

Model 430 Bridge sensor



Description

The Model 430 is a current output signal conditioner, complete with a true differential input instrumentation amplifier, and a highly stable bridge excitation supply. It is powered from the AC line. The input amplifier incorporates a two pole roll off, 3 Hertz filter to reduce the influence of mechanical noise and power line interference on the input. The unit is encapsulated in an epoxy filled plastic container with through bolt mounting holes and screw terminal barrier strips for easy attachment of all wires.

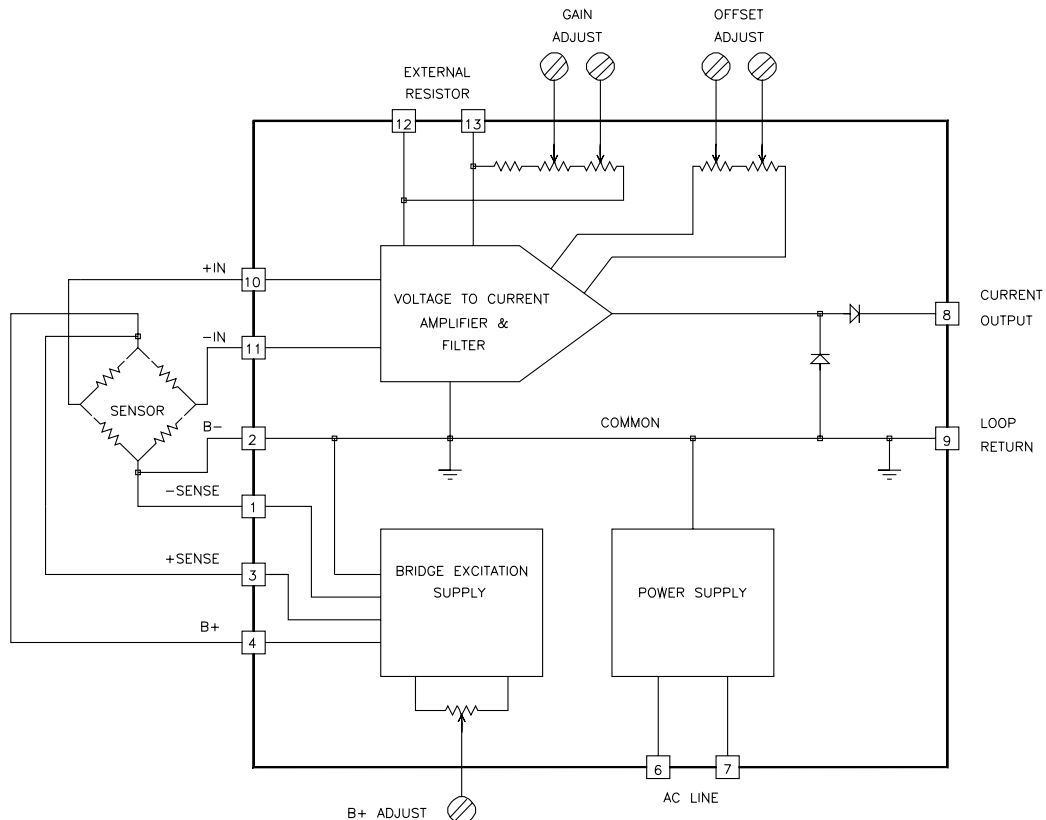
Features

- Complete Sensor Signal Conditioner with Current Output
- 115 Volts AC is all that is required
- Adjustable Voltage Excitation Supply
- Adjustable Gain Amplifier for Sensor Full Scale Outputs from 10 to 50 mV
- Zero Current Adjustable from 0 to +12 mA
- 4-20, 0-20, or 12 ±8 mA Operation
- Rugged Epoxy Encapsulated Self Contained Unit with Screw Terminal Connections

Applications

- Process Control Add-on Loops
- Can be used with All Types of Low Output Sensors
- Differential Sensors

430 Simplified Block Diagram



Model 430 Bridgesensor

Specifications

NOTE: Unless otherwise noted, specifications apply after 1 hour warm-up at 25°C ambient, gain set between 320 and 1600 mA/V.

