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SCXI-1305

SCXI™

SCXI-1126 User Manual

*Eight-Channel Isolated Frequency Input Module
for Signal Conditioning*

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For further support information, refer to the *Signal Conditioning Technical Support Information* document.
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Conventions

The following conventions are used in this manual:

<>

Angle brackets that contain numbers separated by an ellipsis represent a range of values associated with a bit or signal name—for example, DIO<3..0>.

»

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. When this symbol is marked on the product, refer to the *Read Me First: Safety and Radio-Frequency Interference* document, shipped with the product, for precautions to take.

bold

Bold text denotes items that you must select or click 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.

monospace bold

Bold text in this font denotes the messages and responses that the computer automatically prints to the screen. This font also emphasizes lines of code that are different from the other examples.

SCXIBus

Refers to the backplane in the SCXI chassis. A signal on the backplane is referred to as the SCXIBus <signal name> line (or signal). The SCXIBus descriptor may be omitted when the meaning is clear.

Slot 0

Slot 0 refers to the power supply and control circuitry in the SCXI chassis.

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Using the SCXI-1126

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Installing and Configuring the SCXI-1126

This manual describes the electrical and mechanical aspects of the SCXI-1126 module and contains information concerning its installation and operation. The SCXI-1126 is a member of the NI Signal Conditioning eXtensions for Instrumentation (SCXI) family of modules. Specifically, the SCXI-1126 module is designed for signal conditioning of frequency-generating sensors and other analog and digital periodic signal sources. The SCXI-1126 provides eight isolated frequency input channels and each channel is independently configurable through software.

This chapter describes the SCXI-1126, lists what you need to get started, explains how to unpack the SCXI-1126, and describes the optional software and equipment.

About the SCXI-1126

The SCXI-1126 signal conditioning module is used in isolating frequency generating sensors, and other analog and digital periodic signal sources. The SCXI-1126 has eight isolated input channels, each with ten selectable input frequency ranges from 250 Hz to 128 kHz, along with programmable input threshold and hysteresis functions. Each channel also has four selectable, 4-pole lowpass filters with cut-off frequencies ranging from 1 Hz to 1 kHz.

The SCXI-1126 operates in two output modes—parallel output and multiplexed output. In parallel output mode, all eight SCXI-1126 channels connect in parallel to eight E Series data acquisition (DAQ) device channels.

In multiplexed output mode, all eight SCXI-1126 channels are multiplexed into a single E Series DAQ device channel. You can multiplex several SCXI-1126 modules into a single channel and greatly increase the number of analog input signals that can be digitized.

For easy signal attachment to the SCXI-1126, you can use a terminal block to connect such signal connection options as screw terminals and BNC connectors.

With the SCXI-1126, the SCXI chassis can serve as a fast-scanning signal conditioner for laboratory testing, production testing, and industrial process monitoring.

Detailed specifications of the SCXI-1126 are listed in Appendix A, *Specifications*.

Theory of Operation

This section contains a functional overview of the SCXI-1126 module and explains the operation of each functional unit making up the SCXI-1126.

Functional Overview

The block diagram in Figure 1-1 illustrates the key functional components of the SCXI-1126.

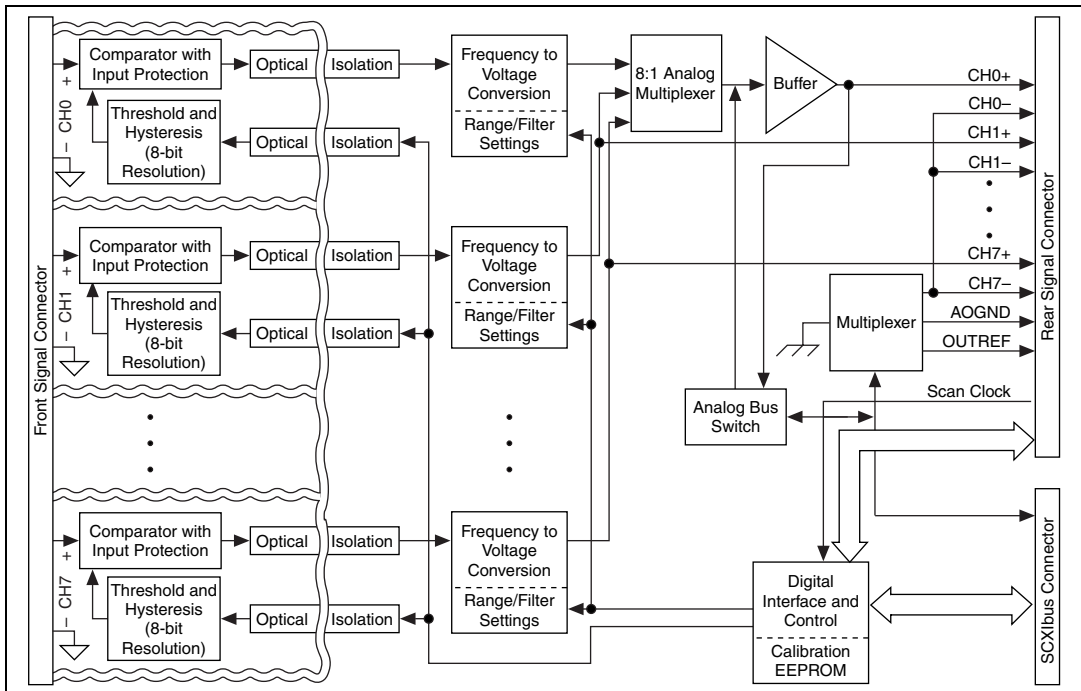


Figure 1-1. SCXI-1126 Block Diagram

The SCXI-1126 consists of eight isolated frequency input channels, each with software-programmable frequency ranges of 0–250 Hz, 0–500 Hz, 0–1 kHz, 0–2 kHz, 0–4 kHz, 0–8 kHz, 0–16 kHz, 0–32 kHz, 0–64 kHz, and 0–128 kHz. Each channel has its own software-programmable input threshold and hysteresis with a voltage range of –0.5 to 4.5 V. In addition, each channel also has a 4-pole, lowpass output filter with software-programmable cutoffs of 1 Hz, 40 Hz, 320 Hz, and 1 kHz. The SCXI-1126 also has a digital section for automatic control of channel scanning, frequency range selection, filter selection, and input threshold and hysteresis level setting.

Channel-to-Channel Isolated Analog Input Stage

The input stage of each channel is isolated from the other channels and from the chassis, up to 250 V_{rms}. Each channel is also protected from input overvoltages, up to 250 V_{rms} powered on or off.

This stage consists of a trigger circuit that compares the input waveform to a user-programmed threshold and hysteresis. The programmable range of the threshold is –0.5 to 4.48 V, and the programmable range of the hysteresis is 0 to 4.98 V. You can extend these ranges by using an attenuator terminal block. For example, the SCXI-1327 100:1 high-voltage attenuator terminal block extends the threshold range from –50 to 250 V, and the hysteresis range from 0 to 250 V. The threshold and hysteresis are programmed to create a window with the upper and lower limits given by the formula:

$$V_{window} = (V_{threshold} - V_{hysteresis}) \text{ to } V_{threshold}$$

where $(V_{threshold} - V_{hysteresis})$ must be greater than –0.5 V.



Note If you are using Traditional NI-DAQ, the formula is $V_{window} = V_{threshold} \pm 0.5 V_{hysteresis}$.

When the input waveform crosses through this window, a trigger occurs. The frequency of these triggers establishes the frequency to be converted by the frequency-to-voltage conversion stage.

Frequency-to-Voltage Conversion Stage

This stage consists of the following:

- A pulse generator, which triggers on the incoming frequency to produce a pulse per frequency cycle with a precisely controlled pulse width that is set by the input frequency range.
- A 1-bit DAC, which uses a stable voltage reference to translate the amplitude of the pulse train to the output voltage range.
- A programmable, 4-pole, active lowpass filter, which averages the output of the 1-bit DAC to produce a clean analog voltage proportional to the input frequency. You can program the filter to any of four bandwidths: 1 Hz, 40 Hz, 320 Hz, or 1 kHz. This added flexibility allows you to reduce the channel response time by selecting a higher filter bandwidth for input frequencies that exceed the minimum recommended value for the selected filter bandwidth. The minimum recommended input frequency for each filter bandwidth is listed in Appendix A, *Specifications*.



Note Because of the low bandwidths of the output filters, you must wait approximately 3 s after changing any of the settings to allow the channels to settle before you can take an accurate measurement. NI-DAQ automatically queries the module to determine when the module outputs have settled.

Analog Output Stage

The output stage consists of the following:

- A buffered analog multiplexer, which multiplexes the outputs of all eight channels to a buffer. The buffer output connects directly to CH0 on the rear signal connector.
- The analog bus switch circuitry, which can route the buffer output to AB0 on the SCXIbus connector instead of CH0 under software control. If the SCXI-1126 is the cabled module, you can configure the analog bus switch circuitry to route a signal placed on AB0 by another SCXI module, using the output buffer, to CH0 where it can be read by the E Series DAQ device. When a signal passes on the SCXIbus from the scanned module to the E Series DAQ device through the cabled module, the measurement is called *indirect scanning*. When a signal passes directly from the cabled module to the E Series DAQ device, the measurement is called *direct scanning*. Figure 1-1 illustrates the signal paths controlled by the analog bus switch circuitry.

You can software configure the output stage for two modes of operation—multiplexed mode or parallel mode.

Multiplexed Mode (Recommended)

In multiplexed mode, an E Series DAQ device connects to only one module in a chassis and reads from CH0 on the rear signal connector. If the SCXI-1126 is the cabled module, all of the SCXI-1126 channels are multiplexed onto CH0 along with the signals from other SCXI modules that are multiplexed on the SCXIBus. If the SCXI-1126 is not the cabled module, all of its channels are placed on the SCXIBus and are then sent to the E Series DAQ device through CH0 on the cabled module. The output signals for channels 1 through 7 on the SCXI-1126 are always sent to the rear signal connector and drive pins 5 through 18. In multiplexed mode, these output signals are ignored by the E Series DAQ device and are short-circuit protected. Use multiplexed mode if your sampling rate is <333 kS/s. Most applications sample rate is ≤ 10 kHz.

