User's Guide

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OM2-162 Bridgesensor

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WARNING: These products are not designed for use in, and should not be used for, patient-connected applications.

Description

The OMEGA OM2-162 Bridgesensor is a complete signal conditioning system on a card designed expressly for either half or full bridge transducers. The OM2-162 consists of a high performance instrumentation amplifier, a user adjustable active filter, high stability bridge supply and all of the required circuitry, trimpots, etc., so that only point to point wiring need be made to the inputs, outputs and power to have a complete signal conditioning system up and running.

The mounting kit provides coarse and fine gain adjustment trimpots along with input and output offset adjustments, DIP switches for setting the bridge supply output and active low pass filter cutoff frequency.

Application of the OM2-162 is easy by following the detailed applications information that is included with this data sheet and full engineering specifications allow easy and complete worst case analysis.

Features

- **Pin for Pin Replacement for Model OM2-160**
- Compact, complete and convenient to use
- Easy access to all trim adjustments
- Half Bridge applications made easy by Internal Completion Resistors
- On card Bridge Balance Trimpot eliminates additional wiring for Three Wire applications
- Changing Bridge supply voltage is easy using on board trimpot with adjustment range from +4 to +10 VDC
- Bridge supply lead resistance effects can be ignored with built-in remote sensing
- Filter frequency can be changed with the flick of a DIP switch

OM2-162 vs OM2-160

The Model OM2-162 is a pin compatible replacement for the Model OM2-160 which is no longer available. The one major difference is that the OM2-162 does not have a reference voltage on pin J. Pin J has no connection. The OM2-162 also has a high frequency input filter to reduce EMI. This filter has a high frequency cutoff above 200KHz which is well above the requirements of weighing systems. See figure 3 OM2-162 INPUT AMP RESPONSE. The output of the instrumentation amplifier, pin P, is not inverted with respect to the Filter Output as it was in the OM2-160. The OUTPUT OFFSET pot, RP1, is disabled by a jumper, J1, which must be removed to use RP1. The external OUTPUT OFFSET input, pin K, is always active.

Applications using the OM2-160 can use the OM2-162 simply by inserting the board and making the typical zero and span adjustments. No wiring changes should be required.

