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SC-2043-SG
User Manual

Eight-Channel Strain Gauge Signal Conditioning Accessory

August 1996 Edition

Part Number 320995B-01

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About This Manual

This manual describes the electrical and mechanical aspects of the SC-2043-SG and contains information concerning its configuration and operation. The SC-2043-SG is an eight-channel strain gauge signal conditioning accessory for National Instruments DAQ boards. The conditioned strain gauge signals are routed directly to the analog input channels of the DAQ board via a 50-pin connector. The SC-2043-SG also has breakout screw terminals for additional analog inputs (MIO and MIO E Series boards only), analog outputs, and digital and timing I/O pins on the DAQ board I/O connector.

Organization of This Manual

The *SC-2043-SG User Manual* is organized as follows:

- Chapter 1, *Introduction*, describes the SC-2043-SG, lists what you need to get started with your SC-2043-SG, describes the optional software and optional equipment, and explains how to unpack your SC-2043-SG.
- Chapter 2, *Installation and Configuration*, describes the installation and configuration of your SC-2043-SG. The topics discussed are connection of the SC-2043-SG to the DAQ board and switch and jumper configuration for your SC-2043-SG.
- Chapter 3, *Signal Connections*, describes the signal connections to the SC-2043-SG board.
- Chapter 4, *Theory of Operation*, contains a functional overview of the SC-2043-SG board and explains the operation of each functional unit making up the SC-2043-SG.
- Chapter 5, *Calibration Procedures*, discusses the calibration procedures for the SC-2043-SG.
- Appendix A, *Specifications*, lists the specifications for the SC-2043-SG.
- Appendix B, *Customer Communication*, contains forms you can use to request help from National Instruments or to comment on our products.
- The *Glossary* contains an alphabetical list and description of terms used in this manual, including abbreviations, acronyms, metric prefixes, mnemonics, and symbols.
- The *Index* contains an alphabetical list of key terms and topics used in this manual, including the page where you can find each one.

Conventions Used in This Manual

The following conventions are used in this manual:

bold italic	Bold, italic text denotes a note, caution, or warning.
italic	Italic text denotes emphasis, a cross reference, or an introduction to a key concept.
Lab/1200	Lab/1200 refers to the National Instruments Lab-PC+, DAQPad-1200, and DAQCard-1200 products unless otherwise noted.
MIO	MIO refers to the National Instruments AT-MIO-16/64 and NB-MIO-16/64 (except the -16H and -DH) DAQ boards unless otherwise noted.
MIO E	MIO E refers to the National Instruments MIO E Series of DAQ boards unless otherwise noted.
`monospace`	Text in this font denotes text or characters that are to be literally input from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, variables, filenames, and extensions, and for statements and comments taken from program code.

Abbreviations, acronyms, metric prefixes, mnemonics, symbols, and terms are listed in the *Glossary*.

National Instruments Documentation

The *SC-2043-SG User Manual* is one piece of the documentation set for your system. You could have any of several types of manuals, depending on the hardware and software in your system. Use the manuals you have as follows:

- Your DAQ hardware user manuals–These manuals have detailed information about the DAQ hardware that plugs into or is connected to your computer. Use these manuals for hardware installation and configuration instructions, specification information about your DAQ hardware, and application hints.

- Software manuals–Examples of software manuals you might have are the LabVIEW and LabWindows® /CVI manual sets and the NI-DAQ manuals. After you set up your hardware system, use either the application software (LabVIEW or LabWindows/CVI) manuals or the NI-DAQ manuals to help you write your application. If you have a large and complicated system, it is worthwhile to look through the software manuals before you configure your hardware.

- Accessory manuals–If you are using accessory products, read the terminal block and cable assembly installation guides or accessory board user manuals. They explain how to physically connect the relevant pieces of the system together. Consult these guides when you are making your connections.

Related Documentation

The following document contains information that you may find helpful as you read this manual:

- Your DAQ hardware user manual

Customer Communication

National Instruments wants to receive your comments on our products and manuals. We are interested in the applications you develop with our products, and we want to help if you have problems with them. To make it easy for you to contact us, this manual contains comment and configuration forms for you to complete. These forms are in Appendix B, *Customer Communication*, at the end of this manual.

Chapter 1
Introduction

This chapter describes the SC-2043-SG, lists what you need to get started with your SC-2043-SG, describes the optional software and optional equipment, and explains how to unpack your SC-2043-SG.

About the SC-2043-SG

The SC-2043-SG is an eight-channel signal conditioning board that interfaces strain gauge signals to National Instruments DAQ boards. Each channel includes half-bridge completion with jumper disable for full-bridge connections, sockets for quarter-bridge completion resistors, amplifier gain of 10, buffered single pole 1.6 kHz filter, offset nulling circuit, and screw terminal connections to accommodate strain gauge bridge measurements. Output voltage excitation leads and input signal leads are attached at the screw terminals. An onboard excitation voltage source is provided, along with screw terminal connections for optional (user-supplied) external excitation, and is common to all channels. The conditioned strain gauge signals are routed to eight single-ended analog inputs on the DAQ board.

Note: ***The NB-MIO-16H and AT-MIO-16H series boards have a maximum gain of 8 and are not intended for interfacing to low-level signals. Therefore, you should not use these boards with the SC-2043-SG.***

The SC-2043-SG has additional breakout screw terminals for convenient signal termination of additional analog inputs, analog outputs, and digital and timing I/O lines on the DAQ board interfacing connector.

The SC-2043-SG is a circuitboard assembly that is placed on a workbench or mounted in a 19-in. rack. The SC-2043-SG draws power from the DAQ board via the 50-pin interfacing connector. A green LED indicates when the board is powered on.

What You Need to Get Started

To set up and use your SC-2043-SG, you will need the following components:

- ❑ SC-2043-SG board
- ❑ *SC-2043-SG User Manual*
- ❑ SC-2043-SG screw terminal labels
- ❑ One of the following software packages and documentation:
  - LabVIEW for Macintosh
  - LabVIEW for Windows
  - LabWindows/CVI for Windows
  - NI-DAQ for Macintosh
  - NI-DAQ for PC compatibles

❑ One of the following:
SH6850 cable or R6850 cable assembly kit (MIO E Series DAQ board)
NB-1 cable (MIO Series, Lab-PC+, or DAQPad-1200 board)
PR50-50F cable (DAQCard-1200)

Detailed specifications of the SC-2043-SG are in Appendix A, *Specifications*.

Software Programming Choices

There are several options to choose from when programming your National Instruments DAQ and SCXI hardware. You can use LabVIEW, LabWindows/CVI, NI-DAQ, or register-level programming.

LabVIEW and LabWindows/CVI Application Software

LabVIEW and LabWindows/CVI are innovative program development software packages for data acquisition and control applications. LabVIEW uses graphical programming, whereas LabWindows/CVI enhances traditional programming languages. Both packages include extensive libraries for data acquisition, instrument control, data analysis, and graphical data presentation.

LabVIEW features interactive graphics, a state-of-the-art user interface, and a powerful graphical programming language. The LabVIEW Data Acquisition VI Library, a series of VIs for using LabVIEW with National Instruments DAQ hardware, is included with LabVIEW. The LabVIEW Data Acquisition VI Libraries are functionally equivalent to the NI-DAQ software.

LabWindows/CVI features interactive graphics, a state-of-the-art user interface, and uses the ANSI standard C programming language. The LabWindows/CVI Data Acquisition Library, a series of functions for using LabWindows/CVI with National Instruments DAQ hardware, is included with LabWindows/CVI. The LabWindows/CVI Data Acquisition libraries are functionally equivalent to the NI-DAQ software.

Using LabVIEW or LabWindows/CVI software will greatly reduce the development time for your data acquisition and control application.

NI-DAQ Driver Software

The NI-DAQ driver software is included at no charge with all National Instruments DAQ hardware. NI-DAQ is not packaged with SCXI or accessory products, except for the SCXI-1200. NI-DAQ has an extensive library of functions that you can call from your application programming environment. These functions include routines for analog input (A/D conversion), buffered data acquisition (high-speed A/D conversion), analog output (D/A conversion), waveform generation, digital I/O, counter/timer operations, SCXI, RTSI, self calibration, messaging, and acquiring data to extended memory.

NI-DAQ has both high-level DAQ I/O functions for maximum ease of use and low-level DAQ I/O functions for maximum flexibility and performance. Examples of high-level functions are streaming data to disk or acquiring a certain number of data points. An example of a low-level function is writing directly to registers on the DAQ device. NI-DAQ does not sacrifice the performance of National Instruments DAQ devices because it lets multiple devices operate at their peak performance.

