

GETTING STARTED GUIDE

NI High-Speed Digitizers

August 2003
323430A-01



Contents

| | |
|---|----|
| Conventions | 3 |
| Introduction..... | 3 |
| Unpack | 4 |
| Verify the Components..... | 4 |
| Install the Software | 5 |
| Install the Hardware..... | 5 |
| PXI Installation | 5 |
| Uninstalling PXI Modules | 7 |
| PCI Installation | 7 |
| NI PCMCIA-5102..... | 9 |
| NI USB-5102 | 10 |
| NI AT-5102..... | 11 |
| Configure and Test Your Digitizer in MAX..... | 12 |
| Connect Signals | 14 |
| NI 5102 Front Panels | 14 |
| NI 5112 Front Panels | 18 |
| NI 5122 Front Panel..... | 20 |
| NI 5620/5621 Front Panels | 22 |
| NI 5911 Front Panel..... | 23 |
| Acquiring Data..... | 24 |
| Acquiring Data Interactively | 24 |
| Acquiring Data Programmatically | 24 |
| Make Your First Measurement | 25 |
| FCC/Canada Radio Frequency Interference Compliance..... | 26 |
| Determining FCC Class | 26 |
| FCC/DOC Warnings..... | 26 |
| Class A | 26 |
| Federal Communications Commission..... | 26 |
| Canadian Department of Communications..... | 27 |
| Compliance to EU Directives | 27 |
| Safety Information | 27 |
| Technical Support Resources..... | 29 |
| NI Web Support | 29 |
| Worldwide Support..... | 29 |

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.

◆ The ◆ symbol indicates that the following text applies only to a specific product, a specific operating system, or a specific software version.



This icon denotes a note, which alerts you to important information.



This icon denotes a caution, which advises you of precautions to take to avoid injury, data loss, or a system crash.

bold Bold text denotes items that you must select or click in the software, such as menu items and dialog box options.

italic Italic text denotes emphasis or a cross reference.

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 disk drives, paths, directories, filenames and extensions, and functions.

Introduction

This document explains how to install, configure, and test NI high-speed digitizers, how to connect signals, and how to begin acquiring data.

For more information on features and programming, refer to the *NI High-Speed Digitizers Help* at **Start»Programs»National Instruments»NI-SCOPE»Documentation»NI High-Speed Digitizers Help**.

For NI high-speed digitizer specifications, refer to the specifications document included with your digitizer or to the *NI High-Speed Digitizers Help*.



Note For the most current versions of documentation and example programs, visit ni.com/instruments.

Unpack

NI high-speed digitizers are shipped in an antistatic bag to protect them from electrostatic discharge (ESD). Prior to removing the digitizer from the bag, touch the antistatic bag to a metal part of your chassis to remove any built up static charge.



Caution When handling the digitizer, ensure that you are grounded with a grounding strap or touching a grounded metal object. Handle the digitizer carefully to avoid touching any exposed pins or electronic circuitry.

Remove the digitizer from the package, remove the packing foam and rubber screw covers, and inspect the digitizer for loose components or any sign of damage. Notify NI if the digitizer appears damaged in any way. Do *not* install a damaged digitizer into your computer or chassis.

Store the digitizer in the antistatic bag when not in use.

Verify the Components

To set up and use an NI high-speed digitizer, you need the following items:

- One of the following NI high-speed digitizers and its documentation:
 - NI PXI-5122 (NI 5122)
 - NI PXI/PCI/USB/PCMCIA/AT-5102 (NI 5102)
 - NI PXI/PCI-5112 (NI 5112)
 - NI PXI-5620/5621 (NI 5620/5621)
 - NI PCI-5911 (NI 5911)
- NI-SCOPE instrument driver software CD
- A PXI chassis and controller, a desktop computer, or a laptop computer with a PCMCIA slot
- 1/8 in. flathead screwdriver
- One of the following application development environment (ADE) software packages and documentation:
 - NI LabVIEW
 - NI LabWindows™/CVI™
 - Microsoft Visual C++ or Visual Basic



Note If you use the Scope Soft Front Panel to interactively control the digitizer, an ADE is not required. The Scope Soft Front Panel (SFP) is included on the NI-SCOPE CD.

