SCXI-1327 High-Voltage Attenuator Terminal Block Installation Guide

Part Number 320624-01

This guide describes how to install and use the SCXI-1327 high-voltage attenuator terminal block with the SCXI-1120 and SCXI-1121 modules. In addition to the SCXI-1327 kit contents, you will need an SCXI chassis, an SCXI-1120 or SCXI-1121 module, Phillips-head number 1 and number 2 screwdrivers, a 0.125 in. flathead screwdriver, long-nose pliers, a wire cutter, and a wire insulation stripper.

Introduction

The SCXI-1327 high-voltage attenuator terminal block is a shielded board with screw terminals that connect to the SCXI-1120 or SCXI-1121 input connector. Each SCXI-1327 channel has a precision 100:1 resistive voltage divider that you can use to measure voltages of up to 250 Vrms. You can individually bypass these dividers for low-voltage measurement applications.

The terminal block has 18 screw terminals for easy connection. One pair of screw terminals connects to the SCXI-1120 or SCXI-1121 chassis ground. When used with the SCXI-1120, the remaining eight pairs of screw terminals are for signal connection to the eight module inputs. When used with the SCXI-1121, four pairs of SCXI-1327 screw terminals are for connecting signals from the four module inputs and four pairs of SCXI-1327 screw terminals are for connecting signals from the module excitation channels.

What Your Kit Should Contain

The SCXI-1327 terminal block kit (part number 776573-27) contains the following components:

Kit Component	Part Number
SCXI-1327 high-voltage attenuator terminal block	182375-01
SCXI-1327 High-Voltage Attenuator Terminal Block Installation Guide	320624-01

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

Temperature Sensor and Jumper Configuration

To accommodate thermocouples with the SCXI-1120 and SCXI-1121 modules, the SCXI-1327 terminal block has a high-accuracy temperature sensor for cold-junction compensation.

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SCXI-1120 Connection

You can connect the temperature sensor to the SCXI-1120 module in two ways:

- For Multiplexed Temperature Sensor (MTS) mode, set terminal block jumper W1 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 with the amplifier outputs. This is the factory-default setting.

- For 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 Jumper W41 Configuration

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

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

SCXI-1121 Connection

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

- For Multiplexed Temperature Sensor (MTS) mode, set terminal block jumper W1 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 with the amplifier outputs. This is the factory-default setting.

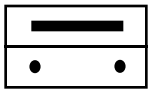
- For Direct Temperature Sensor (DTS) mode, set terminal block jumper W1 to the DTEMP position. This mode connects the temperature sensor to a separate data acquisition channel via pins 11 and 12 (MCH4±) on the module rear signal connector.

In both the MTS and DTS modes, the reference to the temperature sensor signal is the SCXI-1121 analog ground that is connected to MCH0- in the MTS mode or to MCH4- in the DTS mode. Jumper W1 in the DTEMP position connects MCH4+ to the temperature sensor (MTS mode only). Notice that MCH4- is continuously connected to the 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. Table 2 shows the terminal block jumper settings.

Table 2. Jumper Settings on the SCXI-1327 Terminal Block

Jumper W1 Position	Description	Temperature Sensor Connection	
		SCXI-1120	SCXI-1121
	MTS mode selected; factory-default 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-1327 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® 2.5.2 or later, you can use the Convert Thermistor virtual instrument (VI) from the **DAQ Utilities** menu. The VI takes the output voltage of the temperature sensor, the reference voltage, and the precision resistance, and returns the thermistor temperature.

You can also determine the temperature using the following formulas:

$$T(°C) = T_K - 273.15$$

where T_K is the temperature in Kelvin.

To determine the temperature in Kelvin, use the Steinhart-Hart equation:

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

[1]The temperature sensor accuracy includes tolerances in all component values, 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 Ω

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

$V_{TEMPOUT}$ = 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 the average of a large number of samples to obtain the most accurate reading. Noisy environments require more samples for greater accuracy.***

High-Voltage Attenuator Configuration

Each channel has a 100:1 high-voltage attenuator that you can enable or disable by changing switch settings as shown in Figure 1. Each channel requires two switches that must be in the same position for the attenuator to operate correctly. The switches are behind their corresponding terminals.

- Set both switches to the 100:1 position to attenuate the appropriate channel. This setting places a precision 100:1 divider in the circuit to divide the voltage by 100 before the voltage enters the module.
- Set both switches to the 1:1 position to bypass the attenuator of the appropriate channel. This setting removes the 100:1 divider from the input stage.

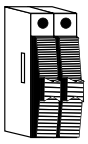
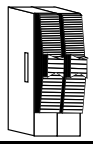
Switch Position	Description
	Bypasses the attenuator for a specific channel.
	Enables the attenuator for a specific channel. Factory setting.

Figure 1. SCXI-1327 High-Voltage Attenuator Configuration

Note: ***For correct operation with the SCXI-1121 module, you must disable the attenuators on the excitation channels.***

Signal Connection

The following warnings contain important safety information concerning hazardous voltages and terminal blocks.

