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CALIBRATION PROCEDURE

SCXI™-1520

This document contains information and step-by-step instructions for calibrating the National Instruments SCXI-1520 module.

Equipment and Other Test Requirements

This section describes the equipment, software, documentation, and test conditions required for calibrating the SCXI-1520.

Test Equipment

Calibration requires a high-precision voltage source with at least 50 ppm accuracy, a multiranging 5 1/2 digit digital multimeter (DMM) with 15 ppm accuracy, and a 16-bit data acquisition (DAQ) device.

NI recommends the following instruments for calibrating the SCXI-1520.

- Calibrator—Fluke 5700A
- DMM—NI 4060 or Agilent 34401A
- 16-bit DAQ device

If these instruments are not available, use the accuracy requirements listed above to select a substitute calibration standard.

Note If you do not have custom connection hardware, you need an SCXI-1314 terminal block and a shielded 68-pin connector cable. These components give easy access to the individual pins on the SCXI-1520 front connectors. You also need an SCXI-1349 cable adapter to connect the SCXI-1520 to the DAQ device.

Software and Documentation

Use the following software and documentation to calibrate the SCXI-1520. You can find them on the NI Web site at `ni.com/support`.

- The latest version of the NI-DAQ driver software
- *NI-DAQ Function Reference Help*

NATIONAL INSTRUMENTS™

- *NI-DAQ User Manual for PC Compatibles*
- *SCXI-1314 Installation Guide*
- *SCXI-1349 Installation Guide*

Software

The SCXI-1520 calibration procedure requires the latest version of the NI-DAQ driver on the calibration system. The driver supports a number of programming languages, including LabVIEW, Measurement Studio, Microsoft Visual C++, Microsoft Visual Basic, and Borland C++. When you install the driver, you need to install support only for the programming language you are using.

Documentation

The *NI-DAQ Function Reference Help* and the *NI-DAQ User Manual for PC Compatibles* contain detailed information on using the NI-DAQ driver. The online help includes detailed information on the driver functions. You can access the help by selecting **Start»Programs»National Instruments DAQ»NI-DAQ Help**. The user manual provides instructions on installing and configuring DAQ devices. The user manual also includes detailed information on creating applications that use the NI-DAQ driver. These are your primary references for writing your calibration utility. For more information on the SCXI-1520, refer to the *SCXI-1520 User Manual*.

Test Conditions

Follow these guidelines to optimize the connections and the environment during calibration.

- Keep connections to the SCXI module short. Long cables and wires act as antennae, picking up extra noise and thermal offsets that can affect measurements.
- Use shielded copper wire for all cable connections to the device. Use twisted-pair wire to reduce noise.
- Maintain the temperature between 18 and 28 °C.
- Keep relative humidity below 80%.
- Allow a warm-up time of at least 15 minutes for the SCXI module and 30 minutes for the DAQ device to ensure that the measurement circuitry is at a stable operating temperature.

Calibration

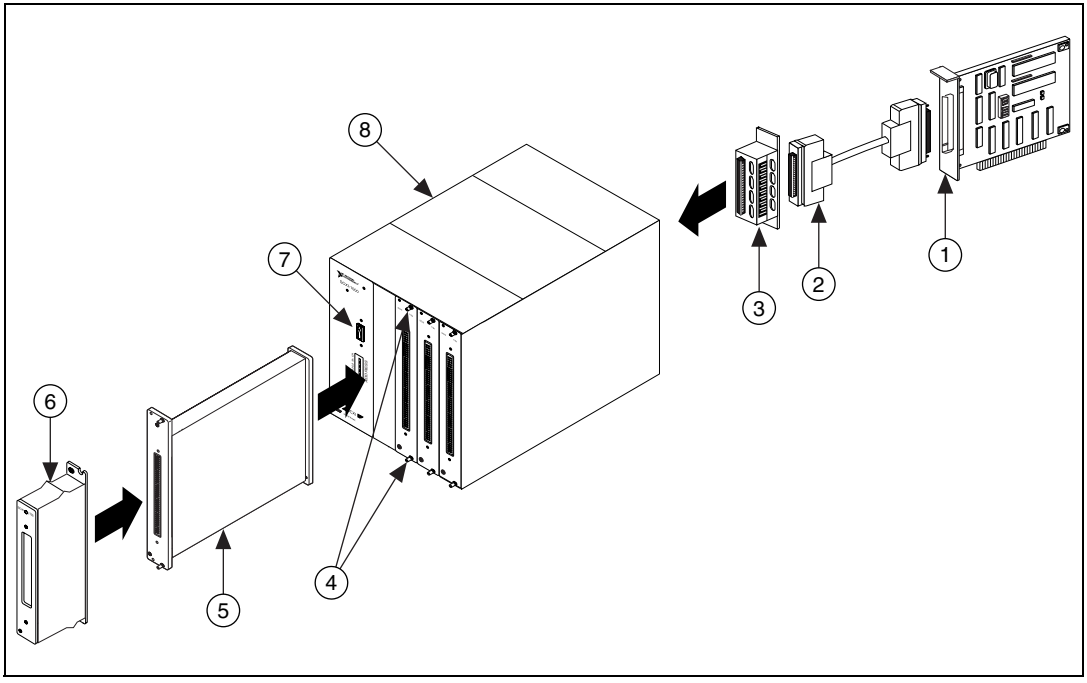
The calibration process consists of the following steps:

1. Setting up the device for testing.
2. Verifying the existing operation of the device to determine whether it is operating within its specifications.
3. Adjusting the device with respect to a known voltage source.
4. Verifying that the device is operating within its specifications after adjustments.

