

Datasheet SDP2000-L

Differential Pressure Sensor with Analog Output

- Calibrated and temperature compensated
- Excellent repeatability, no drift



Product Summary

The SDP2000-L differential pressure sensor for air covers a measurement range of 3500 Pa (14 inch H₂O).

Mounted in a PPS housing the SDP2000-L differential pressure sensor features a unique dynamic range, zero offset and unsurpassed long term stability. This makes it an ideal fit for demanding yet cost sensitive OEM applications in HVAC and medical equipment.

The device is supplied with 5 V and provides a 0.25...4 V output. Although the output of the SDP2000-L differential pressure sensor is analog, the internal linearization and temperature compensation is performed digitally. This results in superior accuracy, outstanding resolution, and lowest temperature dependence.

The outstanding performance of the sensor is based on Sensirion's patented CMOSens® sensor technology, which combines the sensor element, signal processing and digital calibration on a small CMOS chip. The differential pressure is measured by a thermal sensor element using flow-through technology. The well-proven CMOS technology is perfectly suited for high-quality mass production and is the ideal choice for demanding and cost-sensitive OEM applications.

Benefits of Sensirion's CMOSens® Technology

- High reliability and long-term stability
- Best signal to noise ratio
- Industry-proven technology with a track record of more than 15 years
- Designed for mass production
- High process capability

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1. Sensor Performance

Table 1: Sensor specifications (at 23°C and P_{absolute} = 966 mbar, VDD = 5.0 V unless otherwise noted)

Parameter	SDP2000-L			Unit
	Min	Typ	Max	
Measurement range	-100		3500	Pa
	-0.4		14	Inch water
Calibrated range	0		3500	Pa
Power supply	4.75	5.00	5.25	V
Full scale output (100 kΩ load)		4.00		V
Zero Pressure Output		0.250		V
Accuracy		0.1	0.2	% FS ⁽¹⁾
		1	1.5	% m.v. ⁽²⁾
Repeatability		0.3	0.5	% m.v. ⁽²⁾
Offset stability		0	0.3	Pa / year
Additional error over temperature (T ≠ 23°C)		0	0	% FS/°C
		0.03	0.05	% m.v./°C
Resolution < 30% FS ⁽¹⁾	0.2	0.5	1	Pa
Resolution 30..70% FS ⁽¹⁾	1	2.5	8	Pa
Resolution > 70% FS ⁽¹⁾	8	11	14	Pa

⁽¹⁾ FS = full scale or span. For the SDP2000-L it is 3500 Pa

⁽²⁾ m.v. = measured value, i.e. reading

Table 2: Additional sensor specifications

Media	Air, N ₂ – for other gases contact Sensirion.
Operating Conditions: - Temperature - Humidity	-10 °C ... +60 °C / 14°F ... 140 °F non-condensing
Ambient storage conditions ⁽¹⁾	-40 °C ... +80 °C / -40°F ... 176 °F
Orientation sensitivity	below resolution
Response time	40 ms
Admissible overpressure (short term)	1 bar (14.5 PSI)
Burst Pressure Capability	2 bar (29 PSI)
Weight	14 g
Protection Class	IP 20
Wetted materials	Glass (silicon nitride, silicon oxide), Silicon, PPS (Polyphenylene Sulfide), PEEK (Polyetheretherketone), FR4, Silicone as static sealing, Epoxy, Gold
Gas flow through sensor	see Figure 4
REACH and RoHS	REACH and RoHS compliant

⁽¹⁾ For maximum 2 weeks

1.1 Temperature Compensation

The SDP2000-L differential pressure sensor features a sophisticated built-in temperature compensation circuit. The temperature is measured on the CMOSens chip by means of a bandgap reference temperature sensor. Its data is fed into a compensation circuit which is also integrated on the CMOSens® sensor chip. No external temperature compensation is therefore required.

1.2 Altitude Correction

The SDP2000-L differential pressure sensor achieves its unsurpassed performance by using a dynamic measurement principle, i.e. an applied differential pressure forces a small air flow through the sensor. This results in a dependence of the indicated differential pressure on the ambient air density. While the temperature effect is compensated (see Paragraph 1.1) the altitude above sea level has an influence on the SDP2000-L output. If desired, this effect can be compensated by a correction factor according to the following equation:

$$Dp_{\text{eff}} = Dp_{\text{sensor}} \cdot P_{\text{cal}} / P_{\text{amb}}$$

where Dp_{eff} is the effective differential pressure, Dp_{sensor} the differential pressure indicated by the SDP2000-L, P_{cal} the absolute pressure during calibration (966 mbar) and P_{amb} the actual ambient absolute pressure.

