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SCXI™

SCXI-1530/1531
User Manual

ICP Accelerometer Conditioning Module

NATIONAL INSTRUMENTS™

June 2000 Edition
Part Number 322642A-01

Worldwide Technical Support and Product Information

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FCC/Canada Radio Frequency Interference Compliance*

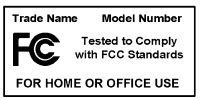
Determining FCC Class

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 labelled 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.

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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.



This icon denotes a warning, which advises you of precautions to take to avoid being electrically shocked.

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.

`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.

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Installing and Configuring the SCXI-1530/1531

About the SCXI-1530/1531

The SCXI-1530/1531 modules are four- and eight-channel Integrated Circuit Piezoelectric (ICP®) accelerometer conditioning modules with programmable current, gain, and filter settings on each channel. The SCXI-1530/1531 also has simultaneous sample-and-hold circuitry. Each channel has programmable gain settings of 1, 10, or 100, and programmable four-pole Bessel filter settings of 2.5, 5, 10, or 20 kHz. Each channel also has a programmable floating 4 mA, 24 V compliant current source.

The SCXI-1530/1531 provides four or eight BNC connectors to interface with accelerometers. This module supports both multiplexed and parallel output modes.

Installing the Software explains how to install the required software for use with the SCXI-1530/1531, including the latest version of NI-DAQ. After installing the software, install any DAQ devices and the SCXI-1530/1531 hardware, and then configure and test the SCXI-1530/1531 to ensure that the installation is complete.

Installing the Software

You can control the SCXI-1530/1531 in an application development environment (ADE) using the NI-DAQ device driver software. The supported ADEs include LabVIEW, BridgeVIEW, LabWindows/CVI, Visual Basic (ComponentWorks), C, and C++ environments. You can also use the SCXI-1530/1531 in conjunction with VirtualBench and Measure.

The following instructions describe how to install the software for your SCXI-1530/1531:

1. Install your ADE if you have not already done so. National Instruments ADEs have release notes containing software installation instructions.
2. Install the NI-DAQ software provided with your DAQ device. NI-DAQ version 6.7 or higher is required to configure and program your SCXI-1530/1531 module. If you do not have NI-DAQ version 6.7 or higher, you can either contact a National Instruments sales representative or download the latest NI-DAQ version from the National Instruments Web site, `www.ni.com`

Installing the SCXI-1530/1531

This section describes how to unpack and install your SCXI-1530/1531 for use with an SCXI chassis and National Instruments DAQ device.

Unpacking

Your SCXI-1530/1531 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 damaging the module, take the following precautions:

- Ground yourself by using a grounding strap or by holding a grounded object.
- Touch the antistatic package to a metal part of your SCXI chassis before removing the module from the package.
- Remove the module from the package and inspect the module for loose components or any other sign of damage. Notify National Instruments if the module appears damaged in any way. Do *not* install a damaged module into your SCXI chassis.
- *Never* touch the exposed pins of connectors.

Installing the SCXI-1530/1531 Module into the SCXI Chassis

You need the following items to complete the installation:

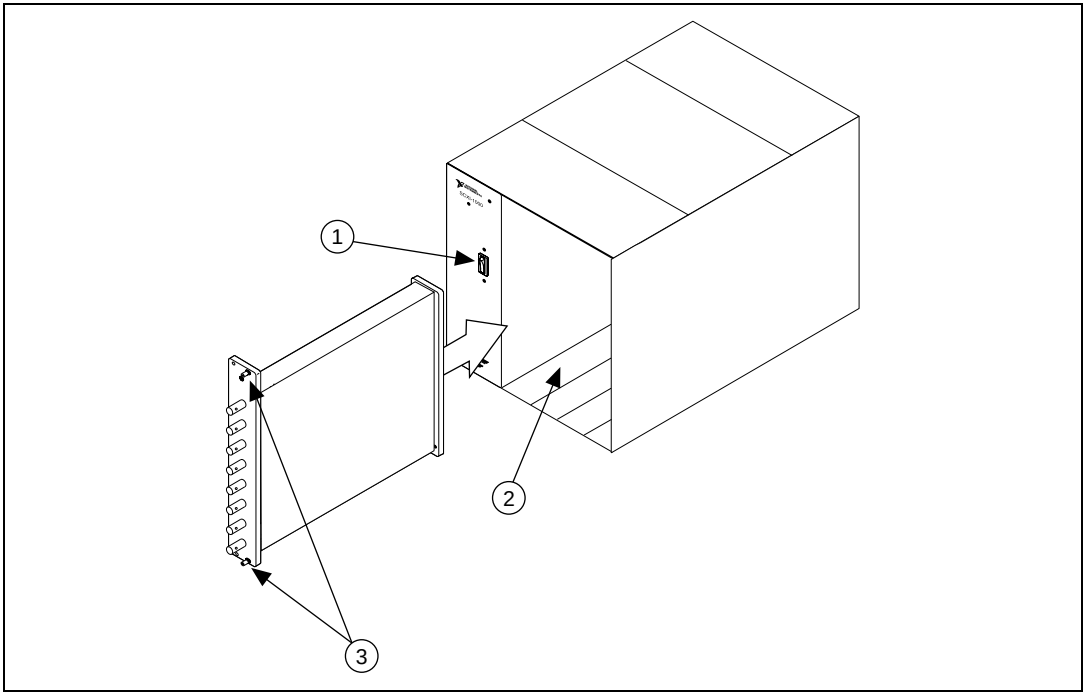
- SCXI-1530/1531 module(s)
- SCXI chassis or PXI combination chassis
- 1/4 in. flathead screwdriver

To install your SCXI-1530/1531 module into the SCXI chassis, follow these steps while referring to Figure 1-1:

1. Turn off the computer that contains or controls the DAQ device or disconnect it from your SCXI chassis.
2. Turn off the SCXI chassis.

Caution Do *not* insert the SCXI-1530/1531 module into a chassis that is turned on.

3. Insert the SCXI-1530/1531 into an open slot in the SCXI chassis. Gently guide the module into the slot guides and push it to the back of the slot 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. Fasten all the SCXI modules to the SCXI chassis using both thumbscrews.



1 SCXI Chassis Power Switch 2 SCXI Chassis Slots 3 SCXI Module Thumbscrews

Figure 1-1. Installing the SCXI-1530/1531 Module

To complete your SCXI-1530/1531 installation, follow the procedure in the appropriate sections that follow.

Connecting the SCXI-1530/1531 to a DAQ Device for Multiplexed Scanning in an SCXI Chassis

With this configuration, you can multiplex all eight input channels of the SCXI-1530/1531 into a single channel of your DAQ device. You need the following items for this installation:

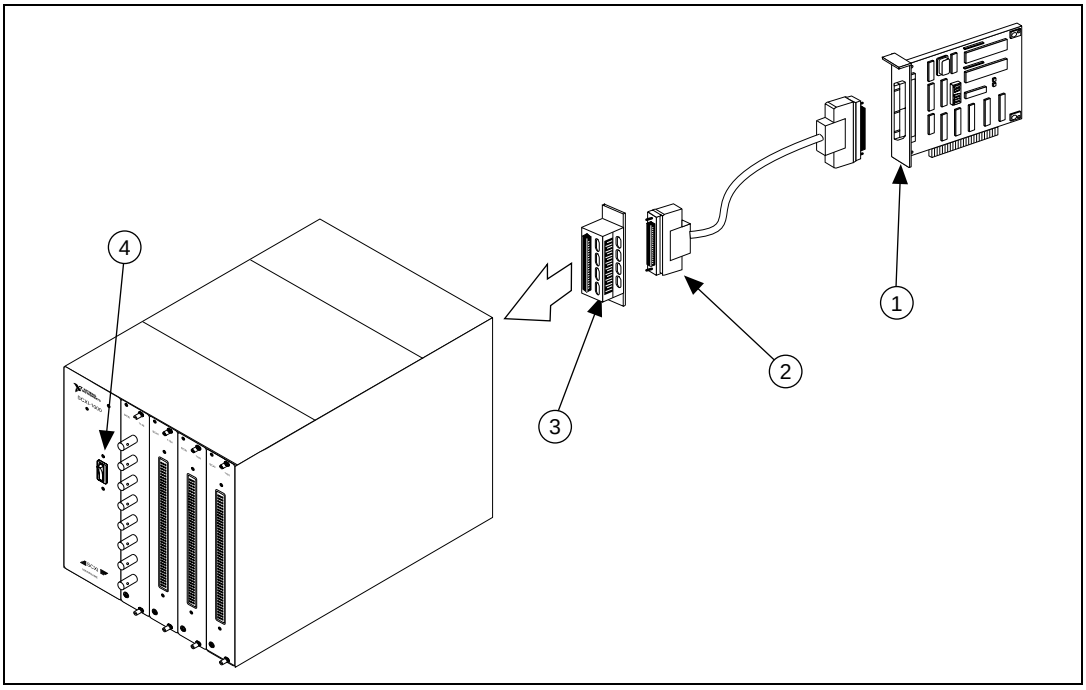
- SCXI chassis with the SCXI modules installed
- SCXI cable assembly, which consists of a cable adapter and a cable
- An installed National Instruments DAQ device
- 1/4 in. flathead screwdriver

Consult your SCXI chassis documentation, other SCXI module documentation, and DAQ device documentation for additional instructions and warnings. Your SCXI-1530/1531 module and any other SCXI modules should already be installed in the chassis according to their installation instructions. You must select one of the analog input modules in the chassis as the *cabled* module, which is the module to which the SCXI cable assembly will be connected. Select the SCXI-1530/1531 or an SCXI-1140 as the cabled module.