Setting Up the SCXI-1520 for Testing

Complete the following steps to set up the SCXI-1520 for testing.

1. Install the SCXI-1520 in slot 1 of the SCXI chassis.
2. Using an SCXI-1349 cable adapter, connect a 68-to-68-pin cable between the SCXI-1520 module and the DAQ device installed in the host computer, as shown in Figure 1.



1	DAQ Device	5	SCXI-1520 Module
2	SH68-68 Cable	6	SCXI-1314 Terminal Block
3	SCXI-1349 Cable Adapter	7	SCXI Chassis Power Switch
4	Thumbscrews	8	SCXI-1000 Chassis

Figure 1. Connecting an SCXI Chassis to a DAQ Device

3. Configure the hardware with Measurement & Automation Explorer (MAX). For more information on configuring the system, refer to the documentation for the DAQ device and the SCXI-1520.

Verifying Gain and Offset Errors

The verification procedure determines how well the SCXI-1520 module is meeting its specifications. You can use this information to select the appropriate calibration interval for your application.

Complete the following steps to verify gain and offset errors of the SCXI-1520.

1. Read the *Test Conditions* section.
2. Refer to the specifications in Table 2.
3. Call `Calibrate_E_Series` to minimize the uncertainty associated with the DAQ device measurements. Set the following parameters:
   - **deviceNumber**—The value assigned by MAX
   - **calOP**—`ND_SELF_CALIBRATE`
   - **setOfCalConst**—`ND_USER_EEPROM_AREA`
   - **calRefVolts**—0.0
4. Call `AI_Configure` to put the DAQ device in bipolar mode. Set the following parameters:
   - **deviceNumber**—The value assigned by MAX
   - **chan**—0
   - **inputMode**—0
   - **inputRange**—0
   - **polarity**—0
   - **driveAIS**—0
5. Call `SCXI_Track_Hold_Setup` to set up the track-and-hold circuitry of the SCXI-1520. Set the following parameters:
   - **SCXIchassisID**—The value assigned by MAX
   - **moduleSlot**—1
   - **inputMode**—2
   - **source**—0
   - **send**—0
   - **holdCount**—1
   - **DAQdeviceNumber**—The value assigned by MAX

6. Call `SCXI_MuxCtr_Setup` to configure the DAQ device counter for use as a multiplexer counter during SCXI channel scanning. Set the following parameters:
   - **deviceNumber**—The value assigned by MAX
   - **enable**—1
   - **scanDiv**—1
   - **ctrValue**—1
7. Connect the calibrator to the appropriate analog input, starting with channel 0. Refer to Table 1 to determine which pins on the 96-pin front connector correspond to the positive and negative inputs of the specified channel. For example, the positive input for channel 0 (S0+) is pin C32. The negative input for channel 0 (S0–) is pin B32. If you are using an SCXI-1314 terminal block, connect the calibrator to the S0+ and S0– inputs.
8. Call `SCXI_SCAN_Setup` to set up the SCXI chassis to perform a multiplexed scanning data acquisition. Set the following parameters:
   - **SCXIchassisID**—The value assigned by MAX
   - **numModules**—1
   - **moduleList**—{1}[1]
   - **numChans**—{1}
   - **startChans**—{The channel number from step 7}
   - **DAQdeviceNumber**—The value assigned by MAX
   - **modeFlag**—0
9. Call `SCXI_Configure_Filter` to configure the filter on the module. Set the following parameters:
   - **chassisID**—The value assigned by MAX
   - **moduleSlot**—1
   - **channel**—The channel number from step 7
   - **filterMode**—0
   - **freq**—0
   - **cutoffDivDown**—0
   - **outClkDivDown**—0
10. Call `SCXI_Set_Potentiometer` to set the fine potentiometer to the center position. Set the following parameters:
    - **SCXIchassisID**—The value assigned by MAX
    - **moduleSlot**—1

[1] Array notation: {*X*} denotes a one-element array initialized with the value *X*; [*Y*] denotes an uninitialized array of size *Y*.

