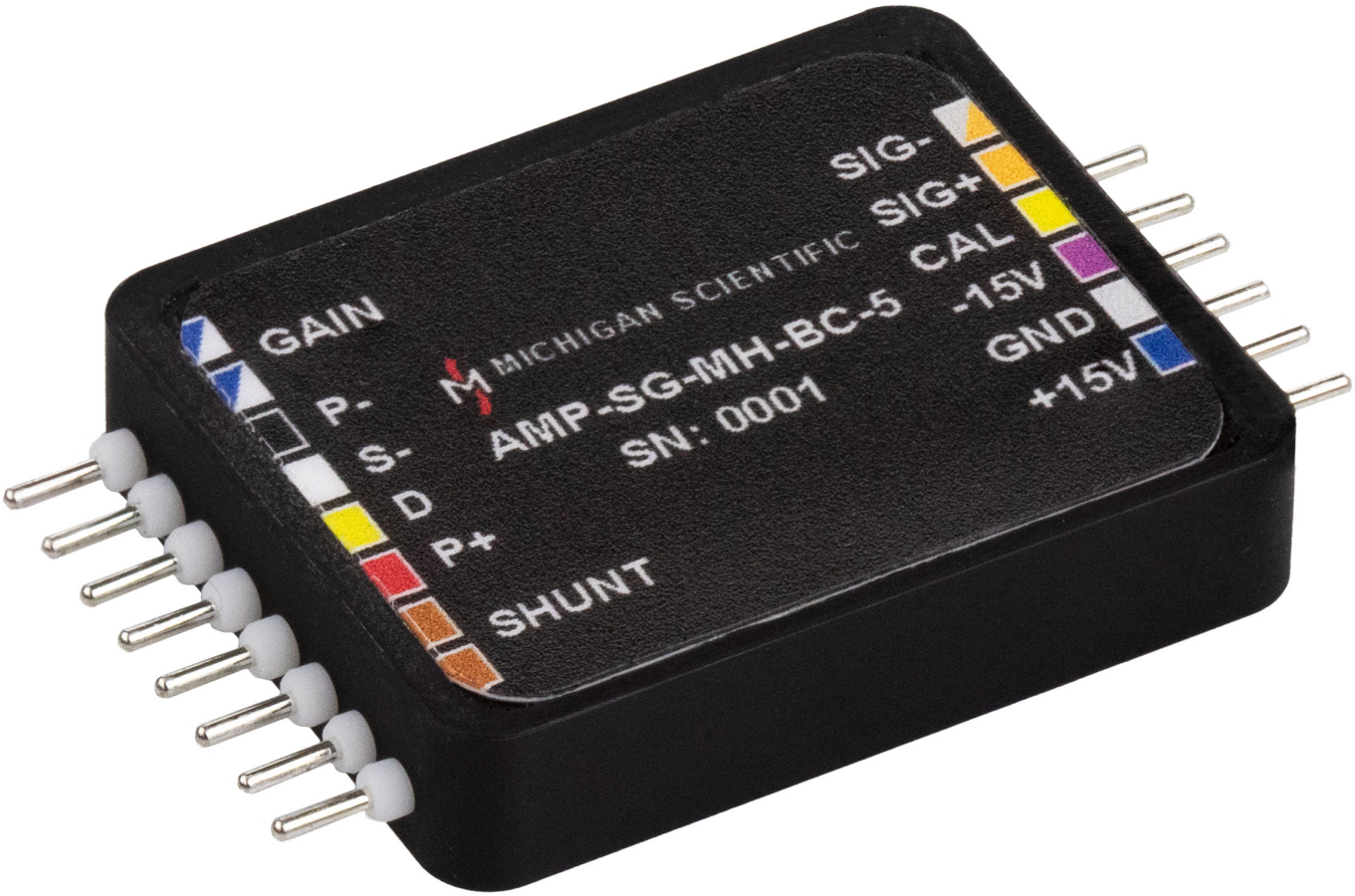


AMP-SG-MH-BC

User Manual

Michigan Scientific Corporation



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AMP-SG-MH-BC Miniature Strain Gauge Amplifier...