NI-DAQ also internally addresses many of the complex issues between the computer and the DAQ hardware such as programming the PC interrupt and DMA controllers. NI-DAQ maintains a consistent software interface among its different versions so that you can change platforms with

minimal modifications to your code. Figure 1-1 illustrates the relationship between NI-DAQ and LabVIEW and LabWindows/CVI.

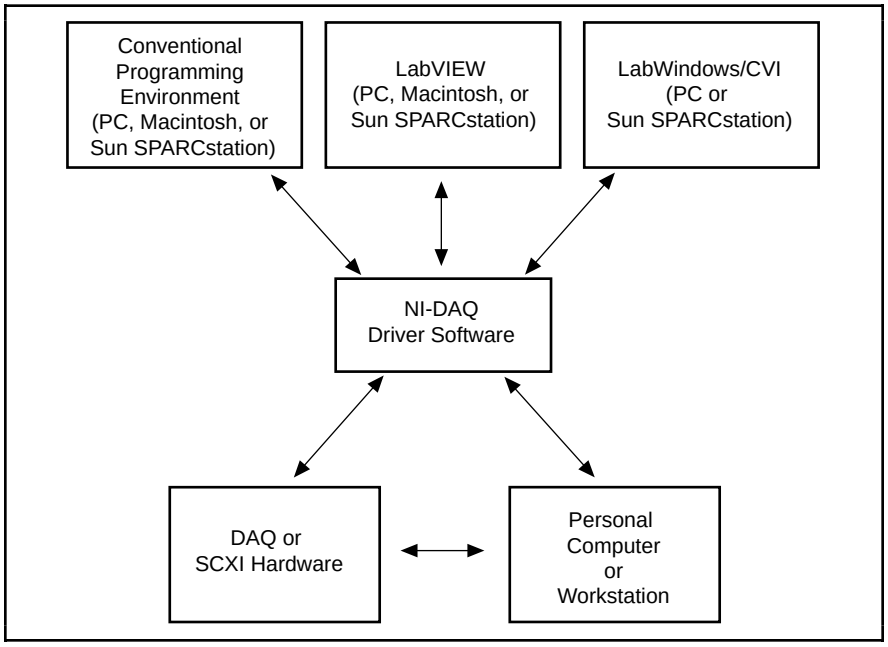


Figure 1-1. The Relationship between the Programming Environment, NI-DAQ, and Your Hardware

Register-Level Programming

The final option for programming any National Instruments DAQ hardware is to write register-level software. Writing register-level programming software can be very time-consuming and inefficient and is not recommended for most users.

Even if you are an experienced register-level programmer, consider using NI-DAQ, LabVIEW, or LabWindows/CVI to program your National Instruments DAQ hardware. Using the NI-DAQ, LabVIEW, or LabWindows/CVI software is easier than and as flexible as register-level programming and can save you weeks of development time.

Optional Equipment

Contact National Instruments to order the following optional equipment:

- Single or double height rack-mount kit with acrylic plastic cover
- Single or double height rack-mount kit with metal wraparound cover
- 120 Ω (0.1%, 10 ppm/°C) quarter-bridge completion resistors (eight per package)
- 350 Ω (0.1%, 10 ppm/°C) quarter-bridge completion resistors (eight per package)

Unpacking

Your SC-2043-SG board is shipped in an antistatic package to prevent electrostatic damage to the board. Electrostatic discharge can damage several components on the board. To avoid such damage in handling the board, take the following precautions:

- Ground yourself via a grounding strap or by holding a grounded chassis such as a computer chassis.
- Touch the antistatic package to a metal part of your computer chassis before removing the board from the package.
- Remove the board from the package and inspect the board for loose components or any other sign of damage. Notify National Instruments if the board appears damaged in any way. *Do not* install a damaged board into your computer.
- *Never* touch the exposed pins of connectors.

Chapter 2
Installation and Configuration

This chapter describes the installation and configuration of your SC-2043-SG. The topics discussed are connection of the SC-2043-SG to the DAQ board and switch and jumper configuration for your SC-2043-SG.

Installation

Note: ***You must power off your computer—and the SC-2043-SG if externally powered—before installing or making any connection to the SC-2043-SG.***

The SC-2043-SG includes two 50-pin cable connectors for signal connection to a DAQ board. Connect the SC-2043-SG to your DAQ board I/O connector using the appropriate cable and SC-2043-SG 50-pin connector. Table 2-1 lists the required cables and connectors to use with each DAQ board option.

Table 2-1. Installation and Cabling Options for the SC-2043-SG

DAQ Board	Required Cabling	SC-2043-SG 50-Pin Connector
68-pin MIO E Series boards[1]	R6850 or SH6850	MIO (J10)
50-pin MIO boards[2]	NB1	MIO (J10)
100-pin MIO boards[3]	R1005050	MIO (J10)
Lab-PC+, DAQPad-1200	NB1	Lab/1200 (J9)
DAQCard-1200	PR50-50F	Lab/1200 (J9)

[1] To install the SC-2043-SG with any of these boards, refer to the installation guide of the cable kit for instructions.

[2] The NB-MIO-16H and AT-MIO-16H boards have a maximum gain of 8 and are not intended for interfacing to low-level signals. Therefore, you should not use these boards with the SC-2043-SG.

[3] The SC-2043-SG connects only to pins 1–50 (ACH<0..15>) of the 100-pin MIO boards.

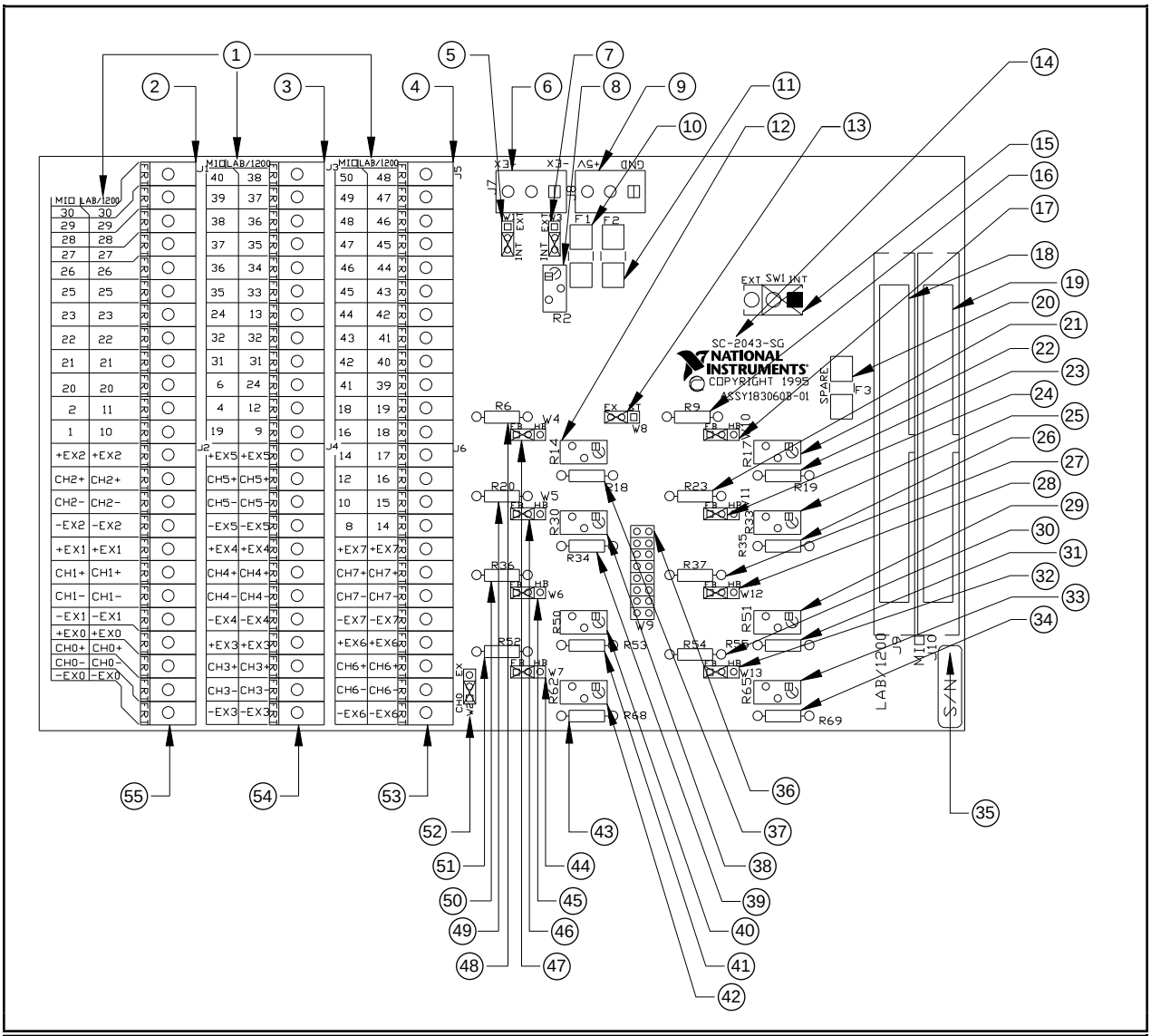
You can mount the SC-2043-SG in a rack-mount chassis using the mounting holes in the four corners of the SC-2043-SG board.

