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SCXI™

SCXI-1129 User Manual

256 Crosspoint High-Density Matrix

NATIONAL INSTRUMENTS™

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FCC/Canada Radio Frequency Interference Compliance*

Determining FCC Class

The Federal Communications Commission (FCC) has rules to protect wireless communications from interference. The FCC places digital electronics into two classes. These classes are known as Class A (for use in industrial-commercial locations only) or Class B (for use in residential or commercial locations). Depending on where it is operated, this product could be subject to restrictions in the FCC rules. (In Canada, the Department of Communications (DOC), of Industry Canada, regulates wireless interference in much the same way.)

Digital electronics emit weak signals during normal operation that can affect radio, television, or other wireless products. By examining the product you purchased, you can determine the FCC Class and therefore which of the two FCC/DOC Warnings apply in the following sections. (Some products may not be labeled at all for FCC; if so, the reader should then assume these are Class A devices.)

FCC Class A products only display a simple warning statement of one paragraph in length regarding interference and undesired operation. Most of our products are FCC Class A. The FCC rules have restrictions regarding the locations where FCC Class A products can be operated.

FCC Class B products display either a FCC ID code, starting with the letters **EXN**, or the FCC Class B compliance mark that appears as shown here on the right.



Consult the FCC web site `http://www.fcc.gov` for more information.

FCC/DOC Warnings

This equipment generates and uses radio frequency energy and, if not installed and used in strict accordance with the instructions in this manual and the CE Mark Declaration of Conformity**, may cause interference to radio and television reception. Classification requirements are the same for the Federal Communications Commission (FCC) and the Canadian Department of Communications (DOC).

Changes or modifications not expressly approved by National Instruments could void the user's authority to operate the equipment under the FCC Rules.

Class A

Federal Communications Commission

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Canadian Department of Communications

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Class B

Federal Communications Commission

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Canadian Department of Communications

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

European Union - Compliance to EEC Directives

Readers in the EU/EEC/EEA must refer to the Manufacturer's Declaration of Conformity (DoC) for information** pertaining to the CE Mark compliance scheme. The Manufacturer includes a DoC for most every hardware product except for those bought for OEMs, if also available from an original manufacturer that also markets in the EU, or where compliance is not required as for electrically benign apparatus or cables.

* Certain exemptions may apply in the USA, see FCC Rules §15.103 **Exempted devices**, and §15.105(c). Also available in sections of CFR 47.

** The CE Mark Declaration of Conformity will contain important supplementary information and instructions for the user or installer.

Conventions

The following conventions are used in this manual:

»	The **»** symbol leads you through nested menu items and dialog box options to a final action. The sequence **File»Page Setup»Options** directs you to pull down the **File** menu, select the **Page Setup** item, and select **Options** from the last dialog box.
	This icon denotes a note, which alerts you to important information.
	This icon denotes a caution, which advises you of precautions to take to avoid injury, data loss, or a system crash.
bold	Bold text denotes items that you must select or click on in the software, such as menu items and dialog box options. Bold text also denotes parameter names.
italic	Italic text denotes variables, emphasis, a cross reference, or an introduction to a key concept. This font also denotes text that is a placeholder for a word or value that you must supply.
`monospace`	Text in this font denotes text or characters that you should enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames and extensions, and code excerpts.

Contents

Chapter 1
Installing and Configuring the SCXI-1129

Installing the Software 1-2
Safety Information 1-3
Unpacking 1-5
Installing the Hardware 1-5
Installing the SCXI-1129 Module into the SCXI Chassis 1-5
Connecting the SCXI-1129 to the DMM in a Single Chassis System 1-7
Single 4-Slot Chassis Configuration 1-8
Single 12-Slot Chassis Configuration 1-9
Connecting the SCXI-1129 to the DMM in a Multichassis System 1-10
4-Slot and 4-Slot Multichassis Configuration 1-10
4-Slot and 12-Slot Multichassis Configuration 1-12
12-Slot and 12-Slot Multichassis Configuration 1-14
Connecting the SCXI-1129 to the DMM in a PXI-1010 Chassis 1-16
DMM in PXI Slots 1 through 7 Configuration 1-16
DMM in PXI Slot 8 Configuration 1-17
Connecting the SCXI-1129 to the DMM in the PXI-1011 Chassis 1-17
DMM in PXI Slots 1 through 3 Configuration 1-18
DMM in PXI Slot 4 Configuration 1-18
Accessing the SCXI-1129 through Other SCXI Modules Using a DAQ Device 1-19
Using a DAQ Device on a PXI-1010 Chassis 1-21
Using a DAQ Device on a PXI-1011 Chassis 1-21
Connecting the SCXI-1129 to an External DMM 1-21
Configuring and Self-Test 1-22
Auto-Detecting Modules 1-23
Manually Adding Modules 1-24

Chapter 2
Using the SCXI-1129

Operating as a Matrix 2-1
Configurations 2-2
4 × 16 Matrix Configuration 2-4
4 × 32 Matrix Configuration 2-6
8 × 16 Matrix Configuration 2-8
4 × 64 Matrix Configuration 2-10
8 × 32 Matrix Configuration 2-12

16 × 16 Matrix Configuration 2-14
Matrix Expansion 2-16
Hardware and Software Scanning 2-20
Hardware-Timed Scanning 2-21
Hardware-Timed Scanning Using a DMM 2-21
Hardware-Timed Scanning Using External Instruments 2-22
Synchronous Scanning 2-23
Handshaking Scanning 2-23
Multimodule Scanning 2-24
Chain Triggering 2-24
Example 2-24
Wire ORed 2-25
Dummy Entries 2-25
Software Scanning 2-26
Independent Switch Control 2-26

Appendix A
Specifications

Appendix B
Accessories

Appendix C
SCXI-1129 Block Diagram

Appendix D
SCXI-1129 Front Connector

Appendix E
Common Questions

Appendix F
Technical Support Resources

Glossary

Index

1

Installing and Configuring the SCXI-1129

The SCXI-1129 is a 256 crosspoint high-density matrix module. It provides up to a 4 × 64, 2-wire switch matrix configuration on an SCXI platform. The SCXI-1129 can also operate as four 4 × 16, 2-wire matrixes; two 4 × 32, 2-wire matrixes; or two 8 × 16, 2-wire matrixes.



Note Common matrix terminology describes matrixes by the number of rows by the number of columns they contain. For example, four rows by 16 columns would be written as 4 × 16.

Through the use of special terminal blocks (refer to Table 2-1, *Terminal Block Matrix Configuration*), the SCXI-1129 can become many different matrix types. Refer to Table 1-1 for a complete list of matrix configurations.

Table 1-1. Possible Configurations of the SCXI-1129

Matrix Configuration	Quantity
4 × 16	4 each
8 × 16	2 each
4 × 32	2 each
4 × 64	1 each
8 × 32	1 each
16 × 16	1 each

To accommodate even larger testing needs, you can expand the matrix size by combining additional modules. With the use of terminal blocks, you can expand rows on the 4 × 16 and 16 × 16 matrixes, and you can expand rows and columns on the 4 × 64 and the 8 × 32 matrixes. These modules support the analog bus through a special adapter, the high-voltage analog bus (HVAB) backplane adapter in the SCXI-1357/1358 kit, at the rear of the module. This adapter allows you to expand the HVAB without complicated

wiring. By connecting multiple modules to the HVAB adapter, it is possible to expand the matrix size without external row or column connectors. For more information on matrix expansion, refer to the *Matrix Expansion* section in Chapter 2, *Using the SCXI-1129*.

The SCXI-1129 is designed to work well at both low and high voltages. For low-voltage measurements, the SCXI-1129 uses relays with < 9 µV thermal offset to ensure accurate measurements. For details, refer to Appendix A, *Specifications*.

Installing the Software

You can control the SCXI-1129 programmatically in an application development environment (ADE) using NI-SWITCH. The supported ADEs include LabVIEW, Measurement Studio, Visual Basic, and C or C++ environments. To install software for the SCXI-1129, complete the following:

1. Install your ADE if you have not done so already.
2. Insert your NI-SWITCH software CD into your CD drive. The installation window appears automatically.



Note If the installation window does not appear, double-click the **My Computer** icon on your PC desktop. Find the CD drive, and double-click the CD directory, double-click `install.exe`.

The NI-SWITCH and NI-DMM installation window offers three choices:

- **Install NI-DMM**—Choose this selection if you want to install only the software for the DMM.
- **Install NI-SWITCH**—Choose this selection if you want to install only the software for the switches.
- **Install NI-SWITCH and NI-DMM**—Choose this selection if you want to install the software for both the DMM and the switches.

3. Click the **Install NI-SWITCH** option.
4. To install the instrument driver, Soft Front Panel(s), and ADE examples, choose **Programmatic and Interactive Support**. To install only the Soft Front Panel(s), choose **Interactive Support Only**.

Note The **Interactive Support Only** choice does *not* allow you to program the instrument with any programming languages.

5. For advanced users only—when installing NI-SWITCH, the **Development Environments** panel provides you with the following choices:
   - If you click the **Advanced** button on this panel, you can custom install National Instruments drivers such as NI-DAQ, NI-IVI, and NI-VISA.
   - If you do *not* want to install certain drivers, click **Advanced** and uncheck the driver(s) you do not want installed.

   If a driver is already unchecked, your computer has the same driver or a newer version of the driver already installed.

Note If a newer version of a driver is present on your PC, the installer will *not* overwrite the driver.

6. After completing the installation, power off your computer.

Safety Information

The following cautions contain important safety information concerning hazardous voltages.

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 can exist even when the equipment is powered 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 I[1] environment per IEC 60664-1. 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,

[1] Category I refers to a signal level such as voltages of an isolation transformer secondary on a PWB.

power the device off and do *not* use it 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.

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.

You *must* insulate all of your signal connections to the highest voltage with which the SCXI-1129 can come in contact.

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 26-20 AWG wire with a minimum voltage rating of 150 V and a temperature value of 60 °C for measuring up to 150 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 can 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 hazardous voltages (≥30 V_{rms} and 42.4 V_{peak} or 60 VDC) are present, you *must* connect a safety earth-ground wire to the terminal block safety-ground lug, shown in Figure 1-1. 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 lug, run an earth-ground wire 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 lug hardware when connecting the safety-ground wire; to do so reduces the safety isolation between the high voltage and safety ground.

Clean the module and accessories by brushing off light dust with a soft non-metallic brush. Remove other contaminants with a stiff non-metallic brush. The unit *must* be completely dry and free from contaminants before returning it to service. The terminal block *must* be used with a UL-listed SCXI chassis.

Unpacking

Your SCXI-1129 module is shipped in an antistatic package to prevent electrostatic damage to the module. Electrostatic discharge can damage several components on the module. To avoid such damage in handling the module, take the following precautions:

- Ground yourself using a grounding strap or by holding a grounded object.
- Touch the antistatic package to a metal part of your computer chassis before removing the module from the package.

Caution *Never* touch the exposed pins of connectors.

Remove the module from the package and inspect the module for loose components or any sign of damage. Notify National Instruments if the module appears damaged in any way. Do *not* install a damaged module into your computer.

Store your SCXI-1129 module in the antistatic envelope when not in use.

Installing the Hardware

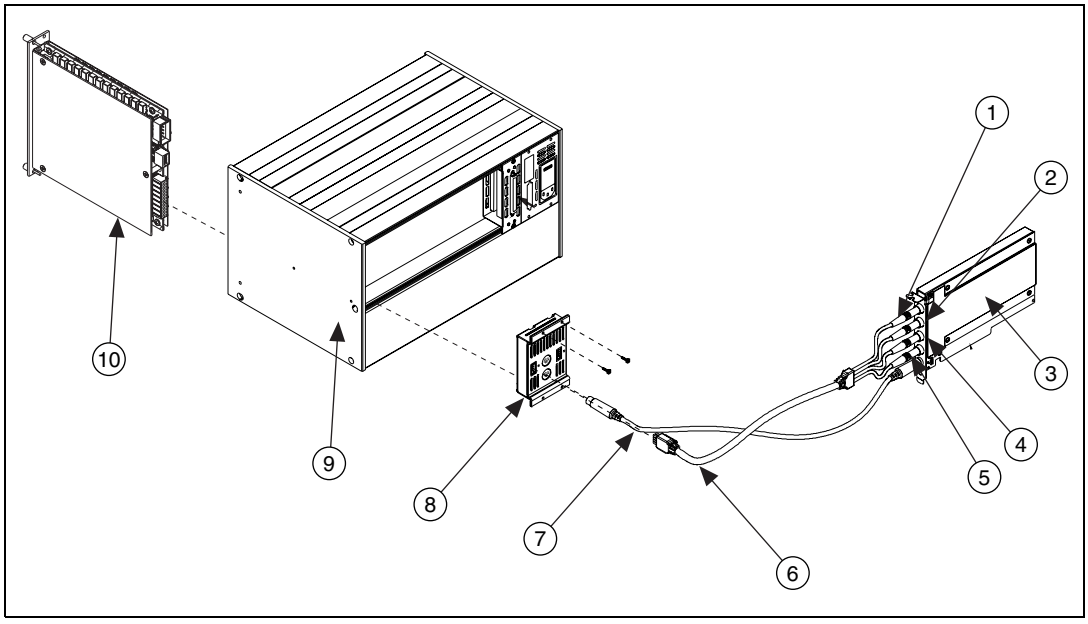
The following section describes how to install your SCXI-1129 for use with SCXI chassis, National Instruments data acquisition (DAQ) devices, and National Instruments digital multimeters (DMMs).

Installing the SCXI-1129 Module into the SCXI Chassis

You need the following items to complete the installation:

- SCXI-1129
- SCXI chassis
- 1/8 in. flathead screwdriver

To install your SCXI-1129 module into the SCXI chassis, refer to Figure 1-1 while completing the following steps:



1 AB0+	5 AB2–	8 2-Slot HVAB-Backplane Adapter
2 AB0–	6 HV8-BAN4	9 SCXI Chassis
3 NI 4060 for PCI	7 SH9MD-9MD	10 SCXI-1129 Module
4 AB2+		

Figure 1-1. Installing the SCXI-1129 into an SCXI Chassis

1. Power off the computer that contains the DAQ/DMM device or disconnect it from your SCXI chassis.
2. Power off the SCXI chassis. Do not insert the SCXI-1129 module into a chassis that is powered on.
3. Insert the SCXI-1129 module into the rightmost slot. Gently guide the module into the module guides and push it to the back of the slot until the connectors make good contact. The module must be firmly engaged; however, do *not* force the module into place.

Note When installing the SCXI-1129 module in an SCXI chassis, the rightmost slot (when the chassis is viewed from the front) must be filled first, then fill the slot to the left with the next SCXI-1129. You can load other SCXI modules from left to right.

4. Insert any other SCXI modules into the remaining slots in the same manner as described in step 3.
5. Secure all the SCXI-1129 modules to the SCXI chassis using both thumbscrews.

To configure your SCXI-1129, follow the procedures for your system in the sections that follow.

Connecting the SCXI-1129 to the DMM in a Single Chassis System

You need the following items for this installation:

- SCXI-1000/1000DC/1001 chassis with the SCXI-1129 modules installed
- SCXI-1357 (4-slot)/1358 (12-slot) kit
  - 1-, 2-, and/or 8-slot HVAB-backplane adapter
  - HV8-to-BAN4 cable
  - SH9MD-9MD cable
  - Two or three 8-position high-voltage plugs
- DMM
- 1/8 in. flathead screwdriver

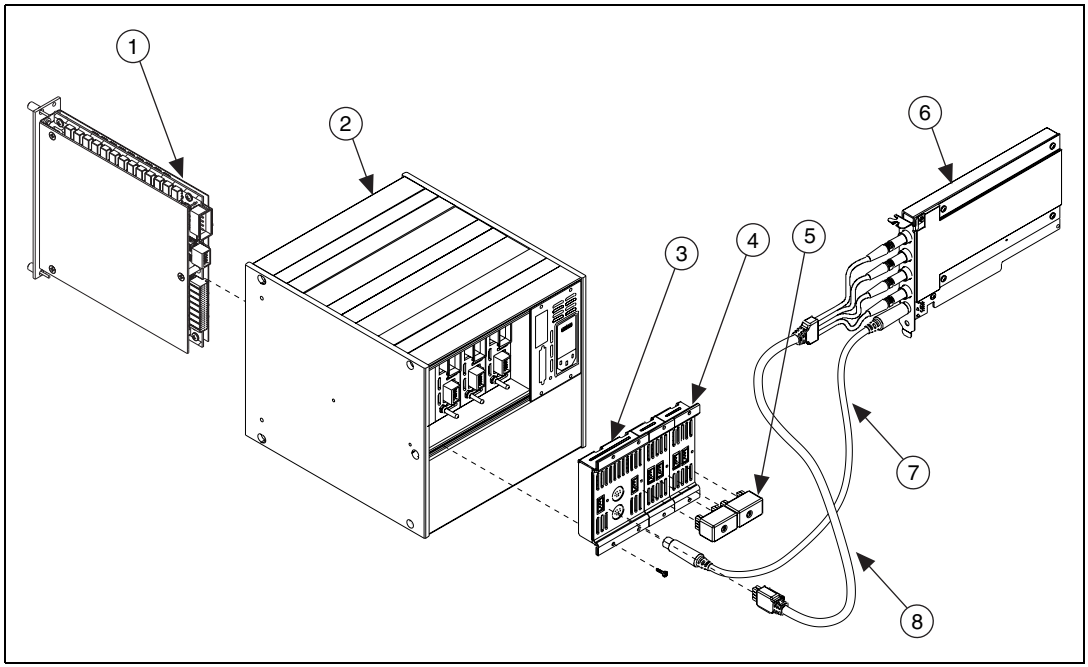
Consult your SCXI chassis documentation and DMM documentation for additional instructions and warnings. Your SCXI-1129 modules and any other SCXI modules should already be installed in the chassis according to their installation instructions.



