SDP1000 / SDP2000

Differential Pressure Transducer for Air and Non-Aggressive Gases

SENSIRION
THE SENSOR COMPANY

_ 500 Pa (2 "H_20 / 5 mbar / 0.07 PSI) and 3500 Pa (14 "H_20 / 35 mbar / 0.5 PSI)
_ For cost sensitive OEM applications in HVAC
_ Fully calibrated and temperature compensated
_ Excellent accuracy and reproducibility (even below 10 Pa)
_ Offset and hysteresis free (< 0.05 % FS)
_ Analog voltage output (0.25…4.0 V)
_ Not sensitive to mounting orientation
_ Linear or square root extracted output characteristics
_ Direct PCB mounting with simple snap-on system

actual size

Preliminary Data Sheet – May 2003 v1.3

SDP1000 / SDP2000 Product Summary

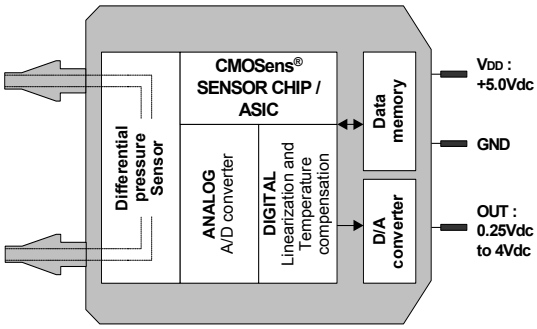
The SDP1000 / SDP2000 differential pressure transducers cover the measurement range from 0 to 500 Pa (2 "H_20) and from 0 to 3500 Pa (14 "H_20), respectively. They are fully calibrated and temperature compensated, show excellent reproducibility, no offset drift and are capable to measure reliably even lowest pressure differences and air volumes.
Mounted in a rugged, chemically inert PPS housing, the SDP1000 / SDP2000 are exceptionally well suited for cost sensitive yet demanding HVAC applications including filter monitoring, fan/ventilator regulation and variable air volume control (VAV).
The SDP1000 and the SDP2000 are available with linear or square root extracted output characteristics.
Its leading performance is based on Sensirion's CMOSens® sensor technology, which combines the sensor element with amplification and A/D conversion on one single chip. The differential pressure is measured by a thermal sensor element. In comparison to other differential pressure sensors, which operate according to this principle, only an extremely small amount of air is required. This leads to a very reliable operation even under harsh conditions. In comparison to membrane based sensors the SDP1000 / SDP2000 sensors show an extended measurement range, high resolution and excellent reproducibility even at lowest pressure ranges. In addition, the SDP1000 / SDP2000 provide an excellent offset stability and show no sensitivity to the mounting orientation.
The SDP1000 / SDP2000 require a supply voltage of 5.0 V to provide a 0.25…4 V output. Since fully exchangeable and calibrated, just a few external electronic components around the SDP1000 / SDP2000 make a high performing differential sensor transmitter with 0..10 V, 4…20 mA or digital interface (check out Sensirion's application notes for the SDP1000 and SDP2000 on www.sensirion.com).

Applications and Ordering Information

_ HVAC and building control including:
_ filter monitoring
_ fan/ventilator control
_ reliable control of over/under pressure in rooms
_ variable air volume applications (VAV)

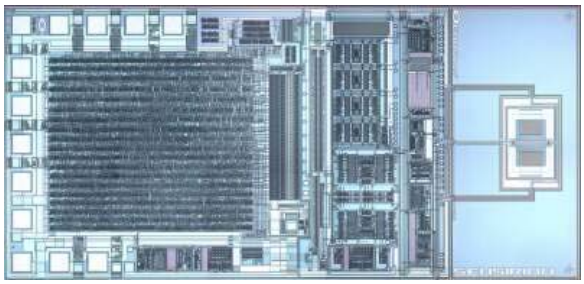
Part number	Pressure range (Full Scale)				Output characteristics
SDP1000-L	500 Pa	5 mbar	2 "H_20	0.07 PSI	linear
SDP2000-L	3500 Pa	35 mbar	14 "H_20	0.50 PSI	linear
SDP1000-R	500 Pa	5 mbar	2 "H_20	0.07 PSI	square-root
SDP2000-R	3500 Pa	35 mbar	14 "H_20	0.50 PSI	square-root

Block Diagram of the SDP1000



Introductory Description

Measurements of the applied differential pressure are taken at a sampling rate of 500 kHz on the CMOSens Chip internal to the SDP1000 device. Simultaneously and at a sampling rate of 50 kHz the actual temperature is acquired. Both the data from the differential pressure sensor and the temperature sensor are converted into the digital domain. Linearization and temperature compensation is done by concurrent digital processing data from both sensors using a two-dimensional look-up table.
The output circuit converts the processed data into a PWM signal which is finally smoothed by a low-pass filter to provide the dc voltage output signal.