To connect the chassis to a DAQ device for multiplexed operation, complete the following steps while referring to Figure 1-2:

1. Turn off the SCXI chassis and the computer that contains the DAQ device.
2. Insert the cable adapter into the back of the SCXI chassis aligned with the module that is to be connected to the DAQ device. See the installation guide for your cable assembly for more information.
3. Connect the cable to the back of the cable adapter ensuring that the cable fits securely.
4. Connect the other end of the cable to the DAQ device that you will use to control the SCXI system.
5. Check the cable installation, making sure the connectors are securely fastened at both ends.
6. Turn on the SCXI chassis.

7. Turn on the computer.
8. If you have already installed the appropriate software, you are ready to configure the SCXI-1530/1531modules for multiplexed operation. See *Configuration and Self-Test* in this chapter.



1	DAQ Device	2	Cable	3	Cable Adapter	4	SCXI Chassis Power Switch

Figure 1-2. Connecting an SCXI Chassis to a DAQ Device

Connecting the SCXI-1530/1531 to a DAQ Device for Multiplexed Scanning in a PXI Combination Chassis

With this configuration, you can multiplex all four or eight channels of your SCXI-1530/1531 into a single channel of your DAQ device in a combination PXI chassis. You need the following items for this installation:

- PXI combination chassis with the SCXI modules installed
- National Instruments PXI E Series DAQ device installed in the right-most slot

Consult your PXI chassis documentation, other SCXI module documentation, and DAQ device documentation for additional instructions and warnings. You should have already installed your SCXI-1530/1531 module and any other SCXI modules in the chassis according to their installation instructions. To use the SCXI-1530/1531 module in multiplexed mode with a DAQ device in a PXI combination chassis, follow these steps:

1. No cables are required between the SCXI-1530/1531 and DAQ device if the National Instruments PXI E Series DAQ device is installed in the right-most 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 DAQ device for controlling the SCXI system is not installed in the right-most slot of the PXI combination chassis, configure the system as described earlier in *Connecting the SCXI-1530/1531 to a DAQ Device for Multiplexed Scanning in an SCXI Chassis*.
2. Turn on the SCXI chassis power.

If you have already installed the appropriate software, you are ready to configure the SCXI-1530/1531 for multiplexed mode operation. See *Configuration and Self-Test* in this chapter.

Connecting the SCXI-1530/1531 to a DAQ Device for Parallel Scanning

With this configuration, you can route all four or eight channels of your SCXI-1530/1531 in parallel to four or eight input channels of the connected DAQ device. Use this mode if you require a higher scanning rate than your SCXI system allows. You need the following items to complete this installation:

- SCXI chassis or PXI combination chassis with the SCXI-1530/1531 module(s) installed
- For each SCXI-1530/1531 operating in parallel mode, you need one each of the following:
  - An installed National Instruments DAQ device
  - an SCXI cable assembly, which consists of a cable adapter and a cable
- 1/4 in. flathead screwdriver

Consult the documentation for your SCXI/PXI chassis and accessories for additional instructions and warnings. All modules should already be installed according to their installation instructions. Follow these steps while referring to Figure 1-2:

1. Turn off the SCXI chassis and the computer that has the DAQ device.
2. Insert the cable adapter into the rear of the SCXI-1530/1531 module accessed in parallel mode by the DAQ device. See the installation guide for your cable assembly for more information.
3. Connect the cable to the back of the cable adapter ensuring that the cable fits securely.
4. Connect the other end of the cable to the National Instruments DAQ device used to access the SCXI-1530/1531 in parallel mode.
5. Connect additional SCXI-1530/1531 modules used for parallel mode operation by repeating steps 2 through 4.
6. Check the installation, making sure the cable is securely fastened at both ends.
7. Power on the SCXI chassis.
8. Power on the computer.

If you have already installed the appropriate software, you are ready to configure the SCXI-1530/1531 module(s) you installed for parallel mode operation.

Configuration and Self-Test

Run Measurement & Automation Explorer to configure and test your SCXI-1530/1531. If you need help during the configuration process, open the Measurement & Automation Help file by selecting **Help Topics** from the **Help** menu. Follow these steps to configure your SCXI system:

1. Double-click the **Measurement & Automation Explorer** icon on your desktop.
2. Click the + next to the **Devices and Interfaces** icon.

   If you have added new modules to an existing chassis, go to step 8. If you inserted modules into an empty chassis, go to step 3.
3. To add a new chassis to the configured **Devices and Interfaces**, right-click **Devices and Interfaces** and select **Insert**.
4. Select the appropriate chassis from the list box and click **OK**.

5. Configure the chassis by selecting a **Chassis ID**. This is an integer value you choose to uniquely identify the chassis for programming and scanning.
6. Select the **Chassis Address** to address the chassis in a multichassis SCXI system. Unless you are using multiple chassis with the same DAQ device, select a **Chassis Address** of `zero`, which is the factory-default setting of all SCXI chassis. If you are using multiple chassis, refer to your SCXI chassis user manual for further information. For remote SCXI chassis, also select the **Baud Rate** and **COM Port**.
7. After completing the chassis configuration, click **Next**.
8. You can now automatically detect which modules are installed in the chassis or manually add them.
   - If you have just added the chassis to **Devices and Interfaces** and are using an E Series or 1200 Series DAQ device, you can automatically detect the modules. Go to *Auto-Detecting Modules* to continue the software configuration of your chassis.
   - If the chassis was already listed in **Devices and Interfaces**, you must add new modules manually. Go to *Manually Adding Modules* to continue the software configuration of your chassis.

Auto-Detecting Modules

If you selected auto-detect, you must have your chassis connected to your DAQ device, except in the case of a remote chassis, which you should connect to the computer using a serial port cable.

Before auto-detecting modules, follow the steps of the *Configuration and Self-Test* section.

To auto-detect your SCXI module(s), follow these steps:

1. Turn on the chassis power.
2. Select **Yes** under **Auto-Detect modules**. Click **Next**. If your chassis is a remote SCXI chassis, go to step 5, otherwise go to step 3.
3. Select your communication path. Click **Next**.
4. If modules were detected, select the module connected to your DAQ device as your communication path.
5. Click **Finish**.

Your Measurement & Automation Explorer software should now recognize your SCXI chassis and SCXI module(s). If the software did not recognize your modules, check your cable connections and retry auto-detecting or try installing the modules manually before taking troubleshooting measures. If the software recognized any module as an SCXI custom module, you may be using the wrong version of NI-DAQ. If you do not have NI-DAQ version 6.7 or higher, you can either contact a National Instruments sales representative or download the latest NI-DAQ version from `www.ni.com`

Your SCXI chassis and SCXI module(s) should now be configured properly. If you need to change your module configuration, see *Configuring the SCXI-1530/1531*. If your configuration is complete, test the system as described in *Self-Test Verification* in this chapter to ensure that your SCXI system is communicating properly with the DAQ device.

Manually Adding Modules

If you did not auto-detect your SCXI modules, you must add each of your modules separately. If you are still in the Chassis Configuration window, select **No** under **Auto-Detect modules,** and click **Finish**. Use the following steps to manually add modules:

1. If you have not already done so, click **+** next to the **Devices and Interfaces** icon to display the list of devices and interfaces.
2. The chassis containing the SCXI-1530/1531 should be displayed in the list. Click **+** next to the **Chassis** icon to display the list of modules already configured in the chassis.
3. Right-click the appropriate (empty) installation slot, and click **Insert**.
4. Select the module installed in that slot, and click **Next**. If the appropriate module name does not appear on the list, you may be using the incorrect version of NI-DAQ. If you do not have NI-DAQ version 6.7 or higher, you can either contact a National Instruments sales representative or download the latest NI-DAQ version from `www.ni.com`
5. Configure your module as follows:
   a. If the selected module is connected to a National Instruments DAQ device, select that device using the **Connected to** control. If it is not connected to a National Instruments DAQ device, select **none**. If you want this DAQ device to control the chassis, confirm that there is a check in the checkbox labeled **This device will control the chassis**.
   b. Select the appropriate scanning mode for your SCXI-1530/1531 using the **Operating Mode** control. If parallel mode is selected,

the **This device will control the chassis** checkbox is automatically deselected. Click **Next**.

c. Select the appropriate gain, filter, and current source settings for each channel on the SCXI-1530/1531. Click **Next**.

If you need to manually install more SCXI-1530/1531 modules in your chassis, repeat steps 3 through 5 to configure each module.

Configuring the SCXI-1530/1531

To configure your SCXI-1530/1531 after auto-detection or to alter your original configuration selections, use the Measurement & Automation Explorer configuration utility. Perform the following steps to configure your SCXI-1530/1531:

1. Double-click the **Measurement & Automation Explorer** icon on your desktop.
2. Click + next to the **Devices and Interfaces** icon to display the list of installed devices and interfaces.
3. Locate the SCXI chassis in the list. Click + next to the **Chassis** icon to display the list of modules in the chassis.
4. Right-click the SCXI-1530/1531 module to configure and select **Properties**. Click the **General** tab.
   a. If the module you are configuring is connected to a National Instruments DAQ device, select that device using the **Connected to** control. If you want this DAQ device to control the chassis, a check should be next to **This device will control the chassis**. If the module you are configuring is not connected to a National Instruments DAQ device, select **none**.
   b. Select the appropriate mode for your SCXI-1530/1531 by using the **Operating Mode** control. If parallel mode is selected, the checkbox labeled **This device will control the chassis** is deselected automatically.
   c. Click the **Channel** tab. Select the appropriate gain, filter, current excitation, and current source settings for each channel on the SCXI-1530/1531. Refer to Chapter 2, *Using the SCXI-1530/1531* for a description of each setting.