Warnings: ***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 module or terminal block, dangerous voltages may exist even when the equipment is turned off. To avoid dangerous electrical shock, do not perform procedures involving cover or shield removal unless you are qualified to do so. Before you remove the cover, disconnect the AC power or any live circuit from the terminal block.***

When using the terminal block with high common-mode voltages, you MUST insulate your signal wires appropriately. National Instruments is not liable for any damages or injuries resulting from inadequate signal wire insulation.

The chassis GND terminals on your terminal block are for grounding high-impedance sources such as a floating source (1 mA maximum). Do NOT use these terminals as safety earth grounds.

If high voltages (≥42 Vrms) are present, YOU MUST CONNECT THE SAFETY EARTH GROUND TO THE STRAIN-RELIEF TAB. This complies with UL 1244 and protects against electric shock when the terminal block is not connected to the chassis. To connect the safety earth ground to the strain-relief tab, 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.

When connecting your signals to the SCXI-1327 high-voltage attenuator terminal block for use with the SCXI-1120 or SCXI-1121, follow the labeling on the SCXI-1327 indicated along the appropriate module type row as indicated in the parts locator diagram of this guide.

To connect the signal to the terminal block, perform the following steps:

1. Remove the grounding screw of the top cover with a Phillips-head number 1 screwdriver.

2. Snap out the top cover of the shield by placing the flathead screwdriver in the groove at the bottom of the terminal block.

3. Enable or bypass each of the attenuators, depending on the signal you are measuring.

   Note: ***For correct operation of the SCXI-1121 excitation channels, disable the attenuators on the excitation channels when you are using the SCXI-1327 with the SCXI-1121.***

4. After loosening the strain-relief screws with a Phillips-head number 2 screwdriver, slide the signal wires one at a time through the front panel strain-relief opening. Add insulation or padding if necessary.

5. Connect the wires to the screw terminals by inserting the wires into the terminals and tightening the screws without letting the wires slip out of the strain relief bar.

6. Tighten the larger strain-relief screws.

7. Snap the top cover back into place.

8. Reinsert the grounding screw to ensure proper shielding.

9. You can now connect the terminal block to the module front connector as explained in the *Installation* section of this guide.

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. Make sure that the module top and bottom thumbscrews do not obstruct the rear panel of the terminal block.

3. Tighten the top and bottom screws on the back of the terminal block to hold it securely in place.

Note: ***To minimize the temperature gradient inside the terminal block, move the SCXI chassis away from any extreme temperature differential.***

Figure 2 shows the SCXI-1327 terminal block parts locator diagram.