You also can use multiplexed mode to perform scanning operations with the SCXI-1126. The SCXI chassis is programmed with a module scan list that dynamically controls which module sends its output to the SCXIBus during a scan. You can specify this list to scan the modules in any order, with an arbitrary number of channels for each module entry in the list. When scanning the SCXI-1126, you can start scans with any channel, but you must scan the channels in a consecutive, ascending order.



Note The SCXI-1126 parallel outputs continuously drive the rear signal connector pins even when the module is configured in multiplexed mode.

While in multiplexed mode, the minimum scan interval is 3 μ s. This is the smallest interval in which you can switch between analog channels on the module and still measure accurate voltages; specifically, the accuracy at 3 μ s is 0.012% of full scale. The 3 μ s scan interval gives you a maximum sampling rate of 333 kHz. Because this rate is much higher than the 1 kHz maximum output bandwidth of a single SCXI-1126 channel, you can sample multiple channels on multiple SCXI modules without undersampling one of the SCXI-1126 channels. Refer to Appendix A, *Specifications*, for more information.

Parallel Mode

In parallel output mode, channel 0 is selected at the output multiplexer and connects to CH0. The seven other channels directly connect to CH1 through CH7, respectively, on the rear signal connector.

When the CH0 signal is configured as channel 0 output, the rear signal connector simultaneously carries each of the outputs of the SCXI-1126 on different pins, and the module is in parallel mode. In this mode you can use an SCXI-1180 feedthrough panel to make each of the outputs available at the front of the chassis. An E Series DAQ device cabled to an SCXI-1126 in parallel mode reads a separate output signal from the module on each of its analog inputs. You cannot multiplex the parallel outputs of a module onto the SCXIBus; only an E Series DAQ device directly cabled to the module has access to these outputs.



Note Since the SCXI-1126 provides programmable lowpass filters to average the output signals, it is uncommon for a signal to vary faster than 1 kHz, so sampling faster than 10 kHz is uncommon. Therefore, parallel mode is not commonly used, but some applications require parallel mode.

Rear Signal Connector, SCXIBus Connector, and Digital Interface

The SCXIBus controls the SCXI-1126. If the SCXI-1126 is the cabled module, the digital interface connects the rear signal connector to the SCXIBus. This allows an E Series DAQ device to control the SCXI-1126 and the rest of the chassis. Refer to the [Signal Connections](#) section of Chapter 2, [Using the SCXI-1126](#), for more information.

Digital Control Circuitry

The digital control circuitry consists of the following:

- The Module ID register, which contains the module ID of 1, a code unique to the SCXI-1126
- The configuration registers that set up the modes of operation and control the functions of the SCXI-1126
- The Address Handler, which controls which register is being addressed

What You Need to Get Started

To set up and use the SCXI-1126, you need the following items:

- SCXI-1126 module
- SCXI-1126 User Manual*
- Read Me First: Safety and Radio-Frequency Interference*
- SCXI chassis and documentation
- SCXI terminal block/connector assembly (optional)
- E Series DAQ device and documentation
- 1/8 in. flathead screwdriver
- Small Phillips screwdriver
- A computer

National Instruments Documentation

The *SCXI-1126 User Manual* is one piece of the documentation set for your data acquisition (DAQ) system. You could have any of several types of manuals depending on the hardware and software in your system. Use the manuals you have as follows:

- *Getting Started with SCXI*—This is the first manual you should read. It gives an overview of the SCXI system and contains the most commonly needed information for the modules, chassis, and software.
- *SCXI Chassis Manual*—Read this manual for maintenance information on the chassis and for installation instructions.
- Your SCXI hardware user manuals—Read these manuals next for detailed information about signal connections and module configuration. They also explain in greater detail how the module works and contain application hints.
- Your DAQ hardware documentation—This documentation has detailed information about the DAQ hardware that plugs into or is connected to the computer. Use this documentation for hardware installation and configuration instructions, specification information about the DAQ hardware, and application hints.

- Software documentation—You may have both application software and NI-DAQ software documentation. National Instruments (NI) application software includes ComponentWorks, LabVIEW, LabWindows™/CVI™, Measure, and VirtualBench. After you set up the hardware system, use either your application software documentation or the NI-DAQ documentation to help you write your application. If you have a large, complicated system, it is worthwhile to look through the software documentation before you configure the hardware.
- Accessory installation guides or manuals—If you are using accessory products, read the terminal block and cable assembly installation guides. They explain how to physically connect the relevant pieces of the system. Consult these guides when you are making the connections.

You can download NI documents from ni.com/manuals.

Software Programming Choices

When programming National Instruments DAQ hardware, you can use an NI application development environment (ADE) or other ADEs. In either case, you use NI-DAQ.

NI-DAQ

NI-DAQ, which shipped with the SCXI-1126 module, has an extensive library of functions that you can call from the ADE. These functions allow you to use all the features of the SCXI-1126. For more information on these functions, refer to the *NI-DAQ C Function Reference Help*.

NI-DAQ carries out many of the complex interactions, such as programming interrupts, between the computer and the DAQ hardware. NI-DAQ maintains a consistent software interface among its different versions so that you can change platforms with minimal modifications to the code. Whether you are using LabVIEW, LabWindows/CVI, Measurement Studio, VI Logger, or other ADEs, your application uses NI-DAQ.

To download the latest version of NI-DAQ, click **Download Software** at ni.com.

National Instruments ADE Software

LabVIEW features interactive graphics, a state-of-the-art interface, and a powerful graphical programming language. The LabVIEW Data Acquisition VI Library, a series of virtual instruments for using LabVIEW with National Instruments DAQ hardware, is included with LabVIEW.

LabWindows/CVI is a complete ANSI C ADE that features an interactive user interface, code generation tools, and the LabWindows/CVI Data Acquisition and Easy I/O libraries.

Measurement Studio, which includes tools for Visual C++ and tools for Visual Basic, is a development suite that allows you to design test and measurement applications. For Visual Basic developers, Measurement Studio features a set of ActiveX controls for using National Instruments DAQ hardware. These ActiveX controls provide a high-level programming interface for building virtual instruments (VIs). For Visual C++ developers, Measurement Studio offers a set of Visual C++ classes and tools to integrate those classes into Visual C++ applications. The ActiveX controls and classes are available with Measurement Studio and the NI-DAQ software.

VI Logger is an easy-to-use yet flexible tool specifically designed for data logging applications. Using dialog windows, you can configure data logging tasks to easily acquire, log, view, and share your data. VI Logger does not require any programming; it is a stand-alone, configuration-based software.

Using LabVIEW, LabWindows/CVI, Measurement Studio, or VI Logger greatly reduces the development time for your data acquisition and control application. Refer to ni.com for more information on these ADEs.

Installing the Software



Note You must install the software before you install the E Series DAQ device.

You can control the SCXI-1126 in an ADE using NI-DAQ. The supported ADEs include LabVIEW, LabWindows/CVI, Visual Basic (ComponentWorks), C, and C++ environments. Complete the following steps to install your SCXI-1126 software.

1. Install your ADE if you have not already done so. NI ADEs have release notes containing software installation instructions.

2. Install the latest version of NI-DAQ. If you do not have the latest version of NI-DAQ, either download it from ni.com or contact an NI sales representative to request it on a CD.



Note You must uninstall the version of NI-DAQ you are using before you update NI-DAQ to the current version.

Installing the SCXI-1126

The following section describes how to install the SCXI-1126 for use with the SCXI chassis and E Series DAQ device.



Note Refer to the *Read Me First: Radio-Frequency Interference* document before removing equipment covers or connecting or disconnecting any signal wires.

Unpacking

The SCXI-1126 module is shipped in an antistatic package to prevent electrostatic damage to the module. Electrostatic discharge can damage several components in 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 the plugged-in 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 NI if the module appears damaged in any way. Do *not* install a damaged module into the SCXI chassis.

Store the SCXI-1126 module in the antistatic package when not in use.

Installing the SCXI-1126 Module into the SCXI Chassis

To install the SCXI-1126 module into the SCXI chassis, complete the following steps while referring to Figure 1-2:

1. Power off the computer that contains the E Series DAQ device, or disconnect it from the SCXI chassis.
2. Power off the SCXI chassis. Do *not* insert the SCXI-1126 module into a chassis that is powered on.
3. Insert the SCXI-1126 into an open slot in the SCXI chassis. Gently guide the module into the slot guides and push it toward the back of the chassis until the front face of the module is flush with the front of the chassis.
4. Insert any other SCXI modules into the remaining slots in the same manner as described in step 3.
5. Secure all the SCXI modules to the SCXI chassis using both thumbscrews.

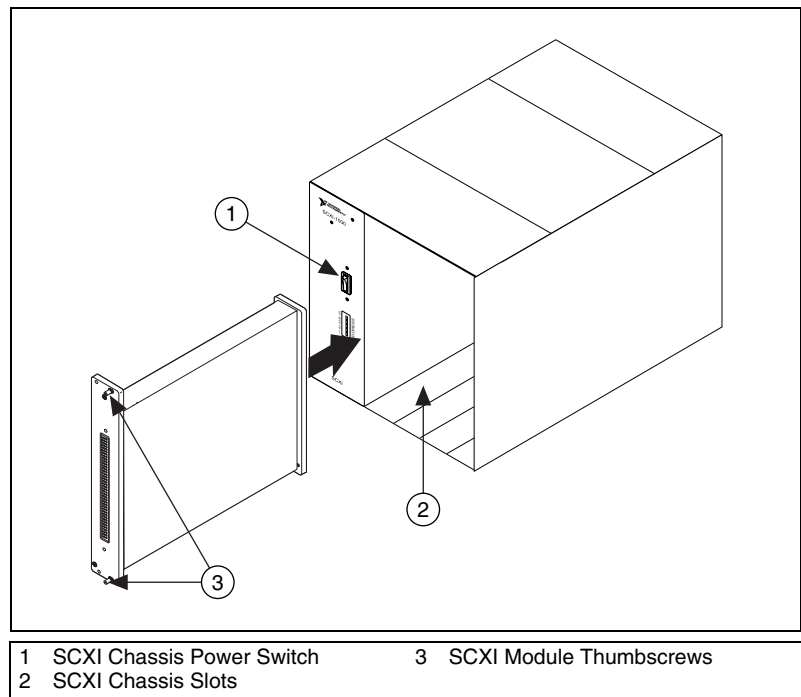


Figure 1-2. Installing the SCXI-1126 Module

To complete the SCXI-1126 installation, follow the procedure in the appropriate sections that follow.

