

Model SC20

Wideband Bridge Signal Conditioner

User's Manual

August 13, 2002

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Model SC20

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Warranty

Wideband Bridge Signal Conditioner

Adds bridge signal conditioning to ADC modules

SC20

Features

- Two-channel-per-card packaging for maximum versatility
- Up to 16 SC20 Conditioners can be inserted in a V710 Active Termination Panel
- Used with the V200 or V213 ADC modules
- 90 kHz bandwidth when used with a V200 ADC sampling at 200,000 samples/s
- Accommodates 1, 2 or 4 active bridge arms
- Programmable shunt calibration
- Programmable bridge balance
- Programmable excitation with 0, 2.5, 5 or 10 V selection
- Excitation regulation and sensing per channel for maximum stability
- 10-wire transducer hookups can be accommodated
- Excitation alarm
- Optional trifilar-wound transformer for excellent high-frequency CMRR

Typical Applications

- Acoustic and vibration measurements
- Rocket motor tests
- High frequency dynamic tests
- Automotive testing
- Tests using bridge-type sensors

General Description *(Product specifications and descriptions subject to change without notice.)*

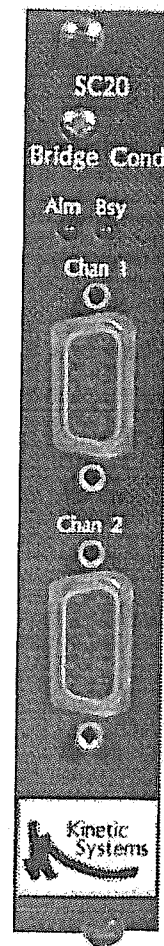
The SC20 is a two-channel bridge signal conditioner. It is packaged in a 3U (5.25") high, 220 mm (8.7") deep, module. It accommodates transducers that represent 1, 2 or 4 active arms of a bridge circuit. Up to 16 SC20 modules (32 channels) can be installed in a single V710 termination panel. Therefore, two 16-channel V200 Sigma-Delta ADC modules or one V213 module can be used with a single chassis of SC20 bridge conditioners. Strain gages, RTDs and other bridge-type sensors can be accommodated.

When used with a V200, this bridge conditioner can achieve a signal bandwidth of 90 kHz, with the V200 sampling at 200,000 samples/s. The SC20 and V200 form an ideal combination for high-bandwidth measurements as the high sample rate, high-rolloff digital filters to prevent signal aliasing, simultaneous sampling (an ADC per channel), programmable gain and AC/DC coupling are already built into the V200 ADC module. When used with a V213, anti-alias filtering is as provided by that module.

Sockets are provided for on-board bridge completion. High-precision 120 Ω and 350 Ω resistors are available. Shunt calibration is activated under program control. Shunt calibration resistors can be plugged into the module to accommodate various bridge requirements. Bridge excitation is programmable, with 0, 2.5, 5 and 10 V selection. The bridge excitation is non-isolated and balanced to ground (e.g. 10 V excitation is supplied to the legs of the bridge as +5 V and -5 V with respect to ground). Each SC20 channel contains a regulator for excitation, and individual remote sensing is provided for high excitation stability.

For applications that exhibit high electrical noise, an option is available that includes a trifilar-wound input transformer. This transformer provides excellent high-frequency common-mode rejection.

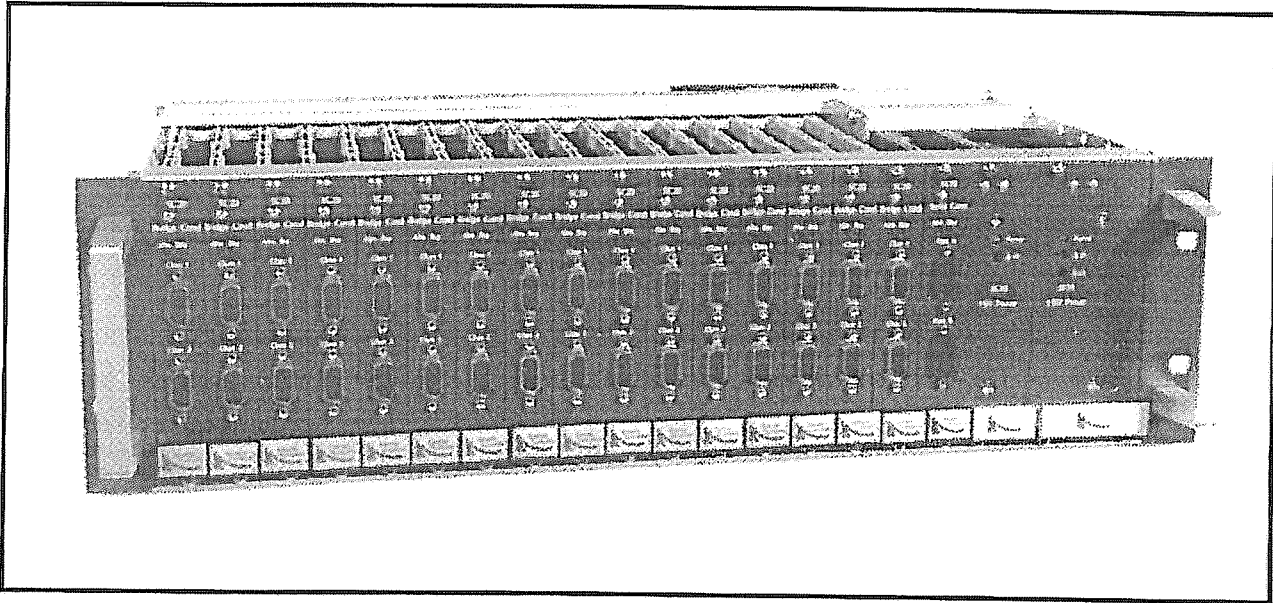
Connections are available to provide a full 10-wire bridge hookup. Each of the bridge channels is connected via a 15-contact "D" connector on the associated SC20 front panel. Setup and control of the SC20 are accomplished via a standard serial port on the SC15 Serial Controller module.



SC20 shown full size

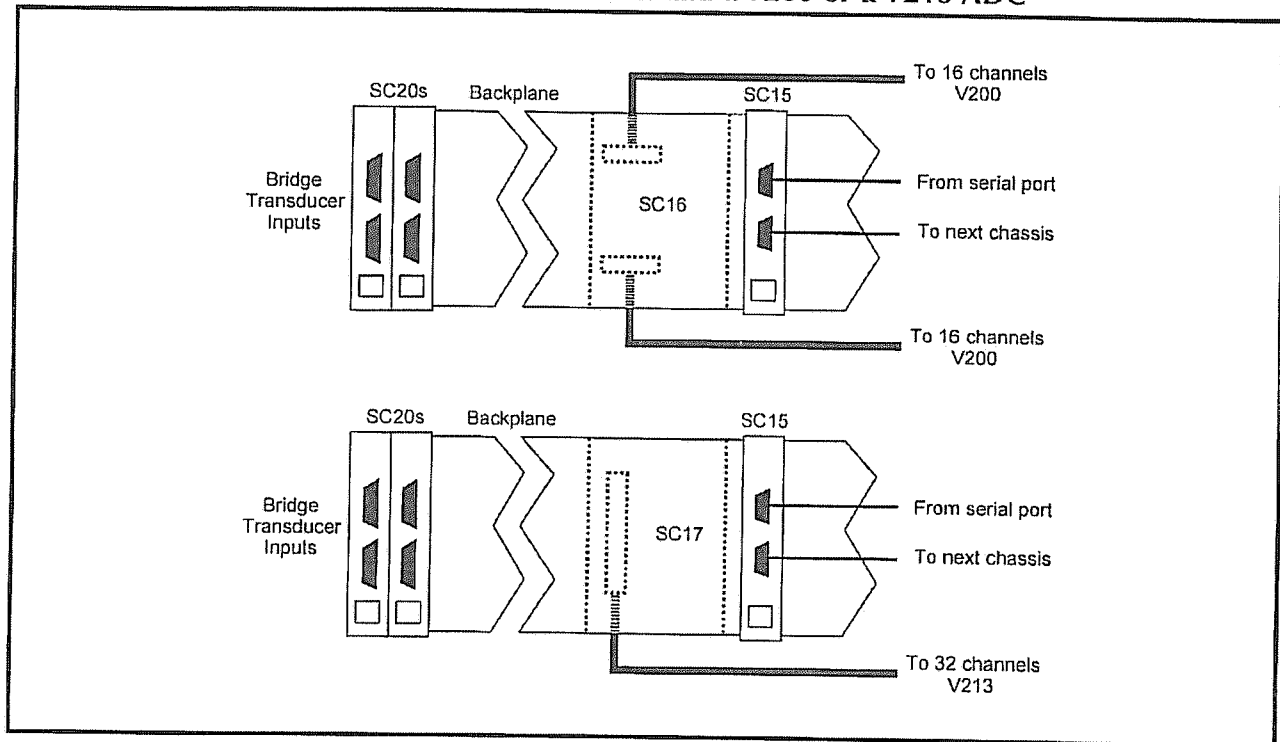
SC20 (continued)

