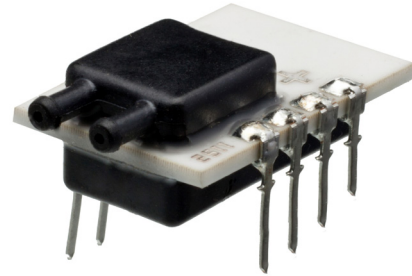


Data Sheet

P1J

Pressure Sensor



Main Features

Pressure Ranges	2, 5, 10, +/-2, +/- 5, inches of water; 5, 12.5, 25, +/- 5, +/- 12.5 mbar
Electrical Connection	PCB thru hole terminal pins, 2.54 mm [.100 inch] pitch
Pressure Connection	Barbed port, 1.9[.08] diameter
Housing Material	PPS, 40% glass filled, black
Terminal Pin Material	Phosphor bronze, tin plated
Supply Voltage	2.7 to 5.5 VDC
Output Signal	14 Bit Digital Output – Digital count at null (0% FS): 1638 Digital count at full scale (100% FS) 14745

Attributes

- Compact Package
- Amplified Temperature Compensated Digital Output
- Position Sensitivity above < 0.1% FS
- EMI/RFI and ESD Protected
- Superior Output Signal Stability
- Printed Circuit Board through Hole Mounting

Typical Applications

- Variable Air Volume Systems
- Filter Pressure Monitoring
- Duct Air Flow
- Modulated Furnace Controls
- Combustion Airflow
- Gaseous Leak Detection
- **Medical Applications:**
Oxygen Concentrators, Ventilators,
Anesthesia Equipment, CPAP,
Wound Therapy.

Description

The P1J series of pressure sensors incorporates a silicon MEMS sensing element in a compact package. Using a 2.7 to 5.5 VDC supply voltage, the P1J provides a SPI or I2C digital output as required by your application. Internal temperature compensation provides accurate, easy to use sensor. The industry standard terminal pins provide ease of use for your printed circuit board designs.

Technical Specifications

Pressure Ranges

from 0 to ...	2" H2O	5" H2O	10" H2O	+/- 2" H2O	+/- 5" H2O
from 0 to ...	5mbar	12.5mbar	25mbar	+/- 5mbar	+/- 12.5 mbar
Proof pressure (min)	1.0 PSI/ (70mbar)	1.0 PSI/ (70mbar)	1.0 PSI/ (70mbar)	1.0 PSI/ (70mbar)	1.0 PSI/ (70mbar)
Burst pressure factor	1.8 PSI/ (125mbar)	1.8 PSI/ (125mbar)	1.8 PSI/ (125mbar)	1.8 PSI/ (125mbar)	1.8 PSI/ (125mbar)

Physical

Expected Operating Life:	10 million full pressure cycles
Shelf Life:	10 years minimum
Stability:	+/- 0.5% of full scale span for 1 year
Vibration:	10 G's peak to peak sinusoidal (20 to 1600Hz)
Shock Resistance:	50 G's ½ Sinewave, 11 mSec pulse, 18 pulses (6 per axis)
Weight:	3.5g max.
Operating Temperature:	-20°C to 85°C
Storage Temperature:	-40°C to 125°C
Humidity:	Up to 92% RH in a non-condensing environment
Media	Dry air

Performance*

Error Band at 25°C	1.0% (2% for 0-2")
Accuracy	0.25% Max (RSS of linearity, hysteresis and repeatability)
Temp. Error	0.05%/ °C
Temp. Error	5% within temperature range -20°C to 0°C and 60°C to 85°C