Caution Before you proceed with your connections, make sure you power off your SCXI chassis.

Single 4-Slot Chassis Configuration

To make connections in the single 4-slot chassis configuration, refer to Figure 1-2 while completing the following steps:



1	SCXI-1129 Module	4	1-Slot HVAB-Backplane Adapter	7	SH9MD-9MD Cable
2	4-Slot SCXI Chassis	5	8-Position HVAB Plug	8	HV8-BAN4 Cable
3	2-Slot HVAB-Backplane Adapter	6	NI 4060 for PCI		

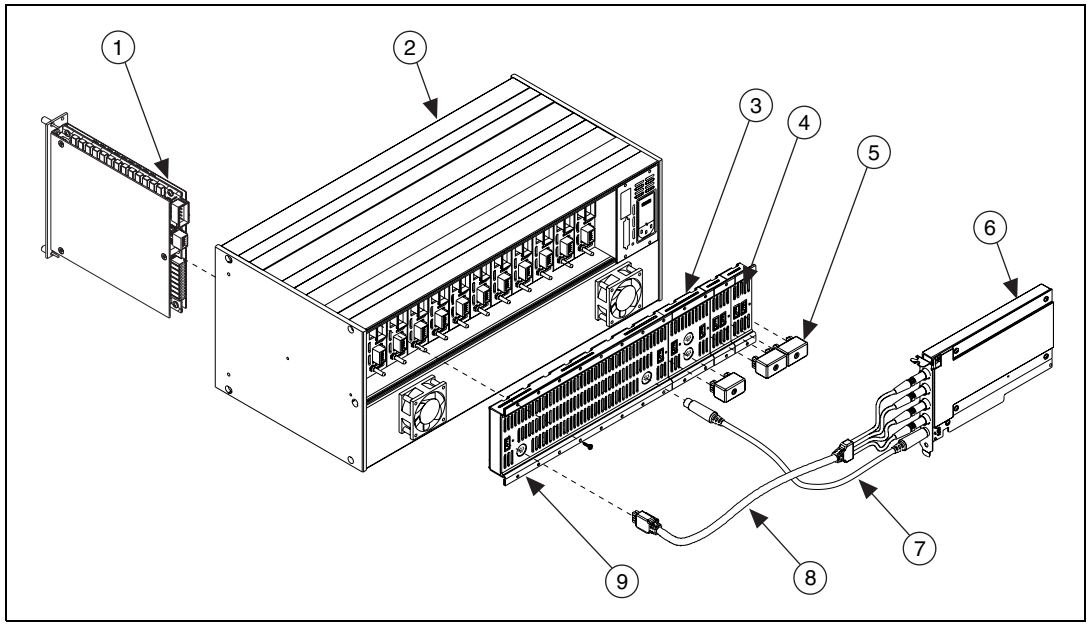
Figure 1-2. 4-Slot Single Chassis Installation

1. Install the 2-slot HVAB-backplane adapter behind slots 3 and 4.
2. Install additional 1-slot HVAB-backplane adapters behind slots 1 and 2 if needed.
3. Install the 8-position HVAB plugs to connect the HVAB-backplane adapters as needed.
4. Connect the HV8-BAN4 cable from the DMM to the HVAB connector behind slot 4.
5. Connect the SH9MD-9MD cable from the DMM to the AUX IN connector.
6. You can install any additional SCXI-1129 modules in any slot that has an HVAB-backplane adapter behind it.

Note In this configuration, a SCXI-1129 is required in slot 4 to establish communication with the chassis. If slot 4 is empty, the system will not operate. It is this module that you must specify in Measurement & Automation Explorer (MAX) as the cabled module to the DMM.

Single 12-Slot Chassis Configuration

To make connections in the single 12-slot chassis configuration, refer to Figure 1-3 while completing the following steps:



1	SCXI-1129 Module	6	NI 4060 for PCI
2	12-Slot SCXI Chassis	7	SH9MD-9MD Cable
3	2-Slot HVAB-Backplane Adapter	8	HV8-BAN4 Cable
4	1-Slot HVAB-Backplane Adapter	9	8-Slot HVAB-Backplane Adapter
5	8-Position HVAB Plug		

Figure 1-3. 12-Slot Single Chassis Installation

1. Install the 8-slot HVAB-backplane adapter behind slots 5 through 12.
2. Install additional 2-slot and 1-slot HVAB-backplane adapters behind slots 1 through 4 if needed.
3. Install the 8-position HVAB plugs to connect the HVAB-backplane adapters as needed.

4. Connect the HV8-BAN4 cable from the DMM to the HVAB connector behind slot 12.
5. Connect the SH9MD-9MD cable from the DMM to the AUX IN connector behind slot 5.
6. You can install any additional SCXI-1129 modules in any slot that has an HVAB-backplane adapter behind it.

Notes Do not connect the SH9MD-9MD cable to the AUX IN connector behind slot 4 on the 2-slot HVAB-backplane adapter.

An SCXI-1129 is required in slot 12 to establish communications with the chassis. If slot 12 is empty, the system will not operate. It is this module that you must specify in MAX as the cabled module to the DMM.

Connecting the SCXI-1129 to the DMM in a Multichassis System

The following sections describe how to configure the following multichassis configurations:

- 4-slot and 4-slot multichassis configuration
- 4-slot and 12-slot multichassis configuration
- 12-slot and 12-slot multichassis configuration

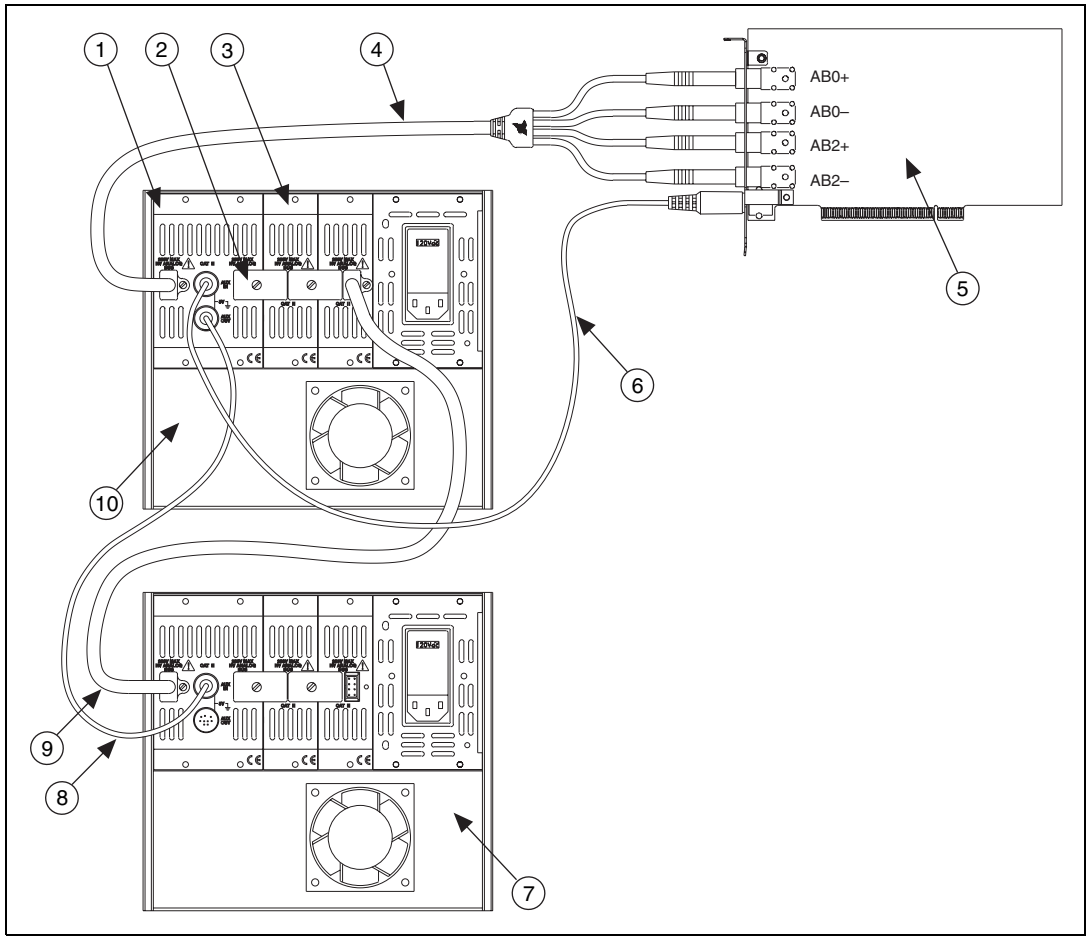
You can also create larger configurations.

4-Slot and 4-Slot Multichassis Configuration

In addition to the items needed for a single chassis system, you need the following to install this configuration:

- SCXI-1357 multichassis expansion kit
  - HV8-HV8 cable
  - SH9MD-9MD cable
  - Two 8-position HVAB plugs
  - One 2-slot HVAB-backplane adapter
  - Two 1-slot HVAB-backplane adapters

To make connections in the 4-slot and 4-slot multichassis configuration, refer to Figure 1-4 while completing the following steps:



1 2-Slot HVAB Backplane Adapter	5 NI 4060 for PCI	8 SH9MD-9MD Cable
2 8-Position HVAB Plug	6 SH9MD-9MD Cable	9 HV8-HV8 Cable
3 1-Slot HVAB Backplane Adapter	7 4-Slot SCXI Chassis	10 4-Slot SCXI Chassis
4 HV8-BAN4 Cable		

Figure 1-4. 4-Slot to 4-Slot Multichassis Configuration Parts Locator Diagram

1. Install the HVAB-backplane adapters and 8-position HVAB plugs in the next chassis as described in steps 1 through 3 in the *Single 4-Slot Chassis Configuration* section.
2. Connect the HV8-HV8 cable from the first chassis, normally the connector behind slot 1, to the HVAB connector (behind slot 4) of the next chassis.
3. Connect the SH9MD-9MD cable from the AUX OUT connector of the first chassis to the AUX IN connector of the next chassis.
4. Repeat steps 1 through 3 for each additional chassis.



Notes An SCXI-1129 is required in slot 4 to establish communications with the chassis. If slot 4 is empty, the system will not operate. It is this module that you must specify in MAX as the cabled module to the DMM.

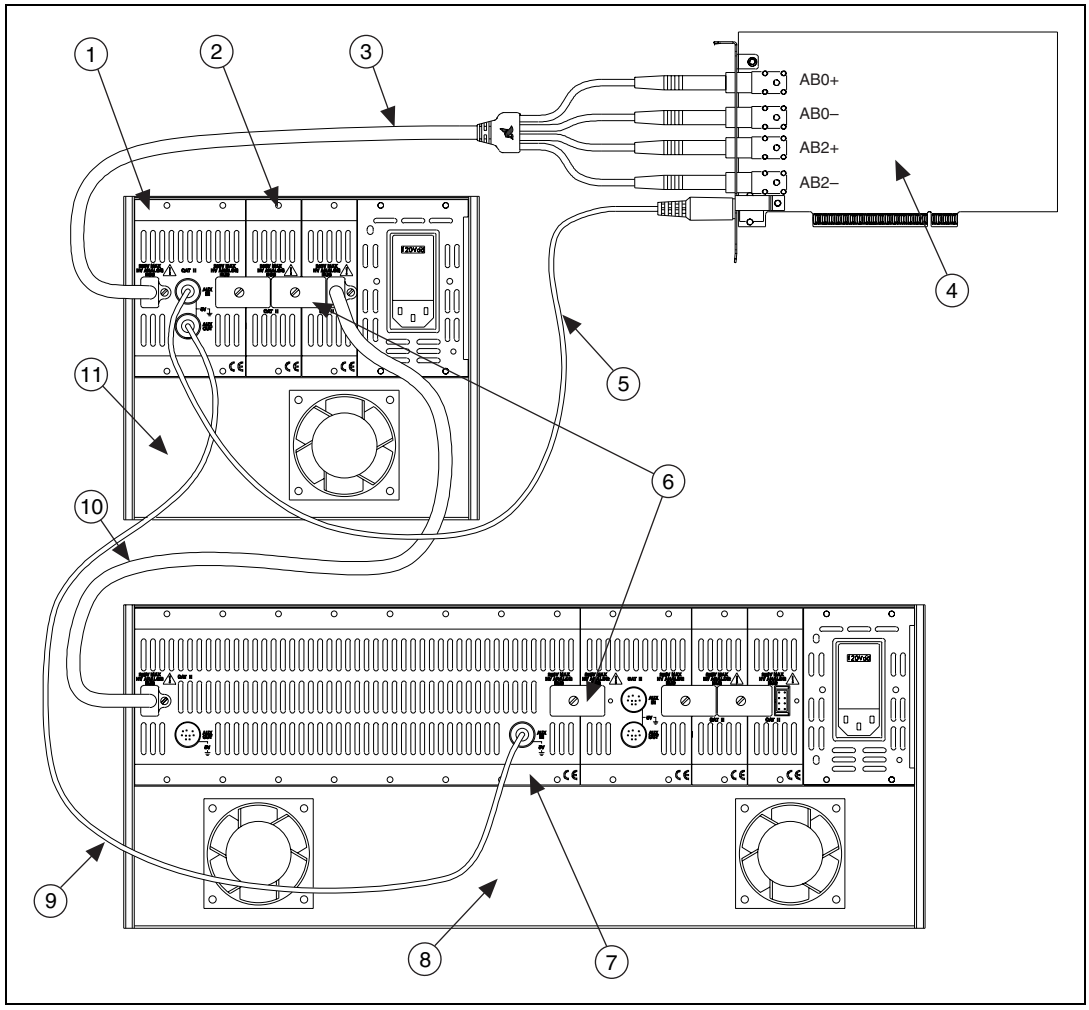
If a chassis is configured with less than four slots of the HVAB-backplane adapter, use the right-most available HVAB connector to extend to the next chassis. In this instance, right-most means the slot closest to slot 1 when the chassis is viewed from the back.

4-Slot and 12-Slot Multichassis Configuration

In addition to the items needed for a single chassis system, you need the following items to install this configuration:

- SCXI-1358 multichassis expansion kit
  - HV8-HV8 cable
  - SH9MD-9MD cable
  - Three 8-position HVAB plugs
  - One 8-slot HVAB-backplane adapter
  - One 2-slot HVAB-backplane adapter
  - Two 1-slot HVAB-backplane adapters

To make connections in the 4-slot and 12-slot multichassis configuration, refer to Figure 1-5 while completing the following steps:



1	2-Slot HVAB-Backplane Adapter	5	SH9MD-9MD Cable	9	SH9MD-9MD Cable
2	1-Slot HVAB-Backplane Adapter	6	8-Position HVAB Plug	10	HV8-HV8 Cable
3	HV8-BAN4 Cable	7	8-Slot HVAB-Backplane Adapter	11	4-Slot SCXI Chassis
4	NI 4060 for PCI	8	12-Slot SCXI Chassis		

Figure 1-5. 4-Slot to 12-Slot Multichassis Configuration Parts Locator Diagram

1. Install the HVAB-backplane adapters and jumper blocks in the 12-slot chassis as described in steps 1 through 3 in the *Single 12-Slot Chassis Configuration* section.
2. Connect the HV8-HV8 cable from the first chassis, normally the connector behind slot 1, to the HVAB connector (behind slot 12) of the next chassis.
3. Connect the SH9MD-9MD cable from the AUX OUT connector of the first chassis to the AUX IN connector (behind slot 5) of the next chassis.
4. Repeat steps 1 through 3 for each additional chassis.

Notes Do not use the SH9MD-9MD cable behind slot 4 of the 2-slot HVAB-backplane adapter on the 12-slot chassis.

An SCXI-1129 is required in slot 4 of the 4-slot chassis and slot 12 of the 12-slot chassis to establish communications with all the chassis in the system. If slot 4 is empty in the 4-slot chassis or slot 12 is empty in the 12-slot chassis, the chassis will not operate. It is this module that you must specify in MAX as the cabled module to the DMM.

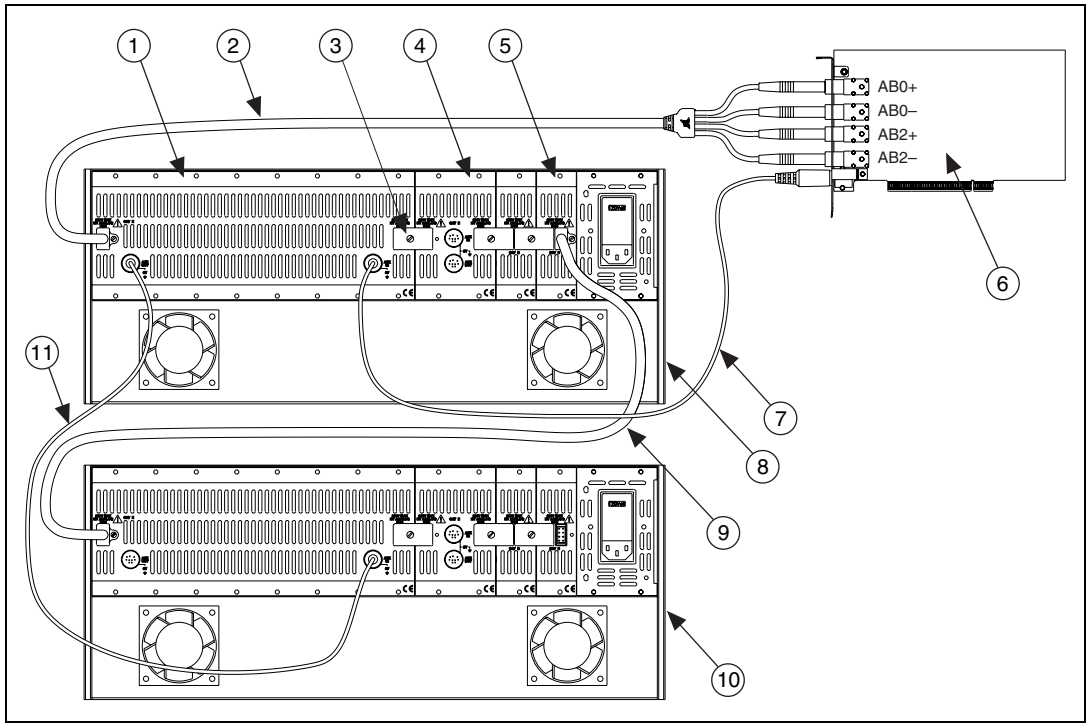
If the 4-slot chassis is configured with less than four slots of the HVAB-backplane adapter, use the right-most available HVAB connector to extend to the next chassis. In this instance, right-most means the slot closest to slot 1 when the chassis is viewed from the back.