V710 Active Termination Panel (shown with 16 SC20 bridge conditioning modules)



Item	Specification
Inputs Number of channels	2
Frequency Response	Controlled by the host ADC module
Excitation	Independent excitation for each channel. Each channel provides +/- excitation and sense leads. Excitation voltages of 0 V, 2.5 V, 5 V and 10 V are available. Open sense lines or an over-current condition will shut down the supply automatically and signal the error condition. Excitation calibration is also provided.
Line regulation	0.003 %/V
Load regulation	0.00025 V/mA
Temperature Coefficient	2 ppm/°C
Bridge Completion	Two channels of bridge completion are provided. ¼-, ½- and full-bridge configurations are supported. The completion resistors plug into the SC20 PC card. 120, 350 and 1000 ohm resistor kits are available.
Shunt Calibration	+/- shunt calibration is performed on each channel. The customer-supplied resistors are installed on the SC20 PC card. Switching is performed under software control.
Gain/Offset Accuracy	Controlled by the host ADC module
Gain Stability	Controlled by the host ADC module
Offset Voltage Stability	Controlled by the host ADC module
Noise	Controlled by the host ADC module
Linearity	Controlled by the host ADC module
CMRR	Controlled by the host ADC module
Bridge Balance	A 12-bit DAC provides the ability to remove bridge offsets of up to ±70 mV with a 350 Ω bridge.
Input Connector Type	15-contact DSUB socket-type connector (3-row type with the same shell size as a DE9S connector)

Connections Between A V710 Termination Panel and a V200 or a V213 ADC



Ordering Information

Model SC20-AA11	Wideband Bridge Signal Conditioner with Trifilar Transformers
Model SC20-AB11	Wideband Bridge Signal Conditioner without Trifilar Transformers
Model SC20-0002	120 Ohm Bridge Completion Resistor Kit (Three resistors per kit)
Model SC20-0003	350 Ohm Bridge Completion Resistor Kit (Three resistors per kit)
Model SC20-0004	1000 Ohm Bridge Completion Resistor Kit (Three resistors per kit)

Related Products

Model V710	Active Termination Panel
Model 5938-Z1A	Connector - 15 Contact "DSUB" (3-row), Pins
Model SC26-AA11	V710 Load Module (Required to maintain power supply regulation whenever eight or less SC-series signal conditioning modules are installed in the V710 Active Termination Panel.)

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UNPACKING AND INSTALLATION

At KineticSystems, static precautions are observed during production, test, and packaging of the modules. This includes using static proof mats and wrist straps. Please observe these same precautions whenever possible when unpacking and installing the modules.

The SC20 is shipped in an anti-static bag within a foam packing container. Carefully remove the module from its static-proof bag. Bridge completion and shunt calibration resistors should be installed at this time (if required). Refer to page 6 for information on installing these components.

Module Insertion

The SC20 is packaged in a 3U (5.25") high, 220mm (8.7") deep, module. Up to 16 SC20 conditioners can be inserted into a single KineticSystems Model V710 active termination panel. The V710 has sixteen positions for 220mm deep KineticSystems SC-series signal conditioning cards, one 220mm deep position reserved for the SC15 Serial Controller and two 160mm deep positions for Model SC10 and SC11 power supplies. In addition, analog output signals from the SC20 modules are routed via the V710 backplane to an analog interface card that is mounted to the rear of the V710 termination panel. Refer to the figures on the previous page for inserting modules into their proper positions.

NOTE: A SC26 load module must be installed in the V710 active termination panel whenever there are eight or less SC-series signal conditioning cards installed. The load module is required to maintain power supply output regulation.

FRONT PANEL INFORMATION

LEDs

The "Bsy" (Busy) LED is illuminated when the registers are being accessed.

The "Alm" (Alarm) LED is illuminated when an Excitation Alarm has occurred due to an overcurrent condition or an open sense lead. The Channel Alarm register (at address 0x0) may be read to determine which channel(s) caused the alarm condition.

Connectors

There are two 15-contact "D" connectors (AMP # 748390-6) mounted on the SC20 front panel. For a definition of the pins on these connectors refer to Figure 3. When using an SC16 analog interface card in conjunction with a V200 ADC module, signal

Model SC20

conditioner outputs for channels 1-16 are available on the lower connector J4, and signal conditioner outputs for channels 17-32 are available on the upper connector J3. The pinout of SC16 connectors J3 and J4 match those of the V200 ADC module input connector(s).

GENERAL DESCRIPTION

Transducer connections are made to the SC20 card via the two front-panel connectors. It accommodates transducers that represent 1, 2 or 4 active arms of a bridge circuit. Connections are available to provide a full 10-wire bridge hookup. Setup and control of the SC20 are accomplished via a standard serial port connected to the Model SC15 Serial Controller.

The SC20 contains two (2) channels of bridge signal conditioning (Refer to Figure 1) with each channel supplying bridge completion circuitry and independent bridge excitation circuitry. When used with a V213 or V200 ADC module, anti-alias filtering and gain are as provided by that module. Optional trifilar transformers are available for noisy environments or where long input cabling is required. These transformers reduce RF and common mode voltages to the input of the SC20.

Bridge completion (if installed) can be inserted automatically by programming the low thermal EMF latching relays. Either 1/4, 1/2 or full bridge configurations can be selected. Bridge completion resistor option kits are available in 120 Ohm and 350 Ohm sets. Each channel also provides bridge balancing. A 12-bit Digital-to-Analog (D/A) converter is used to inject current into the bridge to remove initial offset voltages or preloads of up to 70 mV.

Shunt calibration may be performed across two arms of the bridge, providing +/- shunt calibration capability. The switching is performed using programmable solid state switches.

Excitation functionality provides programmable excitation voltages of 0, ± 1.25 V, ± 2.5 V and ± 5.0 V at currents of up to 50 mA. Bandwidth of the control loop exceeds 2 kHz. Overcurrent conditions or an open sense lead will cause the supply to shut down with an Excitation Alarm being generated when this occurs. Excitation is controlled on a per channel basis, so that different excitation voltages may be set for each channel.

Analog output signals from the SC20 modules are routed via the V710 termination panel backplane to an analog interface card that is mounted on the rear of the V710. Two types of analog interface cards are available that adapt the output signals to a pinout configuration that matches the type of ADC to be used. The SC16 interface routes the analog output signals to 2- 50 position SCSI 2 receptacles that have

Model SC20

pinouts matching the input connector on the V200 ADC module. The SC17 interface routes the analog output signals to 1- 68 position SCSI 2 receptacle that has a pinout matching the input connector on the V213 ADC module.