*Within supply voltage range of 4.5 to 5.5 VDC

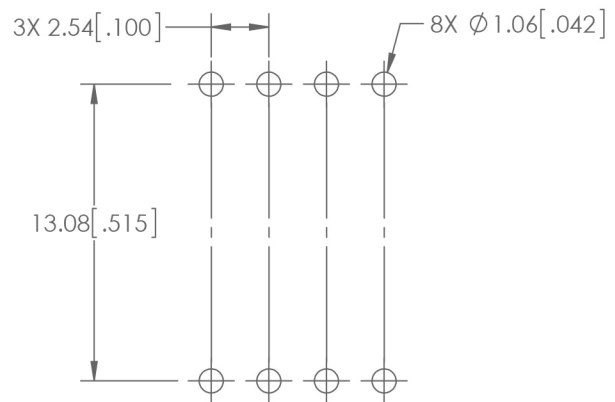
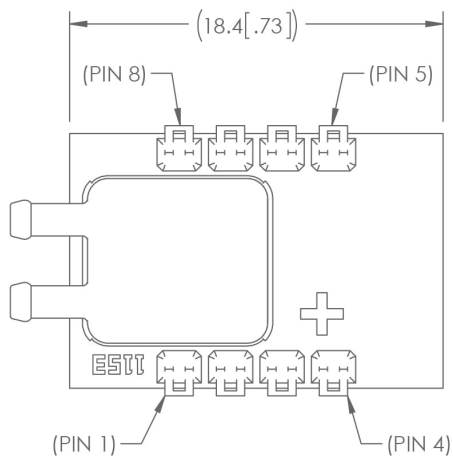
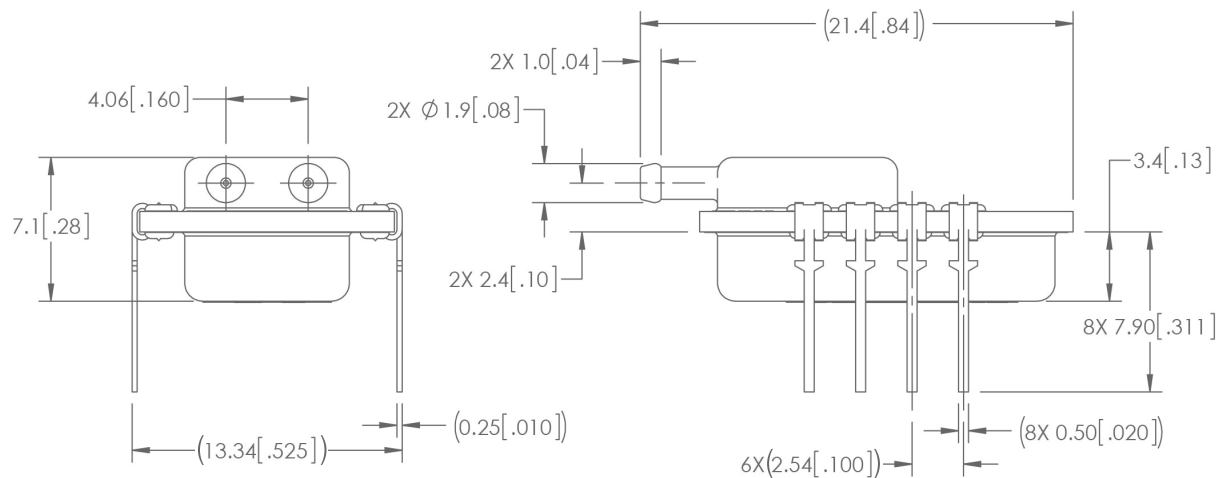
Electrical

Input voltage protection	-0.3 to 6 VDC on Vin PIN, -0.3 to Vs+0.3 on all other pins
Excitation Current	< 2.5mA
Minimum Load	25k Ohms between output and ground
Response Time	0.5 ms