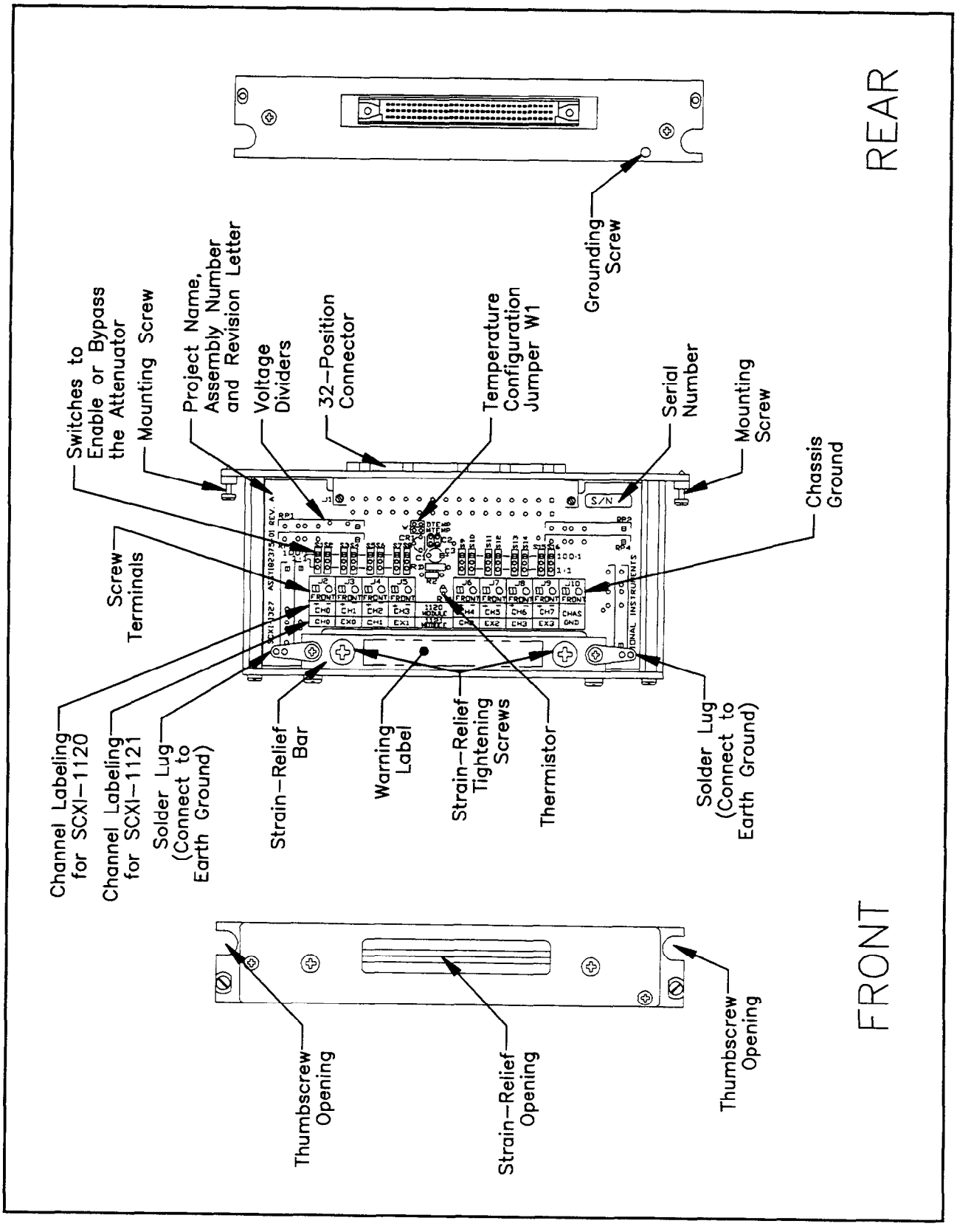


Figure 2. SCXI-1327 Parts Locator Diagram

Specifications

All specifications are typical at 25° C unless otherwise specified.

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
High-voltage divider	
Accuracy	0.06%
Drift	15 ppm/°C
Maximum voltage between any terminals or to earth	250 Vrms
Resistance	1 MΩ

Temperature Sensor Circuit Diagram

You do not need to read this section to operate the SCXI-1327. The circuit diagram in Figure 3 is optional information that you can use if you want more details about the SCXI-1327 temperature sensor.

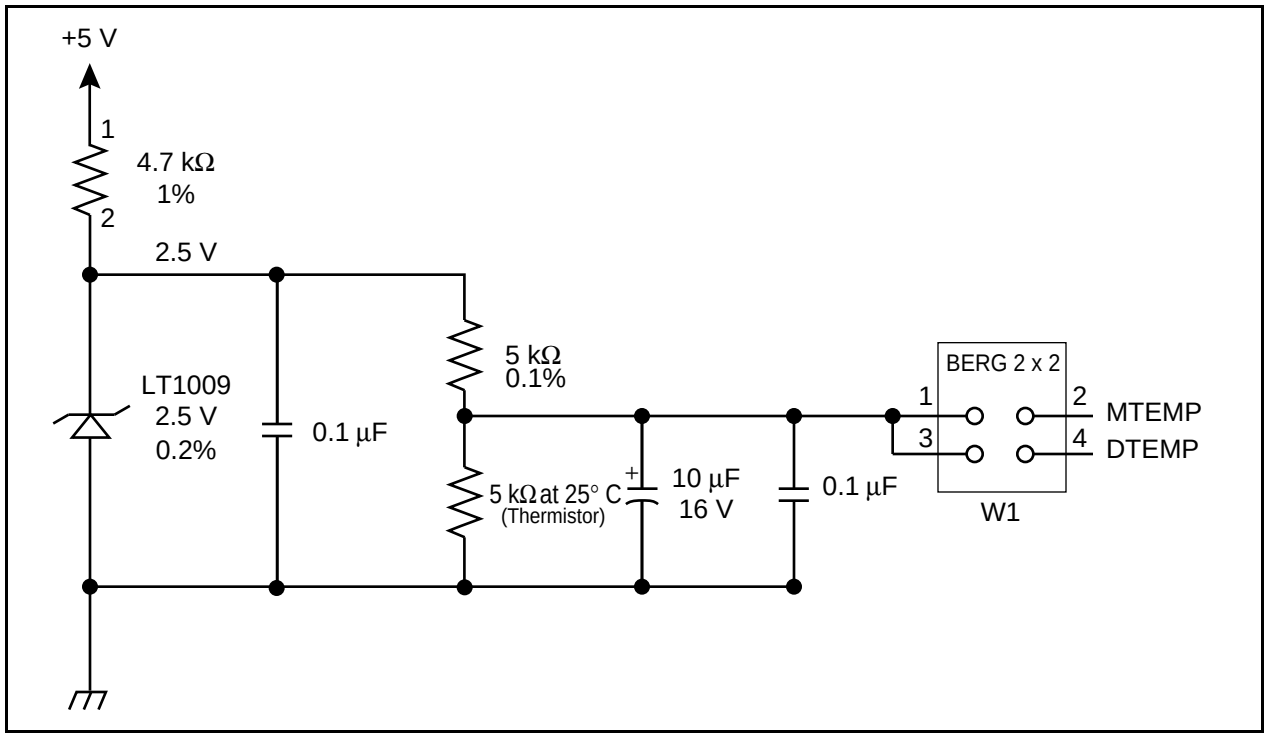


Figure 3. Temperature Sensor Circuit Diagram

[2]The temperature sensor accuracy includes tolerances in all component values, effects caused by temperature and loading, and self-heating. Errors caused by temperature gradients between terminals and the sensor are not included in this specification.