# SCXI™-1313 High-Voltage Attenuator Terminal Block

## Introduction

This document contains information and step-by-step instructions for verifying the performance of the resistor divider networks and the temperature sensor on the National Instruments SCXI-1313 high-voltage attenuator terminal block. The resistor divider networks provide the attenuation that allows the SCXI-1125 module to read large signals of up to 300 $V_{meas}$.

### What Is Calibration?

*Calibration* consists of verifying the measurement accuracy of a device and correcting for any measurement error. For SCXI-1313 terminal blocks, calibration is simply verifying the measurement accuracy of the components on the terminal block. Because these components are not user-adjustable, calibration consists of verification only, without correcting for any error. *Verification* is measuring the performance of a device and comparing the results to the factory specifications of the device.

### Why Should You Verify?

The accuracy of electronic components drifts with time and temperature, which can affect measurement accuracy as the device ages. Verification ensures that your SCXI-1313 terminal block still meets its specifications. If the results of the procedure indicate that the resistor networks or the temperature sensor on your terminal block are out of specification, return the terminal block to NI for repair or replacement.

### How Often Should You Verify?

The measurement accuracy requirements of your application determine how often you should verify the performance of your SCXI-1313 terminal block. NI recommends that you verify your terminal block at least once



every year. You can shorten this interval to six months or 90 days, based on the demands of your application.

# Equipment and Other Test Requirements

This section describes the equipment, software, documentation, and test conditions required for verifying the performance of your SCXI-1313 terminal block.

## Test Equipment

Verification 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 thermometer that is accurate to within 0.1 °C.

NI recommends you use the following instruments for verifying the performance of your SCXI-1313 terminal block:

- Calibrator—Fluke 5700A
- DMM—NI 4060 or HP 34401A

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

## Software and Documentation

You can find all the necessary information to verify the performance of the SCXI-1313 in this verification procedure. No other software or documentation is required. If you would like more information on the SCXI-1313, refer to the *SCXI-1313 Terminal Block Installation Guide*, which you can download from the NI Web site at `ni.com/manuals`.

## Test Conditions

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

- Keep connections to the SCXI-1313 terminal block short. Long cables and wires act as antennae, picking up extra noise that can affect measurements.
- Use shielded copper wire for all cable connections to the device. Use twisted-pair wire to eliminate noise and thermal offsets.
- Keep relative humidity below 80%.
- Maintain a temperature between 15 and 35 °C.

# Verification Procedures

This section contains step-by-step instructions for verifying the performance of the resistor divider networks and the temperature sensor on your SCXI-1313 terminal block.

