

TBX-1329 AC/DC COUPLING TERMINAL BLOCK

This guide describes how to install and use the TBX-1329 AC/DC coupling terminal block with the SCXI-1120, SCXI-1120D, and SCXI-1121 modules.

Introduction

The TBX-1329 is a DIN rail-mountable terminal block that consists of a shielded board with screw terminals to connect to the SCXI-1120, SCXI-1120D, or SCXI-1121 front connector. The TBX-1329 mounts on most European standard DIN EN mounting rails.

The terminal block has 16 screw terminals that unplug for easy connection. Two screws are provided to connect to the SCXI CHASSIS GROUND via the SH32-32-A cable shield. With the SCXI-1120 and SCXI-1120D, the remaining eight pairs of screw terminals connect signals to the eight SCXI module input channels. With the SCXI-1121, four pairs of screw terminals connect signals to the four SCXI module input channels and four pairs connect to the SCXI module excitation channels.

What You Need to Get Started

To set up and use your TBX-1329, you will need the following:

- TBX-1329 AC/DC coupling terminal block
- TBX-1329 AC/DC Coupling Terminal Block Installation Guide*
- 1/8 in. flathead screwdriver (included in kit)
- Your SCXI chassis and documentation
- SCXI-1120, SCXI-1120D, or SCXI-1121 module and documentation

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- SH32-32-A shielded cable assembly
- Long-nose pliers
- $\frac{3}{16}$ in. wrench
- No. 1 Phillips-head screwdriver

Installation



Warning:

SHOCK HAZARD: Refer to the Signal Connection section in this guide before connecting any signals. If signal wires are connected to the terminal block, dangerous voltages may exist even when the equipment is turned off.

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

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.

Use only National Instruments TBX Series cable assemblies with high-voltage TBX Series terminal blocks.

Perform the following steps to mount the SH32-32-A cable assembly and connect the TBX-1329 to your SCXI module. Refer to the figures as needed.

1. Turn off your SCXI chassis.
2. Turn off the computer that contains your data acquisition (DAQ) device or disconnect the device from your SCXI chassis.
3. Unscrew the module from the chassis.
4. Slide the SCXI module out of the SCXI chassis.
5. Unscrew the SCXI module grounding screw with a No. 1 Phillips-head screwdriver and remove the module cover (see Figure 1).