12-Slot and 12-Slot Multichassis Configuration

In addition to the items needed for a single chassis system, you need the following items to install this configuration:

- SCXI-1358 multichassis expansion kit
  - HV8-HV8 cable
  - SH9MD-9MD cable
  - Three 8-position HVAB plugs
  - One 8-slot HVAB-backplane adapter
  - One 2-slot HVAB-backplane adapter
  - Two 1-slot HVAB-backplane adapters

To make connections in the 12-slot and 12-slot multichassis configuration, refer to Figure 1-6 while completing the following steps:



1	8-Slot HVAB-Backplane Adapter	5	1-Slot HVAB-Backplane Adapter	9	HV8-HV8 Cable
2	HV8-BAN4 Cable	6	NI 4060 for PCI	10	12-Slot SCXI Chassis
3	8-Position HVAB Plug	7	SH9MD-9MD Cable	11	SH9MD-9MD Cable
4	2-Slot HVAB-Backplane Adapter	8	12-Slot SCXI Chassis		

Figure 1-6. 12-Slot to 12-Slot Multichassis Configuration Parts Locator Diagram

1. Install the HVAB-backplane adapters and jumper blocks in the 12-slot chassis as described in steps 1 through 3 in the *Single 12-Slot Chassis Configuration* section.
2. Connect the HV8-HV8 cable from the first chassis, normally the connector behind slot 1, to the HVAB connector (behind slot 12) of the next chassis.
3. Connect the SH9MD-9MD cable from the AUX OUT connector of the first chassis to the AUX IN connector (behind slot 5) of the next chassis.
4. Repeat steps 1 through 3 for each additional chassis.

Notes Do not connect the SH9MD-9MD cable to the 2-slot HVAB-backplane adapter.

An SCXI-1129 is required in slot 12 of each 12-slot chassis to establish communications with all the chassis in the system. If slot 12 is empty, the chassis will not operate. It is this module that you must specify in MAX as the cabled module to the DMM.

If a chassis is configured with less than 12 slots of the HVAB-backplane adapter, use the right-most available HVAB connector to extend to the next chassis. In this instance, right-most means the slot closest to slot 1 when the chassis is viewed from the back.

Connecting the SCXI-1129 to the DMM in a PXI-1010 Chassis

You need the following items to complete the installation:

- PXI chassis with the SCXI-1129 modules installed
- SCXI-1357 kit
  - Two 1-slot HVAB-backplane adapters
  - One 2-slot HVAB-backplane adapter
  - HV8 to BAN4 cable
  - Two 8-position HVAB plugs
  - SH9MD-9MD cable
- DMM
- 1/8 in. flathead screwdriver

Consult your PXI-1010 and DMM documentation for additional instructions and warnings. You should have already installed the SCXI-1129 modules and any other SCXI modules in the chassis according to their installation instructions. Before you proceed with your connections, make sure you power off your SCXI chassis.

DMM in PXI Slots 1 through 7 Configuration

To install your DMM in PXI slots 1 through 7, follow these steps:

1. Install your DMM in any one of the PXI slots 1 through 7.
2. In the SCXI subsystem, install the 2-slot HVAB-backplane adapter behind SCXI slots 3 and 4.
3. Install additional 1-slot HVAB-backplane adapters behind SCXI slots 1 and 2 if needed.
4. Install the 8-position HVAB plugs to connect the HVAB-backplane adapters as needed.

5. Connect the HV8-BAN4 cable from the DMM to the HVAB connector behind SCXI slot 4.
6. Connect the SH9MD-9MD cable from the DMM to the AUX IN connector.
7. You can install any additional SCXI-1129 modules in any slot that has an HVAB-backplane adapter behind it.

DMM in PXI Slot 8 Configuration

To install your DMM in PXI slot 8, follow these steps:

1. Install your DMM in PXI slot 8.
2. In the SCXI subsystem, install the 2-slot HVAB-backplane adapter behind SCXI slots 3 and 4.
3. Install additional 1-slot HVAB-backplane adapters behind SCXI slots 1 and 2 if needed.
4. Install the 8-position HVAB plugs to connect the HVAB-backplane adapters as needed.
5. Connect the HV8-BAN4 cable from the DMM to the HVAB connector behind SCXI slot 4 of the SCXI subsystem.
6. You can install any additional SCXI-1129 modules in any slot that has an HVAB-backplane adapter behind it.

Note The SH9MD-9MD is not required for this configuration.

Connecting the SCXI-1129 to the DMM in the PXI-1011 Chassis

You need the following items to complete the installation:

- PXI-1011 chassis with the SCXI-1129 modules installed
- HV8-BAN4 cable
- DMM
- 1/8 in. flathead screwdriver

Consult your PXI-1011 and DMM documentation for additional instructions and warnings. You should have already installed your SCXI-1129 modules and any other SCXI modules in the chassis according to their installation instructions. Before you proceed with your connections, make sure you power off your SCXI chassis.

DMM in PXI Slots 1 through 3 Configuration

To install your DMM in PXI slots 1 through 3, follow these steps:

1. Install your DMM in any one of the PXI slots 1 through 3.
2. In the SCXI subsystem, install the 2-slot HVAB-backplane adapter behind SCXI slots 3 and 4.
3. Install additional 1-slot HVAB-backplane adapters behind SCXI slots 1 and 2 if needed.
4. Install the 8-position HVAB plugs to connect the HVAB-backplane adapters as needed.
5. Connect the HV8-BAN4 cable from the DMM to the HVAB connector behind SCXI slot 4.
6. Connect the SH9MD-9MD cable from the DMM to the AUX IN connector.
7. You can install any additional SCXI-1129 modules in any slot that has an HVAB-backplane adapter behind it.

DMM in PXI Slot 4 Configuration

To install your DMM in slot 4 follow these steps:

1. Install your DMM in slot 4.
2. Install the 2-slot HVAB-backplane adapter behind slots 3 and 4.
3. Install additional 1-slot HVAB-backplane adapters behind slots 1 and 2 if needed.
4. Install the 8-position HVAB plugs to connect the HVAB-backplane adapters as needed.
5. Connect the HV8-BAN4 cable from the DMM to the HVAB connector behind slot 4.
6. You can install any additional SCXI-1129 modules in any slot that has an HVAB-backplane adapter behind it.



Note The SH9MD-9MD is not required for this configuration.

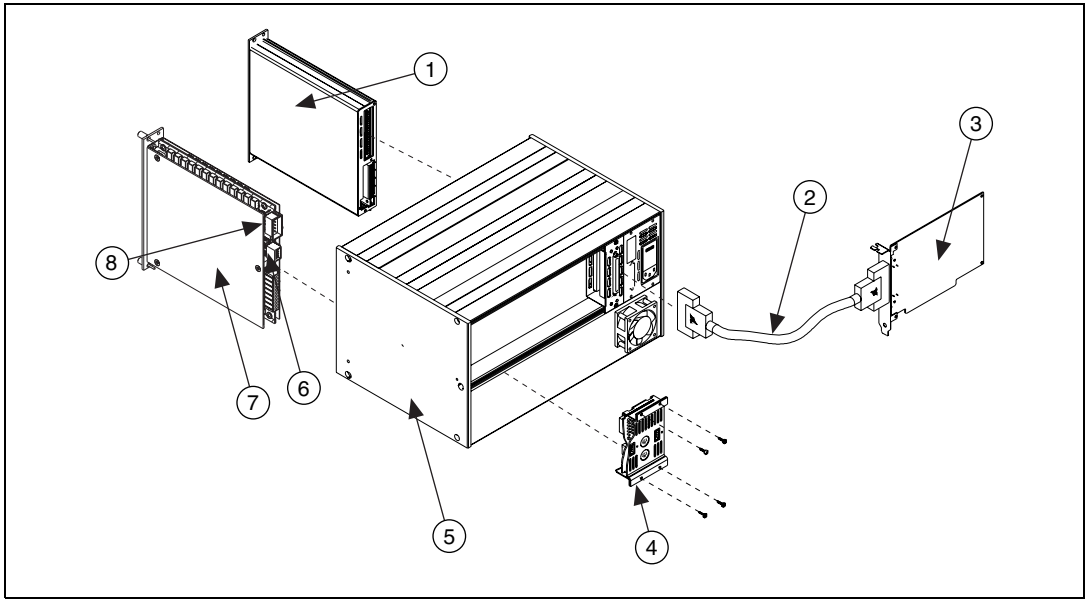
Accessing the SCXI-1129 through Other SCXI Modules Using a DAQ Device

You need the following items to complete the installation:

- SCXI chassis with the SCXI-1129 modules installed (see the appropriate previous sections)
- DAQ device cable adapter
- National Instruments DAQ device
- DAQ cable
- 1/8 in. flathead screwdriver
- At least one other SCXI module other than the SCXI-1129, installed in the chassis

Consult the documentation for your SCXI chassis and other SCXI modules for additional instructions and warnings. You should have already installed any non-SCXI-1129 modules according to their installation instructions. You should have already installed the SCXI-1129 modules and their HVAB-backplane adapters (SCXI-1357/1358) according to the instructions found earlier in this chapter.

To set up the SCXI-1129 module to be accessed by a DAQ device through another SCXI module, refer to Figure 1-7 while completing the following steps:



1	Non-SCXI-1129 Module	4	2-Slot HVAB-Backplane Adapter	6	Digital Signals Connector
2	DAQ Cable	5	SCXI Chassis	7	SCXI-1129 Module
3	MIO or DIO Device			8	HVAB Connector

Figure 1-7. Installing the SCXI-1129 with an SCXI Module and a DAQ Device

1. Connect the MIO/DIO cable adapter to the rear of a module that is not the SCXI-1129 module. Secure the adapter to the SCXI chassis using the screws provided.
2. Attach your DAQ cable to the cable adapter at the rear connector.
3. Attach the other end of the DAQ cable to the National Instruments DAQ device.
4. Check the installation.
5. Power on the SCXI chassis.
6. Power on the computer or reconnect it to your chassis.

If you already have the appropriate software installed, you are ready to configure the SCXI-1129 through an SCXI module other than the SCXI-1129 module. If you have not installed your software, refer to the *Installing the Software* section of this chapter.

Using a DAQ Device on a PXI-1010 Chassis

You should have already installed the SCXI-1129 modules and their HVAB-backplane adapters.

1. Power off the power to the PXI and SCXI chassis.
2. Install your DAQ device in PXI slot 8. Installation in this slot allows the DAQ device to directly control the SCXI-1129 without the need for additional cabling.
3. Power on the power to both the PXI and SCXI chassis.

Using a DAQ Device on a PXI-1011 Chassis

You should have already installed the SCXI-1129 modules and their HVAB-backplane adapters.

1. Power off the power to the PXI and SCXI chassis.
2. Install your DAQ device in PXI slot 4. Installation in this slot allows the DAQ device to directly control the SCXI-1129 without the need for additional cabling.
3. Power on the power to both the PXI and SCXI chassis.

Connecting the SCXI-1129 to an External DMM

You need the following items to complete this installation:

- SCXI-2000/2400 chassis with the SCXI-1129 modules installed or SCXI chassis connected to a DAQ device with the SCXI-1129 modules installed or SCXI chassis connected to a NI 4021 (switch controller) with the SCXI-1129 installed
- SCXI-1357 or SCXI-1358 kit
  - 1-slot, 2-slot, and/or 8-slot HVAB-backplane adapter
  - SH9MD-9MD cable
  - 8-position HVAB plug
- External DMM (if needed)
- HV8-BAN4 or BAN2-WIRE kit (two kits needed for 4-wire)
- Cable or wires to connect the handshaking lines to the SCXI-1129
- 1/8 in. flathead screwdriver

Consult the documentation for your SCXI chassis and other SCXI modules for additional instructions and warnings. You should have installed your SCXI-1129 modules according to the instructions given in the *Installing the SCXI-1129 Module into the SCXI Chassis* section. You should have

already installed any other SCXI modules according to their installation instructions. To install the SCXI-1129 module with an SCXI chassis, follow these steps:

1. Install the SCXI-1129s in the chassis and install the HVAB as described in one of the Connecting the SCXI-1129 backplane sections.
2. To connect an SCXI-1129 to an external DMM device, you need two cables—the HV8-BAN4 or BAN2-WIRE cable, and a cable to connect the handshaking lines from the SCXI-1129 to the DMM. Attach your HV8-BAN4 cable to the HVAB connector on the HVAB-backplane adapter, or connect the bare wire end of the BAN2-WIRE cable to one or more rows on one of the terminal blocks.
3. Attach the other end of the HV8-BAN4 or BAN2-WIRE cable to the inputs of your external DMM device.
4. Connect the handshaking lines from the front of either the SCXI-1333, SCXI-1334, SCXI-1335, SCXI-1336, SCXI-1337, or SCXI-1339 terminal block to the appropriate lines on the external DMM.
5. Check the installation.
6. Power on the SCXI chassis.
7. Power on the computer or reconnect it to your chassis.

The SCXI-1129 module is now installed.

Note For the system to function properly, it must be controlled by a DAQ device or NI 4021 switch controller, or be a SCXI-2000 chassis.

Configuring and Self-Test

Launch MAX to configure and test your SCXI-1129. If you need help during the configuration process, open the Measurement & Automation Help file by selecting **Help»Help Topics**.

1. Double-click the **Measurement & Automation Explorer** icon on your desktop.
2. To add a new chassis, right-click **Devices and Interfaces** and select **Create New**.
3. Select the appropriate chassis from the list box and click **Finish**.

4. To configure the chassis, select the **Chassis ID**. The chassis ID is an arbitrary number that you choose for use by the software to uniquely specify the chassis.
5. Select the **Chassis Address** (refer to your SCXI chassis user manual for further information).

   For the SCXI-2000, you also need to select the **Baud Rate** and **COM Port**.

You now have the choice of auto-detecting your modules or manually adding them depending on your application.

Auto-Detecting Modules

If you selected auto-detect and the chassis is not an SCXI-2000 remote chassis, you must have your chassis connected to your National Instruments device.



Note Make sure you have your chassis powered on.

1. Click **Next**.
2. Select your communication path, except in the case of the SCXI-2000, and click **Next**.
3. Select the module cabled to your communication path, except in the case of the SCXI-2000 or if your module supports Auto Cable Detect, and click **Finish**.



Note The SCXI-1129 has Auto Cable Detect, which means that just by connecting the communications cable to the SCXI-1129, the software can identify that the SCXI-1129 is the cabled module.

Your SCXI chassis and SCXI-1129 modules are now configured in the software with your modules. To configure the properties for a particular module, perform the following steps:

1. Expand **Devices and Interfaces**. You see the chassis selected in the list.
2. Expand **Chassis**.
3. Right-click the module you want to configure and select **Properties**. Tabs are displayed containing attributes for different properties of the module. You can select any tab to see and/or change any attributes.

Manually Adding Modules

If you selected not to auto-detect your SCXI modules, you must add each of your modules separately.

1. Click **Finish** in the SCXI Auto-Detect window.
2. Expand **Devices and Interfaces**. You will see the chassis you selected in the list.
3. Expand **Chassis**.
4. Right-click the slot that is cabled to your device and select **Insert**. For DAQ devices this is the slot cabled to the DAQ device. For DMMs, this is typically slot 4, on 4-slot chassis, and slot 12 on 12-slot chassis, based on the installation instructions in earlier sections used to configure the chassis.
5. Select the module that is intended for that slot and click **Next**.
6. You are now given the option to make this the module that controls the chassis. Select the DAQ device or DMM you cabled to the chassis using the **Connected to:** control. Confirm that there is a check in the checkbox labeled **This device will control the chassis** and click **Next**.
7. You are presented with a series of properties for the module. Select the appropriate values for the attributes and click **Next**. After making your selections, click **Finish**.

You are now finished configuring the slot. Configure the rest of your modules in the same manner.

To remove a module or chassis, right-click the chassis or module you want to remove and select **Delete**.

To test the chassis configuration, right-click the chassis and select **Test**.

2

Using the SCXI-1129

This chapter discusses the operation of the SCXI-1129. The SCXI-1129 is a relay switching matrix.

Operating as a Matrix

A matrix is one of the most flexible switching configurations. Unlike a multiplexer, a matrix can connect multiple inputs to multiple outputs. A multiplexer is typically organized into channels and commons, while a matrix is organized into columns and rows. You can connect any column to any number of rows and any row to any number of columns. At each intersection of a row and column, there is a switch. When the switch is closed, the row is connected to the column. The SCXI-1129 is a 2-wire matrix, as shown in Figure 2-1. Matrixes are useful in applications where you desire maximum switching flexibility.