CMOSens® Sensor Chip.

The SDP1000/SDP2000 is available with linear or square root extracted output characteristics.
The output voltage at zero differential pressure is 0.25 V. At the specified maximum differential pressure the output voltage is 4.0 V. Pressure differences below zero are indicated by a voltage below 0.25 V.

CMOSens® Sensor Technology

CMOSens® is the base technology for all Sensirion multi sensor modules and sensor systems. The unification of semiconductor chip and sensor technology serves as a platform for highly integrated system solutions with excellent sensor precision and reliability. With CMOSens®, the on-chip sensor element forms an integrated system with a high-end amplification and A/D converter circuit. Due to the compact single-chip design, CMOSens® based sensors are very resistant to electromagnetic disturbances, offer excellent sensor precision, fast response time and a very large dynamic measurement range.

1 Sensor Specifications

Table 1: Sensor specifications: (all data for 23 °C / 73 °F and $p_{absolute}$=966 mbar, V_{in}=5.0 V unless otherwise noted).

			SDP1000			SDP2000			
Parameter			**Minimum**	**Typical**	**Maximum**	**Minimum**	**Typical**	**Maximum**	**Units**
Measurement range			- 20		500	-100		3500	Pa
			-0.008		2	-0.4		14	"H_20
			-0.2		5	-1		35	mbar
			-0.0028		0.07	-0.015		0.5	PSI
Resolution	linear output	at <10% FS		0.2			0.9		Pa
				0.0008			0.0036		"H_20
		at FS		2			8		Pa
				0.008			0.032		"H_20
	square-root extracted output	0-100		0.1			0.4		Pa
		0-0.4		0.0004			0.0016		"H_20
		100-250		0.5			1.5		Pa
		0.4-1.0		0.0024			0.006		"H_20
		250-500		3			9		Pa
		1.0-2.0		0.012			0.036		"H_20
Repeatability				0.1[a]			0.4[a]		Pa

[a] Depending on measurement range and output characteristics - corresponds to available resolution.

Table 2: Physical specifications (all data for 23 °C/73 °F and $p_{absolute}$=966 mbar, V_{in}=5.0 Vdc unless otherwise noted).

Parameter	Condition	Minimum	Typical	Maximum	Units
Sensor					
Accuracy[a] / Linearity	at 23°C / 73°F			0.5	% FS [b]
			1	3	% m.v.[b]
Offset	at 23°C / 73°F		0.05	0.1	% FS
Offset drift			no drift[c]		% FS / year
Overpressure resistance		1			bar
		14.5			psi
Response time			40		ms
Ambient temperature	specifications valid	0		50	°C
		32		122	°F
	working	-10		60	°C
		14		140	°F
Temperature coefficient at 23°C / 73°F	Offset		0.01	0.02	% FS / °C
			0.005	0.001	% FS / °F
	Span		0.02	0.03	% FS / °C
			0.01	0.015	% FS / °F
Position sensitivity	p_{abs}=1 bar, pdiff < 10 % FS			0.04	% FS
	p_{abs}=1 bar, pdiff > 10 % FS			0.4	% m.v.

Table 3: Allowed gases, involved materials, leakage and electromagnetic compatibility.

Media	Air, N_2 – for other gases contact Sensirion AG		
Wetted materials	Glass (silicon nitride, silicon oxide), Silicon, PPS (Polyphenylene Sulfide), PEEK (Polyetheretherketone), FR4, Silicone as static sealing		
Gas flow through sensor	max. 100 ml/min at FS.		
Electromagnetic compatibility	EN 61000-4-2	Air discharge (ESD)	± 2 kV
	EN 61000-4-3	High frequency electromagnetic radiation (HF)	3 V/m
	EN 61000-4-4	Fast transients (burst)	± 4 kV

1.1 Sensor Principle

The SDP1000 / SDP2000 device uses a thermal principle to measure the applied differential pressure: The differential pressure drives a small airflow through the sensor (typically < 100 sccm at full scale). The SDP1000 / SDP2000 device measures this flow by means of a heating resistor and two temperature sensors on a thermally insulated membrane. In the presence of an airflow, the temperature distribution on the membrane is disturbed and this asymmetry is picked up by the two temperature sensors. Due to the minimal thermal mass of the membrane, symmetrical arrangement, and accurate temperature measurement, the extraordinary specifications with respect to reproducibility, sensitivity and offset is achieved.

1.2 Output Characteristics

Figure 1 and 2 show the applied differential pressure vs. the voltage output for the linear and the square root extracted characteristics, respectively.
Positive pressure differences are indicated by a voltage ranging from 0.25…4V. Negative pressure differences are indicated by a voltage below 0.25 V (not shown in Figure 1 and 2). The fine lines in Figure 1 and 2 indicate the maximum tolerances including a temperature variation from 0 to 50°C.