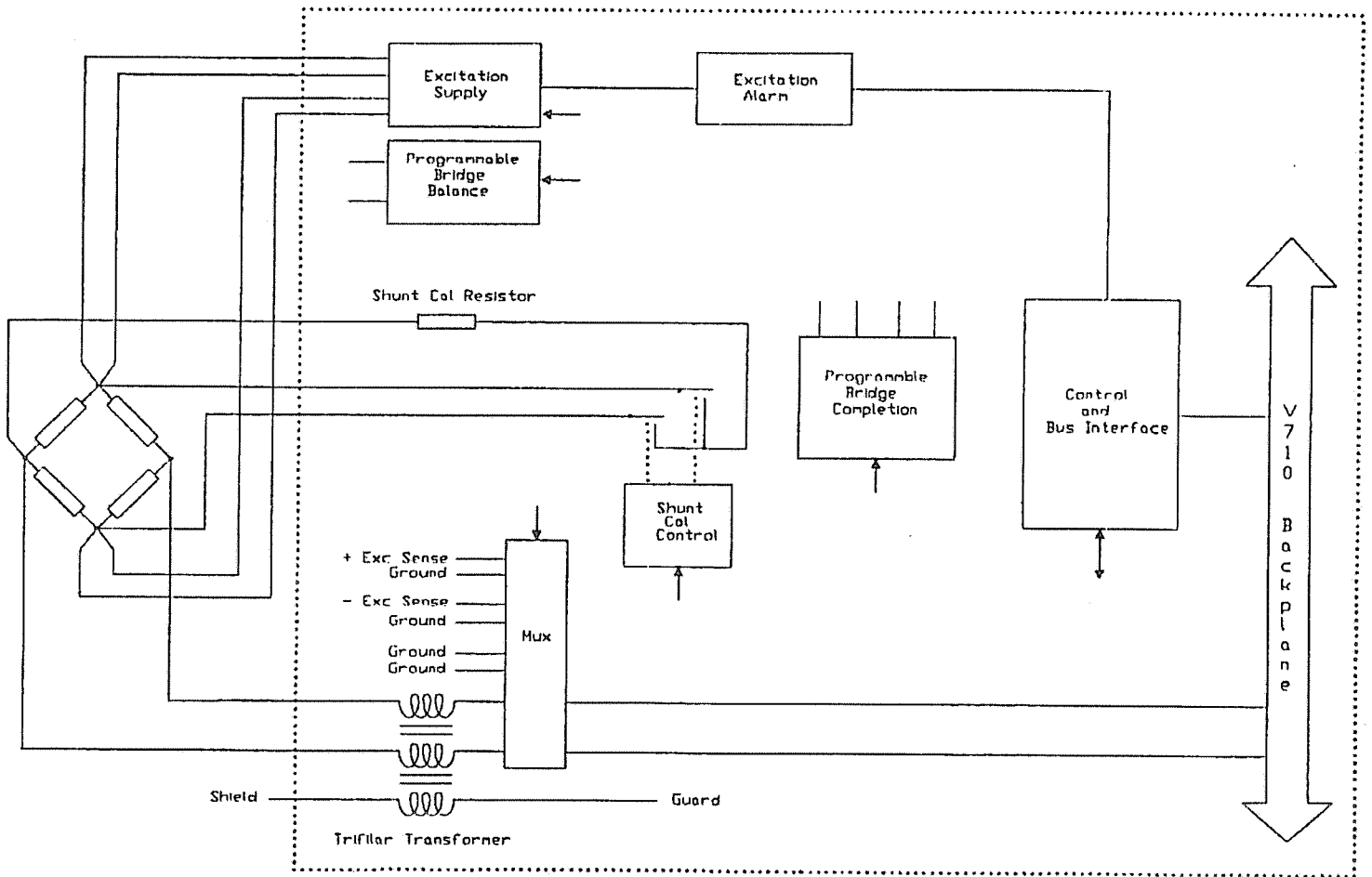


FIGURE 1 - SC20 2-Channel Bridge Signal Conditioner

Model SC20

The SC20 can serve as the input interface for six basic configurations: 1/4 bridge, 1/2 bridge, full bridge, RTD, potentiometer, or voltage inputs. Typical input configurations and connections for a channel are shown in Appendix A.

Sockets are provided for on-board bridge completion. High-precision 120Ω and 350Ω resistor kits are available. The SC20-0002 120Ω bridge completion resistor kit and the SC20-0003 350Ω bridge completion resistor kit each provide one (1) channel of bridge completion. Bridge completion is activated under program control.

Sockets are also provided so a customer supplied shunt resistor may be placed in opposing arms of the bridge to provide +/- shunt calibration. This resistor can be installed onboard the SC20 module or on the customer's transducer. Shunt calibration is activated under program control. Refer to Figure 2 below for the location of bridge completion and shunt calibration resistor sockets on the SC20.

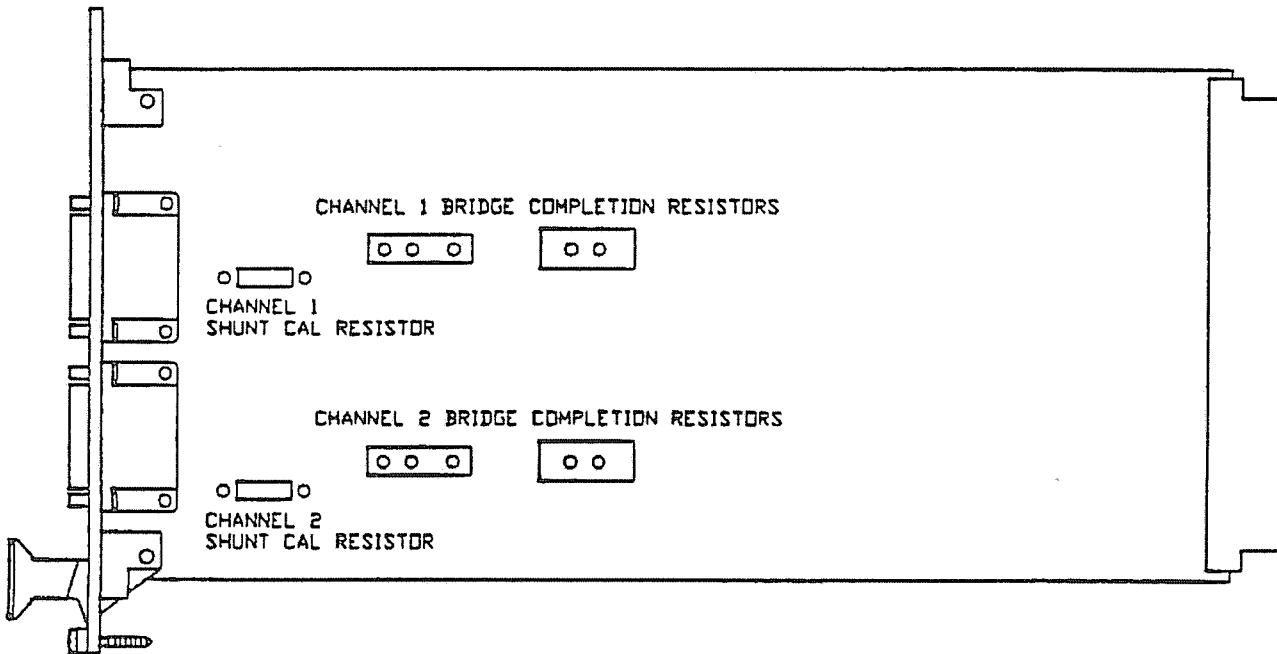


FIGURE 2 - Bridge Completion and Shunt Calibration Resistor Locations

Model SC20

Excitation Voltage Reference Calibration

The excitation voltage circuit on the SC20 consists of a precision +10 volt reference and precision resistor dividers that provide excitation voltages of 0V, $\pm 1.25V$, $\pm 2.5V$ and $\pm 5.0V$. It is recommended that calibration of the +10 volt reference be performed every 12 months. Listed below are the steps required to calibrate the +10 volt excitation reference.

1. Access to the reference potentiometer on the SC20 requires placing the module on a 3U high extender (DIN41612 connector C96 test adapter Schroff part no. 23021-654). Allow the SC20 a 15-minute warm-up period prior to proceeding to Step 2.
2. The 10 volt reference potentiometer PT1 is located at the upper left-hand corner of the module directly behind the module front panel. Using a precision meter such as the HP3458A to monitor test points TP1 (+) and TP2 (-), adjust potentiometer PT1 to +10.0000 volts, ± 0.0005 volts.

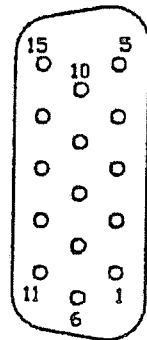
SC20 TROUBLE SHOOTING GUIDE

Problem	Possible Cause
Output at + or - 12 Volts	Input MUX open or no input connection. Input signal saturating amplifier; gain too high at ADC module.
Output always at zero	Input MUX set to zero. Gain at ADC module set too low for input signal. Filter on ADC module set to wrong bandedge.
Signal is clipped	Gain at ADC module set too high
Output not changing with input signal	Input MUX set to other than "Line," possibly to "zero" or " \pm excitation". Gain at ADC module set too low.
Input signal not changing	No excitation voltage
ADC module not receiving data from SC20	Wrong connector adapter card installed on back of V710 active termination panel. V710 power is turned off. Cable connection between V710 and ADC module is bad or missing.

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Problem	Possible Cause
Excitation alarm	Excitation sense lines open. Shorted excitation. Current excitation overload. Excitation voltage too high for transducer.
No shunt calibration	Shunt calibration resistors not installed.