- **channel**—The channel number from step 7
- **value**—2048
- **pottype**—1

11. Call `SCXI_Set_Potentiometer` to set the coarse potentiometer to the center position. Set the following parameters:
    - **SCXIchassisID**—The value assigned by MAX
    - **moduleSlot**—1
    - **channel**—The channel number from step 7
    - **value**—62
    - **pottype**—0
12. Call `SCXI_Set_Excitation` to set the excitation voltage to zero. Set the following parameters:
    - **SCXIchassisID**—The value assigned by MAX
    - **moduleSlot**—1
    - **moduleChan**—The channel number from step 7
    - **excitationType**—2
    - **excitationValue**—0

    `SCXI_Set_Excitation` returns a 32-bit floating-point number, **actualExcitationValuePtr**.
13. Call `SCXI_Configure_Connection` to configure the channel for a full-bridge connection. Set the following parameters:
    - **SCXIchassisID**—The value assigned by MAX
    - **moduleSlot**—1
    - **moduleChan**—The channel number from step 7
    - **connectionType**—6
14. Call `SCXI_Set_Gain` to set the gain you want to test on the module. Set the following parameters:
    - **SCXIchassisID**—The value assigned by MAX
    - **moduleSlot**—1
    - **channel**—The channel number from step 7
    - **gain**—The gain value you want to test; you can find valid gain values in Table 2.
15. Set the calibrator to output the test point voltage from Table 2.
16. Call `SCAN_Op` to acquire the data. Set the following parameters:
    - **deviceNumber**—The value assigned by MAX
    - **numChans**—{1}

- **chans**—{0}
- **gains**—1
- **buffer**—[5000]
- **count**—5000
- **sampleRate**—10000
- **scanRate**—5000

17. Call `SCXI_Scale` to scale the data returned by `SCAN_Op`. Set the following parameters:
    - **SCXIChassisID**—The value assigned by MAX
    - **moduleSlot**—1
    - **channel**—The channel number from step 7
    - **SCXIgain**—The gain value from step 14
    - **TBgain**—1
    - **DAQboard**—The device number of the DAQ device
    - **DAQchannel**—0
    - **DAQgain**—1
    - **numPoints**—5000
    - **binArray**—The array returned by `SCAN_Op` in step 16

    The result is a set of scaled voltages called **scaledArray**.
18. Average the results returned by `SCXI_Scale`. Compare the averaged result to the upper and lower limits in Table 2. If the result falls within these limits, your module has passed this portion of the test. If the result is outside these limits, adjust the module using the steps in the *Adjusting for Gain, Offset, and Excitation Errors* section.
19. Repeat steps 14 through 18 for the remaining gains.
20. Repeat steps 7 through 19 for the remaining channels.



Note If all channels fall within the upper and lower limits, the gain and offset do not need adjustment.

Verifying Voltage Excitation

This section describes how to verify the voltage excitation of the SCXI-1520 and how to calculate new voltage excitation constants. The calibration constants for the voltage excitation on the SCXI-1520 are calculated with respect to the onboard 2.5 V reference voltage. These calibration constants are stored on the module EEPROM and can be read by application software and used for software correction. You cannot physically adjust the excitation on the SCXI-1520. If the measured values of the excitation fall outside the limits given in Table 3, the module is not

operating within specifications. Return it to NI for repair. For more information about how to contact NI for repair, refer to the *Signal Conditioning Technical Support Information* document.

1. Read the *Test Conditions* section.
2. Connect the DAQ device to the SCXI-1520 using an SCXI-1349 cable adapter and a 68-to-68-pin cable.
3. Connect the DMM to the appropriate excitation output terminals, starting with channel 0. Refer to Table 1 to determine which pins on the 96-pin front connector correspond to the positive and negative excitation terminals of the specified channel. For example, the positive excitation terminal for channel 0 (P0+) is pin C30. The negative excitation terminal for channel 0 (P0–) is pin B30. If you are using an SCXI-1314 terminal block, connect the DMM to the P0+ and P0– output terminals of the SCXI-1314.
4. Call `SCXI_Set_Excitation` to set the excitation voltage to the desired value. Set the following parameters:
   - **SCXIchassisID**—The value assigned by MAX
   - **moduleSlot**—1
   - **moduleChan**—The channel number from step 3
   - **excitationType**—2
   - **excitationValue**—The excitation value that you want to measure. Refer to Table 3 for a list of valid values.

   `SCXI_Set_Excitation` returns a 32-bit floating-point number called **actualExcitationValuePtr**. This number was stored in the SCXI-1520 EEPROM when the module was last calibrated, and represents the voltage excitation measured at that time. Record this value as V_{exe}.
5. Read the voltage from the DMM and record it as V_{exm}. You will use V_{exm} to verify the voltage excitation and, if necessary, to calculate new calibration constants in the *Adjusting Calibration Constants* section.
6. Compare V_{exm} from step 5 to the upper and lower limits in Table 2. If V_{exm} is within these limits, the module has passed this portion of the test. If V_{exm} is outside these limits, the module is not operating within specifications. Return it to NI for repair.
7. Divide V_{exe} from step 4 by V_{exm} from step 5. If the resulting value is between 0.999 and 1.001, the calibration constants are within the required specifications. Do not use 0.0 V excitation for this step.
8. Repeat steps 4 through 7 for the remaining excitation levels you want to test on the module.
9. Repeat steps 3 through 8 for the remaining channels you want to test on the module.