Your SCXI chassis and SCXI module(s) should now be configured properly. You should now test the system in the appropriate section that follows to ensure that your SCXI system is communicating properly with the DAQ device.

Self-Test Verification

To test the successful configuration of your system, open the Measurement & Automation Explorer utility and follow these steps:

1. Make sure the chassis power is on and that the chassis is correctly connected to a DAQ device.
2. Click + next to the **Devices and Interfaces** icon to display the list of installed devices and interfaces.
3. From the list that appears, 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**.

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

Troubleshooting Self-Test Verification

If *Self-Test Verification* did not verify your chassis configuration, take the following steps to successfully complete system configuration:

1. If you get the warning message **`Unable to test chassis at this time`**, you have not connected at least one module to a DAQ device. Return to *Configuring the SCXI-1530/1531*, step 4a, and change the configuration control of the cabled module in your system from **Connected to: None** to **Connected to: Device *x***.
2. If you get the warning message **`Failed to find`** followed by the module codes and the message **`Unable to communicate with chassis`**, take the following troubleshooting actions:
   a. Make sure that the SCXI chassis is powered on.
   b. Make sure the cable between the SCXI chassis and DAQ device is properly connected.
   c. Inspect the cable connectors for any bent pins.
   d. Make sure you are using the correct National Instruments cable assembly.
   e. Test your DAQ device to verify it is working properly. See your DAQ device user manual for more information.
3. If you get the warning message **`Failed to find`**, followed by module codes and then the message **`Instead found: module with ID 0Xxx`**, return to *Configuring the SCXI-1530/1531* and make sure the correct module is in the specified slot. If not, delete the incorrect

module as described in *Removing the SCXI-1530/1531 from Measurement & Automation Explorer* and add the correct module as described in *Manually Adding Modules*.

4. If you get the warning message **`Failed to find`**, followed by a module code and then the message **`Slot x is empty`**, check to see if the configured module is installed in the specified slot. If not, install the module by referring to *Installing the SCXI-1530/1531 Module into the SCXI Chassis*. If the module is installed in the correct slot, follow these steps:
   a. Power off the chassis.
   b. Remove the module as specified in *Removing the SCXI-1530/1531 from an SCXI Chassis*.
   c. Verify that no connector pins are bent on the rear connectors.
   d. Reinstall the module as described in *Installing the SCXI-1530/1531 Module into the SCXI Chassis*.
   e. Ensure the module is fully inserted and properly aligned in the slot.
5. Return to *Self-Test Verification* and retest your SCXI chassis.

Removing the SCXI-1530/1531

This section describes how to remove the SCXI-1530/1531 from an SCXI chassis.

Removing the SCXI-1530/1531 from an SCXI Chassis

Please read *Safety Information* found in this chapter before disconnecting signals or removing the SCXI-1530/1531 from the chassis.



Note Only a qualified person who has read and understands all the safety information in this manual should remove an SCXI module.

You need the following items to complete this task:

- SCXI chassis or PXI combination chassis with the SCXI-1530/1531 module(s) installed
- 1/4 in. flathead screwdriver

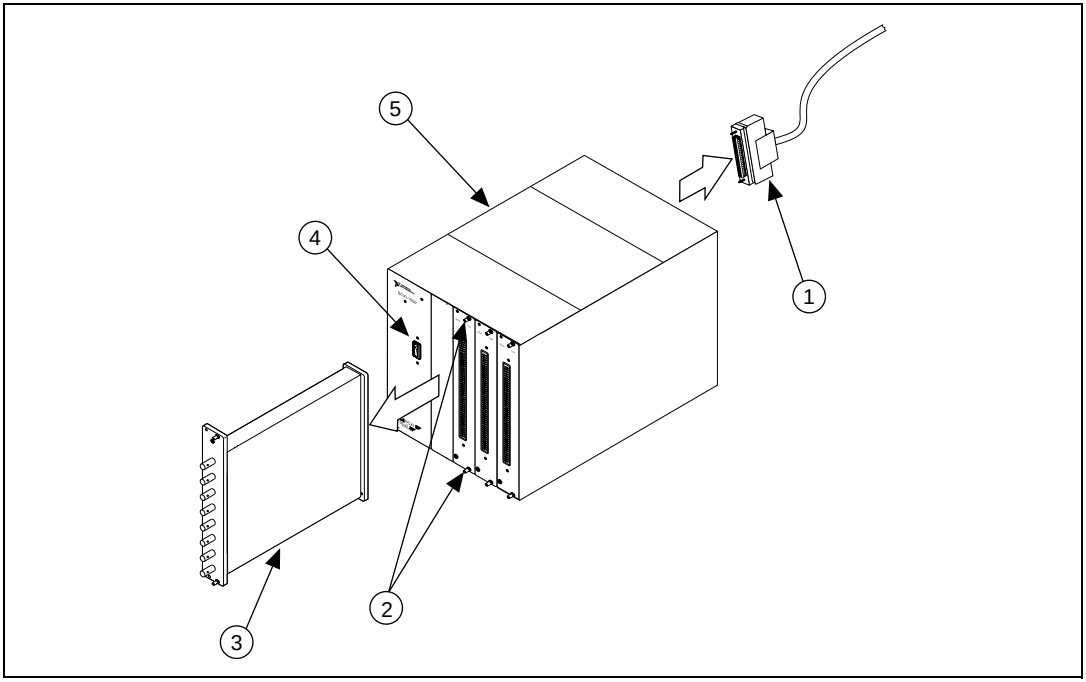
Consult the documentation for your SCXI/PXI chassis and accessories for additional instructions and warnings. To remove the SCXI-1530/1531

module from an SCXI chassis, follow these steps while referring to Figure 1-3:

1. If the SCXI-1530/1531 is the cabled module, disconnect the cable running from the SCXI-1530/1531 to the DAQ device.

Caution Read the safety information in the appropriate section and in the associated terminal block installation guide before adding or removing any signals from the SCXI module or terminal block.

2. Remove any accelerometer cables connected to the SCXI-1530/1531.
3. Turn off the SCXI chassis power. Do not remove the SCXI-1530/1531 module from a chassis that is powered on.
4. Loosen, but do not completely remove, the thumbscrews securing the SCXI-1530/1531 to the chassis by turning them counter-clockwise.
5. Remove the SCXI-1530/1531 by pulling steadily on both thumbscrews until the module slides completely out.



1 Cable	3 SCXI-1530/1531	5 SCXI Chassis
2 SCXI Module Thumbscrews	4 SCXI Chassis Power Switch	

Figure 1-3. Removing the SCXI-1530/1531

Removing the SCXI-1530/1531 from Measurement & Automation Explorer

To remove a module from the Measurement & Automation Explorer utility, follow these steps:

1. Double-click the **Measurement & Automation Explorer** icon.
2. Click **+** next to the **Devices and Interfaces** icon to display the list of installed devices and interfaces.
3. Locate the chassis in the list of installed devices. Click **+** next to the **Chassis** icon to display the list of modules in the chassis.
4. Right-click the module or chassis to delete. Click **Delete**.
5. A confirmation window appears. Click **Yes** to delete the module or chassis. Click **No** to cancel the deletion.

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

Your SCXI chassis and/or SCXI module(s) should now be removed from the list of installed devices in Measurement & Automation Explorer.

Safety Information

The following paragraphs contain important safety information concerning hazardous voltages and hazardous operating conditions. Please adhere to these safety instructions while configuring or connecting signals to the SCXI-1530/1531.

Warnings *Shock Hazard*—This unit should only be opened by qualified personnel aware of the dangers involved. Disconnect all power before removing the cover. If signal wires are connected to the module, dangerous voltages may exist even when the equipment is powered off. Before you remove any installed module, disconnect the AC power line or any high-voltage sources ($\geq 30\ V_{rms}$ and $42.4\ V_{peak}$, or 60 VDC) that may be connected to any terminal block or module.

Do *not* operate the module in an explosive atmosphere or where there may be flammable gases or fumes.

Cautions You *must* insulate all of your signal connections to the *highest* voltage with which the SCXI-1530/1531 may come in contact.

Clean the module and accessories by brushing off light dust with a soft nonmetallic brush.

Remove other contaminants with a stiff nonmetallic brush. The unit must be completely dry and free from contaminants before returning it to service.

Do *not* substitute parts or modify equipment. Because of the danger posed by introducing additional hazards, do not install unauthorized parts or modify the module. Return the module to National Instruments for service and repair to ensure that its safety features are 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.

Connections, including power signals to ground and vice versa, that exceed any of the maximum signal ratings on the SCXI-1530/1531 can damage any or all of the modules in the same SCXI chassis, the host computer, and the SCXI-1530/1531 module itself. National Instruments is *not* liable for any damages or injuries resulting from incorrect signal connections.

