SCXI™-1303 TERMINAL BLOCK

Introduction

This document contains information and step-by-step instructions for verifying the performance of the temperature sensor on the National Instruments SCXI-1303 terminal block. This temperature sensor is for cold-junction compensation of thermocouples on the terminal block.

What Is Calibration?

Calibration consists of verifying the measurement accuracy of a device and correcting for any measurement error. For SCXI-1303 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-1303 terminal block still meets National Instruments standards. If the results of the procedure indicate that the temperature sensor on your terminal block is out of specification, return the sensor to National Instruments 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-1303 terminal block. National Instruments recommends 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-1303 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.

National Instruments recommends you use the following instruments for verifying the performance of your SCXI-1303 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-1303 in this verification procedure. No other software or documentation is required. If you would like more information on the SCXI-1303, refer to the *SCXI-1303 Terminal Block Installation Guide*, which you can download from the National Instruments 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-1303 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 Procedure

This section contains step-by-step instructions for verifying the performance of the temperature sensor on your SCXI-1303 terminal block.

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.

      Figure 1 illustrates the connector pin assignments. 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.

   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 A1 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. Refer to Figure 2 to locate jumper W1 on your terminal block and verify that MTEMP is jumpered.
   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 A3 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.
   c. 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 equilibrates with its surroundings, 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

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

   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 $T_{act} < (T_{meas} - 0.5\ °C)$, the terminal block temperature sensor is nonfunctional. Do not substitute parts or modify equipment. Return the terminal block to National Instruments 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 National Instruments to ensure that the safety features are not compromised.
8. Return jumper W1 to its original position.

You have completed verifying the performance of the temperature sensor of your SCXI-1303 terminal block.

