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SPX-Series
Integrated Circuit Pressure Sensors

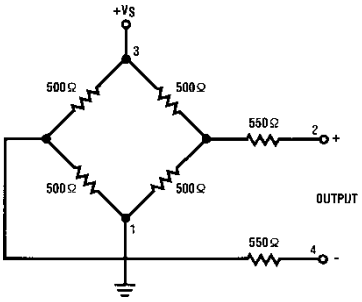
FEATURES

- **Low cost**
- **0 ... 50 kPa to 0 ... 200 kPa**
- **Absolute and differential devices**
- **full scale combined linearity and hysteresis error <0.1 %**
- **Easily mountable via tie wrap, screws or direct soldering in PCB**
- **Small internal volume provides fast response**

APPLICATIONS

- **Medical Equipment**
- **Automotive**
- **Computer Peripherals**
- **Industrial Control**

EQUIVALENT CIRCUIT



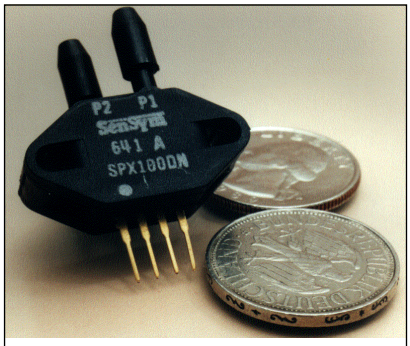
GENERAL DESCRIPTION

The SPX Series feature an integrated circuit piezoresistive pressure sensor which provides an output voltage proportional to applied pressure. These devices use ion implanted resistors in an integral silicon diaphragm to transform the related shear stress, due to pressure, into an electrical output.

The Absolute (A) devices have an internal vacuum reference and an output voltage proportional to absolute pressure. The Differential (D) devices allow application of pressure to either side of the diaphragm and can be used for gage or differential pressure measurements.

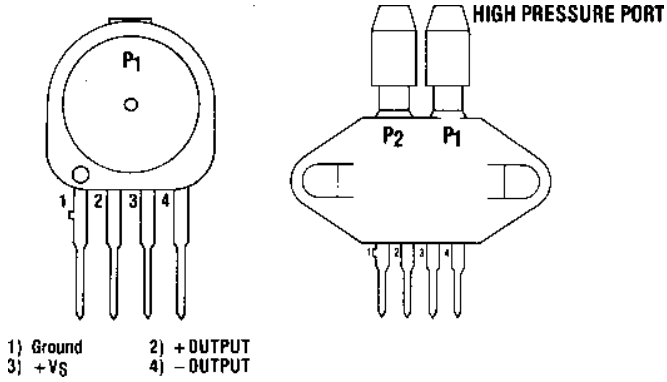
The basic SPX package (ie. SPX50D) has a compact plastic/aluminum housing which can be o-ring sealed or glued into a pressure connection fitting. The "N" package provides easy connections for plastic tubing. Both packages feature a standard 4-pin SIP for easy PC board mounting and electrical connection.

Although Sensym offers signalconditioned transducers, these devices feature only the basic shear stress IC pressure sensor element. This greatly reduces unit cost and allows the electronic designer greater freedom in implementing transducer circuits. These devices are especially useful in applications requiring circuit flexibility, or compatibility with microprocessors.



Scale: 1 cm
1 inch

ELECTRICAL CONNECTION



Note: Polarity applies for positive pressure applied to the high pressure port P1, (forward gage)

January 1998/080

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SPX-Series
Integrated Circuit Pressure Sensors

SenSym

SPECIFICATIONS

Characteristic		Min.	Typ.	Max.	Unit
Operating pressure	SPX50	0	---	50	kPa
	SPX100			100	
	SPX200			200	
Supply curent		---	6.0	---	mA
Full scale span[2]		40	60	95	mV
Zero pressure offset	SPX50	0	20	35	
	SPX100/SPX200		10	35	
Sensitivity	SPX50	800	1200	1900	µV/kPa
	SPX100	400	600	950	
	SPX200	200	300	425	
Combined non-linearity and hysteresis[3]		---	±0.10	±0.50	%FS
Repeatability[4]		---	±0.50	---	
Temperature coefficient of offset[5]		---	±15	---	µV/°C
Temperature coefficient of span[5]		-2550	-2350	-2050	ppm/°C
Temperature coefficient of resistance[5]		1150	1350	1550	
Input resistance		400	500	600	Ohm
Output impedance		---	1600	---	
Response time (10% to 90%)[7]		---	1.0	---	ms
Long term stability of offset and sensitivity[8]		---	0.10	---	%FS

Specification Notes: (For all devices)

1. Reference conditions: Supply voltage, V_S = 3 V_{DC}, T_A = 25°C, Common-mode line pressure = 0psig.
2. Pressure applied to P_1; 1.0 kPa equals 0.145 psi.
3. Span is the algebraic difference between the output voltage at full-scale pressure and the output at zero pressure.
4. Non-linearity is the algebraic sum of the percent of errors due to li nearity and hysteresis given the following definitions:

$$\%FS\ error = \frac{V_{1/2\ full\ scale} - \left\{\left(\frac{V_{full\ scale} - V_{offset}}{full\ scale\ pressure}\right) \times (1/2\ full\ scale\ pressure) + V_{offset}\right\}}{2\ (V_{full\ scale})} \times 100\%$$