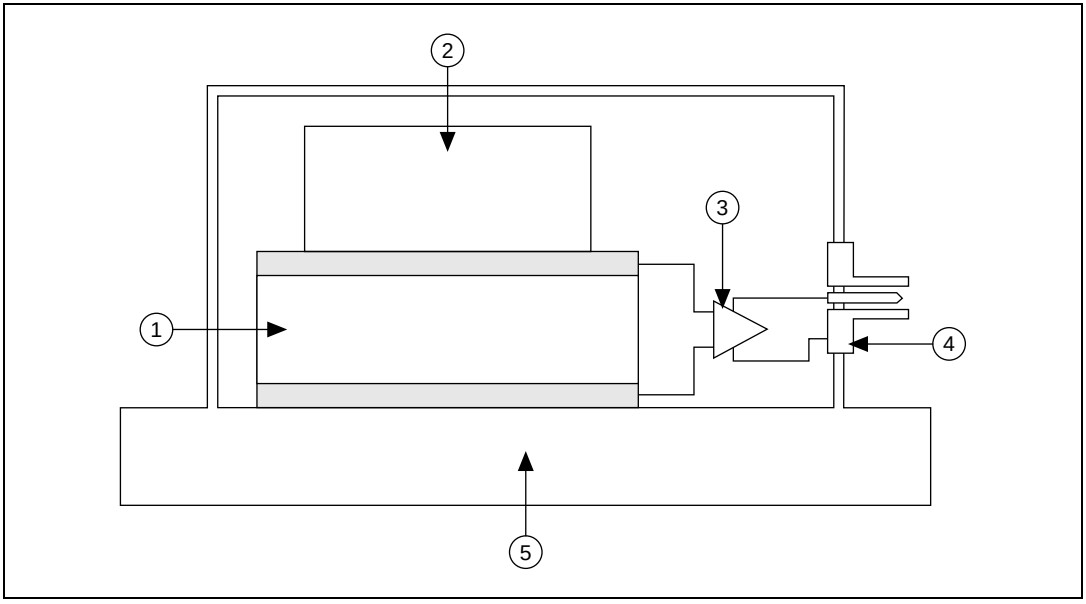
2

Using the SCXI-1530/1531

This chapter describes how to take measurements using the SCXI-1530/1531. The two major modes of operation, multiplexed and parallel, are described, along with how to connect signal sources to the SCXI-1530/1531. Calibration is also described.

Accelerometer Design

A typical current-excited accelerometer is shown in Figure 2-1. Its main components are the accelerometer case, a free-floating seismic mass, and a piezoelectric crystal between the case and mass. When the system undergoes an acceleration, the crystal is either stretched or compressed. This strain on the crystal induces a charge difference between its surfaces. This charge difference is detected by a charge-sensitive amplifier and is converted into a voltage signal. The amplifier is energized by a constant current source. As crystal acceleration varies, the output impedance varies to create the voltage signal in the current path. Therefore, the current-excited accelerometer is both excited and read from the same two connections, resulting in a simple 2-wire system.



1	Piezoelectric Crystal	3	Charge-Sensitive Amplifier	5	Accelerometer Case
2	Seismic Mass	4	Signal Connector		

Figure 2-1. Typical Current-Excited Accelerometer

SCXI-1530/1530 Signal Conditioning

A block diagram of the SCXI-1530/1531 is shown in Figure 2-2. The accelerometer is energized by the current source. You can disable the current source to measure noise in the system. There is also a ground switch that you can turn on or off in software to accommodate both ground-referenced and non-referenced accelerometers. The incoming signal is AC-coupled to a programmable-gain instrumentation amplifier. This amplifier boosts the incoming signal by a gain of 1, 10, or 100. Next, the signal passes through a programmable-bandwidth lowpass Bessel filter for aliasing reduction. The simultaneous sample-and-hold circuitry then assures that all channels are referenced to the same instant in time. Finally, the conditioned signal is sent to the multiplexer circuitry and rear connector.

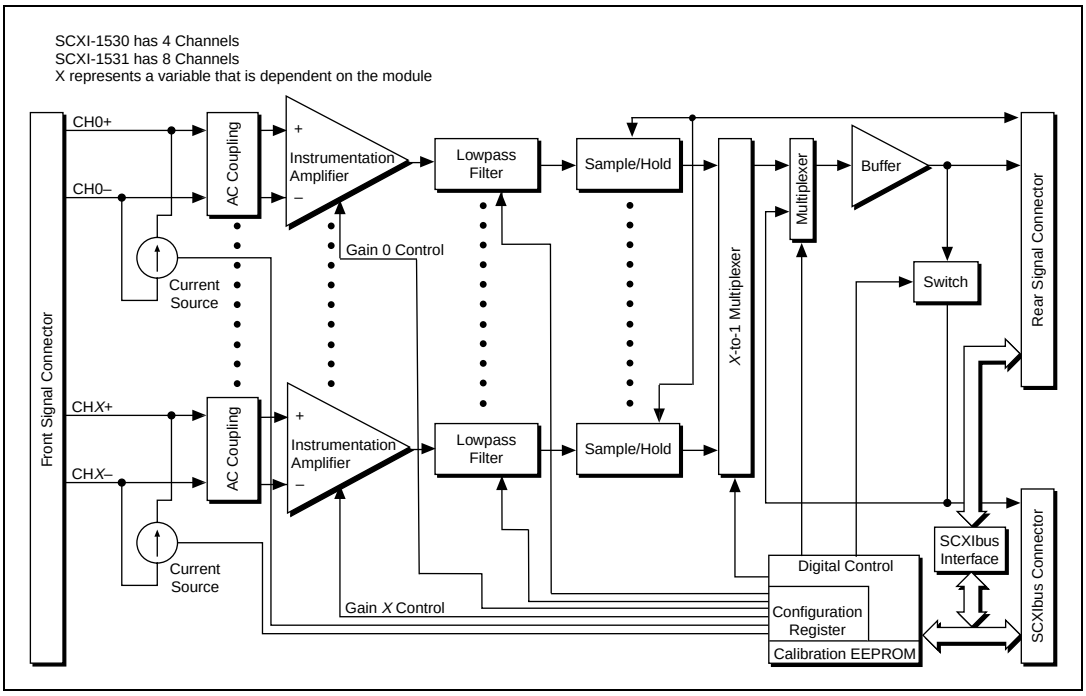


Figure 2-2. SCXI-1530/1531 Module Block Diagram

Making Signal Connections

This section recommends how to connect signals to the SCXI-1530/1531.

With the SCXI-1530/1531 modules, you can make precise acceleration measurements using current-excited accelerometers, such as ICP accelerometers. The floating (non-referenced) current sources provide excitation for the accelerometers. The SCXI-1530/1531 modules allow you to perform all the following operations:

- Configure each input to be single-ended or differential to accommodate both non-referenced or ground-referenced transducers.
- Independently program the AC-coupled amplifiers to different gains to extend the range of usability for a given accelerometer.
- Configure the lowpass filter of each channel to one of four bandwidths to reject signals outside of the desired frequency range.
- Simultaneously sample and hold all four or eight channels to preserve phase information.

Accelerometer Connections

Input signal connections to the SCXI-1530/1531 are made through the front BNC connectors. The channel assignment for the SCXI-1530/1531 front BNC connectors is shown in Figure 2-3.

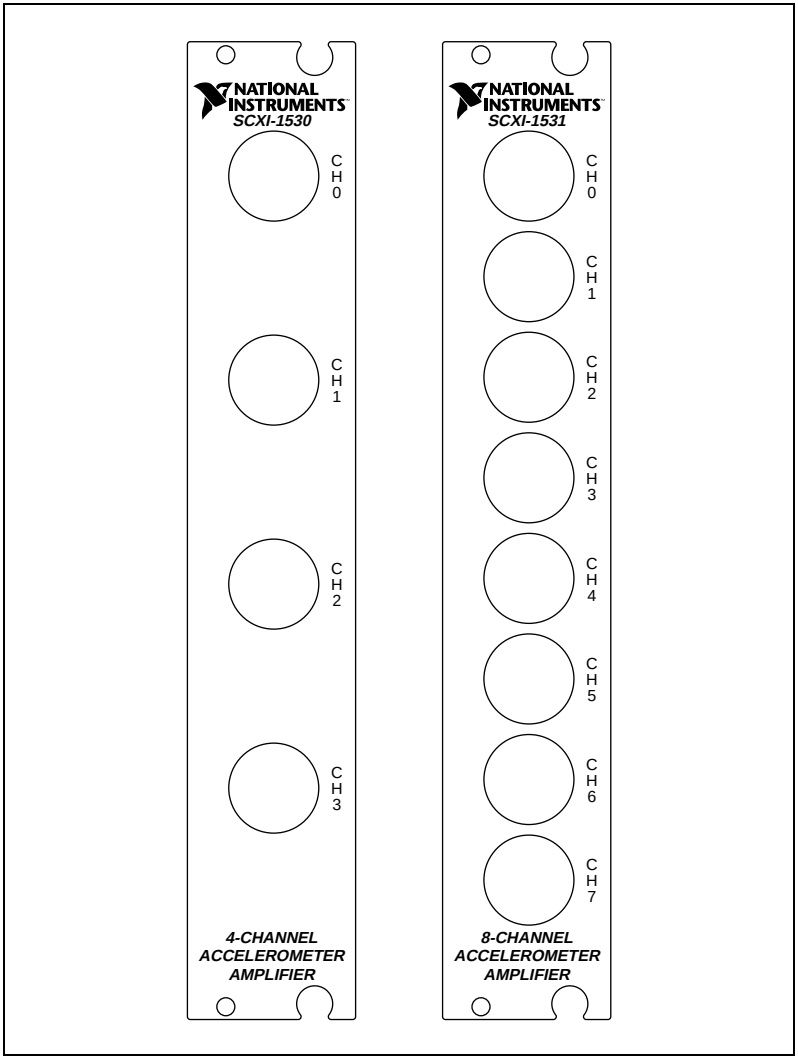


Figure 2-3. SCXI-1530/1531 BNC Connector Assignments

Ground-Referenced Transducer

When the shield of the signal line from the transducer connects either directly or indirectly to earth ground (usually through the metal housing of the transducer), configure the SCXI-1530/1531 channel with ground referencing turned off. This mode prevents the creation of a ground loop in the system that could become a source of induced common-mode noise.