Connecting the SCXI-1126 to an E Series DAQ Device for Multiplexed Scanning in an SCXI Chassis

In this configuration, you can multiplex all eight input channels of the SCXI-1126 into a single channel of the E Series DAQ device.

Consult the SCXI chassis documentation, other SCXI module documentation, and E Series DAQ device documentation for additional instructions and cautions. You should have already installed the SCXI-1126 module and any other SCXI modules in the chassis according to their installation instructions. If you are using more than one SCXI module, refer to the *SCXI Quick Start Guide* to determine to which module to cable the E Series DAQ device.

To connect the chassis to an E Series DAQ device for multiplexed operation, complete the following steps while referring to Figure 1-3:

1. Power off the SCXI chassis.
2. Power off the computer that contains the E Series DAQ device.
3. Insert the cable adapter into the back of the SCXI chassis aligned with the module that you intend to connect to the E Series DAQ device. For more information, refer to the installation guide for the cable assembly.
4. Connect the cable to the back of the cable adapter, ensuring that the cable fits securely.
5. Connect the other end of the cable to the E Series DAQ device you are using to control the SCXI system.
6. Check the cable installation, making sure the connectors and cable adapter are securely fastened at both ends.
7. Power on the SCXI chassis.
8. Power on the computer.

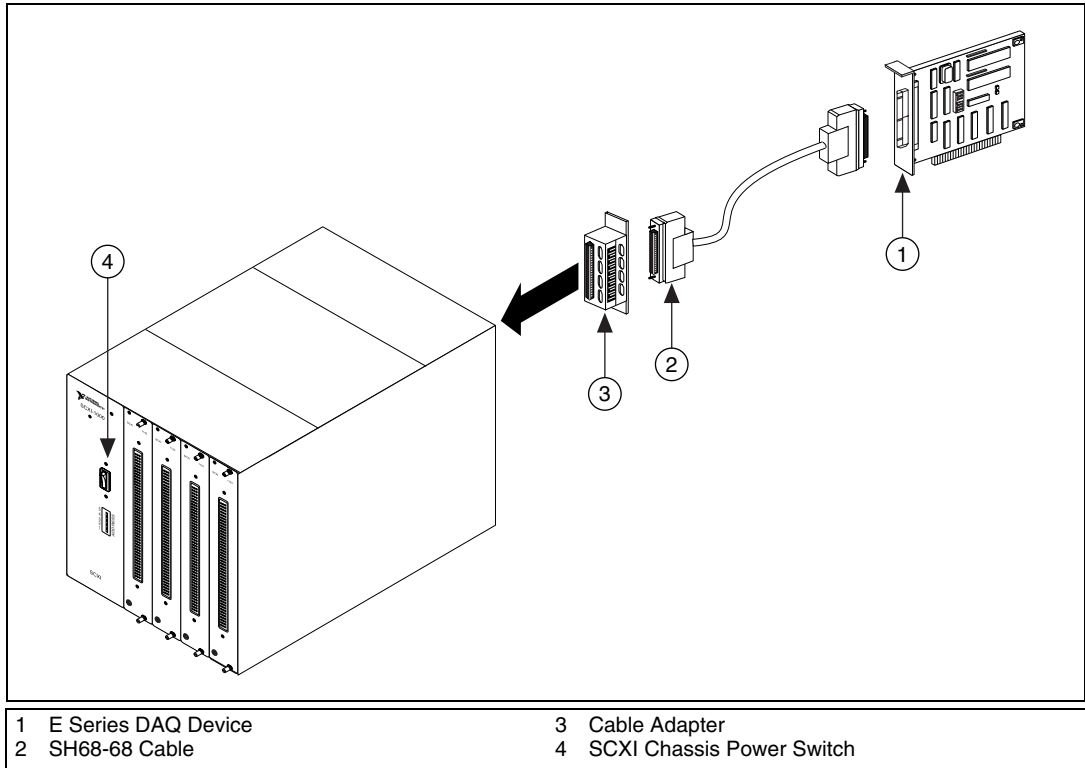


Figure 1-3. Connecting an SCXI Chassis to an E Series DAQ Device

If you have already installed the appropriate software, refer to the [Configuring and Self-Testing](#) section to configure the SCXI-1126 module(s) for multiplexed mode operation.

Connecting the SCXI-1126 to an E Series DAQ Device for Multiplexed Scanning in a PXI Combination Chassis

In this configuration, you can multiplex all eight channels of the SCXI-1126 into a single channel of the E Series DAQ device in a combination PXI chassis. You need the following items for this installation:

- PXI combination chassis with the SCXI module(s) installed
- PXI MIO E Series DAQ device installed in the right-most PXI slot

Consult the PXI chassis documentation, other SCXI module documentation, and E Series DAQ device documentation for additional instructions and cautions. You should have already installed your software,

the SCXI-1126 module, and any other SCXI modules in the chassis according to their installation instructions. To use the SCXI-1126 module in multiplexed mode with an E Series DAQ device in a PXI combination chassis, complete the following steps:

1. No cables are required between the SCXI-1126 and the E Series DAQ device if the PXI E Series DAQ device is installed in the right-most PXI slot. You can configure this device to control the SCXI system using an internal bus that connects the PXI chassis to the SCXI chassis. If the E Series DAQ device for controlling the SCXI system is not installed in the right-most slot of the PXI combination chassis, assemble the system as described in the [Connecting the SCXI-1126 to an E Series DAQ Device for Multiplexed Scanning in an SCXI Chassis](#) section.
2. Power on the SCXI portion of the PXI combination chassis.

You should have already installed the appropriate software. Refer to the [Configuring and Self-Testing](#) section to configure the SCXI-1126 for multiplexed mode operation.

Configuring and Self-Testing

You can configure an SCXI system under **Traditional NI-DAQ Devices** or **NI-DAQmx Devices**. NI recommends using **NI-DAQmx Devices** whenever possible because of the features available in NI ADE software. Using NI-DAQmx allows you to set up property nodes accessible in NI ADE software. When using the SCXI-1126, this allows you to configure filter settings, frequency ranges, threshold level, and threshold hysteresis outside of Measurement & Automation Explorer (MAX).

Configuring SCXI Using Traditional NI-DAQ

Use MAX to configure and test the SCXI-1126. If you need help during the configuration process, open the *MAX Help for Traditional NI-DAQ* by selecting **Help Topics** from the **Help** menu. Complete the following steps to configure the SCXI system.

1. Double-click the **Measurement & Automation Explorer** icon on the desktop. If you are adding a new module to an already configured chassis, go to the [Manually Adding and Configuring Modules in Traditional NI-DAQ](#) section.
2. Add a new chassis to the configured devices and interfaces by right-clicking **Devices and Interfaces** and selecting **Create New**.

3. Select the appropriate chassis from the list box under **Traditional NI-DAQ Device** and click **Finish**.
4. Configure the chassis:
 - a. Select a **Chassis ID**. This is an integer value you choose to uniquely identify the chassis for programming and scanning. The default Chassis ID starts at 1 and increments as the numbers are used.
 - b. Select the **Chassis Address**. This is needed to address the chassis in a multichassis SCXI system. Unless you are using multiple chassis with the same E Series DAQ device, select a Chassis Address of zero, which is the factory-default setting of all SCXI chassis. A chassis address of zero is indicated by setting all of the chassis address DIP switches to the *OFF* position. If you are using multiple chassis or one or more of the chassis address DIP switches is not in the *OFF* position, refer to the *SCXI Chassis User Manual* for further information.
 - c. If you are using a PXI-1010 or PXI-1011 chassis, select the **Controlling SCXI with internal bus** checkbox if you are communicating directly with the SCXI portion of the chassis without external cabling.
 - d. Click **Next**.
5. You can now choose to automatically detect which modules are installed in the chassis or you can manually add them. Click **Next** if you selected **Yes** and **Finish** if you selected **No**. If you selected **No**, go to the [Manually Adding and Configuring Modules in Traditional NI-DAQ](#) section.
6. If you selected auto-detection, select the communication path and click **Next**.
7. Select the cabled module by clicking the module in the list box and clicking **Finish**.

You have completed configuring the SCXI-1126 using Traditional NI-DAQ.

Manually Adding and Configuring Modules in Traditional NI-DAQ

If you did not auto-detect the SCXI modules, you must manually add and configure each of the modules. Complete the following steps to manually add modules.

1. Click the **+** next to **Devices and Interfaces, Traditional NI-DAQ Devices**, and the chassis you want to configure.
2. Add a module in an empty module number. If a module number is not empty, right-click the module number you want to change and select **Delete**.
3. Right-click the slot you want to configure and select **Insert**.
4. In the list box, select a module you want to add and click **Next**.
5. Select the E Series DAQ device to which this specific module connects if it is a cabled module. Otherwise, select **None** and click **Next**. If you select a device, select the **This device will control the chassis** checkbox if you want the device as the communicating device.
6. Continue following the onscreen instructions to complete the configuration. When you have clicked **Finish**, the module configuration is complete.
7. Repeat steps 2 through 6 until you have added all the modules.

