

CB-27T TERMINAL BLOCK

Introduction

This document contains information and step-by-step instructions for verifying the performance of the temperature sensor on the National Instruments CB-27T 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 adjusting for any measurement error. *Verification* is measuring performance of a device and comparing the results to the factory specifications. Because the CB-27T terminal block is not user-adjustable, calibrating this device consists of verifying the performance only, without correcting for any error.

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 CB-27T terminal block still meets NI standards. If the results of the procedure indicate that the temperature sensor on your terminal block is out of specification, return the terminal block 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 CB-27T 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 CB-27T terminal block.

Test Equipment

Verification requires a multiranging 5 1/2 digit digital multimeter (DMM) with 120 ppm accuracy that can perform a 5 to 10 k Ω 4-wire resistance measurement with an excitation current of 100 μ A or less.

NI recommends that you use the following equipment for verifying the performance of your CB-27T terminal block:

- DMM—HP 34401A
- 0.76 mm pin connection adapters—Pomona Electronics 4690
- A thermometer that is accurate to within 0.01 °C

If an HP 34401A is 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 CB-27T in this verification procedure. No other software or documentation is required. If you would like more information on the CB-27T, refer to the *CB-27T Terminal Block Installation Guide*, which you can download free of charge 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 CB-27T 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.

Verifying Temperature Sensor Performance

Complete the following steps to verify the performance of the temperature sensor on your CB-27T terminal block:

1. Move the IEX switch to the OFF position. Figure 1 shows the location of the IEX switch.

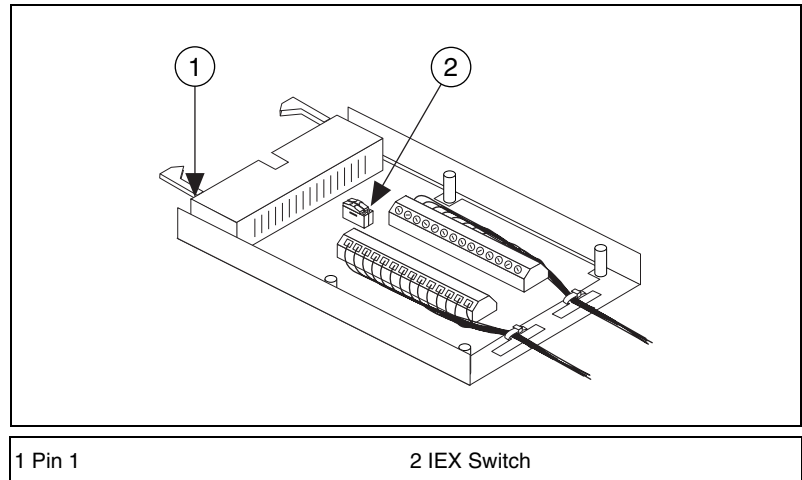


Figure 1. CB-27T IEX Switch

2. Connect the excitation leads of the DMM to the terminal block.
 - a. Hold the terminal block horizontally and view the connector so that pin 1 is in the upper-right corner. Figure 1 shows the location of pin 1 on the terminal block. Figure 2 shows the connector pin assignments.
 - b. Attach a wire to pin 18 of the connector block. Attach the other end of this wire to the positive terminal of the 25 μA current source of the DMM.
 - c. Attach a wire to pin 19 of the connector block. Attach the other end of this wire to the negative terminal of the 25 μA current source of the DMM.

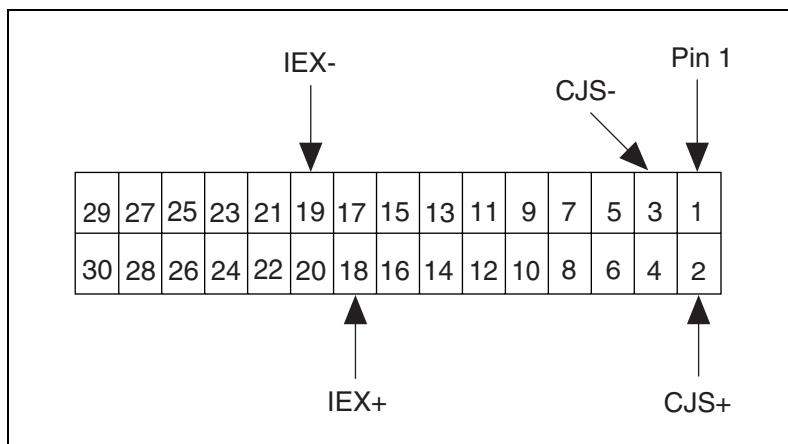


Figure 2. CB-27T Connector Block

3. Connect the sense leads of the DMM to the temperature-sensor output of the terminal block.
 - a. Attach a wire to pin 2 of the connector block. Attach the other end of this wire to the positive input terminal of the DMM.
 - b. Attach a wire to pin 3 of the connector block. Attach the other end of this wire to the negative input terminal of the DMM.
4. Place the terminal block in a temperature-controlled environment where the temperature is between 15 and 35 °C.
5. When the terminal block temperature stabilizes with its surroundings, measure the resistance of the temperature sensor R_{meas} using a calibrated DMM.
6. Measure the actual temperature T_{act} in the temperature-controlled environment using a calibrated thermometer.
7. Convert R_{meas} (in ohms) to measured temperature T_{meas} (in degrees Celsius) by performing the following calculations:
 - a. Calculate:

$$y = \ln(R_{\text{meas}})$$

- b. Calculate:

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

T_{meas} is in degrees Celsius and

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

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

$$c = 1.018793 \times 10^{-7}$$

8. Compare T_{act} to T_{meas}

- If $(T_{\text{meas}} - 0.06\text{ }^{\circ}\text{C}) \leq T_{\text{act}} \leq (T_{\text{meas}} + 0.06\text{ }^{\circ}\text{C})$, you have verified the performance of the terminal block temperature sensor.
- If $T_{\text{act}} < (T_{\text{meas}} - 0.06\text{ }^{\circ}\text{C})$, the terminal block temperature sensor is nonfunctional. Return the terminal block to NI for repair or replacement.
- If $T_{\text{act}} > (T_{\text{meas}} + 0.06\text{ }^{\circ}\text{C})$, the terminal block temperature sensor is nonfunctional. Return the terminal block to NI for repair or replacement.

You have completed verifying the performance of the temperature sensor on your CB-27T terminal block.