OM2-162 Schematic

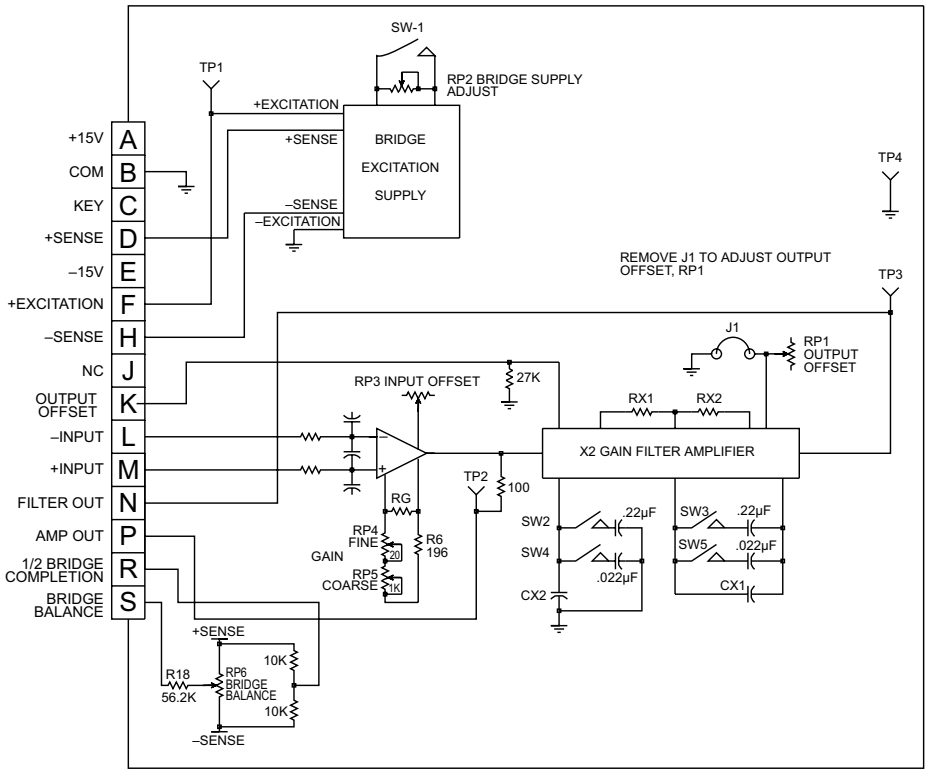


FIGURE 1. Complete schematic of the OM2-162 Bridgesensor

Specifications

Conditions (Unless Noted): Ta = 25°C, Vs = ±15 VDC, G = 500 V/V

Parameter		Minimum	Typical	Maximum	Units
Amplifier (1)					
Gain Range	Adjustable (2) w/External Set Resistor	100 2		500 5000	V/V
Gain Equation			Rg = 100,000/(G-2)		ohms
Gain Equation Accuracy 2 < G < 1000 V/V			3		%
Gain Temperature Coefficient	w/Trimpots Amplifier alone		75 25	150 100	ppm/°C
Nonlinearity, ±10V Output Swing			0.002	0.005	%
Offset Voltage, Input and Output			Adjustable to Zero		
Warmup Drift (3)			±1	±5	µV
Input Offset Vs. Temperature: Vs. Power Supply	 G = 2V/V G = 1000V/V At Other Gains, Max. 		 ±2 ±0.2 ±0.2 ±(20/G) ±1	 ±10 ±1 ±5	 µV/°C µV/V
Output Offset Adjust Range		±10			V
Input Bias Current (4) Vs. Temperature			1 40	5	nA pA/°C
Input Offset Current Vs. Temperature			1 40	5	nA pA/°C
Input Impedance (5)			4G ohms || .0047 µF		
Common Mode Input Voltage:	Range, Linear Response Maximum		±9 ±15		VDC
CMR (6):	1 kHz bw, DC-60 Hz (7) 10 Hz bw, DC-60 Hz (7)		100 120		dB
Input Noise Voltage:	0.1 Hz - 10 Hz 10 Hz - 100 Hz		0.3 1		µV P-P
Current:	0.1 Hz - 10 Hz		80		pA P-P
Rated Output:	Voltage, 2 kohm Load Current Load Capacitance Short Circuit	±10 ±5	 1 minute	 1000	VDC mA pF
Dynamic Response (8):	Small Signal Bandwidth Amp Response (see figure 3)		Adjustable		kHz
Low Pass Filter (9):	Number of Poles DC Gain (Pin P to N) Roll Off		2 +2 40		 V/V dB/Dec
Bridge Excitation Supply (10)					
Output Adjustment Range:	w/Trimpot	4		10	VDC
Output Current		0		120	mA
Load Regulation I_L = 0 - 120 mA			0.02	0.05	%
Line Regulation Vin = 14.5 - 16 VDC			0.005	0.01	%/V
Stability (11):	Short Term Long Term Vs. Temperature Warm-up Drift		0.05 0.2 40 0.01	 80	%/24 Hrs %/kHrs ppm/°C %
Short Circuit Protection			Short Term - 10 minutes		
Output Noise, 10 Hz - 1 kHz			200		µV P-P
Half Bridge Completion					
Nominal Resistance Value			10		kohms
Initial Accuracy				0.1%	%
Temperature Tracking				5	ppm/°C
Balance Adjustment Range, 350 ohm Bridge			±15		mV
Power Requirements					
Voltage:	Rated Performance Operating	 ±13	±15 	 ±16	VDC
Current (12)			±12		mA
Environmental					
Ambient:	Operating Storage	-25 -40		55 80	°C

Notes:

(1) Specifications referred to the filter output (Pin N).
(2) Using on board coarse and fine gain adjust trimpots.
(3) Warm-up drift is specified as the input offset drift for the first 5 minutes after the application of power with G = 1000 V/V, Bridge supply = 10V driving a 350 ohm bridge.
(4) Measured at 25°C Ambient with unit fully warmed up.
(5) Measured from -Input to +Input or input with respect to ground.
(6) Specified with 350 ohm bridge as source impedance.
(7) Filter frequency set with DIP switches.
(8) Small signal response, switch or resistor/capacitor selectable, see applications section.
(9) The low pass filter cutoff frequency is adjustable to 10, 100 and 1000 Hz using the onboard DIP switches and from 1 Hz to 10 KHz using external resistors and capacitors.
(10) Bridge supply must be operated with +Sense connected to the Bridge Supply Pin and with -Sense connected to Common.
(11) Stability is defined after a 5 minute warm-up period and with constant line, load and ambient temperature unless otherwise specified.
(12) Quiescent current for amplifiers only, the current drawn from the bridge supply must be added to the +15 VDC current drain for total current draw.

Functional Description

The OMEGA Model OM2-162 is a completely self contained single channel signal conditioning system on a card. This device offers the high performance and reliability of surface mount circuitry with the completeness of a mounting kit containing all trimpots and components needed for operation. All that needs to be added is power and transducer inputs to get a conditioned output suitable for driving A/D converters, panel meters, indicators, or PC based controllers.

Instrumentation Amplifier

The heart of the OM2-162 is the high performance instrumentation amplifier. This amplifier features low noise, low drift and high accuracy along with trimpot adjustments for coarse/fine gain and input offset voltage. The direct instrumentation amplifier output is brought out to Pin P on the OM2-162, through a 100 ohm isolation resistor. This output is also brought out to the test point AMP OUT at the trimpot edge of the mounting kit. The trimpots allow a gain adjustment range of 100 to 500 V/V with a coarse and fine gain adjuster (clockwise rotation increases gain). A user supplied resistor can be used in place of the trimpots (see equations below) to get any gain from 2 to 5000V/V (referred to filtered output). To use an external resistor remove R6 from the mounting kit to disable the trimpots, then calculate the required value for RG and solder it on the mounting kit in the spot provided.

The gain equation accuracy is ±3 percent for gains from 2 to 1000 V/V.

$$RG = \frac{100{,}000}{G - 2} \text{ ohms}$$

Equation 1: User supplied resistor value required to set gain with respect to Pin N, filtered output.

$$RG = \frac{50{,}000}{G - 1} \text{ ohms}$$

Equation 2: User supplied resistor value required to set gain with respect to Pin P, amplifier direct output. NOTE: If a fixed resistor is used for RG, then resistor R6 should be removed from the OM2-162 to disable the gain trimpots. If a slightly higher RG is used, the pots and R6 can be used to provide a small adjustment range.

Example Resistor Values for Common Gains (to Filtered Output):

Required Gain, Filtered Output	RG Value	
10	12,400 ohms	
100	10,200 ohms	
333.33	301 ohms	(Use for 3mV/V Transducers)
500	205 ohms	(Use for 2mV/V Transducers)
1000	100 ohms	

Note: A high stability, 5 ppm/°C metal film resistor should be selected for RG for maximum performance.

The instrumentation amplifier also has a trimpot adjustment for input offset voltage, this trimpot should be used to null the instrumentation amplifier offset only. System offsets should be adjusted out using the Bridge Balance or the Output Offset feature (see applications section for more information) to retain minimum offset drift of the instrumentation amplifier.
The OM2-162 inputs should be placed as close to the transducer as possible. This will minimize any possible pickup of electrostatic or electromagnetic noise into the very high impedance inputs. See the applications section for more information on shielding methods.

Active Filter

The output of the instrumentation amplifier is connected to the input of a 2 pole, active filter with a gain of 2. This filter has an adjustable filter cutoff frequency of 10, 100 and 1kHz by the use of on board DIP switches and can be set to any frequency from 10 Hz to 10 kHz by the use of user supplied resistors and capacitors. The filtered output is brought out to Pin N and to test point FILTER OUT at the trimpot end of the board on the OM2-162. Pin N is the standard output for most strain gage and instrumentation applications. By using the filtered output extraneous noise above the useful signal frequency is removed at a rate of 40dB/decade above the filter cutoff frequency allowing very precise and low noise measurements to be made. Figure 2 details the DIP switch settings and the equations required to set the filter cutoff to any other frequency.

