



# FDU Series

## Mass flow sensors for gases

### FEATURES

- Ranges 0...±200 sccm<sup>1</sup> or 0...±2 "H<sub>2</sub>O (0...±5 mbar)
- Bidirectional sensing
- Actual mass flow sensing
- Low differential pressure sensing
- Sensortech PRO services

### MEDIA COMPATIBILITY

To be used with dry gases only

The FDU series is NOT designed for liquid flow and will be damaged by liquid flow through the sensor



### SPECIFICATIONS

#### Maximum ratings

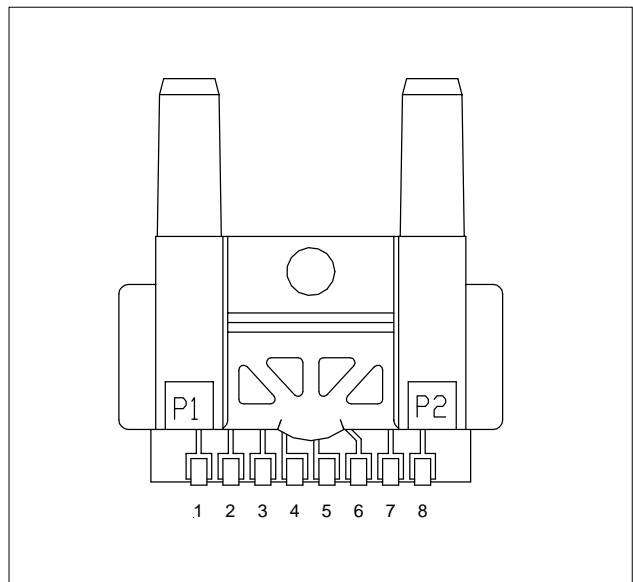
Supply voltage <sup>2</sup>	8 to 15 V typ. 10 ±0.01 V
Power consumption	50 mW
Temperature limits	
Operating	-25 to 85°C
Storage	-40 to 90°C
Mechanical shock	100 g (5 drops, 6 axes)

Note:

<sup>1</sup> sccm denotes standard cubic centimeters per minute

<sup>2</sup> Output voltage is ratiometric to supply voltage

### ELECTRICAL CONNECTION





### FLOW SENSOR CHARACTERISTICS<sup>3</sup>

( $V_s = 10 \pm 0.01$  V,  $T_A = 25^\circ\text{C}$ )

Part no.	Flow range (full scale)	Pressure range	Max. flow change <sup>4</sup>	Output voltage @ trim point
FDUM200DB	$\pm 200$ sccm		5.0 l/sec	77 mV @ 200 sccm
FDUH002DB		$\pm 2$ "H <sub>2</sub> O	5.0 l/sec	38 mV @ 2 "H <sub>2</sub> O

### PERFORMANCE CHARACTERISTICS

( $V_s = 10 \pm 0.01$  V,  $T_A = 25^\circ\text{C}$ )

Characteristics			Min.	Typ.	Max.	Unit
Zero offset			-15	0	15	mV
Repeatability and hysteresis (combined)		FDUM200DB			$\pm 0.35$	%FSO
		FDUH002DB		$\pm 0.1$		% reading
Ratiometricity error <sup>2</sup>				$\pm 0.30$		
Temperature effects <sup>5</sup>	Offset	-25 to 85 °C <sup>6</sup>		$\pm 2.0$ <sup>7</sup>		mV
	Span	-25 to 25 °C	FDUM200DB		-3.0 <sup>8</sup>	%FSO
			FDUH002DB		25 <sup>5</sup>	% reading
		25 to 85 °C	FDUM200DB		$\pm 1.0$ <sup>8</sup>	%FSO
FDUH002DB				-30 <sup>5</sup>	% reading	
Sensor resistance (pin 1 - pin 2, pin 1 - pin 8)			1.5	1.75	2.2	kOhm
Sensor current					0.6	mA
Response time				1.0	3.0	ms
Common mode pressure					25	psi

Notes:

<sup>2</sup> Output voltage is ratiometric to supply voltage

<sup>3</sup> A 5 micron filter is recommended for all devices.