Approvals & Certificates

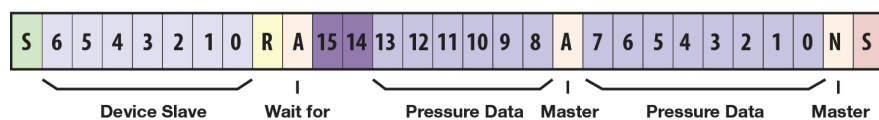
RoHS

Dimensions



RECOMMENDED PCB LAYOUT

I2C Communication



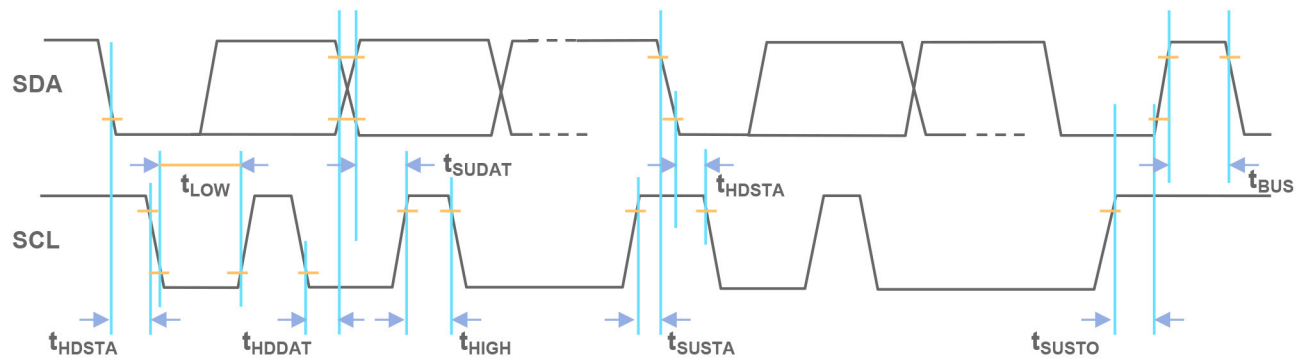
S	Start Condition	A	Acknowledge (ACK)
6 5 4 3 2 1 0	Device Slave Address (example: Bit 5)	N	No Acknowledge (NACK)
2	Data Bit (example: Bit 2)	S	Stop Condition
R	Read/Write Bit (example: Read = 1)		Status Bit

OUTPUT

Signal resolution	12 Bits			
Update rate	0.5 ms			
Digital count at 0% pressure	1638 (10% of 2 ¹⁴ counts or 0x666)			
Digital count at 100% pressure	14745 (90% of 2 ¹⁴ counts or 0x3999)			
Sensor slave addresses	40 (0x28), 56 (0x38), 72 (0x48), 88 (0x58), 104 (0x68), 120 (0x78)			
PARAMETER	SYMBOL	MIN	MAX	UNITS
Analog Supply Voltage to Gnd	VDD	2.7	5.5	V
High-level input voltage	VIH	0.8 × VDD	VDD	V
Low-level input voltage	VIL	0	0.2 × VDD	V
High-level output voltage	VOH	VDD - 0.2	-	V
Low-level output voltage	VOL	-	0.2	V
Output Sourcing Current	IOH_SDA	-1.9	-4.8	mA
Output Sink Current	IOL_SDA	2.3	6.2	mA
Load Capacitance at SDA (@ 400 kHz)	CSDA		200	pF
Pull-up Resistor	RI2C_PU	500		Ω
Input Capacitance (each pin)	CI2C_IN		10	pF
SCL clock frequency	fSCL	100	400	kHz
START condition hold time relative to SCL range	tHDSTA	0.1	-	μs
Minimum SCL clock low width 1)	tLOW	0.6		μs
Minimum SCL clock high width 1)	tHIGH	0.6		μs
Start condition setup time relative to SCL edge	tSUSTA	0.1		μs
Data hold time on SDA relative to SCL edge	tHDDAT	0		μs
Data setup time on SDA relative to SCL edge	tSUDAT	0.1		μs
Stop condition setup time on SCL	tSUSTO	0.1		μs
Bus free time between stop condition and start condition	tBUS	2		μs

1) Combined low and high widths must equal or exceed minimum SCLK period.

