

Model 142 Inline Strain Gage Amplifier



Measurement Specialties, Inc.
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Warranty

Measurement Specialties, Inc. accelerometers are warranted during a period of one year from date of shipment to original purchaser to be free from defects in material and workmanship. The liability of Seller under this warranty is limited to replacing or repairing any instrument or component thereof which is returned by Buyer, at his expense, during such period and which has not been subjected to misuse, neglect, improper installation, repair, alteration, or accident. Seller shall have the right to final determination as to the existence and cause of a defect. In no event shall Seller be liable for collateral or consequential damages. This warrant is in lieu of any other warranty, expressed, implied, or statutory; and no agreement extending or modifying it will be binding upon Seller unless in writing and signed by a duly authorized officer.

Receiving Inspection

Every Measurement Specialties, Inc. accelerometer is carefully inspected and is in perfect working condition at the time of shipment. Each accelerometer should be checked as soon as it is received. If the unit is damaged in any way, or fails to operate, a claim should immediately be filed with the transportation company.

Service Concerns

If a Measurement Specialties, Inc. instrument requires service, first contact the nearest Measurement Specialties, Inc. representative. They may be able to solve the problem without returning the unit to the factory. If it is determined that factory service is required, call Customer Service at the regional headquarters for an RMA number before return.

Returns

All units being returned to the factory require an RMA (Return Material Authorization) number before they will be accepted. This number may

be obtained by calling Customer Service at the regional headquarters with the following information; model number(s), quantity, serial number(s), and symptoms of the problem, if being returned for service. You must include the original purchase order number if under warranty.

Recalibration Services

The Vibration Sensors Design Center and its two manufacturing facilities in China and France offer factory re-calibration services for Variable Capacitance, Piezoresistive, Piezoelectric (including IEPE, ICP etc.) accelerometers and Electronics. NIST (US), DKD (Germany), COFRAC (France) traceable calibration services on sensitivity at 100 Hz (102 or 120 Hz in Europe) and full frequency sweeps are offered. Contact the regional headquarters for pricing information.

Inquiries

Address all inquiries on operation or applications to your nearest Sales Representative, or to the Vibration Applications Support as follows:

Global Headquarters

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Asian Headquarters

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Shenzhen High-Tech Park (North)
Nanshan District, Shenzhen 518057, China
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Description

The Model 142 is a remote in-line strain gage amplifier designed to be used with ¼ bridge strain gage instruments (half bridge option, see page 9). The amplifier features five user selectable gain settings with a gain accuracy of $\pm 0.5\%$ and offers a wide bandwidth to 100kHz. The model 142 offers a patent pending Auto-Zero function that allows the operator to zero the transducer offset voltage to within $\pm 1.5\text{mV}$.

Specifications

Dynamic

Input Type	Uniaxial Strain Gage, 4 Wires, ¼ Bridge
Input Range (V)	0.5 to ($V_{exc} - 0.6$), each input referenced to ground
User Selectable Gain Settings	x10, x50, x100, x200, x500
Bandwidth (-3dB)	DC to 100kHz
Noise ($\text{nV}/\sqrt{\text{Hz}}$)	30 RTI + 2000 RTO
Zero Output After Auto-Zero Actuation ¹	$\pm 1.5\text{mV}$, referenced to 2.5V reference out
Input Range Limit for Auto-Zero Function	$\pm 10\text{Volts/gain}$

Electrical

Excitation Voltage (Vdc)	5 to 30
Reverse Polarity Protection	-20V, on excitation line
Quiescent Current (mA)	15
Reference Out (Vdc)	2.50 ± 0.05 , referenced to ground
Output Voltage Limit (Vpk)	± 2 , referenced to 2.5V reference out
Gain Accuracy (%)	0.5
Output Impedance (Ω)	<50
Insulation Resistance (M Ω)	>100 @ 50Vdc

Environmental

Operating Temperature ($^{\circ}\text{C}$)	-20 to +70
Storage Temperature ($^{\circ}\text{C}$)	-20 to +70
Environmental Protection	IP50
Vibration (g)	20 pk from 50Hz to 2000Hz
Shock (g)	2000 pk with 3.6ms Haversine pulse

Physical

Case Material	Anodized Aluminum
Electrical Connector, Input	Binder Connector P/N 09-0098-00-05 (mates with Binder Connector P/N 99-0413-10-05)
Electrical Connector, Output	Binder Connector P/N 09-0098-00-05 (mates with Binder Connector P/N 99-0413-10-05)
Weight (grams)	34