Chan 1



Chan 2

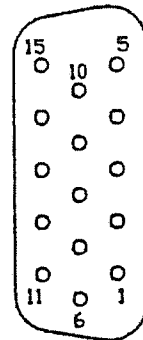


FIGURE 3 - SC20 Front panel connectors

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Front Panel connectors J1 and J2

Pin #	J1 Description	Pin #	J2 Description
1	Ch 1 Pos Monitor	1	Ch 2 Pos Monitor
2	Ch 1 Pos Sense	2	Ch 2 Pos Sense
3	Ch 1 Pos Excitation	3	Ch 2 Pos Excitation
4	Ch 1 Cal Resistor	4	Ch 2 Cal Resistor
5	Ch 1 Pos Input	5	Ch 2 Pos Input
6	Ch 1 Neg Excitation	6	Ch 2 Neg Excitation
7	Ch 1 Neg Sense	7	Ch 2 Neg Sense
8	Ch 1 Neg Monitor	8	Ch 2 Neg Monitor
9	Ch 1 Quarter Bridge	9	Ch 2 Quarter Bridge
10	Ch 1 Neg Input	10	Ch 2 Neg Input
11	No Connection	11	No Connection
12	No Connection	12	No Connection
13	No Connection	13	No Connection
14	Analog Ground	14	Analog Ground
15	Ch 1 Shield	15	Ch 2 Shield

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PROGRAMMING INFORMATION

SC20 Operational Registers

00h - Channel Alarm Register

07	06	05	04	03	02	01	00
						Ch 2 Alarm	Ch 1 Alarm
1 = Alarm Condition							

Bits 0 - 1 contain information about channel excitation alarms. A read of this register will clear the alarm bits.

01h - Channel 1 Excitation/Bridge Configuration Register

07	06	05	04	03	02	01	00
Not Used	Monitor	Local Sense	Bridge Config.		10	5	2.5
	1 = Enable	1 = Enable	00=Full 01=1/2 10=1/4		Excitation (Note: none=0 Volt)		

Bits 0-2 select the excitation voltage. Select only one of the bits for the excitation voltage ("1" = selected). If the excitation has shut down as a result of an Excitation Alarm, the excitation must be reset to 0 before selecting the appropriate excitation voltage.

Bits 3-4 allow selection of the bridge configuration. Bit 5 selects local sense while bit 6 shorts the monitor lines to the excitation lines.

02h - Channel 2 Excitation/Bridge Configuration Register

07	06	05	04	03	02	01	00
Not Used	Monitor	Local Sense	Bridge Config.		10	5	2.5
	1 = Enable	1 = Enable	00=Full 01=1/2 10=1/4		Excitation (Note: none=0 Volt)		

Bits 0-2 select the excitation voltage. Select only one of the bits for the excitation voltage ("1" = selected). If the excitation has shut down as a result of an Excitation

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Alarm, the excitation must be reset to 0 before selecting the appropriate excitation voltage.

Bits 3-4 allow selection of the bridge configuration. Bit 5 selects local sense while bit 6 shorts the monitor lines to the excitation lines.

03h - Channel 1 Bridge Balance Register 1

07	06	05	04	03	02	01	00
DAC 7	DAC 6	DAC 5	DAC 4	DAC 3	DAC 2	DAC 1	DAC 0
Bridge Balance DAC Value							

04h - Channel 1 Bridge Balance Register 2

07	06	05	04	03	02	01	00
+	-	+	-	DAC 11	DAC 10	DAC 9	DAC 8
Shunt Calibration		Bridge Balance Polarity		Bridge Balance DAC Value			

The Bridge Balance DAC value is programmed via bits 0 -7 of Bridge Balance Register 1 and bits 0-3 of Bridge Balance Register 2 (The SC20 utilizes a 12 bit DAC for balance). The polarity of this offset is programmed by selecting one of the bits 4 or 5 of Bridge Balance Register 2. If neither is selected then Bridge Balance is disabled.

Bits 6 and 7 control Shunt Calibration. When neither bit is asserted then the bridge is unshunted. Selecting + or - shunt calibration ("1" = selected) causes the Shunt Cal. resistor (if installed) to be switched into the appropriate arm of the bridge.

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05h - Channel 2 Bridge Balance Register 1

07	06	05	04	03	02	01	00
DAC 7	DAC 6	DAC 5	DAC 4	DAC 3	DAC 2	DAC 1	DAC 0
Bridge Balance DAC Value							

06h - Channel 2 Bridge Balance Register 2

07	06	05	04	03	02	01	00
+	-	+	-	DAC 11	DAC 10	DAC 9	DAC 8
Shunt Calibration		Bridge Balance Polarity		Bridge Balance DAC Value			

The Bridge Balance DAC value is programmed via bits 0 -7 of Bridge Balance Register 1 and bits 0-3 of Bridge Balance Register 2 (The SC20 utilizes a 12 bit DAC for balance). The polarity of this offset is programmed by selecting one of the bits 4 or 5 of Bridge Balance Register 2. If neither is selected then Bridge Balance is disabled.

Bits 6 and 7 control Shunt Calibration. When neither bit is asserted then the bridge is unshunted. Selecting + or - shunt calibration ("1" = selected) causes the Shunt Cal. resistor (if installed) to be switched into the appropriate arm of the bridge.

07h - Input Mux Register

07	06	05	04	03	02	01	00
Not Used				Channel 2 Input MUX		Channel 1 Input MUX	
				00=LINE		00=LINE	
				01=EXC +		01=EXC +	
				10=EXC -		10=EXC -	
				11=ZERO		11=ZERO	

Bits 0 - 3 are used to program the input multiplexer. They allow either the channel (line), ground or +/- Excitation sense voltage to be output. This input MUX selection is provided to allow software Excitation Calibration to be performed. The SC20 uses a zero balanced Excitation supply, so for a 10 volt excitation setting the Excitation + sense line will read +5 volts and the Excitation - sense line will read -5 volts, etc.

