

SSI Technologies – Application Note PS-AN2

MediaSensor™ Absolute, Sealed, Gage Pressure Sensors Family Product Overview

Product Description

The MediaSensor™ (P51) family of bulk micro-machined, absolute, sealed and gage pressure sensors are for both harsh and benign media with superior *accuracy over an operating temperature of -40°C to 105°C*. These compact, robust sensors measure pressures from 3 PSI to 5,000 PSI and are well suited for a variety of automotive, industrial and commercial applications.

Product Features

- **Superb Accuracy:**
 - +/- 0.5% Full Scale for 75 PSI to 5000 PSI
 - +/- 1% Full Scale for 15 PSI to 60 PSI
 - +/- 2% Full Scale for 3 PSI to 10 PSI
- **Pressure Ranges:** 3 PSI to 5,000 PSI
- **Electronics:**
 - 0.5 – 4.5 Volt output (with 5V input)
 - 0.5 – 4.5 Volt output with overvoltage protection (with 5V input)
 - 1-5 Volt output (with 8 - 30V input)
 - 4 – 20 mA output (with 8 - 30V input)
- **Temperature Range:** -40°C to 105°C
- **Maximum Flexibility:** Custom ASIC provides signal conditioning for calibration and temperature compensation.
- **Standard and custom options available for OEM quantities**
- **Excellent price/performance ratio**



MediaSensor™ Family of Pressure Sensors with integrated signal conditioning

- **Compact, Robust Package:** All laser-welded stainless steel design for optimal media isolation in compact size
- **Chemical Compatibilities:** Any gas or liquid compatible with 304L & 316L Stainless Steel. For example, Motor Oil, Diesel, Hydraulic fluid, brake fluid, water, waste water, Hydrogen, Nitrogen, and Air.
- **Typical Applications:** Refrigeration; Fuel Cells; Pumps; Hydraulics; Process Control; Spraying Systems; Pneumatics; Compressors; Flow; Robotics; Agriculture; Hydrogen Storage

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Standard Full Scale Pressure Ranges

- **Gage:** 3, 5, 10, 15, 25, 30, 50, 60, 75, 100, 120, 130, 200, 225, 250 and 300 PSIG
- **Sealed:** 50, 100, 150, 200, 300, 400, 500, 750, 1000, 1500, 2000, 3000 and 5000 PSIA
- **Absolute:** 15, 30, 50, 65, 75, 100, 150, 200, 250, 300, 500, 750, 1000, 1500, 2000, and 3000 PSIA

Measurement Technology

In general, pressure measurement technology translates force from an induced pressure into an electrical quantity. The MediaSensor™ family of pressure transducers and transmitters use piezoresistive technology for its sensor signal processing to measure pressure.

A micro-machined stainless steel convoluted diaphragm with a silicon crystal semiconductor is used. Strain gauges (resistive elements) in the silicon crystal are used in a Wheatstone Bridge circuit. When pressure is applied, the resistivity of the strain gauges changes proportional to the pressure applied. Since a single silicon crystal is used it has a low mechanical hysteresis with good linearity.

One leg of the bridge measures the input pressures port. The other leg of the bridge is connected to the reference port the input pressure port is compared to. The connection to this reference port determines the pressure sensing convention used.

The MediaSensor™ family comes in a choice of three pressure sensing type conventions: absolute, gauge (vented or sealed).

Absolute MediaSensors™ measure pressure relative to perfect Vacuum pressure (0 PSI) which remains unchanged regardless of temperature, location or other ambient conditions such as weather. Absolute MediaSensors™ are calibrated to have 0.5 Vdc, 1 Vdc, or 4 mA respectively at 0 PSIA.

There are two different gauge pressure conventions – Vented Gauge and Sealed Gauge. Gauge MediaSensors™ measure pressure relative to ambient room pressure through a port that is vented (open) to the atmosphere. Gauge MediaSensors™ are calibrated to have 0.5 Vdc, 1 Vdc, or 4 mA respectively at 0 PSIG.

Sealed MediaSensors™ measure pressure relative to a port that is connected to a sealed perfect vacuum chamber. Sealed MediaSensors™ are calibrated to 14.5 PSI absolute. Sealed MediaSensors™ are calibrated to have 0.5Vdc, 1 Vdc, or 4 mA respectively at 14.5 PSIA.

The MediaSensor™ takes the two voltage output ports of the Wheatstone bridge and amplifies the signal. Piezoresistive pressure sensors are sensitive to changes in temperature. The MediaSensor™ uses signal conditioning to compensate for temperature and calibration. The output signal is then converted into one of four forms:

- 1) 0.5 – 4.5 Volt ratiometric output (transducer)
- 2) 0.5 – 4.5 V ratiometric output with Overvoltage protection (transducer)
- 3) 1 – 5 volt output (transducer)
- 4) 4 – 20 mA output (transmitters)



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Ratiometric outputs vary as a ratio of the supply voltage. Transmitters are very suitable in applications that use long cables. There is virtually no error from voltage drop introduced from the wire resistance when sending the signal as a current. They are also less sensitive to electromagnetic interference.

