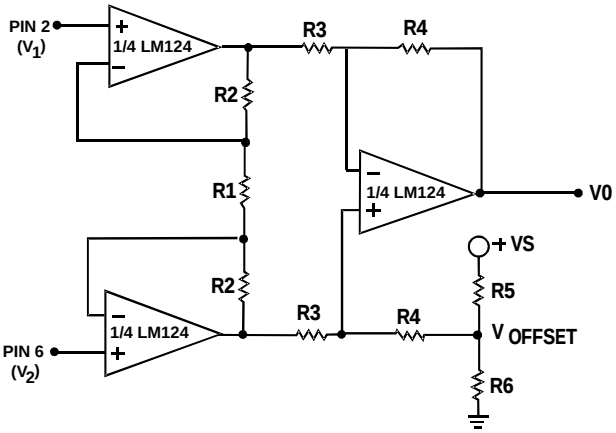
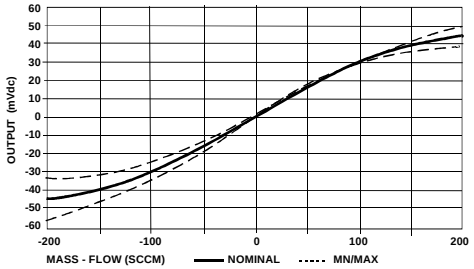


Figure 3. Differential Instrumentation Amplifier

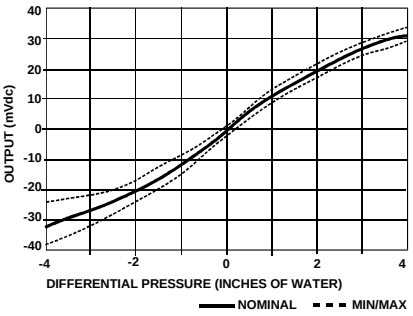


OUTPUT VOLTAGE vs. FLOW

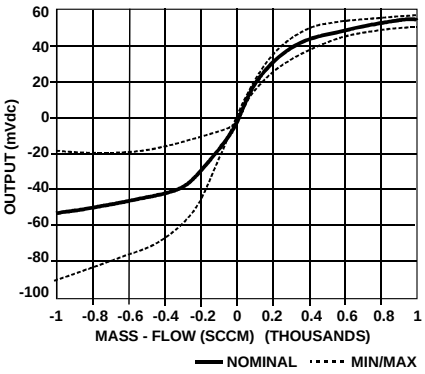
AWM 2100 V



AWM 2200 V



AWM 2300 V



SPECIFICATIONS

Type	AWM2100V	AWM2150V	AWM2200V	AWM2300V
Recommended excitation (using test circuit)	10 ± 0.01 Vdc 15 Vdc max.	10 ± 0.01 Vdc 15 Vdc max.	10 ± 0.01 Vdc 15 Vdc max.	10 ± 0.01 Vdc 15 Vdc max. (2)
Power consumption	30 mW	30 mW	30 mW	30 mW
Output voltage trim point	30 mV @ 100 sccm	2.5 mV @ 5 sccm	20 mV @ 2 in H_2O	50 mV @ 650 sccm
Null voltage	0.00 ± 1.0 mV	0.00 ± 1.0 mV	0.00 ± 1.0 mV	0.00 ± 1.0 mV
Null voltage shift @ -25 to +85°C	± 0.14 mV	± 0.14 mV	± .05 mV	± 0.14 mV
Output voltage shift +25 to -25°C +25 to +85°C	 +2.5% Reading -2.5% Reading	 +5% Reading -5% Reading	 +22% Reading -22% Reading	 +5% Reading -5% Reading (4)
Repeatability and hysteresis max.	± 0.35% reading	± 1.0% reading	± 0.35% reading	± 1.0% reading (3)
Response time, max.	3.0 ms	3.0 ms	3.0 ms	3.0 ms (1)
Temperature range Operating Storage	 -25 °C to 85 °C -40 °C to 90 °C	 -25°C to 85 °C -40 °C to 90 °C	 -25 °C to 85 °C -40 °C to 90 °C	 -25 °C to 85 °C -40 °C to 90 °C
Termination 2,54 mm centers (0.100 in centers)	0,64 mm (0.025 in) square	0,64 mm (0.025 in) square	0,64 mm (0.025 in) square	0,64 mm (0.025 in) square
Weight	10.8 gram	10.8 gram	10.8 gram	10.8 gram
Shock rating (5 drops, ea. of 6 axes)	100 g peak	100 g peak	100 g peak	100 g peak
Overpressure, max.	25 psi	25 psi	25 psi	25 psi (5)
Sensor resistance (Pin 2 - Pin 1, Pin 6 - Pin 1)	5 kOhm typ.	5 kOhm typ.	5 kOhm typ.	5 kOhm typ.
Sensor current (Pin 2 - Pin 1, Pin 6 - Pin 1)	0.3 mA	0.3 mA	0.3 mA	0.3 mA

