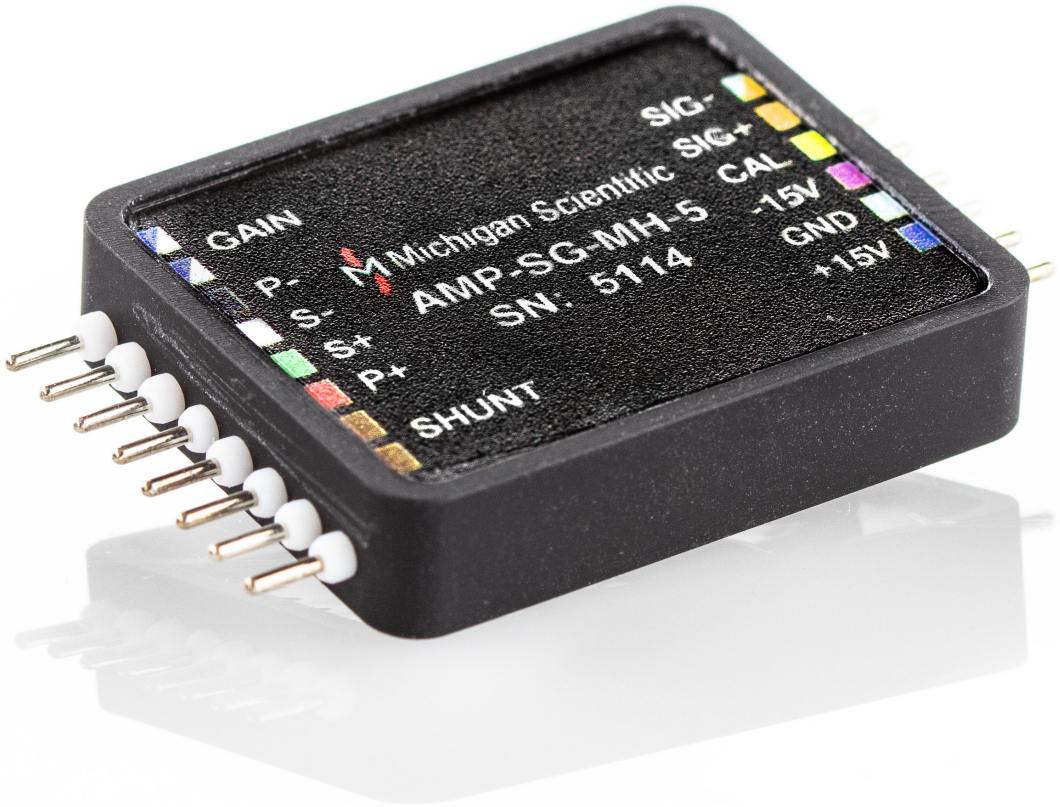


AMP-SG-MH

User Manual

Michigan Scientific Corporation

Michigan Scientific Corporation
8500 Ance Road
Charlevoix, MI 49720
(1-231-547-5511)
michsci.com

1/9/2024 2:30 p.m. twnachazel

Contents

AMP-SG-MH

Miniature Strain Gage Amplifier...

- Precision low drift bridge excitation supply of 5 or 10 Volts
- Bridge excitation may be remotely turned on and off
- Powers resistive bridges of 350 Ω and greater
- Precision, low noise, differential amplifier
- Externally adjustable gain, range of 100 V/V to 2000 V/V
- Amplified signal is at high-level voltage (±10 Volts full scale)
- Signal is greatly immune to external noise source
- Wide signal bandwidth (20 kHz standard, up to 200 kHz)
- Remote shunt calibration capabilities
- Externally adjustable shunt calibration resistance, range of 100 kΩ to 1 MΩ