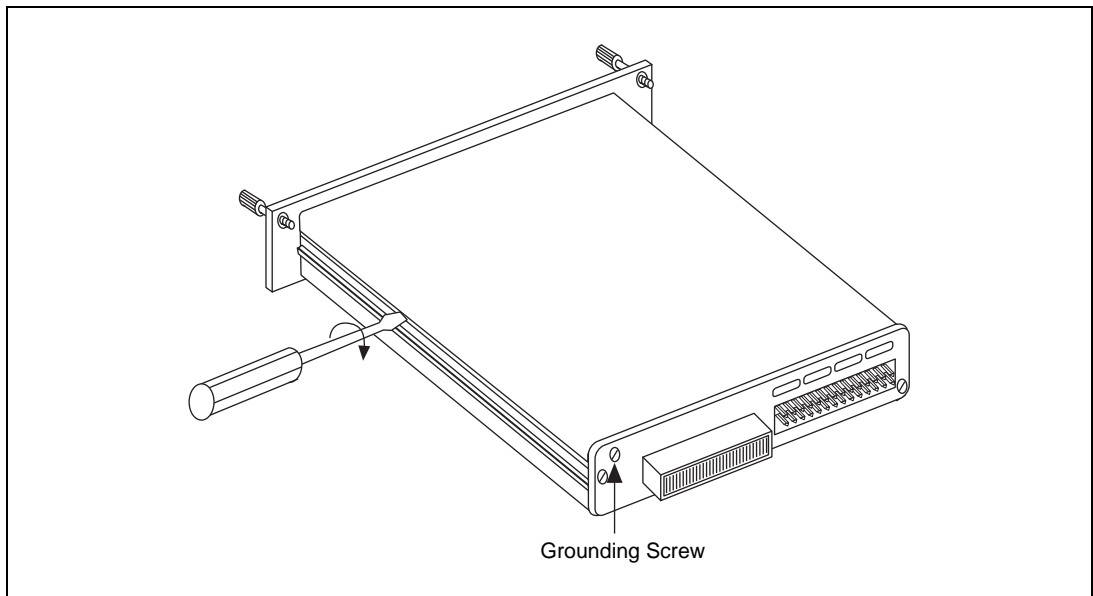


Figure 1. Removing the SCXI Module Cover

6. Place one jack screw from the cable assembly into the SCXI module, as shown in Figure 2.
7. While holding the jack screw in place, insert the lock washer and then the nut. Use long-nose pliers to do this.