1.3 Temperature Compensation

The SDP1000 / SDP2000 feature an automatic, very accurate temperature compensation by means of an internal PTAT bandgap temperature sensor.

[a] Allow the sensor to warm up for appr. 1 min for best results.

[b] %FS = % of full scale, %m.v. = % of measured value/of reading, whichever is bigger.

[c] Drift smaller than resolution, i.e. not measurable.

2 Power Supply and Output

2.1 Power Supply - GND / VDD

The SDP1000 / SDP2000 require a stable voltage supply of 5.0 V. For more details see also Section 3.2 Electrical Specifications.

2.2 Voltage Output

The SDP1000 / SDP2000 features a voltage output from 0.25 V to 4.0 V (Figure 1, 2). An output voltage below 0.25 V indicates negative differential pressure.

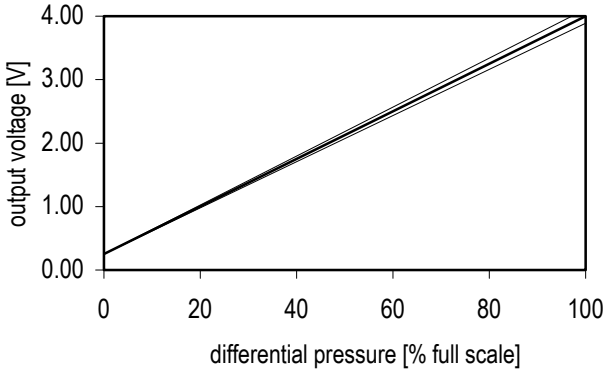


Figure 1: Linear output. The fine lines indicate the maximum tolerances including a temperature variation from 0 to 50°C.

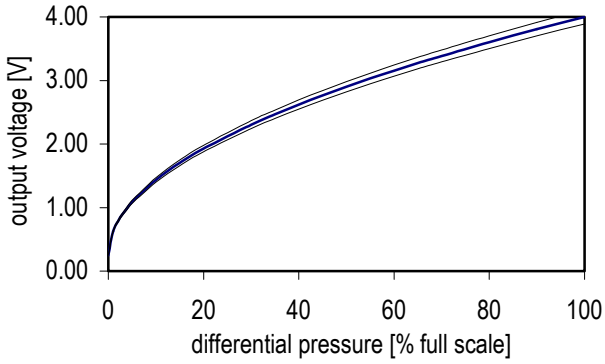


Figure 2: Square root extracted output. The fine lines indicate the maximum tolerances including a temperature variation from 0 to 50°C.

3 Electrical Specifications

3.1 Absolute Maximum Ratings

Ambient storage temperature	-40°C to 80°C / -40°F to 176°F
Ambient operating temperature	-10°C to 60°C / 14°F to 140°F
Overpressure resistance	1.0 bar / 14 PSI

3.2 Electrical Specifications

Table 4: SDP1000 / SDP2000 dc characteristics.

Parameter	Conditions	Min.	Typ.	Max.	Units
Power Supply DC	DC	4.75	5.0	5.5	V
Operating Current	VDD = 5.0 V, no load		3	5	mA
	VDD = 5.0 V, loaded		8	10	mA
Power Dissipation	VDD = 5.0 V, no load		15	25	mW
	VDD = 5.0 V, loaded		40	50	mW

Table 5: SDP1000 / SDP2000 output characteristics.

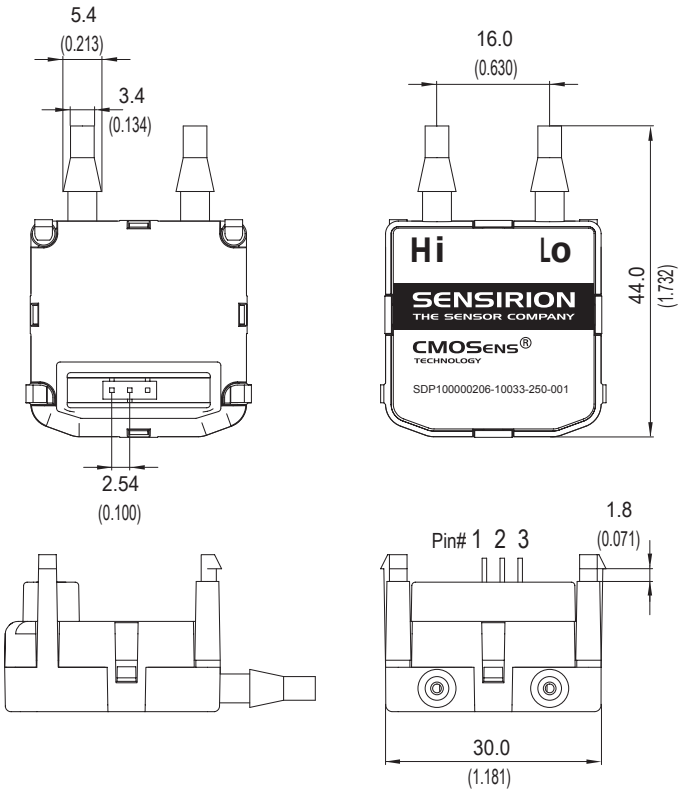
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
V_0	Output Voltage @ 0	Rl=100kΩ	0.243	0.25	0.257	V_{dc}
V_{FS}	Output Voltage @ FS	Rl=100kΩ	3.93	4.00	4.07	V_{dc}
Recommended load			10	10	∞	kΩ