Adjusting for Gain, Offset, and Excitation Errors

The *Determining Gain Errors* and *Adjusting Calibration Constants* sections explain how to determine the gain, offset, and excitation errors of the SCXI-1520 and how to adjust the calibration constants to correct for these errors.

Determining Gain Errors

Complete the following steps to determine the gain errors of the SCXI-1520.

1. Read the *Test Conditions* section.
2. Refer to the specifications in Table 2.
3. Call `Calibrate_E_Series` to minimize the uncertainty associated with the DAQ device measurements. Set the following parameters:
   - **deviceNumber**—The value assigned by MAX
   - **calOP**—`ND_SELF_CALIBRATE`
   - **setOfCalConst**—`ND_USER_EEPROM_AREA`
   - **calRefVolts**—0.0
4. Call `AI_Configure` to put the DAQ device in bipolar mode. Set the following parameters:
   - **deviceNumber**—The value assigned by MAX
   - **chan**—0
   - **inputMode**—0
   - **inputRange**—0
   - **polarity**—0
   - **driveAIS**—0
5. Call `SCXI_Track_Hold_Setup` to configure the track-and-hold circuitry of the SCXI-1520. Set the following parameters:
   - **SCXIchassisID**—The value assigned by MAX
   - **moduleSlot**—1
   - **inputMode**—2
   - **source**—0
   - **send**—0
   - **holdCount**—1
   - **DAQdeviceNumber**—The value assigned by MAX

6. Call `SCXI_MuxCtr_Setup` to configure the DAQ device counter for use as a multiplexer counter during SCXI channel scanning. Set the following parameters:
   - **deviceNumber**—The DAQ device number assigned by MAX
   - **enable**—1
   - **scanDiv**—1
   - **ctrValue**—1
7. Connect the calibrator to the appropriate analog input, starting with channel 0. Refer to Table 1 to determine which pins on the 96-pin front connector correspond to the positive and negative inputs of the specified channel. For example, the positive input for channel 0 (S0+) is pin C32. The negative input for channel 0 (S0–) is pin B32. If you are using an SCXI-1314 terminal block, connect the calibrator to the S0+ and S0– inputs on the SCXI-1314.
8. Call `SCXI_SCAN_Setup` to set up the SCXI chassis to perform a multiplexed scanning data acquisition. Set the following parameters:
   - **SCXIchassisID**—The value assigned by MAX
   - **numModules**—1
   - **moduleList**—{1}
   - **numChans**—{1}
   - **startChans**—{The channel from step 7}
   - **DAQdeviceNumber**—The value assigned by MAX
   - **modeFlag**—0
9. Call `SCXI_Configure_Filter` to configure the filter on the module. Set the following parameters:
   - **chassisID**—The value assigned by MAX
   - **moduleSlot**—1
   - **channel**—The channel from step 7
   - **filterMode**—0
   - **freq**—0
   - **cutoffDivDown**—0
   - **outClkDivDown**—0

   `SCXI_Configure_Filter` returns the actual cutoff frequency that the module uses as a 64-bit floating-point number, **actualFreq**.

10. Call `SCXI_Set_Potentiometer` to set the fine potentiometer to the center position. Set the following parameters:
    - **SCXIchassisID**—The value assigned by MAX
    - **moduleSlot**—1
    - **channel**—The channel number from step 7
    - **value**—2048
    - **pottype**—1
11. Call `SCXI_Set_Potentiometer` to set the coarse potentiometer to the center position. Set the following parameters:
    - **SCXIchassisID**—The value assigned by MAX
    - **moduleSlot**—1
    - **channel**—The channel number from step 7
    - **value**—62
    - **pottype**—0
12. Call `SCXI_Set_Excitation` to set the excitation voltage to zero. Set the following parameters:
    - **SCXIchassisID**—The value assigned by MAX
    - **moduleSlot**—1
    - **moduleChan**—The channel number from step 7
    - **excitationType**—2
    - **excitationValue**—0

    `SCXI_Set_Excitation` returns a 32-bit floating-point number called **actualExcitationValuePtr**.
13. Call `SCXI_Configure_Connection` to configure the channel for a full-bridge connection. Set the following parameters:
    - **SCXIchassisID**—The value assigned by MAX
    - **moduleSlot**—1
    - **moduleChan**—The channel number from step 7
    - **connectionType**—6
14. Call `SCXI_Set_Gain` to set the gain you want to test on the module. Set the following parameters:
    - **SCXIchassisID**—The value assigned by MAX
    - **moduleSlot**—1
    - **channel**—The channel number from step 7
    - **gain**—The gain value you want to test. Refer to Table 2 for gain values and test points.