The SC-2043-SG is installed. You are now ready to install and configure your software. If you are using NI-DAQ, LabVIEW, or LabWindows/CVI, refer to the installation instructions to install and configure your software.

Board Configuration

Note: ***You must configure your DAQ board analog channels for NRSE (nonreferenced single-ended) inputs for use with the SC-2043-SG.***

The SC-2043-SG has one slide switch and 12 jumpers that you use to configure your board. Figure 2-1 shows the switch and jumpers in the parts locator diagram.



1	Screen Printed Screw Terminal Label	14	Product Name and Assembly Number	27	R37	41	R53
2	J1	15	SW1	28	W12	42	R62
3	J3	16	R9	29	R51	43	R68
4	J5	17	W10	30	R54	44	W7
5	W1	18	J9	31	R55	45	W6
6	J7	19	J10	32	W13	46	W5
7	W3	20	F3	33	R65	47	W4
8	R2	21	R23	34	R69	48	R6
9	J8	22	R17	35	Serial Number	49	R20
10	F1	23	R19	36	W9	50	R36
11	F2	24	W11	37	R18	51	R52
12	R14	25	R33	38	R30	52	W2
13	W8	26	R35	39	R34	53	J6
				40	R50	54	J4
						55	J2

Figure 2-1. SC-2043-SG Parts Locator Diagram

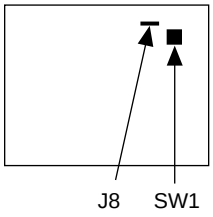
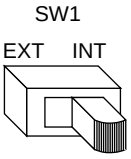
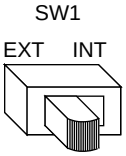
Switch SW1 selects the power supply source for the SC-2043-SG board. Two jumpers, W1 and W3, select the excitation source for the strain gauge bridges. Jumper W2 routes either the excitation voltage signal or the channel 0 signal to analog input channel 0 on the DAQ board. Jumper W8 routes either the excitation voltage signal or an external signal to analog input channel 8 (for MIO and MIO E Series boards only). Jumpers W4–W7 and W10–W13 configure the onboard bridge completion network for each of the eight channels for either half-bridge or full-bridge inputs. Tables 2-2 through 2-6 show the settings for the switch and jumpers.

Power Supply Selection

Set switch SW1 to the INT position to draw power from the +5 V line on the DAQ board. Set switch SW1 to the EXT position to draw power from an external +5 V power supply connected to J8. In external power mode, the SC-2043-SG has two fuses, F1 and F2, to limit the current to 1 A at +5 V. The board also has a spare fuse (F3), as shown in Figure 2-1.

Note: ***If you are using an NB-MIO-16X or a DAQPad-1200 with the SC-2043-SG, you must use an external +5 V power supply with the SC-2043-SG.***

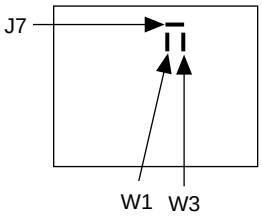
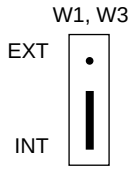
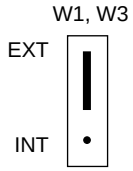
Table 2-2. Power Supply Selection

Switch	Description	Configuration
	INT position—Use this setting to configure the SC-2043-SG to draw power through the DAQ board. (factory setting)	
	EXT position—Use this setting to draw +5 V power from an external supply connected to connector J8.	

Onboard/External Excitation Selection

If you want to use the onboard voltage excitation source to excite your strain gauge bridges, set both jumpers W1 and W3 to the INT position. If you want to use an external excitation source, set both jumpers W1 and W3 to the EXT position and connect your excitation source to connector J7.

Table 2-3. Onboard/External Excitation Jumpers

Jumpers	Description	Configuration
	INT position—Place jumpers W1 and W3 in this position to provide excitation voltage from the onboard excitation source. (factory setting)	
	EXT position—Place jumpers W1 and W3 in this position to provide excitation voltage from an external excitation source connected to connector J7.	

Local Excitation Sense Selection

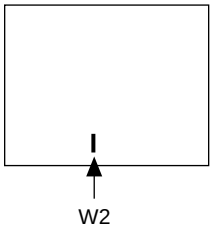
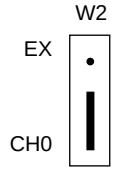
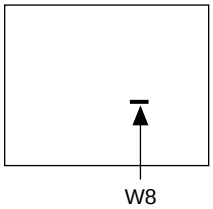
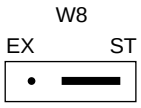
MIO or MIO E Series Boards

If you are using the SC-2043-SG with an MIO or MIO E Series board, you can locally sense the exact level of the excitation voltage by routing the excitation voltage (internal or external) to one of two analog channels, selected by jumpers W8 and W2. Table 2-4 shows these jumper settings.

Setting jumper W8 to the EX position (the factory setting) routes the excitation voltage to ACH8 so you can use ACH<0..7> for conditioned strain gauge signal inputs. Setting jumper W8 to the ST position routes an external signal (from the screw terminal labeled 4 in the MIO column, or ACH8 if you are using the stick-on labels) to ACH8.

Setting jumper W2 to the EX position routes the excitation voltage to ACH0, leaving you ACH<1..7> for conditioned strain gauge signal inputs. Setting jumper W2 to the CH0 position (the factory setting) routes the conditioned strain gauge bridge signal (that entered via the CH0± screw terminals) to ACH0.

Table 2-4. Local Excitation Sense Jumper Settings for MIO and MIO E Series Boards

Jumper	Description	Configuration
	CH0 position—Place the jumper in this position to route the conditioned strain gauge bridge signal (that entered via the CH0± screw terminals) to ACH0. (factory setting)	
	EX position—Place the jumper in this position to route the excitation source voltage to ACH0.	
	EX position—Place the jumper in this position to route the excitation source voltage to ACH8. (factory setting)	
	ST position—Place the jumper in this position to route an external input signal to ACH8.	

Lab/1200 Series Boards

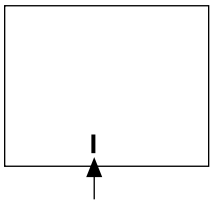
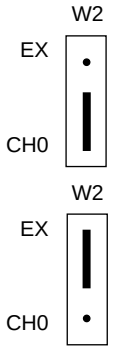
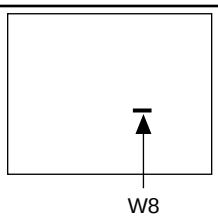
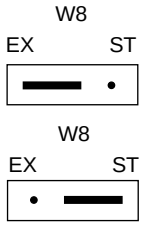
If you are using the SC-2043-SG with a Lab/1200 Series board, you can locally sense the exact level of the excitation voltage by routing the excitation voltage (internal or external) to ACH0, configured by jumper W2. The SC-2043-SG also has jumper W8, which you must also configure. Table 2-5 shows these jumper settings.

Caution: ***Although the factory-default setting for jumper W8 is the EX position, you MUST set jumper W8 to the ST position if you are using a Lab/1200 Series board. Failure to do so can damage your Lab/1200 board if your excitation voltage exceeds 10 V. National Instruments is NOT liable for any damages resulting from incorrect configuration of jumper W8. Refer to Table 2-5 for more information.***

Setting jumper W8 to the ST position routes DAC1OUT (pin 12 on the Lab/1200 connector) to the screw terminal labeled 12 in the Lab/1200 column, or DAC1OUT if you are using the stick-on labels.

Setting jumper W2 to the EX position routes the excitation voltage to ACH0, leaving you ACH<1..7> for strain gauge signal measurement. Setting jumper W2 to the CH0 position (the factory setting) routes the conditioned strain gauge bridge signal (that entered via the CH0± screw terminals) to ACH0.

