CALIBRATION PROCEDURE

SCXI™-1313A

This document contains information and instructions needed to verify the SCXI-1313A resistor divider networks and temperature sensor.

Contents

Conventions

The following conventions apply to this document:

»

The **»** symbol leads you through nested menu items and dialog box options to a final action. The sequence **File»Page Setup»Options** directs you to pull down the **File** menu, select the **Page Setup** item, and select **Options** from the last dialog box.

This icon denotes a note, which alerts you to important information.

This icon denotes a caution, which advises you of precautions to take to avoid injury, data loss, or a system crash. When this symbol is marked on a product, refer to the *Read Me First: Safety and Radio-Frequency Interference* for information about precautions to take.

When symbol is marked on a product, it denotes a warning advising you to take precautions to avoid electrical shock.

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When symbol is marked on a product, it denotes a component that may be hot. Touching this component may result in bodily injury.

bold — Bold text denotes items that you must select or click in the software, such as menu items and dialog box options. Bold text also denotes parameter names.

italic — Italic text denotes variables, emphasis, a cross-reference, or an introduction to a key concept. Italic text also denotes text that is a placeholder for a word or value that you must supply.

`monospace` — Text in this font denotes text or characters that you should enter 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, operations, variables, filenames, and extensions.

`monospace italic` — Italic text in this font denotes text that is a placeholder for a word or value that you must supply.

Software

You can find all the necessary information to verify the performance of the SCXI-1313A in this verification procedure. No other software or documentation is required.

Documentation

If you would like more information about the SCXI-1313A, refer to the *SCXI-1313A Terminal Block Installation Guide*, which you can download from `ni.com/manuals`.

Calibration Interval

Calibrate the SCXI-1313A at a regular interval as defined by the measurement accuracy requirements of your application. NI recommends performing a complete verification at least once every year. Based on your measurement accuracy needs, you can shorten this interval to 90 days or six months.

Test Equipment

NI recommends using the equipment in Table 1 to verify the SCXI-1313A. If these instruments are not available, use the requirements listed to select a suitable substitute.

Table 1. Test Equipment

Equipment	Recommended Model	Requirements
DMM	NI 4070	6 1/2 digit, 15 ppm
5 V Power Supply	NI 4110	—
Digital Thermometer	Brand and model with the required accuracy	Accurate to within 0.1 °C

Test Conditions

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

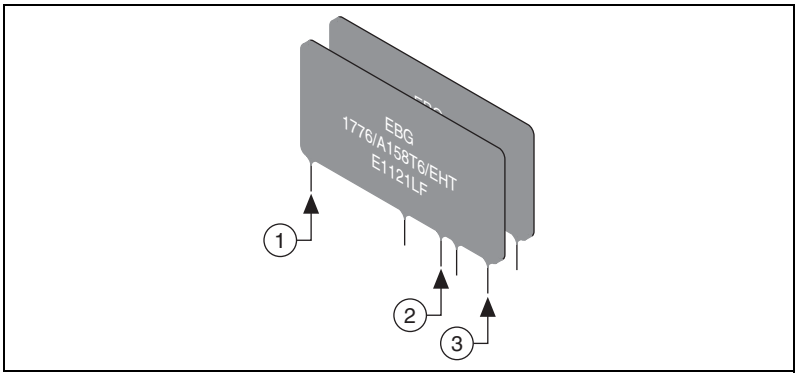
- Maintain the temperature between 18 and 28 °C.
- Keep relative humidity below 80%.

Verification Procedure

The verification procedure determines how well the SCXI-1313A is meeting the performance requirements of the resistor divider networks and the temperature sensor.