The filter stage is also the input for the output offset voltage adjustment. The output offset may be adjusted with the on board trimpot or by driving the output offset input (Pin K) with a low impedance source or the wiper of a trimpot. NOTE: to use the on-board offset pot, J1 must first be removed. The gain from the External Output Offset pin (Pin K) to the filtered output (Pin N) is approximately 1 V/V (i.e. if Pin K is changed by 1 Volt in a positive direction then Pin N will also change by 1 Volt in a positive direction).

If pin K is used as the Output Offset control, than J1 should be installed to prevent interaction of RP1.

Filter Cutoff Frequency Adjustment

Cutoff Frequency	SW2	SW3	SW4	SW5
10 Hz	ON	ON		
100 Hz			ON	ON
1000 Hz or User Select	ALL OFF			

$$CX1 = CX2 = 0.0024\ \mu F \left[\frac{1000}{Fc} - 1 \right]$$

CUTOFF FREQUENCY > 1000 Hz

$$RX1 = 35{,}000/ \left[\frac{Fc}{1000} - 1 \right]$$

$$RX2 = 105{,}000/ \left[\frac{Fc}{1000} - 1 \right]$$

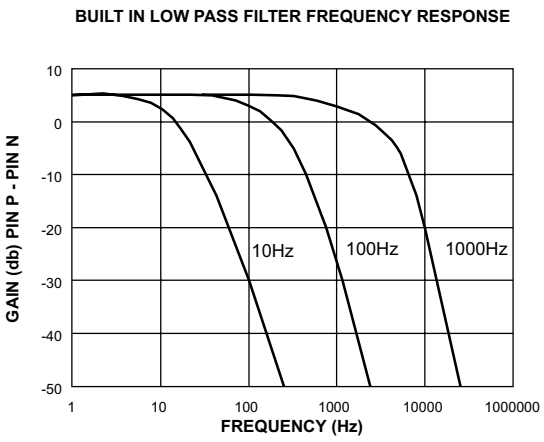


FIGURE 2. Dip switch settings and equations required to set the filter cutoff frequency.

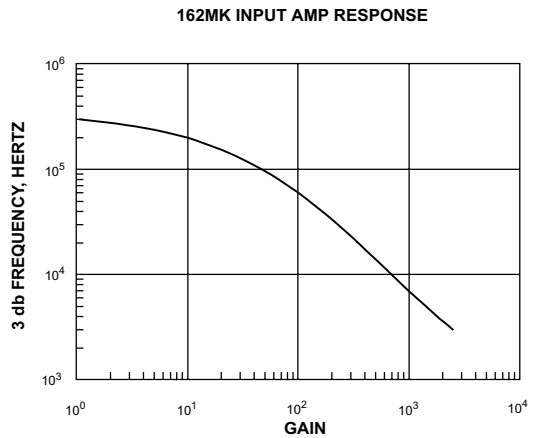


FIGURE 3.

Bridge Supply

The bridge excitation supply is a very well regulated low noise output designed to drive either full or half bridge transducers from 0 to 120mA output current. The output can be set to a fixed +10V by setting DIP switch SW1 ON. By setting SW1 OFF the output can be adjusted from +4 to +10Volts by adjusting the bridge supply adjust trimpot.

The bridge supply uses + and - sense connections to compensate for any line drops that might be present when using remote transducers. See the applications examples for more information on properly using the + and - sense pins. If remote sensing is not required connect +Sense (Pin D) to Bridge Supply (Pin F) and -Sense (Pin H) to Common (Pin B) directly at the mounting kit socket. The maximum voltage difference between the Bridge Supply, Pin F and the +Sense, Pin D, is 0.4V.

Half Bridge Completion/Bridge Balance

Two 10K ohm thin film resistors are connected to the excitation supply sense lines and their center connection is brought out to pin R. These resistors have a low temperature coefficient and track to 5 PPM/°C. This circuit can be used as the other half of a Half Bridge transducer to provide a common mode voltage to the instrumentation amplifier. Pin R can be connected to either the + or - input pin, depending on the polarity of the transducer output signal.