Note:

For more detailed information about temperature and pressure compensation, refer to the selection guide in the differential pressure download center on the Sensirion website.

2. Electrical Specifications

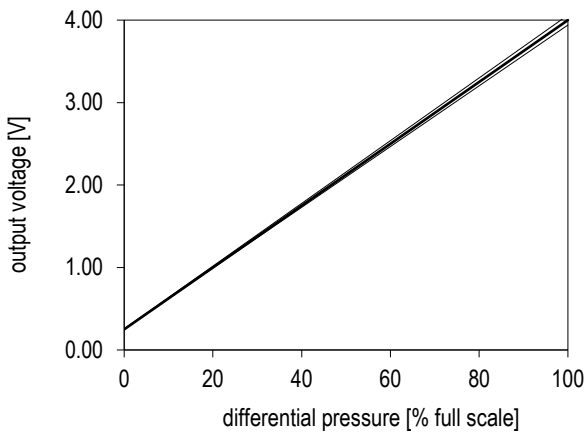
2.1 Power Supply

The SDP2000-L differential pressure sensor requires a stable voltage supply of 5V. Influence of the supply voltage variation on the offset and the sensitivity are given in Table 4

2.2 Voltage Output

The SDP2000-L features a voltage output from 0.25V to 4.0V (Figure 1). An output voltage below 0.25V indicates a negative differential pressure. This range is not calibrated however.

The resistive load at the output pin should be larger than 20kOhm. The capacitive load at the output pin must not be larger than 200pF. If the design shows a larger capacity at the output pin an additional resistor is required in series at the output (e.g. 620Ohm).



Formula: $P = \text{Ifactor} * (\text{voltage}^{(1)} - 0.250)/3.750$

Ifactor =	
Pascal	3500
Inch water	14

⁽¹⁾ voltage: measured output voltage in Volt.

Figure 1: Linear output at 5V supply of the SDP2000-L.

The fine lines indicate the maximum tolerances including a temperature variation from 0 to 50°C.

Table 3: Electrical characteristics

Parameter	Conditions	Min.	Typ.	Max.	Units
Power Supply Voltage V_{DD}		4.75	5.0	5.25	VDC
Operating Current	5 V, no load, zero flow		4.3	5.2	mA
Output capacitive load C_{load}			20	200	pF
Recommended load R_{load}	To GND	20	100	∞	k Ω

Table 4: Typical power supply dependence of the offset and the sensitivity

Parameter	4.75 V	5.0 V	5.25 V	Units
Offset	- 10.3		+ 10.3	Pa
Sensitivity	1.01	1.07	1.13	mV/Pa

3. Physical Dimensions and Mounting Information

3.1 Housing

The SDP2000-L differential pressure sensor is mounted in a PPS housing. The package has been designed to withstand continuous overpressures of at least 1 bar (14.5 PSI). Burst pressure is > 2 bar (29 PSI)

The physical dimensions and mounting information is given in Figure 2 and Figure 3.