Specifications

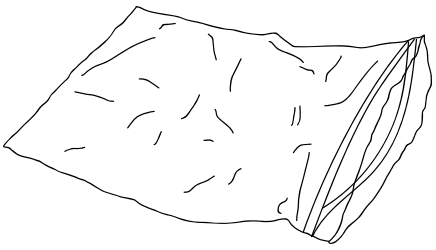
Bridge Excitation	
Type	DC Constant Voltage (Bipolar Excitation)
Magnitude	AMP-SG-MH-5 ±2.5 V (5 Volts total) AMP-SG-MH-10 ±5.0 V (10 Volts total)
Accuracy	0.40%
Temperature Coefficient	0.0005%/°C (0.00028%/°F) max
Current Limit	AMP-SG-MH-5 42 mA AMP-SG-MH-10 84 mA
Remote Calibration	Negative Shunt Calibration
Shunt Resistance internal value external value	100 kΩ & 1 MΩ 100 kΩ - 1 MΩ
Shunt Accuracy @ 100 kΩ @ 1 MΩ	0.01% 0.01%
Gain	Externally Adjustable
Range with jumper with external resistor	100 & 2000 V/V 100 - 2000 V/V
Accuracy @ 25 °C, Gain=100 @ 25 °C, Gain=1000	±0.05% typ (±0.50% max) ±0.50% typ (±1.00% max)
Temperature Coefficient	0.0025%/°C (0.0014% /°F)
Output	
Range	±10 V Max
Capacitive Load	1000 pF Max
Voltage Offset	Referred to Input of Amplifier
Initial @ 25 °C	±10 µV typ (±50 µV max)
Temperature Stability	±0.1 µV/°C typ (±0.25 µV/°C max)
Time Stability	±1.0 µV/month
DC CMRR	160 dB
Noise (rti 0.01 to 10 Hz)	0.7 µV p-p
Dynamic Response	
Frequency Response -3 dB @ Gain=1000 @ Gain=100	20 kHz 20 kHz
Slew Rate	4 V/µS
Settling Time (0.01% @ Gain=100)	9 µS
Power Requirements	
Voltage @ 25 °C	±15 Vdc
Current	±15 mA Plus Bridge Load (±15 mA Additional During Shunt Calibration)
Environment	
Specification	-25 to +85 °C (-13 to +185 °F)
Operation	-55 to +125 °C (-67 to +257 °F)
Mechanical	
Weight	11 g (0.39 oz)
Overall Length	30.54 mm (1.596 in)
Overall Height	6.86 mm (0.270 in)
Overall Width	25.4 mm (1.00 in)

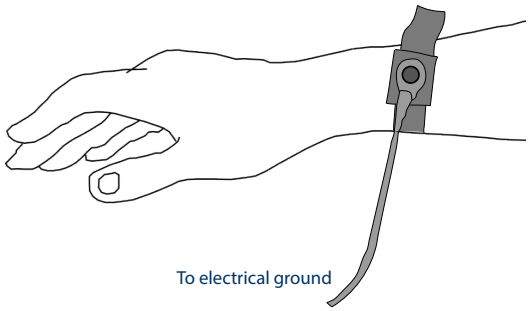
Installation

Electrostatic Sensitivity

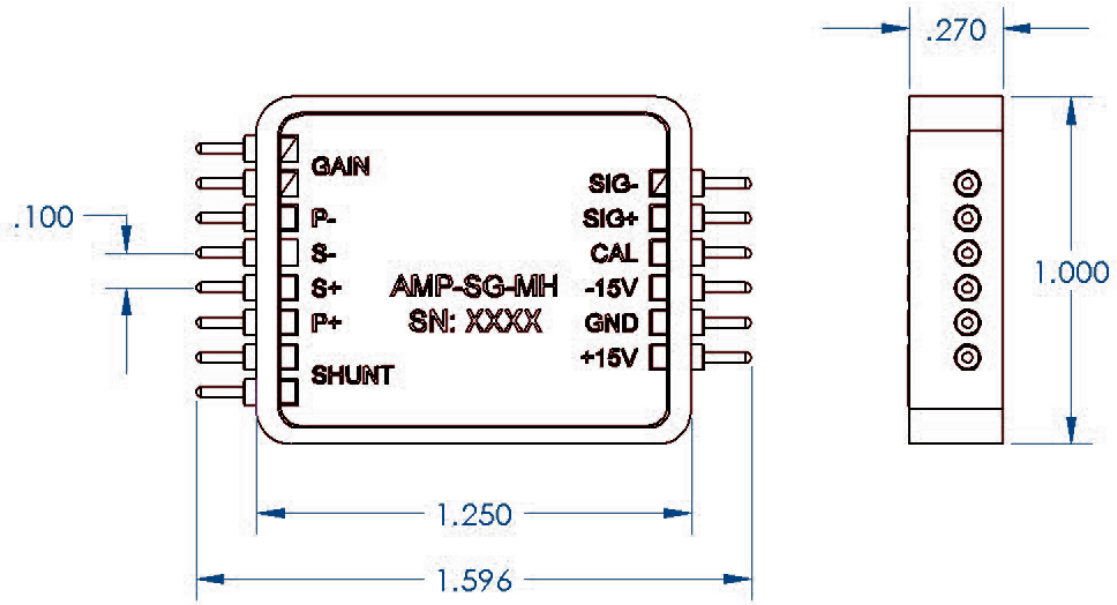
The AMP-SG-MH is an electrostatic sensitive device. The terminals should not be touched except during soldering. Soldering should be performed at electrostatic discharge protected workstations. Wires attached to the AMP-SG-MH should not be touched either.