Table 2-5. Local Excitation Sense Jumper Settings for Lab/1200 Series Boards

Jumper	Description	Configuration
	CH0 position—Place the jumper in this position to route the conditioned strain gauge bridge signal (that entered via the CH0± screw terminals) to ACH0. (factory setting) EX position—Place the jumper in this position to route the excitation source voltage to ACH0.	
	EX position—***NEVER leave the jumper in this position.*** (factory setting) ST position—Always keep the jumper in this position to route the DAC1OUT analog output signal from the Lab/1200 board to a screw terminal.	

Bridge Completion Selection

Jumpers W4–W7 and W10–W13 select half-bridge or full-bridge configuration for each channel on the SC-2043-SG. Setting a jumper in the FB position disconnects the half-bridge completion network from the channel and connects the CH*n*- screw terminal to the negative input of the instrumentation amplifier for full-bridge signal inputs. Setting a jumper in the HB position disconnects the CH*n*- screw terminal from the instrumentation amplifier and connects the half-bridge completion network to the negative input of the instrumentation amplifier. Table 2-6 shows the jumper settings for the half-bridge completion jumpers and Table 2-7 lists their corresponding channels.

Table 2-6. Half-Bridge Completion Jumper Settings

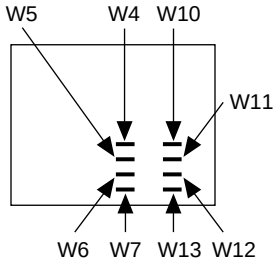
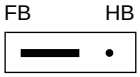
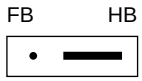
Jumper	Description	Configuration
	FB position—Use this setting to select full-bridge completion. (factory setting)	
	HB position—Use this setting to select half-bridge completion.	

Table 2-7. Half-Bridge Completion Jumpers and Corresponding Channels

Channel	Jumper
0	W7
1	W6
2	W5
3	W4
4	W13
5	W12
6	W11
7	W10

Additionally, there are sockets for eight quarter-bridge completion resistors. When inserted, the quarter-bridge completion resistors connect to the positive inputs of the instrumentation amplifiers and the -EX*n* terminals. To configure a channel for quarter-bridge completion, set the corresponding bridge completion jumper to the HB position and insert your quarter-bridge completion resistor into the appropriate sockets. The parts locator diagram, Figure 2-1, shows where these quarter-bridge completion resistor sockets are located. Table 2-8 lists the quarter-bridge completion resistors and corresponding channels.

Table 2-8. Quarter-Bridge Completion Resistors and Corresponding Channels

Channel	Resistor
0	R52
1	R36
2	R20
3	R6
4	R54
5	R37
6	R23
7	R9

Chapter 3
Signal Connections

This chapter describes the signal connections to the SC-2043-SG board.

I/O Connector Pin Description

Warning: ***Connections, including any power signals connected to ground and vice versa, that exceed any of the maximum input or output signal ratings on the SC-2043-SG and the DAQ board can damage the SC-2043-SG, the DAQ board, and the computer. National Instruments is NOT liable for any damages resulting from any such signal connections.***

The SC-2043-SG has two male 50-pin I/O connectors to connect it to a DAQ board. These connectors, J9 and J10, are labeled *Lab/1200* and *MIO*, respectively. The Lab/1200 connector (J9) carries the signals between the SC-2043-SG and a Lab/1200 board. The MIO connector (J10) carries the signals between the SC-2043-SG and an MIO or MIO E Series board. You can use only one of these connectors to interface to a DAQ board at any time. Figure 2-1 shows the position of these connectors on the SC-2043-SG board.

Notes: ***If you are connecting to an MIO or MIO E Series board, you must use the MIO connector. If you are connecting to a Lab/1200 board, you must use the Lab/1200 connector. These connectors are NOT pin-for-pin compatible and, therefore, you must be careful NOT to use the wrong connector.***

Connector W9 is reserved for National Instruments internal use only.

Tables 3-1 and 3-2 show the pin assignments for the SC-2043-SG I/O connectors. These tables list the pin numbers of the I/O connector and the corresponding signal names for the MIO connector if you are using an MIO or MIO E Series DAQ board, and for the Lab/1200 connector if you are using a Lab/1200 Series DAQ board. Tables 3-3 and 3-4 list the MIO and Lab/1200 I/O connector signal summaries, respectively.

Table 3-1. Pin Assignments for the MIO I/O Connectors

Pin Numbers	MIO Connector Signal Names	MIO E Series I/O Connector Signal Names
1	AIGND	AIGND
2	AIGND	AIGND
3	ACH0†	ACH0†
4	ACH8	ACH8
5	ACH1†	ACH1†
6	ACH9	ACH9
7	ACH2†	ACH2†
8	ACH10	ACH10
9	ACH3†	ACH3†
10	ACH11	ACH11
11	ACH4†	ACH4†
12	ACH12	ACH12
13	ACH5†	ACH5†
14	ACH13	ACH13
15	ACH6†	ACH6†
16	ACH14	ACH14
17	ACH7†	ACH7†
18	ACH15	ACH15
19	AISENSE	AISENSE
20	DAC0OUT	DAC0OUT
21	DAC1OUT	DAC1OUT
22	EXTREF	EXTREF
23	AOGND	AOGND
24	DGND	DGND
25	ADIO0	DIO0
26	BDIO0	DIO4
27	ADIO1	DIO1
28	BDIO1	DIO5
29	ADIO2	DIO2
30	BDIO2	DIO6
31	ADIO3	DIO3
32	BDIO3	DIO7
33	DGND†	DGND†
34	+5 V†	+5 V†
35	+5 V	+5 V
36	SCANCLK	SCANCLK
37	††	EXTSTROBE*

(continues)

Table 3-1. Pin Assignments for the MIO I/O Connectors (Continued)

Pin Numbers	MIO Connector Signal Names	MIO E Series I/O Connector Signal Names
38	††	TRIG1
39	††	TRIG2
40	EXTCONV*	CONVERT*
41	SOURCE1	GPCTR1_SOURCE
42	GATE1	GPCTR1_GATE
43	OUT1	GPCTR1_OUT
44	††	UPDATE*
45	GATE2	WFTRIG
46	OUT2	STARTSCAN
47	SOURCE5	GPCTR0_SOURCE
48	GATE5	GPCTR0_GATE
49	OUT5	GPCTR0_OUT
50	FOUT	FREQ_OUT

† These signals are not routed to screw terminals. All other signals on the I/O connectors are routed directly to screw terminals (J1–J6) for convenient signal termination.

†† The function of this connector pin varies depending on the type of MIO Series board you have. Refer to your MIO board user manual for the appropriate pin name.

Table 3-2. Pin Assignments for the Lab/1200 I/O Connector

Pin Numbers	Lab/1200 Connector Signal Names
1	ACH0†
2	ACH1†
3	ACH2†
4	ACH3†
5	ACH4†
6	ACH5†
7	ACH6†
8	ACH7†
9	AISENSE
10	DAC0OUT
11	AGND
12	DAC1OUT
13	DGND
14	PA0
15	PA1
16	PA2
17	PA3
18	PA4
19	PA5
20	PA6
21	PA7
22	PB0
23	PB1
24	PB2
25	PB3
26	PB4
27	PB5
28	PB6
29	PB7
30	PC0
31	PC1
32	PC2
33	PC3
34	PC4
35	PC5
36	PC6
37	PC7

(continues)

Table 3-2. Pin Assignments for the Lab/1200 I/O Connector (Continued)

Pin Numbers	Lab/1200 Connector Signal Names
38	EXTTRIG
39	EXTUPDATE*
40	EXTCONV*
41	OUTB0
42	GATB0
43	OUTB1
44	GATB1
45	CLKB1
46	OUTB2
47	GATB2
48	CLKB2
49	+5 V†
50	DGND†

† These signals are not routed to screw terminals. All other signals on the I/O connectors are routed directly to screw terminals (J1–J6) for convenient signal termination.

Table 3-3. MIO (J10) I/O Connectors Signal Summary

Signal Name	Pin Number	Description
AIGND	2	Analog Input Ground—This pin provides the AC noise current return point for the analog circuitry and for the onboard excitation supply. It is also routed to a screw terminal.
AISENSE	19	Analog Input Sense—This pin is the reference node for the conditioned strain gauge bridge signals. It is also routed to a screw terminal to provide a reference for analog inputs on channels ACH<8..15>. AISENSE is directly connected to the excitation supply return and is earth-grounded. This makes AISENSE a low impedance reference; therefore, all signals referenced to it MUST be floating.
ACH<0..7>	3, 5, 7, 9, 11, 13, 15, 17	Analog Input Channels 0 through 7—These pins carry the conditioned strain gauge bridge signals (referenced to AISENSE) to the DAQ board. They are not routed to screw terminals.
DGND	24	Digital Ground—This pin is the reference for the +5 VDC power supply. It is also routed to a screw terminal to provide a reference for the digital signals at the screw terminals.
	33	This pin establishes the DC return path for the onboard excitation supply. It is not routed to a screw terminal.
+5 V	34	+5 VDC Source—This pin provides DC power for the SC-2043-SG from the MIO or MIO E Series board. It is not routed to a screw terminal.
Others	Others	The remaining pins are routed directly to screw terminals to provide easy access to the additional analog, digital, and counter/timer I/O signals of the DAQ board. Refer to the *Signal Connections* chapter in your DAQ board user manual for pin descriptions.