8. Tighten the nut by holding it firmly and rotating the jack screw with a 3/16-in. wrench.
9. Repeat steps 6 and 7 for the second jack screw.
10. Replace the SCXI module cover and tighten the grounding screw.

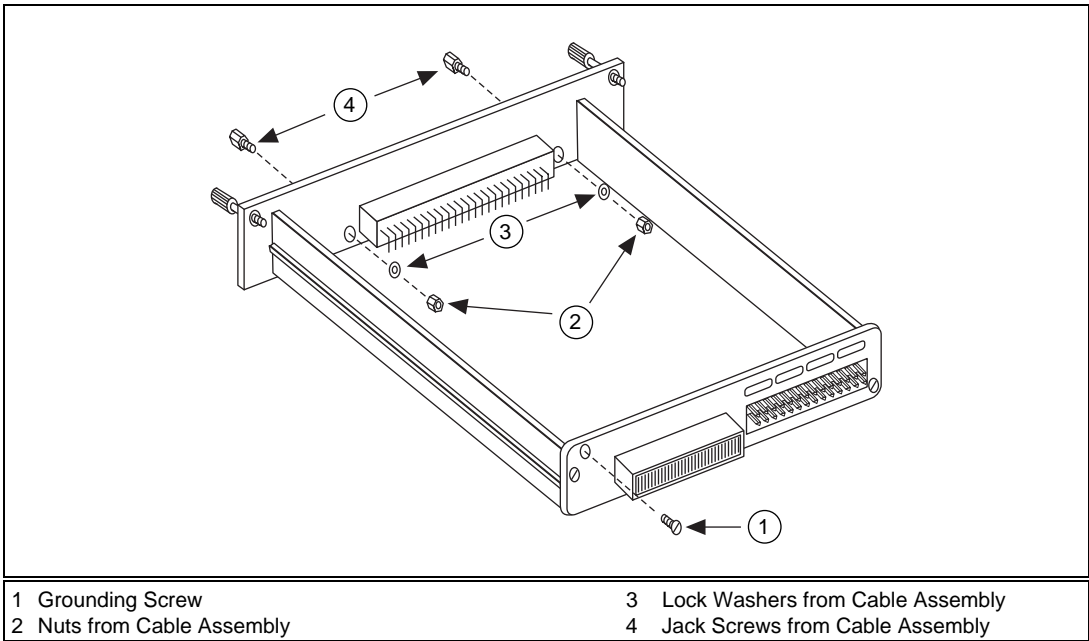
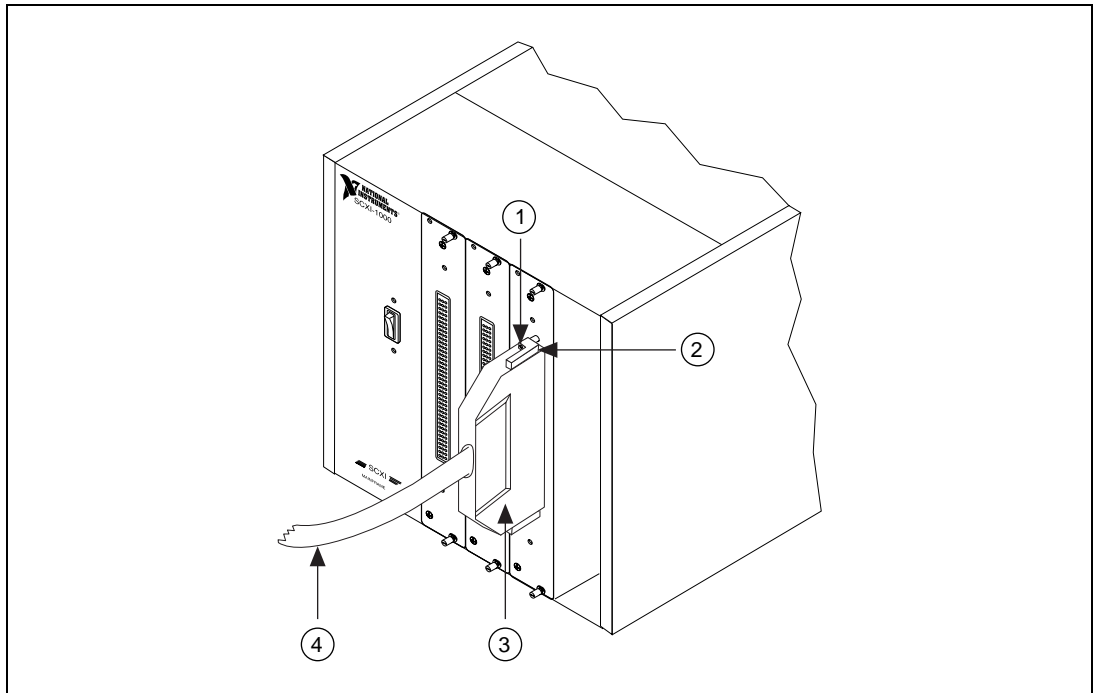