Floating (Non-Referenced) Transducer

When both signal lines of the accelerometer are floating with respect to ground, configure the SCXI-1530/1531 channel with ground referencing turned on. This mode prevents a common-mode potential from building up across the input of the amplifier that can be a noise source.

Current Excitation

Configure current excitation to 4 mA when using ICP or similar accelerometers or when using a transducer that requires a 4 mA excitation current.

Configure the current excitation to off when the channel is not used or when it is connected to a transducer that does not require current excitation.

Determining Scan Rate

The minimum scan rate for the module must be at least 10 times the highest filter bandwidth setting. In extremely noisy environments, even higher scan rates may be necessary. For example, if you are using three channels and their filter bandwidths are 2.5, 2.5, and 5.0 kHz, your minimum scan rate is 50 kHz.

The maximum scan rate for the SCXI-1530/1531 module in multiplexed mode is determined by the formula:

$$S_{MAX} = \frac{1}{8\ \mu s + (N-1)\ 3\ \mu s}$$

where *N* is the number of channels to be scanned. If the DAQ device has a conversion time larger than 3 µs, replace the 3 µs term with the conversion time of the DAQ device.

The maximum scan rate for the SCXI-1530/1531 module in parallel mode is 125 kscans/s or the maximum scan rate of the DAQ device, whichever is lower. There is no maximum scan rate for the SCXI-1530/1531 module when operated in parallel mode with sample-and-hold disabled.

Operating in Multiplexed Mode

You can configure the SCXI-1530/1531 to operate in multiplexed mode as described in *Configuring the SCXI-1530/1531* of Chapter 1, *Installing and Configuring the SCXI-1530/1531*. In multiplexed mode, you can multiplex all input channels of the SCXI-1530/1531 into one output channel that is read by the National Instruments DAQ device.

Theory of Multiplexed Hardware Operation

When you configure a module for multiplexed mode operation, the multiplexed signals routed to the DAQ device depend on which module is cabled to the DAQ device in the SCXI system. If the module being scanned is not directly cabled to the DAQ device, the module sends its signals through the SCXIbus to the cabled module. The cabled module, whose routing is controlled by the SCXI chassis, routes the SCXIbus signals to the DAQ device through the MCH0 signal on the rear signal connector. See the rear signal connector in Figure 2-4. If the DAQ device scans the cabled module, the module routes its input signals through the MCH0 signal on the rear signal connector. The power of SCXI multiplexed scanning is its ability to route many input channels, spanning many modules, to a single channel on the DAQ device.

Note In multiplexed mode, you *must* connect the DAQ device to either the SCXI-1530/1531 module or an SCXI-1140 module if one is in the chassis.

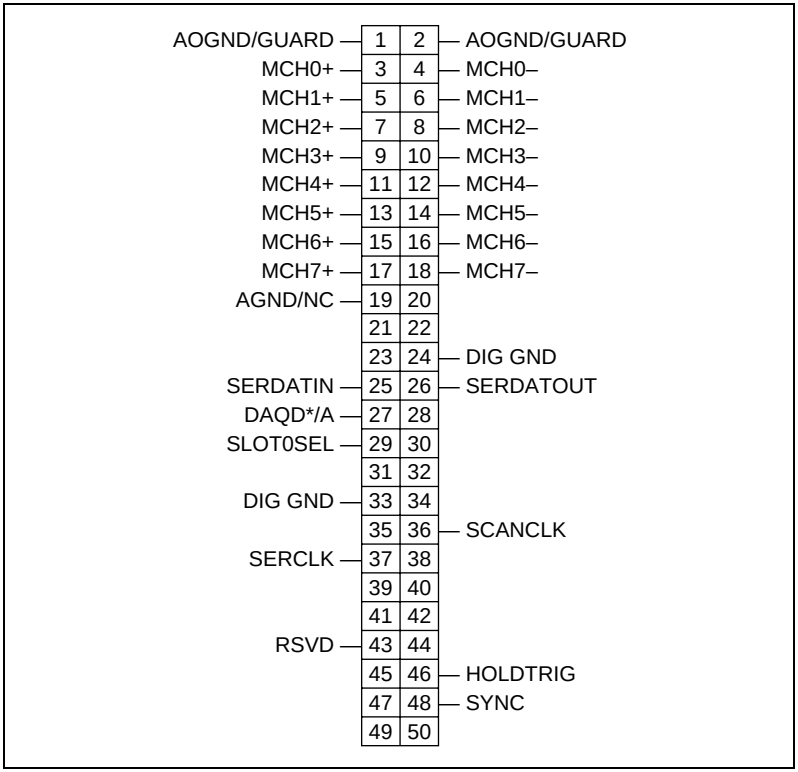


Figure 2-4. SCXI-1530/1531 Rear Signal Connector

Note All SCXI-1530/1531 channels (MCH1 through MCH7) continuously drive the rear signal connector output pins even when you configure the module in multiplexed mode. If the module is cabled to a DAQ device in multiplexed mode, you cannot use the differential inputs 1 through 7 on the DAQ device for general-purpose analog input.

Multiplexed mode is typically used for performing scanning operations with the SCXI-1530/1531. Immediately prior to a multiplexed scanning operation, the SCXI chassis is programmed with a module scan list that controls which module sends its output to the SCXIbus during a scan. You can make this list scan the modules in the chassis in any order, with an arbitrary number of channels for each module entry in the list, limited to a total of 512 channels per chassis. You can randomly scan the channels on the SCXI-1530/1531. The channels can be in any order and the channels can occur multiple times in a single scan. When performing multiple scans, the list pointer of the module automatically wraps around and starts scanning with the first channel in the scan list.

Using Software for Multiplexed Scanning

Performing scanning operations in software depends on the ADE you are using. While using LabVIEW, Measure, or Visual Basic (ComponentWorks), all scanning operations are prepared in the software using an SCXI *channel string* as the input to the channel parameter in the analog input VI or function. These ADEs also support virtual channels using Data Neighborhood (DAQ Channel Wizard) in Measurement & Automation Explorer. In LabWindows/CVI, C, or C++ development environments, you need to make several NI-DAQ function calls to set up each module involved in the scan, the chassis, and the DAQ device controlling the scan. In Virtual Bench, the instruments that support SCXI scanning configure the channels of the module in a menu item in the graphical user interface. In BridgeVIEW, you must configure SCXI channels as virtual channels (tags) in Measurement & Automation Explorer.

A discussion describing how to implement multiplexed scanning in the different ADEs follows. See your ADE manual and the DAQ analog input examples provided with your application software for more detailed information on programming your SCXI modules for scanning in multiplexed mode.

LabVIEW and the SCXI Channel String

For LabVIEW, Measure, and Visual Basic, the channel string determines the sequence in which SCXI channels are scanned. In LabVIEW, an array of these channel strings configures multiple modules in the scan list. When the application program runs, the channel string is used for programming the channel information into the SCXI system. The format of the channel string is as follows:

ob***x*** ! sc***y*** ! md***z*** ! ***channels***

where

ob***x*** is the onboard DAQ device channel, with *x* representing a particular channel where the multiplexed channels are sent. This value is 0 for DAQ channel 0 in a single-chassis system. In a multichassis or remote chassis system, however, the DAQ device channel *x* corresponds to chassis number *n*-1, where DAQ device channel *x* is used for scanning the *n*th chassis in the system.

sc***y*** is the SCXI chassis ID, where *y* is the number you chose when configuring your chassis.

md***z*** is the slot position where the module is located, with *z* being the particular slot number. The slots in a chassis are numbered from left to right, starting with 1.

Note The ob*x* ! specifier is optional in a single chassis system and causes the gains on the module and DAQ device to be automatically set to fit the input limits parameter. When this specifier is omitted, the default gain on the DAQ device is used, but the SCXI-1530/1531 gain is adjusted to fit the input limits.

The last parameter, ***channels***, is the list of channels that are scanned for module ***z***. It can have several formats:

- ob**x** ! sc**y** ! md**z** ! ***n***, where ***n*** is a single input channel.
- ob**x** ! sc**y** ! md**z** ! ***n1:n2***, where ***n1*** and ***n2*** represent a sequential, ascending list of input channels, inclusive.
- ob**x** ! sc**y** ! md**z** ! ***(n1, n2, n3:n4, n1, n5, n2)***, where ***n1***, ***n2***, and ***n5*** represent single channels, not necessarily sequential, and ***n3*** and ***n4*** represent the endpoints of a sequential list of channels, inclusive. In this case, channels ***n1*** and ***n2*** are explicitly repeated in the channel list. This random scanning format is not supported on all SCXI modules.