Table 3-4. Lab/1200 (J9) I/O Connector Signal Summary

Signal Name	Pin Number	Description
AGND	11	Analog Ground—This pin provides the AC noise current return point for the analog circuitry and for the onboard excitation supply. It is also routed to a screw terminal.
AISENSE	9	Analog Input Sense—This pin is the reference node for the conditioned strain gauge bridge signals. It is also routed to a screw terminal. AISENSE is directly connected to the excitation supply return and is earth-grounded. This makes AISENSE a low impedance reference; therefore, all signals referenced to it MUST be floating.
ACH<0..7>	1–8	Analog Input Channels 0 through 7—These pins carry the conditioned strain gauge bridge signals (referenced to AISENSE) to the DAQ board. They are not routed to screw terminals.
DGND	13	Digital Ground—This pin is the reference for the +5 VDC power supply. It is also routed to a screw terminal to provide a reference for the digital signals at the screw terminals.
	50	This pin establishes the DC return path for the onboard excitation supply. It is not routed to a screw terminal.
+5 V	49	+5 VDC Source—This pin provides DC power for the SC-2043-SG from the Lab/1200 board. It is not routed to a screw terminal.
Others	Others	The remaining pins are routed directly to screw terminals to provide easy access to the additional analog, digital, and counter/timer I/O signals of the DAQ board. Refer to the *Signal Connections* chapter in your DAQ board user manual for pin descriptions.

Screw Terminal Description

Screw terminal blocks J1–J6, shown in Figure 2-1, provide excitation output and strain gauge bridge signal inputs, and terminate signals on the MIO and Lab/1200 I/O connectors. Two sets of labels are silkscreened onto the SC-2043-SG board for these screw terminals—one set for the MIO connector and the other for the Lab/1200 connector. Notice that only the excitation output screw terminals, +EX*n*, -EX*n* (*n* is the channel number), and the analog signal input screw terminals CH*n*+ and CH*n*- have signal names. All other screw terminals on terminal blocks J1–J6 are labeled with the pin numbers of the MIO and Lab/1200 I/O connector pins to which they are mapped.

Additionally, a sheet of sticker labels printed with signal names for every screw terminal is included with your SC-2043-SG. This sheet consists of three sets of sticker labels, one set printed with MIO Series signal names, one set with Lab/1200 Series signal names, and one set with MIO E Series signal names. You can peel off the appropriate set of sticker labels and apply them on the SC-2043-SG board over the silkscreened labels by following these steps:

1. Select the set of sticker labels (MIO, Lab/1200, or MIO E Series) that corresponds to the type of DAQ board to which you are connecting the SC-2043-SG.

2. Peel off each of the three labels and mount them on the SC-2043-SG over the silkscreened labels. For the Lab/1200 boards, make sure you match the sticker label signal numbers to the Lab/1200 silkscreened signal numbers on the board.

Table 3-5 lists the screw terminals (J1–J6) signal summary.

Table 3-5. Screw Terminals J1–J6 Signal Summary

Signal Name	Description
CH<0..7>±	Input Channels—These inputs are the input signals for analog channels 0 through 7.
±EX<0..7>	Voltage Excitation Outputs—These output signals route the excitation voltage supply (internal or external) to the sensors connected to these channels.
Others	All other screw terminals provide signal termination for the remaining I/O lines of the DAQ board, except ACH<0..7>, +5 V, and one DGND line. Refer to Tables 3-1 and 3-2 for these signal pin numbers. If you are not using the sticker labels that come in the SC-2043-SG kit, the numbers silkscreened on the board beside these screw terminals are the pin numbers of the MIO and Lab/1200 I/O connector pins to which they are mapped.

There are two additional screw terminal blocks, J7 and J8, shown in Figure 2-1. Screw terminal block J7 is for external voltage excitation input signals, which hook up to the +EX and -EX terminals. When the SC-2043-SG is configured for external excitation, the ±EX inputs are routed directly to the ±EX<0..7> excitation output screw terminals.

Note: ***The -EX input signal is connected to DGND on the SC-2043-SG. Because this low-impedance connection can cause a ground loop, which may affect your measurements, your excitation voltage source MUST be floating.***

Screw terminal block J8 is for external +5 V power inputs, which hook up to the +5 V signal and ground terminals. When the SC-2043-SG is configured for external power these inputs provide power to the SC-2043-SG.

Note: ***The ground input signal is directly connected to DGND on the SC-2043-SG. In order to avoid a ground loop, which may affect your measurements, your +5 V power supply MUST be floating.***

Analog Input Connections

Sensor Connection to the SC-2043-SG

You can connect strain gauges to the SC-2043-SG in full-bridge, half-bridge, and quarter-bridge configurations. See Chapter 2, *Installation and Configuration*, to make sure that you have configured the SC-2043-SG channels correctly before you connect any sensors to them.

Note: ***Configure any unused channels for full-bridge connections and short their input screw terminals (CHn±) to their excitation return screw terminals (-EXn).***

Full-Bridge Connection

In this configuration all four elements of the bridge are external to the SC-2043-SG. Four lead wires connect the full-bridge to screw terminals +EX*n*, -EX*n*, CH*n*+, and CH*n*-. The pair of wires connected to +EX*n* and -EX*n* provides excitation voltage to the bridge, and the other pair connected to CH*n*+ and CH*n*- senses the output voltage of the bridge. Figure 3-1 shows this configuration, along with the appropriate half-bridge jumper placement.

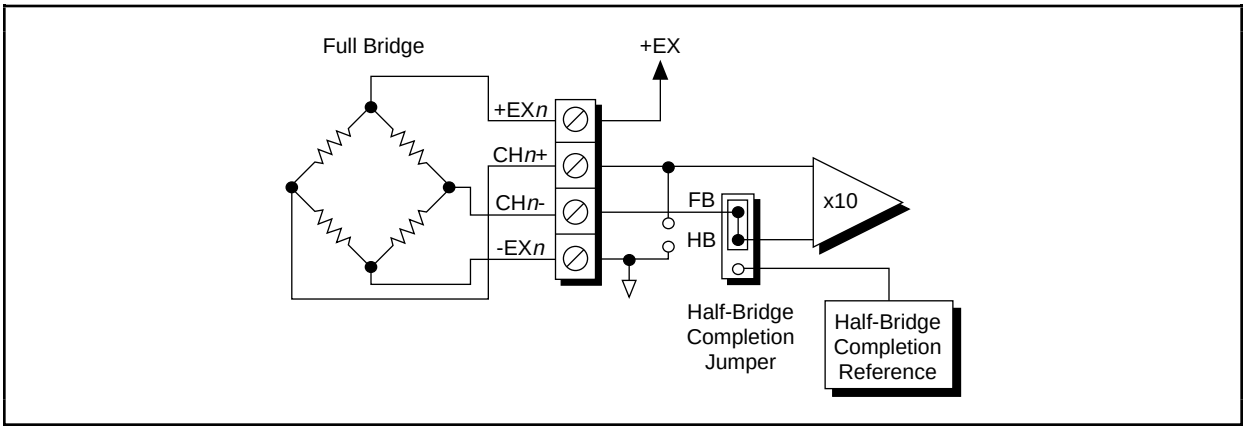


Figure 3-1. Full-Bridge Connection to the SC-2043-SG

Half-Bridge Connection

In this configuration only two strain gauges are used. Bridge completion is provided by a half-bridge completion reference internal to the SC-2043-SG. Three lead wires connect the half-bridge to screw terminals +EX*n*, -EX*n*, and CH*n*+. The pair of wires connected to +EX*n* and -EX*n* provides excitation voltage to the half-bridge, and the other wire connected to CH*n*+ senses the output voltage of the half-bridge with respect to the internal half-bridge completion reference. Figure 3-2 shows this configuration, along with the appropriate half-bridge jumper placement.