Model SC20

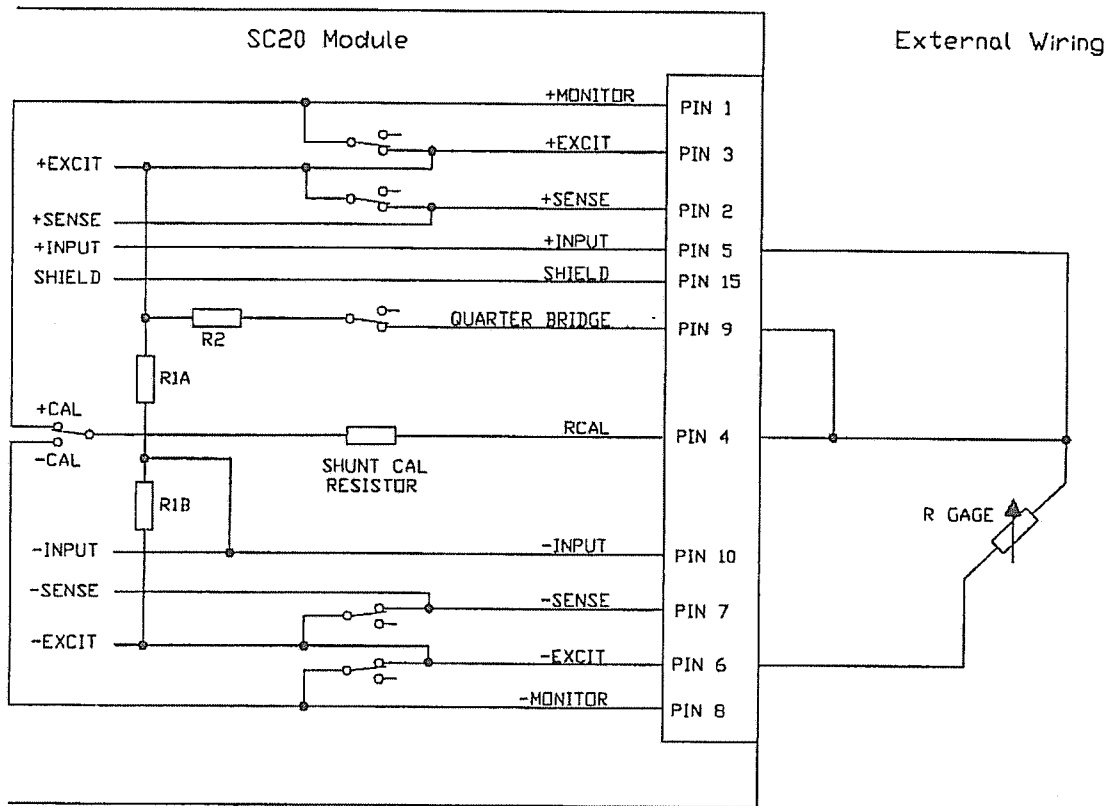


FIGURE A.1
1/4 BRIDGE - INTERNAL SENSING AND INTERNAL CAL RESISTOR

Model SC20

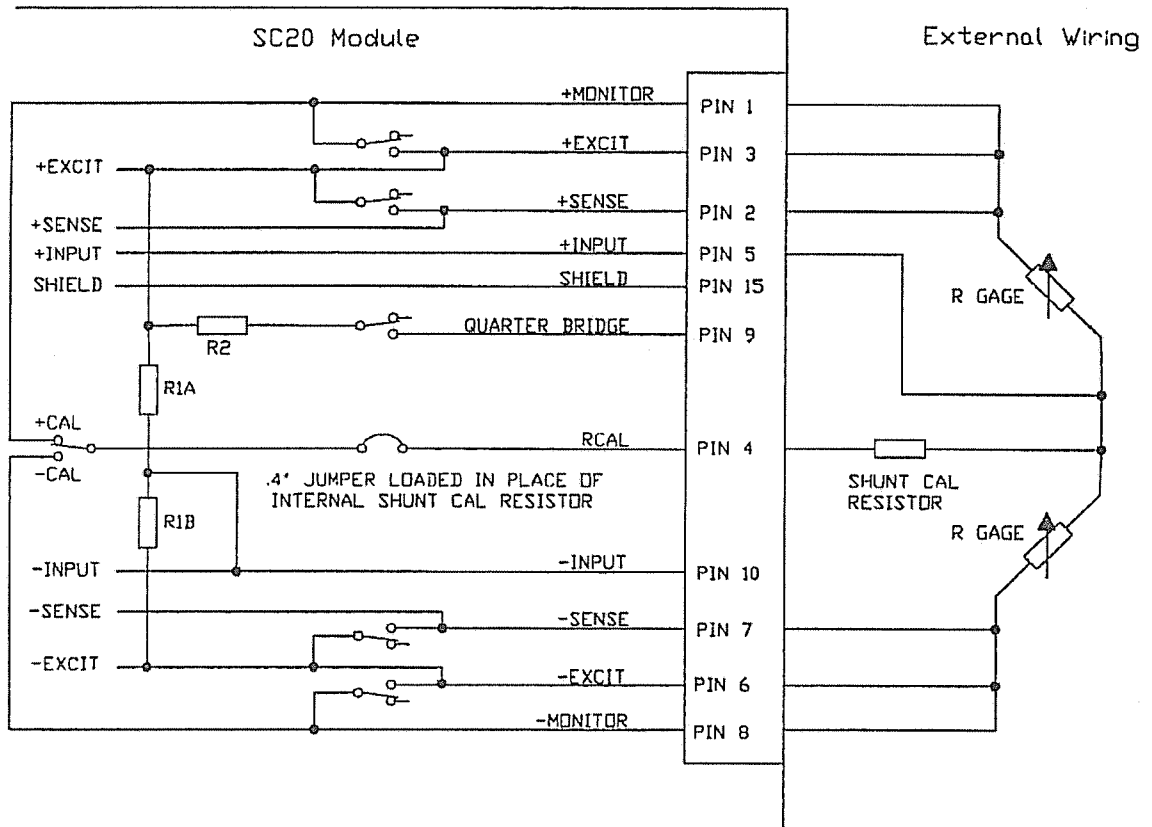


FIGURE A.2
1/2 BRIDGE - EXTERNAL SENSING AND EXTERNAL CAL RESISTOR

Model SC20

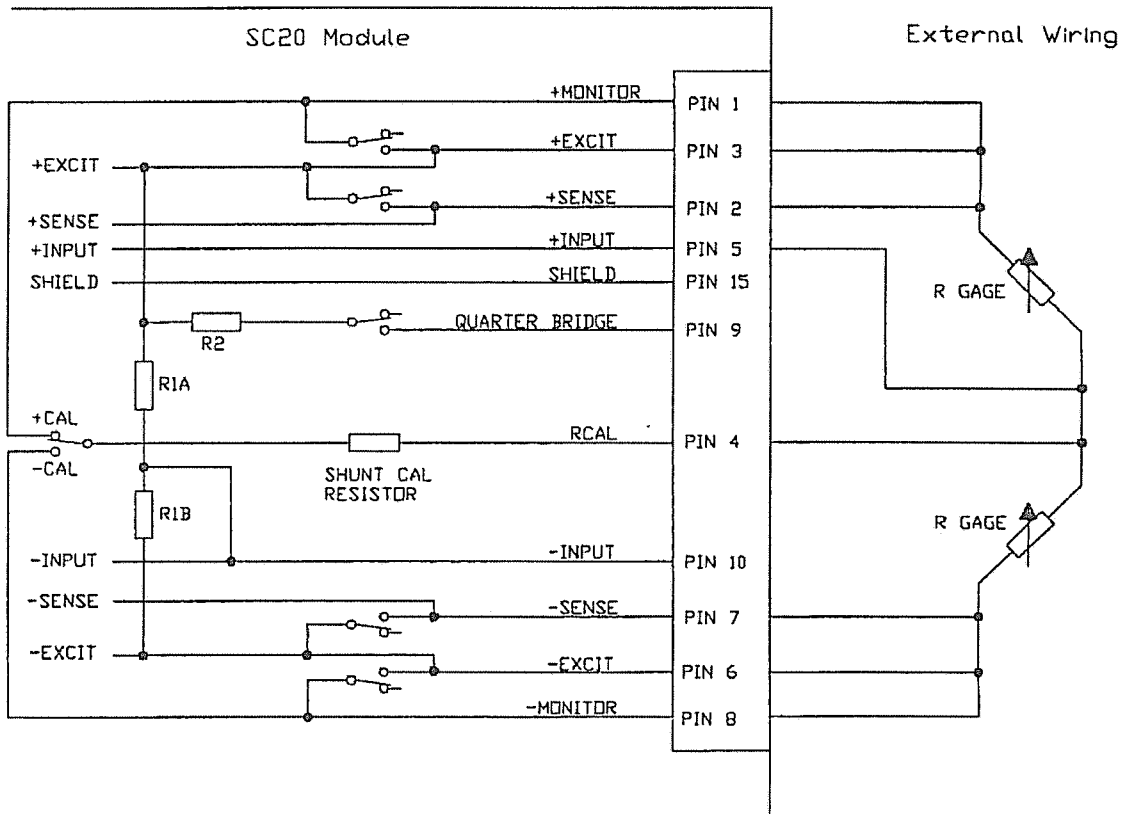


FIGURE A.3
1/2 BRIDGE - EXTERNAL SENSING AND INTERNAL CAL RESISTOR

Model SC20

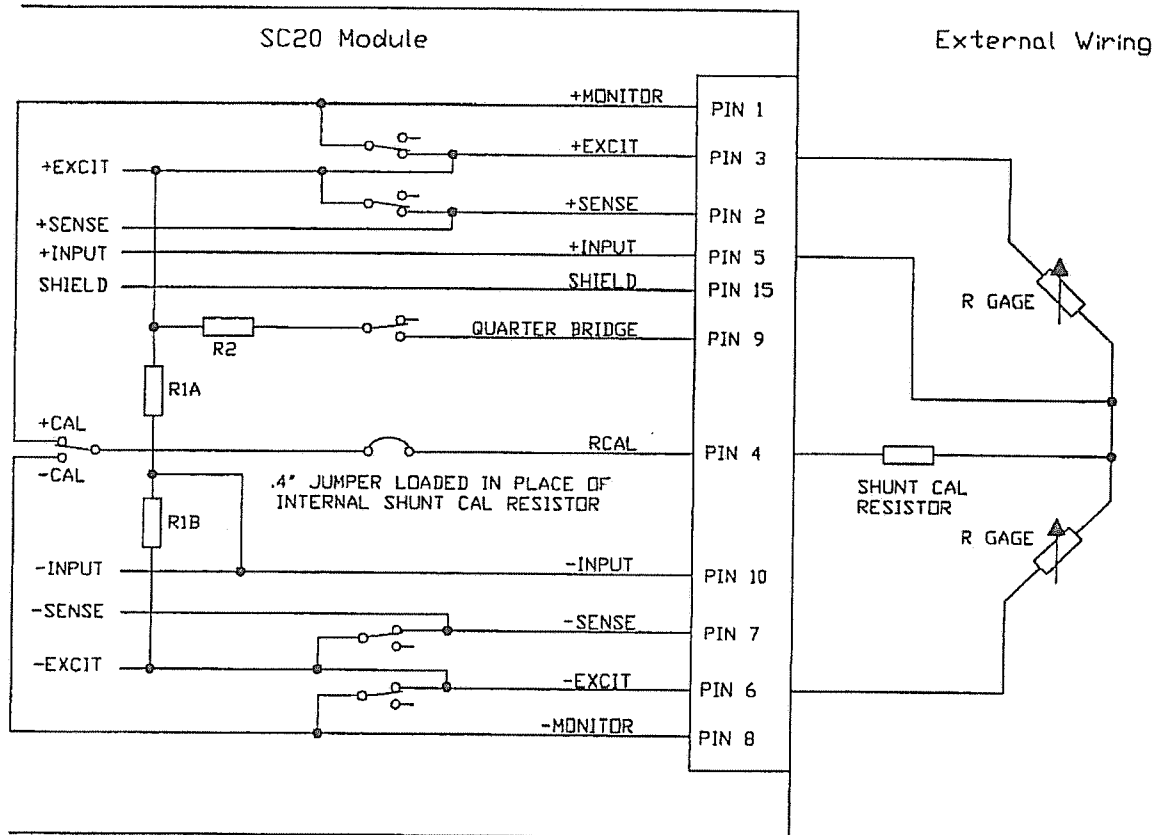


FIGURE A.4
1/2 BRIDGE - INTERNAL SENSING AND EXTERNAL CAL RESISTOR

Model SC20

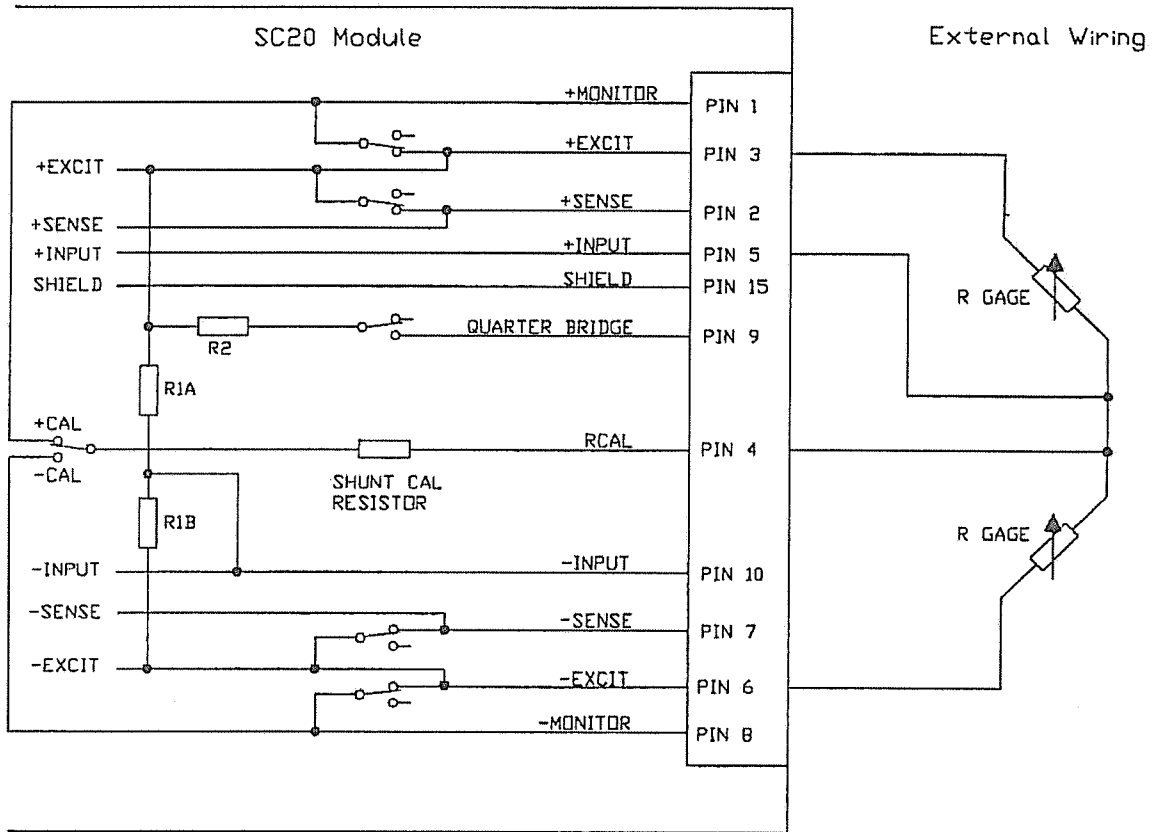


FIGURE A.5
1/2 BRIDGE - INTERNAL SENSING AND INTERNAL CAL RESISTOR

Model SC20

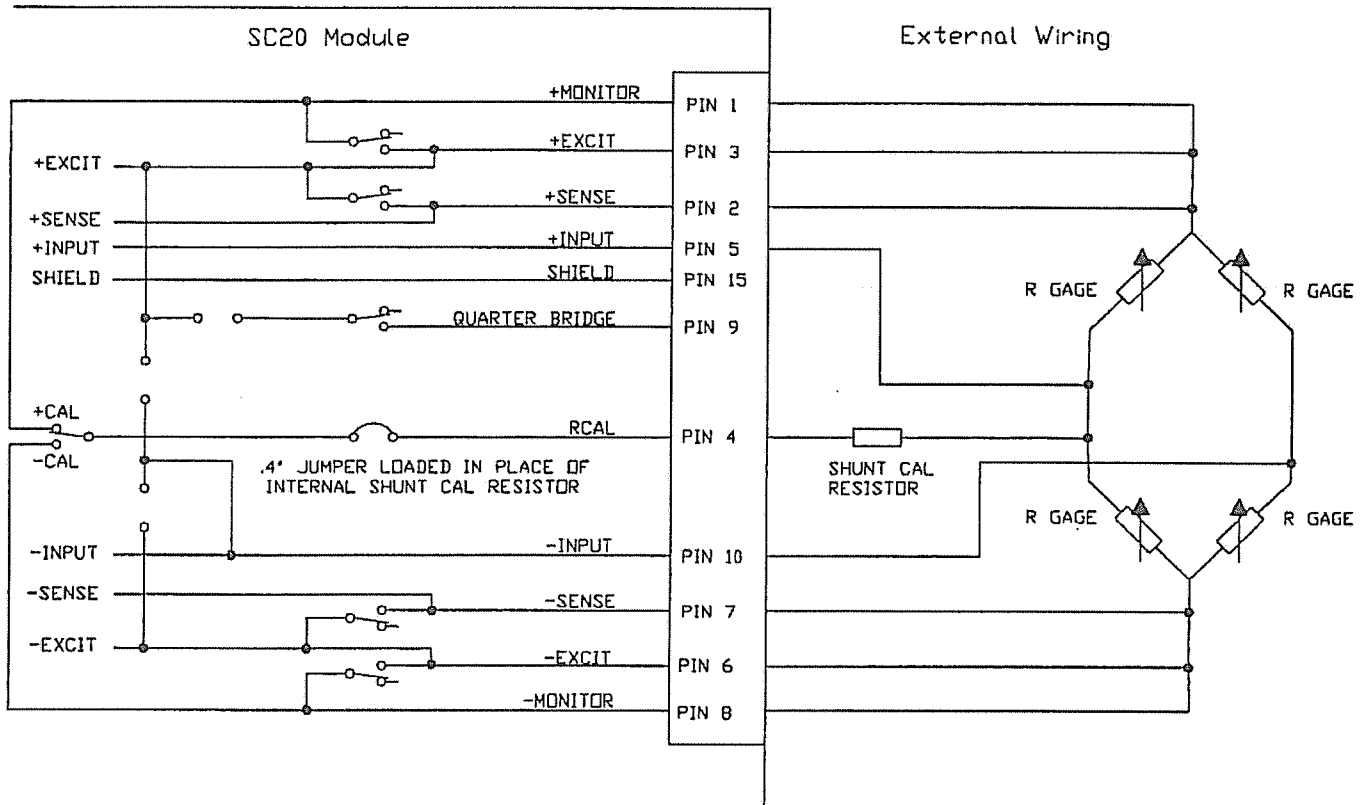


FIGURE A.6
FULL BRIDGE - EXTERNAL SENSING AND EXTERNAL CAL RESISTOR

Model SC20

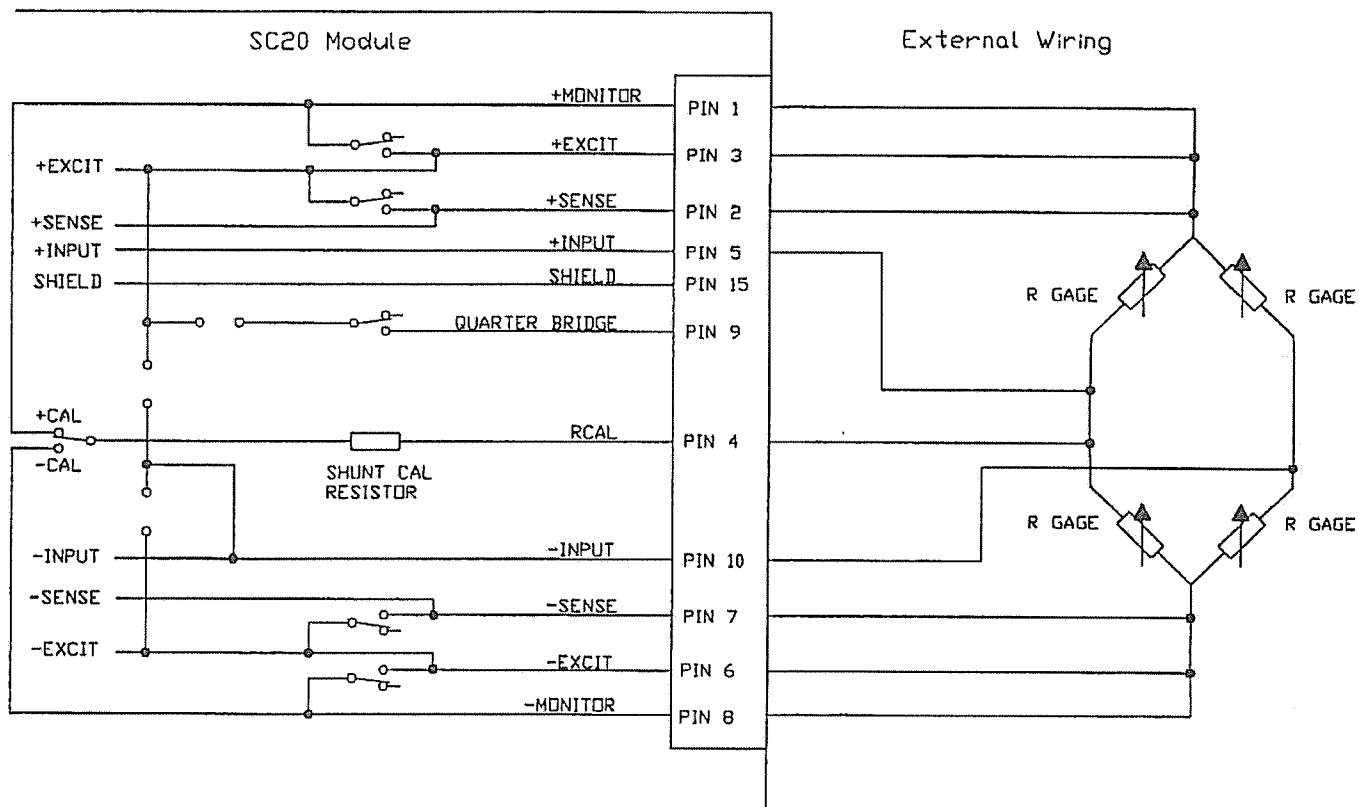


FIGURE A.7
FULL BRIDGE - EXTERNAL SENSING AND INTERNAL CAL RESISTOR

Model SC20

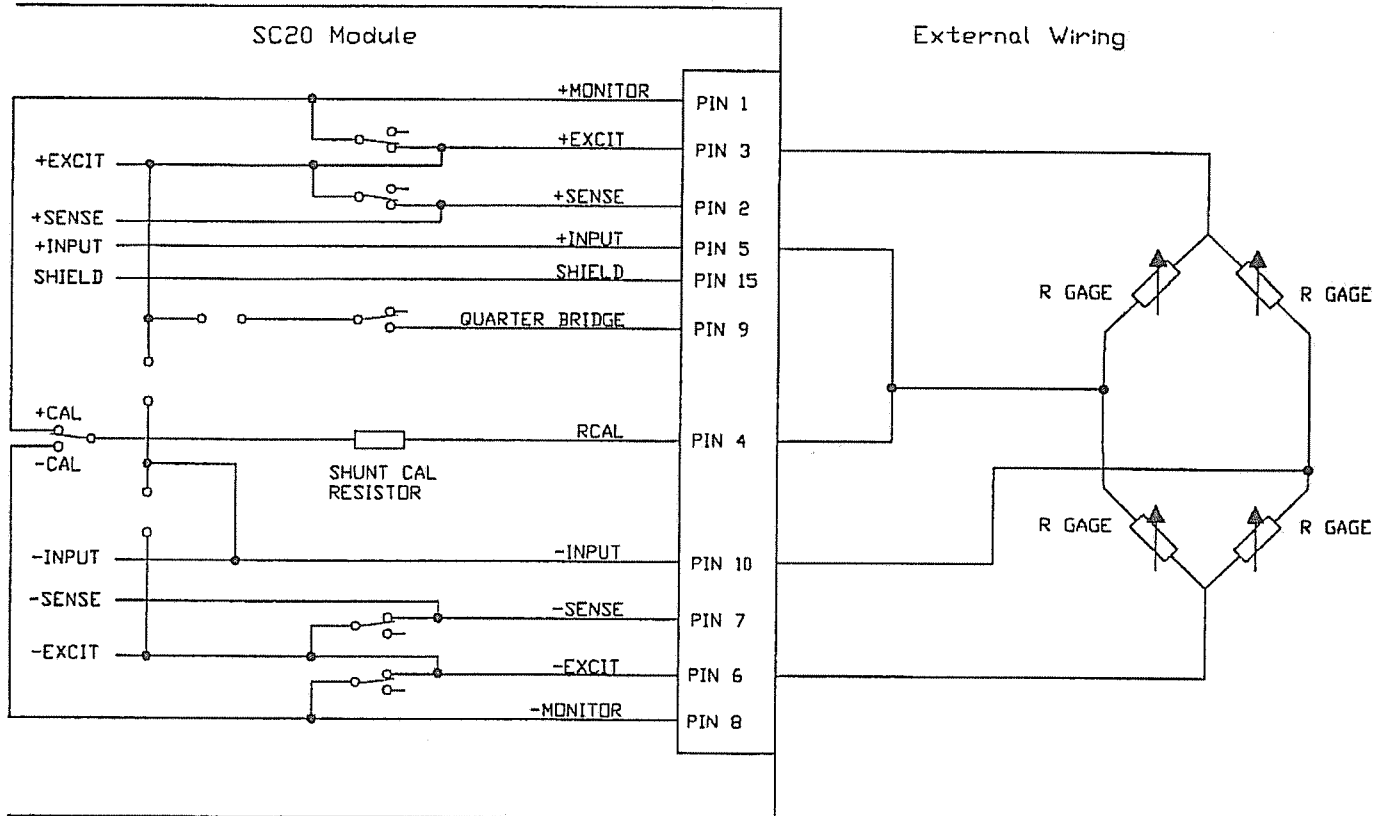


FIGURE A.8