15. Set the calibrator to output the test point voltage from Table 2.
16. Call `SCAN_Op` to acquire the data. Set the following parameters:
    - **deviceNumber**—The device number of the DAQ device
    - **numChans**—{1}
    - **chans**—{0}
    - **gains**—1
    - **buffer**—[5000]
    - **count**—5000
    - **sampleRate**—10000
    - **scanRate**—5000
17. Call `DAQ_VScale` to scale the data returned by `SCAN_Op`. Set the following parameters:
    - **deviceNumber**—The value assigned to the DAQ device by MAX
    - **chan**—0
    - **gain**—1
    - **gainAdjust**—1
    - **offset**—0
    - **count**—5000
    - **binArray**—The array returned by `SCAN_Op`

    The result is **voltArray**, a set of scaled voltages measured with respect to the output of the SCXI module.
18. Average the results returned by `DAQ_VScale`.
19. Record the averaged voltage from step 18 as V_{mp} and the calibrator voltage as V_{inp}.
20. Set the calibrator to the negative test-point value for the same gain.
21. Repeat steps 16 through 18.
22. Record the averaged voltage from step 18 as V_{mn} and the calibrator voltage as V_{inn}. You now have two pairs of data points, (V_{mp}, V_{inp}) and (V_{mn}, V_{inn}), to use in the *Gain Calibration Constants* section.
23. Repeat steps 14 through 22 for the remaining gains you want to adjust on this module.
24. Repeat steps 7 through 23 for the remaining channels you want to adjust on this module.

Adjusting Calibration Constants

Complete the following steps to adjust the calibration constants on the SCXI-1520.

Gain Calibration Constants

1. Calculate the gain adjustment for each channel using the following equation:

$$GainAdjust = \frac{V_{mp} - V_{mn}}{(V_{inp} - V_{inn}) \times gain}$$

where

GainAdjust is a value used later in this process

V_{mp} is the measured output of the module given a positive input voltage V_{inp}

V_{mn} is the measured output of the module given a negative input voltage V_{inn}

gain is the gain setting of the module

2. Call `SCXI_Adv_Module_Write` to write the new gain calibration constants to the module. Set the following parameters:
   - **SCXIchassisID**—The value assigned by MAX
   - **moduleSlot**—1
   - **moduleClass**—2
   - **address**—$2 \times iquo + 9$, where *iquo* is the integer part of the module channel divided by 2
   - **numBytes**—4
   - **data**—The value of *GainAdjust* represented as 4 bytes in a 4-element array stored little-endian
   - **whichAccess**—0
   - **regMethod**— –1
   - **subAddress**—$(296 \times irem + 722) + (4 \times index)$, where *irem* is the integer remainder of the module channel divided by 2 and *index* is the index from Table 2 that corresponds to the gain you are adjusting
3. Repeat steps 1 and 2 for the remaining gains and channels.

Offset Calibration Constants

1. Call `SCXI_Calibrate` and set the following parameters:
   - **SCXIChassisID**—The value assigned by MAX
   - **moduleSlot**—1
   - **moduleChan**—The number of the channel you want to calibrate
   - **opCode**—0
   - **calibrationArea**—0
   - **SCXIgain**—1
   - **refVoltage**—1
   - **DAQdevice**—The value assigned by MAX
   - **DAQchan**—0
2. Repeat step 1 for each of the remaining channels.

Excitation Calibration Constants

Note This adjustment is not needed for the 0.0 V excitation.

1. Call `SCXI_Adv_Module_Read` to get the value of the 2.5 V reference voltage on the SCXI-1520. Use the following parameters:
   - **SCXIchassisID**—The value assigned by MAX
   - **slot**—1
   - **moduleClass**—2
   - **address**—3
   - **numBytes**—4
   - **data**—The array that returns the value of the SCXI-1520 2.5 V reference voltage. The data is returned as 4 bytes in a 4-element array stored little-endian.
   - **whichAccess**—0
   - **regMethod**— –1
   - **subAddress**—104
2. Calculate the excitation calibration constant to be written to the module. Use the following equation:

$$ExcitationAdjust = V_{exm}/Vref_2.5$$

where

V_{exm} is the measured value of the excitation voltage from step 5 of the *Verifying Voltage Excitation* section

Vref_2.5 is the value of the 2.5 V reference voltage from step 1

3. Call `SCXI_Adv_Module_Write` to write the new excitation adjust calibration constants to the module. Set the following parameters:
   - **SCXIchassisID**—The value assigned by MAX
   - **moduleSlot**—1
   - **moduleClass**—2
   - **address**—$2 \times iquo + 9$, where *iquo* is the integer part of the module channel divided by 2
   - **numBytes**—4
   - **data**—The value of *ExcitationAdjust* represented as 4 bytes in a 4-element array stored little-endian
   - **whichAccess**—0
   - **regMethod**— –1
   - **subAddress**—$(296 \times irem + 654) + (4 \times index)$, where *irem* is the integer remainder of the module channel divided by 2, and *index* is the index from Table 3 that corresponds to the excitation voltage you are adjusting
4. Repeat steps 2 and 3 for the remaining excitation voltages and channels.