If an electrostatic discharge protected workstation is not available, use a grounded wrist-strap and ground the strain gage amplifier. Do not handle the device in areas where static charges are obviously present. Always store the AMP-SG-MH in an anti-static bag or container when not in use.





Mechanical Installation

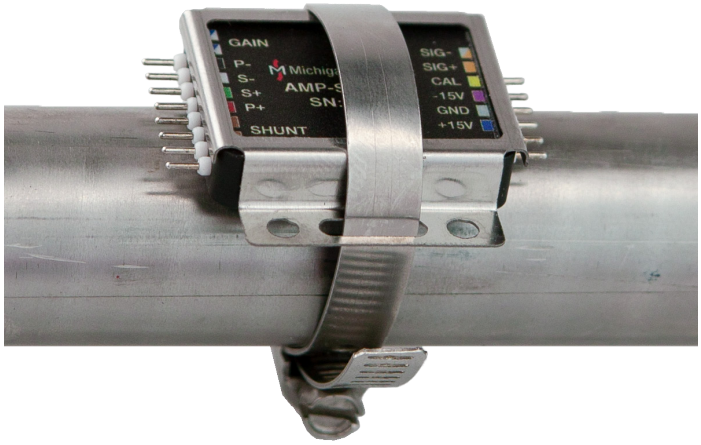


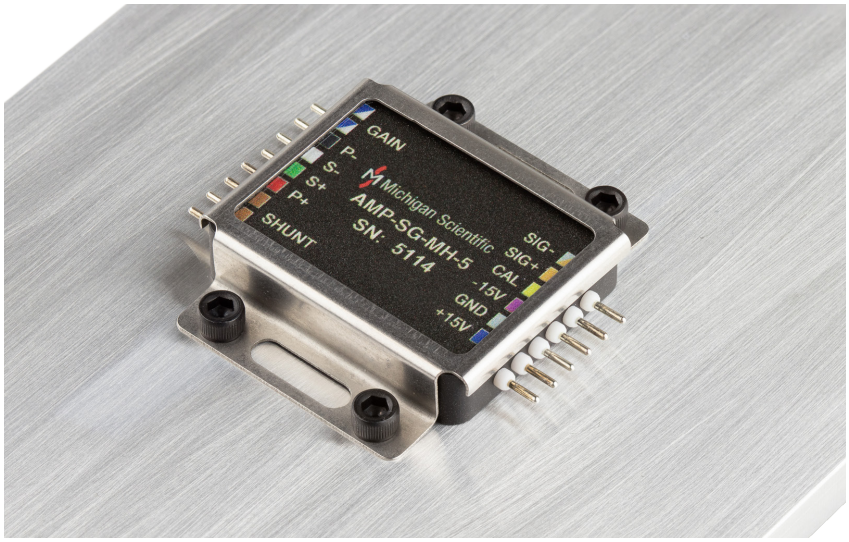
The AMP-SG-MH can be installed with a bracket or using adhesive.

It can be adhered to a clean surface with DOW Corning 3145 RTV adhesive. Manufacturer's directions for curing should be followed.

The AMP-SG-MH can be mounted to a shaft or flat surface using an optional metal bracket.

The bracket can be mounted to a flat surface using bolts and to a shaft with the use of a hose clamp.