FULL BRIDGE - INTERNAL SENSING AND INTERNAL CAL RESISTOR

Model SC20

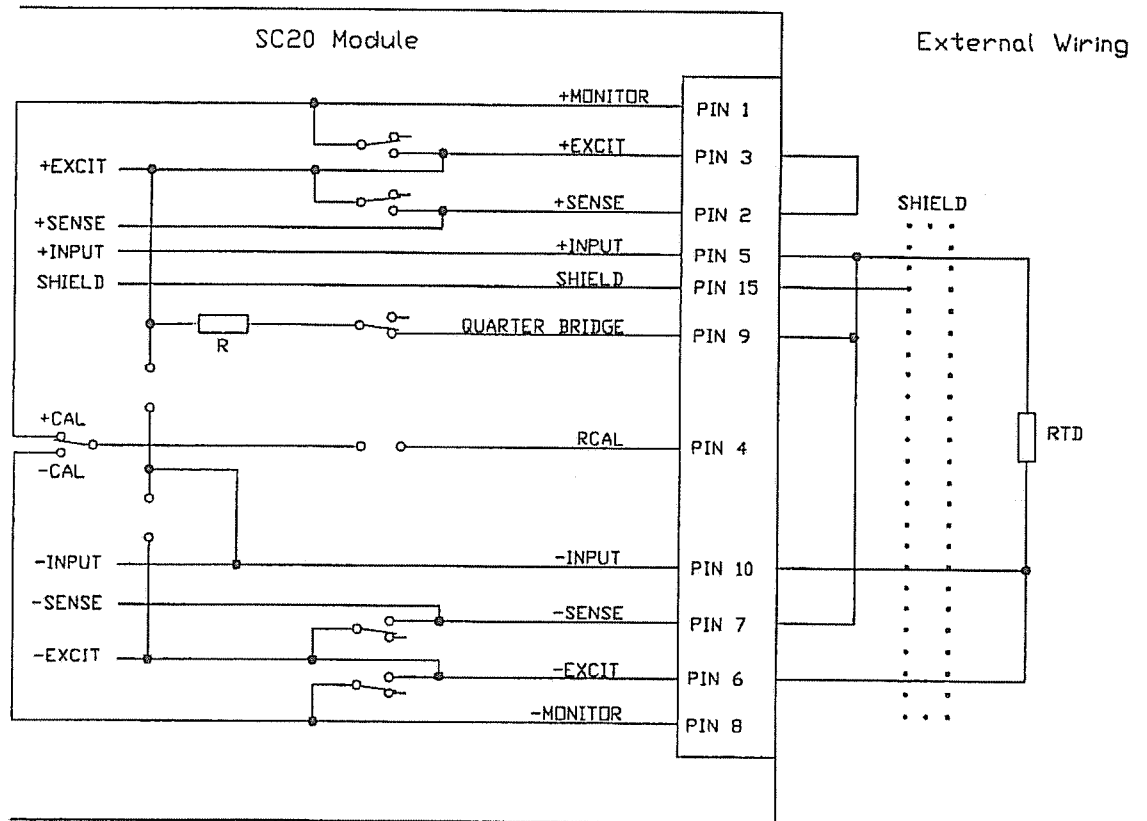


FIGURE A.9
RTD CONNECTION

Model SC20

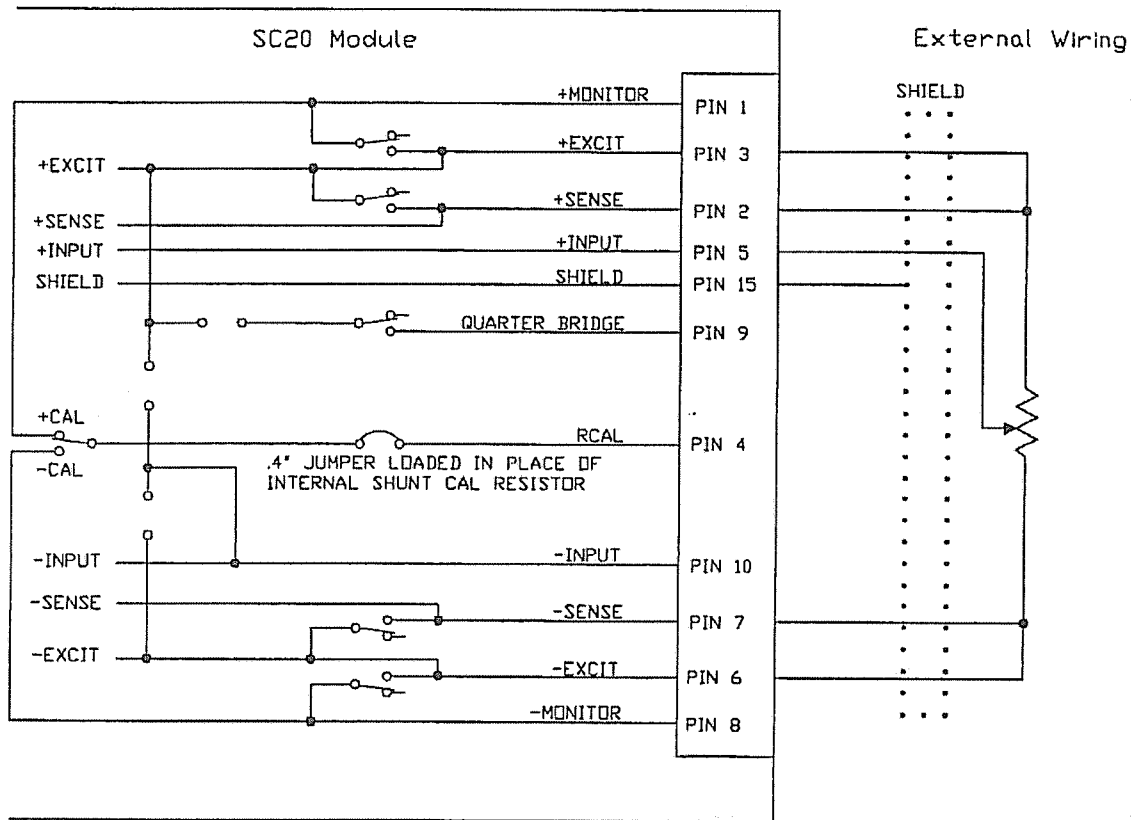


FIGURE A.10
POTENTIOMETER CONNECTION

Model SC20

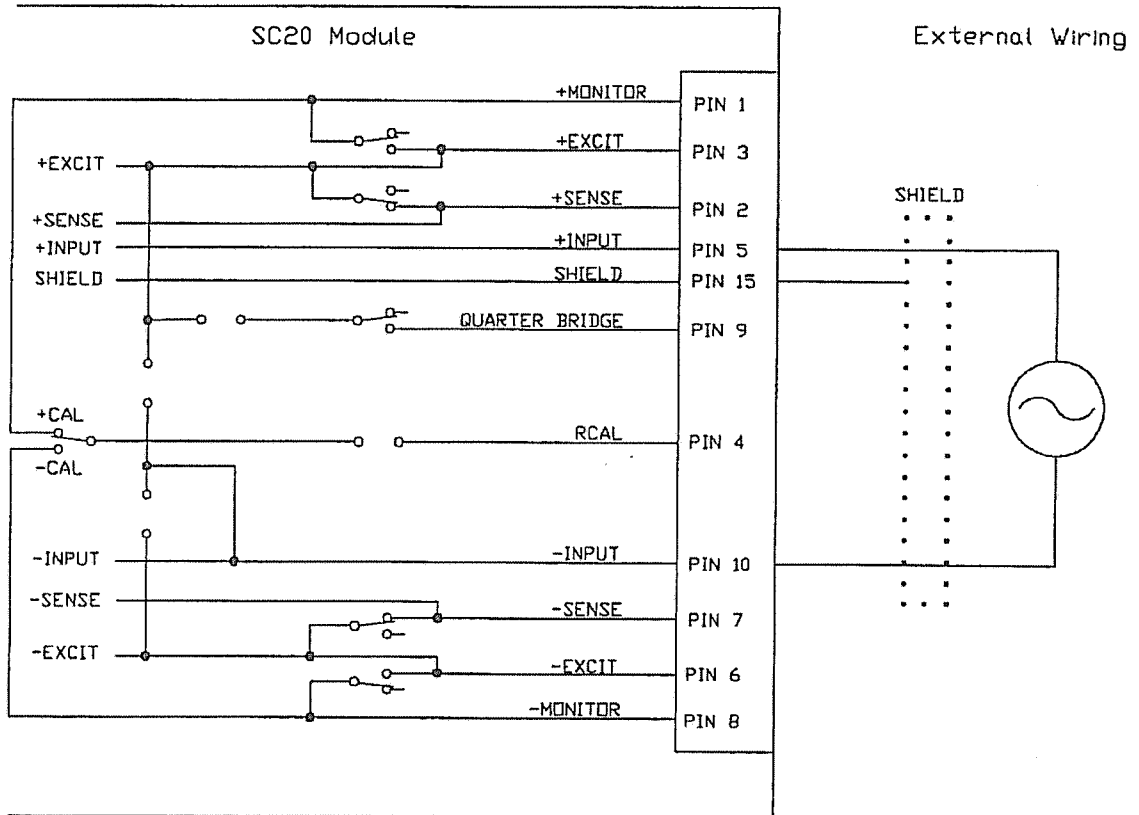


FIGURE A.11
VOLTAGE INPUT

WARRANTY

KineticSystems Company, LLC warrants its standard hardware products to be free of defects in workmanship and materials for a period of one year from the date of shipment to the original end user. Software products manufactured by KineticSystems are warranted to conform to the Software Product Description (SPD) applicable at the time of purchase for a period of ninety days from the date of shipment to the original end user. Products purchased for resale by KineticSystems carry the original equipment manufacturer's warranty.

KineticSystems will, at its option, either repair or replace products that prove to be defective in materials or workmanship during the warranty period.