Verifying Resistor Divider Networks

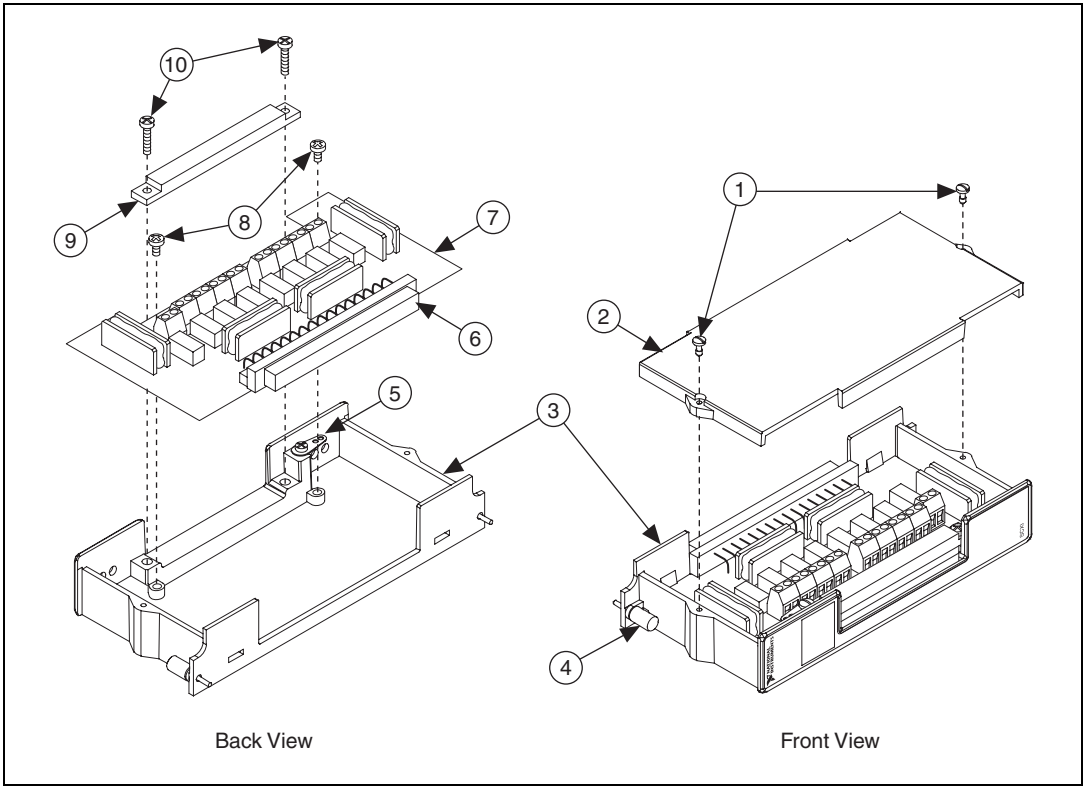
Figure 1 shows the pin designations on the resistor network. To verify the performance of each of the eight divider networks, RP1 through RP8, complete the following steps:



1 Pin 1 2 Pin 3 3 Pin 5

Figure 1. SCXI-1313A Resistor Network Pin Designations

1. Set the DMM for resistance measurement. To access the pins of the resistor networks, you must remove the circuit board from the housing. Refer to Figure 2 and complete the following steps:
   a. Remove the two top cover screws.
   b. Remove the two strain-relief screws.
   c. Remove the two circuit board attachment screws.
   d. Remove the circuit board from the terminal block enclosure and turn it over to the back side. The pins of the resistor networks should be protruding slightly from the back of the circuit board.



1 Top Cover Screws	5 Safety-Ground Lug	8 Circuit Board Attachment Screws
2 Top Cover	6 Rear Connector	9 Strain-Relief Bar
3 Terminal Block Enclosure	7 Circuit Board	10 Strain-Relief Screws
4 Thumbscrew (2)		

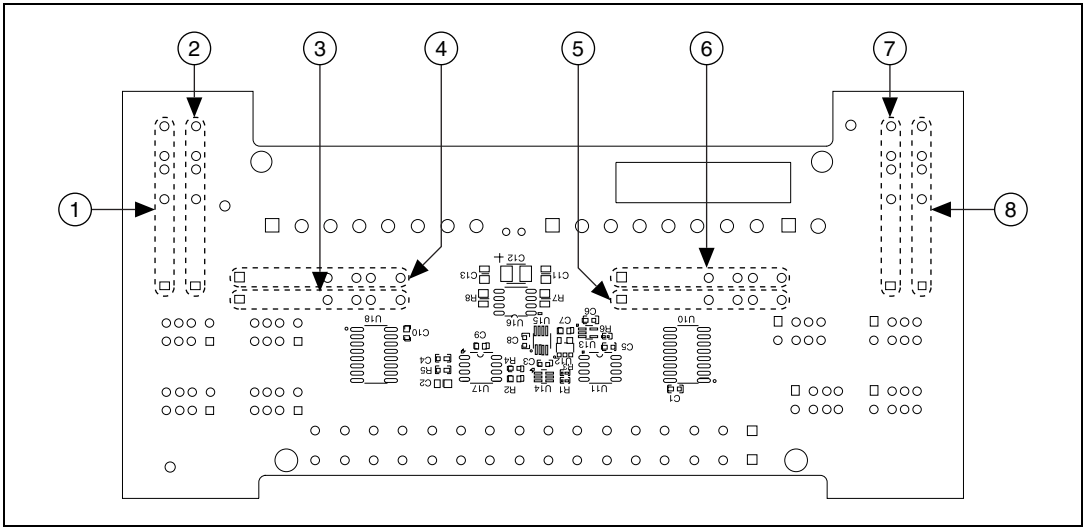
Figure 2. SCXI-1313A Parts Locator Diagram

2. Measure the resistance of each of the eight resistor networks, shown in Figure 3, on the circuit board:

Note Pin 1 is the square solder pad on each resistor network.

a. Measure and record $R_{1\text{-}5}$, which is the resistance value from pin 1 to pin 5 on the resistor network you are testing.

b. Measure and record $R_{3\text{-}5}$, which is the resistance value from pin 3 to pin 5 on the resistor network you are testing.



