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SGA3A STRAIN GAGE AMPLIFIER BOX

OPERATOR'S MANUAL

OBSERVE
PRECAUTIONS FOR
HANDLING
ELECTROSTATIC
SENSITIVE DEVICES

Table of Contents

INTRODUCTION **3**

FEATURES **3**

OPERATION **4**

General Operation 4
Operation with PS Series Power Supplies 4

INSTALLATION **5**

Setting up SGA3A 5
Power Input Connector 5

APPENDIX **7**

AMP-SG-M1 Specifications 7
AMP-SG-M1 Electrical Installation 8
Electrostatic Precautions *8*
Gain Formula *9*
Shunt Calibration Resistance Formula *9*
AMP-SG-M1 Block Diagram 10

Introduction

The SGA3A *Strain Gage Amplifier Box* is designed to provide strain gage excitation and signal amplification. This Amplifier Box may be used in conjunction with Michigan Scientific load cells and slip rings.

The SGA3A contains three MSC AMP-SG-M1 modular strain gage amplifiers. Each amplifier module incorporates a precision low drift bridge excitation supply, a stable differential amplifier, and a remotely activated shunt calibration resistor for system span verification.

Features

- Precision low drift bridge excitation supply 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. See transducer calibration sheet for set values.
- Amplified signal is at high-level voltage (±10 Volts full scale).
- Signal is greatly immune to external noise sources.
- Wide signal bandwidth (40kHz standard, up to 200kHz).
- Remote shunt calibration capabilities.
- Externally adjustable shunt calibration resistance, range of 100kΩ to 1MΩ. See transducer calibration sheet for set value.

Operation

General Operation

SGA3A amplifier box must be powered with + 15 Volts DC, - 15 Volts DC, and a power common. These supplies should be connected to power connector (see installation). If the supplies are reversed, i.e. -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. Killing bridge excitation allows measurement of the amplifier's contribution to the signal's offset, and permits observation and evaluation of environmental signal noise (e.g. EMI & RFI).

As shipped, the signal from the strain gage bridge is amplified by a gain specific to the accompanied transducer. See transducer calibration sheet for specific values. Instruction can be found for changing the gain for each individual amplifier 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. Applying –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 is set to a shunt specific to the accompanied transducer. See transducer calibration sheet for specific value. Instructions for changing the shunt calibration resistance can be found in the Shunt Calibration Resistance Formula section.

Operation with PS Series Power Supplies

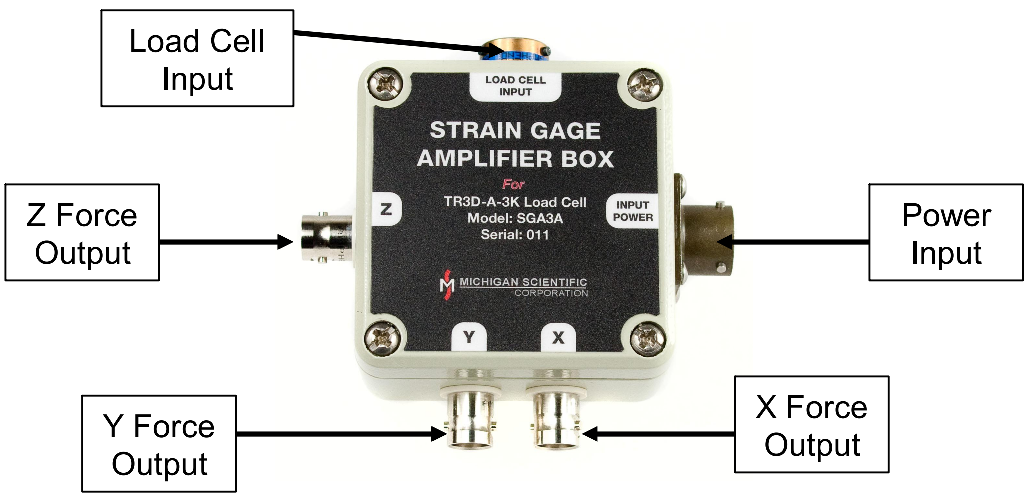
Michigan Scientific PS Series power supplies provide the ±15 Volts and common necessary to power MSC AMP-SG-M1 amplifiers. These power supplies reverse the power polarity to switch off the bridge excitation. Positive and negative shunt calibrations are also performed with a flip of the shunt calibration switch.

MSC PS Series power supplies can power many AMP-SG-M1 amplifiers. The limit depends on bridge excitation, bridge resistance, and power supply current capability.

Installation

Setting up SGA3A

1. Connect the SGA3A to its assigned 3D-load cell with the load cell input connector. Each SGA3A label indicates which Load Cell it was used with during calibration.



2. Connect the ±15 VDC power source to the Amplifier box using the Power Input connector. The pin out for this connector is in the table below. A mating connector and cable is provided.

Power Input Connector
Pin - Out

Pin	Function	Wire Color
A	+ 15VDC	White
B	Ground	Green
C	- 15 VDC	Black
D	-	-
E	Shield	Shield
F	Shunt Calibration Control	Red

3. Connect a BNC connector to each of the three labeled force output channels.

4. Turn on power to the amplifier box. The load cells should now output a voltage proportional to load. The sensitivities for each transducer channel can be found on their associated calibration sheet. Each signal is has a ±10 Volt maximum. The signals should be zeroed with no load applied to the load cell to eliminate transducer unbalance from the signal.

