SCXI-1328 High-Accuracy Isothermal Terminal Block

This guide describes how to install and use the SCXI-1328 high-accuracy isothermal terminal block with the SCXI-1120, SCXI-1120D, and SCXI-1121 modules.

Introduction

The SCXI-1328 high-accuracy isothermal terminal block consists of a shielded board with screw terminals to connect to the SCXI module input connector. The SCXI-1328 has a high-precision thermistor and an aluminum isothermal plate to minimize the temperature gradients across the screw terminals when you measure thermocouples.

The terminal block has 18 screw terminals for easy connection. One pair of screw terminals connects to the SCXI module chassis ground. With the SCXI-1120/D, the remaining eight pairs of screw terminals are for signal connection to the eight module inputs. With the SCXI-1121, four pairs of screw terminals are for the four module inputs and four pairs are for the module excitation channels.

What You Need to Get Started

- SCXI-1328 terminal block
- *SCXI-1328 High-Accuracy Isothermal Terminal Block Installation Guide*
- SCXI chassis
- SCXI-1120, SCXI-1120D, or SCXI-1121 module
- No. 1 and No. 2 Phillips-head screwdrivers
- 0.125 in. flathead screwdriver
- Long-nose pliers

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- Wire cutters
- Wire insulation stripper

If your kit is missing any components, contact National Instruments.

Safety Information

Cautions ***DO NOT OPERATE THE DEVICE IN AN EXPLOSIVE ATMOSPHERE OR WHERE THERE MAY BE FLAMMABLE GASES OR FUMES.***

KEEP AWAY FROM LIVE CIRCUITS. Do not remove equipment covers or shields unless you are trained to do so. If signal wires are connected to the device, hazardous voltages may exist even when the equipment is turned off. To avoid a shock hazard, do not perform procedures involving cover or shield removal unless you are qualified to do so and disconnect all field power prior to removing covers or shields.

Equipment described in this document must be used in an Installation Category II environment per IEC 664. This category requires local level supply mains-connected installation.

DO NOT OPERATE DAMAGED EQUIPMENT. The safety protection features built into this device can become impaired if the device becomes damaged in any way. If the device is damaged, turn the device off and do not use until service-trained personnel can check its safety. If necessary, return the device to National Instruments for service and repair to ensure that its safety is not compromised.

Do not operate this equipment in a manner that contradicts the information specified in this document. Misuse of this equipment could result in a shock hazard.

Terminals are for use only with equipment that has no accessible live parts.

DO NOT SUBSTITUTE PARTS OR MODIFY EQUIPMENT. Because of the danger of introducing additional hazards, do not install unauthorized parts or modify the device. Return the device to National Instruments for service and repair to ensure that its safety features are not compromised.

When using the device with high common-mode voltages, you MUST insulate your signal wires for the highest input voltage. National Instruments is NOT liable for any damages or injuries resulting from inadequate signal wire insulation. Use only 26-14 AWG wire with a voltage rating of 300 V and 60° C for measuring 250 to 300 V.

When connecting or disconnecting signal lines to the SCXI terminal block screw terminals, make sure the lines are powered off. Potential differences between the lines and the SCXI ground create a shock hazard while you connect the lines.

Connections, including power signals to ground and vice versa, that exceed any of the maximum signal ratings on the SCXI device can create a shock or fire hazard or can damage any or all of the boards connected to the SCXI chassis, the host computer, and the SCXI device. National Instruments is NOT LIABLE FOR ANY DAMAGES OR INJURIES resulting from incorrect signal connections.

If high voltages (≥30 Vrms and 42.4 V peak or 60 VDC) are present, YOU MUST CONNECT A SAFETY EARTH GROUND WIRE TO THE TERMINAL BLOCK SAFETY GROUND SOLDER LUG, shown in Figure 1. This complies with safety agency requirements and protects against electric shock when the terminal block is not connected to the chassis. To connect the safety earth ground to the safety ground solder lug, run an earth ground wire in the cable from the signal source to the terminal block. National Instruments is NOT liable for any damages or injuries resulting from inadequate safety earth ground connections.

Do not loosen or re-orient the safety ground solder lug hardware when connecting the safety ground wire; to do so reduces the safety isolation between the high voltage and safety ground.

Clean devices and terminal blocks by brushing off light dust with a soft, nonmetallic brush. Remove other contaminants with deionized water and a stiff nonmetallic brush. The unit must be completely dry and free from contaminants before returning to service.