Electrical Installation

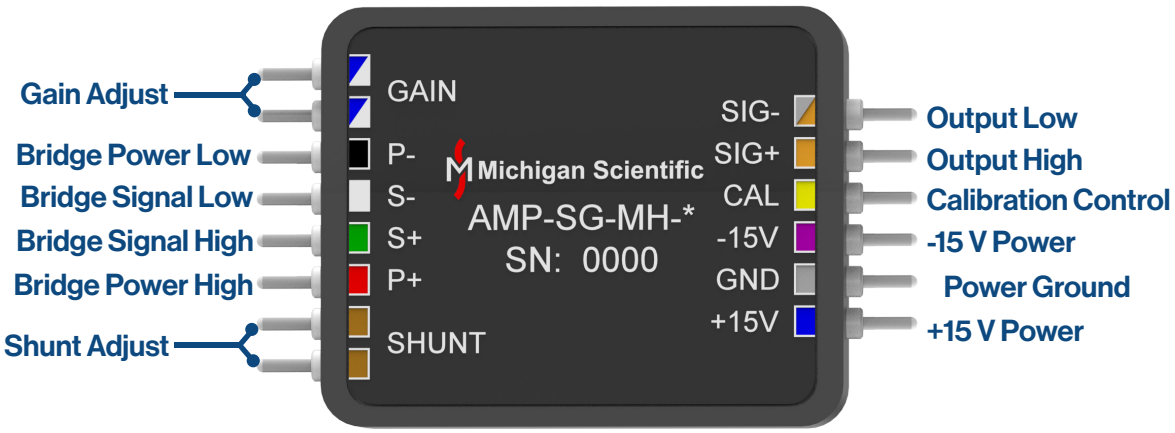
The solder terminals on the AMP-SG-MH are color coded to help determine which supply, control, or signal goes to which wire.

Terminal Signals

Signal		Terminals
Bridge Connections	Positive Excitation	Red
	Negative Excitation	Black
	Bridge Signal High	Green
	Bridge Signal Low	White
Output Connections	Positive 15 V	Blue
	Negative 15 V	Violet
	Common	Gray
	Calibration Control	Yellow
	Output High	Orange
	Output Low	Orange/gray
Adjustment Connections	Gain Adjust	White/blue
	Shunt Calibration Resistance Adjust	Brown

The Output High is measured relative to the Output Low. Michigan Scientific recommends the Output Low be used and not the Common to reduce errors from voltage drops along the power common wire.

A full Wheatstone bridge is needed to allow the AMP-SG-MH to regulate the bridge excitation. Without the bridge, measurements of the excitation are not meaningful. Completion resistors can be added externally to the amplifier.



General Operations

AMP-SG-MH must be powered with ±15 Volts and a common. These supplies should be connected to the proper terminals (see installation) for normal operation. If the supplies are reversed, -15 Volts to the +15 Volt pin and +15 Volts to the −15 Volt pin, the amplifier still operates, but the bridge's excitation is killed. This allows measurement of the amplifier's contribution to the signal's offset, the noise floor and magnetic contributions to the signal.

The signal from the strain gauge bridge is amplified by 100 V/V to 2000 V/V. Instruction can be found for setting the gain in the Gain Formula section.

Applying +15 Volts to the calibration control pin invokes a shunt calibration resistor from positive bridge excitation to positive bridge signal. −15 Volts to the calibration control pin invokes the resistor from the positive bridge excitation to the negative bridge signal. This induces an offset in the bridge that simulates a known load on the transducer allowing the user to calibrate a data acquisition system without applying the actual load.