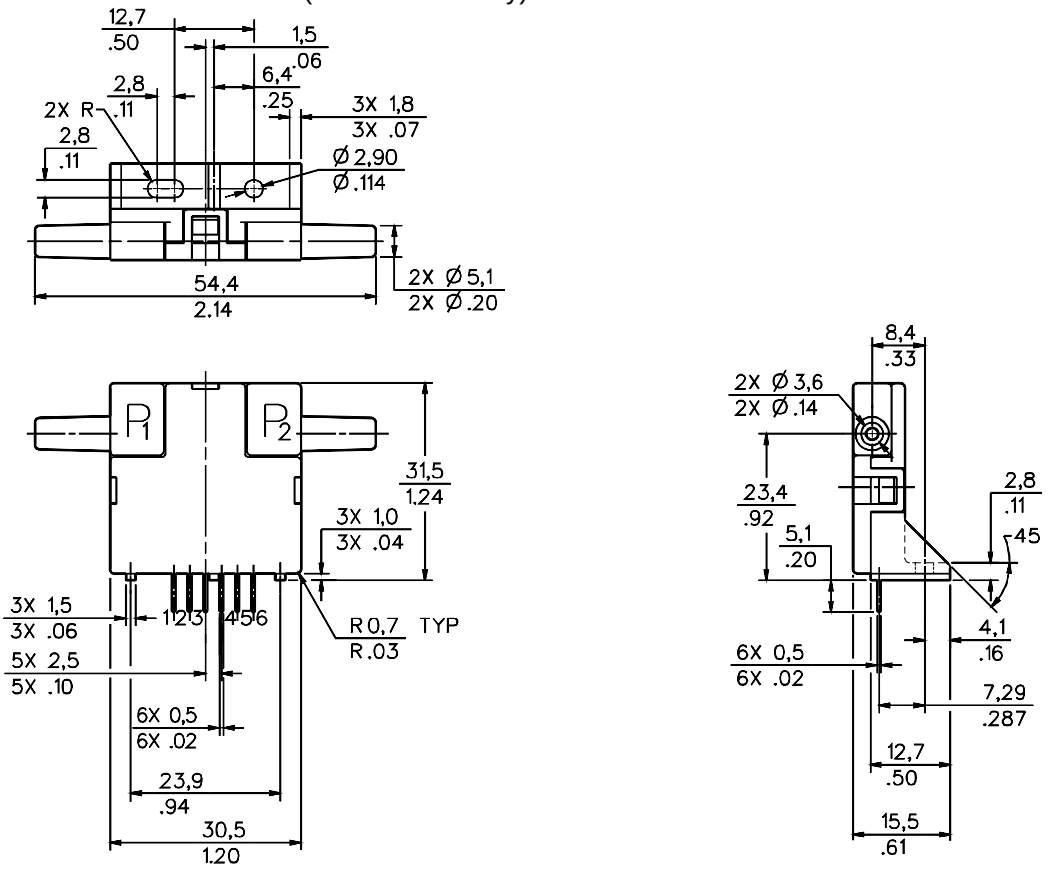
1. Response time typically 1 ms from 10%-90%.
2. Output voltage is ratiometric to supply voltage.
3. Repeatability and hysteresis tolerances reflect inherent inaccuracies of the measurement equipment.
4. Temperature shifts in differential pressure devices are mostly due to the density change of the gas over temperature. Temperature shifts in massflow devices are due to the change of the second order TCR coefficient over temperature.
5. Maximum flow rate to prevent damage to sensing element (includes flow pulse) is 5 LPM.

OUTPUT FLOW Vs. INTERCHANGEABILITY

AWM2100V			AWM2150V			AWM2200V			AWM2300V		
Flow sccm	Nom. mV	Tol.*± mV	Flow sccm	Nom. mV	Tol.* ± mV	Pres. in H_2O	Nom. mV	Tol.* ± mV	Flow sccm	Nom. mV	Tol.* ± mV
200	44.50	4.25	20	9.55	3.0	4.00	31.75	3.50	1000	55.50	3.70
150	38.75	3.00	15	7.35	2.0	3.00	26.75	2.50	800	52.90	3.50
100	30.00	1.50	10	4.90	1.5	2.00	20.00	1.20	650	50.00	2.50
50	16.50	2.50	5	2.50	0.6	1.00	11.20	1.80	400	40.50	3.00
0	0.00	1.00	3	1.50	0.9	0	0.00	1.00	200	29.20	3.20
-50	-16.50	4.50	0	0	0.5	-1.00	-11.20	3.00	0	0.00	1.00
-100	-30.00	5.00	-3	-1.50	1.2	-2.00	-20.00	3.30	-200	-28.90	15.00
-150	-38.75	7.65	-5	-2.50	1.2	-3.00	-26.75	5.30	-400	-41.20	26.00
-200	-44.50	9.75	-10	-4.90	3.0	-4.00	-31.75	7.00	-600	-48.20	29.50
			-15	-7.35	4.0				-800	-52.50	32.50
			-20	-9.55	6.0				-1000	-55.00	36.00

*The unique design of the microbridge mass airflow sensor accommodates your special application requirements. Custom laser trimming and flow channel dimensioning can conform performance characteristics to specific applications. Contact your HONEYWELL sales office, see page 4..