- Contains bridge completion resistors for half- and quarter-bridge
- Precision low drift bridge excitation supply of 5 or 10 Volts
- Bridge excitation may be remotely turned on and off
- Precision, low noise, differential amplifier
- Externally adjustable gain
- Amplified signal is at high-level voltage
- Wide signal bandwidth
- Remote shunt calibration capabilities
- Externally adjustable shunt calibration resistance

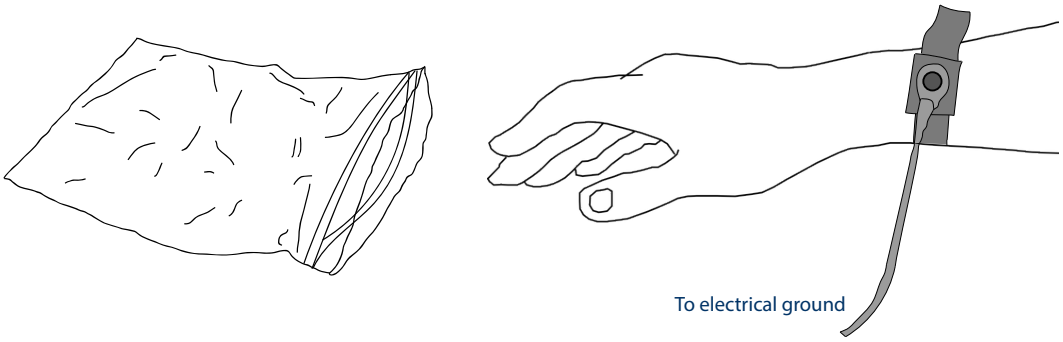
Bridge Excitation	
Type	DC Constant Voltage (Bipolar Excitation)
Magnitude	AMP-SG-MH-BC-5 ±2.5 V (5 Volts total) AMP-SG-MH-BC-10 ±5.0 V (10 Volts total)
Accuracy	0.40 %
Temperature Coefficient	0.0005 %/°C (0.00028 %/°F) max
Current Limit	AMP-SG-MH-BC-5 42 mA AMP-SG-MH-BC-10 84 mA
Completion Resistance	350 Ω
Remote Calibration	Positive and Negative Shunt Calibration
Shunt Resistance internal value external value	100 kΩ & 1 MΩ 100 kΩ - 1 MΩ
Shunt Accuracy at 100 kΩ at 1 MΩ	0.1 % 0.1 %
Gain	Externally Adjustable
Range with jumper with external resistor	100 & 2000 V/V 100 - 2000 V/V
Accuracy at 25 °C, Gain = 100 at 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 at 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 at Gain = 1000 at Gain = 100	20 kHz 20 kHz
Slew Rate	4 V/µS
Settling Time (0.01% at Gain = 100)	9 µS
Power Requirements	
Voltage at 25 °C	±15 Vdc
Current	±15 mA Plus Bridge Load (±30 mA 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)
Dimensions	40.54 x 25.4 x 6.86 mm (1.596 x 1.00 x 0.270 in)

Installation

Electrostatic Sensitivity

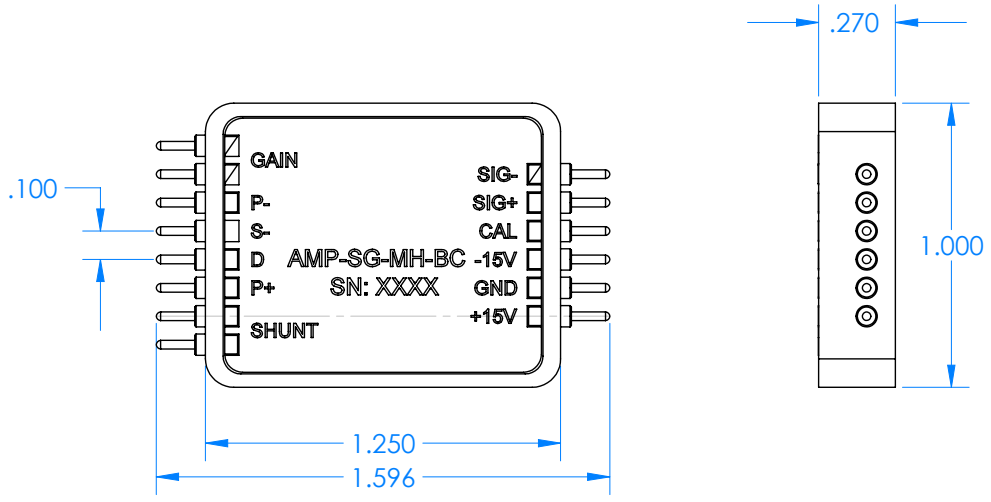
The AMP-SG-MH-BC is an electrostatic sensitive device. The terminals should not be touched except during soldering. Soldering should be performed at electrostatic discharge protected workstations. Wires attached to the AMP-SG-MH-BC should not be touched either.