Amplifier	
Current Output Span	4 to 20 mA: 0 to 20 mA: 12 ±8 mA
Zero Adjust	0 to +12 mA
Minimum Output	0 to +60 microamp
Temperature Coefficient	0.03% of Full Output/°C max
Gain	
Adjustment Range for 4-20 mA Output	10 to 50 mV
Linearity	±0.05% of Full Output
Temp Stability	200 ppm/°C max.
Gain Potentiometer Hysteresis	0.2% of span max.
Input Bias Current	±30 nanoAmp max.
Offset	±30 nanoAmp max.
Input Impedance	
Differential and Common Mode	1000 megohms
Common Mode Rejection, DC	90dB min.
Common Mode Input	±7.5 Volts
Maximum Input	±15 Volts
Output	
Compliance Voltage	0 to +10 Volts
Current	0 to +20 mA
Loop Resistance	0 to 500 ohms
Output Impedance at DC	10 megohms, min.
Noise at gain = 320 mA/Volt 1 to 100 Hertz	1 microamp RMS, max.
Frequency Response, 3dB	3 Hertz, 2 Poll roll off
Response Time To 1% of Final Value To 0.1% of Final value	200 ms, typ. 300 ms, typ.
External Reverse Current	200mA DC, max. (diode clamped to common)
Maximum Output Current	25 mA typical
Bridge Supply	
Voltage Adjustment Range	4 to 15 Volts
Current Output	See "B+ Voltage vs. Load Current" curve for limits
Area A: 105 to 125 VAC 50/60 Hz	0 to 100 mA
Area B: 108 to 125 VAC 60 Hz	0 to 115 mA
Regulation - Load and Line	
0 to 100mA	0.05% maximum
Output Noise	
120 Hz Bandwidth	0.5mV RMS, maximum
Temperature Stability	200ppm/°C
B+ Potentiometer Hysteresis	0.3% of output maximum
Short Circuit Current	600mA, typical
Power Input	115 VAC, ±10% 50/60Hz @ 6.5 VA maximum
Optional	100, 220 or 230 VAC
Line Isolation	
Capacitance	50pF typical
Dielectric Withstand	1100 Volts RMS
Environment	
Ambient Operating	0° to +55°C
Storage	-25° to +85°C
Weight	18 oz. (510 grams)
Size	3.75"L x 2.0"W x 2.87"H 9.53 x 5.1 x 7.62 (cm)

Getting Started with the Model 430

I. Hook Up Procedure

- A. Connect the +out of your load cell to the +INPUT, pin 10.
- B. Connect the -out of your load cell to the -INPUT, pin 11.

Note: If the ±SENSE are not used in your load cell application, the connections in step C & D need to be followed. If the ±SENSE are going to be used, do not jumper them as described in steps C & D.

- C. Connect B+, pin 4, to the +excitation of your load cell and jumper the +SENSE, pin 3, to B+, pin 4.
- D. Connect B-, pin 2, to the -excitation of your load cell and jumper the -SENSE, pin 1, to B-, pin 2.
- E. Connect the VAC power supply to the AC input lines, pins 6 and 7.

II. Turn On Procedure

- A. Verify that the hook up procedure is complete.
- B. Verify the correct AC voltage is applied to the 430; i.e. 100, 115, 220, 230.
- C. Turn on the AC source supply to the 430.
- D. Set the required EXCITATION supply voltage to the load cell by adjusting B+ ADJUST.

III. Calibration Procedure for Zero Current Adjustment

- A. Jumper the + and - input terminals, pins 10 and 11, together.
- B. Connect an amp meter across the output, pins 8 and 9.
- C. Adjust the COARSE OFFSET and the FINE OFFSET potentiometers for the desired ZERO current.

IV. Full Scale Current Adjustment

- A. Remove the jumper between the + and - input terminals and apply a known load to your load cell, in most cases it would be 100% of full scale.
- B. Adjust the COARSE GAIN and FINE GAIN potentiometers for the desired FULL SCALE output.
- C. Calibration is now complete. However, the user should recheck the ZERO & FULL SCALE current output before continuing.

Model 430 Bridge sensor

Amplifier

The input amplifier is a high input impedance, differential amplifier with built in gain and offset adjustment potentiometers. The coarse and fine gain pots enable the Model 430 to interface with sensor full scale output from 50 mV down to 10 mV.