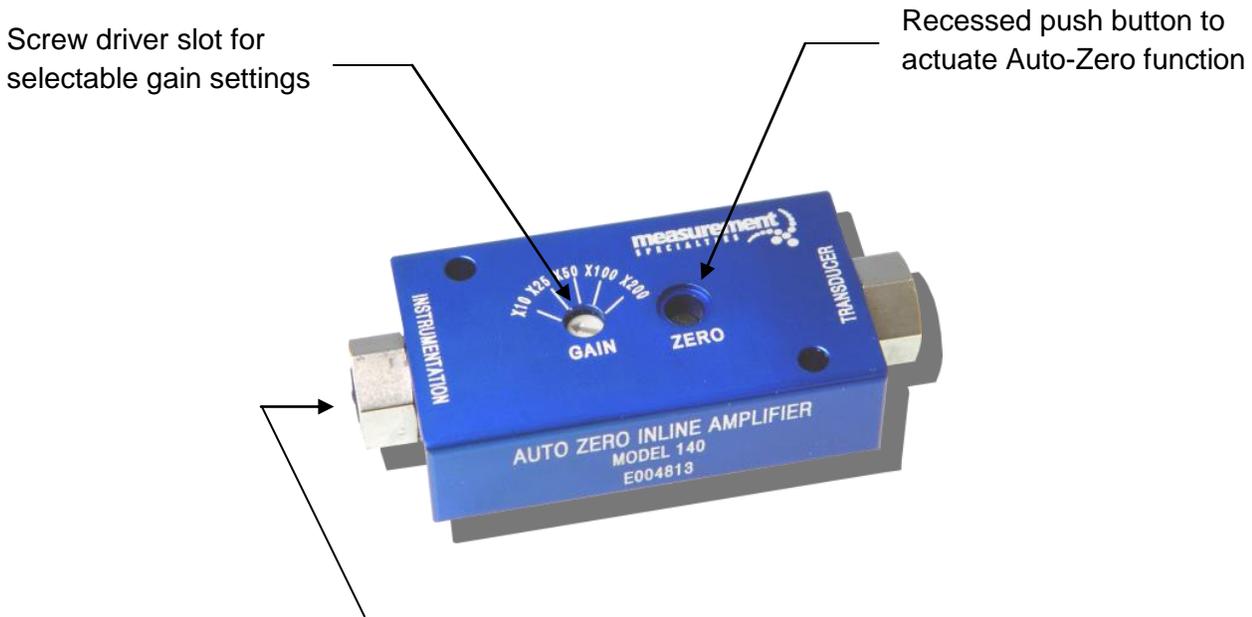
¹ Auto-zero can be actuated using pushbutton or grounding remote auto-zero pin for minimum 2 sec. Multiple actuations may be required to achieve the $\pm 1.5\text{mV}$ limit.

Physical Configuration

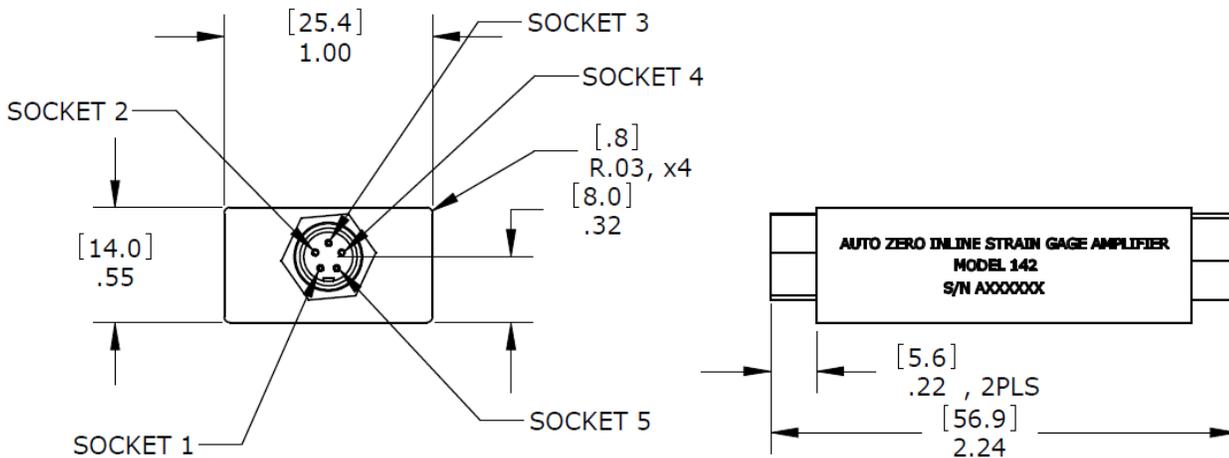
The model 142 amplifier is packaged in a compact anodized aluminum housing and includes two Binder connectors for the electrical interface. Two mounting holes are offered for the screw mounting option.