Install the Software

Make sure you install the software *before* you install the hardware. To install the software, complete the following steps:

1. If you are using an ADE or third-party tool, install it now if you have not already done so. The supported ADEs include LabVIEW, LabWindows/CVI, Visual Basic, and other C or C++ environments.
2. Install NI-SCOPE. The NI-SCOPE CD includes the instrument driver software you need to configure, test, and program the digitizer.
 - a. Insert the NI-SCOPE CD and click **Install Software** in the window that appears.



Note If the installation window does not appear automatically, navigate to your CD drive and double-click `setup.exe`.

- b. To install the driver, ADE examples, and the Scope Soft Front Panel, select the **Programmatic and Interactive Support** option when prompted. To install only the Scope Soft Front Panel, select **Interactive Support Only**.

Install the Hardware

This section describes how to install hardware into several platforms: PXI, PCI, PCMCIA, USB, and AT. To prevent damage to the device caused by ESD or contamination, handle the device using the edges or the metal bracket. Refer to the [Safety Information](#) section for more information.



Note For all platforms, you must install the software *before* you install the hardware.



Caution You *must* power off and unplug your PC or chassis before installing hardware.

PXI Installation

NI PXI modules can be installed in any PXI slot marked with a peripheral slot compatibility glyph (a circle containing the slot number).

1. Power off and unplug the PXI chassis before installing a PXI module.
2. If the PXI chassis has multiple fan speed settings, ensure that the fans are set to high.
3. Position the PXI chassis so that inlet and outlet vents are not obstructed. For more information, refer to the chassis documentation.
4. Ensure that the ejector handle is in the unlatched (downward) position.

5. Holding the module by the ejector handle, slide it into an empty slot, ensuring that the base card (the card on the left when looking at the front of the module) engages with the card guides in the chassis, as shown in Figure 1.

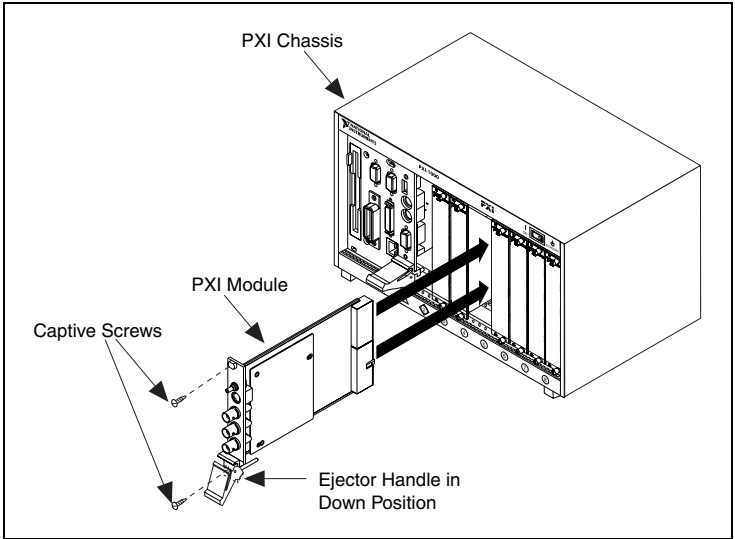


Figure 1. PXI Installation

6. Slide the module completely into the chassis and latch by pulling up on the ejector handle.
7. Tighten the captive screws at the top and bottom of the module front panel. Performance may suffer if both screws are not tightened properly.
8. Before operating the module, cover all empty PXI slots using blank PXI filler panels.
9. Plug in and power on the PXI chassis.

NI PXI modules are sensitive instruments and should be handled carefully. Do not expose the module to temperatures or humidity beyond the rated maximums. Keep the module free of dust by cleaning with compressed air only. Do not clean the module with any solvents or liquids. For more information about module cooling, refer to the guidelines in the *Maintain Forced-Air Cooling Read Me First* included in your digitizer kit.

All NI digitizers ship with a calibration certificate. For more information on calibration, visit ni.com/calibration.

Uninstalling PXI Modules

When removing PXI modules from the chassis, ensure that you are grounded with a grounding strap or are touching a grounded metal surface. To avoid ESD, do not touch the exposed pins of the PXI connector or any exposed circuitry on the module. When not in use, PXI modules should be stored in the original packaging to avoid damage.



Caution During operation the metal surfaces of PXI modules may become hot. Be careful when removing the module from the chassis or when moving it to a different peripheral slot. When removing the module, hold it by the ejector handle and front panel *only*.