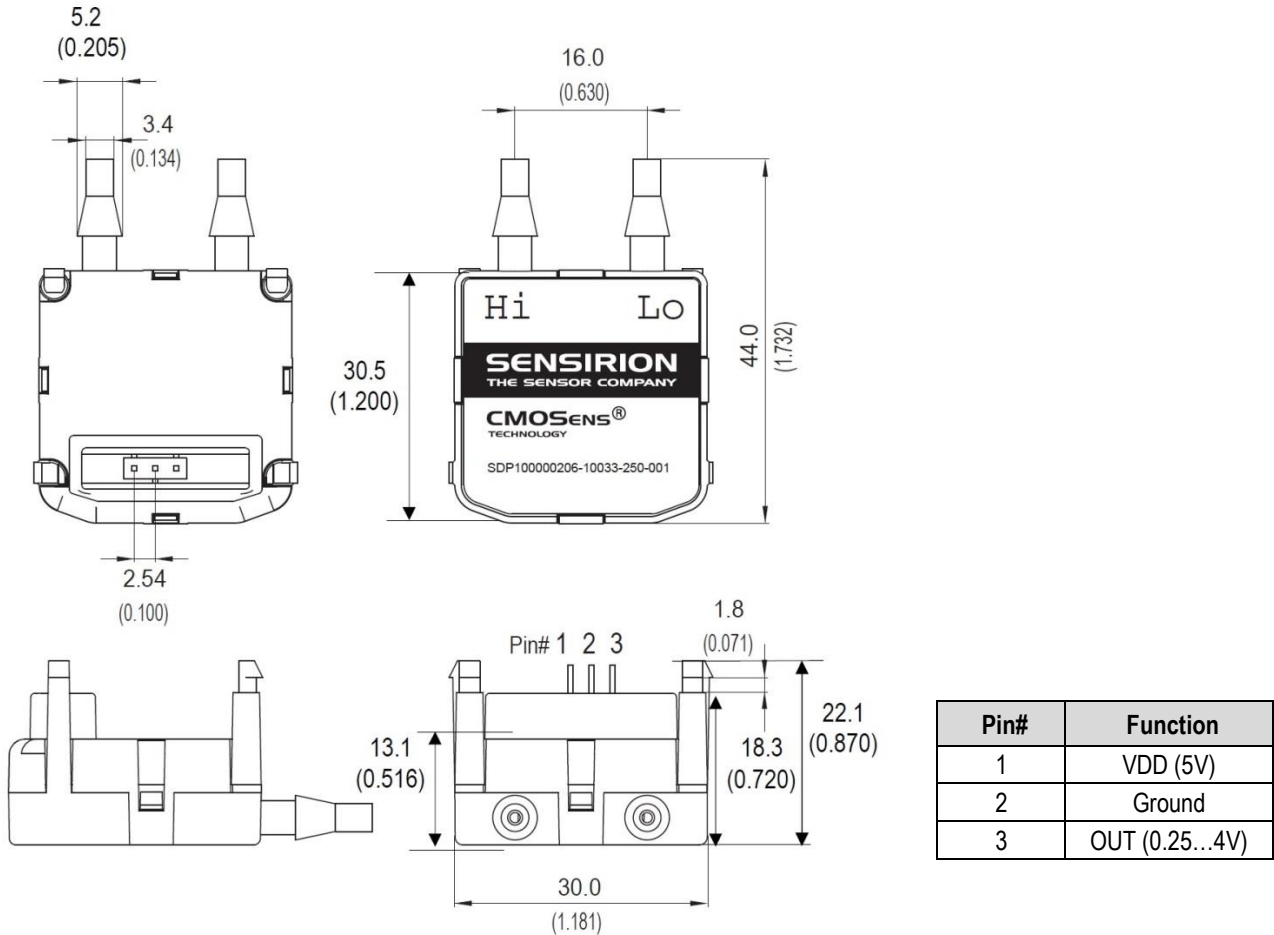
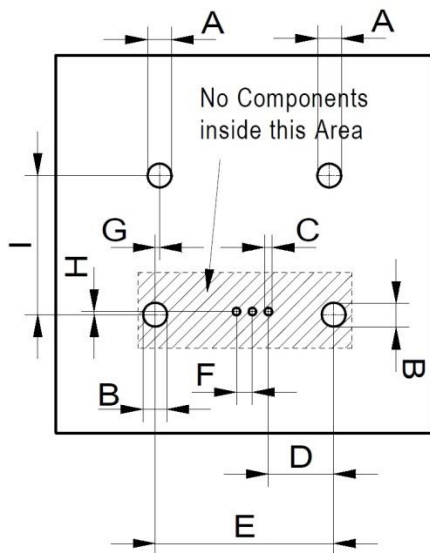


Figure 2: Pin out and physical dimensions in mm (inch). The drawing is not to scale



Dim.	[mm]	[inch]	[mil]
A	3.00	0.118	118
B	3.30	0.130	130
C	1.20	0.047	47
D	10.20	0.402	402
E	28.20	1.110	1110
F	2.54	0.100	100
G	0.60	0.024	24
H	0.50	0.020	20
I	22.70	0.894	894

Figure 3: SDP2000-L PCB footprint. The drawing is not to scale

3.2 Soldering Instructions

The SDP2000-L differential pressure sensor can be wave soldered. Direct reflow soldering is not recommended since it may affect the accuracy.

If reflow soldering is required Sensirion recommends to use an SMD connector (e.g. type Samtec SSM103-L-SV) and to mount the SDP2000-L after soldering.

3.3 Connecting Hose

Sensirion recommends a hose with an inner diameter of 1/8 to 3/20 inch (3.18 to 3.8mm). Due to the dynamic measurement principle, a small air flow is required (Figure 4) which leads to a dependence on the length of the hose (Figure 5). Tubes up to 1 m show less than 1 % error of the measured value.