The top cover of the model 142 amplifier includes the following.

- A screw driver slot for the five selectable gain settings; x10, x50, x100, x200, x500
- A recessed push button to actuate the Auto-Zero function



2x Binder connector series 711, part number 09-0098-00-05
Mates with Binder connector part number 99-0413-10-05

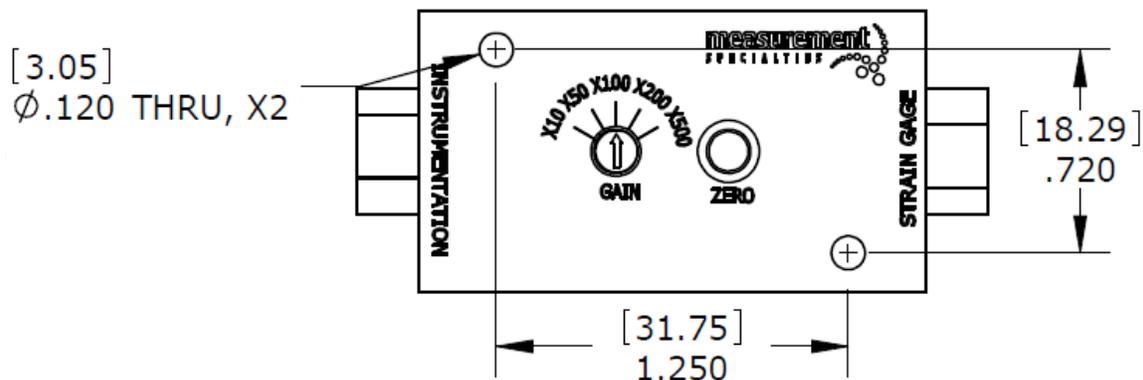
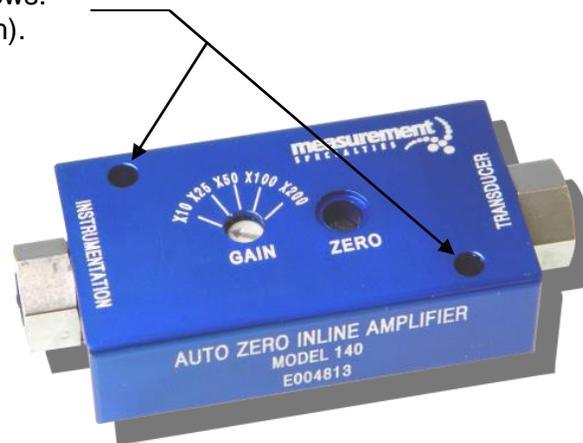


Mounting Installation

The model 142 in-line amplifier can be mounted with various methods. The three preferred methods of mounting are as follows:

1. Screw mounting.
 - The mounting surface should be flat, clean and free of any residue or foreign material.
 - Torque screws to recommended limits below using steel washers under the heads of the mounting screws.
2. Adhesive mounting.
 - A silicone RTV is recommended for adhesive mounting of the amplifier.
 - For removal, gently shear the amplifier loose from the mounting surface. Make sure not to use excessive force as this may damage the amplifier.
3. Double-sided tape mounting.
 - A strong double sided tape with acrylic adhesive is recommended (eg. 3M 444 series).
 - For removal, gently shear the amplifier loose from the mounting surface. Make sure not to use excessive force as this may damage the amplifier.

2x mounting holes for #4-40 or
M3 metric mounting screws.
Torque to 3 lb-in (0.3 Nm).



Humidity Protection

For model 142 amplifier has an ingress protection rating of IP50 (dust protection). It is not designed to be used in any wet environments.