The SCXI chassis and SCXI module(s) should now be configured properly. If you need to change the module configuration, right-click the module you want to change and select **Properties**. If you need to change the actual module, repeat steps 2 through 6. If the configuration is complete, test the system as described in the *Verifying and Self-Testing the Configuration in Traditional NI-DAQ* section to ensure the SCXI system is communicating properly with the E Series DAQ device.

Verifying and Self-Testing the Configuration in Traditional NI-DAQ

To test the successful configuration of the system, complete the following steps after opening MAX.

1. Verify that the chassis power is on and is correctly connected to an E Series DAQ device.
2. Display the list of devices and interfaces by clicking the **+** next to the **Devices and Interfaces** icon.
3. From the list that appears under Traditional NI-DAQ Devices, locate the chassis you want to test. Right-click the chassis and click **Test**.
4. If the communication test is successful, a message **The Chassis has been Verified** appears. Click **OK**.

The SCXI system should now operate properly with your ADE software. If the test did not complete successfully, refer to the [Troubleshooting the Self-Test Verification](#) section for troubleshooting steps.

To configure the frequency range, filter range, threshold level, and threshold hysteresis of the SCXI-1126, refer to the [SCXI-1126 Configuration Settings](#) section.

Configuring SCXI Using NI-DAQmx

Use MAX to configure and test the SCXI-1126. If you need help during the configuration process, open the *MAX Help for NI-DAQmx* by selecting **Help Topics** from the **Help** menu. Complete the following steps to configure the SCXI system.

1. Double-click the **Measurement & Automation Explorer** icon on the desktop.
2. Click the **+** next to the **Devices and Interfaces** icon. If you are adding modules to an already configured chassis, go to the [Manually Adding and Configuring Modules in NI-DAQmx](#) section.
3. Add a new chassis to the configured devices and interfaces by holding down the right mouse button on **NI-DAQmx Devices** and selecting **Create New DAQmx Device**.
4. Select **NI-DAQmx SCXI Chassis**.
5. Select the appropriate chassis from the pull-down menu.
6. Configure the chassis:
 - a. Select the **Chassis Communicator** that is connected to the SCXI chassis.
 - b. Select the **Communicating SCXI Module Slot**.
 - c. Select the **Chassis Address**.
7. You can now choose to automatically detect which modules are installed in the chassis, or you can manually add them by selecting or clearing the **Auto-Detect Modules** checkbox.
8. Left-click **Save** and go to step 1 in the [Manually Adding and Configuring Modules in NI-DAQmx](#) section to complete configuration.

Manually Adding and Configuring Modules in NI-DAQmx

You must add and configure each of the modules in the **Chassis Configuration** window. If you are not in the **Chassis Configuration** window, right-click on the chassis in which the module is installed and select **Properties**. Complete the following steps to manually add modules.

1. Left-click the down arrow in the module column corresponding to the slot where the added module is located. If the appropriate module name does not appear on the list, refer to Appendix B, *Common Questions*.
2. Left-click the down arrow in the **Accessory** column to select the appropriate accessory on the module.
3. To change the cabled module, put the module in parallel mode, change the E Series DAQ device which connects to this module, or set up a multichassis daisy chain, left-click the **Details** button and click the **Cabling** tab.
4. When you have finished, click **OK**.
5. When you have completed configuring the module, click **OK**.

The SCXI chassis and SCXI module(s) should now be configured properly. If you need to change the module configuration, right-click the module you want to change and select **Properties**. If you need to change the actual module, go to the Chassis Configuration window and repeat steps 1 through 5. If the configuration is complete, test the system as described in the *Verifying and Self-Testing the Configuration in NI-DAQmx* section to ensure the SCXI system is communicating properly with the E Series DAQ device.

Verifying and Self-Testing the Configuration in NI-DAQmx

To test the successful configuration of the system, complete the following steps after opening MAX:

1. Verify that the chassis power is on and is correctly connected to an E Series DAQ device.
2. Display the list of devices and interfaces by clicking the + next to the **Devices and Interfaces** icon.
3. From the list that appears under NI-DAQmx Devices, locate the chassis you want to test. Right-click the chassis and click **Test**.
4. If the communication test is successful, a message **Chassis verified** appears. Click **OK**.

The SCXI system should now operate properly with your ADE software. If the test did not complete successfully, refer to the *Troubleshooting the Self-Test Verification* section for troubleshooting steps.

To configure the frequency range, filter range, threshold level, and threshold hysteresis of the SCXI-1126, refer to the [SCXI-1126 Configuration Settings](#) section.

Troubleshooting the Self-Test Verification

If the Self-Test Verification did not verify the chassis configuration, check the following items to successfully complete system configuration:

- If you get the message **Unable to test chassis at this time**, you have not designated at least one module as connected to an E Series DAQ device.
 1. Return to the [Manually Adding and Configuring Modules in NI-DAQmx](#) section.
 2. Change the configuration of the cabled module in the system from not being connected to connected to device *x*.
- If you get the message **Failed to find**, followed by the module codes and the message **Unable to communicate with chassis**:
 1. Make sure the SCXI chassis is powered on.
 2. Make sure the cable between the SCXI chassis and E Series DAQ device is properly connected.
 3. Inspect the cable connectors for bent pins.
 4. Make sure you are using the correct NI cable assembly.
 5. Test the E Series DAQ device to verify it is working properly. Refer to the E Series DAQ device user manual for more information.
- If you get the message **Failed to find**, followed by module codes and the message **Instead found: module with ID 0Xzz**:
 1. Return to the [Manually Adding and Configuring Modules in NI-DAQmx](#) section and make sure the correct module is in the specified slot.
 2. Delete the incorrect module as described in the [Removing the SCXI-1126 from Measurement & Automation Explorer](#) section.
 3. Add the correct module as described in the [Manually Adding and Configuring Modules in NI-DAQmx](#) section.

- If you get the message **Failed to find**, followed by a module code and the message **Slot x is empty**:
 1. Check to see if the configured module is installed in the specified slot. If not, install the module by referring to the [Installing the SCXI-1126 Module into the SCXI Chassis](#) section.
 2. If the module is installed in the correct slot, power off the chassis.
 3. Remove the module as specified in the [Removing the SCXI-1126 from an SCXI Chassis](#) section.
 4. Verify that no connector pins are bent on the rear signal connector.
 5. Reinstall the module as described in the [Installing the SCXI-1126 Module into the SCXI Chassis](#) section, ensuring the module is fully inserted and properly aligned in the slot.

After checking the preceding items, return to the [Verifying and Self-Testing the Configuration in NI-DAQmx](#) section and retest the SCXI chassis.

If these measures do not successfully configure the SCXI system, refer to Appendix B, [Common Questions](#), for more information.

SCXI-1126 Configuration Settings

This section describes how to set the frequency range, filter frequency, threshold level, and threshold hysteresis of each channel. After you have installed and verified the SCXI chassis and SCXI-1126, you can configure the SCXI-1126.

Configuring Using Traditional NI-DAQ

To configure the SCXI-1126 using Traditional NI-DAQ, complete the following steps:

1. Right-click the module number containing the SCXI-1126.
2. Select **Properties**.
3. On the **General** tab, select the E Series DAQ device to which the module connects and the operating mode.
4. On the **Channel** tab, select the **Channel**, **Frequency Range**, and **Filter Frequency**, and then enter the **Threshold Level** and **Threshold Hysteresis**.
5. On the **Accessory** tab, select the accessory connected to the SCXI-1126.
6. Select **OK**.

Configuring Using NI-DAQmx

To configure the SCXI-1126 using NI-DAQmx, complete the following steps:

1. Right-click **Data Neighborhood** and select **Create New**.
2. Select **DAQmx Task** or **DAQmx Channel**. To configure multiple channels, select **DAQmx Task**. Otherwise, select **DAQmx Channel**.
3. Click **Next**.
4. Select **Analog Input** then select **Frequency** and click **Next**.
5. If you are creating a task, keep the **Create New Local Channels** selected and select the channels to add to the task. You can select blocks of channels by pressing the <Shift> key while making the selections or individual channels by pressing the <Ctrl> key while making the selections. If you are creating a channel, you can select only one channel. Click **Next**.
6. Select the name of the task or channel, and then click **Finish**.

You can now set the frequency range, filter frequency, threshold level, and threshold hysteresis.

Frequency Range

To set the frequency range, complete the following steps:

1. Select the channel(s) you want to configure for frequency range. You can select blocks of channels by pressing the <Shift> key while making the selections or individual channels by pressing the <Ctrl> key while making the selections.
2. Under the **Settings** tab, set the input range by entering the **Min** and **Max** values.
3. Repeat steps 1 and 2 until you have configured all the channels.

Filter Frequency

To set the filter frequency, complete the following steps:

1. Select the channel(s) you want to configure for filter frequency. You can select blocks of channels by pressing the <Shift> key while making the selections or individual channels by pressing the <Ctrl> key while making the selections.
2. Under the **Device** tab, click the down arrow to set the lowpass filter cutoff frequency and select the desired filter.
3. Repeat steps 1 and 2 until you have configured all the channels.

Threshold Level

To set the threshold level, complete the following steps:

1. Select the channel(s) you want to configure for threshold level. You can select blocks of channels by pressing the <Shift> key while making the selections or individual channels by pressing the <Ctrl> key while making the selections.
2. Under the **Settings** tab, set the threshold level by entering the value in the **Level** box.
3. Repeat steps 1 and 2 until you have configured all the channels.

Threshold Hysteresis

To set the threshold hysteresis, complete the following steps:

1. Select the channel(s) you want to configure for threshold hysteresis. You can select blocks of channels by pressing the <Shift> key while making the selections or individual channels by pressing the <Ctrl> key while making the selections.
2. Under the **Settings** tab, set the threshold hysteresis by entering the value in the **Hysteresis** box.
3. Repeat steps 1 and 2 until you have configured all the channels.

Removing the SCXI-1126

This section provides details for removing an SCXI-1126 module from an SCXI chassis and for removing the SCXI-1126 module from MAX.