PCI Installation

To install your PCI device, complete the following steps:

1. Power off and unplug the PC.
2. Remove the PC cover.
3. Insert the device into an open PCI slot, as shown in Figure 2.
4. Secure the device with the screw provided in the kit.
5. Replace the PC cover.
6. Plug in and power on the PC.

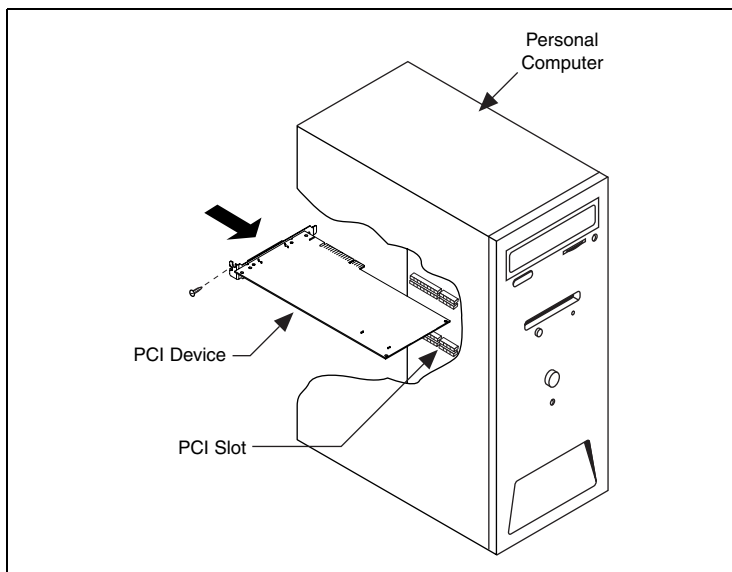


Figure 2. PCI Installation

◆ NI 5911

When you install the NI 5911, make sure that the BNC connector is centered between the metal frame of the chassis, as shown in Figure 3. Signal degradation can occur if the outer shell of the BNC cable touches the computer chassis. Also, to minimize noise, do not allow the shell of the BNC cable to touch or lie near the metal on a PC.

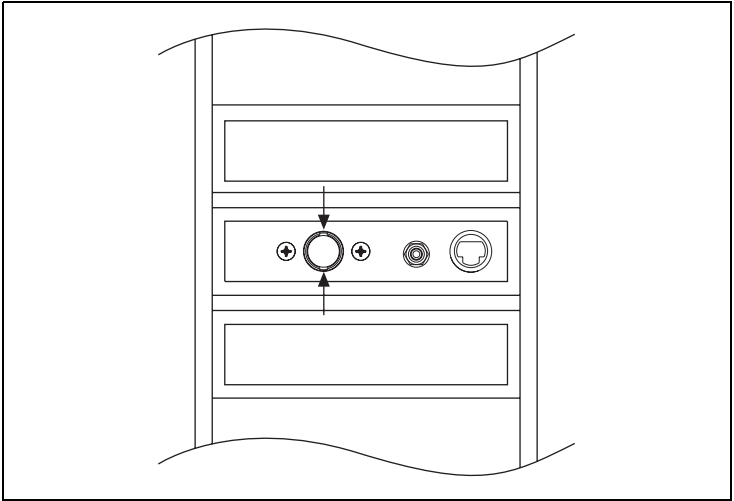


Figure 3. NI 5911 Installation



Note Multiple NI 5911 devices in the same computer may raise operating temperatures beyond specification and give rise to imprecise data. NI strongly recommends leaving an empty PCI slot between multiple NI 5911 devices or adding a fan.

NI PCMCIA-5102

To install the NI PCMCIA-5102, complete the following steps:

1. Power off and unplug your laptop.
2. Install the digitizer as shown in Figure 4.
3. Power on your laptop.

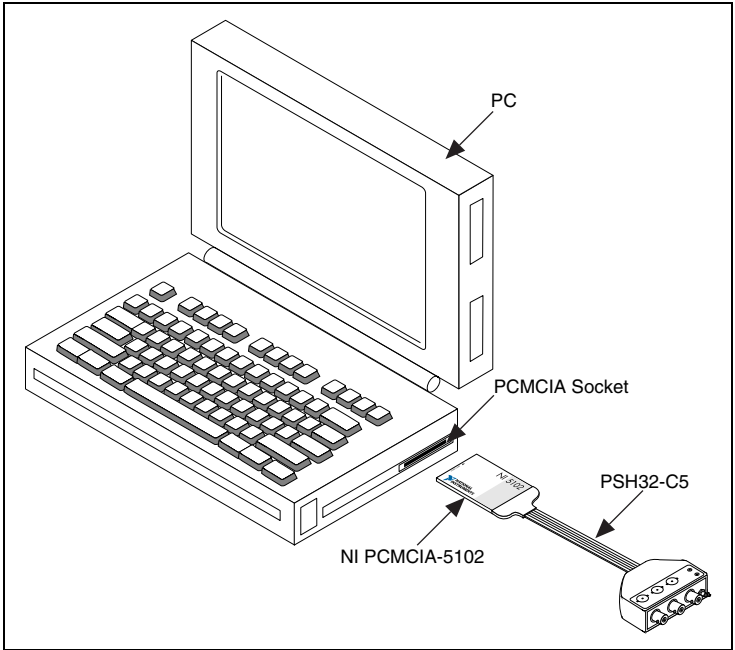


Figure 4. PCMCIA Installation

NI USB-5102

To install the NI USB-5102, complete the following steps:

1. Power down your PC and the NI USB-5102.
2. Connect the USB cable to the PC and the digitizer, as shown in Figure 5.

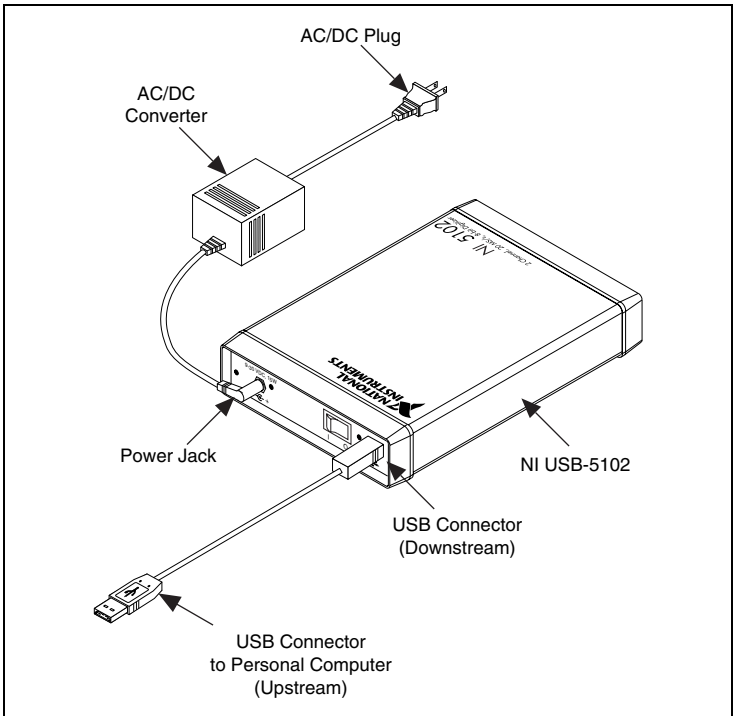


Figure 5. USB Installation

3. Plug the power cord into the power jack on the NI USB-5102.
4. Plug the AC/DC plug on the power cord into the power source.
5. Power on the computer.

NI AT-5102

To install the NI AT-5102, complete the following steps:

1. Power off and unplug the PC.
2. Remove the PC cover.
3. Insert the NI AT-5102 into an open ISA slot, as shown in Figure 6.