Note Repeating channels or having channels out of sequence in a scan list is not supported on all SCXI modules. Please refer to the manual of each module for information on this feature.

LabVIEW and the Virtual Channel String

For LabVIEW, BridgeVIEW, Measure, and Visual Basic, you can also use virtual channels. For the SCXI-1530/1531, you create virtual channels that are analog input channels with custom names (called *tags* in BridgeVIEW). These virtual channels perform scaling, linearization, and offset adjustment transparently without additional code. Virtual channels are useful when you use transducers that require different scaling factors on the same SCXI-1530/1531 channel. When using virtual channels, you can use transducers that need special scaling in a generic analog-input application without performing hard-coded scaling or linearization. If the scaling changes or you want to connect a different transducer to your SCXI-1530/1531, no changes are needed in the application. You can create a different virtual channel using its name in the channel string.

Note You cannot mix virtual channels with the SCXI channel strings shown in the previous section. For example, if you create a virtual channel named `acc2`, you *cannot* use the channel string `ob0 ! sc1 ! md2 ! 0, acc2, 3`.

To create a virtual channel for the SCXI-1530/1531:

1. Insert a new analog input channel in the **Data Neighborhood** path in Measurement & Automation Explorer.
2. Name the channel.
3. Follow the software prompts to create virtual channels. For more information on virtual channels, consult the Measurement & Automation Explorer online help file.

To use the virtual channels, enter the name of the virtual channel into the analog input channel string. If using multiple virtual channels, separate them using a comma, or enter them in a different index in the channel string array. All scaling and autozeroing is done automatically by the application.

Note You can randomly scan virtual analog input channels; therefore, you can enter virtual channels in any order or repeat them in the channel string.

Performing a Multiplexed Scan Using SCXI or Virtual Channel Strings

To perform a multiplexed scan in your application, perform the following steps:

1. Open an analog input example in your ADE.
2. Enter the appropriate SCXI channel string or virtual channel string into the **channels** parameter.
3. Enter the **input limits** for signals connected to your module to adjust the gain settings in your system, or use the default gain settings from the Measurement & Automation Explorer, and then run the application. When using virtual channels, the default limits configured in the virtual channel configurator are used.

You have completed a multiplexed scan using your SCXI-1530/1531.

This is not a comprehensive discussion of SCXI scanning using LabVIEW, BridgeVIEW, Measure, or ComponentWorks, but should give you enough information to help you get started with the examples that are shipped with these software packages.

C and Low-Level DAQ Functions

When using a C-based environment, several steps are needed to configure the SCXI-1530/1531 for multiplexed scanning. The following procedure outlines the steps for programming with the low-level DAQ function calls:

1. Use `SCXI_Load_Config` to prepare your SCXI-1530/1531 settings by either loading the original SCXI configuration settings, or use `SCXI_Set_Gain` and `SCXI_Configure_Filter` to specify the gain and filter settings. Use the `AI Parameter` function to set the current excitation.
2. Use `SCXI_SCAN_Setup` to specify the module scan list, the start channel of each module, and the number of channels to scan on each module. This function accepts an array of start channels and an array of the number of channels to scan in each module. Therefore, it is not possible to repeat channels or use nonsequential channels using this function.
3. Use `SCXI_MuxCtr_Setup` to program the DAQ device with the correct number of channels multiplexed per scan. This number must match the total number of channels programmed in step 2.
4. Use the NI-DAQ `SCXI_Track_Hold_Setup` function to setup the origin and destination of the track-and-hold signal.

You are now ready to acquire the channel data with the DAQ device. If you are using a multifunction DAQ device, use `SCAN_OP` to perform the scanning operation. After scanning, convert the binary data to voltage data using `SCXI_Scale`. Refer to the *NI-DAQ User Manual* for additional information on scanning with DAQ devices.

Operating in Parallel Mode

You can configure the SCXI-1530/1531 to operate in parallel mode as described in *Configuring the SCXI-1530/1531* of Chapter 1, *Installing and Configuring the SCXI-1530/1531*. In parallel mode, all four or eight analog output channels on the SCXI-1530/1531 are connected to four or eight analog input channels on the DAQ device. Every SCXI-1530/1531 configured for parallel mode must have a DAQ device directly cabled to it.

Theory of Parallel Hardware Operation

In parallel mode, the MCH0 signal on the rear signal connector is configured as the output corresponding to the SCXI-1530/1531 analog input channel 0. The rear signal connector carries each of the analog outputs of the SCXI-1530/1531 to the connected DAQ device. In this

mode, you can use an SCXI-1180 feedthrough connector to make each of the outputs available at the front of the chassis. This is useful for cascading these signals to other modules for additional signal conditioning purposes. The advantage to using parallel mode is that you are bypassing scanning and are not limited by the settling time required by the multiplexer of the SCXI-1530/1531 module. Using this mode, you may be able to scan the channels more accurately and at a faster rate, depending upon which DAQ device you connect to your module.

Using Software for Parallel Scanning

Performing SCXI-1530/1531 scanning operations in parallel mode requires no special channel strings or function calls for setting up channel sequencing as is required in multiplexed mode. Scanning the SCXI-1530/1531 channels on a differentially configured DAQ device is done as if there were no SCXI-1530/1531 module connected. The only requirement is that you must configure the module for parallel mode in Measurement & Automation Explorer as described in *Configuring the SCXI-1530/1531* of Chapter 1, *Installing and Configuring the SCXI-1530/1531*.

LabVIEW and Parallel Mode

In LabVIEW, the SCXI-1530/1531 configuration settings are automatically passed from Measurement & Automation Explorer. LabVIEW can also set the SCXI-1530/1531 configuration parameter **operating mode** to parallel or multiplexed programmatically using the `Set SCXI Information` VI. In BridgeVIEW, Measure, and ComponentWorks, set the operating mode using Measurement & Automation Explorer as described in Chapter 1, *Installing and Configuring the SCXI-1530/1531*.

After parallel mode is configured in software, you can scan the SCXI-1530/1531 channels by entering the corresponding DAQ device channels or a sequential SCXI channel string in the **channel** parameter in the analog input application. You can also enter virtual channels.

C and Parallel Mode

When using a C-based ADE, no special steps are needed to configure the chassis, the SCXI-1530/1531, or the DAQ device for parallel scanning. You still have to configure the gain and filter settings by using `SCXI_Set_Gain` and `SCXI_Configure_Filter`. You should also use the NI-DAQ `SCXI_Track_Hold_Setup` and `SCXI_Track_Hold_Control` functions to configure the

SCXI-1530/1531 for proper operation. You can use any of the DAQ device analog input functions to get the data from the four or eight channels of the SCXI module. After scanning, convert the binary data to voltage data by using `SCXI_Scale`. See the *NI-DAQ User Manual* for additional information on parallel scanning of SCXI modules.

Calibration

The SCXI-1530/1531 is shipped with a calibration certificate and is calibrated by the factory to the specifications described in Appendix A, *Specifications*. Calibration constants are stored inside the calibration EEPROM and provide correction factors that are used by your application development software. These values correct your measurements for both offset and gain errors in the module.

Calibration Procedures

You can calibrate the offset and gain on the SCXI-1530/1531 using National Instruments software. When calibrating the SCXI-1530/1531, make sure the DAQ device you are using was recently calibrated or you will invalidate the calibration on the SCXI-1530/1531. To perform internal calibrations see the *Internal Calibration* section. Contact National Instruments to obtain procedures to perform external calibrations.

Note Ensure that the calibration on the DAQ device you are using is up to date and traceable. If you adjust the gain or offset values using an uncalibrated device, you invalidate the calibration on the SCXI-1530/1531. Any subsequent measurements taken with the module may be inaccurate.

Remember that the calibration you perform on the SCXI-1530/1531 is only as accurate as the calibration device you are using. Refer to Appendix A, *Specifications*, for accuracy specifications for the SCXI-1530/1531.

Internal Calibration

To perform gain and offset calibration on your module, follow this procedure if you are using LabVIEW:

1. Make sure the DAQ device you are using has a valid calibration and meets the accuracy specifications for your application.
2. In LabVIEW, use the SCXI Calibrate VI to calibrate your module.
   a. Enter the DAQ device and the SCXI channel string for the module you want to calibrate.

b. Select **internal calibration** as the calibration operation to perform.

c. Select the **Default EEPROM load area** as the area to update.

d. The offset varies with the selected gain value. Therefore, enter the high and low limits that correspond to the gain value for which you are calibrating offset. See Table 2-1 for a list of the gain values and the corresponding input limits you must enter.

Table 2-1. Gain Values and Input Limits

Gain	High Limit	Low Limit
1	+10 V	–10 V
10	+1 V	–1 V
100	+0.1 V	–0.1 V

3. Run the application.

If you are using a C-based ADE, use the following procedure to do an offset calibration on the SCXI-1530/1531:

1. Make sure the DAQ device you are using has a valid calibration and meets the accuracy specifications for your application.
2. Use the NI-DAQ function `SCXI_Calibrate` to calibrate one channel of the SCXI-1530/1531.
   a. Enter the DAQ device, DAQ channel, module slot, and module channel for the channel you want to calibrate.
   b. Select **internal calibration (0)** as the operation to perform.
   c. Select the **load area (1)** as the EEPROM area to update.
   d. Since offset varies with gain, enter the gain setting for which you are calibrating offset.
3. Repeat step 2 for calibrating additional channels.