A Bridge Balance circuit is also provided. RP6, BAL ADJ, is also connected across the excitation sense leads and it's swinger is brought out to Pin S through R18. With pin S connected to the same amplifier input as a 350 ohm Half Bridge transducer, a bridge balance range of ±50% is available. Alternately, pin S can be connected to the Bridge Completion resistors. However, in this case R18 should be increased to 1 megohm to reduce the sensitivity of the adjustment. The Bridge Balance pin can be connected to either input when a Full Bridge transducer is used.

General Calibration Procedures

The OM2-162 comes from the factory adjusted to the following specifications:

GAIN ..... 333 V/V

INPUT OFFSET ..... Adjusted to 0, ±2mV

OUTPUT OFFSET ..... J1 Installed

BRIDGE SUPPLY ..... SW1 CLOSED, Bridge Output at +10 Volts

FILTER ..... SW2 - SW5 OFF, Filter at 1 kHz

BRIDGE BALANCE ..... Pin S at 0 Volts

When adjusting the OM2-162 to other values the following methodology should be used,

1) Ground the inputs, set the input offset trimpot to get 0 Volts on the output you will be using (Pins N or P). Input offset is for amplifier nulling only. Do not use the input offset for zeroing systems offsets, use the bridge balance or the output offset adjustments for system offset correction.

2) Using a millivolt calibrator or the transducer output itself, set the gain so that the proper full scale output voltage is realized (the mV calibrator or transducer should be set to simulate full scale output).

3) If system offsets must be accounted for repeat step 1 again with the inputs disconnected from the source and connected to ground, or short them together with the bridge connected, then reconnect the inputs and re-zero the output with the bridge balance (if used).

4) Steps 1 - 3 above may need to be repeated several times to achieve the desired accuracy of gain and offset.