For installation in environments that could be subjected to falling water, it is recommended to install a protective shrink sleeving around the housing of the amplifier. Temporary potting of the gain setting and auto-zero cavities with silicone RTV are also recommended to provide additional protection. The mating connectors will also need to be properly protected from falling water with adhesive and shrink sleeving.

Cable Attachment

The model 142 amplifier incorporates two Binder connectors mounted on each side of the housing. For reliable operation it is recommend that a small amount of thread locking compound is used to secure the connector plug during testing.

The cable assembly should also be properly secured at regular intervals during testing. It is recommended to use clamps, wax, or tape to secure the cable to minimize cable motion that can add noise to the output signal. The initial attachment should be within two to three inches of the amplifier with some slack in the cable to prevent tension at the connector joint

Avoid routing cables near high-voltage wires and also ground the shield at the data acquisition to minimize ground loops.

Calibration

A calibration certificate is provided with each model 142 that presents the actual gain at each gain setting, and the actual values for the 5Vdc regulated supply output and the 2.5Vdc reference output. The calibration cycle is one year.

System Installation

The model 142 amplifier is designed to be operated from 5-30Vdc excitation and provide a maximum $\pm 2V$ full scale output (depending on gain setting) with a 2.5V reference voltage.

The amplifier is designed to be installed in a benign environment between the strain gage instrumentation and the data acquisition system or recording instrument.

Measurement Specialties offers the following accessories that can be purchased with your equipment.

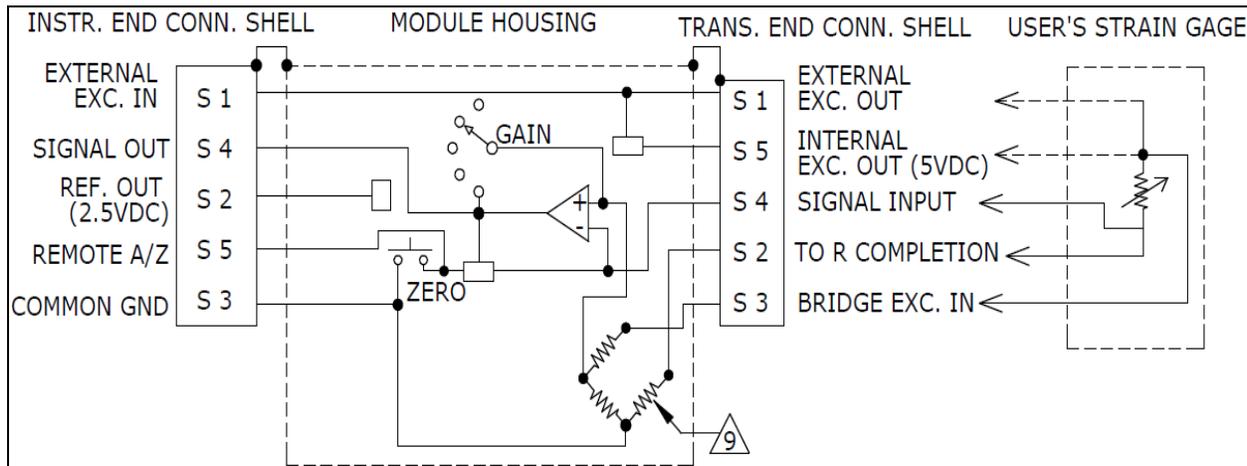
- Mating cable assembly model 379-XXX (-XXX in length in inches). This cable assembly is ideally installed between the model 142 amplifier and the data acquisition system.
- Mating connector plug model AC-G04393 (Binder connector 99-0413-10-05). This connector plug should be installed on the mating cable from the strain gage instrumentation.

The system installation is illustrated below.