Removing the SCXI-1126 from Measurement & Automation Explorer

To remove a module from MAX, complete the following steps after launching MAX:

1. Display the list of installed devices and interfaces by clicking the + next to the **Devices and Interfaces** icon. If the SCXI-1126 is configured under **NI-DAQmx**, remove the module under **NI-DAQmx Devices**. If the SCXI-1126 is configured under **Traditional NI-DAQ**, remove the module under **Traditional NI-DAQ Devices**.
2. Locate the chassis in the list of installed devices. Display the list of modules in the chassis by clicking the + next to the **Chassis** icon.
3. Right-click the module or chassis you want to delete and click **Delete**.
4. You are presented with a confirmation window. Click **Yes** to continue deleting the module or chassis or **No** to cancel this action.



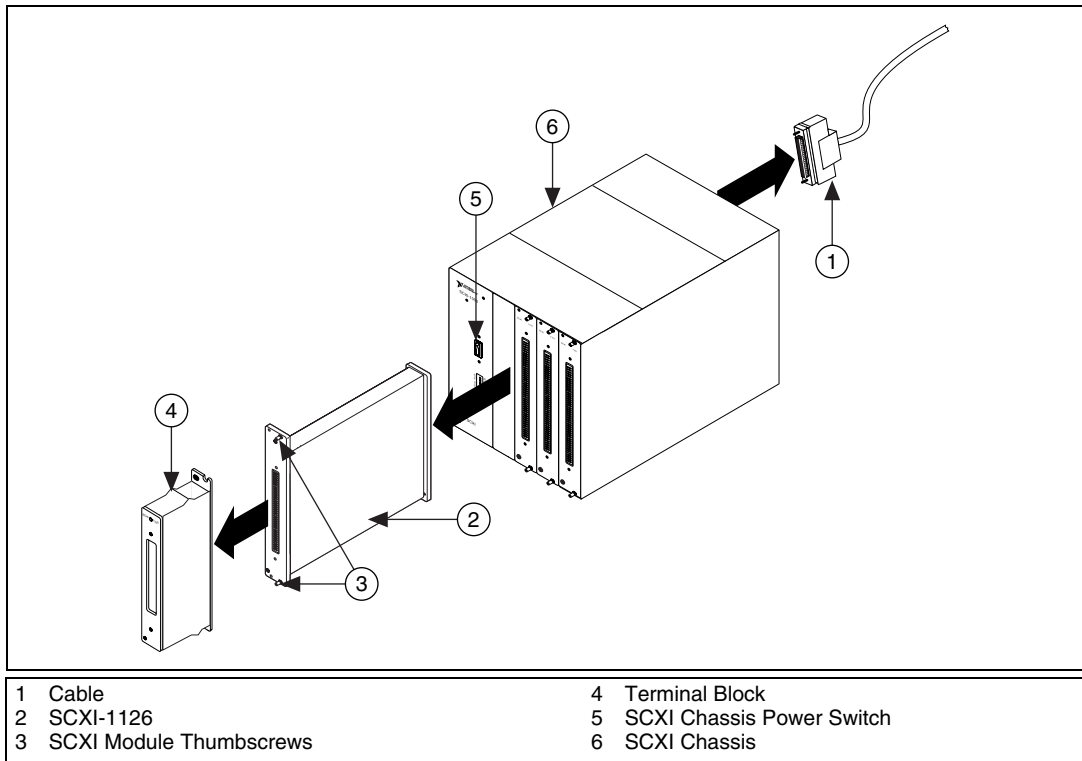
Note Deleting the SCXI chassis deletes all modules in the chassis. All configuration information for these modules is also lost.

The SCXI chassis and/or SCXI module(s) should now be removed from the list of installed devices in MAX.

Removing the SCXI-1126 from an SCXI Chassis

Consult the documentation for an SCXI chassis or PXI/SCXI combination chassis and accessories for additional instructions and cautions. To remove the SCXI-1126 module from an SCXI chassis, complete the following steps while referring to Figure 1-4:

1. Power off the SCXI chassis. Do *not* remove the SCXI-1126 module from a chassis that is powered on.
2. If the SCXI-1126 is the cabled module, disconnect the cable running from the SCXI-1126 to the E Series DAQ device.
3. Remove any terminal block that connects to the SCXI-1126.
4. Rotate the thumbscrews that secure the SCXI-1126 to the chassis counter-clockwise until they are loose, but do not completely remove the thumbscrews.
5. Remove the SCXI-1126 by pulling steadily on both thumbscrews until the module slides completely out.



Using the SCXI-1126

This chapter describes the input and output signal connections, and includes specifications and connection instructions to the SCXI-1126 module using the SCXI-1126 front connector and rear signal connector.

Signal Connections

If you are using a terminal block with the SCXI-1126, refer to the terminal block installation guide documentation for signal connection information. This section provides information about various signal types such as floating, ground-referenced, signals with or without high common-mode voltage, and signals with or without unwanted DC components, and how to connect them.

Analog Input Channels

Each input channel pair corresponds to a separate frequency input channel and is fully isolated from the other inputs and from earth ground. The inputs are designed in a floating single-ended configuration, which allows the measured signal to be referenced to a ground level with common-mode voltage up to 250 V_{rms}. Figure 2-1 shows how to connect a ground-referenced signal to the SCXI-1126. Figure 2-2 shows how to connect a floating signal, and Figures 2-3 and 2-4 show how to AC couple signals to remove unwanted DC components on the SCXI-1126. Figures 2-1 through 2-4 show the signal path from the signal source up to the E Series DAQ device. The signal exits the SCXI-1126 and enters the E Series DAQ device, which is configured in differential (DIFF) mode.



Notes For better noise immunity or to reference floating signal sources, connect the negative input channel to the chassis ground as shown in the **Optional** boxes of Figure 2-2 and Figure 2-3. If the application requires isolation, do not connect to chassis ground.

If you are using the SCXI-1304 or SCXI-1305 terminal block, leave the switches in *G*, the ground-referenced position, when the application requires isolation. Placing the switch in *F*, the floating position, engages the bias resistor that connects the negative signal (CH-) of each channel together. This breaks the channel-to-channel isolation barrier.

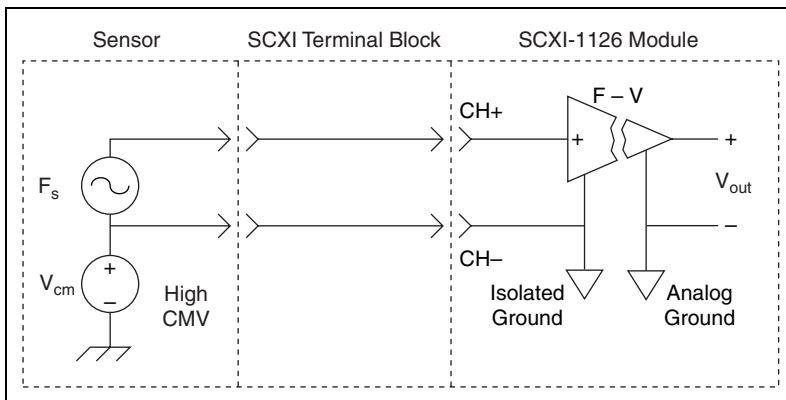


Figure 2-1. Ground-Referenced Signal Connection for the SCXI-1126 with High Common-Mode Voltage

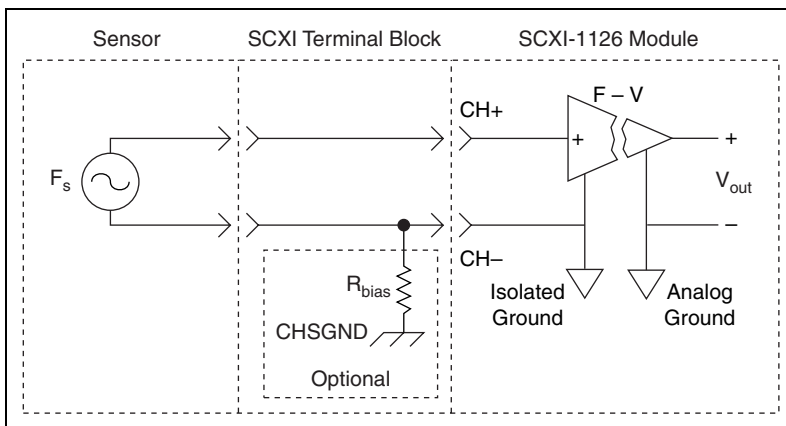


Figure 2-2. Floating Signal Connection for the SCXI-1126 Referenced to Chassis Ground for Better Signal-to-Noise Ratio



Caution Adding the bias resistor (R_{bias}), shown in Figure 2-2, breaks the isolation barrier.

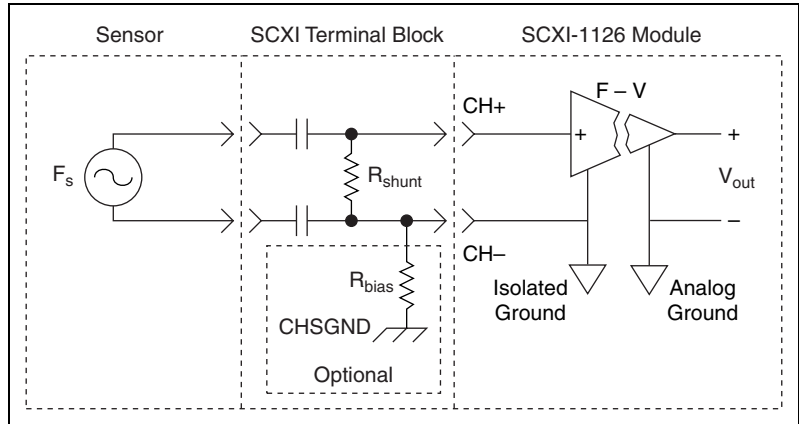


Figure 2-3. Floating AC Coupled Signal Connection for the SCXI-1126



Caution Adding the bias resistor (R_{bias}), shown in Figure 2-3, breaks the isolation barrier.