Transportation charges for shipping products to KineticSystems shall be prepaid by the purchaser, while charges for returning the repaired warranty product to the purchaser, if located in the United States, shall be paid by KineticSystems. Return shipment will be made by UPS, where available, unless the purchaser requests a premium method of shipment at their expense. The selected carrier shall not be construed to be the agent of KineticSystems, nor will KineticSystems assume any liability in connection with the services provided by the carrier.

The product warranty may vary outside the United States and does not include shipping, customs clearance, or any other charges. Consult your local authorized representative or reseller for more information regarding specific warranty coverage and shipping details.

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Products will not be accepted for credit or exchange without the prior written approval of KineticSystems. If it is necessary to return a product for repair, replacement or exchange, a Return Authorization (RA) Number must first be obtained from the Repair Service Center prior to shipping the product to KineticSystems. The following steps should be taken before returning any product:

1. Contact KineticSystems and discuss the problem with a Technical Service Engineer.
2. Obtain a Return Authorization (RA) Number.
3. Initiate a purchase order for the estimated repair charge if the product is out of warranty.
4. Include a description of the problem and your technical contact person with the product.
5. Ship the product prepaid with the RA Number marked on the outside of the package to:

KineticSystems Company, LLC
Repair Service Center
900 North State Street
Lockport, IL 60441

Telephone: (815) 838-0005
Facsimile: (815) 838-4424
Email: tech-serv@kscorp.com