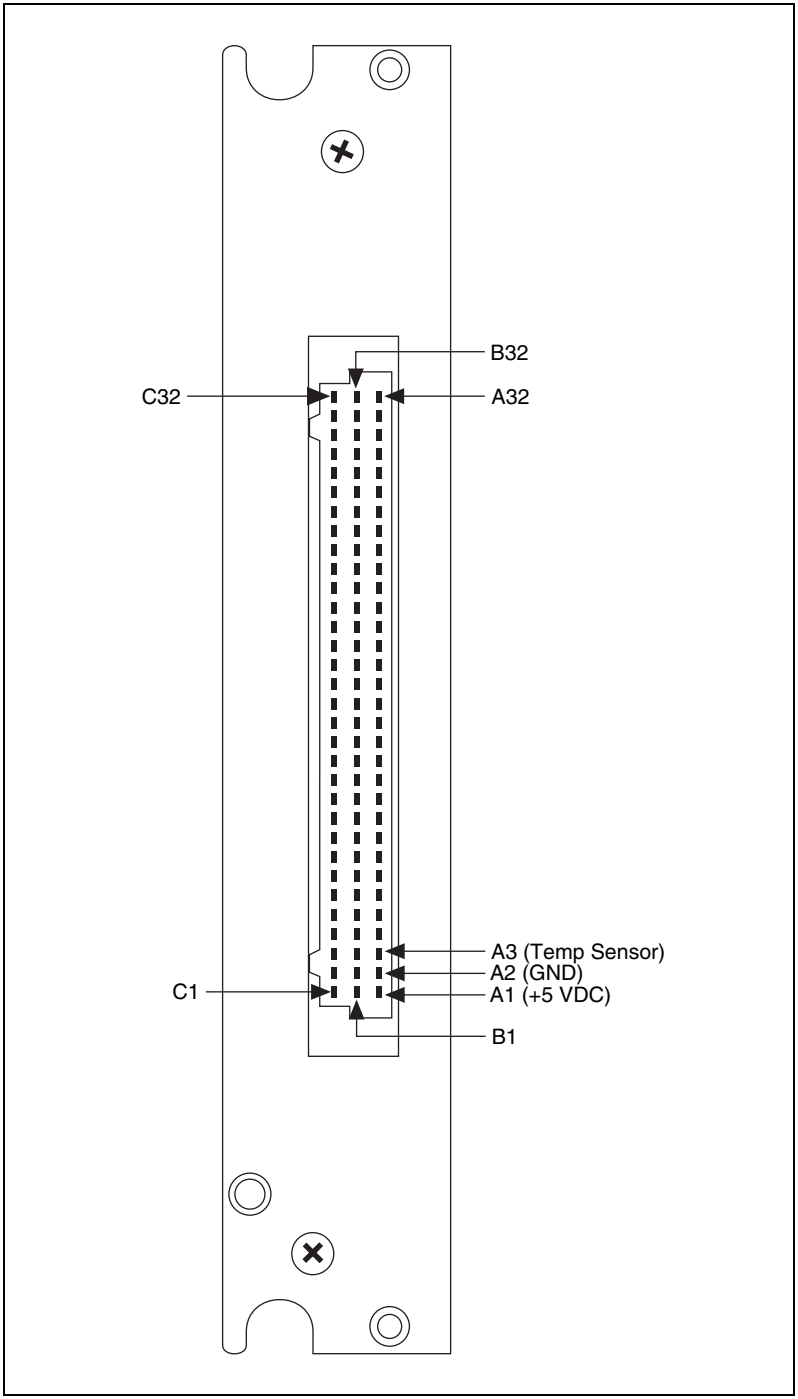

Figure 1. SCXI-1303 Front Connector Pin Assignments

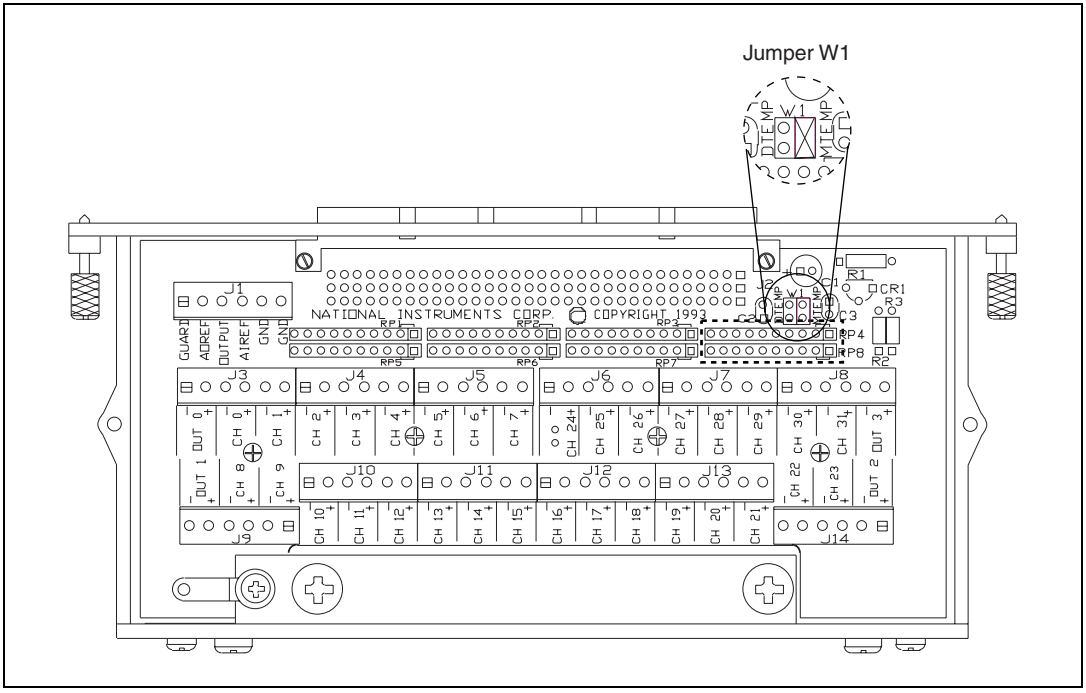

Figure 2. Location of Jumper W1 on the SCXI-1303 Terminal Block