Some piezoresistive pressure transducers use only an unprotected silicon sensing element. Silicon is a brittle crystalline material, which can sometimes crack under severe cold transient environments. The MediaSensor™ pressure transducer uses an additional 316L stainless steel convoluted diaphragm with a protective non-silicone oil to protect the sensitive silicon sensing element from the harsh media and environmental conditions. The 316L stainless steel diaphragm not only provides for optimal water and chemical media isolation for the silicon crystal sensing element but can handle cold temperature transients without sustaining damage.

Under cold transient conditions and within our operating temperature range, the oil does not gel and acts as a buffer for the silicon sensing element from the extreme temperature transients found in certain applications such as refrigeration.

MediaSensor™ Compensations Features

All the compensation circuitry is internal to the MediaSensor™ pressure transducer. No external compensation modules are needed.

1) Zero balancing (Null Offset) Calibration

During manufacturing the Wheatstone Bridge resistive elements are closely matched and compensated, however an offset voltage (due to resistance differences) may still exist. SSI MediaSensor™ compensates for this offset over operating temperature range (refer to Table 1).

2) Span Calibration

The resistance of silicon gauges is temperature dependent. The span will shift with temperature to a final stabilized value as it warms up. SSI MediaSensor™ compensates for this span variation over operating temperature range.



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Typical Connections

The following torque limits should be used when mounting the MediaSensor™ pressure port.

Straight Thread w/O-Ring:	Recommended Torque
High Pressure (> 750 PSI)	300 in lb
All others with out Port types T, U, Y	150 in lb
Parts with Ports T,U, Y	120 in lb
NPTF Thread:	2 T.F.F.T. (Turns From Finger Tight)

MediaSensor™ 4 -20mA Output connections:

- 1) Connect the Power Lead (Red) to the + terminal of the supply voltage.
- 2) Connect the Return Lead (White) to the + terminal of the current measuring device
- 3) Connect the – terminal of the current measuring device to the – terminal of the supply voltage.

MediaSensor™ Voltage Output connections:

- 1) Connect the Power Lead (Red) to the + terminal of the supply voltage.
- 2) Connect the Ground Lead (Black) and the – terminal of the supply voltage to – input of your voltage measurement equipment.
- 3) Connect the Vout Lead (White) to the + input of your voltage measurement equipment.



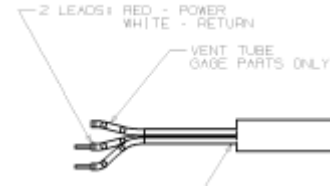
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Packaging

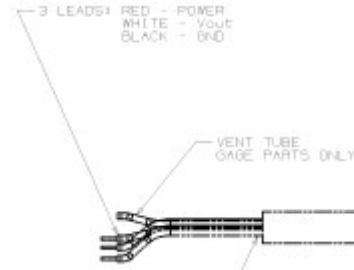
MediaSensor™ is readily available in a large selection of standard packaging options. MediaSensor™ offers an integral harness with 6 standard lengths and four standard readily available connectors (Packard, Deutsch, M12 and Mini DIN). In addition, SSI will work with the customer to meet their needs with custom options for large volume orders. (I.e... special fittings & connectors; special pressure ranges; operating temperature; and increased accuracy).

Integral Harness (Standard lengths of 6", 12", 18", 24", 36" and 72"). The Harness can be constructed of either PVC Jacketed 18 or 24 AWG Wire.



Wire Color
Red - Power
White - Return

Integral Harness Transmitter (4 to 20 mA)



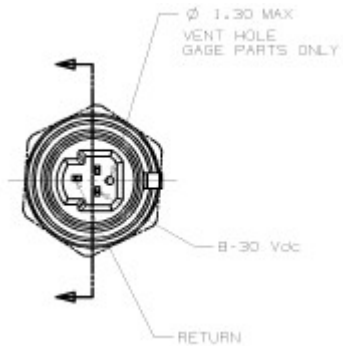
Wire Color
Red - Power
White - Vout
Black - Ground

Integral Harness Transducer(1 to 5 Vdc or 0.5 to 4.5Vdc)

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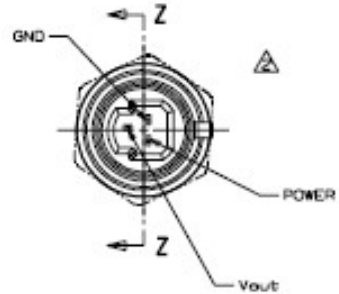
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Standard Connector Options



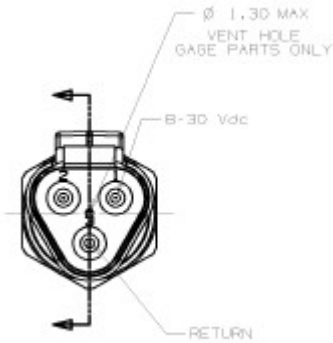
- Pin 1 - Power
- 2 - Not Used
- 3 - Return

