

NPI-15 Voltage Compensated Series High Pressure, Media Isolated Pressure Sensor

DESCRIPTION

The Lucas NovaSensor® voltage compensated NPI Series offers the performance of our current compensated sensors with the convenience of using a voltage supply. Voltage compensation allows the sensor to be connected directly to the power supply, thereby eliminating the need for additional components to construct a constant current source. These sensors enable field interchangeability with a calibrated FSO of $100 \text{ mV} \pm 1 \%$.

As with all NPI media isolated sensors, they are designed to operate in hostile environments and yet give the outstanding sensitivity, linearity, and hysteresis of a silicon sensor. The piezoresistive sensor chip is housed in a fluid-filled cylindrical cavity and isolated from measured media by a stainless steel diaphragm and body. The NPI Series employs SenStable® processing technology, providing excellent output stability.

The modular design allows for a variety of pressure port modules which are hermetically welded to the sensor header module. Standard types A, B, H, and J are shown inside.

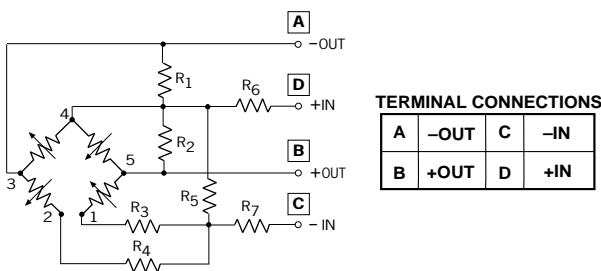
For compensation of temperature effects, a resistor network is supplied on a hybrid ceramic substrate. The IsoSensor design minimizes temperature errors to provide a maximum offset error of 1.0% FSO and a maximum full-scale output error of 0.75% FSO over the 0 to 70°C compensated range.



FEATURES

- Solid state, high reliability
- High sensitivity with $100 \text{ mV} \pm 1 \%$ FSO at 10 VDC
- 316L stainless steel, IsoSensor design
- Linearity 0.1% FSO typical
- Thermal accuracy FSO 0.2% typical
- Four standard ranges: 500, 1000, 3000 and 5000 psi available in absolute or sealed gage
- Standard configurations include:
 - 1/2"–20 UNF threaded male port with 1.0" flange
 - 0.59" diameter x 0.87" long cylinder with o-ring seals
 - 1/4"–18 NPT male port with 7/8" flange
 - 1/8"–27 NPT male port with 7/8" flange
- Custom configurations and other pressure ranges available. Please consult factory

SCHEMATIC DIAGRAM



Note: Pin #4 connected to chip substrate.

APPLICATIONS

- Process control systems
- Hydraulic systems and valves
- Automobiles and trucks
- Biomedical instruments
- Refrigeration and HVAC controls
- Appliances and consumer electronics
- Ship and marine systems
- Aircraft and avionic systems