I2C Timing Diagram



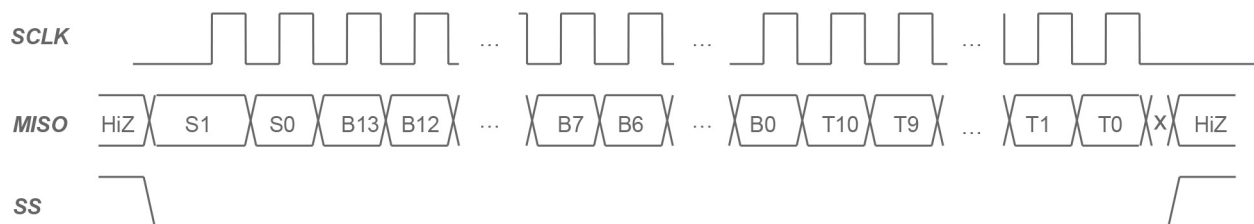
Note

There are three adjustments to the I2C implementation compared with the original I2C™ protocol:

- Sending a start-stop condition without any transitions on the CLK line (no clock pulses in between) creates a communication error for the next communication, even if the next start condition is correct and the clock pulse is applied. An additional start condition must be sent, which results in restoration of proper communication.
- The restart condition—a falling SDA edge during data transmission when the CLK clock line is still high—creates the same situation. The next communication fails, and an additional start condition must be sent for correct communication.
- A falling SDA edge is not allowed between the start condition and the first rising SCL edge. If using an I2C™ address with the first bit 0, SDA must be held low from the start condition through the first bit.

SPI Communication

Output Packet with Positive Edge Sampling

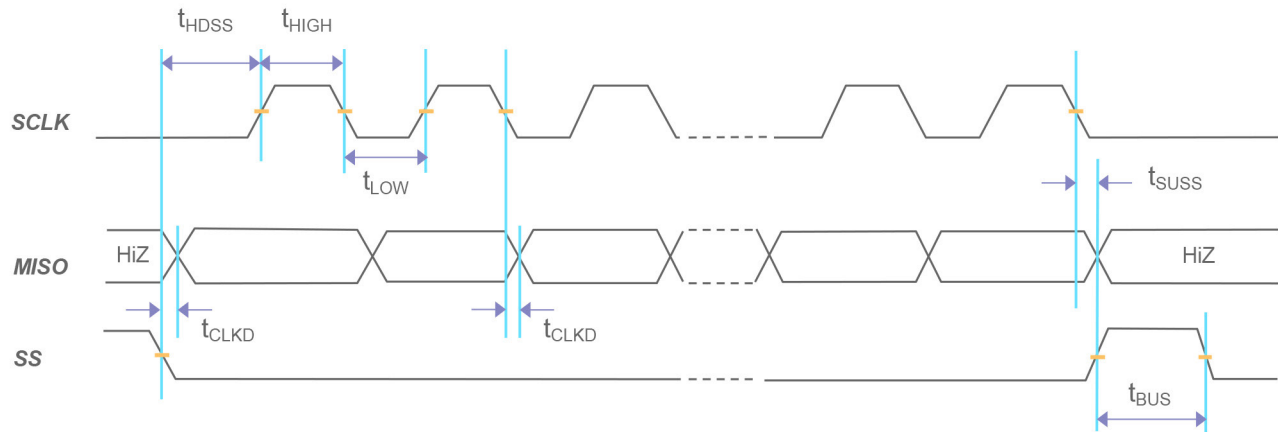


Packet = [{S(1:0), B(13:8)}, {B(7:0)}, {T(10:3)}, {T(2:0),xxxxx}] Where
 S(1:0) = Status bits of packet (normal, command, busy, diagnostic)
 B(13:8) = Upper 6 bits of 14-bit bridge data
 B(7:0) = Lower 8 bits of 14-bit bridge data
 T(10:0) = NOT corrected temperature data (mask out or terminate read early)

