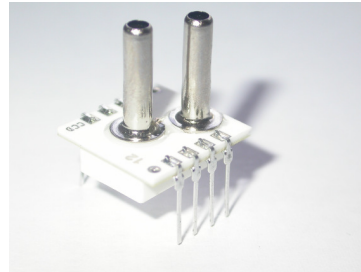


LOW PRESSURE RANGE DIFFERENTIAL SENSOR WITH I²C OUTPUT

This Smartec differential pressure sensor has an I²C output. The sensor is compensated for offset, sensitivity, temperature drift and nonlinearity. The sensor has a range of 102 mm H₂O FS. Other pressure ranges can be delivered on request (0.3 – 100 PSI).



Electrical Characteristics

Performance Characteristic at V_{cc} =5V excitation @ 25 °C.

Parameter	Min	Typ	Max	Units.
Supply Voltage	4.75	5.00	5.25	V
Supply Current	-		3	mA
Pressure range (fs)		±102		mmH2O
Linearity 1)	-2.5		+2.5	%FS
Thermal Hysteresis 1)	-0.1		+0.1	%FS
Temp coeff. Offset 1)	-2.5		+2.5	%FS
Temp coeff. Span 1)	-2		2	%FS
Conversion rate		2000	4000	Hz
Resolution		15		Bits
Input High	0,7		1	V
Input low	0		0.3	V
Output Low			0.1	V
Set-up time	2		5	ms
Pressure overload			10X	rating
Temp compensation	0		50	°C
Operating Temp range	-20		70	°C
Storage temperature	-40		125	°C

1) all values + 1 LSB

- It is advised to place a 100nF capacitor between V_{cc} and Gnd
- Wetted materials are: Pyrex glass, RTV, Ceramic, Nickel and Silicon

I²C Protocol

General conventions

- Before a communication, the I²C -bus must be free or not busy. It means that the SCL and SDA lines must both be released by all devices on the bus, and they become HIGH by the bus pull-up resistors.
- The host must provide SCL clock pulses necessary for the communication. Data is transferred in a sequence of 9 SCL clock pulses for every 8-bit data byte followed by 1-bit status of the acknowledgement.
- During data transfer, except the START and STOP signals, the SDA signal must be stable while the SCL signal is HIGH. It means that the SDA signal can be changed only during the LOW duration of the SCL line.
- S: START signal, initiated by the host to start a communication, the SDA goes from HIGH to LOW while the SCL is HIGH.
- P: STOP signal, generated by the host to stop a communication, the SDA goes from LOW to HIGH while the SCL is HIGH. The bus becomes free thereafter.
- W: write bit, when the write/read bit = LOW in a write command.
- R: read bit, when the write/read bit = HIGH in a read command.
- A: device acknowledge bit, returned by the SPD sensor. It is LOW if the device works properly and HIGH if not. The host must release the SDA line during this period in order to give the device the control on the SDA line.
- A': master acknowledge bit, not returned by the device, but set by the master or host in reading 2-byte data. During this clock period, the host must set the SDA line to LOW in order to notify the device that the first byte has been read for the device to provide the second byte onto the bus.
- NA: Not Acknowledge bit. During this clock period, both the device and host release the SDA line at the end of a data transfer, the host is then enabled to generate the STOP signal.
- In a write protocol, data are sent from the host to the device and the host controls the SDA line, except during the clock period when the device sends the device acknowledgement signal to the bus.
- In a read protocol, data are sent to the bus by the device and the host must release the SDA line during the time that the device is providing data onto the bus and controlling the SDA line, except during the clock period when the master sends the master acknowledgement signal to the bus.

During running measurement cycle, data is updated with most actual results.

Start	F1hex(ReadCmd)	ACK	Data0	ACK	Data1	NACK	Stop
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(Master controls the SDA line Slave controls the SDA line)

After *Data1* is received master can generate an ACK and then receive *Data0* again. This means readout can be processed in loop without resend initialization by master.



SPD102DIhyb

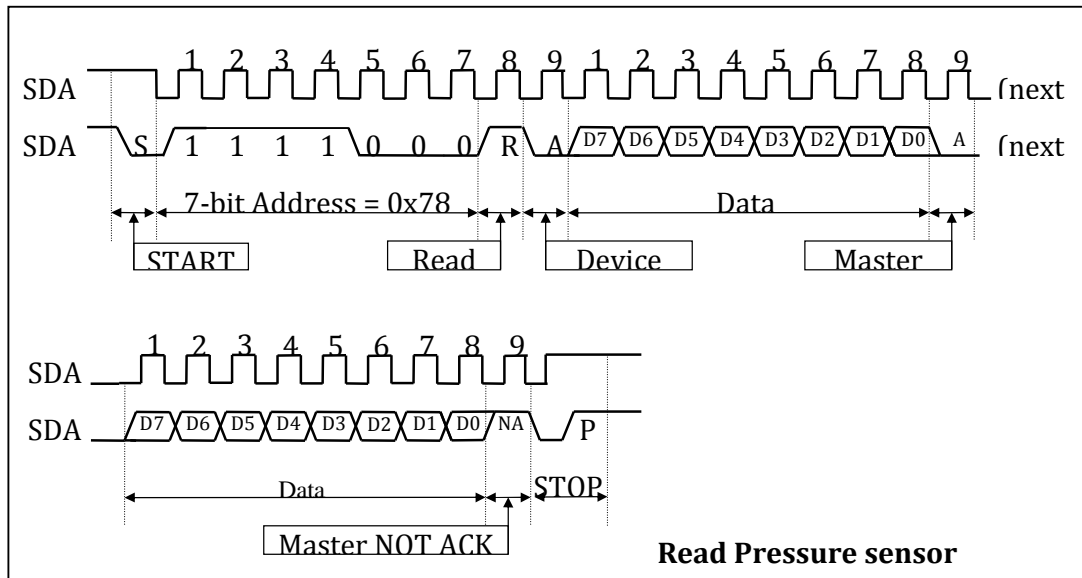


Fig. 2: Read operation - data request fC

From 15 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. Below is explained how the pressure can be derived from the 15-bits data word.

The pressure is presented as a 15-bits digital word. The digital word is between 0 and 4FFF in Hexadecimal or from 0 to 32767 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 15 bits are outside the pressure range. This is done to detect wrong function of the sensors and under- and overflow. So when the decimal value is lower then 3277 or higher then 29,491 the sensor is out of range.

The SPD102DIhyb a -102 to +102 mm differential sensor.

The span is 204 mm H₂O. This is 80% of the digital scale, so 102 mm over 26,214 dec points on the output, which means 26,144/204 per mm H₂O = 128.50 for each mm H₂O. The binary offset at -102 mm is again 10% of the binary range is 3,277 dec.

This means the relation between the decimal output and the pressure can be derived as:

$$\text{Output(dec)} = (\text{Pressure(mm H}_2\text{O)} + 102) \times 128.50 + 3,277$$

or

$$\text{Pressure (mm H}_2\text{O)} = \frac{\text{Output (dec)} - 3,277}{218.50} - 102$$