Figure 2. Preparing the SCXI Module for the Cable Assembly

11. Slide the SCXI module back into place in the SCXI chassis.
12. Verify that the four backshell mounting ears on the cable assembly are in the position shown in Figure 3 and Figure 4. If not, remove the backshell mounting ears and install them in the position shown.
13. Connect one end of the cable assembly to your SCXI module front connector and secure the SH32-32-A cable by screwing both backshell mounting screws into the jack screws.

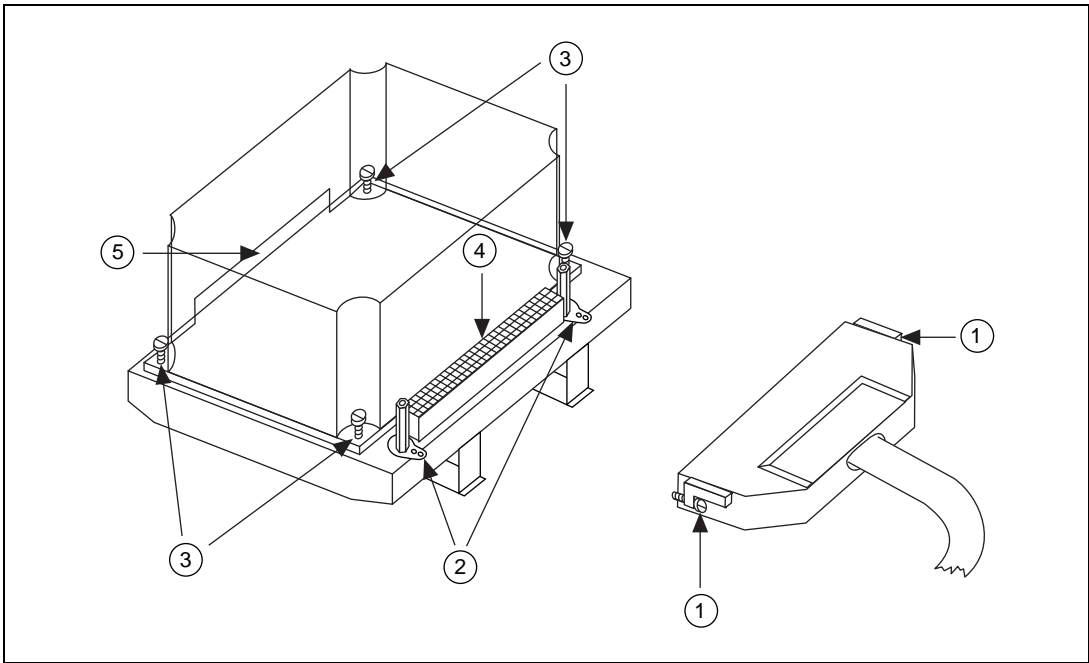


- | | |
|----------------------------|-------------------|
| 1 Backshell Mounting Screw | 3 Backshell |
| 2 Backshell Mounting Ear | 4 SH32-32-A Cable |

Figure 3. Connecting the SH32-32-A Cable to the SCXI Module

14. Connect the other end of the cable assembly to your TBX-1329 terminal block connector and secure the SH32-32-A cable by tightening both backshell mounting screws. See Figure 4.

See Figure 5 for the completed installation.



- | | | |
|--------------------------------------|----------------------------|---------------------|
| 1 Backshell Mounting Screws and Ears | 3 Captive Cover Screws | 5 Signal Wire Entry |
| 2 Safety Ground Solder Lugs | 4 Terminal Block Connector | |

Note: The SH32-32-A cable is not shown in the exact position for proper connection to the terminal block connector. See Figure 5 for the completed connection.

Figure 4. Connecting the SH32-32-A Cable to the TBX-1329 Terminal Block

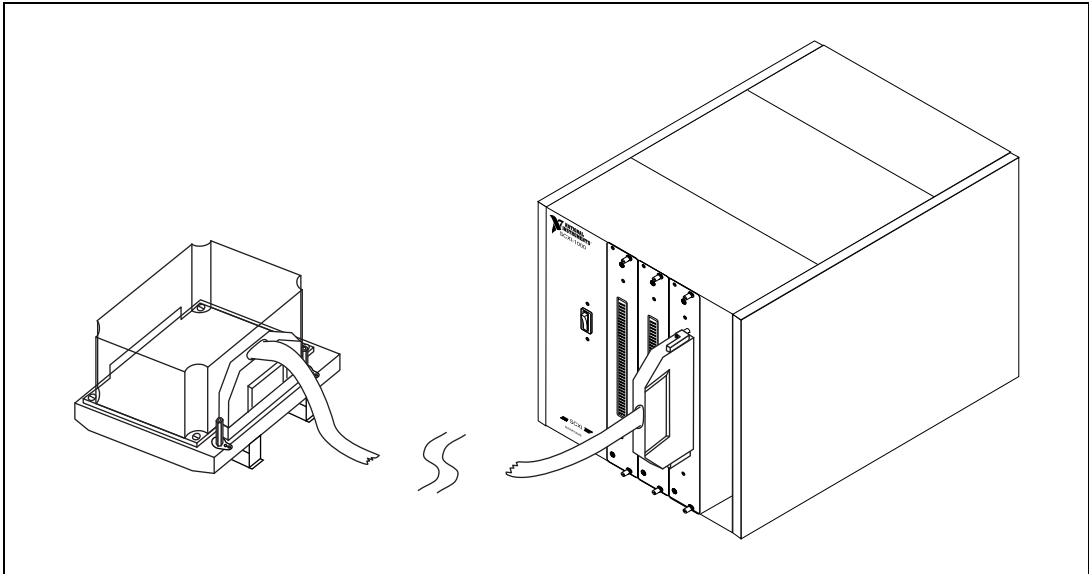


Figure 5. The Completed Installation

Rack Mounting

When you have completed the installation, you are ready to mount the TBX assembly in your rack. If you are using the National Instruments TBX Rack-Mount Assembly, refer to the *TBX Rack-Mount Installation Guide* for instructions. If you are not using this rack-mount assembly, perform the following steps to mount the TBX assembly directly onto your DIN rail.