OUTPUT				
Signal resolution	12 Bits			
Update rate	0.5 ms			
Digital count at 0% pressure	1638 (10% of 2 ¹⁴ counts or 0x666)			
Digital count at 100% pressure	14746 (90% of 2 ¹⁴ counts or 0x3999)			
PARAMETER	SYMBOL	MIN	MAX	UNITS
Analog Supply Voltage to Gnd	VDD	2.7	5.5	V
High-level input voltage	VIH	0.8 × VDD	VDD	V
Low-level input voltage	VIL	0	0.2 × VDD	V
High-level output voltage	VOH	VDD - 0.2	-	V
Low-level output voltage	VOL	-	0.2	V
Output Sourcing Current @ VOH	IOH_MISO	-1.9	-4.8	mA
	IOH_SS	-0.63	-1.9	mA
Output Sink Current @ VOL	IOL_MISO	2.3	6.2	mA
	IOL_SS	0.85	3.0	mA
Input Capacitance (each pin)	CI2C_IN		10	pF
SCLK clock frequency (4 MHz clock)	fSCL	50	800	kHz
SCLK clock frequency (1 MHz clock)	tSCL	50	200	kHz
SS drop to first clock edge	tHDSS	2.5		μs
Minimum SCL clock low width 1)	tLOW	0.6		μs
Minimum SCL clock high width 1)	tHIGH	0.6		μs
Clock edge to data transition	tCLKD	0	0.1	μs
Rise of SS relative to last clock edge	tSUSS	0.1		μs
Bus free time between rise and fall of SS	tBUS	2		μs

1) Combined low and high widths must equal or exceed minimum SCLK period.

SPI Timing Diagram



Note

The MISO line is setup to change state on the falling edge of the SCLK clock. Accordingly, the master should sample the data on the rising edge of the SCLK signal.

I2C/SPI Diagnostic Features

The P1J offers a full suite of diagnostic features to ensure robust system operation. The diagnostic states are indicated by a transmission of the status of the 2 MSBs of the bridge high byte data or by a saturated output at 3FFFH.

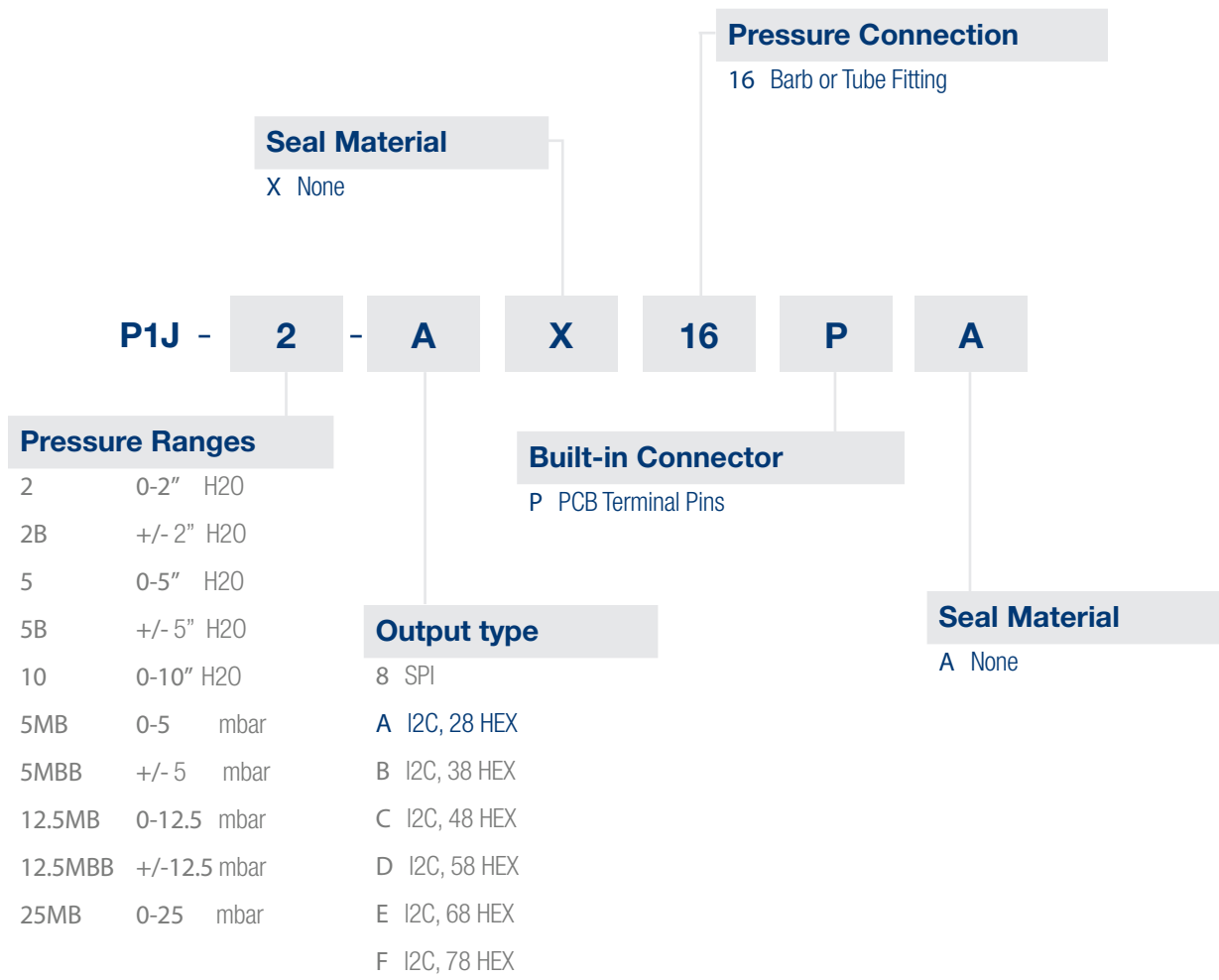
Status bits (2 MSB's of Output Package)	Definition
00	Normal operation, good data packet
01	Device in Command Mode
10	Stale data: Data that has already been fetched since the last measurement cycle. Note: If a data fetch is performed before or during the first measurement after power-on reset, then "stale" will be returned, but this data is actually invalid because the first measurement has not been completed.
11	Diagnostic condition exists

