

## NPI-19 Voltage Compensated Series Medium 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.

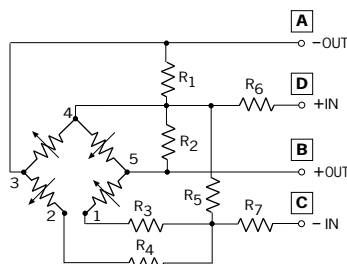
For compensation of temperature effects, a resistor network is supplied on a hybrid ceramic substrate. The IsoSensor design minimizes temperature errors to provide a maximum offset error of 1.0% FSO and a maximum full-scale output error of 0.75% FSO over the 0 to 70°C compensated range.



### 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
- Six standard ranges: 15, 30, 50, 100, 200 and 300 psi available, gage or absolute
- Standard configurations include:
  - 1/2"–20 UNF threaded male port with 1.0" flange
  - 0.74" diameter x 0.28" 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



TERMINAL CONNECTIONS

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

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

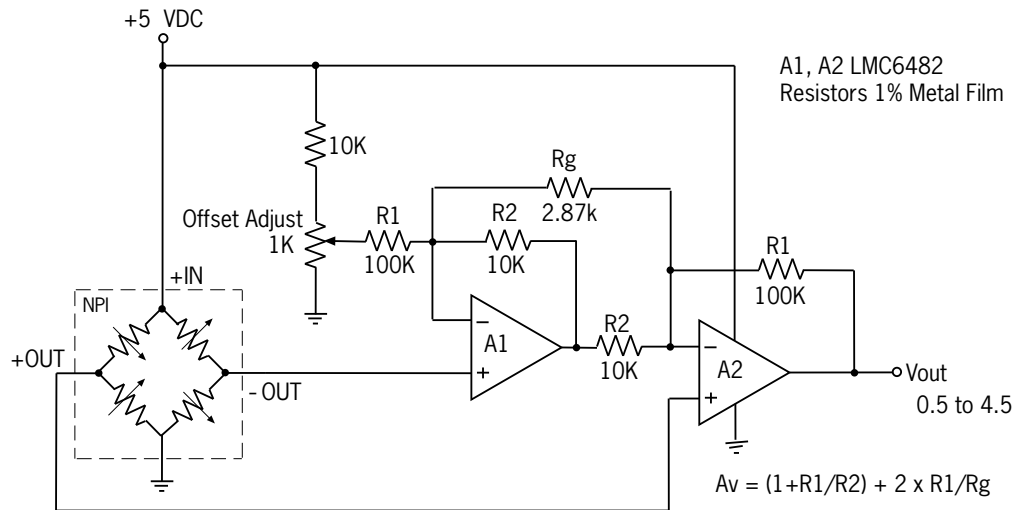
PARAMETER	VALUE	UNITS	NOTES
<b>GENERAL</b>			
Pressure Ranges	0-15	psi	103.4 kPa
	0-30	psi	206.8 kPa
	0-50	psi	344.7 kPa
	0-100	psi	689.4 kPa
	0-200	psi	1,379 kPa
	0-300	psi	2,068 kPa
Maximum Overpressure		2 x	rated pressure
<b>ELECTRICAL @ 25°C (77°F) unless otherwise stated</b>			
Input Excitation	10	VDC	15 VDC max.
Insulation Resistance	10 <sup>8</sup>	Ω	@ 50 V <sub>DC</sub>
Input Impedance	4,000	Ω	
Output Impedance	5,000	Ω	± 20%
Bridge Impedance	5,000	Ω	± 20%
<b>ENVIRONMENTAL</b>			
Temperature Range			
Operating <sup>(9)</sup>	-40 to +125	°C	-40 to +257°F
---Compensation Range	0 to +70	°C	+32° to +158°F
Vibration	10	g <sub>RMS</sub>	20 to 2000Hz
Shock	100	g	11 milliseconds
Life (Dynamic Pressure Cycle)	1 x 10 <sup>6</sup>	cycles	
<b>MECHANICAL</b>			
Weight	≈10 ≈45	grams grams	NPI-19A-XXX NPI-19B/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: 16.76 dia. X 0.99 (0.66 x 0.039) Type B: 2-013 per ISO 3601/1		