The SCXI-1530/1531 may take a few seconds to perform the calibration. After completion, your module has new calibration constants stored for the channels and gains calibrated.

A

Specifications

This appendix lists the specifications for the SCXI-1530/1531 modules. These specifications are typical at 25 °C unless otherwise noted.

Inputs

Number of input channels

SCXI-1530 4

SCXI-1531 8

Amplifier input impedance
both powered on and off ..... 1 MΩ

Amplifier coupling ..... AC

Accelerometer input
excitation current..... 4 mA ±10%, 24 V compliant

Current source drift ..... –2.5 µA/°C max

Current source dynamic impedance ..... >400 kΩ

Current source noise, 0.1 to 10 kHz..... 22 μA_{rms} typ, 80 μA_{pp} max

Common-mode rejection ratio ..... 75 dB min, 90 dB typ

Common-mode voltage range ..... ±24 V operational
±42 V without damage

Outputs

Maximum output voltage ..... ±10 V

Output impedance ..... 200 Ω

Amplifier input noise, RTO ..... 25 μV_{rms} typ, 125 μV_{pp} max

Transfer Characteristics

Voltage gain

Gain=1 .....0 dB

Gain=10 .....20 dB

Gain=100 .....40 dB

Gain drift.....±10 ppm/°C max

Gain accuracy .....±0.5% before calibration,
0.03% after calibration
at 400 Hz and BW of 20 kHz

Interchannel gain error

Frequency	Gain Error
0.01 f_c	±0.003 dB
0.1 f_c	±0.03 dB
0.5 f_c	±0.5 dB
0.8 f_c	±0.7 dB
1.0 f_c	±0.7 dB

Interchannel phase error

Frequency	Phase Error
0.01 f_c	±0.08°
0.1 f_c	±0.73°
0.5 f_c	±3.6°
0.8 f_c	±5.8°
1.0 f_c	±7.2°

Nonlinearity .....0.004% of FSR max

Output DC offset

Gain	DC Offset
1	±30 mV max
10	±3 mV max
100	±300 µV max

Output DC offset drift ..... ±20 µV/°C max

Filter type ..... 4-pole Bessel lowpass
2-pole 0.2 Hz RC highpass

Bandwidth ..... 2.5, 5, 10, 20 kHz

Simultaneous Sample and Hold

Acquisition time ..... 7 µs max

Hold mode settling time ..... 1 µs max

Hold step ..... 5 mV typ

Droop rate ..... 30 mV/s max

Interchannel skew ..... 100 ns

Physical

Dimensions ..... 3.0 by 17.3 by 24.4 cm
(1.2 by 6.8 by 8.0 in.)

Front connectors ..... BNC (female)

Rear connectors ..... 50-pin male ribbon
96-pin female SCXIbus

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 meters.
Installation Category II[1]
Pollution Degree 2

[1] Category II refers to local-level power distribution, such as that provided by a standard wall outlet.

B

Common Questions

This appendix lists common questions related to the use of the SCXI-1530/1531 modules.

What is the difference between the SCXI-1530 and SCXI-1531?

The SCXI-1530 has four input channels. The SCXI-1531 has eight input channels.

Are there any cabling restrictions when using an SCXI-1530/1531 module with a plug-in E Series DAQ device?

Yes. If a chassis contains an SCXI-1140 or SCXI-1530/1531 module, then at least one of these modules must be the *cabled* module, the module that is connected directly to the DAQ device. This ensures that a timing signal (from GPCTR0 on the DAQ device) is available for use by all simultaneous-sampling SCXI modules in the chassis.

Can I use the SCXI-1530/1531 with any current-excited accelerometers, not just ICP accelerometers?

Yes, subject to the specifications given in Appendix A, *Specifications*.

Can I use the SCXI-1530/1531 with transducers other than current-excited accelerometers?

Yes, you can use these modules for general-purpose analog-input applications where simultaneous sampling, programmable gain, and programmable cutoff frequency are needed. However, remember that these modules are AC coupled, therefore you cannot perform DC measurements.

National Instruments marketing literature and technical documents use the terms *track-and-hold* (T/H) and *sample-and-hold* (S/H) to refer to simultaneous sampling. What is the difference between these terms?

There is no difference. These terms are synonymous.

Which version of the NI-DAQ driver software is needed in order to use the SCXI-1530/1531?

NI-DAQ version 6.7 or later is required for the SCXI-1530/1531.

How do I obtain the most current version of NI-DAQ?

Visit `ni.com` and follow the link, **Download Software»Drivers and Updates»Search Drivers and Updates**, and type in the keyword `NI-DAQ` to find the latest version of NI-DAQ for your operating system.

Can I use the SCXI-1530/1531 with a version of NI-DAQ that works under the Macintosh Operating System (MacOS)?

At the time this manual was printed, no.

I have gone over the *Self-Test Verification* in Chapter 1, *Installing and Configuring the SCXI-1530/1531*, yet I still cannot correctly test and verify that my SCXI-1530/1531 is working. What should I do now?

Unfortunately, there always exists the chance that something is not operating correctly in your system, or the combination of the components in your system is not operating correctly together. You may have to call or e-mail a technical support representative.

The technical support representative will often suggest additional troubleshooting measures to try in order to isolate the problem. If requesting technical support by phone, have your system near at hand so that you can try these measures immediately. National Instruments contact information is listed in Appendix C, *Technical Support Resources*.

How do I configure an SCXI-1200 for use with an SCXI-1530/1531 module?

When using the SCXI-1200 with the SCXI-1530/1531, make sure the SCXI-1200 is configured for NRSE mode in the Measurement & Automation Explorer.

Can the SCXI-1530/1531 be configured and used in parallel mode?

Yes.

Can I use onboard channels one through seven on the DAQ device if it is directly connected to an SCXI-1530 module?

No. Since these modules support parallel mode, the rear signal connector of the SCXI-1530 module drives the first four differential input channels, zero through three, on a 68-pin E Series DAQ device. However, the remaining four input channels, four through seven, are available for general-purpose acquisition, regardless of whether the module is configured for parallel or multiplexed operation.

Can I use onboard channels one through seven on the DAQ device if it is directly connected to an SCXI-1531 module?

No. Since these modules support parallel mode, the rear signal connector of the SCXI-1531 modules drives all eight differential input channels on a 68-pin E Series DAQ device. This is true even if the module is configured for multiplexed mode.

Which digital lines are unavailable on the DAQ device if it is connected directly to an SCXI-1530/1531 module?

Table B-1 shows the digital lines that are used by the SCXI-1530/1531 for communication and scanning. These lines are unavailable for general-purpose digital I/O if the SCXI-1530/1531 is connected to the DAQ device.

Table B-1. Digital Signals on the SCXI-1530/1531

DAQ Signal Name	SCXI Signal Name	50-Pin Connector	68-Pin Connector	Direction[1]
DIO0	SERDATIN	25	52	Output
DIO4	SERDATOUT	26	19	Input
DIO1	DAQD*/A	27	17	Output
DIO2	SLOT0SEL*	29	49	Output
SCANCLK	SCANCLK	36	46	Output
EXTSROBE*	SERCLK	37	45	Output
STARTSCAN	SYNC*	46	38	Output

[1] With respect to the DAQ device.

Some SCXI modules permit *random scanning*. Does the SCXI-1350/1531 permit random scanning?

Yes. Random scanning is described in Chapter 2, *Using the SCXI-1530/1531*.

Which accessories can I use to connect signals to the front of the SCXI-1530/1531?

BNC jacks are built into the front of the module. No accessories, such as terminal blocks, are needed.

Which type of coaxial cable should I use to connect accelerometers to the BNC connectors on the front of the SCXI-1530/1531?

Since the SCXI-1530/1531 has high-impedance inputs, it places no restriction on the characteristic impedance of accelerometer cables. Use the coaxial cable recommended by the accelerometer manufacturer.

How do I calculate the maximum permitted scan rate when using one or more SCXI-1530/1531 modules in multiplexed mode?

The minimum scan time is 8 µs + 3 µs (N – 1) where N is the number of SCXI-1530/1531 channels to scan. The maximum scan rate is 1 divided by the minimum scan time.

Can I externally *scan clock* an SCXI-1530/1531 module as I would an SCXI-1140 module?

No.

How do I synchronize multiple SCXI-1530/1531 modules in multiplexed mode so all channels are sampled simultaneously?

In LabVIEW, all modules with S/S capability that are included in a channel string array are automatically synchronized.

Can I use the SCXI-1530/1531 with VirtualBench? Measure?

Yes.

Does the 8 µs constant used to determine the scanning rate depend on the number of bits of precision of the DAQ device?

No.

C

Technical Support Resources

This appendix describes the comprehensive resources available to you in the Technical Support section of the National Instruments Web site and provides technical support telephone numbers for you to use if you have trouble connecting to our Web site or if you do not have internet access.