<sup>4</sup> Maximum allowable rate of flow change to prevent damage.

<sup>5</sup> Temperature shifts in differential pressure devices are mostly due to the density change of the gas over temperature.

<sup>6</sup> Shift is relative to 25 °C.

<sup>7</sup> Assumes low TCR bridge resistance used (pins 2 and 8).

<sup>8</sup> Requires recommended Rc value of 1K Ohm is used (pins 3 to 7) and typ. heater control circuit. Maximum current Rh.



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### FLOW SPECIFICATIONS

( $V_s = 10 \pm 0.01$  V,  $T_A = 25^\circ\text{C}$ )

#### FDUM200DB

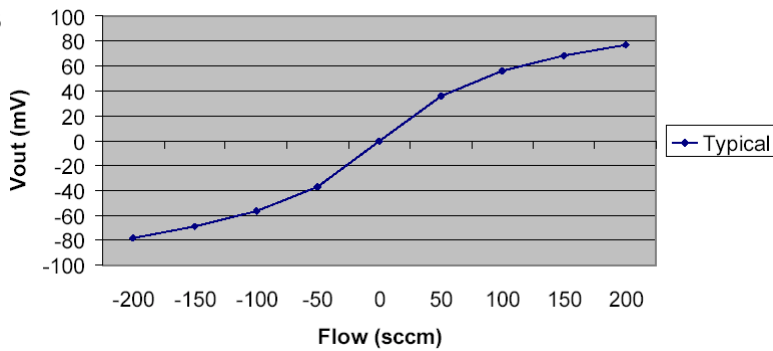
Flow (sccm)	Nominal (mV Typical)	$\pm$ Tolerance (mV Typical)
200	77	32
150	68	29
100	56	25
50	36	17
0	0	20
-50	-37	18
-100	-57	26
-150	-69	30
-200	-78	33

#### FDUH002DB

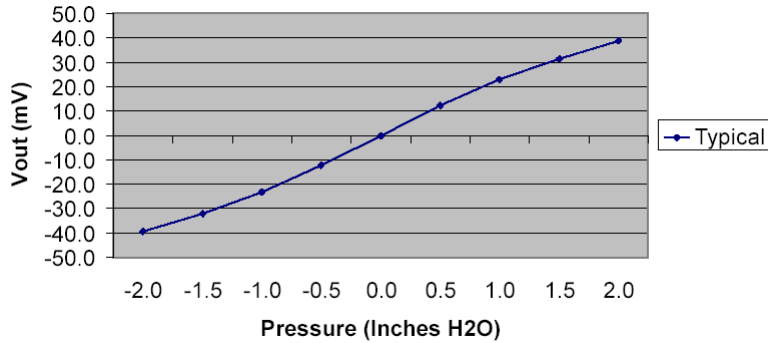
Pressure (inch H2O)	Nominal (mV) Typical	Typical Min. (mV)	Typical Max. (mV)
2.0	38	22	77
1.5	32	18	66
1.0	23	12	49
.5	12	7	29
0	0	-20	20
-.5	-12	-7	-30
-1.0	-23	-12	-51
-1.5	-32	-18	-68
-2.0	-39	-22	-79