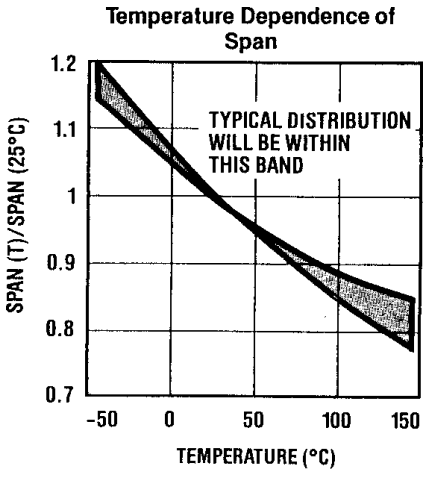
   Hysteresis - the maximum output difference at any point within the operating pressure range for increasing and decreasing pressure.
5. Maximum difference in output at any pressure within the operating pressure range and temperature within 10°C to 85°C after:
   a) 1,000 temperatuer cycles -40°C to 125°C
   b) 1.5 million pressure cycles, 0 kPa to full-scale span.
6. Slope of the endpoint straight line from -40°C to 125°C.
   This is the best straight line fit for operation between 0°C and 70°C. For operating outside this temperature, contact factory for more specific applications information.
7. Response time for a 0 kPa to full-scale span pressure step change.
8. Long term stability over a one year period.

PRESSURE SENSOR CHARACTERISTICS

Maximum ratings (for all devices)

Supply voltage, V_S	6 V_{DC}
Temperature range	-40°C to 125°C
Operating	-65°C to 150°C
Storage	
Common-mode line pressure	60 psig
Lead temperature (soldering, 4 seconds)	250°C
Proof pressure	2 x Operating pressure
Burst pressure	3 x Operating pressure

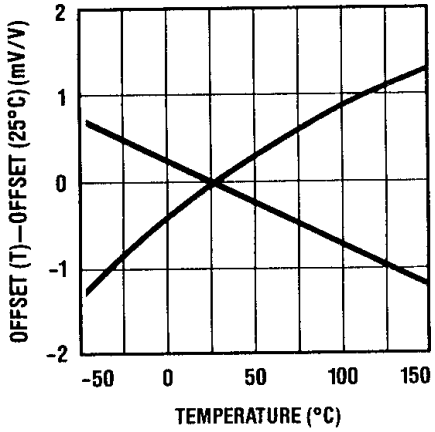
Temperature dependence of span



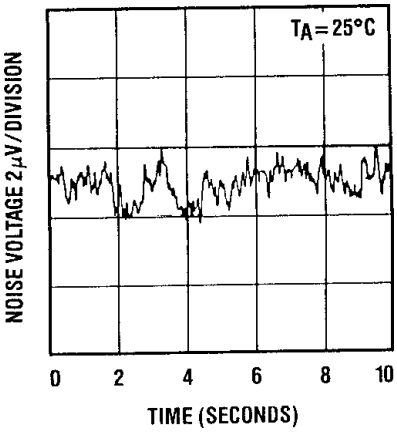
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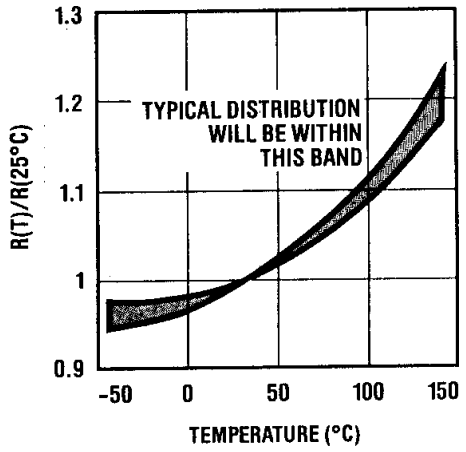
Temperature dependence of offset



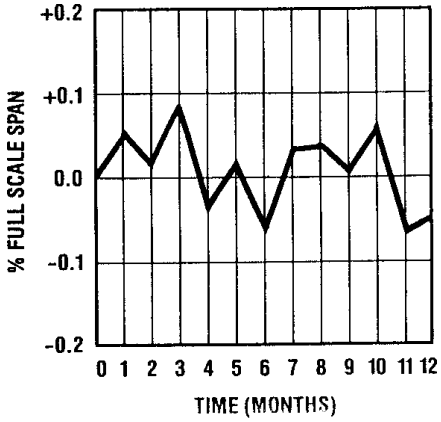
0.1 kHz to 10 Hz Noise



Temperature dependence of bridge resistance, R_B



Typical long term stability of span and offset



GENERAL DISCUSSION

OUTPUT CHARACTERISTICS

The SPX series devices give a voltage output which directly proportional to applied pressure. The devices will give an increasing positive going output when increasing pressure is applied to pressure port P_1 of the device. If the device is operated in the backward gage mode, the output will increase with decreases in pressure.