MOUNTING DIMENSIONS (for reference only) mm/in



NOTE: Positive flow direction is defined as proceeding into Port 1 (P1) and out of Port 2 (P2), resulting in positive output (Pin 6 > Pin 2). Negative flow direction is defined conversely and results in negative output (Pin 6 < Pin 2).

ORDER GUIDE

Catalog Listing	Description Flow Range
AWM2100V	±200 sccm / ± 0.2 in H_2O full scale
AWM2150V	±20 sccm / ± .02 in H_2O full scale
AWM2200V	± 60 sccm (± 20 sccm) ± 2 in H_2O full scale
AWM2300V	± 1000 sccm / ± 1.36 in (± 0.1 in) H_2O full scale

MASSFLOW vs. DIFFERENTIAL PRESSURE

The microbridge chip is fundamentally a mass flow sensor chip using a thermal transfer mechanism. The more mass flowing past the chip, the more heat being transferred. The sensing range can be expanded when sensing a sampled flow of the main flow by decreasing the ratio of the main flow path's diameter to the minimum diameter of the airflow tube within the sensor. Choking off the sampled flow results in reverse amplification, achieved by mechanical means. It is then possible to measure differential pressure proportional to mass flow. The greater the differential pressure, the more mass that flows. Variations in density of flowing media due to ambient pressure and temperature changes will change AWM2200V differential pressure sensor output in proportion to the change in absolute density. The other mass flow sensors are not affected by density changes.

MOUNTING INSTRUCTIONS

CAUTION

PRODUCT DAMAGE

Do not expose ports to forces greater than 5 pounds in a direction perpendicular to port centerline. Forces greater than 5 pounds may damage sensor housing.

Failure to comply with these instructions may result in product damage.

1. Use a maximum torque of 2 in./lbs. when tightening mounting screws or other fasteners.
2. Grasp housing between thumb and forefinger to connect tubing to sensor ports. Note: In this position, the port designation will be covered. The port is supported when the sensor is held in this position.
3. Ease tubing onto port. Thin-walled 1/4" Tygon or equivalent tubing is recommended.

SOLDERING INSTRUCTIONS

Note: sensor should be securely attached to PC board before soldering

Hand soldering:

1. Use temperature controlled soldering iron with 3,2 mm (1/8 in) diameter tip.
2. Set temperature at 400 °C [750 °F]. Hold tip on terminal for 5 seconds maximum.
3. Use Type R flux rosin core solder and hand clean after soldering.

SOLDERING INSTRUCTIONS, continued

Wave soldering:

1. Set solder temperature at 250 °C [480 °F] maximum.
2. Run belt at minimum of 1.54 m [5 feet] per minute.
3. Cover tube ends when cleaning.

CLEANING

CAUTION

CLEANING DAMAGE

- Do not use ultrasonics when cleaning. This may damage the microstructure.
- Cover ends of tube during cleaning. Certain solvents may attack the epoxy sealing chip tube to ceramic substrate.
- Do not use: methylene chloride, methyl pyrrolidone, III trichlorethane, or any oxidizing type acid such as formic acid.

Failure to comply with these instructions may result in product damage.

Avoid cleaning the sensor if at all possible. If necessary, clean the sensor with water or isopropyl alcohol only and dry the device thoroughly.

WARRANTY/REMEDY

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship. Contact your local sales office for warranty information. If warranted goods are returned to Honeywell during the period of coverage, Honeywell will repair or replace without charge those items it finds defective. The foregoing is Buyer's sole remedy and is **in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose.**

Specifications may change without notice. The information we supply is believed to be accurate and reliable as of this printing. However, we assume no responsibility for its use.

While we provide application assistance personally, through our literature and the Honeywell web site, it is up to the customer to determine the suitability of the product in the application.

For application assistance, current specifications, or name of the nearest Authorized Distributor, contact a nearby sales office. Or call:

1-800-537-6945 USA
1-800-737-3360 Canada
1-815-235-6847 International

FAX

1-815-235-6545 USA

INTERNET

www.honeywell.com/sensing
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Freeport, Illinois 61032

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