Reading New Calibration Constants to Memory

Note You can call `SCXI_Get_Chassis_Info` and `SCXI_Get_Module_Info` to find variables (parameters) for `SCXI_Set_Config`. Refer to the *Traditional NI-DAQ Help* for detailed function help.

Reset NI-DAQ to read new calibration constants by calling `SCXI_Set_Config` with the following parameters:

- **SCXIchassisID**—The value assigned by MAX
- **chassisType**—0 for SCXI-1000, 1 for SCXI-1001, 4 for PXI-1010, 5 for PXI-1011
- **address**—0–31 as found in MAX
- **commMode**—1
- **commPath**—MIO device number
- **numSlots**—physical number of slots in chassis, 4, 8, or 12
- **moduleTypes**—array of length numSlots, with each element corresponding to a slot in the chassis. Use –1 if the index corresponds to an empty slot. Use 51 if the index corresponds to a slot containing an SCXI-1520.

- **opModes**—array of length numSlots, use –1 for an empty slot, 0 for multiplex mode, 1 for parallel mode, and 2 for parallel mode using the secondary connector of the DAQ device
- **DAQboards**—array of size numSlots, with 0 for all slots with no DAQ device cabled to the module, and the MIO device number for the slot containing the module cabled to the DAQ device

Verifying Adjusted Values

After completing the adjustments to the SCXI-1520, it is important that you verify the analog input operation by repeating the steps listed in the *Verifying Gain and Offset Errors* and *Verifying Voltage Excitation* sections. Reverifying after adjustments ensures that the SCXI-1520 is operating within its specifications.

Front Signal Connector Pin Assignments

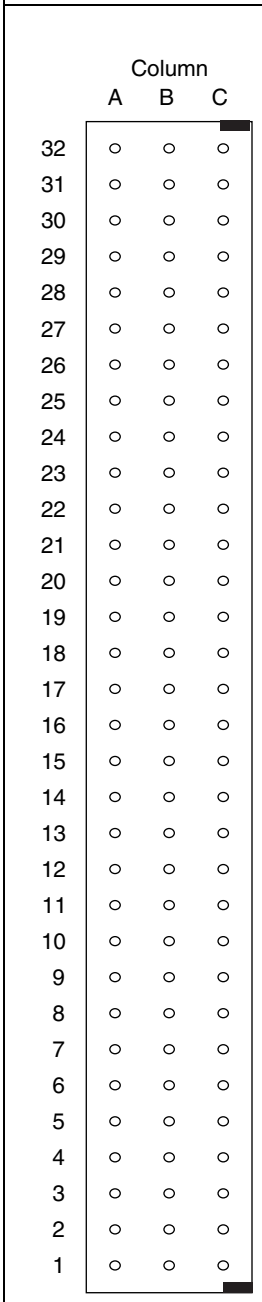
The pin assignments for the SCXI-1520 front signal connector are shown in Table 1. The front signal connector is a special 96-pin DIN C male connector through which you make all signal connections. The terminal assignments are as follows:

- S*X*+ and S*X*– are for analog input
- RS*X*+ and RS*X*– are for remote sense
- P*X*+ and P*X*– are for excitation output
- SCA*X* are for shunt calibration circuit A
- SCB*X* are for shunt calibration circuit B

where *X* is the channel number.

The negative terminals are listed in Column B and the positive terminals are listed in Column C. The pins labeled RSVD are reserved. Do *not* make any connections to these pins.

Table 1. Front Signal Pin Assignments

Front Connector Diagram	Pin Number	Column A	Column B	Column C
	32	SCB0	S0–	S0+
	31	SCB0	RS0–	RS0+
	30	SCB1	P0–	P0+
	29	SCB1	SCA0	SCA0
	28	RSVD	S1–	S1+
	27	RSVD	RS1–	RS1+
	26	RSVD	P1–	P1+
	25	RSVD	SCA1	SCA1
	24	SCB2	S2–	S2+
	23	SCB2	RS2–	RS2+
	22	SCB3	P2–	P2+
	21	SCB3	SCA2	SCA2
	20	RSVD	S3–	S3+
	19	RSVD	RS3–	RS3+
	18	RSVD	P3–	P3+
	17	RSVD	SCA3	SCA3
	16	SCB4	S4–	S4+
	15	SCB4	RS4–	RS4+
	14	SCB5	P4–	P4+
	13	SCB5	SCA4	SCA4
	12	RSVD	S5–	S5+
	11	RSVD	RS5–	RS5+
	10	RSVD	P5–	P5+
	9	RSVD	SCA5	SCA5
	8	SCB6	S6–	S6+
	7	SCB6	RS6–	RS6+
	6	SCB7	P6–	P6+
	5	SCB7	SCA6	SCA6
	4	RSVD	S7–	S7+
	3	RSVD	RS7–	RS7+
	2	RSVD	P7–	P7+
	1	RSVD	SCA7	SCA7

Specification Tables

Table 2 contains the specifications you should use when verifying and calibrating the gain and offset of the SCXI-1520. If the module has been calibrated within the last year, the test point value should fall between the *Lower Limit (V)* and *Upper Limit (V)* values.