1. Snap the TBX terminal block onto the DIN rail with a firm push.
To remove the TBX terminal block from the DIN rail, place a flathead screwdriver into the slot above the terminal block base and pry it from the rail.
2. Install the SCXI chassis using the appropriate chassis rack-mount kit.

Signal Connection

The following warnings contain important safety information concerning the use of hazardous voltage levels with TBX-1329 terminal blocks.



Warning:

SHOCK HAZARD: Only qualified personnel aware of the dangers involved should use the TBX-1329. 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. National Instruments is NOT liable for any damages or injuries due to misuse of high-voltage signals connected to the terminal block.

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.

When using the terminal block with high-voltage levels, you must insulate all signal wires appropriately to the highest voltage the terminal block may come in contact with. National Instruments is not liable for any damages or injuries resulting from inadequate signal wire insulation.

Any CHASSIS GROUND terminal on your terminal block is for grounding high-impedance sources such as a floating source (1 mA maximum). Do not use these terminals as safety earth grounds.

Operating common-mode voltage must not exceed 250 Vrms between channels or from any channel to earth.

If you are using an SCXI-1121 module, read the next section, *Voltage Drops and Strain Gauge*, before proceeding with the signal connections.

Voltage Drops and Strain Gauge with the SCXI-1121

When you use the SCXI-1121 with the TBX-1329 to measure strain gauges, a small amount of voltage drop will develop across the excitation wires in the SH32-32-A cable. This voltage drop is due to the wire resistance and the current flow in these leads when a strain gauge is connected at the TBX-1329 across the excitation outputs provided on the SCXI-1121.

To reduce errors in your output voltage, first you need to calculate the voltage drop across the SH32-32-A cable. This voltage drop, which results in an error in your measurement, depends on the cable length and on the strain gauge value and configuration. The SH32-32-A cable has a resistance of 0.21 Ω /m.

To determine the amount of error introduced by the cable, do the following:

1. Calculate the total resistance (R_{TL}) of the cable based on the cable length.
2. Refer to your strain gauge data sheet for the bridge resistance of your strain gauge (R_{SG}) connected at the TBX-1329.
3. Use the following formula to determine the total voltage drop (V_{drop}) in the SH32-32-A cable excitation leads:

$$V_{drop} = [R_{TL} / (R_{TL} + R_{SG})] \times V_{ex}$$

where V_{ex} = excitation voltage.

For example, if you have a 1 m SH32-32-A cable, 120 Ω full-bridge strain gauge, and $V_{ex} = 3.333$ V, your calculations from Steps 1 through 3 would be:

1. $R_{TL} = 2 \times 0.21 \text{ } \Omega/\text{m} \times 1 \text{ m} = 0.42 \text{ } \Omega$; notice that you multiply the cable length by two to take into consideration both the V_{ex+} and V_{ex-} lead resistances.
2. $R_{SG} = 120 \text{ } \Omega$, which is the total equivalent bridge resistance as seen from the $V_{ex+/-}$ terminals of the TBX-1329.
3. $V_{drop} = 11.6 \text{ mV} \Leftrightarrow 0.3\%$ of 3.333 V excitation.

You then need to calculate the voltage drop across the field signal wires you are connecting to the TBX-1329. Perform similar calculations for your field wires as you did for your cable. Resistance may vary depending on your cable and field wires. Add this error amount to the voltage drop across the SH32-32-A cable to get a total voltage drop.

Notice that you can compensate for this error along with any additional cable lead resistance introduced by the strain gauge connection wires. One simple way of compensation is to calculate the lead resistance as shown in Steps 1 through 3, then input it along with your other strain gauge parameters into the conversion formula in your National Instruments data acquisition software packages. Or, locate the load closer to your SCXI module by using shorter cable lengths, or use heavy-gauge wire to connect to the TBX-1329.