NI Web Support

To provide you with immediate answers and solutions 24 hours a day, 365 days a year, National Instruments maintains extensive online technical support resources. They are available to you at no cost, are updated daily, and can be found in the Technical Support section of our Web site at `www.ni.com/support`

Online Problem-Solving and Diagnostic Resources

- **KnowledgeBase**—A searchable database containing thousands of frequently asked questions (FAQs) and their corresponding answers or solutions, including special sections devoted to our newest products. The database is updated daily in response to new customer experiences and feedback.
- **Troubleshooting Wizards**—Step-by-step guides lead you through common problems and answer questions about our entire product line. Wizards include screen shots that illustrate the steps being described and provide detailed information ranging from simple getting started instructions to advanced topics.
- **Product Manuals**—A comprehensive, searchable library of the latest editions of National Instruments hardware and software product manuals.
- **Hardware Reference Database**—A searchable database containing brief hardware descriptions, mechanical drawings, and helpful images of jumper settings and connector pinouts.
- **Application Notes**—A library with more than 100 short papers addressing specific topics such as creating and calling DLLs, developing your own instrument driver software, and porting applications between platforms and operating systems.

Software-Related Resources

- **Instrument Driver Network**—A library with hundreds of instrument drivers for control of standalone instruments via GPIB, VXI, or serial interfaces. You also can submit a request for a particular instrument driver if it does not already appear in the library.
- **Example Programs Database**—A database with numerous, non-shipping example programs for National Instruments programming environments. You can use them to complement the example programs that are already included with National Instruments products.
- **Software Library**—A library with updates and patches to application software, links to the latest versions of driver software for National Instruments hardware products, and utility routines.

Worldwide Support

National Instruments has offices located around the globe. Many branch offices maintain a Web site to provide information on local services. You can access these Web sites from `www.ni.com/worldwide`

If you have trouble connecting to our Web site, please contact your local National Instruments office or the source from which you purchased your National Instruments product(s) to obtain support.

For telephone support in the United States, dial 512 795 8248. For telephone support outside the United States, contact your local branch office:

Australia 03 9879 5166, Austria 0662 45 79 90 0, Belgium 02 757 00 20,
Brazil 011 284 5011, Canada (Calgary) 403 274 9391,
Canada (Ontario) 905 785 0085, Canada (Québec) 514 694 8521,
China 0755 3904939, Denmark 45 76 26 00, Finland 09 725 725 11,
France 01 48 14 24 24, Germany 089 741 31 30, Greece 30 1 42 96 427,
Hong Kong 2645 3186, India 91805275406, Israel 03 6120092,
Italy 02 413091, Japan 03 5472 2970, Korea 02 596 7456,
Mexico (D.F.) 5 280 7625, Mexico (Monterrey) 8 357 7695,
Netherlands 0348 433466, New Zealand 09 914 0488,
Norway 32 27 73 00, Poland 0 22 528 94 06, Portugal 351 1 726 9011,
Singapore 2265886, Spain 91 640 0085, Sweden 08 587 895 00,
Switzerland 056 200 51 51, Taiwan 02 2528 7227,
United Kingdom 01635 523545

Glossary

Prefix	Meaning	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}

Symbols

%	percent
/	per
°	degrees
Ω	ohms

A

A	amperes
AC	alternating current
accelerometer	a transducer that converts acceleration into a voltage or current
AC coupled	allowing the transmission of AC signals while blocking DC signals
acquisition time	the time required by a sample-and-hold system to switch from hold mode back to tracking mode
A/D	analog-to-digital
ADE	application development environment such as LabVIEW, LabWindows/CVI, BridgeVIEW, Visual Basic, C, and C++

aliasing	the consequence of sampling that causes signals with frequencies higher than half the sampling frequency to appear as lower frequency components in a frequency spectrum
amplification	a type of signal conditioning that improves accuracy in the resulting digitized signal by increasing signal amplitude relative to noise
auto-zero	the technique of internally shorting the inputs to a differential amplifier, while disconnecting the signal source, to compensate for temperature-induced offset voltage errors

B

bandwidth	the range of frequencies present in a signal, or the range of frequencies to which a measuring device can respond
Bessel filter	a lowpass filter whose characteristics are optimized for phase linearity
BNC	a type of coaxial signal connector
BW	bandwidth

C

C	Celsius
CE	European emissions control standard
CFR	Code of Federal Regulations
CH*x*+	positive input terminal for channel *x*
CH*x*–	negative input terminal for channel *x*
CMRR	common-mode rejection ratio—a measure of the ability of a differential amplifier to reject interference from a common-mode signal, usually expressed in decibels (dB)
CMV	common-mode voltage
code width	the smallest detectable change in an input voltage of a DAQ device

D

DAQ	data acquisition—(1) collecting and measuring electrical signals from sensors, transducers, and test probes or fixtures and inputting them to a computer for processing; (2) collecting and measuring the same kinds of electrical signals with A/D and/or DIO boards plugged into a computer, and possibly generating control signals with D/A and/or DIO boards in the same computer
DAQ device	a data acquisition device. Examples are DIO, E series MIO, and Lab/1200 plug-in data acquisition devices.
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
differential input	the two-terminal input to a differential amplifier
DIGGND	digital ground signal
DIN	Deutsche Industrie Norme
DIO	digital I/O
DMM	digital multimeter
droop rate	the rate that a sample-and-hold circuit in hold mode deviates from the true hold value, expressed in millivolts per second
dynamic impedance	the ratio of voltage change of a system over its current change, expressed in ohms

E

EEPROM	electrically erasable programmable read-only memory—ROM that can be erased with an electrical signal and reprogrammed. Some SCXI modules contain an EEPROM to store measurement-correction coefficients.
EMC	electromechanical compliance
EMI	electromagnetic interference
excitation	supplying a voltage or current source to energize an active sensor or circuit

F

F	Fahrenheit
f_c	cutoff frequency
filtering	a type of signal conditioning that allows you to remove unwanted frequency components from the signal you are trying to measure
FSR	full scale range

G

gain	the factor by which a signal is amplified, sometimes expressed in decibels
gain accuracy	a measure of deviation of the gain of an amplifier from the ideal gain
gain error	*see* gain accuracy

H

hold mode settling time	the time it takes for a sample-and-hold circuit to switch from sampling (tracking) mode to hold mode and settle within a given percentage at the true hold value
hold step	the difference in the true hold value and the measured hold value in a sample-and-hold circuit
Hz	hertz—cycles per second of a periodic signal

I

ICP	Integrated Circuit Piezoelectric
in.	inch or inches
input bias current	the current that flows into the inputs of a circuit
input impedance	the measured resistance and capacitance between the input terminals of a circuit
instrumentation amplifier	a very accurate differential amplifier with a high input impedance

interchannel skew	the difference in hold mode settling time between two sample-and-hold circuits
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

L

lowpass filter	a filter that passes signals below a cutoff frequency while blocking signals above that frequency
LSB	least significant bit

M

m	meters
max	maximum
MCH*x*–	negative analog output channel terminal for channel *x*
MCH*x*+	positive analog output channel terminal for channel *x*
min	(1) minutes (2) minimum
MIO	multifunction I/O
MSB	most significant bit
multiplexed mode	an SCXI operating mode in which analog input channels are multiplexed into one module output so that your cabled DAQ device has access to the module's multiplexed output as well as the outputs of all other multiplexed modules in the chassis
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
mux	multiplexer

N

NC	not connected (signal)
NI-DAQ	National Instruments driver software for DAQ hardware

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. Noise corrupts signals you are trying to measure.
nonlinearity	For an amplifier, a measure of the maximum output deviation from an ideal linear response in units of percent relative to full scale. The ideal linear response is taken to be a straight line on a plot of measured output voltage to measured input voltage with the ends of the line connecting the extremes of the plot at the full-scale limits.
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

offset error	the output of a system with a zero-volt input

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 DAQ device connected to the module
ppm	parts per million
PXI	PCI eXtensions for Instrumentation—An open specification that builds on the CompactPCI specification by adding instrumentation-specific features.

R

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.
RSC	rear signal connector

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
RTI	referred to input—Calculates a specification relative to the input range.
RTO	referred to output

S

s	seconds
sample-and-hold	a circuit with a sample mode where the output tracks the input and a hold mode where the output remains at the last known input before switching modes
scan	one or more analog or digital input samples. Typically, the number of input samples in a scan is equal to the number of channels in the input group. For example, one pulse from the scan clock produces one scan which acquires one new sample from every analog input channel in the group.
SCANCLK	clock that triggers scanning
scan interval accuracy	the minimum interchannel delay needed to achieve a given accuracy
scan rate	the number of scans a system takes during a given time period, usually expressed in scans per second
SCXI	Signal Conditioning eXtensions for Instrumentation
SCXIbus	located in the rear of an SCXI chassis, the SCXIbus is the backplane that connects modules in the same chassis to each other
seismic mass	a mass that is not mechanically attached to a rigid support and is therefore free to move
sensor	*see* transducer
SERDATOUT	serial data output signal
settling time	the amount of time required for a voltage to reach its final value within specified limits
shunt	*see* auto-zero
signal conditioning	the manipulation of signals to prepare them for digitizing

simultaneous sample-and-hold	a series of sample-and-hold circuits that are connect in a manner so as to switch modes in unison
sync	synchronization pulse for scanning
system noise	a measure of the amount of noise seen by an analog circuit or an ADC when the analog inputs are grounded

T

transducer	a device that translates a measurable physical quantity into a voltage or current signal
typ	typical

U

UL	Underwriters Laboratory

V

V	volts
VDC	volts direct current
VI	virtual instrument—(1) a combination of hardware and/or software elements, typically used with a PC, that has the functionality of a classic stand-alone instrument (2) a LabVIEW software module (VI), which consists of a front panel user interface and a block diagram program
virtual channels	channel names that can be defined outside the application and used without having to perform scaling operations
V_{rms}	volts, root mean square

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