Table 2. SCXI-1520 Gain and Offset Calibration Table

Test Point (V)	Gain	Lower Limit (V)	Upper Limit (V)	Index
4.900000	1	4.891100	4.908900	0
0.000000	1	–0.004000	0.004000	0
–4.900000	1	–4.908900	–4.891100	0
4.260870	1.15	4.253130	4.268609	1
0.000000	1.15	–0.003478	0.003478	1
–4.260870	1.15	–4.268609	–4.253130	1
3.769230	1.3	3.762385	3.776077	2
0.000000	1.3	–0.003077	0.003077	2
–3.769230	1.3	–3.776077	–3.762385	2
3.266670	1.5	3.260733	3.272600	3
0.000000	1.5	–0.002667	0.002667	3
–3.266670	1.5	–3.272600	–3.260733	3
2.722220	1.8	2.717278	2.727167	4
0.000000	1.8	–0.002222	0.002222	4
–2.722220	1.8	–2.727167	–2.717278	4
2.450000	2	2.445550	2.454450	5
0.000000	2	–0.002000	0.002000	5
–2.450000	2	–2.454450	–2.445550	5
2.227270	2.2	2.223227	2.231318	6
0.000000	2.2	–0.001818	0.001818	6
–2.227270	2.2	–2.231318	–2.223227	6
2.041670	2.4	2.037958	2.045375	7
0.000000	2.4	–0.001667	0.001667	7

Table 2. SCXI-1520 Gain and Offset Calibration Table (Continued)

Test Point (V)	Gain	Lower Limit (V)	Upper Limit (V)	Index
–2.041670	2.4	–2.045375	–2.037958	7
1.814810	2.7	1.811519	1.818111	8
0.000000	2.7	–0.001481	0.001481	8
–1.814810	2.7	–1.818111	–1.811519	8
1.580650	3.1	1.577774	1.583516	9
0.000000	3.1	–0.001290	0.001290	9
–1.580650	3.1	–1.583516	–1.577774	9
1.361110	3.6	1.358639	1.363583	10
0.000000	3.6	–0.001111	0.001111	10
–1.361110	3.6	–1.363583	–1.358639	10
1.166670	4.2	1.164548	1.168786	11
0.000000	4.2	–0.000952	0.000952	11
–1.166670	4.2	–1.168786	–1.164548	11
0.875000	5.6	0.873411	0.876589	12
0.000000	5.6	–0.000714	0.000714	12
–0.875000	5.6	–0.876589	–0.873411	12
0.753850	6.5	0.752477	0.755215	13
0.000000	6.5	–0.000615	0.000615	13
–0.753850	6.5	–0.755215	–0.752477	13
0.653330	7.5	0.652147	0.654520	14
0.000000	7.5	–0.000533	0.000533	14
–0.653330	7.5	–0.654520	–0.652147	14
0.563220	8.7	0.562195	0.564241	15
0.000000	8.7	–0.000460	0.000460	15
–0.563220	8.7	–0.564241	–0.562195	15
0.490000	10	0.489110	0.490890	16
0.000000	10	–0.000400	0.000400	16

Table 2. SCXI-1520 Gain and Offset Calibration Table (Continued)

Test Point (V)	Gain	Lower Limit (V)	Upper Limit (V)	Index
–0.490060	10	–0.490890	–0.489110	16
0.426090	11.5	0.425313	0.426861	17
0.000000	11.5	–0.000348	0.000348	17
–0.426090	11.5	–0.426861	–0.425313	17
0.376920	13	0.376238	0.377608	18
0.000000	13	–0.000308	0.000308	18
–0.376920	13	–0.377608	–0.376238	18
0.326670	15	0.326073	0.327260	19
0.000000	15	–0.000267	0.000267	19
–0.326670	15	–0.327260	–0.326073	19
0.272220	18	0.271728	0.272717	20
0.000000	18	–0.000222	0.000222	20
–0.272220	18	–0.272717	–0.271728	20
0.245000	20	0.244555	0.245445	21
0.000000	20	–0.000200	0.000200	21
–0.245000	20	–0.245445	–0.244555	21
0.222730	22	0.222323	0.223132	22
0.000000	22	–0.000182	0.000182	22
–0.222730	22	–0.223132	–0.222323	22
0.204170	24	0.203796	0.204538	23
0.000000	24	–0.000167	0.000167	23
–0.204170	24	–0.204538	–0.203796	23
0.181480	27	0.181152	0.181811	24
0.000000	27	–0.000148	0.000148	24
–0.181480	27	–0.181811	–0.181152	24
0.158060	31	0.157777	0.158352	25
0.000000	31	–0.000129	0.000129	25