Packard Connector Transmitter (4 to 20 mA)



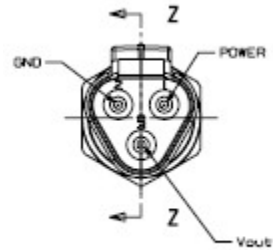
- Pin 1 - Power
- 2 - Ground
- 3 - Vout

Packard Connector Transducer (1 to 5 Vdc or 0.5 to 4.5Vdc)



- Pin 1 - Power
- 2 - Not Used
- 3 - Return

Deutsch Connector Transmitter (4 to 20 mA)



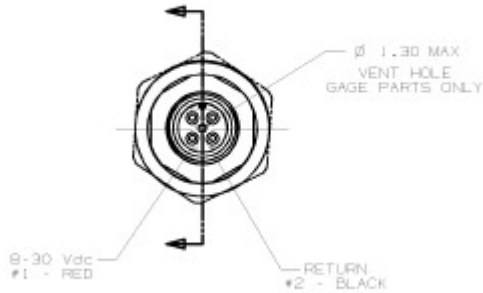
- Pin 1 - Power
- 2 - Ground
- 3 - Vout

Deutsch Connector Transducer (1 to 5 Vdc or 0.5 to 4.5Vdc)



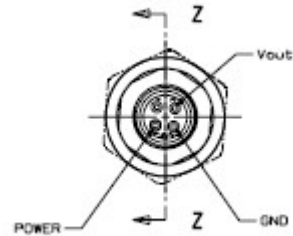
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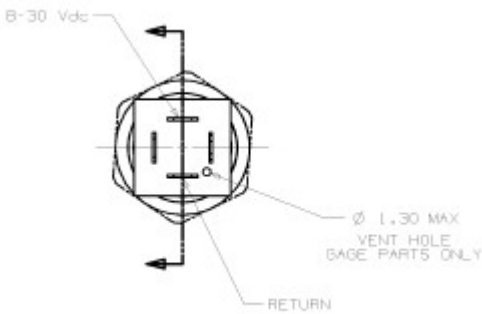
- Pin 1 - Power
- 2 - Return
- 3 - Not Used
- 4 - Not Used

M12 Connector Transmitter (4 to 20 mA)



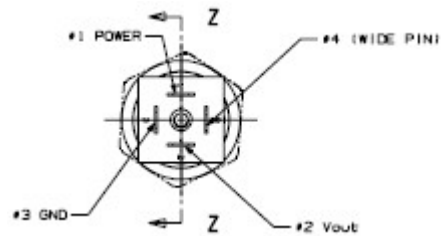
- Pin 1 - Power
- 2 - Ground
- 3 - Vout
- 4 - Not Used

M12 Connector Transducer (1 to 5 Vdc or 0.5 to 4.5Vdc)



- Pin 1 - Power
- 2 - Return
- 3 - Not Used
- 4 - Not Used

DIN 43650 Transmitter Connector



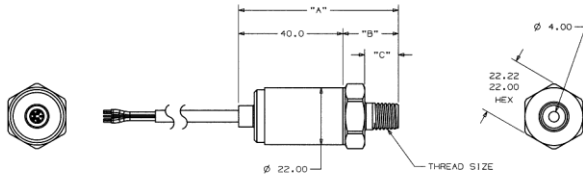
- Pin 1 - Power
- 2 - Vout
- 3 - Ground
- 4 - Not Used

DIN 43650 Transducer Connector

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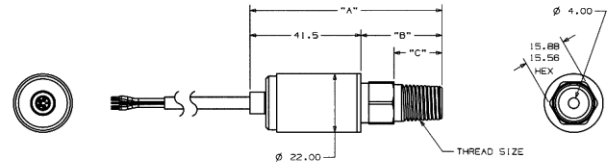
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Standard Packaging Options



THREAD SIZE	LENGTH "A"	LENGTH "B"	LENGTH "C"
1/4-18 NPT	66.6	26.0	18.0
1/8-27 NPT	61.6	21.0	13.0
M12-1.5 6g	59.6	19.0	11.0
7/16-20 UNF	59.6	19.0	11.0
3/8-24 UNF	58.1	17.5	9.5

Integral Harness with 22mm Hex



THREAD SIZE	LENGTH "A"	LENGTH "B"	LENGTH "C"
1/4-18 NPT	72.0	30.5	18.0
1/8-27 NPT	67.0	25.5	13.0
M12-1.5 6g	65.0	23.5	11.0
7/16-20 UNF	65.0	23.5	11.0
3/8-24 UNF	63.5	22.0	9.5

Integral Harness with 5/8" Hex

Harness Construction: PVC Jacketed 18 or 24 AWG Wire

Please visit our website at <http://www.ssitechnologies.com> for a more information and a listing of all the series of pressure sensors in the MediaSensor™ family or call SSI toll-free at **1- 888- 477- 4320**