### OUTPUT VS. FLOW CURVES

#### FDUM200DB

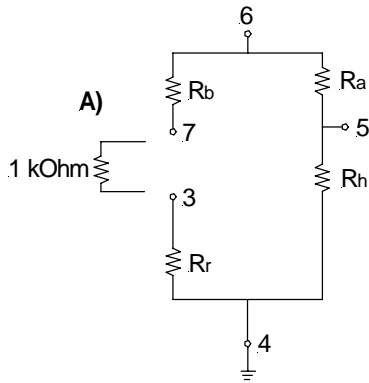


#### FDUH002DB

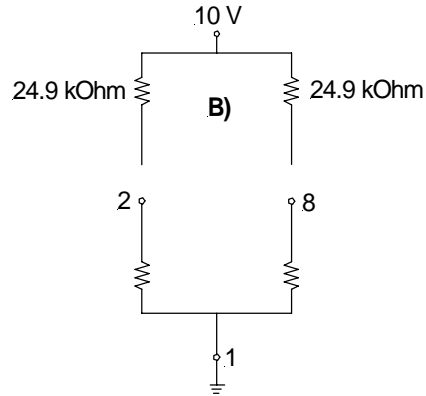




**HEATER CONTROL CIRCUIT**



**SENSING BRIDGE SUPPLY CIRCUIT**



**Note:**

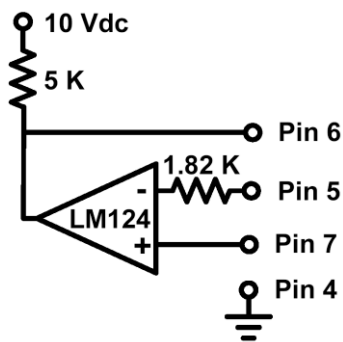
**Circuits required for operation per specifications. Circuits are not on board the sensor.**

A) Customer supplied 1 kOhm resistor (affects temperature compensation and span voltage).

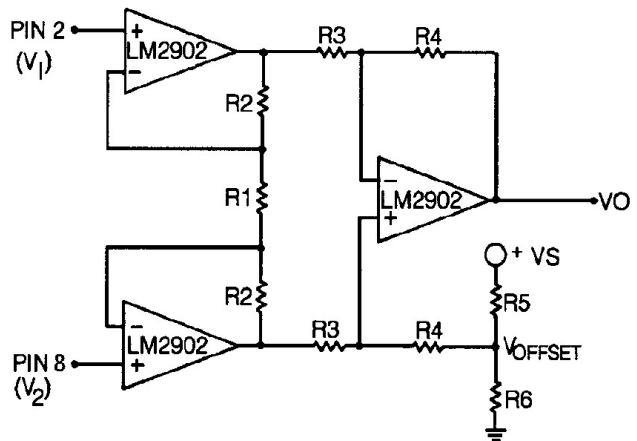
B) Customer supplied 24.9 kOhm matched bridge resistors (affects null output voltage).

Output is measured differentially from pins 8 to 2.