Table 2. SCXI-1520 Gain and Offset Calibration Table (Continued)

Test Point (V)	Gain	Lower Limit (V)	Upper Limit (V)	Index
–0.158060	31	–0.158352	–0.157777	25
0.136110	36	0.135864	0.136358	26
0.000000	36	–0.000111	0.000111	26
–0.136110	36	–0.136358	–0.135864	26
0.116670	42	0.116455	0.116879	27
0.000000	42	–0.000095	0.000095	27
–0.116670	42	–0.116879	–0.116455	27
0.087500	56	0.087341	0.087659	28
0.000000	56	–0.000071	0.000071	28
–0.087500	56	–0.087659	–0.087341	28
0.075380	65	0.075248	0.075521	29
0.000000	65	–0.000062	0.000062	29
–0.075380	65	–0.075522	–0.075248	29
0.065330	75	0.065215	0.065452	30
0.000000	75	–0.000053	0.000053	30
–0.065330	75	–0.065452	–0.065215	30
0.056320	87	0.056220	0.056424	31
0.000000	87	–0.000046	0.000046	31
–0.056320	87	–0.056424	–0.056220	31
0.049000	100	0.048891	0.049109	32
0.000000	100	–0.000060	0.000060	32
–0.049000	100	–0.049109	–0.048891	32
0.042610	115	0.042507	0.042710	33
0.000000	115	–0.000059	0.000059	33
–0.042610	115	–0.042710	–0.042507	33
0.037690	130	0.037597	0.037788	34
0.000000	130	–0.000058	0.000058	34

Table 2. SCXI-1520 Gain and Offset Calibration Table (Continued)

Test Point (V)	Gain	Lower Limit (V)	Upper Limit (V)	Index
–0.037690	130	–0.037788	–0.037597	34
0.032670	150	0.032577	0.032756	35
0.000000	150	–0.000057	0.000057	35
–0.032670	150	–0.032756	–0.032577	35
0.027220	180	0.027139	0.027305	36
0.000000	180	–0.000056	0.000056	36
–0.027220	180	–0.027305	–0.027139	36
0.024500	200	0.024421	0.024580	37
0.000000	200	–0.000055	0.000055	37
–0.024500	200	–0.024580	–0.024421	37
0.022270	220	0.022196	0.022350	38
0.000000	220	–0.000055	0.000055	38
–0.022270	220	–0.022350	–0.022196	38
0.020420	240	0.020342	0.020491	39
0.000000	240	–0.000054	0.000054	39
–0.020420	240	–0.020491	–0.020342	39
0.018150	270	0.018076	0.018220	40
0.000000	270	–0.000054	0.000054	40
–0.018150	270	–0.018220	–0.018076	40
0.015810	310	0.015737	0.015875	41
0.000000	310	–0.000053	0.000053	41
–0.015810	310	–0.015875	–0.015737	41
0.013610	360	0.013545	0.013678	42
0.000000	360	–0.000053	0.000053	42
–0.013610	360	–0.013678	–0.013545	42
0.011670	420	0.011603	0.011731	43
0.000000	420	–0.000052	0.000052	43

Table 2. SCXI-1520 Gain and Offset Calibration Table (Continued)

Test Point (V)	Gain	Lower Limit (V)	Upper Limit (V)	Index
–0.011670	420	–0.011731	–0.011603	43
0.008750	560	0.008689	0.008811	44
0.000000	560	–0.000052	0.000052	44
–0.008750	560	–0.008811	–0.008689	44
0.007540	650	0.007479	0.007598	45
0.000000	650	–0.000052	0.000052	45
–0.007540	650	–0.007598	–0.007479	45
0.006530	750	0.006475	0.006592	46
0.000000	750	–0.000052	0.000052	46
–0.006530	750	–0.006592	–0.006475	46
0.005630	870	0.005575	0.005690	47
0.000000	870	–0.000052	0.000052	47
–0.005630	870	–0.005690	–0.005575	47
0.004900	1000	0.004843	0.004957	48
0.000000	1000	–0.000052	0.000052	48
–0.004900	1000	–0.004957	–0.004843	48

Table 3. Excitation Limits

Excitation (V)	Lower Limit (V)	Upper Limit (V)	Index
0	–0.020000	0.020000	0
0.625	0.603125	0.646875	1
1.25	1.226250	1.273750	2
1.875	1.849375	1.900625	3
2.5	2.472500	2.527500	4
3.125	3.095625	3.154375	5
3.75	3.718750	3.781250	6
4.375	4.341875	4.408125	7
5	4.965000	5.035000	8
5.625	5.588125	5.661875	9
6.25	6.211250	6.288750	10
6.875	6.834375	6.915625	11
7.5	7.457500	7.542500	12
8.125	8.080625	8.169375	13
8.75	8.703750	8.796250	14
9.375	9.326875	9.423125	15
10	9.950000	10.050000	16

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