The devices are ratiometric to the supply voltage. Changes in supply voltage will cause changes in the transfer curves, offset voltage, and full-scale span.

USER CALIBRATION

SPX series devices feature a basic IC pressure sensor element. This will keep overall system costs down by allowing the user to select calibration and temperature compensation circuits which specifically match individual applications needs. In most cases, the primary signal conditioning elements to be added to the SPX by the user are: offset and span calibration and temperature compensation. Some typical circuits are shown in the application section.

VACUUM REFERENCE (ABSOLUTE DEVICES)

Absolute sensors have a hermetically sealed vacuum reference chamber. The offset voltage for these units is measured at vacuum, 0 psia. Since all pressure is measured relative to a sealed vacuum reference, all changes in barometric pressure or changes in altitude will cause changes in the device output.

MEDIA COMPATIBILITY

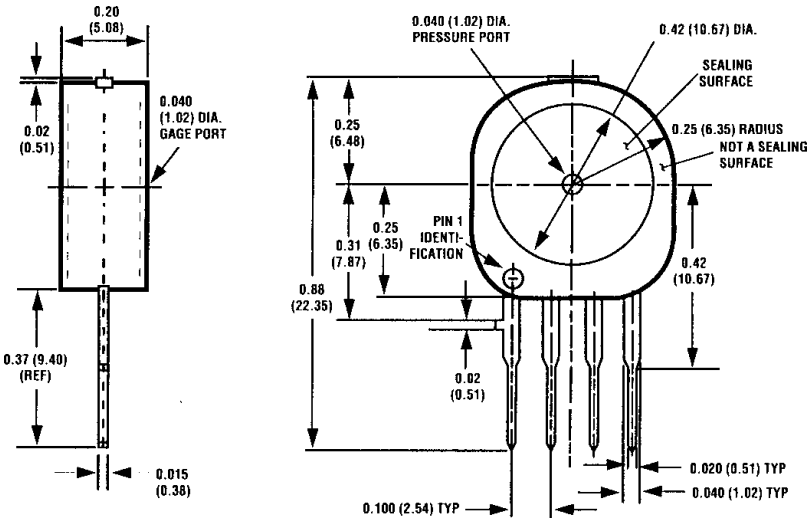
SPX sensors are designed to measure non-corrosive and non-ionic pressure fluids like dry air. Because the circuitry on the devices is coated with a protective silicon gel, otherwise corrosive environments can be compatible with the sensors. As shown in the physical construction diagram below, fluids must generally be compatible with silicon gel, plastic, and aluminium for forward gage use; and RTV, silicon, glass and aluminium for backward gage or differential applications. For questions concerning media compatibility, contact the factory.

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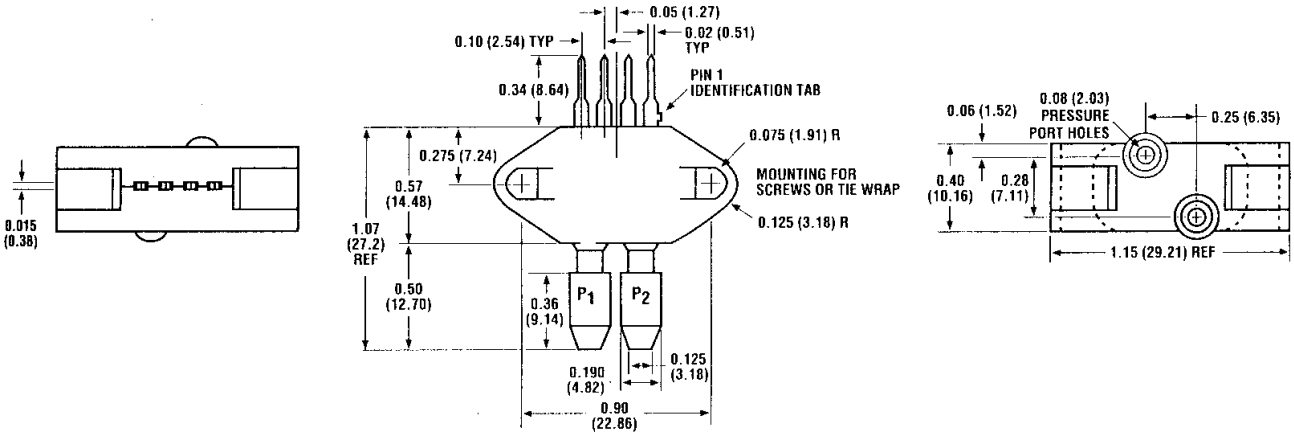
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PHYSICAL DIMENSIONS

Button Package



N Package



ORDERING INFORMATION

To order, use the following part numbers:

Operating pressure	Absolute device	Differential / gage device	Packaged sensor N packaged
0 - 7 psid	---	SPX50D	SPX50DN
0 -15 psia	SPX100A	---	SPX100AN
0 - 15 psid	---	SPX100D	SPX100DN
0 - 30 psia	SPX200A	---	SPX200AN
0 - 30 psid	---	SPX200D	SPX200DN

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