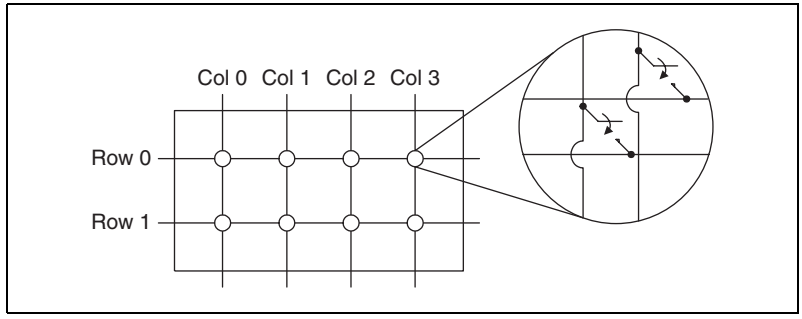


Figure 2-1. 2 × 4, 2-Wire Matrix Configuration

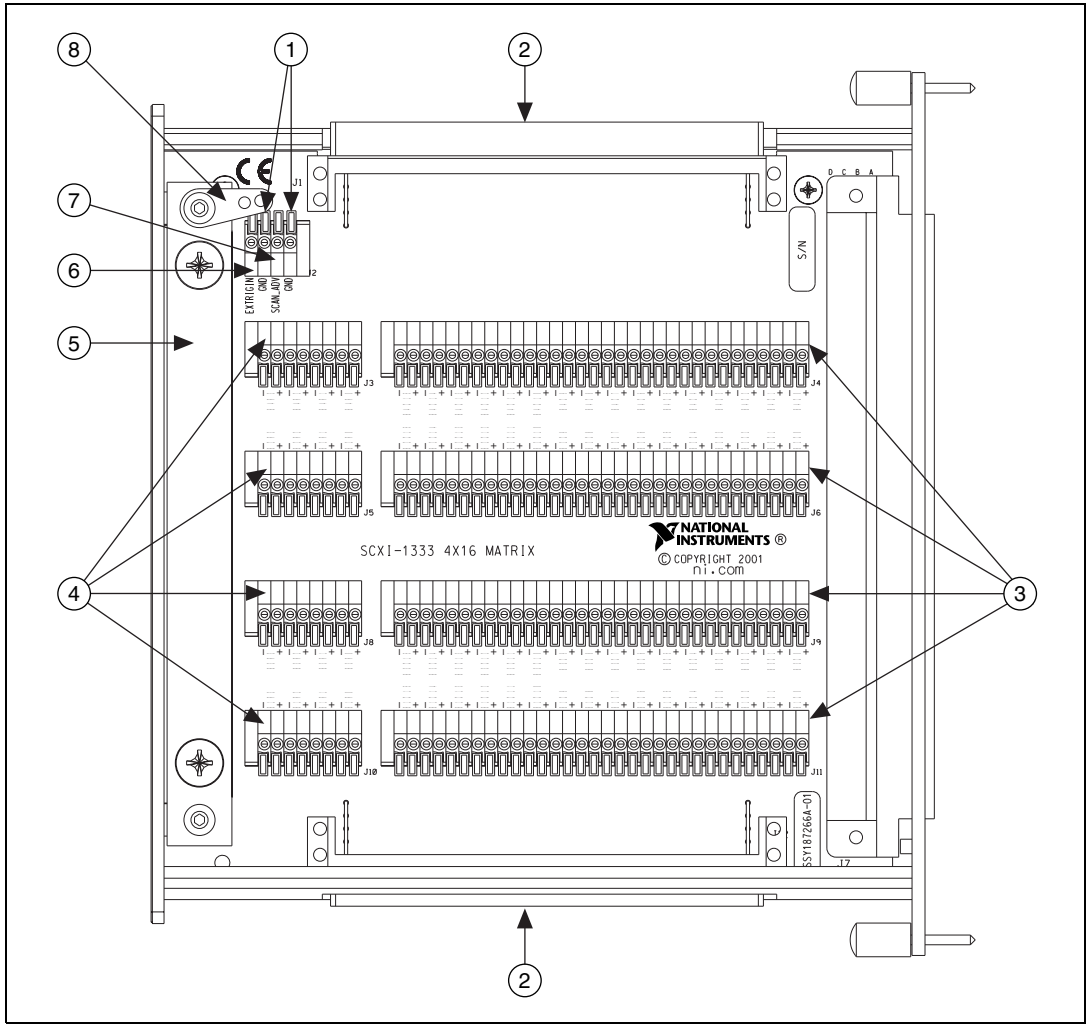
Configurations

Matrix switching is a flexible, and very powerful, method for making complex connections. You can make simultaneous connections so that one input is able to drive many outputs. It is also possible for several outputs to drive a single input.

You can use the SCXI-1129 with one of six different terminal blocks to make various matrix configuration, as shown in Table 2-1. Terminals provide the means of connection to labeled row and column terminals. Refer to Figure 2-2 for an example of a terminal block.

Table 2-1. Terminal Block Matrix Configuration

Terminal Block	Matrix Configuration	Quantity of Matrixes
SCXI-1333	4 × 16	4
SCXI-1337	8 × 16	2
SCXI-1339	4 × 32	2
SCXI-1334	4 × 64	1
SCXI-1335	8 × 32	1
SCXI-1336	16 × 16	1



1	Ground Reference for Trigger Signals	5	Cable Strain-Relief
2	Column Expansion Bus	6	External Trigger Input (EXTRIGIN)
3	Column Connections	7	Scanner Advance Output (SCAN ADV)
4	Row Connections	8	Safety Ground Lug

Figure 2-2. Terminal Block Example (SCXI-1333)

4×16 Matrix Configuration

Figure 2-3 shows an example of the SCXI-1129 configured as a 4 × 16, 2-wire matrix. In the 4 × 16 matrix configuration, you have independent access to four, 4 × 16 matrixes. The diagram shows connections for a general test setup that connects both instruments and devices under test (DUTs) to columns while using rows as connection points. You can create other terminal block configurations by connecting rows/columns of the basic configuration.

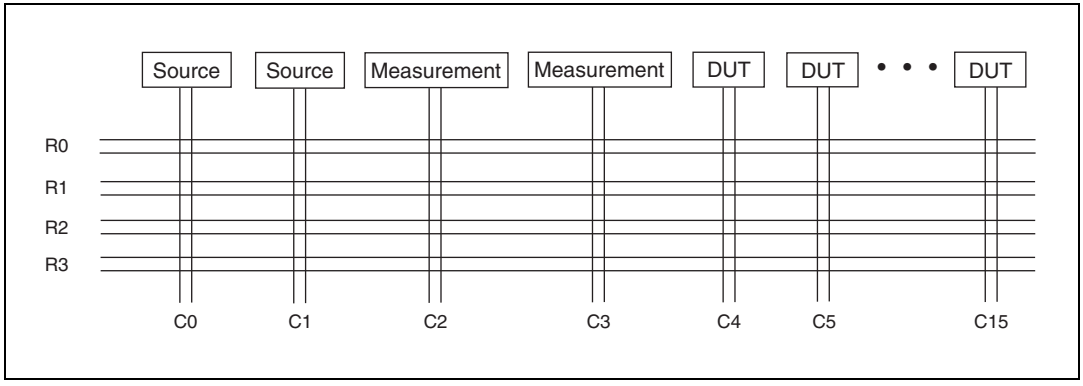
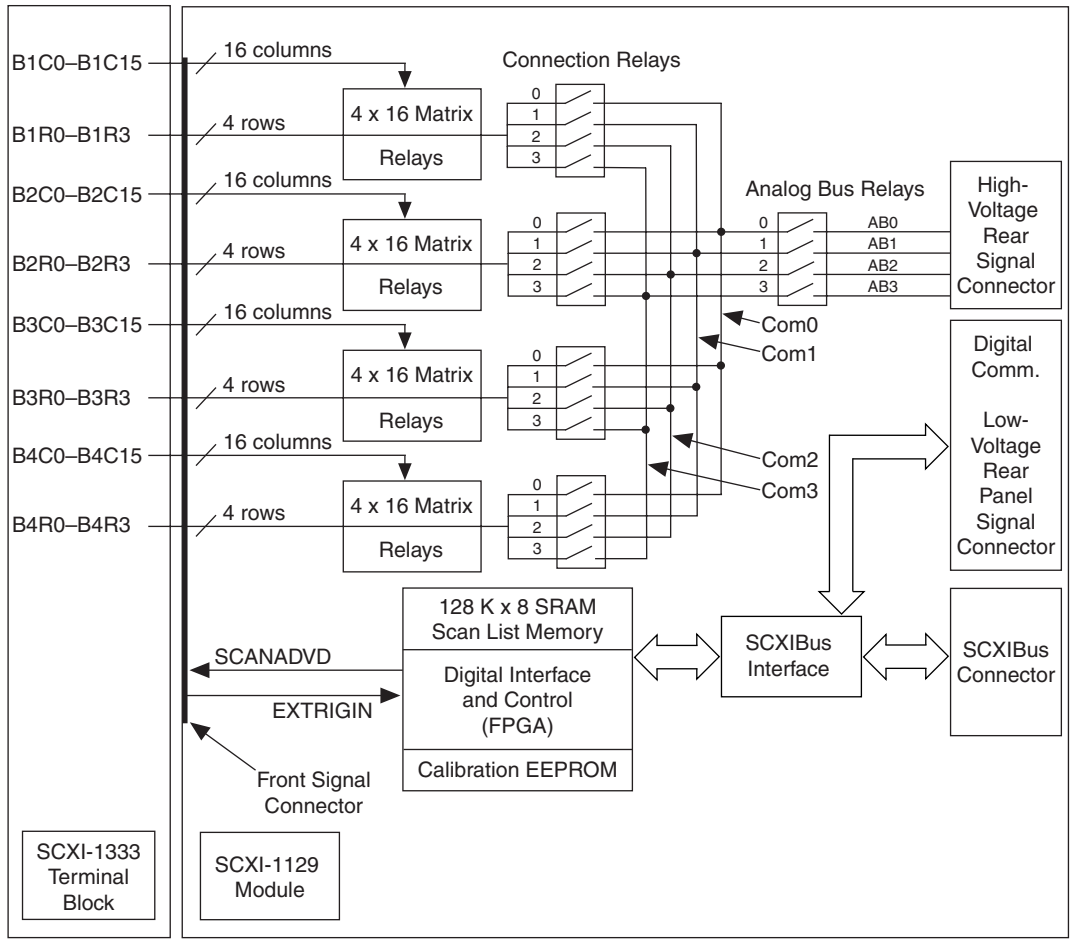


Figure 2-3. 4 × 16 Matrix Test Setup Example

Figure 2-4 is the block diagram of the SCXI-1129 in the 4 × 16 configuration. The diagram is the basic configuration of the SCXI-1129 and shows the channels name that NI-SWITCH uses. With software, you can create different configurations by connecting the rows of the appropriate switch banks.

For example, connecting the rows of banks one and two and the rows of banks three and four creates a dual, 4 × 32 matrix. Connecting the rows of all four banks creates a 4 × 64 matrix. You can access signals through the terminal block or, if the HVAB is connected, directly from the backplane. This matrix is the most general purpose and versatile of the matrixes. To connect signals to the HVAB, connect the chosen rows to COM0–COM3, then connect COM0–COM3 to AB0–AB3.



B1R0 = Bank 1 Row 0
B1C0 = Bank 1 Column 0

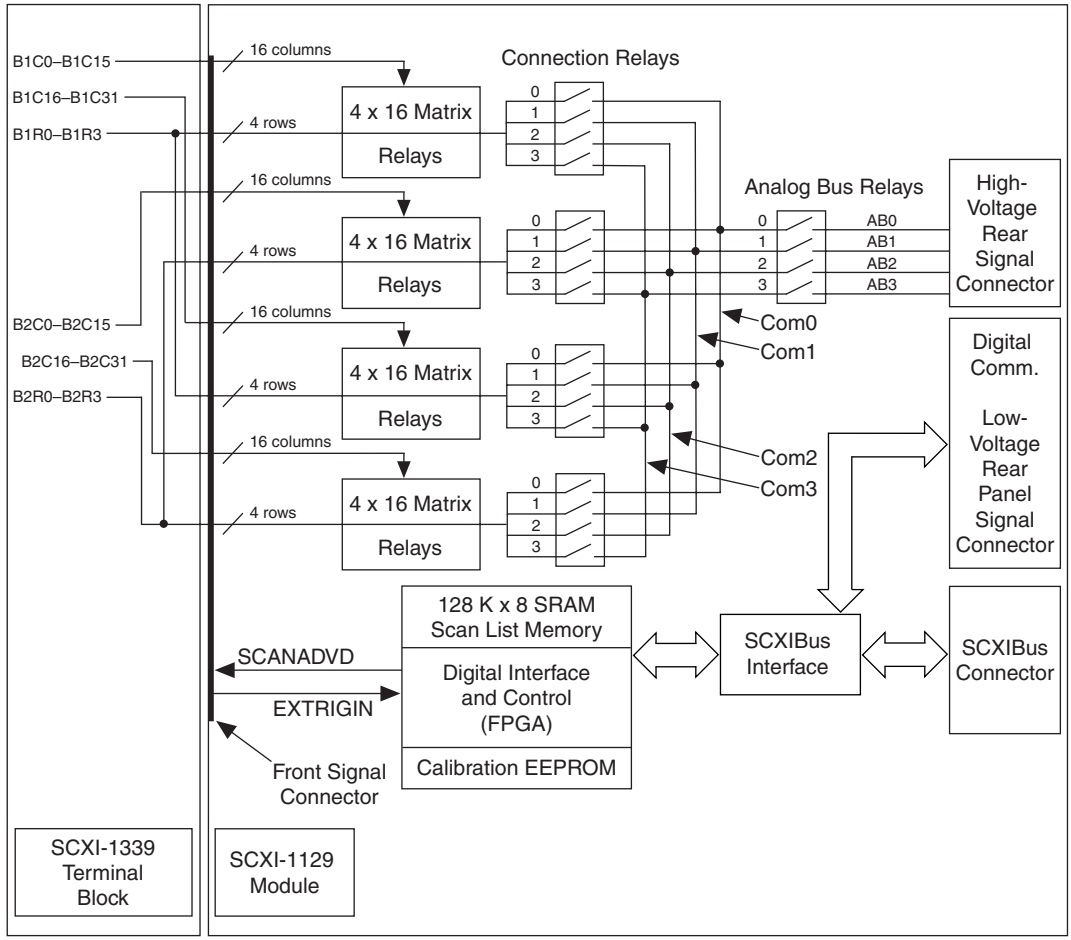
Each row and column consists of two wires. One for source (+) and one for return (–).

Note: The analog bus relays have a built-in safety interlock. For safety reasons, they cannot be closed unless a terminal block is connected.

Figure 2-4. 4 × 16 Matrix Configuration

4 × 32 Matrix Configuration

The 4 × 32 matrix configuration gives you control of two independent, 4 × 32 matrixes. You can make connection to the rows using either the HVAB or the terminal block. Columns are accessed through the terminal block. This configuration provides a more convenient way to create matrixes for applications that require a higher column count than the 4 × 16 matrix while still providing access to the analog bus. To connect signals to the HVAB, connect the chosen rows to COM0–COM3, then connect COM0–COM3 to AB0–AB3. Refer to Figure 2-5 for the channel names that NI-SWITCH uses.



B1R0 = Bank 1 Row 0
B1C0 = Bank 1 Column 0

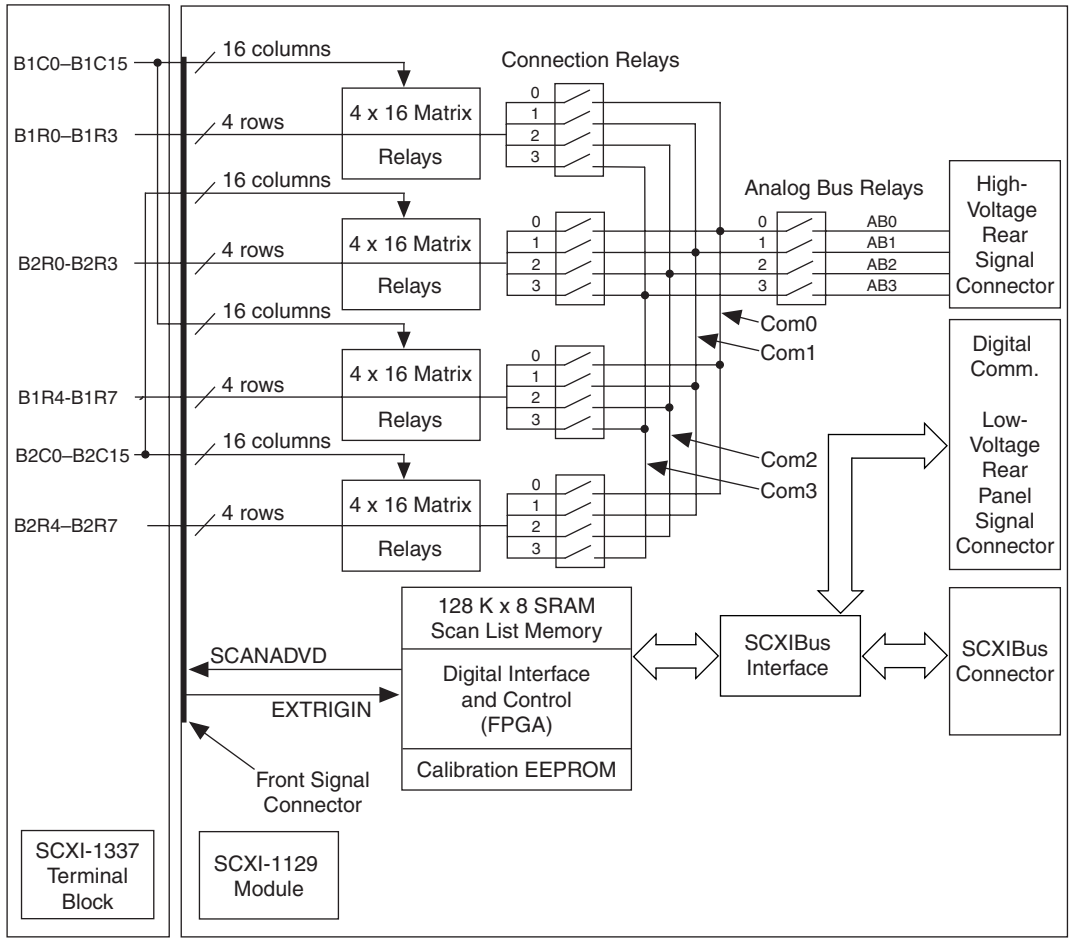
Each row and column consists of two wires. One for source (+) and one for return (–).