1	Resistor Network RP1	3	Resistor Network RP3	5	Resistor Network RP5	7	Resistor Network RP7
2	Resistor Network RP2	4	Resistor Network RP4	6	Resistor Network RP6	8	Resistor Network RP8

Figure 3. Resistor Network Locator Diagram

3. Calculate the following:

$$Ratio_n = R_{3-5}/R_{1-5}$$

where *n* is the designation of the resistor divider network. Carry the calculation out the nearest 10^{-7} decimal place.

4. Compare the $Ratio_n$ value to the nominal value of 1/100 (0.01). If the $Ratio_n$ value is within the *High Limit* and *Low Limit* found in Table 2, the resistor network is verified within specification.

Table 2. Resistor Network Specification Limits

Nominal Value	High Limit	Low Limit
0.01	0.0100060	0.0099940

5. Repeat steps 2 through 4 for each resistor network.

After you have verified all eight resistor networks, you have completed the verification procedure for the resistor networks on the SCXI-1313A. If this procedure determined that any of the components are out of specification, do not attempt any adjustments. Return the terminal block to NI to ensure that the safety features of the terminal block are not compromised. For information about contacting NI to return the terminal block, refer to the *Technical Support Information* document.

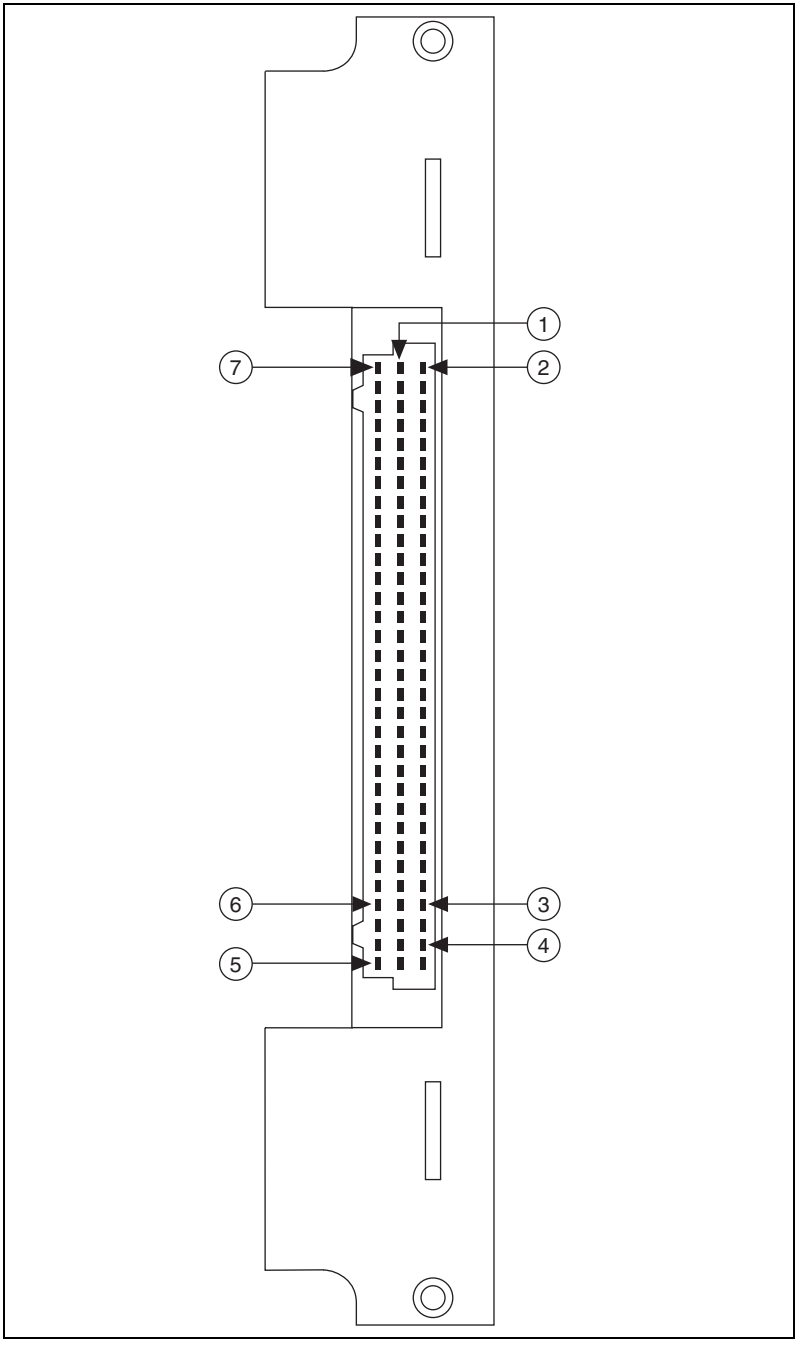
Verifying Temperature Sensor Performance