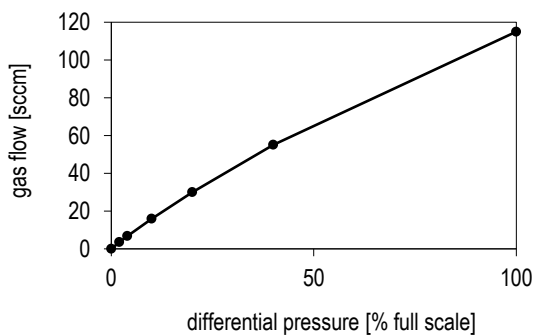


Figure 4: Typical air flow through the SDP2000-L. Please note: 1 sccm = 1 cm³/min at 0°C and 1013 mbar pressure (1 sccm = 0.001 norm liter)

Length of the connecting hose	Deviation of Measured Value
0.5 m (20 inch)	- 0.4 %
1.0 m (40 inch)	- 0.8 %
2.0 m (80 inch)	- 1.6 %
4.0 m (160 inch)	- 3.2 %

Figure 5: Influence of the length of the connecting hose on the accuracy (using 3/16 inch inner diameter). Example: a 50 Pa difference pressure is shown as 49.8 Pa when using 0.5 m tube with 3/16 inch diameter

4. Shipping Package

SDP2000-L is shipped in trays of 25pcs.

5. Ordering Information

Use the part names and item numbers shown in the following table when ordering SDP2000-L differential pressure sensor. For the latest product information and local distributors, visit www.sensirion.com.

Part name	Description / Output	Product number
SDP2000-L	3500Pa, Analog linear voltage output	1-100113-03

Revision History

Date	Author	Version	Changes
April 2017	ANB	1	Separate datasheet for SDP2000-L. Specifications are unchanged.

Important Notices

Warning, personal injury

Do not use this product as safety or emergency stop devices or in any other application where failure of the product could result in personal injury (including death). Do not use this product for applications other than its intended and authorized use. Before installing, handling, using or servicing this product, please consult the datasheet and application notes. Failure to comply with these instructions could result in death or serious injury.

If the Buyer shall purchase or use SENSIRION products for any unintended or unauthorized application, Buyer shall defend, indemnify and hold harmless SENSIRION and its officers, employees, subsidiaries, affiliates and distributors against all claims, costs, damages and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if SENSIRION shall be allegedly negligent with respect to the design or the manufacture of the product.

ESD Precautions

The inherent design of this component causes it to be sensitive to electrostatic discharge (ESD). To prevent ESD-induced damage and/or degradation, take customary and statutory ESD precautions when handling this product.

See application note "Handling Instructions" for more information.

Warranty

SENSIRION warrants solely to the original purchaser of this product for a period of 12 months (one year) from the date of delivery that this product shall be of the quality, material and workmanship defined in SENSIRION's published specifications of the product. Within such period, if proven to be defective, SENSIRION shall repair and/or replace this product, in SENSIRION's discretion, free of charge to the Buyer, provided that:

- notice in writing describing the defects shall be given to SENSIRION within fourteen (14) days after their appearance;

- such defects shall be found, to SENSIRION's reasonable satisfaction, to have arisen from SENSIRION's faulty design, material, or workmanship;
- the defective product shall be returned to SENSIRION's factory at the Buyer's expense; and
- the warranty period for any repaired or replaced product shall be limited to the unexpired portion of the original period.

This warranty does not apply to any equipment which has not been installed and used within the specifications recommended by SENSIRION for the intended and proper use of the equipment. EXCEPT FOR THE WARRANTIES EXPRESSLY SET FORTH HEREIN, SENSIRION MAKES NO WARRANTIES, EITHER EXPRESS OR IMPLIED, WITH RESPECT TO THE PRODUCT. ANY AND ALL WARRANTIES, INCLUDING WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSLY EXCLUDED AND DECLINED.

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Headquarters and Subsidiaries

SENSIRION AG
Laubisruetistr. 50
CH-8712 Staefa ZH
Switzerland

phone: +41 44 306 40 00
fax: +41 44 306 40 30
info@sensirion.com
www.sensirion.com

Sensirion Taiwan Co. Ltd.
phone: +41 44 306 40 00
info@sensirion.com

Sensirion Inc., USA
phone: +1 312 690 5858
info-us@sensirion.com
www.sensirion.com

Sensirion Japan Co. Ltd.
phone: +81 3 3444 4940
info-jp@sensirion.com
www.sensirion.co.jp

To find your local representative,
please visit
www.sensirion.com/contact

Sensirion Korea Co. Ltd.
phone: +82 31 337 7700~3
info-kr@sensirion.com
www.sensirion.co.kr

Sensirion China Co. Ltd.
phone: +86 755 8252 1501
info-cn@sensirion.com
www.sensirion.com.cn

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