Parameter	Units	Compensated <sup>(1)</sup>			Notes
		15, 30, 50, 100, 200 and 300			
		Min.	Typ.	Max.	
Offset	mV	-2	±1	2	
Full Scale Output	mV	99	100	101	2
Linearity	%FSO	-0.25	0.1	0.25	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

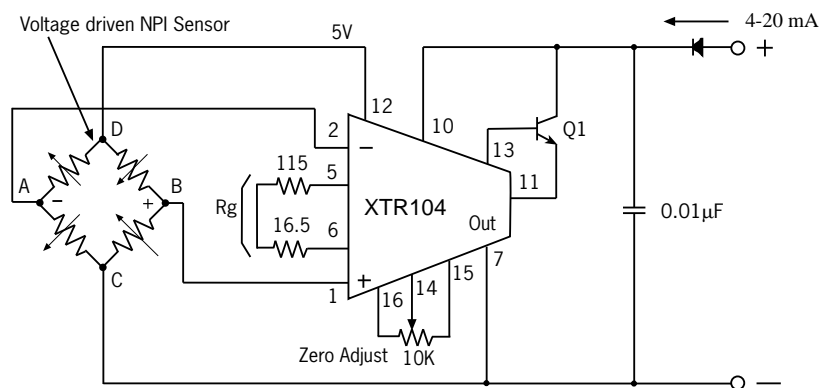
- Notes:**
- Performance with offset, thermal accuracy of offset, and thermal accuracy of FSO compensation resistors.
  - FSO measured with 1.0mA input excitation.
  - Linearity by best fit straight line.
  - 0 to +70°C with reference to 25°C.
  - 0 to 70°C.
  - Normalized offset/bridge voltage — 100 hours.
  - 1 year.
  - All values measured at 25°C and at 1.0mA constant current, unless otherwise noted.
  - Reduced performance outside compensation range.



# Application Circuits



The voltage compensated NPI-19 requires only two op amps for its signal conditioning circuit. The circuit is greatly simplified, because the NPI-19 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.



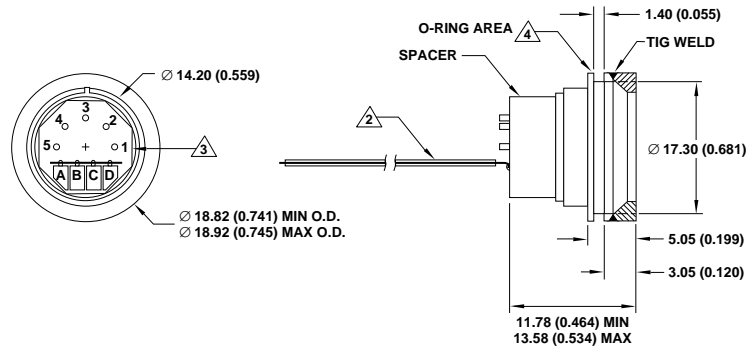
A simple 4–20 mA pressure transmitter can be made with the NPI-19 and a XTR104 (Burr-Brown Corp.). The XTR104 provides the sensor with a five volt power supply and converts the millivolt signal from the sensor to a current output.  $R_g$  consists of two resistors, which are used to set the circuit gains 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  $\pm 500$  microamps of adjustment at the output.