Complete the following steps to verify the performance of the temperature sensor on the SCXI-1313A:

1. Connect the 5 V power supply to the terminal block.
   a. Hold the terminal block vertically and view it from the rear as shown in Figure 4. The terminals on the 96-pin DIN connector are designated as follows:
      – Column A is on the right, Column B is in the middle, and Column C is on the left.
      – Row 1 is at the bottom and Row 32 is at the top.

      Refer to Figure 4 for the pin assignments on the SCXI-1313A. Individual pins are identified by their column and row. For example, *A3* denotes the terminal located in Column A and Row 3. This conforms to the labeling of the pins on the front connector of a mating SCXI module. It does not necessarily correspond to the labeling of the pins on the rear of the terminal block connector itself, which you can only view by opening the terminal block enclosure.

Note Not all pins are populated on this connector.



1 B 32	4 A 2 (GND)	6 C 4 (Temp Sensor)
2 A 32	5 C 1	7 C 32
3 A 4 (+5 VDC)		

Figure 4. SCXI-1313A Connector Pin Assignments

b. Strip 12.7 mm (0.5 in.) of insulation from one end of a 22 AWG solid wire. Insert the stripped end of the wire into terminal A4 on the 96-pin female DIN connector on the rear of the terminal block. Attach the other end of this wire to the positive terminal of the +5 VDC power supply.

c. Strip 12.7 mm (0.5 in.) of insulation from one end of a 22 AWG solid wire. Insert the stripped end of the wire into terminal A2 on the 96-pin female DIN connector on the rear of the terminal block. Attach the other end of this wire to the negative terminal of the +5 VDC power supply.

2. Connect a calibrated DMM to the temperature-sensor output of the terminal block.

   a. Strip 12.7 mm (0.5 in.) of insulation from one end of a 22 AWG solid wire. Insert the stripped end of the wire into terminal C4 on the 96-pin female DIN connector on the rear of the terminal block. Attach the other end of this wire to the positive input terminal of the calibrated DMM.

   b. Connect the negative input terminal of the calibrated DMM to the negative terminal of the +5 VDC power supply.

3. Place the terminal block in a temperature-controlled environment where the temperature is between 15 and 35 °C.

4. When the terminal block temperature stabilizes at the ambient temperature, measure the temperature sensor output V_{meas} using a calibrated DMM.

5. Measure the actual temperature T_{act} in the temperature-controlled environment using a calibrated thermometer.

6. Convert V_{meas} (in volts) to measured temperature T_{meas} (in degrees Celsius) by performing the following calculations:

   a. Calculate

$$x = \frac{2.5 - V_{meas}}{5000}$$

   b. Calculate

$$y = \ln\left(\frac{V_{meas}}{x}\right)$$

c. Calculate

$$T_{meas} = \left(\frac{1}{a + y(b + cy^2)}\right) - 273.15$$

where T_{meas} is in degrees Celsius

$a = 1.295361 \times 10^{-3}$

$b = 2.343159 \times 10^{-4}$

$c = 1.018703 \times 10^{-7}$

7. Compare T_{act} to T_{meas}.
   - If $(T_{meas} - 0.5\ °C) \leq T_{act} \leq (T_{meas} + 0.5\ °C)$, the performance of the terminal block temperature sensor has been verified.
   - If T_{act} is not within this range, the terminal block temperature sensor is nonfunctional.

If this procedure determined that the temperature sensor is nonfunctional, do not attempt to substitute parts or modify the equipment. Return the terminal block to NI to ensure that the safety features of the terminal block are not compromised. For information about contacting NI about returning the terminal block, refer to the *Technical Support Information* document.

You have completed verifying the performance of the temperature sensor of the SCXI-1313A terminal block.