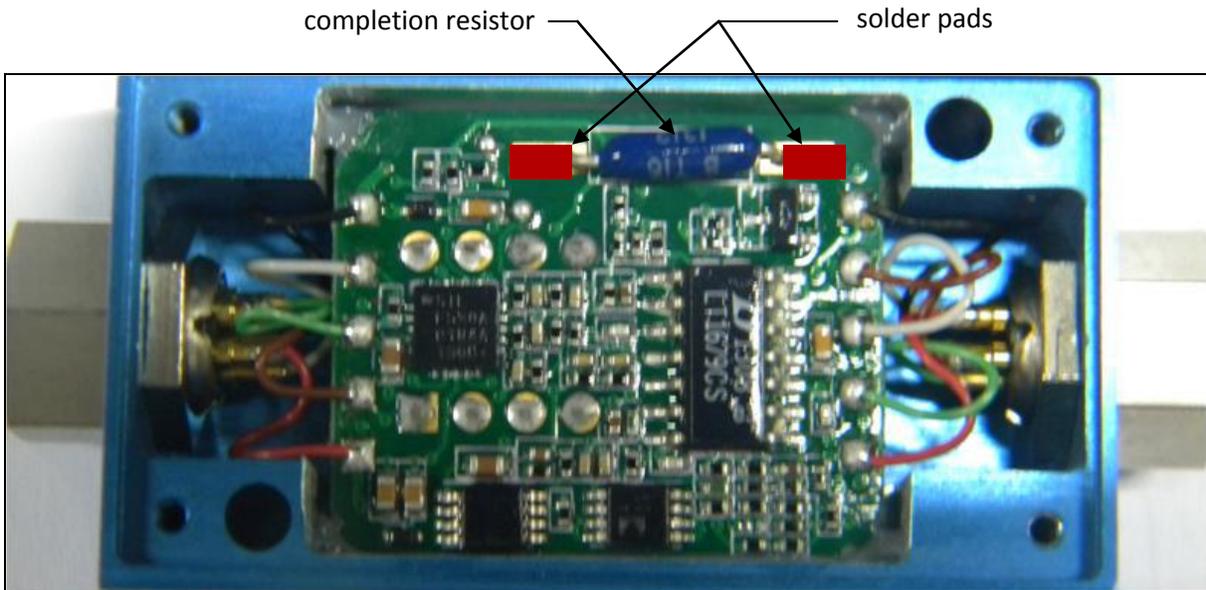
Completion Resistor Installation

The model 142 is supplied with a 350 ohm completion resistor installed at the factory. This resistor can be replaced by the user with another value if required to match that of the strain gage.



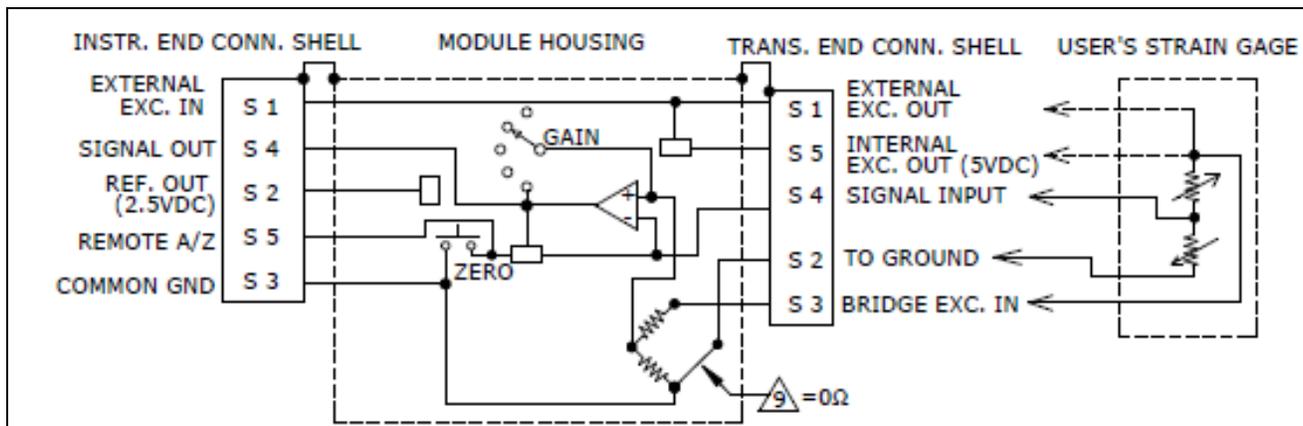
 completion resistor

The leads of the completion resistor have been soldered to pads located on the top surface of the circuit board at the factory. The user can replace the resistor by first removing the cover of the 142 which is attached by four 0-80 cap screws. The user needs to follow standard industry practice in reflowing the solder attachment using a soldering iron, cleaning residual flux, and taking the proper precautions for ESD protection. Note that overheating the solder joints can damage the circuit. The leads of the replacement resistor need to be formed and trimmed to fit the solder pads. Use the factory-installed completion resistor as a template. The leads need not poke through the circuit board. The suggested metal film resistor replacement is the Vishay Dale PTF56 series, $\pm 0.1\%$, $\pm 5\text{ppm}$, $1/8\text{W}$.