## Verifying Resistor Divider Networks

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

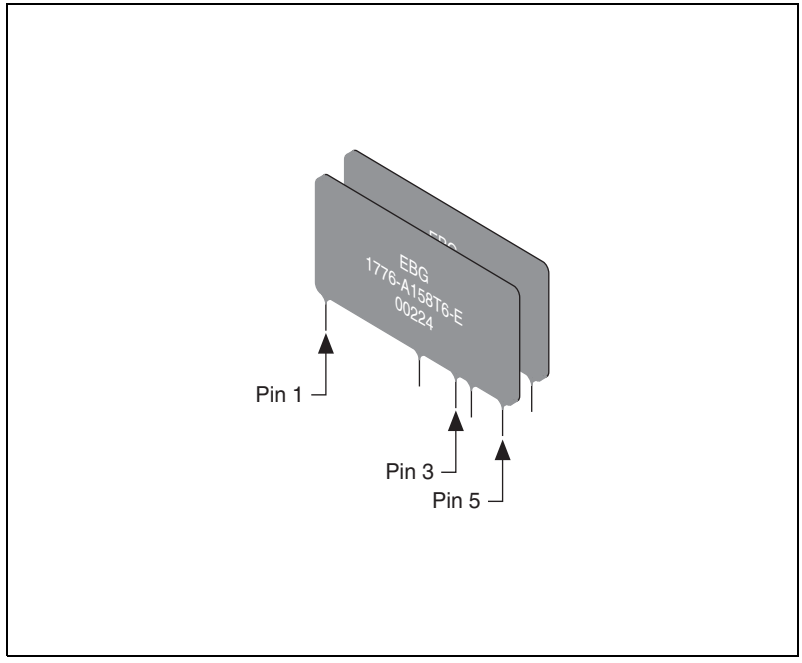
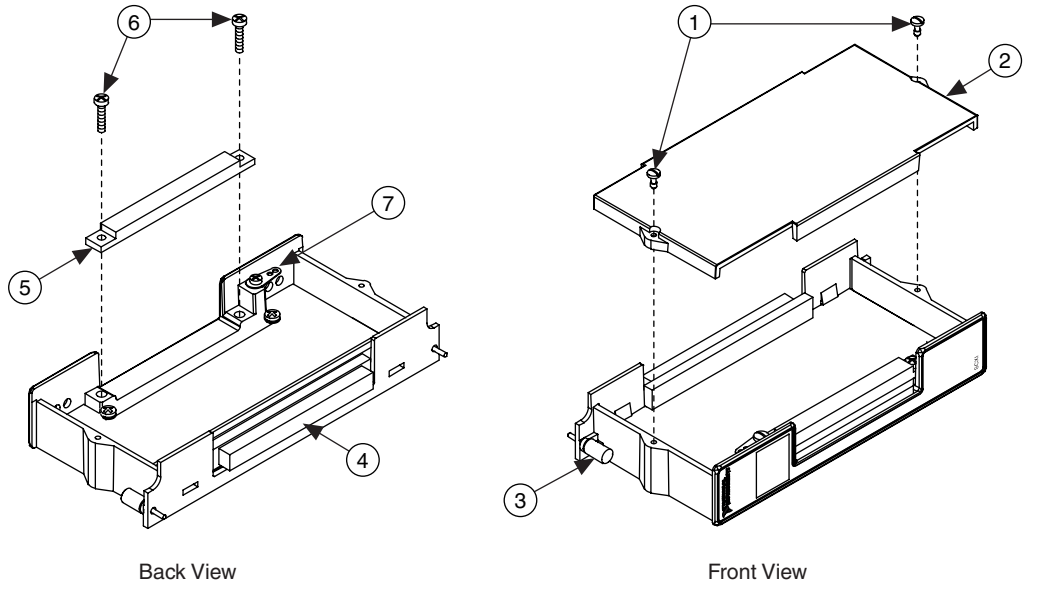



**Figure 1.** SCXI-1313 Resistor Network Pin Designations

1. Set your DMM for resistance measurement. To access the pins of the resistor networks, you need to remove the device from its casing. Refer to Figure 1 to locate the parts and do the following:
   a. Removing the two screws located on the outside of the casing. Figure shows the location of these screws.
   b. Remove the two screws holding the strain relief bar and remove the bar.

c. Remove the two screws that attach the device to the casing.

d. Take the board out of the casing and turn it over to the back side. The pins of the resistor networks should be protruding slightly from the back of the board.




| | | | |
|---|---|---|---|
| 1 Top Cover Screws<br>2 Top Cover | 3 Thumbscrew<br>4 Mating Connector | 5 Strain-Relief Bar<br>6 Strain-Relief Screws | 7 Safety-Ground Lug |

**Figure 2.** SCXI-1313 Parts Locator Diagram

2. Measure the resistance of each of the eight resistor networks on your device:

   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.

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):
   a. If $0.0099940 \leq Ratio_n \leq 0.0100060$, you have verified the performance of the resistor network $RP_n$.
   b. If $Ratio_n < 0.0099940$, the performance of the resistor divider network is out of specification.
   c. If $Ratio_n > 0.0100060$, the performance of the resistor divider network is out of specification. After you have verified all eight resistor networks, you have completed the verification procedure for the resistor networks. If this procedure determined that any of the components are out of specification, do not attempt any adjustments. Return your device to NI to ensure that the safety features of your device are not compromised.

You have completed verifying the performance of the resistor divider networks on your SCXI-1313 terminal block. Continue to the next section to verify the performance of the temperature sensor.

## Verifying Temperature Sensor Performance

Complete the following steps to verify the performance of the temperature sensor on your terminal block:

1. Connect a +5 VDC power source to the terminal block.
   a. Hold the terminal block vertically upright and view it from the rear. 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 3 for the pin assignments on the SCXI-1313. 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 for this connector.

   b. Strip 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 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 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 with its surroundings, measure the temperature sensor output $V_{\mathbf{meas}}$ using a calibrated DMM.