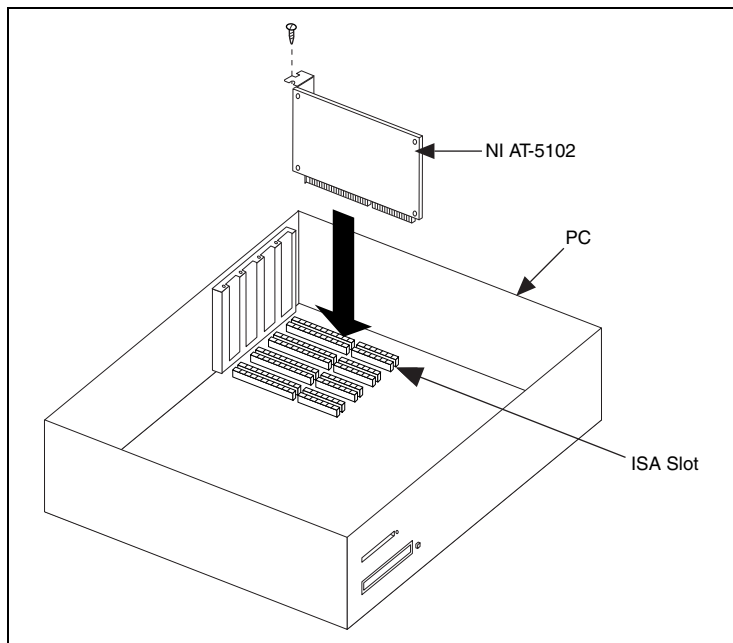


Figure 6. NI AT-5102 Installation

4. Secure the device with the screw provided in the kit.
5. Replace the PC cover.
6. Plug in and power on the PC.

Configure and Test Your Digitizer in MAX

1. Launch Measurement & Automation Explorer (MAX).
2. Double-click **Devices and Interfaces** to see the list of installed devices. MAX automatically detects the installed device. The Configuration Tree lists both Traditional NI-DAQ devices and NI-DAQmx devices, as shown in Figure 7.

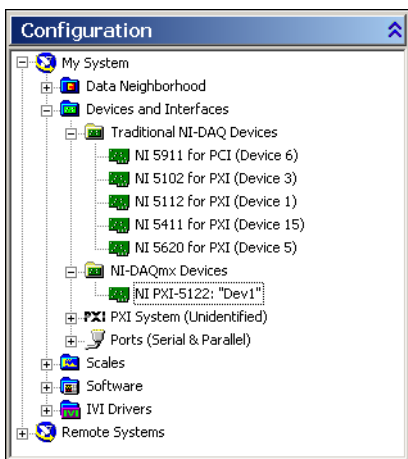


Figure 7. MAX Configuration Tree



Note If your device is not listed, press <F5> to refresh. If the device is still not listed, repeat the steps in the [Install the Hardware](#) section. For more information about using MAX, refer to the available help files within MAX.

3. Record the device number or device name assigned to the device. You need this number when programming your device.
 - ◆ **Traditional NI-DAQ (NI 5102/5112/5620/5621/5911)**—Select your device to see its properties in the configuration view. The device number appears in the Value column. When developing your application, the resource name for your device is DAQ::*n*, where *n* is the device number MAX assigned to your device.
 - ◆ **NI-DAQmx (NI 5122)**—The assigned device name is appended to the device in its Configuration Tree label. For example, after installing the NI 5122, the device Configuration Tree label may appear as NI PXI-5122: “*Dev1*”, where *Dev1* is the device name.

When developing your application, the resource name for your device is the device name MAX assigned to the device.



Note To avoid modifying existing applications that use a Traditional NI-DAQ device number, change the assigned NI-DAQmx device name. To change an NI-DAQmx device name, right-click on the device, select **Rename**, and enter the Traditional NI-DAQ device number used in your application, for example, 2.

4. Perform a self-test on your device to verify installation.

◆ **Traditional NI-DAQ**—Right-click on the device, select **Properties**, and click **Test Resources**.

◆ **NI-DAQmx**—Right-click on the device and select **Self-Test**.

A dialog box appears and indicates whether the device has passed the test.



Note If the device does not pass the test, repeat the steps in the *Install the Hardware* section. If the device still does not pass the test, visit NI Technical Support at ni.com/support.

5. Run the test panels on your device to verify the signal.

a. Connect a signal to the digitizer, and select the appropriate parameters such as range, input limits, sample rate, and sample mode.

b. Access the test panel.

◆ **Traditional NI-DAQ**—Click **Run Test Panels** in the Properties window.

◆ **NI-DAQmx**—Right-click on your device and select **Test Panels**.



Note For both types of devices, you can enable triggering by clicking the **Advanced** button on the test panel.

6. Exit MAX when you have finished testing the device.



Note All NI digitizers have self-calibration capabilities. You can access this feature for all NI digitizers programmatically with NI-SCOPE and your ADE, or you can use the Scope Soft Front Panel. However, only the NI 5122 can be calibrated using MAX.

Connect Signals

This section describes the front panels and signal connections for each digitizer.

NI 5102 Front Panels

The NI 5102 is available for five platforms: PXI, PCI, AT, PCMCIA, and USB. This section describes the front panels and signal connections for each type of NI 5102 digitizer.

- ◆ **NI PXI-5102**—Figure 8 shows the NI PXI-5102 front panel. Refer to Figure 9 for the AUX connector pinout information.