# Dimensions and Ordering Information

## PORT TYPE A

### PIN OUT

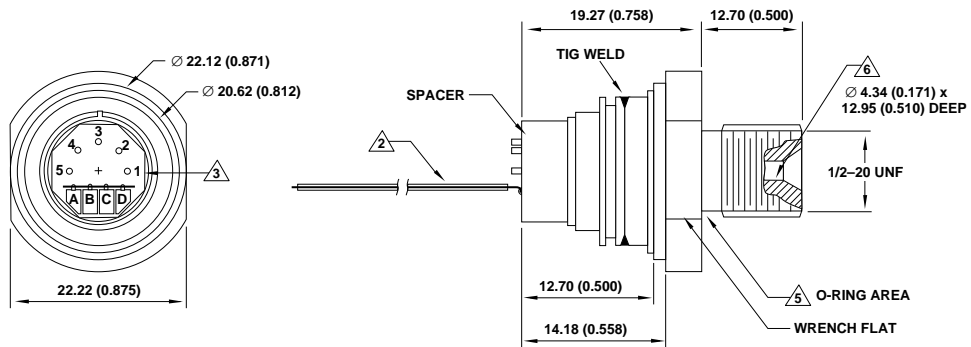
A	-OUT
B	+OUT
C	-IN
D	+IN



## PORT TYPE B

### PIN OUT

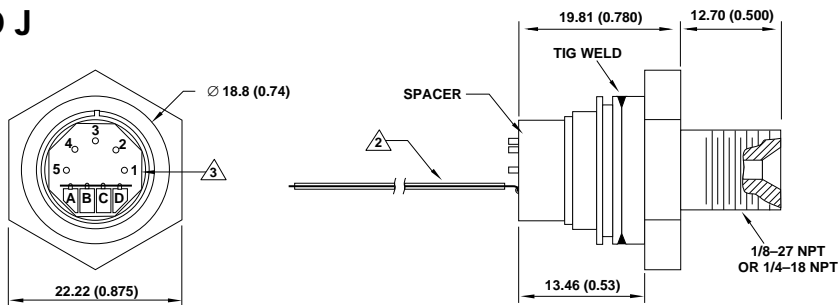
A	-OUT
B	+OUT
C	-IN
D	+IN



## PORT TYPE H AND J

### PIN OUT

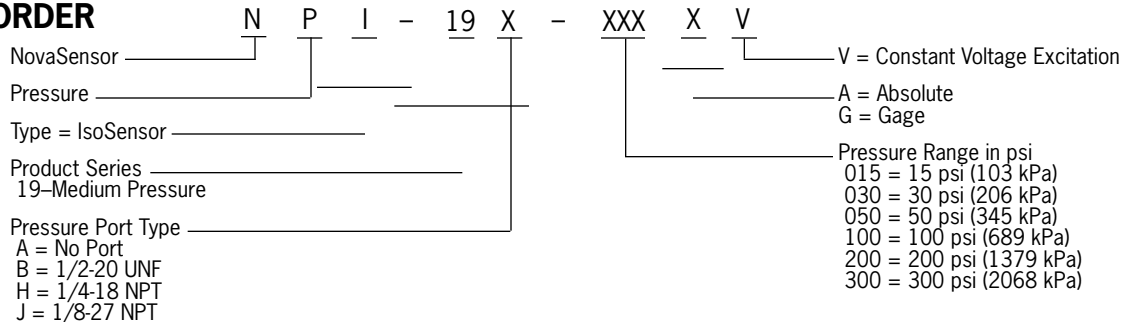
A	-OUT
B	+OUT
C	-IN
D	+IN



- Notes:**
1. All dimensions are in millimeters (inches).
  2. A flat 2" long kapton flex cable is standard.
  3. Ceramic substrate.

4. Uses O-ring 0.66" ID-x 0.039" cross section.
5. Uses 2-013 per I.S.O. 360 1/1 o-ring for outside seal.
6. Uses 2-003 per I.S.O. 360 1/1 o-ring for inside seal.

## HOW TO ORDER



### Sales Terms:

Lucas NovaSensor standard sales terms apply. Prices and specifications are subject to change without notice.

### Warranty:

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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