When the two MSBs are 11, one of the following faults listed below is indicated.

- Invalid EEPROM signature
- Loss of bridge positive or negative
- Bridge input short
- Loss of bridge source
- Loss of bridge sink

All diagnostics are detected in the next measurement cycle and reported in the subsequent data fetch. Once a diagnostic is reported, the diagnostic status bits will not change unless both the cause of the diagnostic is fixed and a power-on-reset is performed.

How to Order



Example:
P1J-2-AX16PA

Description:
P1J Pressure sensor 0 -2" H2O, I2C 28 Hex digital output, no internal material seal, barbed tube fitting port with PCB Terminal Pin connection, no external material seal.



Before installation and operation, ensure that the appropriate pressure sensor has been selected in terms of pressure range, design and specific measuring conditions. Non-compliance can result in serious injury and/or damage to the equipment.

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- Manufacturing Facility
- Commercial Office



Contact Information

North America

Custom Sensors & Technologies (CST)
235 E. Main St., Suite 102A
Northville, MI 48167, USA
Phone: +1 (248) 465-0815
Fax: +1 (248) 465-0810
E-mail: pressure.sensors@kavlico.com

Europe

Custom Sensors & Technologies (CST)
Potsdamer Strasse 14
32423 Minden, Germany
Phone: +49 571 3859-0
Fax: +49 571 3859-119
E-mail: info@kavlico.de

China

Custom Sensors & Technologies (CST)
11th Floor, Chang Feng
International Tower, 89
Yunling Road (east), Putuo District
Shanghai - 200062, China
Phone: +86 (21) 8025 7166
Fax: +86 (21) 6107 1771
E-mail: china@cstsensors.com

India

Custom Sensors & Technologies (CST)
Trident Tower, No. 23, 4th Floor, 100 Feet Road
Ashoka Pillar Road, 2nd Block, Jaydnagar
Bangalore - 560011, India
Phone: +91 80 4113-2204/05
Fax: +91 80 4113-2206
E-mail: india@cstsensors.com

South Korea

Custom Sensors & Technologies (CST)
14F, Kbiz DMC Tower, 189,
Seongam-ro, Mapo-gu,
Seoul, Korea 121-904
Phone: +82 2 2629-8312
Fax: +82 2 2629-8310
E-mail: korea@cstsensors.com

East Asia & Pacific Countries

Custom Sensors & Technologies (CST)
10/F, Wharf T&T Centre, Harbour City,
7 Canton Road, Tsim Sha Tsui,
Kowloon, HONG KONG
Phone: +852 3960 6473
Fax: +852 3669 7111
E-mail: eap@cstsensors.com