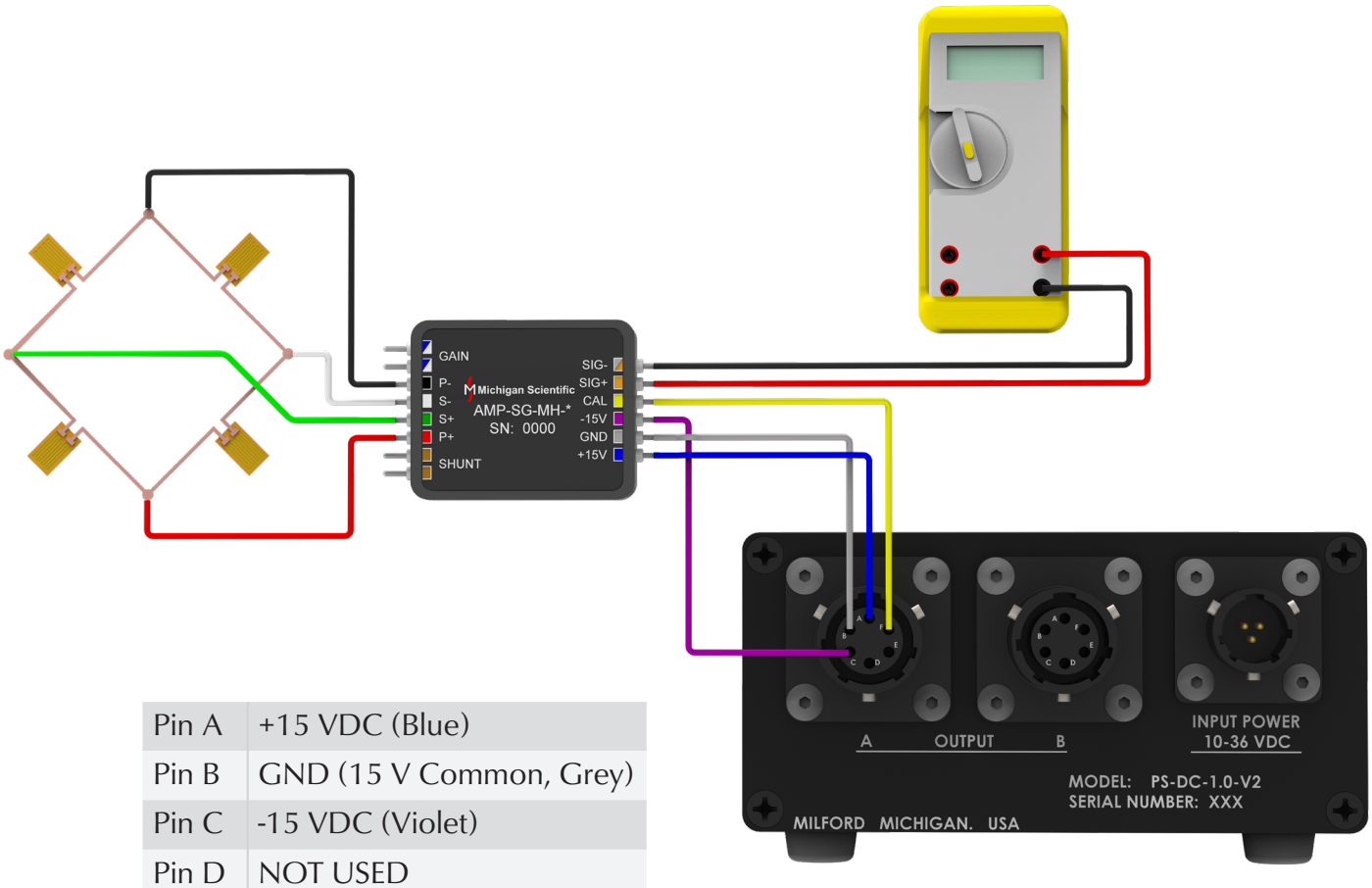
The shunt calibration resistance can be set from 100 kΩ to 1 MΩ. Instructions for setting this can be found in the Shunt Calibration Resistance Formula section.

Operation with PS Series Amplifier Control Units

Any Michigan Scientific power supply will provide the ±15 Volts and common. These power supplies reverse the polarity when the bridge excitation switch is off. Positive and negative shunt calibrations are also performed with a flip of the shunt calibration switch.

The PS-DC controls the amplifiers, and the excitation to strain gage bridges, and commands spinning strain gage amplifiers to apply their internal shunt calibration resistor to the appropriate arm of the strain gage bridge. PS Series power supplies can power many spinning amplifiers depending on bridge excitation, bridge resistance, and power supply current capability.

The diagram below is an example of a PS-DC controlling an AMP-SG-MH and the excitation to a full Wheatstone bridge.



Pin A	+15 VDC (Blue)
Pin B	GND (15 V Common, Grey)
Pin C	-15 VDC (Violet)
Pin D	NOT USED
Pin E	NOT USED
Pin F	Shunt Cal Control (Yellow)

Gain and Shunt Settings

Gain Formula

The gain of the AMP-SG-MH can be set to 2000 V/V by shorting the White/Blue terminals, or to 100 V/V by leaving the terminals open. For intermediate gains, a resistor can be soldered across the terminals. The following formula determines the resistor needed for a selected gain:

$$R_{ext} = \frac{24.014 \times 10^6 - 12007.24 \times Gain}{505.053 \times Gain - 50505.053}$$

Michigan Scientific can supply resistors, but if the user supplies their own Michigan Scientific suggests a 0.01% tolerance with a less than 25 ppm/°C temperature coefficient.

Shunt Calibration Resistance Formula

The resistance that is placed across the arm of the bridge is adjustable. When the Brown terminals are shorted the resistance is 100 kΩ. The resistance is 1 MΩ when the terminals are open. Placing a resistor on these terminals can make any resistance between 100 kΩ and 1 MΩ. The following equation is used to determine the external resistance:

$$R_{ext} = \frac{9 \times 10^{10} - 9 \times 10^5 \times R_{cal}}{R_{cal} - 1 \times 10^6}$$

Michigan Scientific can supply resistors, but if the user supplies their own Michigan Scientific suggests a 0.01% tolerance with a less than 25 ppm/°C temperature coefficient.

Block Diagram