Current Measurement

To measure current with the TBX-1329, you can place a current loop receiver resistor in the sockets on the TBX-1329. Table 1 shows the TBX-1329 socket assignment per channel.

Table 1. Socket Assignments per Channel

Channel Number	Resistor Designator
0	R0
1	R1
2	R2
3	R3
4	R4
5	R5
6	R6
7	R7

Wiring Instructions



Caution: *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 250 V. Prepare your signal wire by stripping the insulation no more than 7 mm.*

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. 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.

To connect your field signals to the TBX-1329 terminal block for use with the SCXI modules, follow the labeling on the TBX-1329 indicated along the appropriate row as shown in the parts locator diagram, Figure 6. Connections for the SCXI-1120D and SCXI-1120 are the same. Refer to Figures 4 and 6 as you perform the following instructions:

1. Remove the TBX-1329 terminal block cover by unscrewing the four captive cover screws in the cover corners. These screws stay attached to the cover without falling out.

2. Connect the signal wires to the screw terminals:
 - a. Prepare your signal wire by stripping the insulation no more than 7 mm.
 - b. Connect the signal wires to the screw terminals by inserting the stripped end of the wire fully into the terminals.
 - c. Tighten the terminals to a torque of 5–7 in.-lb (56–79 Newton cm).

Refer to your SCXI module user manual for examples of how to connect to field signals and loads. Notice that the CHASSIS GROUND terminals are connected to the SCXI chassis via the cable shield. This is not shown in your SCXI module user manual. Allow your signal wires to exit through the TBX-1329 cover opening.

3. Relieve strain on your signal wires by tie-wrapping them to the mounting rails of your rack.
4. Replace the TBX-1329 terminal block cover and tighten the captive cover screws.

The installation and signal connection are now complete.

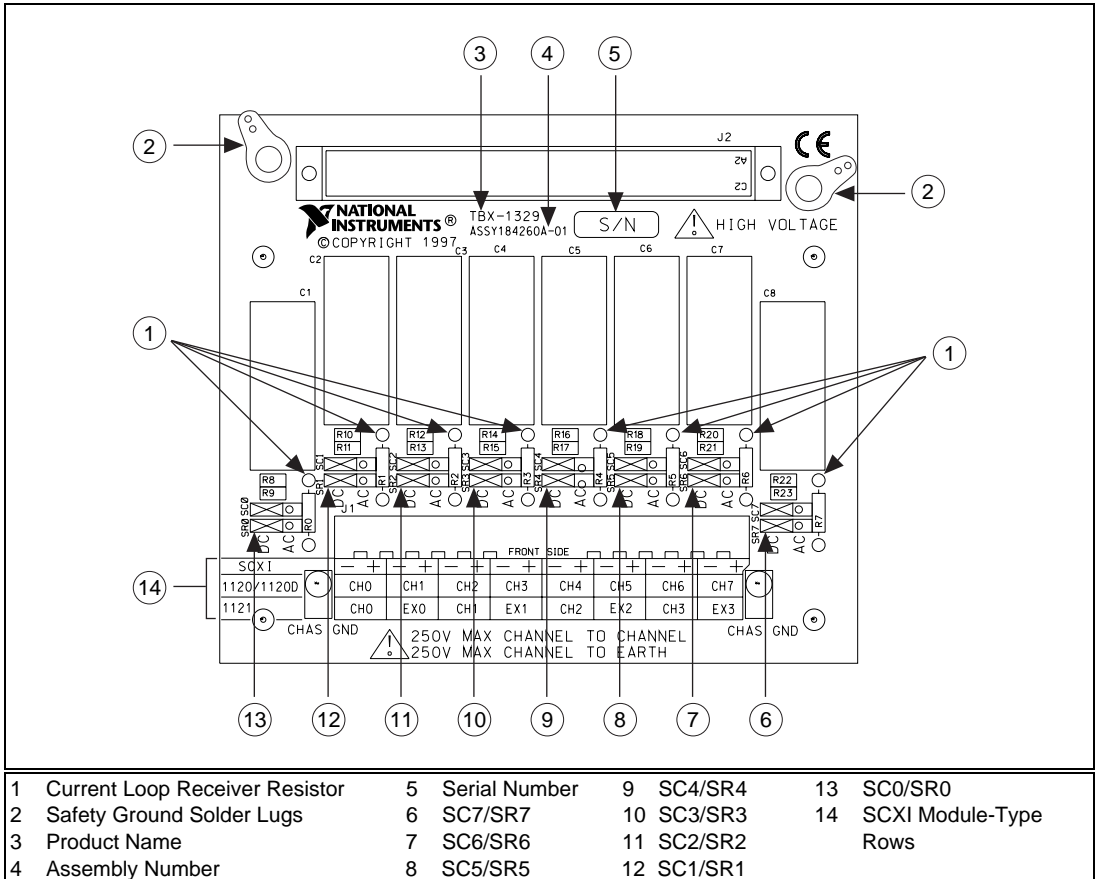
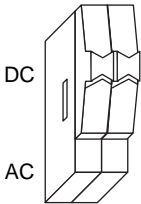
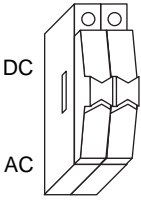