**HEATER CONTROL CIRCUIT**  
(suggested)



**DIFFERENTIAL INSTRUMENTATION**  
**AMPLIFIER CIRCUIT** (optional)



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

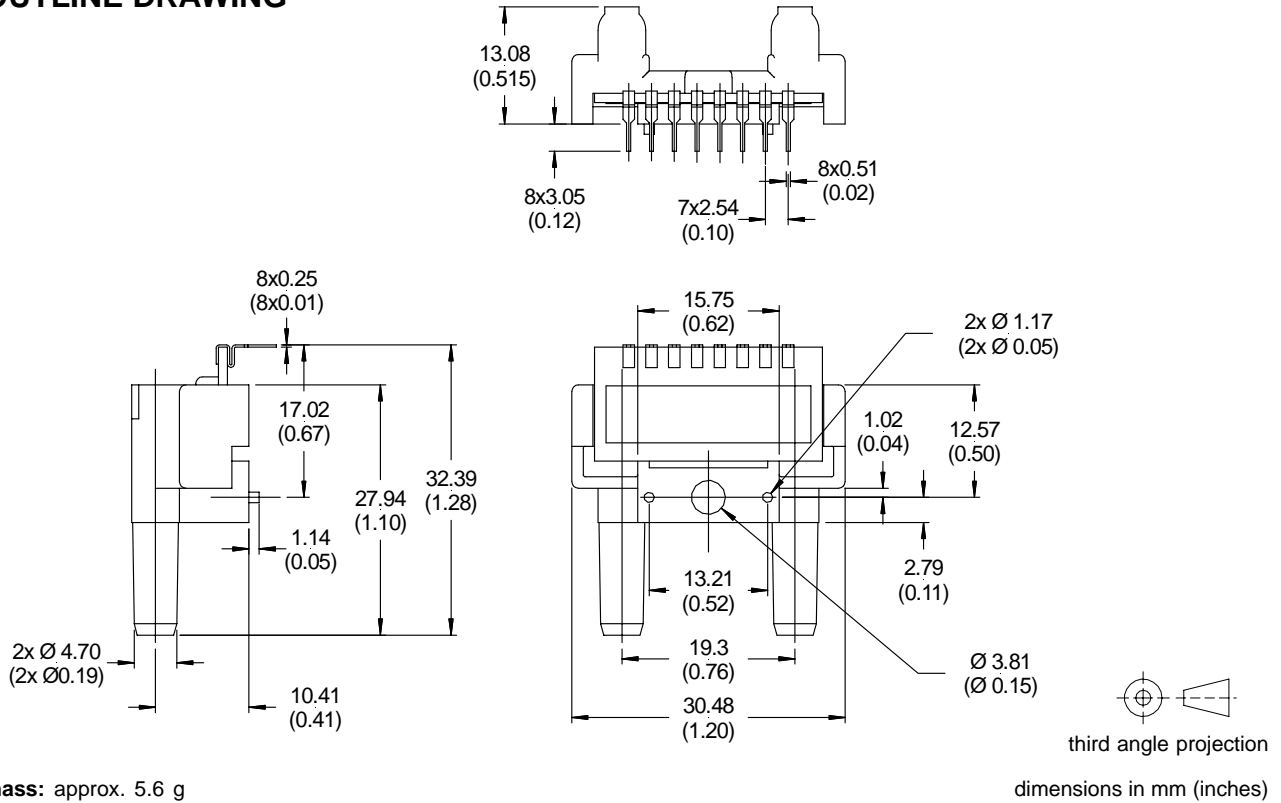
$$\text{where } V_{Offset} = V_s \left( \frac{R_6}{R_6 + R_5} \right)$$



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### OUTLINE DRAWING



### GAS CORRECTION FACTORS<sup>9</sup>

Gas type	Correction factor (approx.)
Helium (He)	0.5 <sup>10</sup>
Hydrogen (H <sub>2</sub> )	0.7 <sup>10,11</sup>
Argon (Ar)	0.95
Nitrogen (N <sub>2</sub> )	1.0
Oxygen (O <sub>2</sub> )	1.0
Air	1.0
Nitric oxide (NO)	1.0
Carbon monoxide (CO)	1.0
Methane (CH <sub>4</sub> )	1.1
Ammonia (NH <sub>3</sub> )	1.1
Nitrous oxide (N <sub>2</sub> O)	1.35
Nitrogen dioxide (NO <sub>2</sub> )	1.35
Carbon dioxide (CO <sub>2</sub> )	1.35

Notes:

<sup>9</sup> Gas correction factors are referenced to nitrogen (N<sub>2</sub>) as calibration gas type. Approximate gas correction factors are provided as guidelines only. Individual gas types may perform differently at temperature extremes and varying flow rates.

<sup>10</sup> When sensing Hydrogen (H<sub>2</sub>) or Helium (He) it may be necessary to power the mass flow sensor using increased supply voltage: Hydrogen typ. 12 V, Helium typ. 15 V

<sup>11</sup> Hydrogen (H<sub>2</sub>) flow measurement requires the use of a special sensor. These devices provide normal operation when sensing hydrogen flow and are designated with an "H" at the end of the order number.



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#### ORDERING INFORMATION - AVAILABLE LISTINGS

**Note:** Preferred listings are highlighted in grey

Flow range	Dry gas
±200 sccm	FDUM200DB

Pressure range	Dry gas
±2 "H <sub>2</sub> O (±5 mbar)	FDUH002DB

#### Sensortech PRO services:

- Extended guarantee period of 2 years
- Improved performance characteristics
- Custom product modifications and adaptations even for small quantities
- Advanced logistics models for supply inventory and short delivery times
- Technical support through application engineers on the phone or at your site
- Fastest possible technical response for design and QA engineers
- ... plus other services on request

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