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

6. Convert $V_{\mathbf{meas}}$ (in volts) to measured temperature $T_{\mathbf{meas}}$ (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

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

where $\mathbf{T_{meas}}$ 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 $T_{act} < (T_{meas} - 0.5\ °C)$, the terminal block temperature sensor is nonfunctional. Do not substitute parts or modify equipment. Return the terminal block to NI for repair to ensure that the safety features are not compromised.
   - If $T_{act} > (T_{meas} + 0.5\ °C)$, the terminal block temperature sensor is nonfunctional. Do not substitute parts or modify equipment. Return the terminal block to NI for repair to ensure that the safety features are not compromised.

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

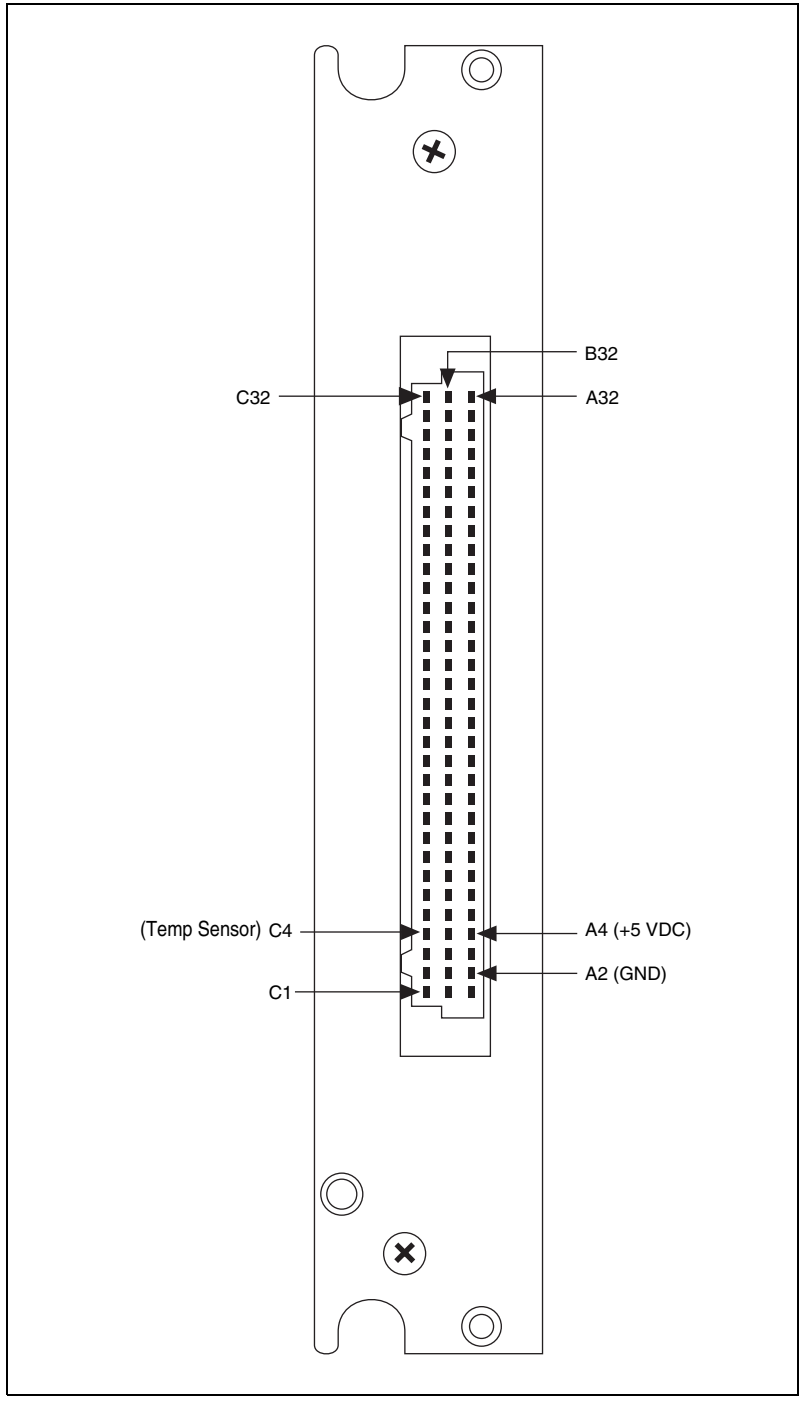



**Figure 3.** SCXI-1313 Connector Pin Assignments