Temperature Sensor and Jumper Configuration

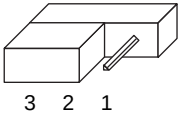
To accommodate thermocouples with the SCXI-1120/D and SCXI-1121 modules, the terminal block has a high-accuracy temperature sensor for cold-junction compensation.

SCXI-1120/D Connection

You can connect the temperature sensor to the SCXI-1120/D module in either of two ways:

- Multiplexed Temperature Sensor (MTS) mode—Set terminal block jumper W1, shown in Table 2, to the MTEMP position. This mode connects the temperature sensor to the MTEMP pin (C4) on the module front connector and multiplexes the sensor output at the module output multiplexer along with the amplifier outputs. This is the factory setting.
- Direct Temperature Sensor (DTS) mode—Set terminal block jumper W1 to the DTEMP position. This mode connects the temperature sensor to a separate data acquisition channel via pin 18 (MCH7–) on the module rear signal connector when you set module jumper W41 to position 3, as shown in Table 1.

Table 1. SCXI-1120/D Jumper W41 Configuration

SCXI-1120/D Jumper W41 Position	Description
	Configures the temperature sensor for the DTS mode

In both MTS and DTS modes, the reference to the temperature sensor signal is the SCXI-1120/D analog ground that is connected to MCH0– in MTS mode, or to OUTREF or AOGND (with module jumper W46 set in position AB-R2 or AB-R0, respectively) in DTS mode.

SCXI-1121 Connection

You can connect the temperature sensor to the SCXI-1121 module in either of two ways:

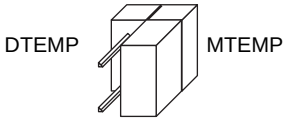
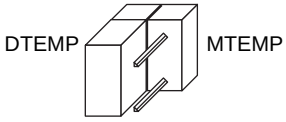
- Multiplexed Temperature Sensor (MTS) mode—Set terminal block jumper W1, shown in Table 2, to the MTEMP position. This mode connects the temperature sensor to the MTEMP pin (C4) on the module front connector and multiplexes the sensor at the module output multiplexer along with the amplifier outputs. This is the factory setting.
- Direct Temperature Sensor (DTS) mode—Set terminal block jumper W1 to the DTEMP position. This mode connects the temperature sensor to a separate data acquisition channel via MCH4± (pins 11 and 12) on the module rear signal connector.

In both the MTS and DTS modes, the reference to the temperature sensor signal is SCXI-1121 analog ground connected to MCH0– in MTS mode or to MCH4– in DTS mode (jumper W1 in DTEMP position connects MCH4+ to the temperature sensor). Notice that MCH4– is continuously connected to SCXI-1121 ground, whereas MCH0– is switched through the output multiplexer.

Terminal Block Jumper Configuration

One jumper block comprises both the MTEMP and DTEMP positions; thus, you can use only one configuration at a time. The parking position for the jumper block is the MTEMP position; the temperature sensor is disabled until the RTEMP bit in the Configuration Register selects the sensor (MTS mode only). Table 2 shows the terminal block jumper settings.

Table 2. Jumper Settings on the SCXI-1328 Terminal Block

Jumper W1 Position	Description	Temperature Sensor Connection	
		SCXI-1120/D	SCXI-1121
	MTS mode selected; factory setting; parking position	Connects the sensor output to the module output multiplexer	Connects the sensor output to the module output multiplexer
	DTS mode selected	Connects the sensor to the MCH7– signal on the module rear signal connector via module jumper W41	Connects the sensor to the MCH4+ signal on module rear signal connector

Temperature Sensor Output and Accuracy

The SCXI-1328 temperature sensor outputs 1.91 to 0.58 V from 0° to 55° C and has an accuracy of ±0.5° C over the 15° to 35° C range and ±0.9° C over the 0° to 15° and 35° to 55° C ranges[1].

National Instruments software can convert a thermistor voltage to the thermistor temperature for the circuit diagram shown later in this guide. In LabVIEW, you can use the Convert Thermistor Reading virtual instrument (VI) in the **Data Acquisition»Signal Conditioning** palette. If you are using LabWindows/CVI or NI-DAQ, use the Thermistor_Convert function. The VI takes the output voltage of the temperature sensor, the reference voltage, and the precision resistance and returns the thermistor temperature.