The offset potentiometers allow the setting of the zero current from 0 to +12 mA. This range allows the Model 430 to provide output spans of 0 to 20 mA, 4 to 20 mA, or 12 ±8 mA bipolar.

The output has a compliance of 0 to +10 Volts which will allow several in line process control detectors adding up to a total of 500 ohms loop resistance. The current output line is clamped to the common line with a diode to prevent an inadvertent inductive voltage spike from destroying the unit. This diode can conduct a DC current up to 200 mA and up to 500 mA surges of less than 8 ms.

Connecting to a Sensor

Any amplifier has a finite input current which must have a DC return path to the amplifier common. This path is automatically provided when the Model 430 Bridge Excitation Supply is used to excite the sensor. If for some reason, an external supply is used to excite the sensor, one side of the external supply must be connected to the Model 430 common, terminal 9 or 2. Either the positive or the negative side may be connected to the 430 common, depending on how the external supply is connected to the rest of your system. The input common mode voltage to pins 10 and 11 of the Model 430 must be between ±7.5 Volts.

When the Full Scale output of a sensor is measured in millivolts, i.e. say 10 millivolts, care must be exercised in the entire wiring system. At 10 millivolts full scale, each microvolt (10⁻⁶ Volts) contributes 0.01% of full scale output. Wire connections can generate microvolts of potential due to Contact Potentials and Thermoelectric Potentials. All wires used in making connections between a sensor and the Model 430 should be of the same material. If any intervening connections are made such as a terminal block, the terminal block connecting points should have good thermal contact so they will always be at the same temperature.

Zero Current Adjustment

Connect the + and - input terminals, 10 and 11, together and connect them to COMMON, terminal 9. Adjust the COARSE and FINE OFFSET potentiometers for the desired current. Since a bridge in general is not perfectly balanced, the final ZERO adjustment should be made with the sensor connected to the amplifier and the required EXCITATION voltage set.

The ZERO adjustment should be made at about 10% of full scale output from the sensor when setting the ZERO for a 0 to 20mA span, since the output current does not go negative.

Bridge Excitation Supply

The Bridge Excitation supply is adjustable from 4 Volts to 15 Volts. The allowable load current is limited by internal power dissipation and varies from 50 mA at 4 Volts to 100mA at 15 Volts. See curve B+ VOLTAGE vs CURRENT for the safe operating area. The AREA A range of voltage and current covers all common bridges from 125 ohms and up. The bridge supply is capable of driving 4, 350 ohm load cells, providing that the line voltage does not drop below 108 VAC 60 Hz. Reference AREA B in B+ Voltage vs Load current.

The supply has provisions for remote sensing when the excitation lines may have significant resistance compared to the sensor. The +SENSE and -SENSE terminals must be connected to the B+ and B- terminals respectively, i.e. connect terminals 1 and 2 together, and connect terminals 3 and 4 together when remote sensing is not being used.

More current may be drawn from the EXCITATION supply than is shown by the B+ VOLTAGE vs CURRENT curve by using a resistor in series with the B+ lead and connecting the +SENSE terminal at the sensor. This resistor should be calculated to produce a voltage drop of 15V minus the desired bridge voltage so the B+ output is close to 15 Volts. As an example, a 40 ohm bridge would draw 100 mA at 4 Volts, which is outside the safe operating area. 15-4=11 Volts to drop across the series resistor. 11V/0.1A=110 ohms. Use a 2 watt series resistor. The temperature coefficient of this resistor is not critical. Adjust the Excitation supply for 4 Volts across the sensor, i.e., between the +SENSE and -SENSE terminals.

Determining Amplifier Gain

The Model 430 is a voltage input, current output amplifier. The gain is therefore described as milliamps output per volt input. Thus, for a change from 4 mA to 20 mA, a 16 mA span, with a 0 to .1 Volt change on the input, the gain is 160 mA/Volt.

Calculate the required gain, G, from the following equation:

$$G = \frac{\text{Span in mA}}{\text{Sensor Full Scale Output Volts}}$$

For a span of 16mA and sensor output voltage of 50 mV,

$$G = 16/0.05 = 320 \text{ mA per volt.}$$

B+ VOLTAGE vs LOAD CURRENT