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-BC in an anti-static bag or container when not in use.



Mechanical Installation

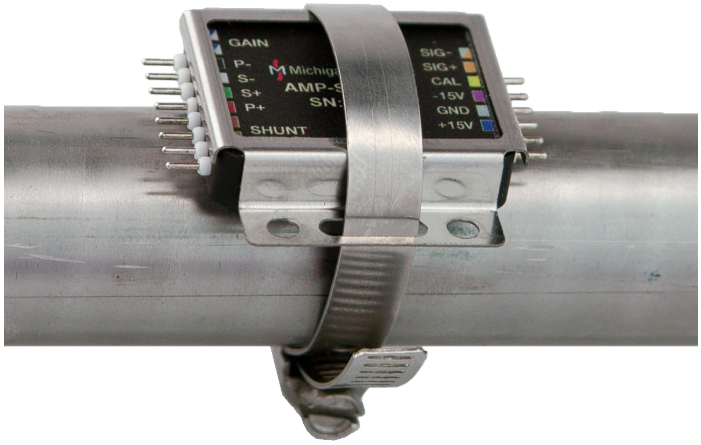
The AMP-SG-MH-BC could be adhered to a clean surface with DOW Corning 3145 RTV adhesive. Manufacturer's directions for curing should be followed.



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

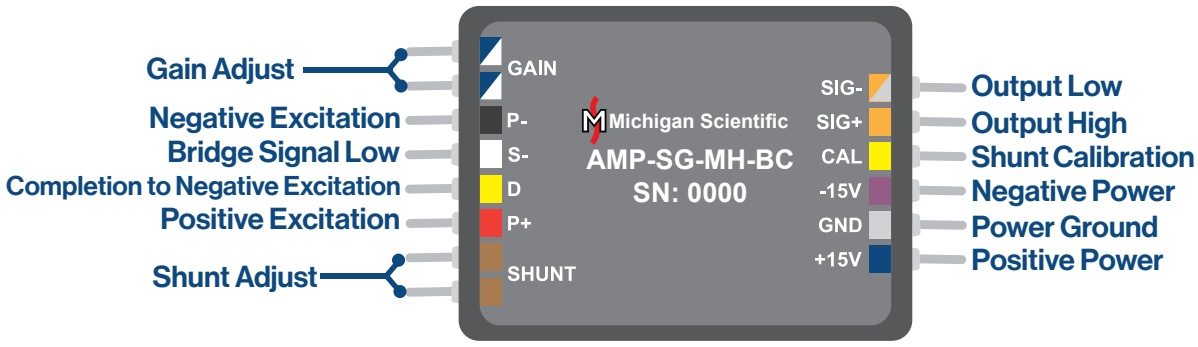
The solder terminals on the AMP-SG-MH-BC are color coded to help determine which supply, control, or signal goes to which wire.

Terminal Signals

Functions		Terminals
Bridge Connections	Positive Excitation	Red
	Negative Excitation	Black
	Completion to Negative Excitation	Yellow
	Bridge Signal Low	White
Output Connections	+15 V	Blue
	-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 strain gauge bridge is needed to allow the AMP-SG-MH-BC to regulate the bridge excitation. The AMP-SG-MH-BC has completion resistors built-in for either quarter or half bridge measurements. Without a quarter or half bridge connected properly, measurement of the excitation is not meaningful.



General Operations

AMP-SG-MH-BC 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.

