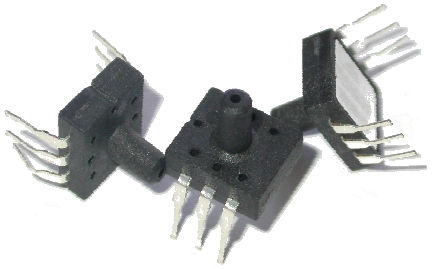
Pressure sensor SPD015GD

This Smartec pressure sensor has a digital output. The sensor is compensated for offset, sensitivity, temperature drift and nonlinearity.
The sensor is available in the ranges 1 to 100 psi.
Available in Gauge and Absolute type. The SPD digital series can be considered as an "digital"successor of the SPD series

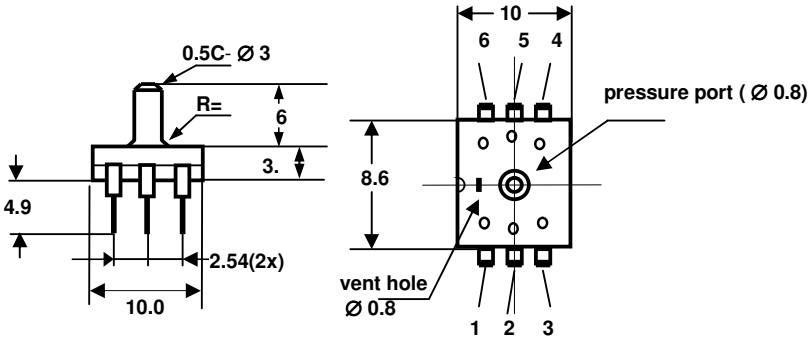


Electrical Characteristics

Performance Characteristic at Vcc =5V excitation @ 25 °C.

Parameter	Min	Typ	Max	Units.
Excitation Voltage	2,7	5	5,5	V
Excitation Current	-		2,5	mA
Pressure range	0		15	psi
Resolution		14		Bit
Temp Coeff Span *)	-0,5		0,5	%FS
Temp Coeff Offset *)	-0,5		0,5	%FS
Linearity	-0,25		0,25	%FS
Update rate		40		Hz
compensating range	5		60	°C
Operating temperature	-20		85	°C
Storage temperature	-40		125	°C
Over pressure			2x	FS

Wetted materials are: Glass, RTV, PPA and silicon; for other media as clean air contact Smartec
*) all errors included, temperature compensation over 70 °C



Pin	Description
1	NC
2	NC
3	Gnd
4	Vcc
5	SIG out
6	NC

Do NOT use NC pins
Apply 100nF between Gnd and Vcc

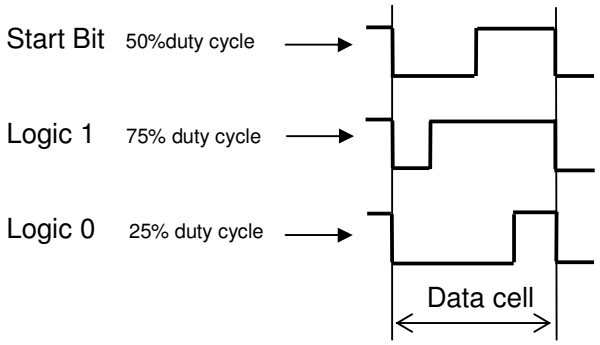
Hardware Communications

In the table below the hardware output specifications are depicted.

Output Parameter	Min	Typ	Max	Unit	Remarks
Rise time			9	µs	
load Capacitance	0	1	15	nF	
Voltage level-low		0	0,2x	Vdd	CMOS driver
Voltage level high	0,8x	1x		Vdd	with respect to Vdd
ESD protection			>4000	V	for all pins

It is advised to apply a 100nF capacitor between Vdd and Vss.

The digital interface protocol is based on bit serial manchestercode output. This represents a signal duty cycle of 75% is a logical 1 and a duty cycle of 25% represents a logical 0. Below in little drawing the manchestercode is depicted.



Output format
The output of the sensor is a two byte word. The first byte contains the most significant 6 bits of the 14 bit output word and the second byte represent the least 8 significant bits of the 14 bits output. The first two bits of the first byte are zero. The format of the pressure sensor output is depicted below:

Digital pressure sensor output a two bytes package

Data byte –high **Data byte –low**

S Start Bit

X Data Bit

P Parity Bit

Between the two data bytes there is a stop bit (always "1") with the length of half of the data cell (not drawn)

The transmission speed depends on the update rate and ranges up to 8 KHz.
The software has to determine the digital output speed by the “Start Bit”. This Start bit is 50% low and 50% high. Based on this in formation the speed of the incoming data can be interpreted. The parity is defined as even meaning in case the number of 1's in the word is even the parity is zero and in case the number is odd the parity bit is 1.
Between the high and lower byte there is a stop bit, level 1, with the length of half of the data cell (not drawn in picture).

From 14 bits incoming data to pressure value.
The digital SPD series pressure sensors are calibrated to a straight line transfer function between the incoming pressure and the outgoing digital word. The pressure can easily be calculated from the transfer function. Below is explained how the pressure can be derived from the 14-bits data word.

The pressure is presented as a 14-bits digital word. The digital word is between 0 and 3FFF in Hexadecimal or from 0 to 16383 in decimal. For the ease of calculation we use only the decimal presentation.

In general the upper 10% and the lower 10% of the numeric range of the 14 bits are outside the pressure range.
To make it more clear for the user two examples are given how to calculate the relation between pressure and digital output.

100 psi sensor.

The relation between the pressure and the output digital word can be calculated as given below:

In case a 0 – 100 psi sensor the lower end of the scale will be decimal 1638 (= 10% of the full scale of 16383 and the 100 psi value will be 14,745 (= 90% of 16,383)
This means the 100 psi range will be transferred to 13,107 decimal values (= 14,745 – 1638). This means each psi will be equal to 131.07 dec points
The transfer function can be determined by the formula below.

Ouput (dec) = Pressure (psi) X 131.07 + 1,638

or

$$\text{Pressure (psi)} = \frac{\text{Output (dec)} - 1{,}638}{131.07}$$

We always advise to limit the transfer from 10 to 90% of the binary range. This means an over- and under-pressure can be detected.

The same way calculation can be used for the transfer function of differential sensor.
In case another transfer function is needed please contact us.

-10 to +10 psi differential sensor.

The span is 20 psi. This is 80% of the digital scale, so 20 psi over 13.107 dec points on the output, which means 13,107/20 per psi = 655.35 for each psi. The binary offset at –10 psi is again 10% of the binary range is 1,638 dec.
The relation between the output and the pressure can be derived as:
Output(dec) = (Pressure(psi)+10) x 655.35 + 1,638

or

$$\text{Pressure (psi)} = \frac{\text{Output (dec)} - 1{,}638}{655.35} - 10$$

For other pressure ranges the output scaling factor and offset can be calculated easily.
Note that the examples above are specified in units of psi. The example transfer functions are only valid for this unit. In case other pressure units (Bar, Kpa, etc.) are applicable the transfer function has to be modified for that particular unit. In case of questions please contact our office.

Order Code:

SPD100GD 100 PSI Gauge sensor with serial digital output.
(For other pressure range please contact your distributor)