Alternatively, you can use the following formulas:

$$T(^\circ C) = T_K - 273.15$$

where T_K is the temperature in kelvin

$$T_K = \frac{1}{[a + b(\ln R_T) + c(\ln R_T)^3]}$$

[1] Includes the combined effects of the temperature sensor accuracy and the temperature difference between the temperature sensor and any screw terminal. The temperature sensor accuracy includes tolerances in all component values, the effects caused by temperature and loading, and self-heating.

$a = 1.295361 \times 10^{-3}$
$b = 2.343159 \times 10^{-4}$
$c = 1.018703 \times 10^{-7}$

R_T = resistance of the thermistor in ohms

$$R_T = 5,000\left(\frac{V_{TEMPOUT}}{2.5 - V_{TEMPOUT}}\right)$$

$V_{TEMPOUT}$ = output voltage of the temperature sensor

$$T(°F) = \frac{[T(°C)]9}{5} + 32$$

where T(° F) and T(° C) are the temperature readings in degrees Fahrenheit and degrees Celsius, respectively.

☞ **Note** ***Use an average of a large number of samples to obtain the most accurate reading. Noisy environments require more samples for greater accuracy.***

Signal Connection

☞ **Note** ***Refer to the*** *Safety Information* ***section before removing equipment covers or connecting or disconnecting any signal wires.***

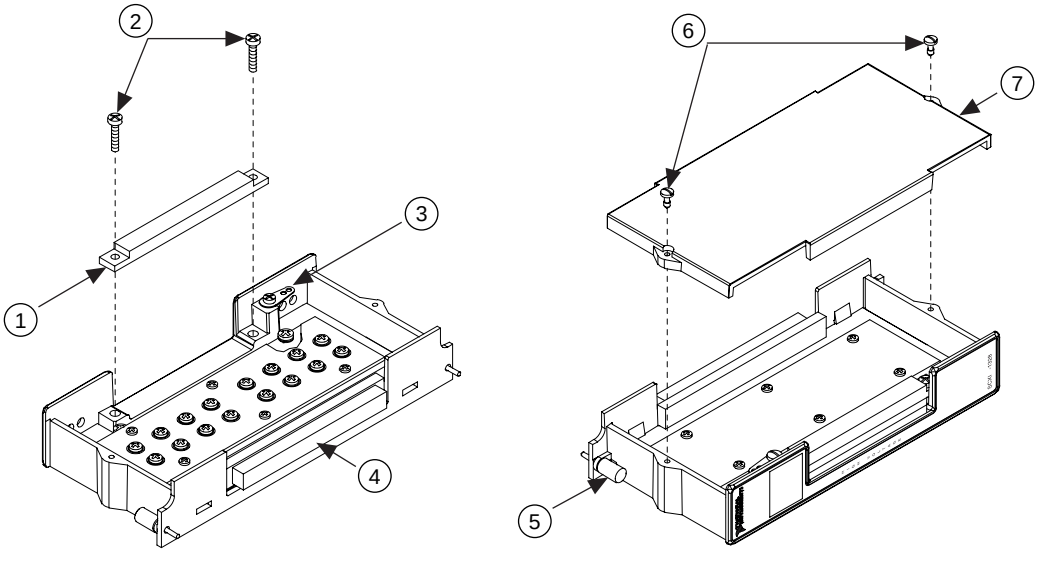
When connecting your signals to the SCXI-1328, follow the labeling on the SCXI-1328 for the appropriate module, as indicated in Figure 2.

To connect the signal to the terminal block, perform the following steps, referring to Figures 1 and 2 as necessary:

1. Unscrew the top cover screws and remove the cover.
2. Loosen the strain-relief screws and remove the strain-relief bar.
3. Run the signal wires through the strain-relief opening. You can add insulation or padding if necessary.
4. Prepare your signal wire by stripping the insulation no more than 12 mm.
5. Connect the wires to the screw terminals by wrapping the wires around the screw. No bare wire should extend past the screw head. Exposed wire reduces the safety isolation between the high voltage and safe low voltages.
6. Tighten the screws to a torque of 5–7 in.-lb.

7. Connect safety earth ground to the safety ground solder lug. Refer to the *Safety Information* section for connection information.
8. Reinstall the strain-relief bar and tighten the strain-relief screws.
9. Reinstall the top cover and tighten the top cover screws.
10. Connect the terminal block to the module front connector as explained in the *Installation* section later in this guide.