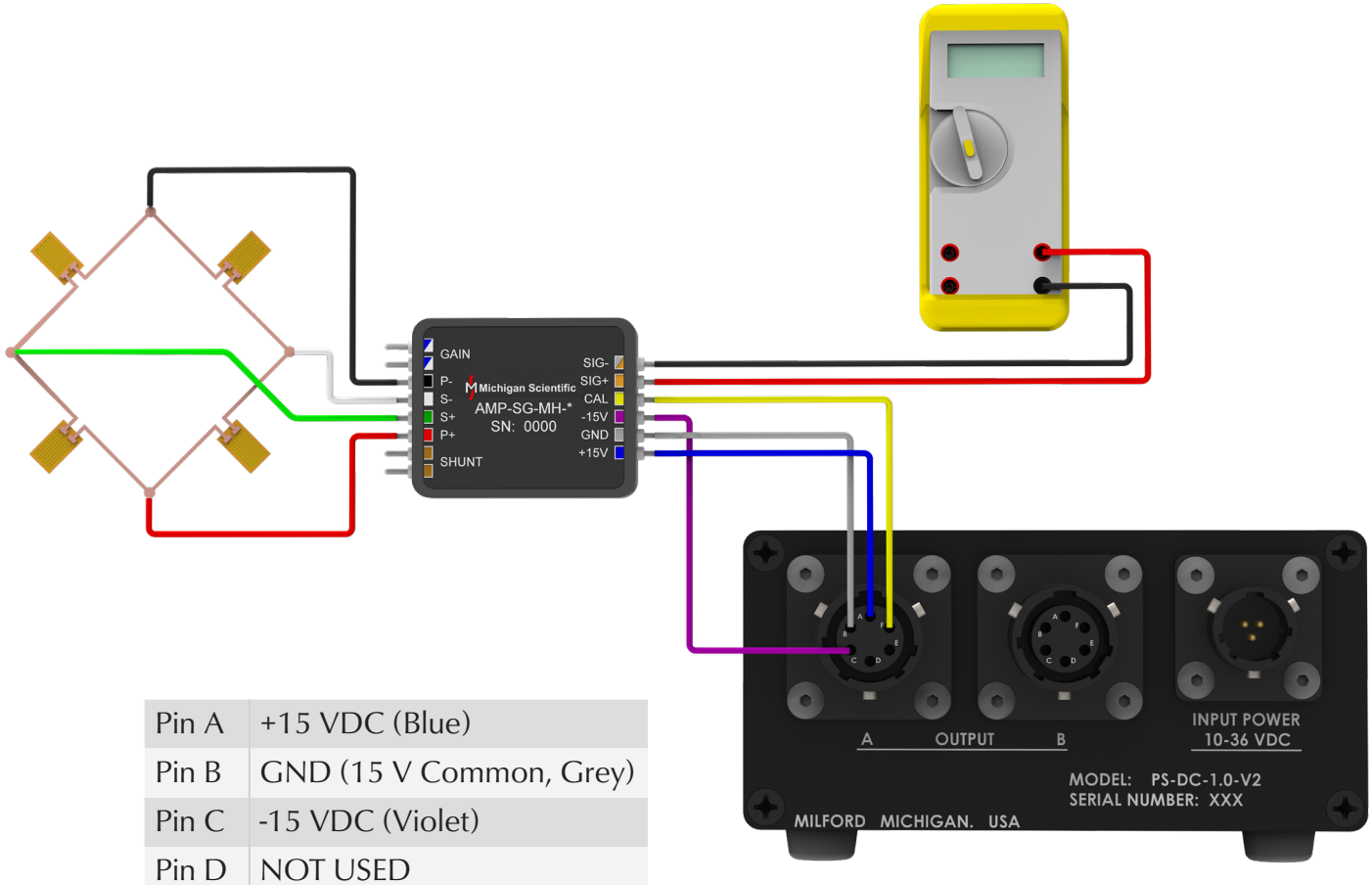
Applying +15 Volts to the calibration control pin invokes a shunt calibration resistor from positive bridge excitation to positive bridge signal. −15 Volts to the calibration control pin invokes the resistor from the positive bridge excitation to the negative bridge signal. This induces an offset in 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.