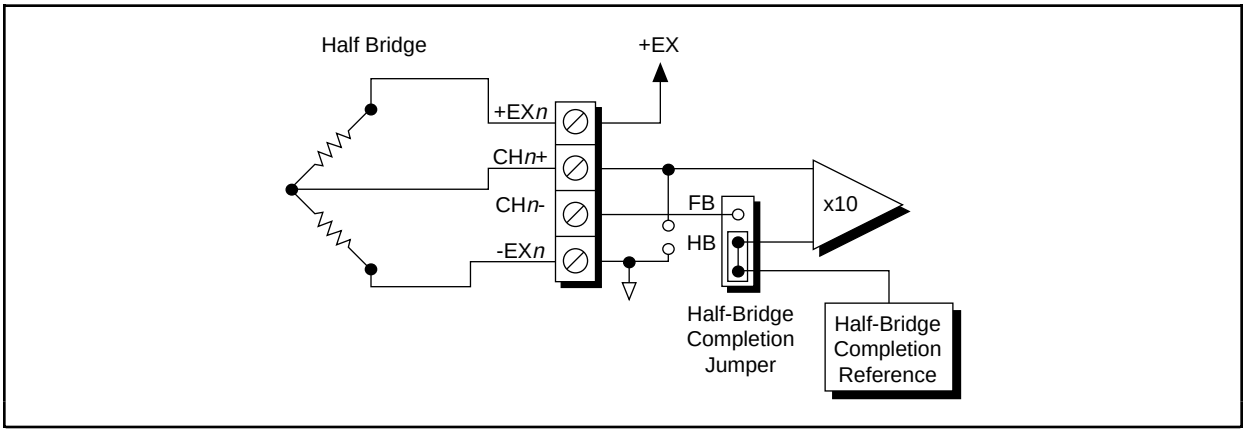


Figure 3-2. Half-Bridge Connection to the SC-2043-SG

Quarter-Bridge Connection

In this configuration only one strain gauge is used. Bridge completion is provided by the internal half-bridge completion reference as well as a quarter-bridge completion resistor. This quarter-bridge completion resistor is equal in value to the external strain gauge element. Insert your completion resistor in the appropriate sockets. Two lead wires connect the quarter-bridge strain gauge to screw terminals +EX*n* and CH*n*+. If your strain gauge has three lead wires—two wires at one end and one at the other end—connect the two wires sharing the same end of the strain gauge at the CH*n*+ screw terminal, and connect the single wire end to the +EX*n* screw terminal. Figure 3-3 shows this configuration, along with the appropriate quarter-bridge completion resistor and half-bridge jumper placement.

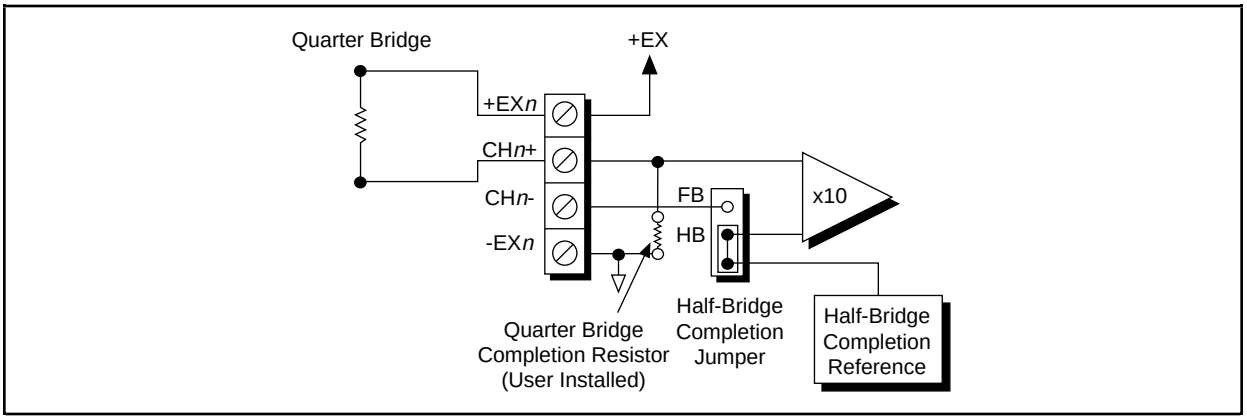


Figure 3-3. Quarter-Bridge Connection to the SC-2043-SG

Offset Nulling

Offset Nulling Adjustment

The SC-2043-SG has circuitry for offset nulling adjustment of Wheatstone bridges. The nulling circuitry uses the excitation voltage as a reference and operates with full-bridge, half-bridge and quarter-bridge strain gauge configurations. Each channel has its own nulling circuit, with a trimming potentiometer to adjust the nulling voltage level, listed in Table 3-6.

Table 3-6. Offset Nulling Adjust Potentiometer and Corresponding Channel

Channel	Trimming Potentiometer
0	R62
1	R50
2	R30
3	R14
4	R65
5	R51
6	R33
7	R17

To null the static voltage offset of the system, including the bridge, use the following procedure:

1. Configure and connect your bridge to the selected channel.
2. Read the channel output.
3. While monitoring the output, rotate the trimming potentiometer wiper with a flathead screwdriver until you reach 0 V.

You have nulled your system offset and are ready for a measurement.

Nulling Range Adjustment

The nulling range of the offset nulling circuitry is approximately ±5 mV referred to input (RTI), assuming an excitation voltage of 2.5 V. The nulling circuit of each channel has a resistor which sets this nulling range. You can change the nulling range of the offset nulling circuitry for each channel by replacing its nulling resistor with a resistor of another value. Therefore, you can mix your ranges to accommodate each channel requirement. Table 3-7 lists the nulling resistors and their corresponding channels.

Table 3-7. Nulling Resistor and Corresponding Channel

Channel	Nulling Resistor
0	R68
1	R53
2	R34
3	R18
4	R69
5	R55
6	R35
7	R19

The value of all the nulling resistors on the SC-2043-SG is 47 kΩ. Notice that these resistors are socketed for easy replacement. These sockets best fit a 1/4 W resistor lead size.

If you want to change the nulling range of any channel, use the following formula to determine the nulling resistor value you need to achieve your desired nulling range:

$$R_{null} \approx EX\left(\frac{100}{\left|V_{\text{desired nulling range}}\right| \text{ RTI}}\right)\Omega$$

where:

R_{null} is the nulling resistor value,
EX is the excitation voltage (factory-adjusted to 2.5 V),
$V_{desired\ nulling\ range}$ RTI is the desired nulling range, referred to input.

For example, assuming:

EX = 2.5 V

$V_{\text{desired nulling range}}$ RTI = ±1 mV RTI

Then, using the above formula, the new nulling resistor should have a value of:

$$R_{null} \approx 2.5\ V\left(\frac{100}{|\pm 1\ mV|\ RTI}\right)\Omega$$

$$\approx 250\ k\Omega$$

Other Connection Considerations

If you are using an MIO or MIO E Series board with 8 additional single-ended analog input channels, remember that your DAQ board will be configured for NRSE operation and all analog inputs are referenced to AISENSE (pin 19 on the MIO I/O connector).

Note: ***AISENSE is ground referenced on the SC-2043-SG. In order to avoid a ground loop, which may affect your measurements, all analog input signals MUST be floating.***

For all other input and output signals, refer to the appropriate sections in your DAQ board user manual for additional signal connection information.

Chapter 4
Theory of Operation

This chapter contains a functional overview of the SC-2043-SG board and explains the operation of each functional unit making up the SC-2043-SG.

Functional Overview

The SC-2043-SG consists of eight channels, each comprising a bridge completion network, an instrumentation amplifier with a gain of 10, offset nulling, filtering, and screw terminal connections to accommodate strain gauge bridge measurements. An onboard excitation voltage source is provided, along with the option of user-supplied external excitation. Additional breakout screw terminals are also provided for signal termination of analog, digital, and timing I/O lines on the DAQ board I/O connector.

The key functional components of the SC-2043-SG are:

- Bridge completion network
- Amplification
- Offset nulling
- Filtering
- MIO and Lab/1200 I/O connectors and breakout screw terminals
- Excitation voltage source
- Power supply

The remainder of this chapter describes the theory of operation for each of these components.

The block diagram in Figure 4-1 illustrates the key functional components of the SC-2043-SG.