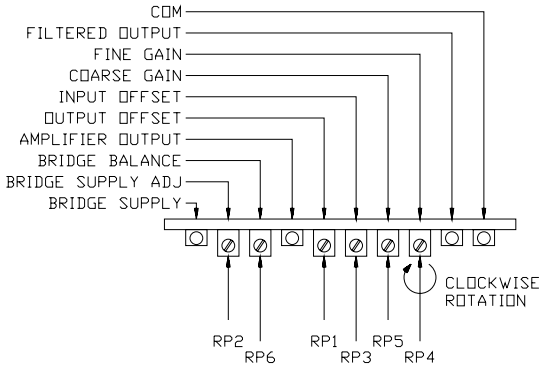


FIGURE 4. OM2-162 Trimpot Adjustment Detail

OM2-162 Application Examples

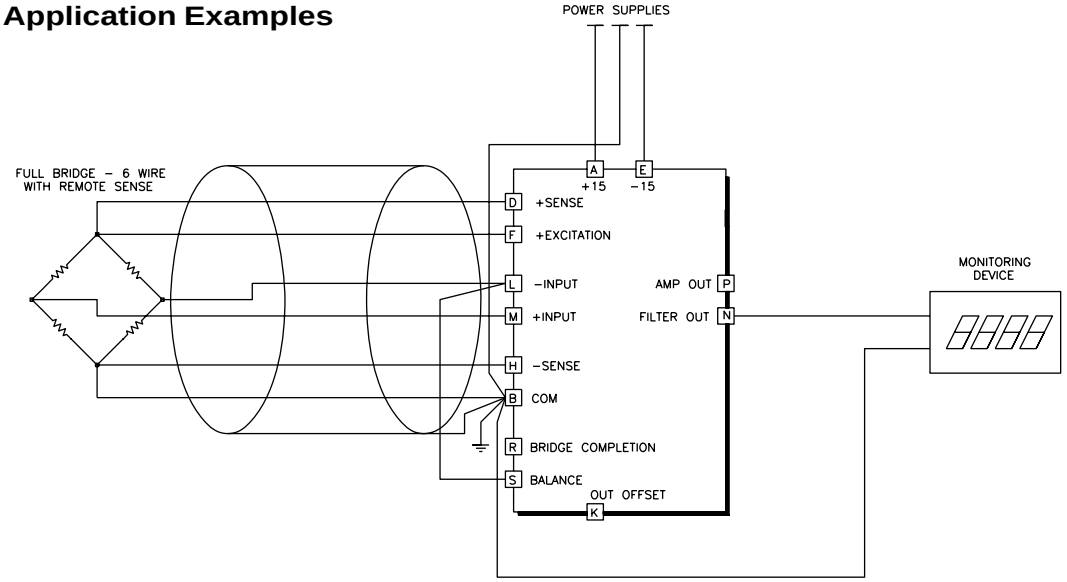


FIGURE 5. Full Bridge with Remote Excitation Sense

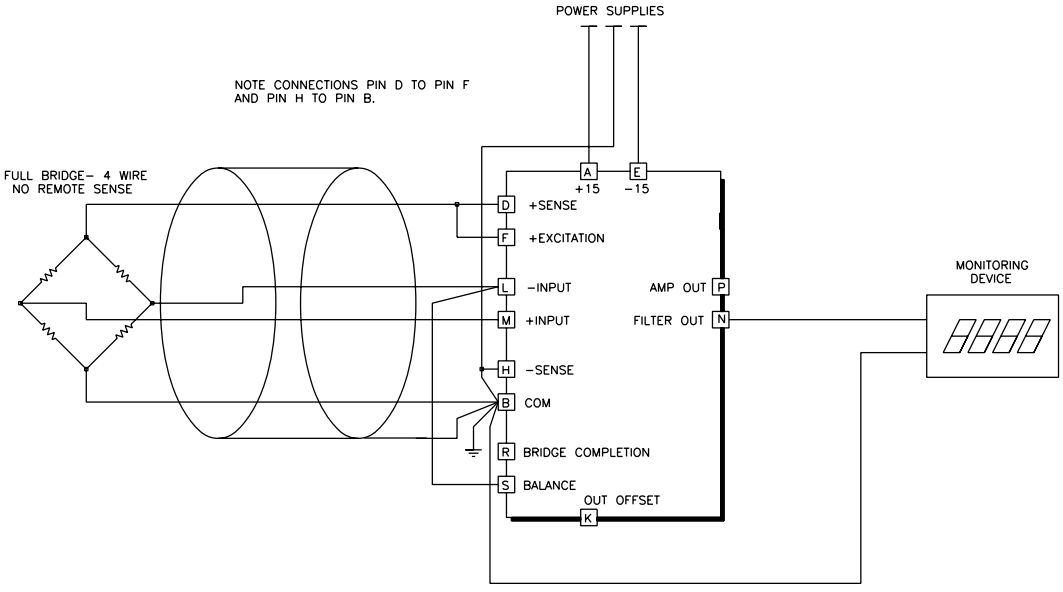