Note: The analog bus relays have a built-in safety interlock. For safety reasons, they cannot be closed unless a terminal block is connected.

Figure 2-5. 4 × 32 Matrix Configuration

8×16 Matrix Configuration

The 8 × 16 matrix configuration gives you control of two independent, 8 × 16 matrixes. You can access the HVAB at up to four rows at a time. To connect signals to the HVAB, connect the chosen rows to COM0–COM3, then connect COM0–COM3 to AB0–AB3. This configuration provides a more convenient way to create matrixes for applications that require a higher row count than the 4 × 16 matrix. Refer to Figure 2-6 for the channel names that NI-SWITCH uses.



B1R0 = Bank 1 Row 0
B1C0 = Bank 1 Column 0

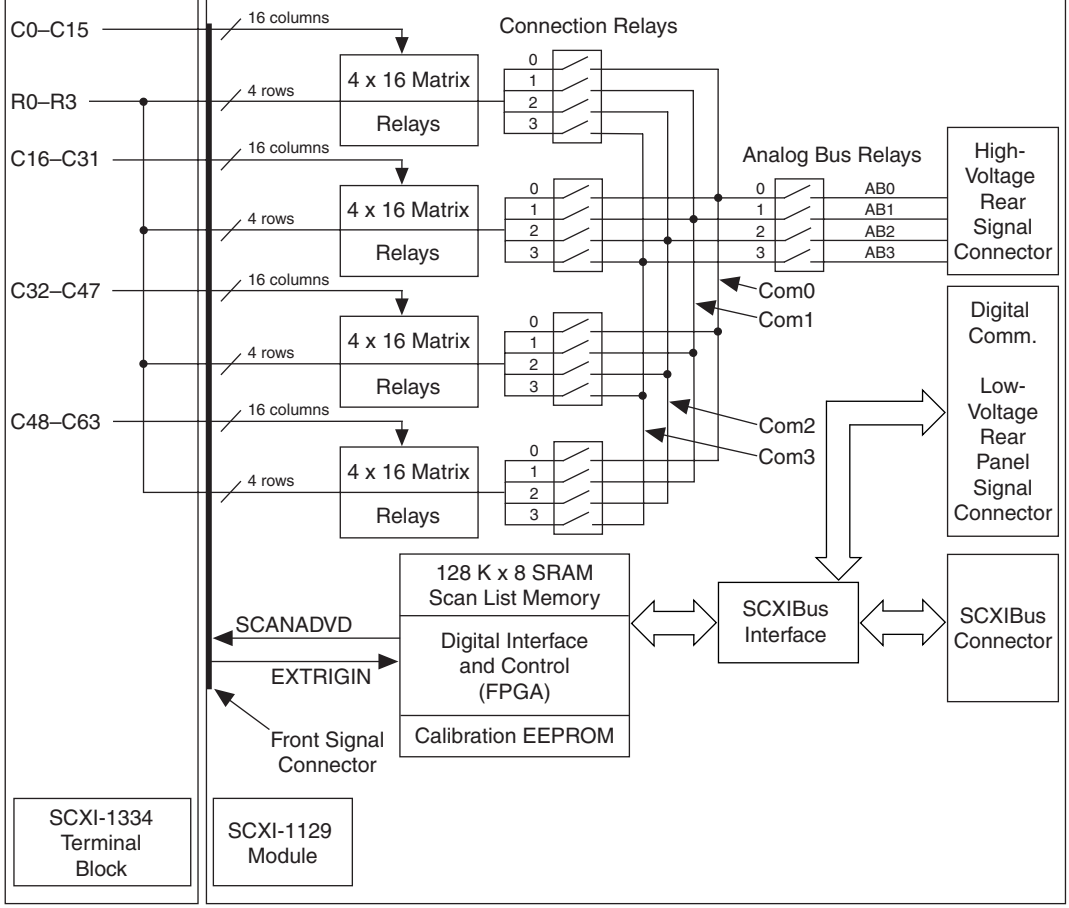
Each row and column consists of two wires. One for source (+) and one for return (–).

Note: The analog bus relays have a built-in safety interlock. For safety reasons, they cannot be closed unless a terminal block is connected.

Figure 2-6. 8 × 16 Matrix Configuration

4 × 64 Matrix Configuration

The 4 × 64 matrix configuration gives you control over the entire switch matrix with no subdivisions. All 256 crosspoints are accessible as a single block. You can now make connections using either the HVAB or the terminal block. To connect signals to the HVAB, connect the chosen rows to COM0–COM3, then connect COM0–COM3 to AB0–AB3. Columns are accessed through the terminal block. This configuration provides a more convenient way to access all of the switches in the matrix while still having access to the HVAB. Refer to Figure 2-7 for the channel names that NI-SWITCH uses.



B1R0 = Bank 1 Row 0
B1C0 = Bank 1 Column 0

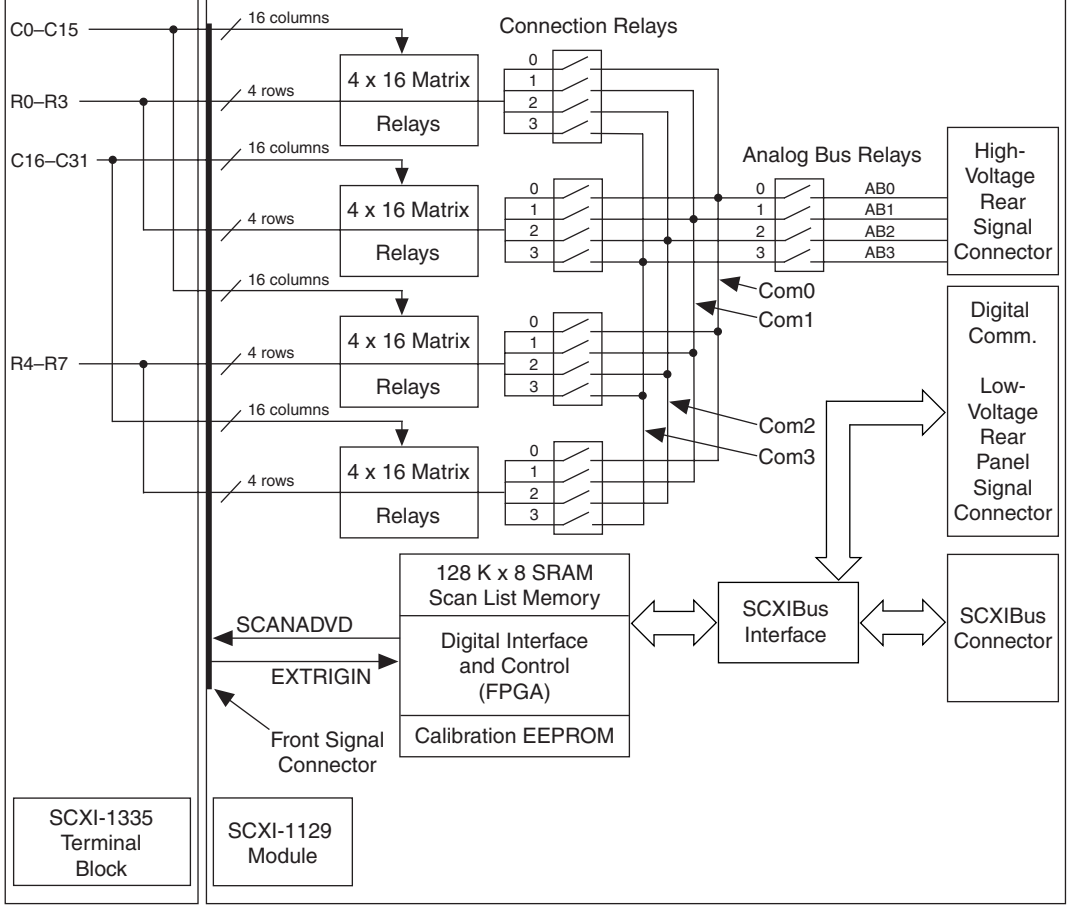
Each row and column consists of two wires. One for source (+) and one for return (–).

Note: The analog bus relays have a built-in safety interlock. For safety reasons, they cannot be closed unless a terminal block is connected.

Figure 2-7. 4 × 64 Matrix Configuration

8 × 32 Matrix Configuration

The 8 × 32 matrix configuration gives you control over the entire switch matrix with no subdivisions. All 256 crosspoints are treated as a contiguous block. This configuration provides an easy way to create a full 256 crosspoint matrix for applications requiring more than four rows—but still needing many columns. You can access the HVAB at up to four rows at a time. To connect signals to the HVAB, connect the chosen rows to COM0–COM3, then connect COM0–COM3 to AB0–AB3. Refer to Figure 2-8 for the channel names that NI-SWITCH uses.



B1R0 = Bank 1 Row 0
B1C0 = Bank 1 Column 0

Each row and column consists of two wires. One for source (+) and one for return (–).

Note: The analog bus relays have a built-in safety interlock. For safety reasons, they cannot be closed unless a terminal block is connected.

Figure 2-8. 8 × 32 Matrix Configuration

16 × 16 Matrix Configuration

The 16 × 16 matrix configuration gives you control over the entire switch matrix with no subdivisions. All 256 crosspoints are treated as a contiguous block. This configuration provides an easy way to create a full 256 crosspoint matrix for applications requiring equal rows and columns. Figure 2-9 is a 1-wire representation of the SCXI-1129 configured as a 16 × 16 matrix. The diagram shows connections for a general test setup that connects several instruments to one complex DUT. In this way, you can use the same instrumentation to test many different portions of the DUT. You can access the HVAB at up to four rows at a time. To connect signals to the HVAB, connect the chosen rows to COM0–COM3, then connect COM0–COM3 to AB0–AB3. Refer to Figure 2-10 for the channel names that NI-SWITCH uses.

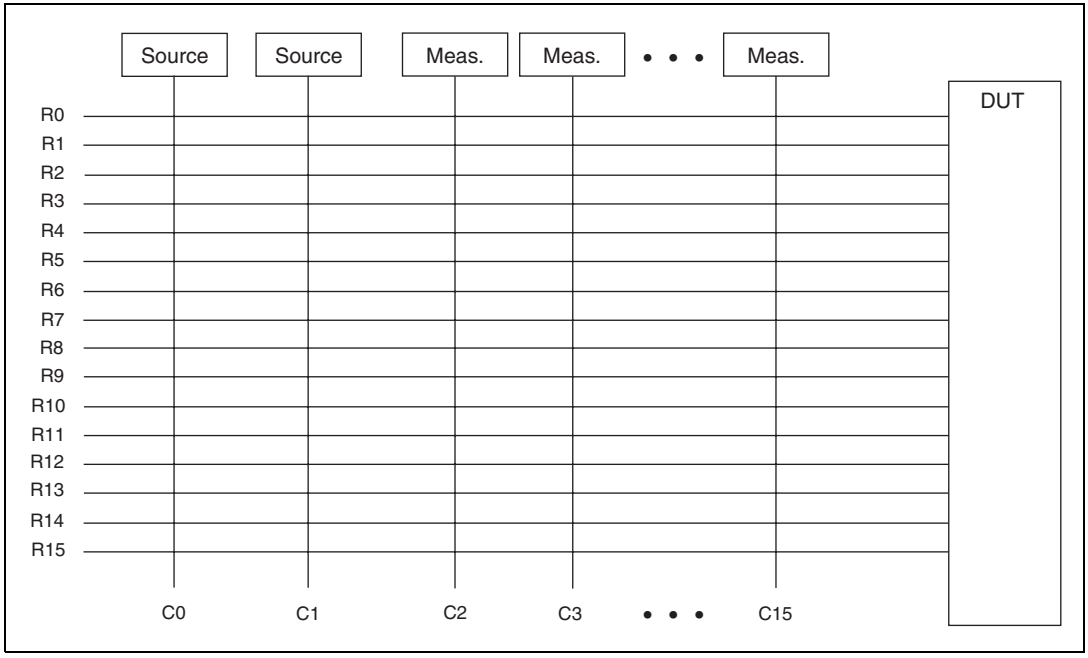
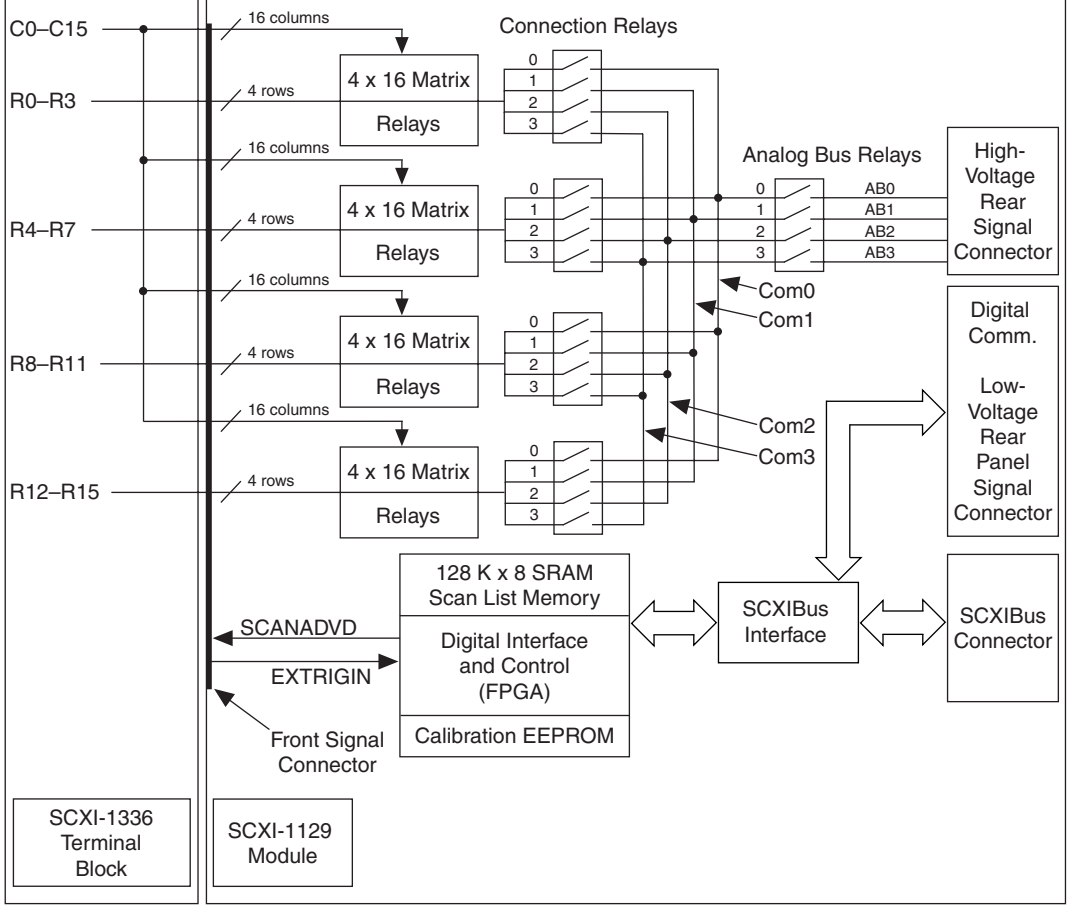


Figure 2-9. 16 × 16 Matrix Test Setup Example



B1R0 = Bank 1 Row 0
B1C0 = Bank 1 Column 0

Each row and column consists of two wires. One for source (+) and one for return (–).

Note: The analog bus relays have a built-in safety interlock. For safety reasons, they cannot be closed unless a terminal block is connected.

Figure 2-10. 16 × 16 Matrix Configuration

Matrix Expansion

In addition to the configurations discussed above, it is possible to combine modules with the same configuration to create much larger matrixes. You can expand matrix modules through the terminal blocks by connecting columns and/or rows. Figure 2-11 shows an example of an 8×64 matrix created by connecting two 8×32 matrixes using a matrix expansion cable.