Figure 6. TBX-1329 Parts Locator Diagram

AC/DC Coupling Configuration

Each channel of the TBX-1329 has two switches you can use to switch from AC to DC; thus, each channel can be configured individually. The factory-default setting for the switches is the DC position so that the terminal block will pass all signals, DC and AC, to the SCXI module. In the AC position the switches switch in a capacitor and, depending on which module you use, a referencing resistor. This will block the DC components of the input signal and provide a true AC signal to the SCXI module. Each switch is uniquely marked to make switch identification easier. Each switch that switches the capacitor into the circuit is labeled with *SC#*. Each switch that switches the resistor into the circuit is labeled with *SR#*. The # symbol represents the channel number; for example, *SC2* is the capacitor switch for channel 2 and *SR2* is the resistor switch for channel 2. Table 2 shows the TBX-1329 terminal block switch settings.

Table 2. TBX-1329 Terminal Block Switch Settings

Switch Settings for Each Channel	Description	Switch Configuration	
		SCXI-1120 and SCXI-1121	SCXI-1120D
	DC coupling selected; removes capacitor and resistor from the circuit. Signals go straight through.	Switch both <i>SC#</i> and <i>SR#</i> switches for DC coupling.	Switch both <i>SC#</i> and <i>SR#</i> switches for DC coupling.
	AC coupling selected; <i>SC#</i> connects the capacitor to the circuit. <i>SR#</i> connects the resistor to the circuit.	Switch both <i>SC#</i> and <i>SR#</i> switches for AC coupling.	Switch ONLY <i>SC#</i> switch for AC coupling. <i>SR#</i> must be in the DC position.

Cleaning Instructions

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.

Specifications

Maximum working voltage (signal + common mode).....	Each input should remain within 250 Vrms of ground and any other channel
-3 db cutoff frequency	0.072 Hz
Capacitors can block up to.....	250 VDC
Compatible DIN rails.....	DIN EN 50 022 DIN EN 50 035
Terminal block dimensions.....	12.7 × 7.62 × 11.18 cm (5 × 3 × 4.4 in.)
Altitude	Up to 2,000 m
Environmental temperatures	
Operating	0° to 50° C
Storage	-55° to 150° C
Relative humidity	5% to 90% at 35° C noncondensing

National Instruments Customer Support

If you have additional questions, please contact our technical support staff at: Tel: (512) 795-8248, Fax: (512) 794-5678. Our corporate headquarters address is: 6504 Bridge Point Parkway, Austin, TX 78730-5039, Tel: (512) 794-0100.