PS Series power supplies can power many spinning amplifiers depending on bridge excitation, bridge resistance, and power supply current capability.



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-BC 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.

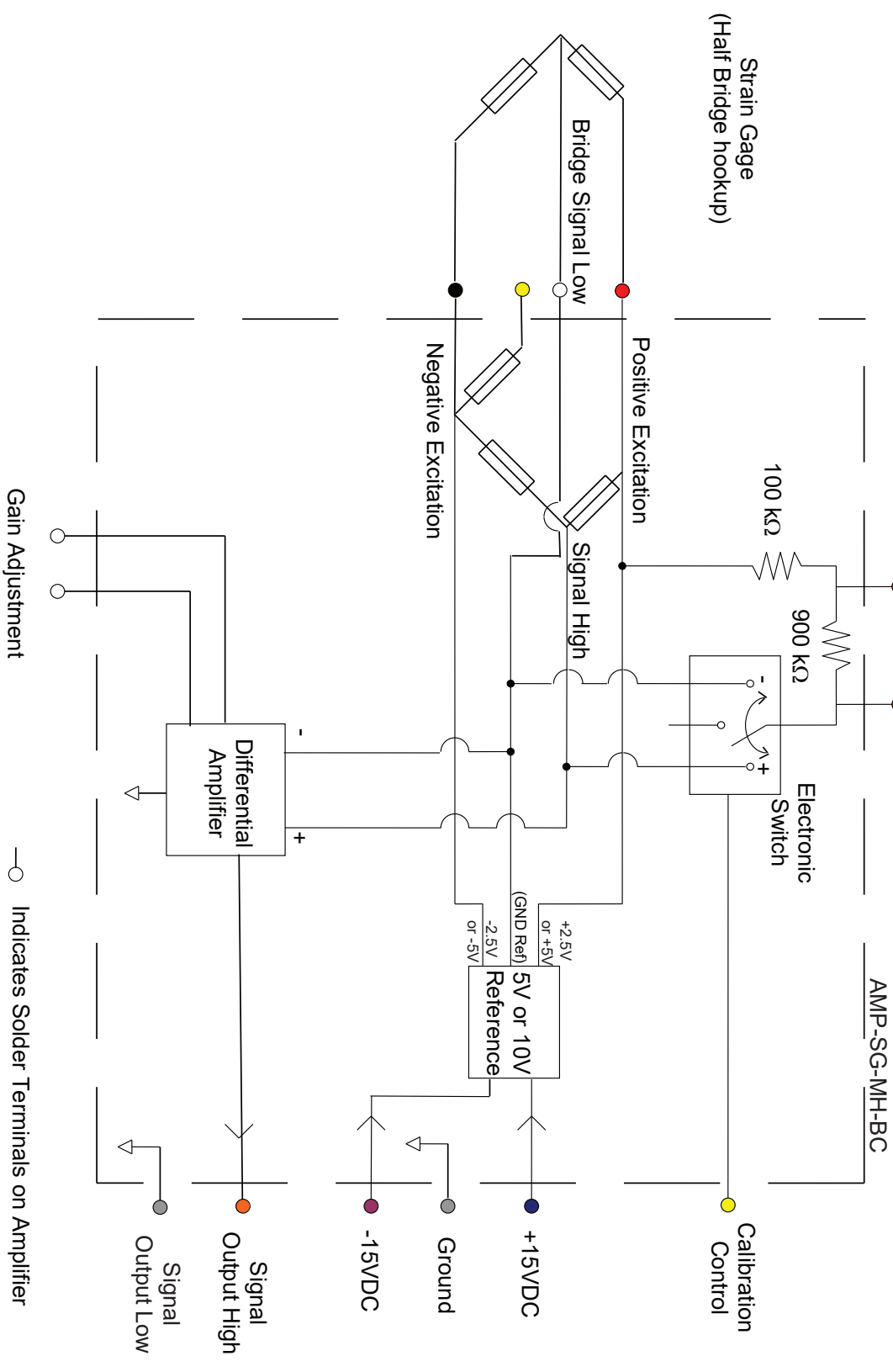
Shunt Calibration Resistance Formula

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.

Half Bridge Block Diagram



Quarter Bridge Block Diagram