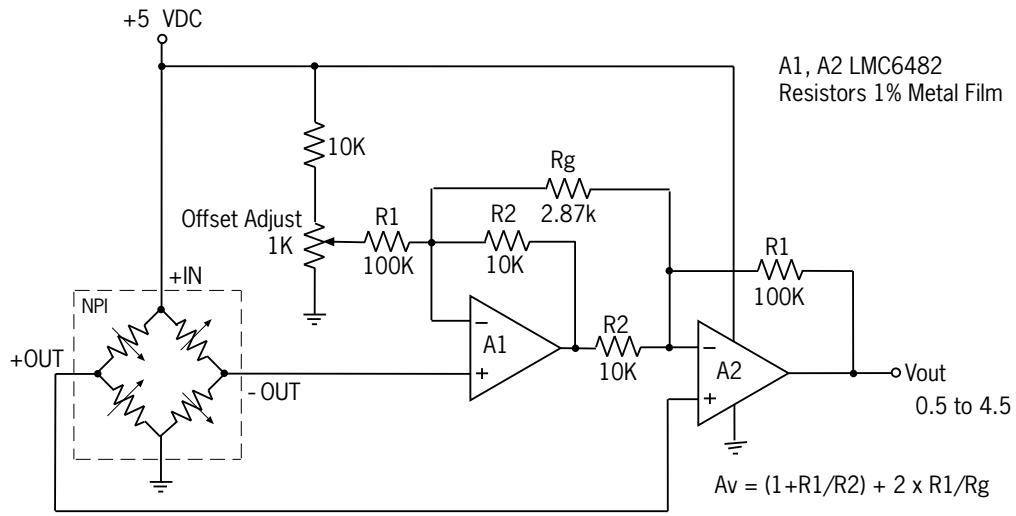
Operating Characteristics

PARAMETER	VALUE	UNITS	NOTES
GENERAL			
Pressure Range	0-500	psi	3,447 kPa
	0-1,000	psi	6,894 kPa
	0-3,000	psi	20,682 kPa
	0-5,000	psi	34,470 kPa
Maximum Pressure	2 x		rated pressure
ELECTRICAL @ 25°C (77°F) unless otherwise stated			
Input Excitation	10	VDC	15 VDC max.
Insulation Resistance	10 ⁸	Ω	@ 50 V _{DC}
Input Impedance (min.)	4,000	Ω	
Output Impedance	5,000	Ω	± 20%
Bridge Impedance	5,000	Ω	± 20%
ENVIRONMENTAL			
Temperature Range			
Operating ⁽⁹⁾	-40 to +125	°C	-40° to +257°F
Compensation Range	0 to +70	°C	+32° to +158°F
Vibration	10	g _{RMS}	20 to 2000Hz
Shock	100	g	11 milliseconds
Life (Dynamic Pressure Cycle)	10 x 10 ⁶	cycles	
MECHANICAL			
Weight	≈ 28	grams	NPI-15A-XXX
	≈ 47	grams	NPI-15B/H/J-XXX
Media Compatibility	All corrosive media compatible with 316L stainless steel		
Case and Diaphragm Material	316L stainless steel		
Recommended O-Ring	Type A: 12mm (.472") ID x 1.5mm (.059") wall		
	Type B: 2-013 per ISO 3601/1		

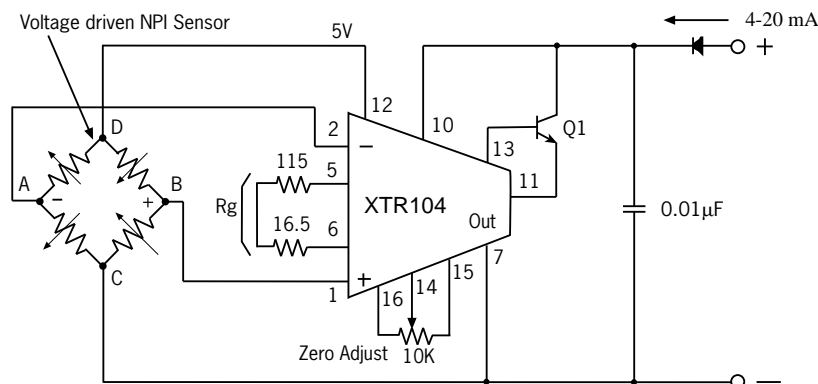
PARAMETER	UNITS	COMPENSATED(1)			NOTES
		MIN.	TYP.	MAX.	
500, 1,000, 3,000 & 5,000 psi					
Offset	mV	-2	± 1	2	
Full Scale Output	mV	99	100	101	2
Linearity	%FSO	-0.35	0.1	0.35	3
Hysteresis and Repeatability	%FSO	-0.05	0.01	0.05	
Thermal Accuracy of Offset	%FSO	-1.0	0.2	1.0	4
Thermal Accuracy of FSO	%FSO	-0.75	-0.2	0.75	4
Thermal Hysteresis	%FSO	-0.2	±0.1	0.2	5
Short-Term Stability of Offset	μV/V		±5		6
Short-Term Stability of FSO	μV/V		±5		6
Long-Term Stability of Offset	%FSO		±0.1		7
Long-Term Stability of FSO	%FSO		±0.1		7

- Notes:**
1. Performance with offset, thermal accuracy of offset and thermal accuracy of FSO compensation resistors.
 2. FSO measured with 10 VDC.
 3. Linearity by best fit straight line.
 4. 0 to +70°C with reference to 25°C.
 5. 0° to 70°C.
 6. Normalized offset/bridge voltage — 100 hours.
 7. 1 year.
 8. All values measured at 25°C and at 10 VDC, unless otherwise noted.
 9. Reduced performance outside compensation range.

Application Circuits



The voltage compensated NPI-15 requires only two op amps for its signal conditioning circuit. The circuit is greatly simplified, because the NPI-15 can be connected directly to a five volt supply and provide a rail to rail output as shown. The amplifier gain is given by: $A_v = (1 + R1/R2) + 2 \times R1/R_g$. With a full-scale output of $50 \text{ mV} \pm 1\%$, a single $2.87 \text{ k}\Omega$ resistor is all that is needed to get a 4.03 volt amplified span. If more precision is needed, a $2.8 \text{ k}\Omega$ resistor and 200 ohm pot can be used. Offset adjustment is achieved using a $1 \text{ k}\Omega$ pot to trim the offset voltage from the sensor and set V_{out} to 0.5 volts at zero pressure.