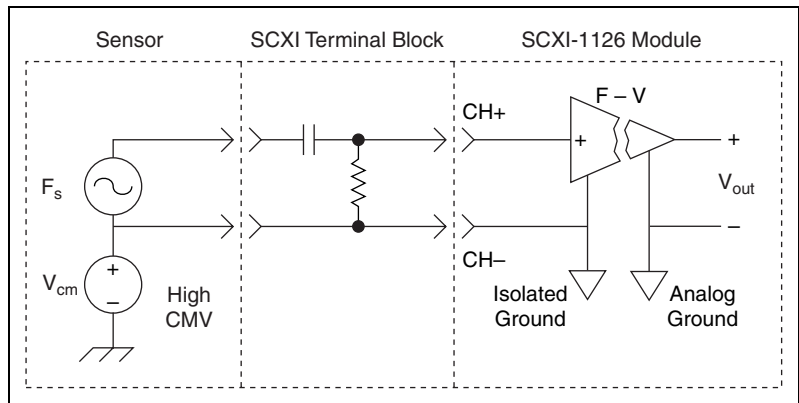


Figure 2-4. AC Coupled Signal Connection for the SCXI-1126 with High Common-Mode Voltage

When you connect AC coupled signals to the SCXI-1126, as shown in Figures 2-3 and 2-4, connect an external resistor from the positive input channel to the signal reference to provide the DC path for the positive input bias current. Typical resistor values range from 100 k Ω to 1 M Ω . This solution, although necessary in this case, reduces the input impedance of the input channel. This can introduce loading errors if the signal source has a high output impedance. Refer to Appendix A, *Specifications*, for information on channel input impedance.

The input signal range of an SCXI-1126 input channel is -0.5 to 4.5 V referenced to its negative input. In addition, the input channels are overvoltage protected to 250 V_{rms} with power on or off at a maximum of 5 mA_{rms} sink or source.

SCXI-1126 Front Connector

This section provides detailed information about the front and rear signal connectors. If you are creating a custom terminal block using the SCXI-1330 terminal block, read this section for information on signal locations on the front signal connector.

Table 2-1 shows the SCXI-1126 positive input channel locations in Column A with their corresponding negative input channels located in column C. The pin descriptions are given in Table 2-2, and the analog input connections are discussed in the [Analog Input Channels](#) section.

Table 2-1. Front Signal Pin Assignments

| Front Connector Diagram | Pin Number | Column A | Column B | Column C | | | |
|--|------------|----------|----------|----------|------|---|------|
| <div style="text-align: center;">Column</div> <table style="margin-left: auto; margin-right: auto;"> <tr> <td style="padding: 0 10px;">A</td> <td style="padding: 0 10px;">B</td> <td style="padding: 0 10px;">C</td> </tr> </table> | A | B | C | 32 | CH0+ | — | CH0– |
| | A | B | C | | | | |
| | 31 | — | — | — | | | |
| | 30 | CH1+ | — | CH1– | | | |
| | 29 | — | — | — | | | |
| | 28 | NC | — | NC | | | |
| | 27 | — | — | — | | | |
| | 26 | CH2+ | — | CH2– | | | |
| | 25 | — | — | — | | | |
| | 24 | CH3+ | — | CH3– | | | |
| | 23 | — | — | — | | | |
| | 22 | NC | — | NC | | | |
| | 21 | — | — | — | | | |
| | 20 | CH4+ | — | CH4– | | | |
| | 19 | — | — | — | | | |
| | 18 | CH5+ | — | CH5– | | | |
| | 17 | — | — | — | | | |
| | 16 | NC | — | NC | | | |
| | 15 | — | — | — | | | |
| | 14 | CH6+ | — | CH6– | | | |
| | 13 | — | — | — | | | |
| | 12 | CH7+ | — | CH7– | | | |
| | 11 | — | — | — | | | |
| | 10 | NC | — | NC | | | |
| | 9 | — | — | — | | | |
| | 8 | NC | — | NC | | | |
| | 7 | — | — | — | | | |
| | 6 | NC | — | NC | | | |
| | 5 | — | — | — | | | |
| | 4 | NC | — | NC | | | |
| | 3 | — | — | — | | | |
| | 2 | — | — | — | | | |
| 1 | NC | — | NC | | | | |
| NC means no connection | 2 | CHSGND | — | NC | | | |
| — means no physical pin | 1 | — | — | — | | | |

Front Connector Signal Descriptions

SCXI-1126 front connector signal descriptions are listed in Table 2-2.

Table 2-2. SCXI-1126 Front Connector Signal Descriptions

| Pin | Signal Name | Description |
|--|-------------------|--|
| A2 | CHSGND | Chassis Ground—Connects to the SCXI chassis. |
| A4, A6, A8, A10, C2, C4, C6, C8, C10, A16, C16, A22, C22, A28, C28 | Not Connected | Do <i>not</i> connect any signals to these pins. |
| A12, A14, A18, A20, A24, A26, A30, A32 | CH7+ through CH0+ | Positive Input Channels—Positive inputs to channels 7 through 0, respectively. |
| C12, C14, C18, C20, C24, C26, C30, C32 | CH7– through CH0– | Negative Input Channels—Negative inputs to channels 7 through 0, respectively. |

SCXI-1126 Rear Signal Connector



Note If you are using the SCXI-1126 with an E Series DAQ device and cable assembly, you do not need to read the remainder of this chapter. If you are using the SCXI-1180 feedthrough panel, the SCXI-1343 rear screw terminal adapter, or the SCXI-1351 one-slot cable extender with the SCXI-1126, read this section.

Figure 2-5 shows the pin assignments for the SCXI-1126 rear signal connector. These signals are described in the [Rear Connector Signal Descriptions](#) section.

| | | | |
|-----------|----|----|-----------|
| AOGND- | 1 | 2 | AOGND |
| CH0+ | 3 | 4 | CH0- |
| CH1+ | 5 | 6 | CH1- |
| CH2+ | 7 | 8 | CH2- |
| CH3+ | 9 | 10 | CH3- |
| CH4+ | 11 | 12 | CH4- |
| CH5+ | 13 | 14 | CH5- |
| CH6+ | 15 | 16 | CH6- |
| CH7+ | 17 | 18 | CH7- |
| OUTREF | 19 | 20 | NC |
| NC | 21 | 22 | NC |
| NC | 23 | 24 | DIG GND |
| SERDATIN | 25 | 26 | SERDATOUT |
| DAQD*/A | 27 | 28 | NC |
| SLOT0SEL* | 29 | 30 | NC |
| NC | 31 | 32 | NC |
| DIG GND | 33 | 34 | NC |
| NC | 35 | 36 | SCANCLK |
| SERCLK | 37 | 38 | NC |
| NC | 39 | 40 | NC |
| NC | 41 | 42 | NC |
| RSVD | 43 | 44 | NC |
| NC | 45 | 46 | NC |
| NC | 47 | 48 | NC |
| NC | 49 | 50 | NC |

NC = No Connection

Figure 2-5. SCXI-1126 Rear Signal Connector Pin Assignments

Rear Connector Signal Descriptions

SCXI-1126 rear connector signal descriptions are listed in Table 2-3. For more information on differential (DIFF), referenced single-ended (RSE), or nonreferenced single-ended (NRSE) modes, go to ni.com/info and enter `rdfwnc`.

Table 2-3. Rear Connector Signal Descriptions

| Pin | Signal Name | Direction | Description |
|--|-------------------|-----------|---|
| 1–2 | AOGND | Output | Analog Output Ground—These pins are software programmed to connect to the analog reference when the SCXI-1126 is in RSE mode. |
| 3–18 | CH0± through CH7± | Output | Analog Output Channels 0 through 7—These pins connect to the E Series DAQ device DIFF analog input channels. In DIFF mode, CH0– through CH7– are software programmed to connect to the analog reference (power on and reset state). |
| 19 | OUTREF | Output | Output Reference—This pin is software programmed to connect to the analog reference when the SCXI-1126 is in NRSE mode. Connect it to the analog input sense pin of the E Series DAQ device in NRSE mode. |
| 24, 33 | DIG GND | — | Digital Ground—These pins supply the reference for E Series DAQ device digital signals and connect to the SCXI-1126 digital ground. |
| 25 | SERDATIN | Input | Serial Data In—The E Series DAQ device uses this signal to program modules in all slots. |
| 26 | SERDATOUT | Output | Serial Data Out—The cabled module uses this signal to return serial output data from any module to the E Series DAQ device. |
| 27 | DAQD*/A | Input | E Series DAQ device Data/Address Line—The E Series DAQ device uses this signal to indicate to the module whether the incoming serial stream is data or address information. |
| 29 | SLOT0SEL* | Input | Slot 0 Select—The E Series DAQ device uses this signal to indicate whether the information on SERDATIN is sent to a module or to the Slot 0 controller. |
| 36 | SCANCLK | Input | Scan Clock—Indicates to the SCXI-1126 that the E Series DAQ device took a sample and caused the SCXI-1126 to change channels. |
| 37 | SERCLK | Input | Serial Clock—The E Series DAQ device uses this signal to clock the data on the SERDATIN and SERDATOUT lines. |
| 43 | RSVD | Input | Reserved. |
| Note: All other pins are not connected. | | | |

The digital I/O (DIO) and timing signals of the SCXI-1126 connect to the DIO and timing lines of the E Series DAQ devices, as shown in Table 2-4. For more information on these signals, consult the E Series DAQ device user manual.

Table 2-4. SCXIbus to SCXI-1126 Rear Signal Connector to E Series DAQ Device Pin Equivalencies

| SCXIbus Line | SCXI-1126 Rear Signal Connector | E Series DAQ Device |
|---------------------|--|----------------------------|
| MOSI | SERDATIN | DIO0 |
| D*/A | DAQD*/A | DIO1 |
| INTR* | SLOT0SEL* | DIO2 |
| SPICLK | SERCLK | EXTSTROBE* |
| MISO | SERDATOUT | DIO4 |

Specifications

All specifications for the SCXI-1126 assume a 20 to 30 °C ambient operating temperature and are valid for one year from the date of purchase unless otherwise noted. All specifications are relative to calibration standards and require a 15 minute warm-up period. Specifications do not include transducer error.

