SCXI™-1321 TERMINAL BLOCK

Introduction

This document contains information and step-by-step instructions for verifying the temperature sensor performance and the value of shunt calibration resistors of the National Instruments SCXI-1321 terminal block.

What Is Calibration?

For SCXI-1321 terminal blocks, calibration is simply determining the measurement accuracy of the components on the terminal block. Because these components are not user-adjustable, calibration consists of a verification procedure only.

Why Calibrate?

Electronic components drift with time, which can affect measurement accuracy as the device ages. Calibration ensures that your SCXI-1321 terminal block still meets National Instruments standards. If the results of the procedure indicate that your terminal block is out of specification, return it to National Instruments for repair.

How Often Should You Calibrate?

The measurement accuracy requirements of your application determine the calibration interval of your SCXI-1321 terminal block. National Instruments recommends you perform a complete calibration 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 verification.

Test Equipment

Verification requires a high-precision voltage source with at least 50 ppm accuracy, and a multiranging 5 1/2 digit digital multimeter (DMM) with 15 ppm accuracy.

National Instruments recommends you use the following instruments for verification of your SCXI-1321:

- Calibrator—Fluke 5700A
- DMM—NI 4060 or HP34401A

If the exact instrument is not available, use the accuracy requirements listed above to select a substitute calibration standard.

Software and Documentation

No software is required to verify the operation of the SCXI-1321. You can find all the necessary information in this calibration procedure. However, if you would like more information on the product, refer to the *SCXI-1321 Terminal Block Installation Guide*.

Test Conditions

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

- Keep connections to the SCXI-1321 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 temperature between 15 °C and 35 °C.

Verification Procedures

This section contains step-by-step instructions for verifying the performance of the temperature sensor and the value of the shunt-calibration resistors of your SCXI-1321 terminal block.

Verifying Temperature Sensor Performance

Complete the following steps to verify the performance of the temperature sensor on your SCXI-1321 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 for the purposes of this procedure:
      – 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.

      Individual pins are identified by their column and row. For example, "A3" denotes the terminal located in Column A and Row 3. This corresponds to the labeling of the pins on the front connector of a matching 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.
   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 °C and 35 °C.
4. When the terminal block temperature has equilibrated with its surroundings, measure the temperature sensor output $\mathbf{V_{meas}}$ using a calibrated DMM.
5. Measure the actual temperature $\mathbf{T_{act}}$ in the temperature-controlled environment using a calibrated instrument.
6. Convert $\mathbf{V_{meas}}$ (in volts) to measured temperature $\mathbf{T_{meas}}$ (in degrees Celsius) by multiplying $\mathbf{V_{meas}}$ by 100.
7. Compare $\mathbf{T_{act}}$ to $\mathbf{T_{meas}}$.
   a. If $(\mathbf{T_{meas}} - 0.9\ °C) \leq \mathbf{T_{act}} \leq (\mathbf{T_{meas}} + 0.9\ °C)$, the operation of the temperature sensor has been verified.
   b. If $\mathbf{T_{act}} < (\mathbf{T_{meas}} - 0.9\ °C)$, the temperature sensor is nonfunctional. Repair or replace the terminal block.
   c. If $\mathbf{T_{act}} > (\mathbf{T_{meas}} + 0.9\ °C)$, the temperature sensor is nonfunctional. Repair or replace the terminal block.

You have completed the procedure for verifying the operation of the temperature sensor on the SCXI-1321 terminal block.

Verifying the Value of the Shunt-Calibration Resistors

Complete the following steps to verify the value of the shunt-calibration resistors on your SCXI-1321 terminal block:

1. Open the terminal block enclosure by removing the side cover.
2. Place nulling-circuit jumpers W1 through W4 in the “D” (disabled) position.
3. Locate R4 on the printed circuit board. R4 is a socketed resistor used for shunt calibration of channel 0. National Instruments provides the SCXI-1321 terminal block to users with a 301 kΩ, 1% tolerance resistor installed. However, users are free to replace this resistor with another one having different resistance or tolerance values. If R4 is not a 301 kΩ, 1% tolerance resistor, modify step 5 accordingly.
4. Using a calibrated DMM, measure the resistance of R4.
5. Determine if the value of the shunt-calibration resistor meets the specification.
   a. If $301\ k\Omega - \{0.01 \times 301\ k\Omega\} \leq R4 \leq 301\ k\Omega + \{0.01 \times 301\ k\Omega\}$, the value of the shunt-calibration resistor has been verified.
   b. If $R4 < 301\ k\Omega - \{0.01 \times 301\ k\Omega\}$, the shunt-calibration resistor is out of specification. Return it to National Instruments for repair or replacement.

c. If R4 > 301 kΩ + {0.01 × 301 kΩ}, the shunt-calibration resistor is out of specification. Return it to National Instruments for repair or replacement.

6. Repeat steps 3 through 5 for the remaining shunt-calibration resistors:
   a. R6 (channel 1)
   b. R8 (channel 2)
   c. R10 (channel 3)
7. Close the terminal block enclosure by attaching the side cover.

You have completed the procedure for verifying the value of the shunt-calibration resistors on your SCXI-1321.