4 Physical Dimensions and Mounting Information

The SDP1000 / SDP2000 is mounted in chemically inert PPS housing. The rugged package has been designed to withstand overpressures of at least 1 bar (14 PSI).

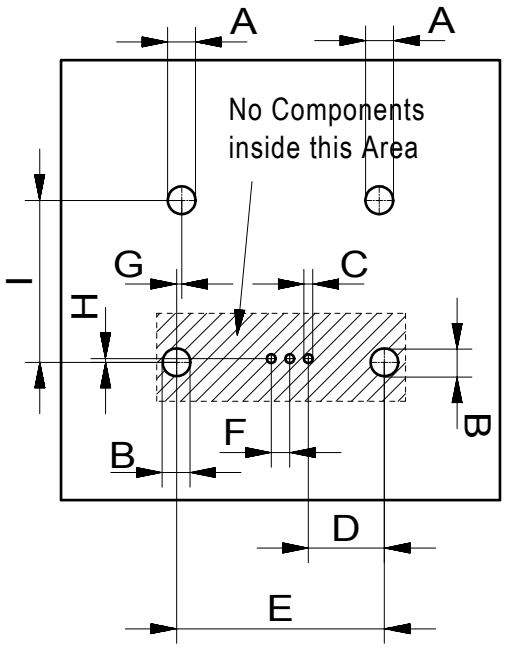
Physical dimensions and mounting informations are provided in Figure 3 and 4.

4.1 Dimensions and pin out



Pin#	Function
1	VDD +5Vdc
2	GND
3	Out 0.25 – 4.0Vdc

Figure 3: Pin out and physical dimensions in cm (inch). The drawing is not to scale.



Dim.	[mm]	[inch]	[mil]
A	3.00	0.118	118
B	3.20	0.126	126
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 4: SDP1000/SDP2000 PCB footprint. The drawing is not to scale.

4.2 Soldering instructions

The SDP1000 / SDP2000 can be wave soldered. For reflow soldering contact Sensirion.

4.3 Connecting tubes

Sensirion recommends tubes with an inner diameter of 3/16".

5 Ordering Information

When ordering SDP1000 / SDP2000 please refer to the following part names and article numbers. For the latest product information check out Sensirion's website on http://www.sensirion.com

Part name	Output	Range (Full scale)				Article Number
SDP1000-L	Voltage 0.25 - 4.0 V, linear	500 Pa	5 mbar	2 "H_20	0.07 PSI	1-100110-01
SDP2000-L	Voltage 0.25 - 4.0 V, linear	3500 Pa	35 mbar	14 "H_20	0.50 PSI	1-100113-01
SDP1000-R	Voltage 0.25 - 4.0 V, square root	500 Pa	5 mbar	2 "H_20	0.07 PSI	1-100111-01
SDP2000-R	Voltage 0.25 - 4.0 V, square root	3500 Pa	35 mbar	14 "H_20	0.50 PSI	1-100112-01
SDPx000-OEM	Digital output on request	Other ranges on request				-

6 Important Notices

6.1 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. **Failure to comply with these instructions could result in death or serious injury.**

Should buyer purchase or use SENSIRION AG products for any such unintended or unauthorized application, buyer shall indemnify and hold SENSIRION AG and its officers, employees, subsidiaries, affiliates and distributors harmless 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 such claim alleges that SENSIRION AG was negligent regarding the design or manufacture of the part.

6.2 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 normal ESD precautions when handling this product.

6.3 Warranty

SENSIRION AG makes no warranty, representation or guarantee regarding the suitability of its product for any particular purpose, nor does SENSIRION AG assume any liability arising out of the application or use of any product or circuit and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters can and do vary in different applications. All operating parameters, including "Typical" must be validated for each customer applications by customer's technical experts.

SENSIRION AG reserves the right, without further notice, to change the product specifications and/or information in this document and to improve reliability, functions and design.

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