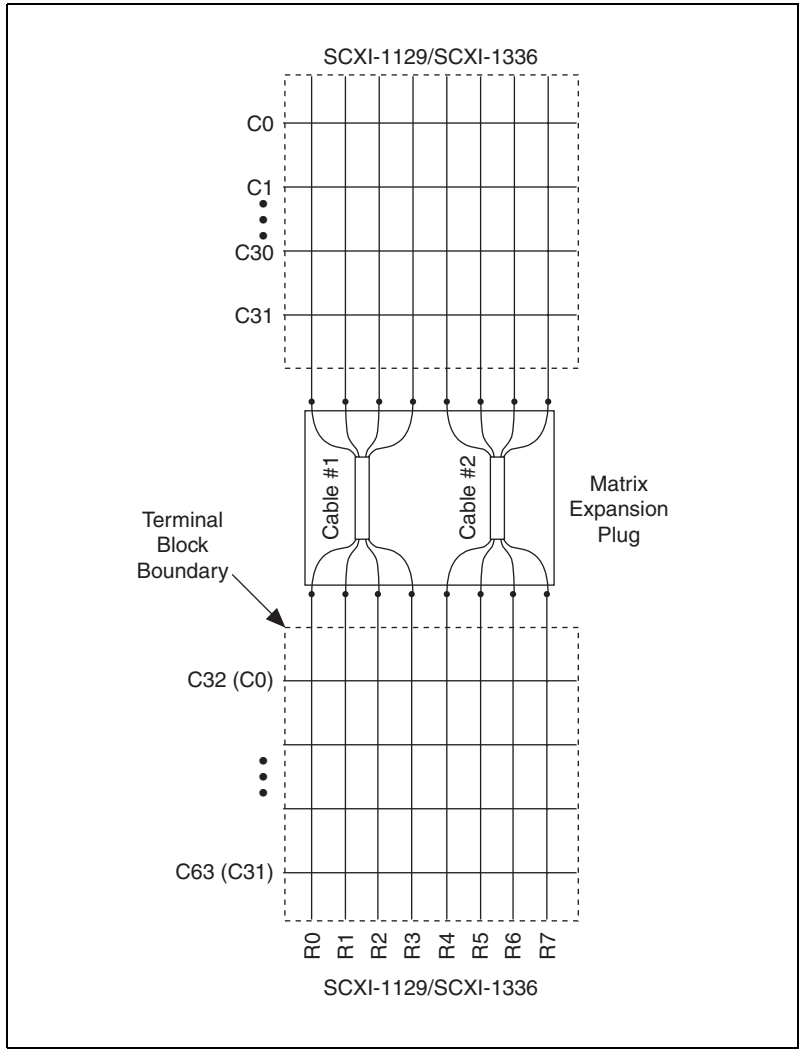


Figure 2-11. 8×64 Matrix Schematic

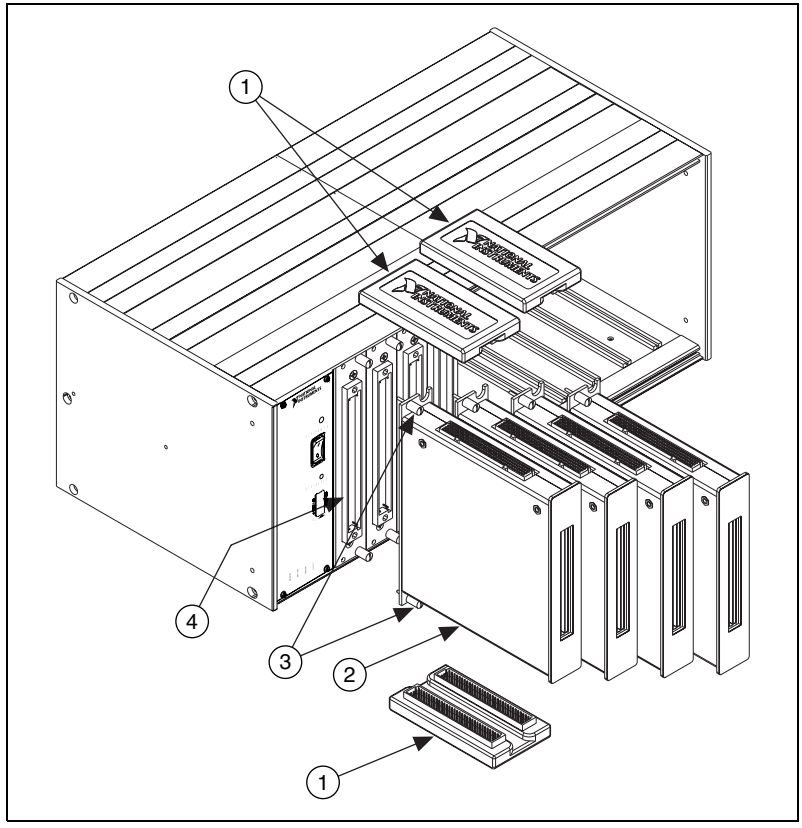
The matrix expansion methods available for the different terminal blocks are shown in Table 2-2.

Table 2-2. Terminal Block Matrix Expansion

Terminal Block	Expansion Type
SCXI-1333 (4 × 16)	Column connection
SCXI-1337 (8 × 16)	None
SCXI-1339 (4 × 32)	None
SCXI-1334 (4 × 64)	Column and row connection
SCXI-1335 (8 × 32)	Column and row connection
SCXI-1336 (16 × 16)	Column connection

The preferred expansion method is to connect columns using the matrix expansion plug. You can use this plug to daisy-chain module columns across an entire chassis, as shown in Figure 2-12.

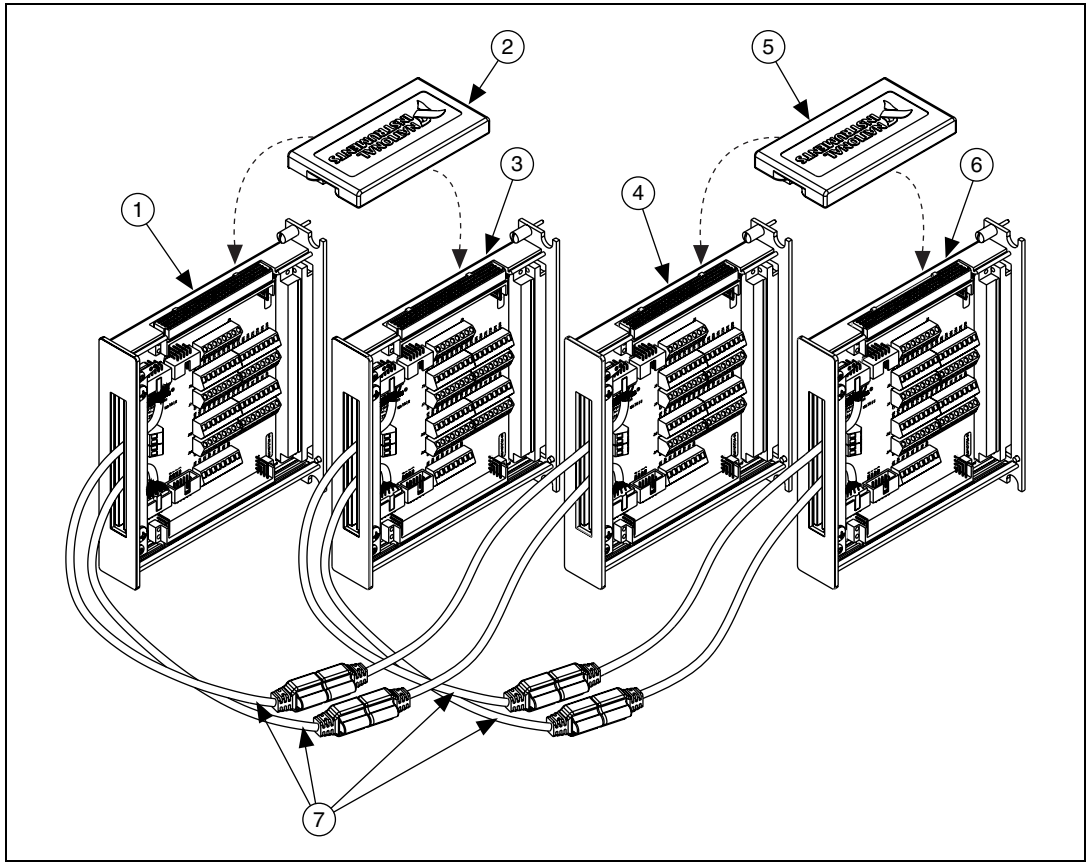
Caution Only daisy-chain terminal blocks of the same type together. Daisy-chaining different types of terminal blocks together can cause damage to the module or to the equipment connected to the module. For example, you can daisy-chain two or more SCXI-1333 terminal blocks; however, do *not* daisy-chain the SCXI-1333 together with any other type of terminal block.



1	Matrix Expansion Plugs	3	Thumbscrews
2	SCXI-1333 Terminal Block	4	SCXI-1129 Front Connector

Figure 2-12. Example of Daisy-Chained Modules

The SCXI-1334 and SCXI-1335 terminal blocks also have the ability to expand columns by connecting rows, as shown in Figure 2-13. With these two modes of expansion, you can create very large matrixes.



1 SCXI-1335 1	4 SCXI-1335 3	6 SCXI-1335 4
2 Matrix Expansion Plug 1	5 Matrix Expansion Plug 2	7 Matrix Expansion Cables
3 SCXI-1335 2		

Figure 2-13. Example of Column and Row Expansion Using SCXI-1335 Modules

In the 4×64, 4×16, and 4×32 matrixes, you can to use the HVAB to both expand the matrix size and connect instruments to DUTs. By connecting the configuration relays (B0COM*x* to B3COM*x*), you can connect the rows of the four 4×16 matrixes and the two 4×32 matrixes so that a single 4×64 matrix is formed. Also, by connecting relays AB0–AB3, you can connect these rows to the HVAB allowing you to connect instruments through the SCXI backplane. This connection means that you can use multiple modules to construct 4×128, 4×192, and larger matrixes without

the need to daisy-chain terminal blocks. You can also use the 4 × 16 matrix in a similar fashion. You cannot accomplish this connection with other matrix types since the row granularity is greater than four, or in the case of the 4 × 64 matrix, you cannot subdivide it.

To make a larger matrix, such as a 16 × 64 matrix, you must make both column and row expansions. To build a larger matrix, follow these steps:

1. Expand the columns to the target number, 64 in this case, by connecting the rows of the appropriate number of SCXI-1335s (8 × 32 matrix), two in this case, using matrix expansion cables. This configuration results in a 8 × 64 matrix block.
2. Expand the rows to the target number, 16 in this case, by connecting the columns of the appropriate number of 8 × 64 matrix blocks, two in this case, using matrix expansion plugs.

Figure 2-13 shows four SCXI-1335s connected to form a 16 × 64 matrix.

Hardware and Software Scanning

The SCXI-1129 provides a very flexible scanning architecture. You have individual control over every crosspoint and configuration relay, which means you can:

- Do random switching
- Do multiplexing
- Use the 4 × 16 matrix banks independently

There are two basic methods of scanning: hardware-timed scanning and software scanning. In hardware-timed scanning, the measurement instrument, such as a DMM, communicates through digital triggering signals to the SCXI-1129. In its simple form, hardware-timed scanning uses one triggering signal to advance the matrix to the next state in the scan. This process is called synchronous scanning.

Note When using a DMM to control a SCXI chassis, synchronous mode is the only mode in which the DMM and the SCXI-1129 operate.

Another hardware-timed scanning method is called handshaking. While synchronous scanning requires just one signal from the instrument to the matrix, handshaking requires an additional signal connected from the matrix to the instrument. This additional trigger, Scanner Advanced, notifies the measuring instrument that the matrix has settled and that the next measurement can be made. This method is useful when using

an SCXI-1129 with external instruments to guarantee that both the measurement instrument and the matrix have settled before taking the next measurement.

The second type of scanning, software scanning, is a method by which matrix connections are initiated through the software. This method requires no trigger connections. Software scanning does not offer the time accuracy of hardware-timed scanning.

Hardware-Timed Scanning

In hardware-timed scanning, the software downloads a list of commands to the SCXI-1129. The software then starts executing the scan list. The scan list executes until reaching a wait for a trigger command. When the SCXI-1129 receives a trigger, the scan list continues to advance until receiving another wait for trigger command. Between waiting for triggers, the switch state of the matrix can be changed. When the matrix has changed state, the scan list can be instructed to send a Scanner Advanced (SCANADVD) signal to the measurement instrument indicating that the system is ready for another measurement to be made.

Hardware-Timed Scanning Using a DMM

When using a DMM to control a chassis, synchronous mode is the only mode in which the DMM and the SCXI-1129 can operate. The DMM issues a trigger to change the matrix configuration at regular intervals. You can program the interval at which the DMM sends triggers; set the interval as follows.

$$n \times 352\ \mu s + \left(\frac{n-1}{3}\right)(4\ ms) + \text{debounce time}$$

where n is the number of activated switches.

The module that connects directly to the DMM is referred to as the cabled module. If more SCXI-1129 modules are added to your system, the trigger is bused over the SCXI backplane allowing other modules to be triggered, as shown in Figure 2-14. These additional modules are referred to as non-cabled modules since they do not require you to cable the DMM directly to them.

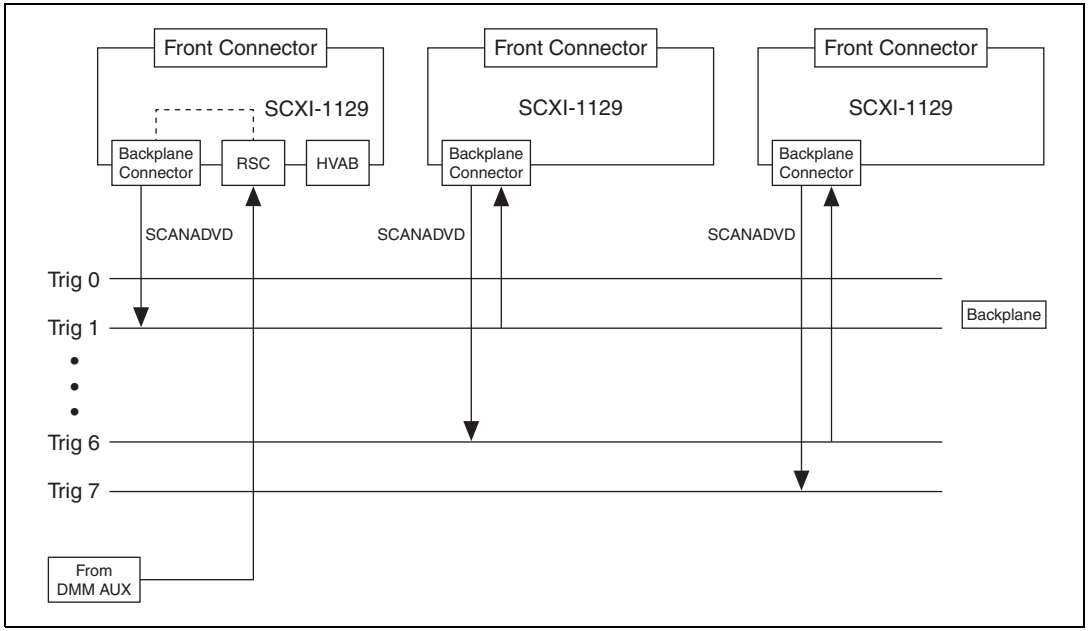


Figure 2-14. Cabling a DMM and Using Trig0–Trig7 to Bus the VMC/EXTRIG_1 to a Non-Cabled Module

The SCXI-1129 can accept trigger signals from any of the following sources:

- Rear signal connector
- Front connector
- Software trigger
- Triggers 0–7

Note Not all trigger lines are supported in all chassis. Make sure that the correct chassis is chosen for your particular application.

Note Trig0 - Trig7 refers to ttl0 - ttl7 in NI-SWITCH.

Hardware-Timed Scanning Using External Instruments

When using the SCXI-1129 with an external measurement instrument, you can use either synchronous or handshaking mode to advance though the scan list.

Synchronous Scanning

In the synchronous scanning mode, the measuring device, such as a DMM, issues a trigger, voltmeter complete (VMC), to advance the matrix scan list at regular intervals. Each interval must be long enough to guarantee that the matrix has fully settled before the next measurement is taken. Refer to *Hardware-Timed Scanning*. For example, you can connect the VMC of your DMM to the SCXI-1129 through a spring terminal labeled EXTTRIGIN on the SCXI-1333 terminal block. You can configure the SCXI-1129 to accept a VMC signal with either rising or falling edges.

If you have more that one SCXI-1129 module, it is not necessary to cable the VMC to each module. You can bus the VMC onto the SCXI backplane (Trig 0 to Trig 7) allowing other modules to be triggered as shown in Figure 2-15.

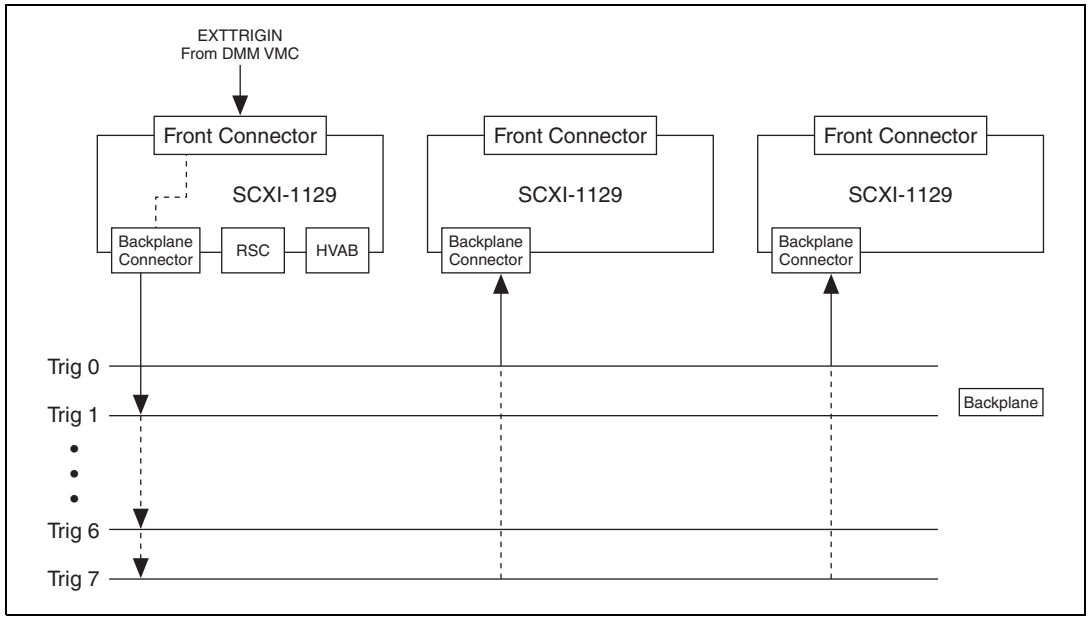


Figure 2-15. Cabling an External DMM

Handshaking Scanning

The SCXI-1129 supports a handshaking scanning mode. This mode uses the standard VMC/SCANADVD handshaking scheme. In this mode, the matrix responds to every VMC trigger by advancing the matrix to the next state, waiting for the matrix to settle, and then sending a scanner advanced pulse out on a SCANADVD output trigger back to the DMM.