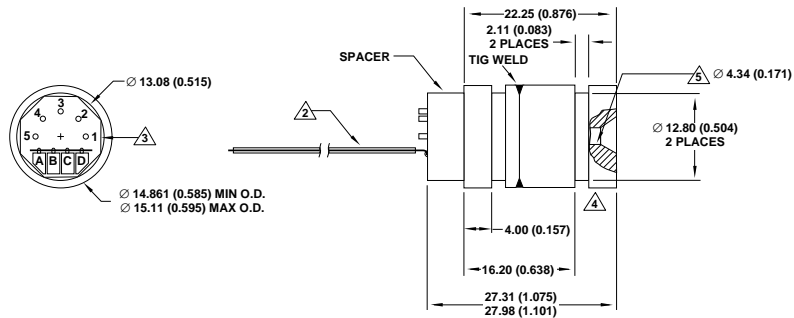
A simple $4\text{--}20 \text{ mA}$ pressure transmitter can be made with the NPI-15 and a XTR104 (Burr-Brown Corp.). The XTR104 provides the sensor with a five volt power supply and converts the millivolt signal from the sensor to a current output. R_g consists of two resistors, which are used to set the circuit gains as follows: $R_g = 2500/(1/FSO-1)$. A pot can be substituted for one of the resistors to improved gain calibration and accuracy. The offset adjustment provides $\pm 500 \text{ microamps}$ of adjustment at the output.

Packaging and Ordering Information

PORT TYPE A

PIN OUT

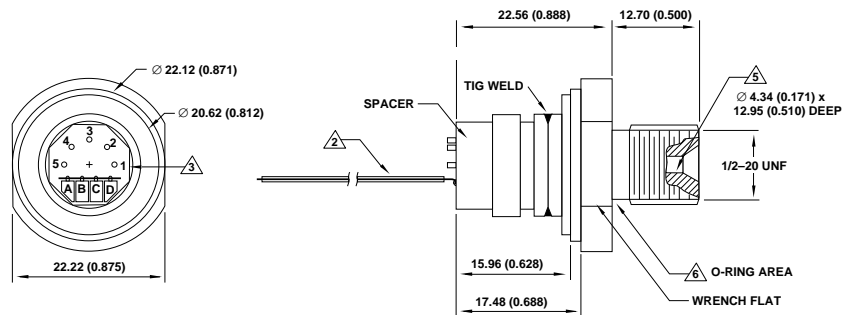
A	-OUT
B	+OUT
C	-IN
D	+IN



PORT TYPE B (Note 7)

PIN OUT

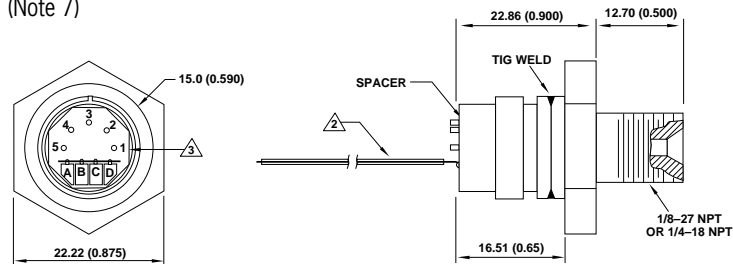
A	-OUT
B	+OUT
C	-IN
D	+IN



PORT TYPE H AND J (Note 7)

PIN OUT

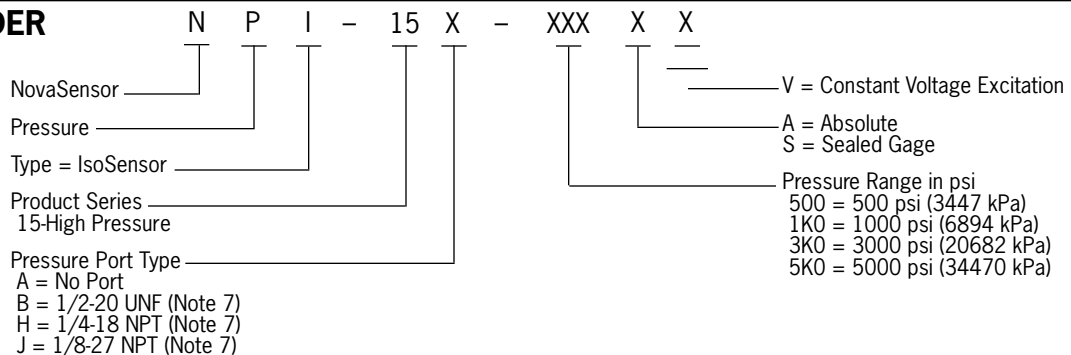
A	-OUT
B	+OUT
C	-IN
D	+IN



Notes:

1. All dimensions in inches (millimeters).
2. A flat, 2" long Nylon flex cable is standard.
3. Ceramic substrate.
4. Uses 12mm ID x 1.5mm o-ring for outside seal.
5. Uses 2 - 003 per I.S.O. 360 1/1 o-ring for inside seal.
6. Uses 2 - 013 per I.S.O. 360 1/1 o-ring for outside seal.
7. Not available in 3,000 PSI and 5,000 PSI

HOW TO ORDER



Sales Terms: Warranty:

Lucas NovaSensor standard sales terms apply. Prices and specifications are subject to change without notice.
 Lucas NovaSensor warrants its products against defects in material and workmanship for 12 months from date of shipment. Products not subjected to misuse will be repaired or replaced. THE FOREGOING IS IN LIEU OF ANY OTHER EXPRESSED OR IMPLIED WARRANTIES. Lucas NovaSensor reserves the right to make changes to any product herein and assumes no liability arising out of the application or use of any product or circuit described or referenced herein.



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