FIGURE 6. Full Bridge with No Remote Sense

OM2-162 Application Example

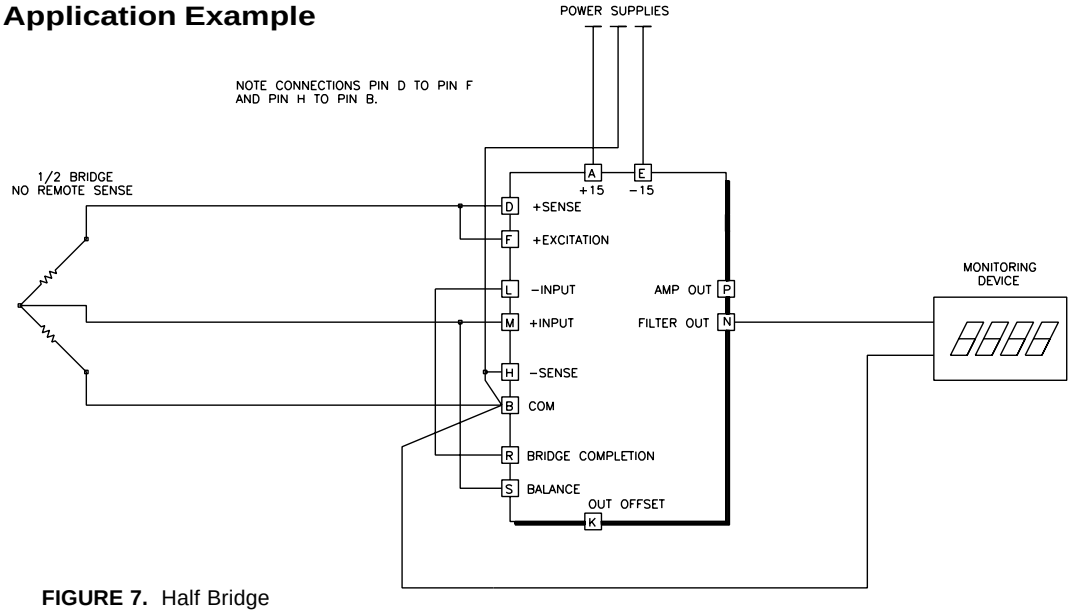
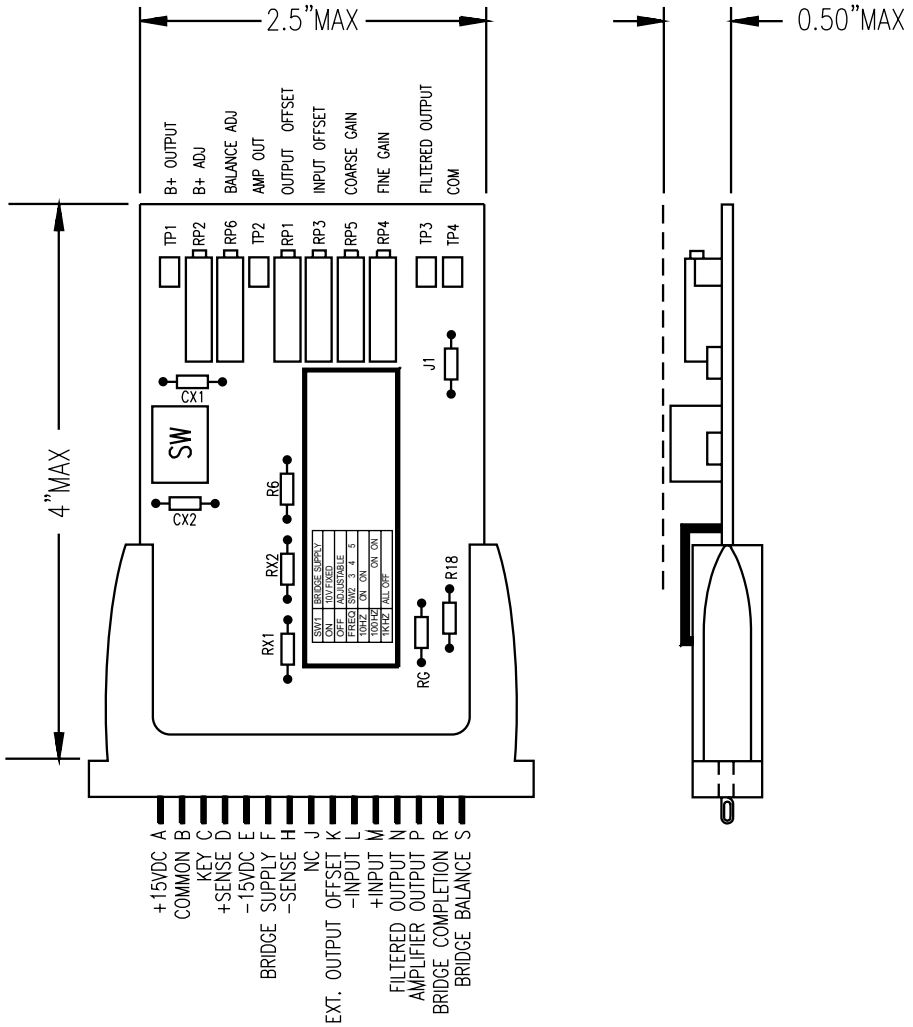


FIGURE 7. Half Bridge

OM2-162 Mechanical Specifications



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