For example, you can connect the VMC of the DMM to the SCXI-1129 through a spring terminal labeled EXTRIGIN on the SCXI-1333 terminal block. You must also connect the SCANADVD signal from the SCXI-1333 terminal block to your DMM external trigger input. Refer to Figure 2-2.

If you have more than one module in your system, it is not necessary to cable the VMC to each module. You can bus the VMC onto the SCXI backplane (Trig 0 to Trig 7), allowing other modules to be triggered as shown in Figure 2-15.

Multimodule Scanning

The SCXI-1129 supports three multimodule operation modes. This enables you to control many SCXI-1129 modules as if they were a single unit.

Chain Triggering

Multimodule scanning on the SCXI-1129 is similar to single-module scanning. When scanning multiple modules, there is a chance of channel contention. In other words, more than one module could be competing for the same channel if switches do not open and close at the right time. You can avoid this problem if you have one module triggering the following module after it has already switched and settled. Below is an example of three SCXI-1129 modules being scanned. The measurement device is receiving the SCANADVD signals as well as sending the VMC signals to the switches.

Example

Module 1	Switches, sends SCANADVD, waits for VMC, sends trigger to module 2, waits for trigger from module 3.
Module 2	Waits for trigger from module 1, sends SCANADVD, waits for VMC, sends trigger to module 3.
Module 3	Waits for trigger from module 2, switches, sends SCANADVD, waits for VMC, sends trigger to module1.

This method allows modules to communicate as to when to start switching as well as telling the measurement device when the switches have settled. This guarantees no channel contentions while switching.

Wire ORed

In wire ORed operation, you can make more than one module switch at the same time. In this mode, you can connect the SCANADVD signals together as show in Figure 2-16. By doing this, the SCANADVD lines are ORed together so that no scan advance is issued until the last module releases the line. When the last module releases the SCANADVD line, the measurement device receives the signal to take a new measurement. This method also guarantees no channel contentions while switching.

Dummy Entries

This method allows you to control multiple modules by entering dummy entries into the scan lists of the modules. Refer to the *NI-SWITCH User Manual* section for more information. Take care when using this method to insure that there are no bus or channel contentions when switching between modules.

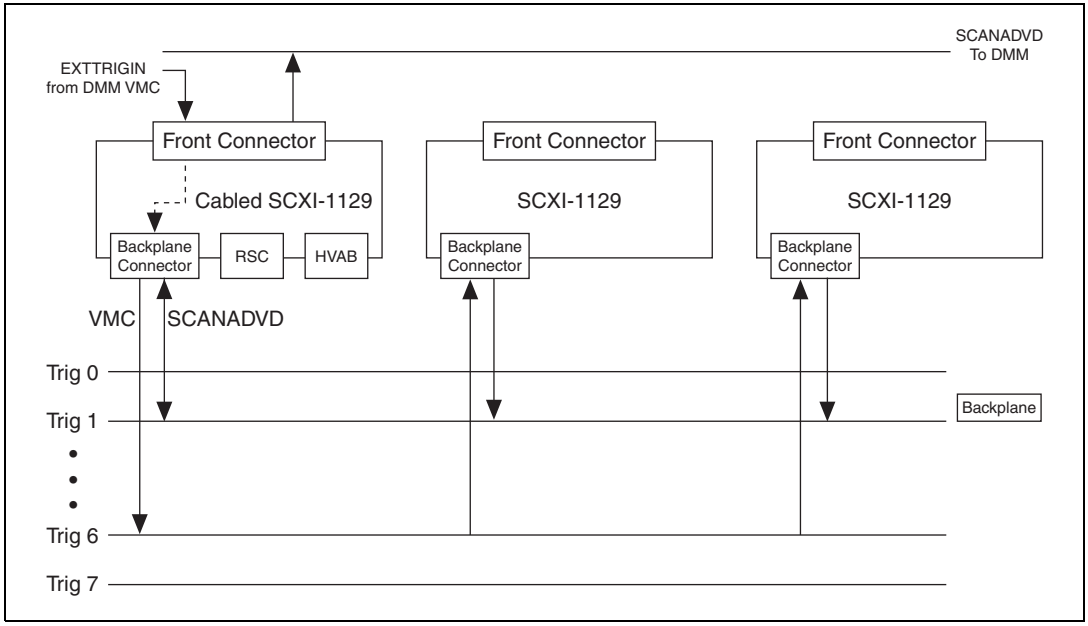


Figure 2-16. Wire ORed Operation

Software Scanning

Unlike hardware-timed scanning, software scanning does not use hardware-generated triggers. In software scanning, a list of matrix configurations, kept by the software, is scanned by selecting the desired configuration on the SCXI-1129 and making the required measurements. Refer to the *NI-SWITCH Software User Manual* for more information on software scanning.

Independent Switch Control

You can independently control all 276 relays on the SCXI-1129, including connection relays and HVAB relays. To close/open the relays, refer to them by their appropriate name. Refer to Table 2-3.

Note Independent switch control is valid only in the 4 × 16 configuration.

Table 2-3. Relay Names

Matrix Relays				Connection Relays	Analog Bus Relays
Bank 1	**Bank 2**	**Bank 3**	**Bank 4**		
B1R0C0... B1R0C15	B2R0C0... B2R0C15	B3R0C0... B3R0C15	B4R0C0... B4R0C15	B1COM0... B1COM3	AB0
B1R1C0... B1R1C15	B2R1C0... B2R1C15	B3R1C0... B3R1C15	B4R1C0... B4R1C15	B2COM0... B2COM3	AB1
B1R2C0... B1R2C15	B2R2C0... B2R2C15	B3R2C0... B3R2C15	B4R2C0... B4R2C15	B3COM0... B3COM3	AB2
B1R3C0... B1R3C15	B2R3C0... B2R3C15	B3R3C0... B3R3C15	B4R3C0... B4R3C15	B4COM0... B4COM3	AB3

A

Specifications

This appendix lists the specifications for the SCXI-1129 modules. These specifications are typical at 25 °C unless otherwise noted.

Input Characteristics

Number of 2-wire crosspoints 256

Matrix type ..... Quad 4 × 16

Common-mode voltage

- Channel to channel ..... 150 V_{rms} or DC
- Channel to earth ..... 150 V_{rms} or DC

Maximum allowed voltage

- AC ..... 150 V_{rms}
- DC ..... 150 VDC

Maximum switching capacity

- DC ..... 1 A at 30 V
- AC ..... 0.25 A at 150 V

Maximum switching power per crosspoint ..... 37.5 VA, 30 W

Maximum path ..... < 1 Ω

Transfer Characteristics

Thermal EMF (differential) ..... < 9 µV

Maximum frequency bandwidth (50 Ω termination)

- Worst-case path ..... 10 MHz

Channel to channel crosstalk (50 Ω termination)

10 kHz .....< –80 dB

100 kHz .....< –68 dB

1 MHz.....< –53 dB

Dynamic Characteristics

Maximum operating speed .....125 cycles/s

Relay operate time (at 20 °C).....4 ms max

Relay release time (at 20 °C) .....4 ms max

Expected life

Mechanical (at 180 cpm).....5×10^7 operations

Electrical at maximum load.....1×10^5 operations

Trigger Characteristics

Scanner advanced pulsewidth.....1 µs to 64 µs
6-bit programmable

Scanner advanced delay.....1 µs to 64 µs
6-bit programmable

External trigger input pulsewidth .....200 ns

Stability

Recommended warm-up time.....5 minutes

Physical

Dimensions .....3.0 by 17.2 by 20.3 cm
(1.2 by 6.9 by 8.0 in.)

Environment

Operating temperature ..... 0 to 50 °C

Storage temperature..... –20 to 70 °C

Relative humidity .....10 to 90% noncondensing

Safety

Designed in accordance with IEC-61010-1, UL 3111-1, and CAN/CSA C22.2 No. 1010.1 for electrical measuring and test equipment

Approved at altitudes up to 2000 m.

Installation Category I

Pollution Degree 2

Indoor use only

Emissions and Immunity

EMC/EMI	CE, C-Tick and FCC Part 15 (Class A) Complaint
Electrical emissions	EN 55011 Class A at 10 m; FCC Part 15A above 1 GHz
Electrical immunity	Evaluated to EN 61326:1998, Table 1

Note For full EMC and EMI compliance, you must operate this device with shielded cabling. See the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, click **Declaration of Conformity** at `ni.com/hardref.nsf`. This website lists the DoCs by product family. Select the appropriate product family, followed by your product, and a link to the DoC (in Adobe Acrobat format) appears. Click the Acrobat icon to download or read the DoC.

B

Accessories

This appendix lists various National Instruments products you can use with your SCXI-1129 module.

- The SCXI-1333 terminal block converts the switch card to a 4×16 matrix configuration.
- The SCXI-1334 terminal block converts the switch card to a 4×64 matrix configuration.
- The SCXI-1335 terminal block converts the switch card to a 8×32 matrix configuration.
- The SCXI-1336 terminal block converts the switch card to a 16×16 matrix configuration.
- The SCXI-1337 terminal block converts the switch card to a 8×16 matrix configuration.
- The SCXI-1339 terminal block converts the switch card to a 4×32 matrix configuration.
- Use the 1-slot, 2-slot, and 8-slot HVAB-backplane adapters to connect the HVAB of the SCXI-1129 to the DMM. You can also use them to establish HVAB connections across multiple SCXI-1129 modules or SCXI chassis. 2-slot and 8-slot HVAB-backplane adapters have four connectors on the external side—two HVAB connectors, one digital input in (AUXIN) connector, and one digital input out (AUXOUT) connector. The 1-slot SCXI-1357 has only HVAB connectors. The purpose of the AUXIN connector is to cable the digital communication signals from the DMM to the SCXI-1129 and finally to the SCXI chassis backplane. The AUXOUT connector connects the DMM communication signals to the next chassis if one is present.
- Use a SH9MD-9MD cable to connect digital communication lines of the DMM to the SCXI-1129 AUXOUT connector. You can also use this cable to carry signals to the next chassis.

- Use an HV8-BAN4 cable to connect the HVAB of the SCXI-1129(s) to the DMM analog bus.
- Use 8-position HVAB plugs to interconnect the HVAB of the HVAB-backplane adapters.

Contact National Instruments for more specific information about these products.

C

SCXI-1129 Block Diagram

Figure C-1 shows the SCXI-1129 high-density matrix module block diagram. All row and column connections, as well as the triggers, are accessed through the 180-pin connector on the front of the module. The internal module structure is a quad, 4 × 16 column matrix. The matrix can access the high-voltage analog backplane (HVAB) through the matrix connection relays and the high-voltage bus relays.

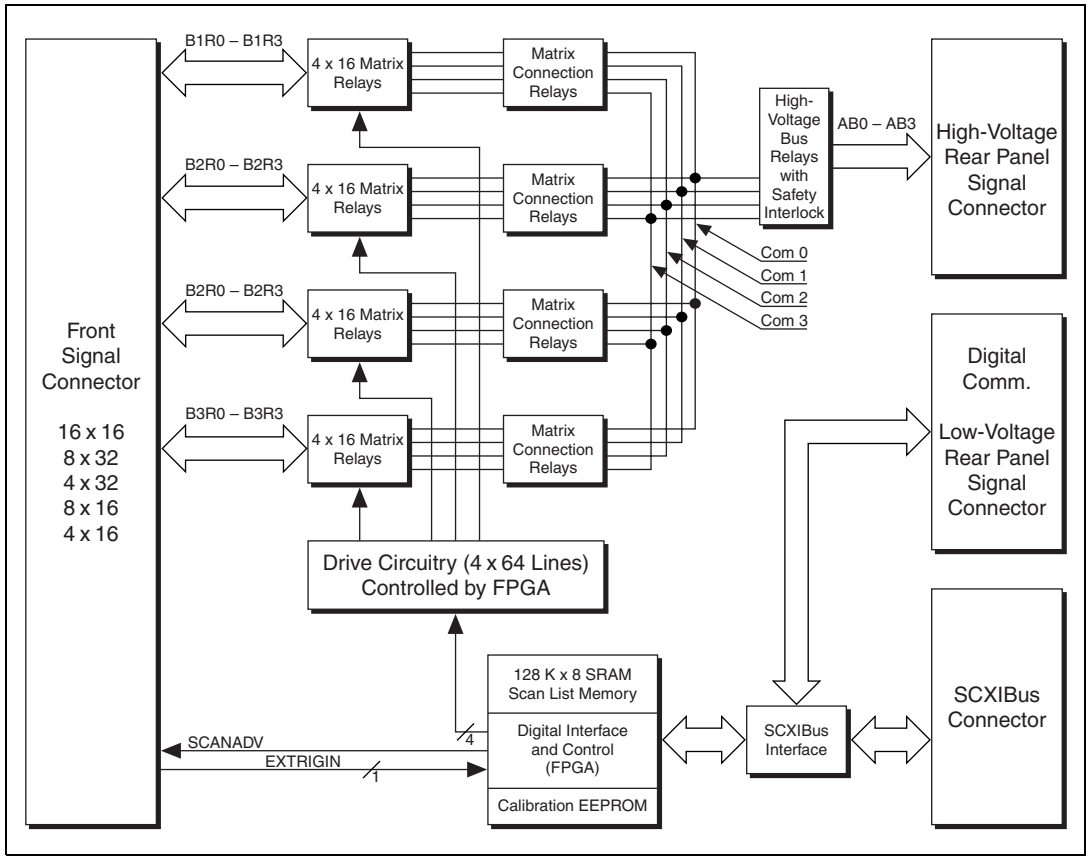


Figure C-1. SCXI-1129 Block Diagram

D

SCXI-1129 Front Connector

This appendix contains a connector diagram for the SCXI-1129 switch modules. The diagram also show the signal names that are used.

When you connect a custom terminal block or cable it is important that you incorporate the safety interlock scheme into the terminal block/cable. The safety interlock disconnects the high-voltage bus from the matrix if the terminal block or matrix configuration module is removed. This action prevents potentially hazardous voltages from appearing on exposed front panel connectors. You can incorporate the safety interlock scheme by connecting the INTERLOCK signal to the +5 V signal. Refer to Table D-1 for descriptions of signal names.

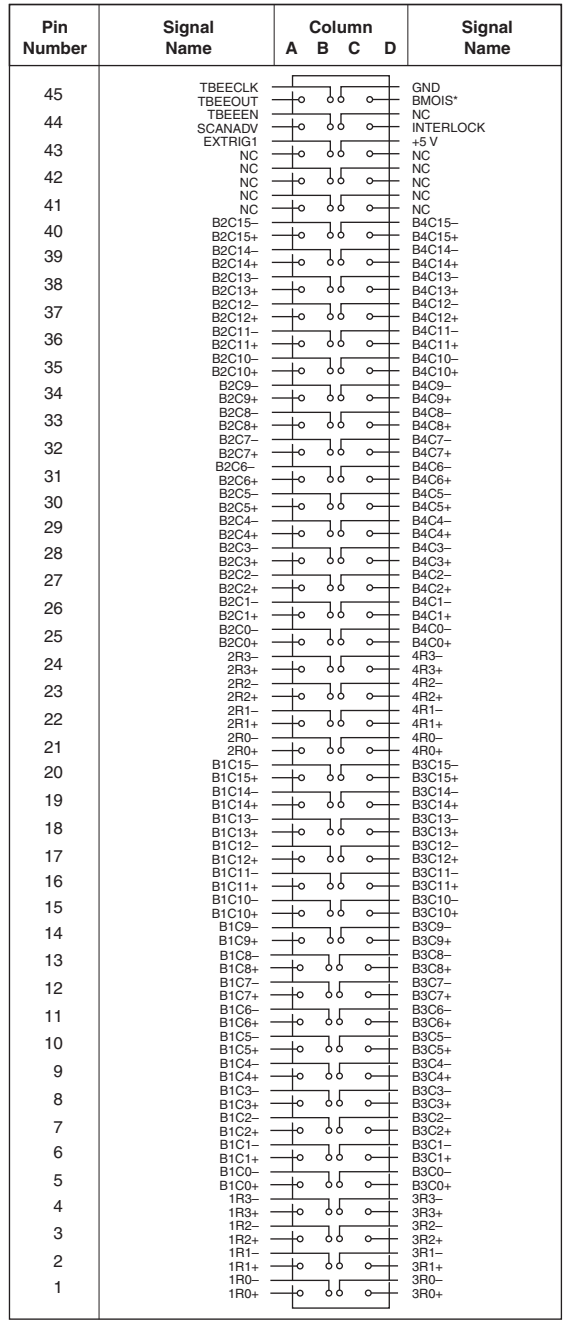


Figure D-1. SCXI-1129 Front Connector

Table D-1. Front Connector Signal Description

Signal Name	Type	Description
+5 V	Output	+5 VDC isolated source—powers the EEPROM and the INTERLOCK signal
GND	Output	Ground
EXTRIGIN	Input	External Trigger Input—trigger from an instrument to advance the switch matrix to the next state in the scan list
SCANADVD	Output	Scanner Advanced—trigger to an instrument that indicates the switch matrix has advanced to the next state in the scan list
TBEEEN	Input	Terminal block EEPROM chip select signal
TBEEOUT	Output	Terminal block EEPROM data output signal
TBEECLK	Input	Terminal block EEPROM clock input signal
BMOSI*	Input	Terminal block EEPROM data input signal
1R0+ to 1R3+ 1R0– to 1R3–	I/O	Bank 1, matrix row connections
2R0+ to 2R3+ 2R0– to 2R3–	I/O	Bank 2, matrix row connections
3R0+ to 3R3+ 3R0– to 3R3–	I/O	Bank 3, matrix row connections
4R0+ to 4R3+ 4R0– to 4R3–	I/O	Bank 4, matrix row connections
B1C0+ to B1C15+ B1C0– to B1C15–	I/O	Bank 1, matrix column connections
B2C0+ to B2C15+ B2C0– to B2C15–	I/O	Bank 2, matrix column connections
B3C0+ to B3C15+ B3C0– to B3C15–	I/O	Bank 3, matrix column connections
B4C0+ to B4C15+ B4C0– to B4C15–	I/O	Bank 4, matrix column connections

E

Common Questions

This appendix addresses common questions you may have while using your SCXI-1129 module.