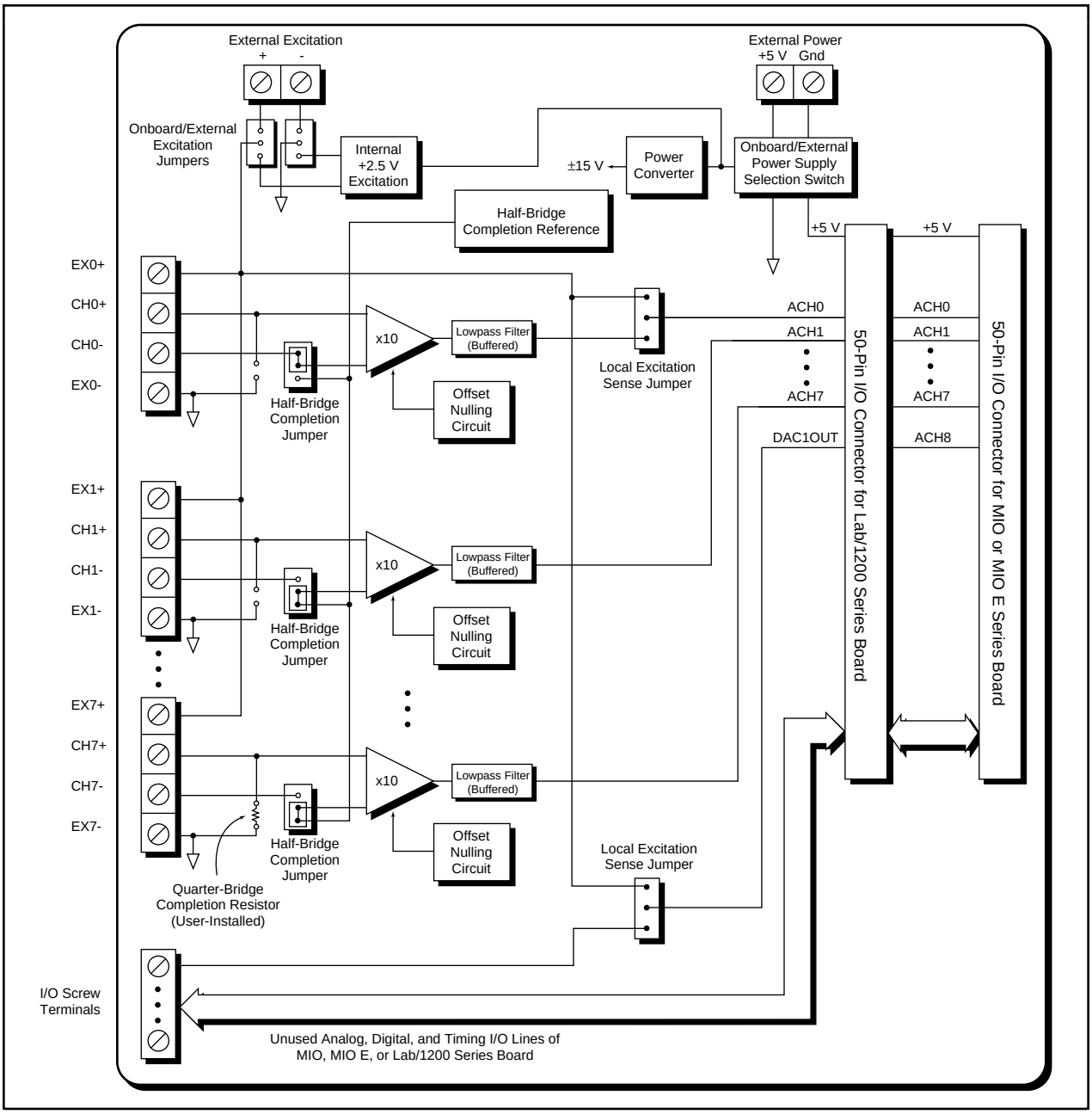


Figure 4-1. SC-2043-SG Block Diagram

Bridge Completion Network

The SC-2043-SG provides onboard bridge completion that you can use with half-bridge and quarter-bridge networks.

The SC-2043-SG has a single half-bridge reference that is common to all channels, consisting of a resistive divider network of two 2.5 kΩ resistors, with 0.02% ratio tolerance and 2 ppm/°C tracking temperature coefficient (TCR). Each channel has a jumper that configures the channel for either half-bridge or full-bridge inputs. When configured for half-bridge inputs, the jumper connects the half-bridge reference output to the negative input of the instrumentation amplifier in that channel for half-bridge completion. When configured for full-bridge inputs, the jumper disconnects the half-bridge reference output from the instrumentation amplifier negative input and connects the negative input to the CH*n*- screw terminal for full-bridge signal inputs. Additionally, sockets are provided for eight quarter-bridge completion resistors. When inserted, the quarter-bridge completion resistors are connected to the positive inputs of the instrumentation amplifiers and the -EX*n* terminals, as shown in the block diagram.

Amplification

Each channel of the SC-2043-SG has an instrumentation amplifier with a fixed gain of 10, to which the bridge output signals are routed. The instrumentation amplifier inputs are protected from over-voltages up to ±45 V with the SC-2043-SG powered on and ±30 V powered off. These amplifiers fulfill two purposes on the SC-2043-SG board. First, they convert differential input signals into single-ended signals referred to the SC-2043-SG AISENSE node for input common-mode signal rejection. With this conversion, the SC-2043-SG can extract the bridge input signals from common-mode noise voltages before the DAQ board samples and converts the signals. Second, the instrumentation amplifiers amplify input signals, resulting in increased measurement resolution and accuracy.

Note: ***If you select the SC-2043-SG as an accessory when you configure your DAQ board using the NI-DAQ software, NI-DAQ compensates for the gain of 10 by automatically dividing any input channels 0 through 7 by 10 on the DAQ board.***

Configure all unused channels for full-bridge connections and short their inputs to their respective excitation return screw terminals (-EXn). If the inputs are left open-circuited, the unused channels will saturate, causing the power consumption of the SC-2043-SG board to increase significantly.

Offset Nulling

The SC-2043-SG has circuitry for offset nulling adjustment of Wheatstone bridges. The nulling circuitry uses the excitation voltage as a reference and operates with full-bridge, half-bridge and quarter-bridge strain gauge configurations. Each channel has its own nulling circuit, with a trimming potentiometer to adjust the nulling voltage level. The nulling circuit of each channel also has a resistor that sets the nulling range. You can change the nulling range of the offset nulling circuitry for each channel by replacing its nulling resistor with a resistor of another value. Therefore, you can mix your ranges to accommodate each channel requirement. The offset nulling circuitry has the added advantage of nulling the offset voltages of your entire signal path, including the bridge, the SC-2043-SG channel, and the DAQ board analog input channel.

Filtering

Each channel of the SC-2043-SG has a postgain, lowpass filter. This filter is a single-pole, buffered, RC filter with a cutoff frequency of 1.6 kHz.

I/O Connectors and Breakout Screw Terminals

The outputs of all eight channels are connected to the ACH<0..7> analog input channel pins on the MIO I/O connector and the Lab/1200 I/O connector. All the remaining pins, except two, on these connectors are mapped to breakout screw terminals (J1–J6). These two pins are +5 V (pin 34 on the MIO and pin 49 on the Lab/1200 I/O connectors) and DGND (pin 33 on the MIO and pin 50 on the Lab/1200 I/O connectors). Refer to Chapter 3, *Signal Connections*, for the pin assignments of the I/O connectors and their mapping to the screw terminals.

Excitation Voltage Source

The SC-2043-SG has an onboard excitation voltage source for Wheatstone bridge excitation. This source is powered by the +5 V power supply and is routed to eight output screw terminal pairs (±EX<0..7>), one pair per channel. The excitation source provides an adjustable, regulated voltage output with a range of 1.5 to 2.5 VDC, controlled by a potentiometer (R2), and short-circuit current limiting (approximately 1 A). The factory-default onboard excitation source setting is 2.5 V. Screw terminals on J7 can connect an external excitation source of up to 10 VDC to the SC-2043-SG. Two jumpers select whether the onboard excitation source or the external excitation source is routed to the output screw terminal pairs ±EX<0..7>. The offset nulling circuitry also uses the excitation source output as a reference.

You can locally sense the exact level of the excitation voltage by routing the excitation voltage via jumpers W2 and W8 to ACH0 or ACH8 of the MIO board or to ACH0 on a Lab/1200 board. Refer to Chapter 2, *Installation and Configuration*, for further information on excitation source configuration.

Note: ***There is NO onboard overvoltage protection and current limiting protection for the external excitation inputs. Therefore, if you select external excitation, you MUST ensure that your excitation supply does not exceed 10 V and is current-limited.***

Power Supply

The SC-2043-SG contains an onboard power switch (SW1) to either power the SC-2043-SG from the DAQ board or draw power from an external +5 V supply. Fuses F1 and F2 limit the external +5 V power supply input to 1A at +5 V. The SC-2043-SG also has a spare fuse, F3, as shown in Figure 2-1. From the +5 V power supply, an onboard DC-DC converter generates a ±15 V source, which is used to power the analog circuitry. The +5 V power supply also powers the onboard excitation supply. A green LED indicates that the board is receiving power.