Frequency Input

Input Characteristics

Number of channels 8

Input frequency ranges (software selectable) and corresponding output voltage range¹

| Input Frequency Ranges | Output Voltage Range |
|------------------------|----------------------|
| 0 to 250 Hz | 0 to 5 V |
| 0 to 500 Hz | |
| 0 to 1 kHz | |
| 0 to 2 kHz | |
| 0 to 4 kHz | |
| 0 to 8 kHz | |
| 0 to 16 kHz | |
| 0 to 32 kHz | |
| 0 to 64 kHz | |
| 0 to 128 kHz | |

¹ V refers to DC or AC peak.

Minimum recommended input frequency

| Filter Setting | Minimum Input Frequency |
|----------------|-------------------------|
| 1 Hz | 15 Hz |
| 40 Hz | 600 Hz |
| 320 Hz | 5 kHz |
| 1000 Hz | 15 kHz |

Minimum input pulse width1.5 μ s (5 V, 128 kHz TTL pulse-train)

Input signal amplitude range \pm 50 mV min to \pm 250 V max (RMS or DC)

Input coupling.....DC (or AC with AC coupled terminal block)

Maximum working voltage (Signal + common-mode voltage)Each input should remain within 250 V_{rms} of chassis ground or any other input terminal

Overvoltage protection¹250 V_{rms} powered on or off

Inputs protectedCH<0..7>

Input impedance

Powered on50 G Ω (–0.5 to 4.5 V)

Overload50 k Ω (–250 to –0.5 V and 4.5 to 250 V)

Powered off50 k Ω

Input bias current500 pA max (over operating temperature range)

Threshold (software programmable)

Range.....–0.5 to 4.48 V (–50 to 250 V with SCXI-1327 high-voltage attenuator terminal block)

¹ Voltage is limited to 30 V_{rms} (\pm 42.4 V) if you are using an SCXI-1305 terminal block.

Resolution 8 bits
 Hysteresis 0 to 4.98 V (0 V to 250 V
 with SCXI-1327 high-voltage
 attenuator terminal block)

Transfer Characteristics¹

| Input Frequency Ranges | Accuracy | | | | |
|------------------------------|--------------------|--------------------|---------------------|-------------------------------|-------|
| | % of Reading + Hz | | | Noise (Hz) (DC to 255 kHz) | |
| | 24 Hours | 90 Days | 1 Year | Peak | RMS |
| 250 Hz | 0.0150% ± 0.011 Hz | 0.0217% ± 0.018 Hz | 0.0418% ± 0.039 Hz | 0.05 | 0.008 |
| 500 Hz | 0.0150% ± 0.023 Hz | 0.0217% ± 0.036 Hz | 0.0418% ± 0.077 Hz | 0.10 | 0.015 |
| 1 kHz | 0.0150% ± 0.045 Hz | 0.0217% ± 0.073 Hz | 0.0418% ± 0.154 Hz | 0.20 | 0.030 |
| 2 kHz | 0.0150% ± 0.091 Hz | 0.0217% ± 0.145 Hz | 0.0418% ± 0.308 Hz | 0.40 | 0.061 |
| 4 kHz | 0.0150% ± 0.181 Hz | 0.0217% ± 0.290 Hz | 0.0418% ± 0.616 Hz | 0.80 | 0.121 |
| 8 kHz | 0.0150% ± 0.363 Hz | 0.0217% ± 0.580 Hz | 0.0418% ± 1.231 Hz | 1.60 | 0.242 |
| 16 kHz | 0.0150% ± 0.726 Hz | 0.0217% ± 1.160 Hz | 0.0418% ± 2.462 Hz | 3.20 | 0.485 |
| 32 kHz | 0.0150% ± 1.451 Hz | 0.0217% ± 2.319 Hz | 0.0418% ± 4.924 Hz | 6.40 | 0.970 |
| 64 kHz | 0.0150% ± 2.902 Hz | 0.0217% ± 4.638 Hz | 0.0418% ± 9.848 Hz | 12.80 | 1.939 |
| 128 kHz | 0.0150% ± 5.803 Hz | 0.0217% ± 9.276 Hz | 0.0418% ± 19.696 Hz | 25.60 | 3.879 |

¹ Accuracy based on combination of all errors, including effects of temperature drift over 20 to 30 °C range. Noise specifications include effects of PCI-6030E with 1, 2, or 5 m SCXI cable assembly.

Output Characteristics

Filters (software programmable)

Type.....4-pole, active lowpass

Bandwidth and response time

| Bandwidth (-3 dB) (Hz) | Step Response Settling Time (Full-Scale Input Step) (ms) | | |
|---------------------------|---|----------------|------------------|
| | To $\pm 1\%$ | To $\pm 0.1\%$ | To $\pm 0.024\%$ |
| 1 | 800.0 | 1530.0 | 5300.0 |
| 40 | 30.0 | 55.0 | 180.0 |
| 320 | 3.2 | 7.0 | 30.0 |
| 1000 | 0.8 | 1.0 | 1.2 |

Scan interval (per channel, any frequency range and filter bandwidth)

$\pm 0.012\%$ accuracy¹3 μs

$\pm 0.006\%$ accuracy²10 μs

$\pm 0.0015\%$ accuracy²20 μs

Output impedance

Multiplexed output mode100 Ω

Parallel output mode.....330 Ω

Output short-circuit protectionIndefinite duration

Outputs protected.....CH<0..7>

¹ Includes effects of PCI-6060E with 1 or 2 m SCXI cable assembly

² Includes effects of PCI-6030E with 1 or 2 m SCXI cable assembly

Power-Up and Reset States

| Channel Characteristics | Power-up State | Software Reset State | Hardware Reset State |
|-------------------------------------|----------------|--|--|
| Output modes | | | |
| Scanning mode | Parallel | Retains last setting prior to software reset | Parallel |
| E Series DAQ device connection mode | DIFF | Retains last setting prior to software reset | DIFF |
| Input frequency range | 0–128 kHz | 0–128 kHz | 0–128 kHz |
| Filter setting | 1 Hz | 1 Hz | 1 Hz |
| Threshold level | –0.5 V | –0.5 V | Retains last setting prior to software reset |
| Hysteresis level | 0 V | 0 V | Retains last setting prior to software reset |

Stability

Recommended warm-up time.....15 minutes

Temperature drift (0 to 20 °C, 30 to 50 °C)

In ppm/°C±9 ppm of reading ±6.4 ppm
of range/°C

| Input Frequency Ranges | Temperature Drift % of Reading/°C + Hz/°C |
|-------------------------------|--|
| 250 Hz | 0.0009% ± 0.002 Hz |
| 500 Hz | 0.0009% ± 0.003 Hz |
| 1 kHz | 0.0009% ± 0.006 Hz |
| 2 kHz | 0.0009% ± 0.013 Hz |
| 4 kHz | 0.0009% ± 0.026 Hz |
| 8 kHz | 0.0009% ± 0.051 Hz |
| 16 kHz | 0.0009% ± 0.102 Hz |
| 32 kHz | 0.0009% ± 0.204 Hz |
| 64 kHz | 0.0009% ± 0.407 Hz |
| 128 kHz | 0.0009% ± 0.814 Hz |

Calibration cycle.....one year

Physical

Dimensions17.2 by 20.3 cm (6.8 by 8.0 in.)

I/O connectors.....50-pin male ribbon cable rear
signal connector;
32-pin male DIN C front I/O
connector

Maximum Working Voltage

Maximum working voltage refers to the signal voltage plus the common-mode voltage.

Channel-to-earth..... 250 V, Installation Category II

Channel-to-channel 250 V, Installation Category II

Environmental

Operating temperature..... 0 to 50 °C

Storage temperature –20 to 70 °C

Humidity 10 to 90% RH, noncondensing

Maximum altitude 2,000 m

Pollution Degree (indoor use only) 2

Safety

This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- EC 61010-1, EN 61010-1
- UL 3111-1, UL 61010B-1
- CAN/CSA C22.2 No. 1010.1



Note For UL and other safety certifications, refer to the product label or to ni.com.

Electromagnetic Compatibility

Emissions EN 55011 Class A at 10 m. FCC Part 15A above 1 GHz

Immunity EN 61326:1997 + A2:2001, Table 1

EMC/EMI..... CE, C-Tick and FCC Part 15 (Class A) Compliant



Note For EMC compliance, operate this device with shielded cabling.

CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

Low-Voltage Directive (safety).....73/23/EEC

Electromagnetic Compatibility.....89/336/EEC
Directive (EMC)



Note Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, click **Declarations of Conformity Information** at ni.com/hardref.nsf/.

Common Questions

When I set the individual channel gains programmatically on the SCXI-1126 module, each call to `SCXI_Set_Gain` takes several seconds to return. Is this normal behavior?

This is normal behavior for the SCXI-1126. It takes 3 seconds to settle after a call to `SCXI_Set_Gain`. For example, if you called `SCXI_Set_Gain` on 4 channels of the SCXI-1126, it takes about 12 seconds for all the calls to return (3 seconds per channel \times 4 channels = 12 seconds).

When I try to manually add and configure my module, it is not in the list of modules. Why is my module not listed?

You might have an old version of NI-DAQ. If you do not have the latest version of NI-DAQ, you can download it from ni.com or contact an NI sales representative to get a CD.

I have a single SCXI-1126 module in my SCXI chassis. If I control it in multiplexed mode, I get correct values when I read the channels. If I control the module in parallel mode, I get values that are not scaled back after the gain. How do I correct this problem?

You saw incorrect values in parallel mode because you did not reconfigure NI-DAQ to control the SCXI-1126 module in parallel mode. You can do this by launching MAX and selecting the SCXI-1126 module. Right-click the SCXI-1126 module and select **Properties**. Select the E Series DAQ device that connects to the SCXI-1126 module and choose **Parallel** for the mode. You also must tell NI-DAQ the gain to use for each channel. Once you have completed the configuration, NI-DAQ changes the mode of the chassis and turns the SCXIbus off. This links the SCXI-1126 module to the E Series DAQ device.