Appendix

AMP-SG-M1 Specifications

PARAMETER		SPECIFICATION
BRIDGE EXCITATION		
Type		DC Constant Voltage (Bipolar excitation)
Magnitude		AMP-SG-M1-5 ? .5 V (5 volts total) AMP-SG-M1-10 ? .0 V (10 volts total)
Accuracy		0.40%
Temperature Coefficient		0.0005 % / 癈 (0.00028 % / 癒) Max
Current Limit		AMP-SG-M1-5 42 mA AMP-SG-M1-10 84 mA
REMOTE CALIBRATION		Positive & negative shunt calibration
Shunt Resistance	internal value external value	100kΩ & 1MΩ 100kΩ through 1MΩ
Shunt Accuracy	at 100kΩ at 1MΩ	0.01% 0.01%
GAIN		Externally adjustable
Range	with jumper with external resistor	100 & 2000 V / V 100 through 2000 V / V
Accuracy	@ 25癈, Gain=100 @ 25癈, Gain=1000	? .05 % typ (? .50 % max) ? .50 % typ (? .00 % max)
Temperature Coefficient		0.0025 % / 癈 (0.0014 % / 癒)
OUTPUT		
Range		? 0 V Max
Capacitive Load		1000 pF Max
VOLTAGE OFFSET		Referred to input of amplifier
Initial	@ 25癈	? 0 µV typ (? 0 µV max)
Temperature Stability		? .1 µV / 癈 typ (? .25 µV / 癈 max)
Time Stability		? .0 µV / Month
DC CMRR		160 dB
Noise	rti 0.01 to 10 Hz	0.7 µV p-p
DYNAMIC RESPONSE		
Frequency Response -3dB		
	@ Gain=1000	20 kHz
	@ Gain=100	40 kHz
Slew rate		4 V / µS
Settling Time	0.01% @ Gain=100	9 µS
POWER REQUIREMENTS		
Voltage	@ 25癈	? 5 VDC
Current		? 5 mA plus Bridge Load (+15 mA additional during shunt calibration)
ENVIRONMENT		
Specification		-25 to +85 癈 (-13 to +185 癒)
Operation		-55 to +125 癈 (-67 to +257 癒)
MECHANICAL		**AMP-SG-M1 AMP-SG-EH1.5**
Weight		14.17 G (0.50 Oz) 35 G (1.25 Oz)
Overall Length		31.75 mm (1.250 in) 38.1 mm (1.500 in)
Overall Height		6.35 mm (0.250 in) 12.7mm (0.500 in)
Overall Width		20.32 mm (0.800 in) 25.4mm (1.000 in)

AMP-SG-M1 Electrical Installation

Electrostatic Precautions

The AMP-SG-M1 (Three are contained inside the SGA3A) is an electrostatic sensitive device. The wires should not be touched except during soldering. Soldering should be performed at electrostatic discharge protected workstations. Wires attached to the AMP-SG-M1 should not be touched either.

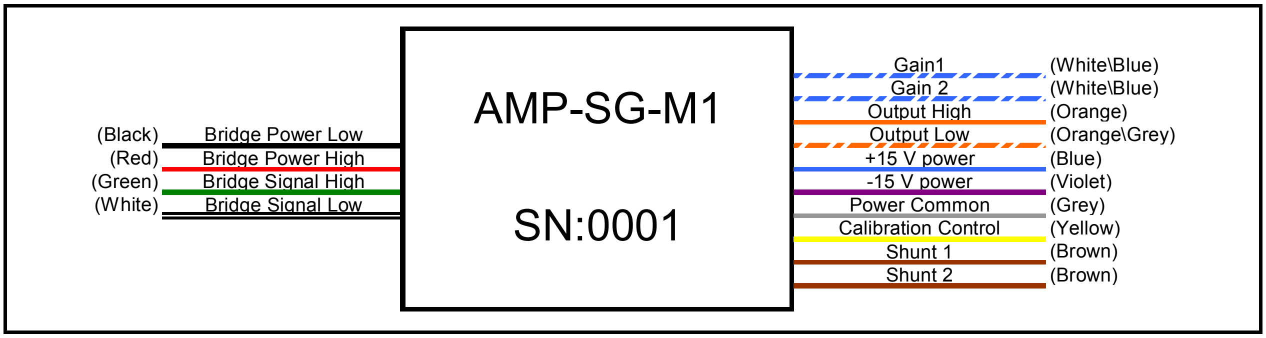
If an electrostatic discharge protected workstation is not available, use a grounded wrist-strap and ground the strain gage amplifier. Do not handle the device in areas where static charges are obviously present. Always store the AMP-SG-M1 in an anti-static bag or container when not in use.

The hook-up wires on the AMP-SG-M1 are color coded to help determine which supply, control or signal goes to which wire.

SIGNAL	WIRES
BRIDGE CONNECTIONS:	
Positive Excitation	Red
Negative Excitation	Black
Bridge Signal High	Green
Bridge Signal Low	White
OUTPUT CONNECTIONS:	
Positive 15V	Blue
Negative 15V	Violet
Common	Gray
Calibration Control	Yellow
Output High	Orange
Output Low	Orange\Grey
ADJUSTMENT WIRES:	
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 Power Common to reduce errors from voltage drops along the power common wire.

A full strain gage bridge is needed to allow the AMP-SG-M1 to regulate the bridge excitation. Without the bridge, measurements of the excitation are not meaningful. Bridge completion resistors can be added externally to the amplifier.



Gain and Shunt Settings

Gain Formula

The Gain of the AMP-SG-M1 can be set to 2000 V/V by shorting the White\Blue wires or to 100 V/V by leaving the wires open. For intermediate gains a resistor can be soldered across the wires. 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 wires are shorted the resistance is 100 kΩ. The resistance is 1 MΩ when the wires are open. Placing a resistor on these wires can make any resistance in-between. 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.

AMP-SG-M1 Block Diagram