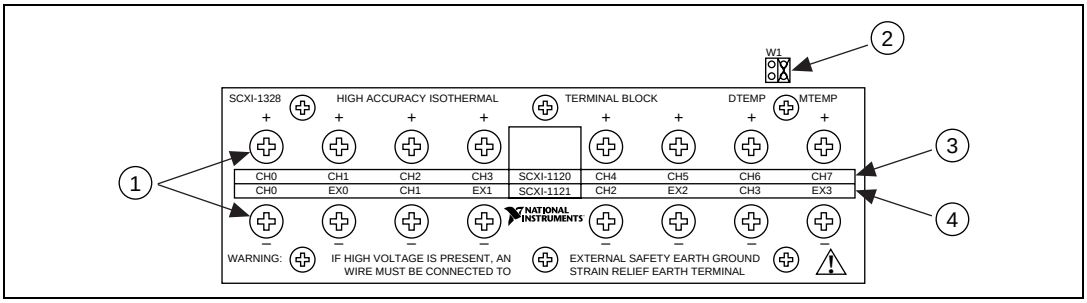
Figure 1 shows the SCXI-1328 terminal block parts locator diagram.



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

Figure 1. SCXI-1328 Parts Locator Diagram

Figure 2 shows the SCXI-1328 signal connections.



1	Screw Terminals	2	Berg Connector (W1)	3	Channel Labeling for the SCXI-1120/D	4	Channel Labeling for the SCXI-1121

Figure 2. SCXI-1328 Signal Connections

Installation

To connect the terminal block to the SCXI module front connector, perform the following steps:

1. Connect the module front connector to its mating connector on the terminal block.
2. Tighten the top and bottom thumbscrews on the back of the terminal block to hold it securely in place.

Note ***For accurate cold-junction compensation, place the SCXI chassis away from an extreme temperature differential.***

Specifications

Cold-junction sensor

Accuracy[2] .....0.5° from 15° to 35° C
0.9° from 0° to 15°
and 35° to 55° C

Repeatability.....0.2° from 15° to 35° C

Output.....1.91 to 0.58 V from 0° to 55° C

[2] Includes the combined effects of the temperature sensor accuracy and the temperature difference between the temperature sensor and any screw terminal. The temperature sensor accuracy includes tolerances in all component values, the effects caused by temperature and loading, and self-heating.

Temperature Sensor Circuit Diagram

You do not need to read this section to operate the SCXI-1328. The circuit diagram in Figure 3 is optional information you can use if you want more details about the SCXI-1328 temperature sensor.

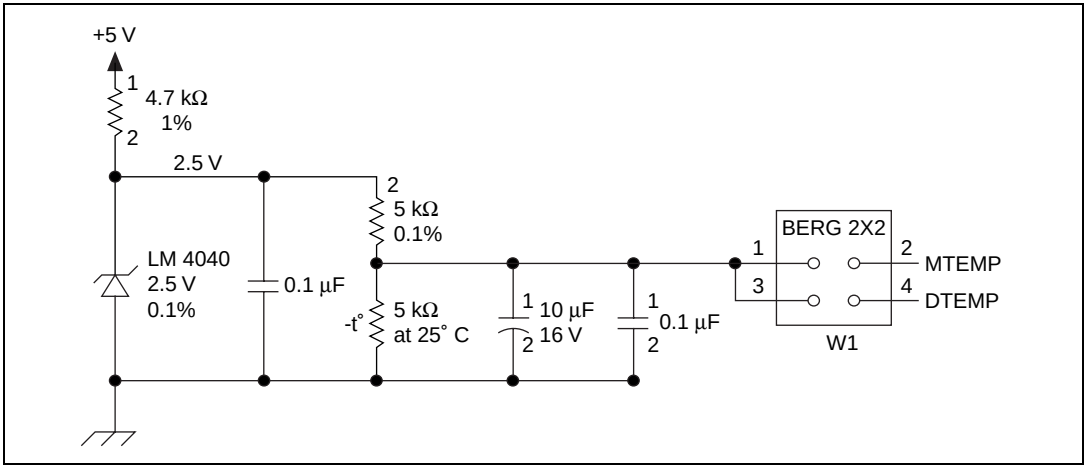


Figure 3. Temperature Sensor Circuit Diagram

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