Chapter 5
Calibration Procedures

This chapter discusses the calibration procedures for the SC-2043-SG board.

Excitation Adjustment

Onboard Excitation Source

The excitation voltage source on the SC-2043-SG is factory-adjusted to 2.5 V ±0.5%. This circuit has one potentiometer (R2) that you must adjust to change the excitation voltage level on all eight output channels.

Note: ***Because the offset nulling circuitry uses the excitation voltage as a reference, if you want to change the excitation voltage level or you are using external excitation, you MUST complete your excitation voltage level adjustments before adjusting the offset nulling circuitry. If you do not, you will have to readjust the offset nulling voltage levels on all channels.***

If you want to readjust the onboard excitation voltage level to a different value, you must perform the following steps:

1. If you are using a rack-mount kit, remove the cover to expose the calibration pot.

2. Configure all your strain gauge bridges to the desired SC-2043-SG channels so that the excitation voltage source is calibrated with the exact bridge load it must supply. Refer to Chapter 3, *Signal Connections*, for more information.

   Note: ***Remember to short the input terminals (CHn±) of any unused channel to its negative excitation output terminal (-EXn).***

3. Select and read the channel that is configured for local excitation sensing. If you have not configured the SC-2043-SG for local excitation sensing, refer to Chapter 2, *Installation and Configuration*, for more information.

4. Adjust the potentiometer (R2) wiper with a flathead screwdriver until the voltage you are monitoring reaches the exact level desired.

5. Replace the rack-mount chassis cover, if used.

External Excitation Source

You can connect an external excitation source of up to 10 VDC to screw terminal block J7 on the SC-2043-SG. If you are using an external excitation source, you must perform the following steps.

1. If you are using a rack-mount kit, remove the cover.

   Caution: ***If you are using the SC-2043-SG with a Lab/1200 board, you MUST set jumper W8 to the ST position. Failure to do so can damage your Lab/1200 board if your excitation voltage exceeds 10 V. National Instruments is NOT liable for any damages resulting from incorrect configuration of jumper W8. Refer to Table 2-5 and Chapter 2,*** *Configuration and Installation****, for more information.***

2. Configure the SC-2043-SG for external excitation so that your excitation source is connected to screw terminal block J7. Refer to Chapter 2, *Installation and Configuration*, and Chapter 3, *Signal Connections*, for more information.

3. Configure all your strain gauge bridges to the desired SC-2043-SG channels so that the excitation voltage source is calibrated with the exact bridge load it must supply.

   Note: ***Remember to short the input terminals (CHn±) of any unused channel to its negative excitation output terminal (-EXn).***

4. Select and read the channel that is configured for local excitation sensing. If you have not configured the SC-2043-SG for local excitation sensing, refer to Chapter 2, *Installation and Configuration*, for more information.

5. Adjust your excitation source output level until the voltage you are monitoring reaches the exact level desired. Do NOT exceed 10 VDC.

6. Replace the rack-mount chassis cover, if used.

Appendix A
Specifications

This appendix lists the specifications for the SC-2043-SG. These are typical at 25° C unless otherwise noted.

Analog Input

Input Characteristics

Number of channels ..... 8 differential
Input signal ranges ..... ±1 V (fixed gain of 10 on each channel)
Max working voltage (signal + common mode) ..... Each input should remain within ±11 V of ground
Overvoltage protection ..... ±45 V powered on, ±30 V powered off
    Inputs protected ..... CH<0..7>±

Transfer Characteristics

Nonlinearity ..... ±0.01% FSR
Gain error ..... ±0.15% of reading max

Amplifier Characteristics

Input impedance
    Normal powered on ..... 10 GΩ
    Powered off or overload ..... 5.2 kΩ
Input bias current ..... ±2.5 nA
Input offset current ..... ±1.5 nA
CMRR ..... 93 dB min
Output range ..... ±11 V

Dynamic Characteristics

Bandwidth ..... 1.6 kHz (single-pole RC filter)
System noise ..... 5 µVrms (referred to input)

Stability

Recommended warm-up time ..... 10 minutes
Offset temperature coefficient ..... ±3.5 µV/°C (referred to input)
Gain temperature coefficient ..... ±10 ppm/°C

Excitation

Channels ..... 1, connected to 8 screw terminal pairs
Level ..... 2.5 V, ±0.5% (adjustable from 1.5 to 2.5 V)
Current drive[1] ..... 167 mA at 2.5 V
Drift ..... ±480 ppm/°C

[1] Excitation current drive assumes eight full-bridge 120 Ω strain gauges.

Bridge type ..... Half or full (jumper-selectable); with sockets for quarter-bridge completion
Bridge completion ..... Two 2.5 kΩ, ±0.02% ratio tolerance (±2 ppm/°C tracking TCR resistors)
Offset nulling range ..... ±5 mV, referred to input

Power Requirement (from DAQ Board)[2]

+5 VDC (±10 %)
Using external excitation ..... 570 mA
Using internal 2.5 V excitation ..... 600–770 mA[3]

Physical

Dimensions ..... 4.6 by 20.1 by 12.4 cm (1.8 by 7.9 by 4.9 in.)
I/O connectors
  I/O signals ..... 72 labeled screw terminals
  DAQ board connector ..... Two 50-pin ribbon-cable connectors

Environment

Operating temperature ..... 0° to 50° C
Storage temperature ..... -20° to 75° C
Relative humidity ..... 5% to 90% noncondensing

2 Power requirements assume all eight inputs are used or shorted to their respective excitation return (-EX*n*) screw terminals. Open-circuited inputs will increase power requirements.

3 When using internal excitation, the power requirement will depend on number and type of strain gauges. The maximum power requirement listed (770 mA) assumes eight 120 Ω full-bridge inputs. The minimum power requirement listed (600 mA) assumes one 350 Ω half-bridge input.

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Netherlands	03480 33466	03480 30673
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Fax (___)_____ Phone (___)_____

Computer brand _____ Model _____ Processor _____

Operating system _____

Speed _____ MHz RAM _____ MB Display adapter _____

Mouse _____ yes _____ no Other adapters installed _____

Hard disk capacity _____ MB Brand _____

Instruments used _____

National Instruments hardware product model _____ Revision _____

Configuration _____

National Instruments software product _____ Version _____

Configuration _____

The problem is _____

_____

_____

_____

_____

List any error messages _____

_____

_____

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_____

The following steps will reproduce the problem _____

_____

_____

_____

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SC-2043-SG Hardware and Software Configuration Form

Record the settings and revisions of your hardware and software on the line to the right of each item. Complete a new copy of this form each time you revise your software or hardware configuration, and use this form as a reference for your current configuration. Completing this form accurately before contacting National Instruments for technical support helps our applications engineers answer your questions more efficiently.

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- Programming Language Version _____
- Other Boards in System _____
- Base I/O Address of Other Boards _____
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Glossary

Prefix	Meaning	Value
p-	pico-	10^{-12}
n-	nano-	10^{-9}
µ-	micro-	10^{-6}
m-	milli-	10^{-3}
k-	kilo-	10^{3}
M-	mega-	10^{6}

°	degrees
Ω	ohms
+5 V	+5 V signal
A	amperes
ACH#	DAQ board analog input channel number
A/D	analog-to-digital
AGND	analog ground signal
AIGND	analog input ground signal
AISENSE	analog input sense signal
AOGND	analog output ground
C	Celsius
CH*n*±	module positive or negative input channel number
DAC	digital-to-analog converter
DAC#OUT	digital-to-analog converter output signal
DAQ	data acquisition
DC	direct current
DGND	digital ground
DIO	digital input-output
±EX	voltage excitation input signals
±EX*n*	positive or negative voltage excitation output channels
EXT	external
EXTREF	external reference signal
EXTSTROBE*	external strobe signal
FB	full bridge
HB	half bridge
Hz	hertz
in.	inches
INT	internal
I/O	input/output
LED	light-emitting diode
m	meters
MB	megabytes

NRSE	nonreferenced single-ended
ppm	parts per million
RAM	random-access memory
RC	resistance-capacitance
rms	root mean square
RTI	referred to input
s	seconds
SCANCLK	scan clock signal
ST	screw terminal
TCR	temperature coefficient
tempco	temperature coefficient
V	volts
VI	virtual instrument
VDC	volts direct current
Vrms	volts, root mean square

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