Note Any other modules you add to the chassis in this configuration are ignored. No communication is made to them from that E Series DAQ device.

If you are still having problems, contact NI at ni.com/support.

Glossary

| Symbol | Prefix | Value |
|--------|--------|------------|
| p | pico | 10^{-12} |
| 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

| | |
|----------|-----------------------|
| ° | degree |
| Ω | ohm |
| / | per |
| % | percent |
| + | positive of, or plus |
| - | negative of, or minus |

A

| | |
|------------|---|
| A | amperes |
| A/D | analog-to-digital |
| AC | alternating current |
| AC coupled | allowing the transmission of AC signals while blocking DC signals |

| | |
|------------------|--|
| ADC | analog-to-digital converter—an electronic device, often an integrated circuit, that converts an analog voltage to a digital number |
| ADC resolution | the resolution of the ADC, which is measured in bits. An ADC with 16 bits has a higher resolution, and thus a higher degree of accuracy, than a 12-bit ADC. |
| address | character code that identifies a specific location (or series of locations) in memory |
| alias | a false lower frequency component that appears in sampled data acquired at too low a sampling rate |
| AOGND | analog output ground |
| A_{rms} | amperes, root mean square |
| AWG | American Wire Gauge |
| B | |
| b | bit—one binary digit, either 0 or 1 |
| B | byte—eight related bits of data, an eight-bit binary number. Also used to denote the amount of memory required to store one byte of data. |
| bandwidth | the range of frequencies present in a signal, or the range of frequencies to which a measuring device can respond |
| C | |
| C | Celsius |
| CH<0..7> \pm | analog output channel signals 0 through 7, positive and negative |
| CHAN | channel select bit |
| channel | pin or wire lead to which you apply, or from which you read, an analog or digital signal. Analog signals can be single-ended or differential. For digital signals, channels are grouped to form ports. |
| channel clock | the clock controlling the time interval between individual channel sampling within a scan. Devices with simultaneous sampling do not have this clock. |
| CHS | chassis bit |

| | |
|--------------------|--|
| CHSGND | chassis ground |
| CLKOUTEN | scan clock output enable bit |
| CMV | common-mode voltage |
| common-mode range | the input range over which a circuit can handle a common-mode signal |
| common-mode signal | the mathematical average voltage, relative to the ground of the computer, of the signals from a differential input |

D

| | |
|-----------------|---|
| D/A | digital-to-analog |
| DAC | D/A converter—an electronic device, often an integrated circuit, that converts a digital number into a corresponding analog voltage or current |
| DAQ | data acquisition—(1) collecting and measuring electrical signals from sensors, transducers, and test probes or fixtures and processing the measurement data using a computer; (2) collecting and measuring the same kinds of electrical signals with A/D and/or DIO devices plugged into a computer, and possibly generating control signals with D/A and/or DIO devices in the same computer |
| DAQD*/A | the data acquisition device data/address line signal used to indicate whether the SERDATIN pulse train transmitted to the SCXI chassis contains data or address information |
| dB | decibel—the unit for expressing a logarithmic measure of the ratio of two signal levels: $dB=20\log_{10} V1/V2$, for signals in volts |
| DC | direct current |
| DC coupled | allowing the transmission of both AC and DC signals |
| default setting | a default parameter value recorded in the driver. In many cases, the default input of a control is a certain value (often 0) that means <i>use the current default setting</i> . |
| device | a plug-in data acquisition device, module, card, or pad that can contain multiple channels and conversion devices. SCXI modules are distinct from devices, with the exception of the SCXI-1200, which is a hybrid. |
| digital trigger | a TTL level signal having two discrete levels—a high and a low level |
| DIGGND | digital ground signal |
| DIN | Deutsche Industrie Norme |

DIO digital input/output

F

F (1) Fahrenheit—a temperature measurement scale;
(2) farad—a measurement unit of capacitance

F_s frequency source

frequency the number of alternating signals that occur per unit time

H

hysteresis the window below a certain trigger level a signal must pass before the trigger occurs

Hz hertz—cycles per second of a periodic signal. The unit of measure for frequency.

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

II input current leakage

in. inch or inches

K

K kelvin

kbytes/s a unit for data transfer that means 1,000 or 10³ bytes/s

kS 1,000 samples

M

M (1) Mega, the standard metric prefix for 1 million or 10⁶, when used with units of measure such as volts and hertz; (2) mega, the prefix for 1,048,576, or 2²⁰, when used with B to quantify data or computer memory

MB megabytes

| | |
|------------------|--|
| MIO | multifunction input/output |
| multiplexed mode | an SCXI operating mode in which analog input channels are multiplexed into one module output so that your cabled E Series DAQ device has access to the multiplexed output of the module as well as the outputs of all other multiplexed modules in the chassis |
| mux | multiplexer—a switching device with multiple inputs that sequentially connects each of its inputs to its single output, typically at high speeds, in order to measure several signals with a single analog-to-digital converter |

N

| | |
|--------|---|
| NC | not connected (signal) |
| NI-DAQ | the driver software needed in order to use NI E Series DAQ devices and SCXI components |
| noise | an undesirable electrical signal—noise comes from external sources such as AC power lines, motors, generators, transformers, fluorescent lights, soldering irons, CRT displays, computers, electrical storms, welders, radio transmitters, and internal sources such as semiconductors, resistors, and capacitors; corrupts signals you are trying to measure |
| NRSE | nonreferenced single-ended mode—all measurements are made with respect to a common measurement system reference, but the voltage at this reference can vary with respect to the measurement system ground |

O

| | |
|--------|-------------------------|
| OUTREF | output reference signal |
|--------|-------------------------|

P

| | |
|---------------|--|
| parallel mode | a type of SCXI operating mode in which the module sends each of its output channels directly to a separate analog input channel of the E Series DAQ device connected to the module |
| peak to peak | a measure of signal amplitude; the difference between the highest and lowest excursions of the signal |
| ppm | parts per million |

R

| | |
|---------------------------|--|
| referenced signal sources | signal sources with voltage signals that are referenced to a system ground, such as the earth or a building ground. Also called grounded signal sources. |
| relative accuracy | a measure in LSB of the accuracy of an ADC. It includes all non-linearity and quantization errors. It does not include offset and gain errors of the circuitry feeding the ADC. |
| resolution | the smallest signal increment that can be detected by a measurement system. Resolution can be expressed in bits, in proportions, or in percent of full scale. For example, a system has 12-bit resolution, one part in 4,096 resolution, and 0.0244% of full scale resolution. |
| rms | root mean square—the square root of the average value of the square of the instantaneous signal amplitude; a measure of signal amplitude |
| RSE | referenced single-ended mode—all measurements are made with respect to a common reference measurement system or a ground. Also called a grounded measurement system. |
| RSVD | reserved bit, pin, or signal |
| RTD | resistance temperature detector—a metallic probe that measures temperature based on its coefficient of resistivity |

S

| | |
|------------|---|
| s | seconds |
| scan | one or more analog samples taken at the same time, or nearly the same time. Typically, the number of input samples in a scan is equal to the number of channels in the input group. For example, one scan, acquires one new sample from every analog input channel in the group. |
| scan clock | the clock controlling the time interval between scans. On devices with interval scanning support (for example, the AT-MIO-16F-5), this clock gates the channel clock on and off. On devices with simultaneous sampling (for example, the EISA-A2000), this clock clocks the track-and-hold circuitry. |
| scan rate | the number of scans a system takes during a given time period, usually expressed in scans per second |
| SCANCLK | scan clock signal used to increment to the next channel after each E Series DAQ device analog-to-digital conversion |

| | |
|---------------------|---|
| SCXI | Signal Conditioning eXtensions for Instrumentation |
| SE | single-ended—a term used to describe an analog input that is measured with respect to a common ground |
| self-calibrating | a property of a E Series DAQ device that has an extremely stable onboard reference and calibrates its own A/D and D/A circuits without manual adjustments by the user |
| sensor | a device that converts a physical phenomenon into an electrical signal |
| SERCLK | serial clock signal used to synchronize digital data transfers over the SERDATIN and SERDATOUT lines |
| SERDATIN | serial data input signal |
| SERDATOUT | serial data output signal |
| settling time | the amount of time required for a voltage to reach its final value within specified accuracy limits |
| signal conditioning | the manipulation of signals to prepare them for digitizing |
| signal divider | performing frequency division on an external signal |
| SLOT0SEL* | slot 0 select signal |
| system noise | a measure of the amount of noise seen by an analog circuit or an ADC when the analog inputs are grounded |

T

| | |
|-----------------------|--|
| thermistor | a resistive temperature sensor |
| thermocouple | a temperature sensor created by joining two dissimilar metals. The junction produces a small voltage as a function of the temperature. |
| threshold | the voltage level a signal must reach for a trigger to occur |
| throughput rate | the data, measured in bytes/s, for a given continuous operation, calculated to include software overhead |
| transducer | a device that converts energy from one form into another |
| transducer excitation | a type of signal conditioning that uses external voltages and currents to excite the circuitry of a signal conditioning system into measuring physical phenomena |

| | |
|---------------|--|
| transfer rate | the rate, measured in bytes/s, at which data is moved from source to destination after software initialization and set up operations; the maximum rate at which the hardware can operate |
| trigger | any event that causes or starts some form of data capture |
| TTL | transistor-transistor logic |

U

| | |
|-------------|--|
| unipolar | a voltage range that only spans positive voltages |
| update | the output equivalent of a scan. One or more analog or digital output samples. Typically, the number of output samples in an update is equal to the number of channels in the output group. For example, one pulse from the update clock produces one update which sends one new sample to every analog output channel in the group. |
| update rate | the number of output updates per second |

V

| | |
|------------------|-------------------------|
| V | volts |
| VDC | volts, direct current |
| V_{rms} | volts, root mean square |

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