How fast can I scan with the SCXI-1129 module?

The fastest scan rate for the SCXI-1129 is 125 scans/s. Typically, when using a DMM to make accurate measurements, the DMM requires hundreds of milliseconds. Consequently, the DMM becomes the limiting factor in determining the scan rate.

What should I do if the software detects the module, but the switches do not switch?

- Verify that the switches do not switch. Close your application program and then launch the soft front panel as described in the Set up and Test document you received with your kit. The soft front panel shows the state of each relay switch on the module. Try closing and opening the switches using the low level switch functions.
- Check the return codes of the NI-SWITCH operation to ensure that there are no errors (negative values) or warnings (positive values). You can also use the NI-Spy utility, which is installed with NI-SWITCH, to check for error codes.
- Finally, verify that your program is correct. For reference, see the examples described in the *NI-SWITCH Software User Manual*. The NI-SWITCH driver also ships with several examples in source code. Compare your algorithm to the ones in the examples.

What should I do if scanning does not work in the handshaking mode with a third-party DMM?

- Ensure that you have configured the SCXI-1129 and the instrument to correctly route all the trigger lines. The output trigger of the instrument should connect to the trigger input of the SCXI-1129. In addition, make sure the scanner advanced trigger of the SCXI-1129 connects to the input trigger of the instrument.
- If you use the SCXI-1129 to initiate the scan, make sure the DMM is waiting for a trigger before enabling scanning on the SCXI-1129.

- If you use the DMM to initiate the scan, enable scanning on the SCXI-1129 before configuring the DMM to start taking measurements. This is the recommended method for scanning.
- Be sure to check the return codes of the NI-SWITCH operation to ensure that there are no errors (negative values) or warnings (positive values). You can also use the NI-Spy utility, which is installed with NI-SWITCH, to check for error codes.
- Verify that your program is correct. For reference, see the examples described in the *NI-SWITCH Software User Manual*. The NI-SWITCH driver also ships with several examples in source code. Compare your algorithm to the ones in the examples.

Do I need to program the SCXI-1129 myself?

The SCXI-1129 comes with the NI-SWITCH driver software that exports the full functionality of the module. NI-SWITCH handles the complex issues of register writes to the module and operating system interfacing.

Can I plug a non SCXI-1129 module into a slot that has a high-voltage analog backplane?

Yes. You can plug in a module that does not support the HVAB. The non-SCXI-1129 module does not connect to the HVAB or the digital communication lines on the HVAB backplane adapter.

Must I install the complete high-voltage analog backplane?

No. You do not have to install the complete backplane. There can be instances where it is necessary for a non-SCXI-1129 module to communicate to a device using a different backplane adapter. For example, using a separate digital module in parallel mode. In this case, you can remove that segment of the HVAB although it is important that you do not remove the section of the HVAB that is controlling the chassis.

Can I use the HVAB for matrix expansion?

Yes. With the module AB0–AB3 relays connected, you can use the HVAB backplane to connect the matrix rows together. For example, you can create a 4×256 matrix in a 4-slot chassis. First, install four SCXI-1129s into the chassis. Now you have four independent 4×64 matrixes. Install the 2-slot HVAB-backplane adapter behind slots 3 and 4. This connects the rows between slots 3 and 4 creating a 4×128 matrix. Next, install another 2-slot HVAB-backplane adapter between slots 1 and 2 to create a second 4×128 matrix. Finally, connect the two, 2-slot adapters with an 8-position

HVAB plug. You now have a 4×256 matrix that uses the backplane to automatically connect rows. You can use either the SCXI-1333 quad 4×16, or SCXI-1334 4×64 terminal blocks to connect to the matrix columns in this configuration.

F

Technical Support Resources

Web Support

National Instruments Web support is your first stop for help in solving installation, configuration, and application problems and questions. Online problem-solving and diagnostic resources include frequently asked questions, knowledge bases, product-specific troubleshooting wizards, manuals, drivers, software updates, and more. Web support is available through the Technical Support section of `ni.com`

NI Developer Zone

The NI Developer Zone at `ni.com/zone` is the essential resource for building measurement and automation systems. At the NI Developer Zone, you can easily access the latest example programs, system configurators, tutorials, technical news, as well as a community of developers ready to share their own techniques.

Customer Education

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Glossary

Prefix	Meanings	Value
n-	nano-	10^{-9}
µ-	micro-	10^{-6}
m-	milli-	10^{-3}
k-	kilo-	10^{3}
M-	mega-	10^{6}
G-	giga-	10^{9}

Symbols

°	degrees
Ω	ohms
%	percent
±	plus or minus

A

A	amperes
AC	alternating current
ADE	application development environment

B

bus	the group of conductors that interconnect individual circuitry in a computer. Typically, a bus is the expansion vehicle to which I/O or other devices are connected.

C

C	Celsius
channel	pin or wire lead on the multiplexer to which you apply or from which you read the analog or digital signal. Signals can be single-ended or differential.

D

DC	direct current
device	a plug-in board, card, or pad that can contain multiple channels and conversion devices. Some examples of devices are computers, multimeters, multiplexers, oscillators, operator interfaces, and counters.
digital multimeter	a multifunction meter used to make measurements such as voltage, current, resistance frequency, temperature, and so on
DMM	*See* digital multimeter.
drivers/driver software	software that controls a specific hardware device such as a switch card

E

external trigger	a voltage pulse from an external source that triggers an event such as A/D conversion

H

handshaking	the use of two trigger lines between two instruments, such as a switch and a DMM, to synchronize their actions
HVAB	high-voltage analog bus
Hz	hertz—the number of scans read or updates written per second

I

I/O	input/output—the transfer of data to/from a computer system involving communications channels, operator interface devices, and/or data acquisition and control interfaces
in.	inches

M

matrix	superset of multiplexer; consists of connected rows and columns that allows for a direct connection from any row to any column
multiplexer	a switching device with multiple inputs that sequentially connects each of its inputs to its output, typically at high speeds, in order to measure several signals with a single analog input channel

N

NI-SWITCH	an IVI-based instrument driver that supports the National Instruments line of switch cards

P

PXI	PCI with extensions for instrumentation

R

relay	a switch that connects or disconnects the signal to a common through the physical movement of a metal arm

S

s	seconds
scan	the data acquisition of signals connected to multiple channels of a multiplexer. Typically, the measurement device uses a trigger to advance the multiplexer to the next channel in the scan.

scan list	a list of channels supplied to NI-SWITCH that indicates the order in which channels will be scanned
SCANADVD	scanner advance signal—in handshake scanning this signal is generated by the switching module to let the instrument or DMM know that the switching module has finished settling at the current channel
scanner advanced trigger	the trigger generated by the switch card when scanning. The trigger occurs after the switch card has closed a switch and the switch has settled.
SCXI	Signal Conditioning eXtensions for Instrumentation—the National Instruments product line for conditioning low-level signals within an external chassis near sensors so only high-level signals are sent to DAQ devices in the noisy PC environment
soft front panel	a graphical program included with NI-SWITCH that you can use to interactively control the switch

T

terminal block	an accessory containing wire connection points, typically screw terminals
trigger	any event that causes or starts some form of data capture

V

V	volts
VDC	volts, direct current
VMC	voltmeter complete signal—during synchronous or handshake scanning with an external DMM this signal advances the switching module to the next channel. It is called External Trigger In (EXT_TRIG_IN) on the SCXI-1331 terminal block.

W

W	watts
wire	data path between nodes

Index

Numbers

1R0+ to 1R3+ signal (table), D-3
1R0– to 1R3– signal (table), D-3
2 × 4 two-wire matrix configuration (figure), 2-1
2R0+ to 2R3+ signal (table), D-3
2R0– to 2R3– signal (table), D-3
3R0+ to 3R3+ signal (table), D-3
3R0– to 3R3– signal (table), D-3
4 × 16 matrix configuration, 2-4 to 2-5
4 × 32 matrix configuration, 2-6 to 2-7
4 × 64 matrix configuration, 2-10 to 2-11
4R0+ to 4R3+ signal (table), D-3
4R0– to 4R3– signal (table), D-3
+5 V signal (table), D-3
8 × 16 matrix
    configuration, 2-8 to 2-9
    matrix expansion (figure), 2-16
8 × 32 matrix configuration, 2-12 to 2-13
16 × 16 matrix configuration, 2-14 to 2-15

A

accessories, B-1 to B-2
adding modules manually, 1-24
auto-detecting modules, 1-23

B

B1C0+ to B1C15+ signal (table), D-3
B1C0– to B1C15– signal (table), D-3
B2C0+ to B2C15+ signal (table), D-3
B2C0– to B2C15– signal (table), D-3
B3C0+ to B3C15+ signal (table), D-3
B3C0– to B3C15– signal (table), D-3
B4C0+ to B4C15+ signal (table), D-3
B4C0– to B4C15– signal (table), D-3
block diagram of SCXI-1129, C-1
BMOSI* signal (table), D-3

C

cables, B-1 to B-2
chain triggering, multimodule scanning, 2-24
common questions, E-1 to E-3
configuration and self-test. *See also* installation.
    auto-detecting modules, 1-23
    manually adding modules, 1-24
    possible configurations (table), 1-1
    running Measurement & Automation utility (MAX), 1-22 to 1-23
configuration of matrix. *See* matrix operation.
connector. *See* front connector.
conventions used in manual, *vi*
customer education, F-1

D

DAQ devices
    accessing SCXI-1129 through other SCXI modules, 1-19 to 1-20
    PXI-1010 chassis, 1-21
    PXI-1011 chassis, 1-21
digital multimeters. *See* DMMs.
DMMs
    connecting external DMMs to SCXI-1129, 1-21 to 1-22
    connecting SCXI-1129 in multichassis system, 1-10 to 1-16
        4-slot and 4-slot multichassis configuration, 1-10 to 1-12
        4-slot and 12-slot multichassis configuration, 1-12 to 1-14
        12-slot and 12-slot multichassis configuration, 1-14 to 1-16

connecting SCXI-1129 in PXI-1010 chassis, 1-16 to 1-17
DMM in PXI slot 8, 1-17
DMM in PXI slots 1 through 7, 1-16 to 1-17
connecting SCXI-1129 in PXI-1011 chassis
DMM in PXI slot 4, 1-18
DMM in PXI slots 1 through 3, 1-18
connecting SCXI-1129 in single chassis system, 1-7 to 1-10
items required, 1-7
single 4-slot chassis configuration, 1-8 to 1-9
single 12-slot chassis configuration, 1-9 to 1-10
handshaking mode fails to work with third-party DMM, E-1 to E-2
hardware-timed scanning, 2-21 to 2-22
dummy entries, multimodule scanning, 2-25
dynamic characteristics, SCXI-1129, A-2

E

environment specifications, A-2 to A-3
external DMMs, connecting to SCXI-1129, 1-21 to 1-22
external instruments in hardware-timed scanning
handshaking scanning mode, 2-23 to 2-24
synchronous scanning mode, 2-23
EXT_TRIG_IN signal (table), D-3

F

front connector, D-1 to D-3
pin assignments (figure), D-1
signal descriptions (table), D-3

G

GND signal (table), D-3

H

handshaking scanning mode
description, 2-23 to 2-24
fails to work with third-party DMM, E-1 to E-2
hardware installation. *See* installation.
hardware-timed scanning, 2-21 to 2-24
handshake scanning, 2-23 to 2-24
overview, 2-21
synchronous scanning, 2-23
using DMM, 2-21 to 2-22
using external instruments, 2-22 to 2-24
HVAB (high-voltage analog bus) backplane adapters
common questions about, E-2 to E-3
connecting SCXI-1129 to DMM or other modules, B-1
overview, 1-1

I

independent switch control
opening/closing relays, 2-26
relay names (table), 2-27
input characteristics, SCXI-1129, A-1
installation, 1-3 to 1-22. *See also* configuration and self-test.
connecting SCXI-1129 to DMM in multichassis system, 1-10 to 1-16
4-slot and 4-slot multichassis configuration, 1-10 to 1-12
4-slot and 12-slot multichassis configuration, 1-12 to 1-14
12-slot and 12-slot multichassis configuration, 1-14 to 1-16
connecting SCXI-1129 to DMM in PXI-1010 chassis, 1-16 to 1-17
DMM in PXI slot 8, 1-17
DMM in PXI slots 1 through 7, 1-16 to 1-17

connecting SCXI-1129 to DMM in PXI-1011 chassis, 1-17 to 1-18
DMM in PXI slot 4, 1-18
DMM in PXI slots 1 through 3, 1-18
connecting SCXI-1129 to DMM in single chassis system, 1-7 to 1-10
items required, 1-7
single 4-slot chassis configuration, 1-8 to 1-9
single 12-slot chassis configuration, 1-9 to 1-10
connecting SCXI-1129 to external DMM, 1-21 to 1-22
DAQ devices
accessing SCXI-1129 using DAQ device, 1-19 to 1-20
PXI-1010 chassis, 1-21
PXI-1011 chassis, 1-21
installing SCXI-1129 into SCXI chassis, 1-5 to 1-7
safety information, 1-3 to 1-5
software installation, 1-2 to 1-3
unpacking SCXI-1129, 1-5

M

manually adding modules, 1-24
matrix operation, 2-1 to 2-20
configurations
2 × 4 two-wire matrix configuration (figure), 2-1
4 × 16 matrix configuration, 2-4 to 2-5
4 × 32 matrix configuration, 2-6 to 2-7
4 × 64 matrix configuration, 2-10 to 2-11
8 × 16 matrix configuration, 2-8 to 2-9
8 × 32 matrix configuration, 2-12 to 2-13
16 × 16 matrix configuration, 2-14 to 2-15
terminal block example (figure), 2-3
terminal block matrix configuration (table), 2-2
matrix expansion, 2-16 to 2-20
8 × 64 matrix schematic (figure), 2-16
column and row expansion using SCXI-1335 modules (figure), 2-19
daisy-chained modules (figure), 2-18
terminal blocks (table), 2-17
overview, 2-1 to 2-2
Measurement & Automation utility (MAX), 1-22 to 1-23
multichassis system, installing. *See* installation.
multimodule scanning, 2-24 to 2-26
chain triggering, 2-24
dummy entries, 2-25
wire ORed, 2-25, 2-26

N

National Instruments DMM. *See* DMMs.
NI Developer Zone, F-1
NI-SWITCH software
installation, 1-2 to 1-3
programming SCXI-1129, E-2

P

physical specifications, A-2
pin assignments for front connector (figure), D-1
PXI-1010 chassis
connecting with SCXI-1129, 1-16 to 1-17
DMM in PXI slot 8, 1-17
DMM in PXI slots 1 through 7, 1-16 to 1-17
using DAQ device, 1-21

PXI-1011 chassis
connecting with SCXI-1129, 1-17 to 1-18
DMM in PXI slot 4, 1-18
DMM in PXI slots 1 through 3, 1-18
using DAQ device, 1-21

Q

questions about SCXI-1129, E-1 to E-3

R

relay names (table), 2-27

S

safety information, 1-3 to 1-5
safety specifications, A-3
SCANADVD signal
description (table), D-3
handshaking scanning, 2-23 to 2-24
hardware-timed scanning, 2-21
scanning, 2-20 to 2-27
hardware-timed scanning, 2-21 to 2-24
handshake scanning, 2-23 to 2-24
overview, 2-21
synchronous scanning, 2-23
using DMM, 2-21 to 2-22
using external instruments, 2-22 to 2-24
independent switch control, 2-26 to 2-27
multimodule scanning, 2-24 to 2-26
chain triggering, 2-24
dummy entries, 2-25
wire ORed, 2-25
overview, 2-20 to 2-21
scan rate, E-1
software scanning, 2-26
SCXI chassis, installing SCXI-1129 into. *See* installation.
SCXI-1129
accessories, B-1 to B-2
block diagram, C-1
common questions, E-1 to E-3
front connector, D-1 to D-3
overview, 1-1 to 1-2
specifications, A-1 to A-3
self-test. *See* configuration and self-test.
signal descriptions for front connector (table), D-3
single-chassis system, installing. *See* installation.
software installation, 1-2 to 1-3
software scanning, 2-26
specifications, A-1 to A-3
dynamic characteristics, A-2
environment, A-2 to A-3
input characteristics, A-1
physical, A-2
safety, A-3
stability, A-2
transfer characteristics, A-1 to A-2
trigger characteristics, A-2
stability specifications, A-2
switches do not switch, E-1
synchronous scanning mode, 2-23
system integration, by National Instruments, F-1

T

TBEECLK signal (table), D-3
TBEEEN signal (table), D-3
TBEEOUT signal (table), D-3
technical support resources, F-1 to F-2
terminal blocks
daisy chaining
example (figure), 2-18
possible damage (caution), 2-17

matrix configuration
possible terminal blocks (table), 2-2
terminal block example (figure), 2-3
matrix expansion
column and row expansion (figure), 2-19
methods (table), 2-17
terminal blocks compatible with SCXI-1129, B-1
transfer characteristics, SCXI-1129, A-1 to A-2
trigger characteristics, SCXI-1129, A-2
troubleshooting problems, E-1 to E-3

W

Web support from National Instruments, F-1
wire ORed multimodule scanning
description, 2-25
example (figure), 2-26
Worldwide technical support, F-2

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