Half Bridge Strain Gage Measurements

The model 142 can be wired for half bridge strain gage measurements if required. For this configuration, the completion resistor will need to be replaced with a 0Ohm value. The wiring configuration for this option is illustrated in the schematic below.



$\triangle 9 = 0\Omega$ completion resistor

Transducer Excitation

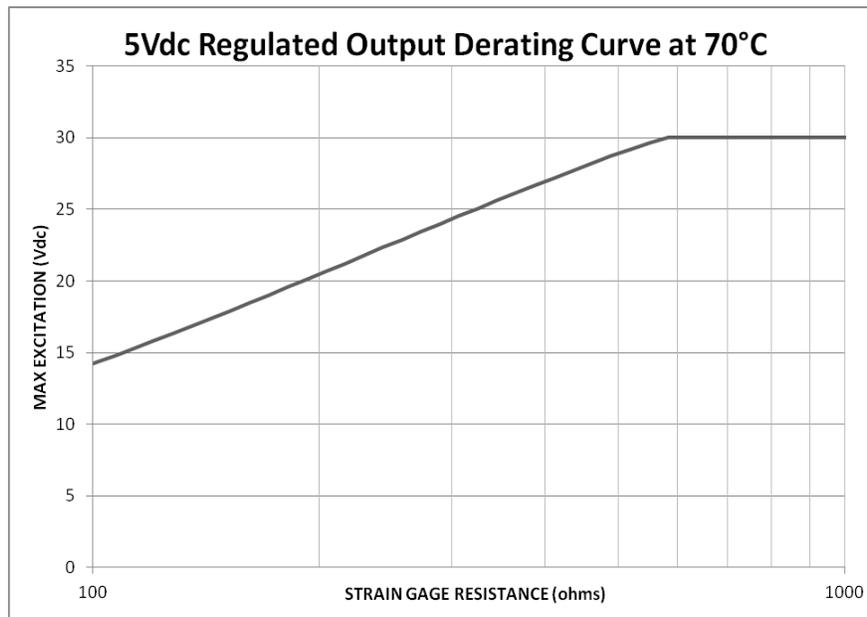
The amplifier offers two options for powering the desired transducer. A regulated 5.0 +0.0/-0.1 Vdc supply is available on Transducer Pin 5. For other supply voltage requirements, Transducer Pin 1 should be used which is the pass through power from the 5-30Vdc excitation source. This output is not regulated and should be a clean supply to the transducer.

The wiring connection diagram is illustrated in the prior section.

Do not connect both Pin 1 and Pin 5 to the strain gage. Connect only one of the pins depending on if the regulated 5Vdc power supply will be used or the pass through power from the excitation source.

When using the 5Vdc regulated supply (Pin 5), the excitation voltage may need to be derated for a given strain gage resistor value. The derating curve is illustrated below given an ambient temperature of 70°C.

For example, a 350 ohm strain gage (with matching completion resistor) cannot have an excitation voltage applied to the 142 that exceeds 25.7Vdc.



There is no restriction on the pass through power (Pin 1).

Auto-Zero Function

The model 142 amplifier incorporates a unique Auto-Zero feature. The Auto-Zero can be actuated by two methods.

1. Manually pushing the recessed Auto-Zero button on the top cover for a minimum of two seconds.
2. Remotely grounding the connection to Pin 5 of the Instrumentation output connector for a period of two seconds minimum. To avoid inadvertent zeroing, the connection to pin 5 needs to be isolated from grounding or extraneous voltage signals.

Multiple actuations may be required for the output to pull within the limit of ± 1.5 mV. The amplifier can auto-zero unamplified bridge offsets within a range of ± 10 volts per gain. The bridge consists of the strain gage and three fixed resistors. For example, a gain setting of X10 allows the correction of offsets from the bridge within a range of ± 1 volt. Conversely, offsets within ± 20 mV can be corrected given a gain setting of X500. Note that the auto-zero correction factor is permanently retained until its next actuation (ie. auto-zero can not be disabled).

If the gain setting on the amplifier is changed at any time or the transducer is replaced, the Auto-Zero procedure needs to be re-actuated.