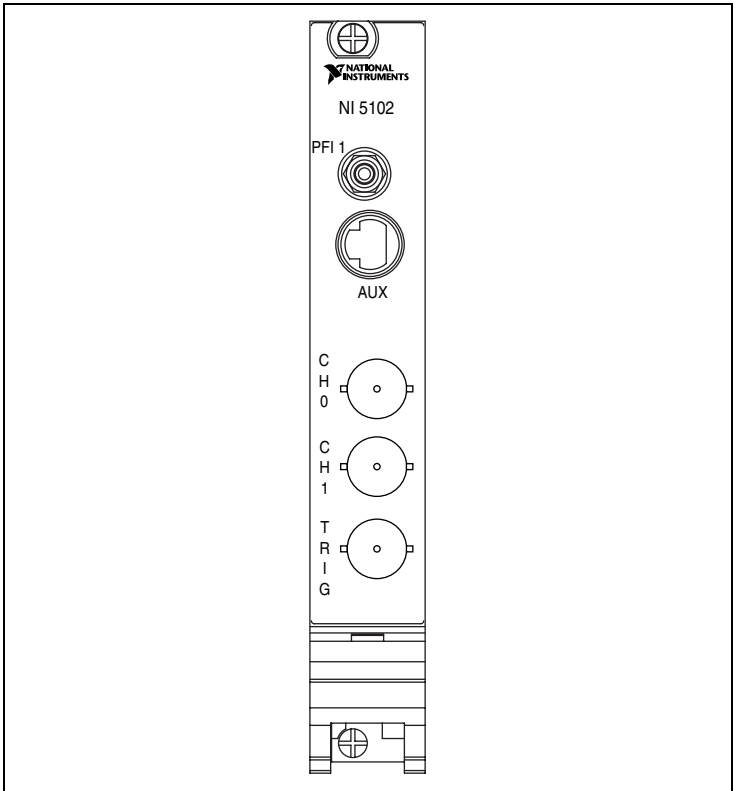


Figure 8. NI PXI-5102 Front Panel Connectors

Table 1 describes the signal connections for the NI PXI-5102.

Table 1. NI PXI-5102 Front Panel Connector Signals

| Connector | Description | Function |
|------------|-----------------------------------|--|
| CH 0, CH 1 | Standard BNC female connector | Analog input connection; digitizes data and triggers acquisitions. |
| TRIG | Standard BNC female connector | External analog trigger connection; signals on the TRIG connector cannot be digitized. |
| PFI 1 | Standard SMB jack connector | Multipurpose digital timing and triggering signal. |
| AUX | 9-pin mini-circular DIN connector | Access to PFI 2 (with optional cable). Refer to Figure 9 for pinout information. |

Figure 9 shows the pin assignments for the 9-pin mini-circular DIN connector on the NI PXI-5102.

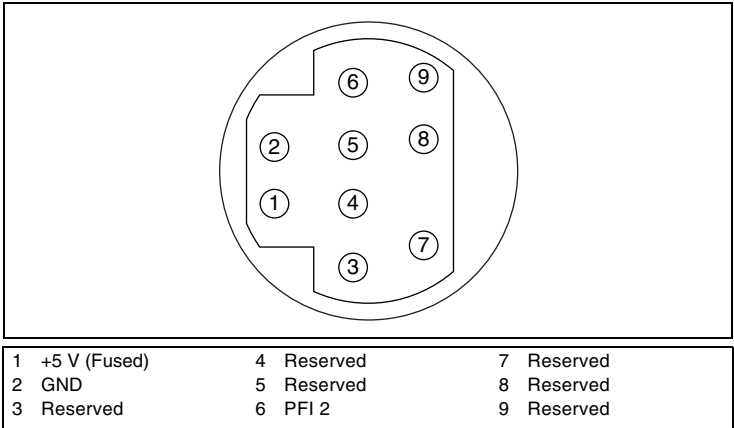


Figure 9. 9-Pin DIN Connector for NI PXI-5102, NI PXI/PCI-5112, and NI 5911



Note The +5 V signal is fused at 1.1 A. However, NI recommends limiting the current from this pin to 30 mA. The fuse is self-resetting.

- ◆ **NI PCI/AT-5102 Front Panel**—Figure 10 shows the front panel of the NI PCI/AT-5102 front panel.

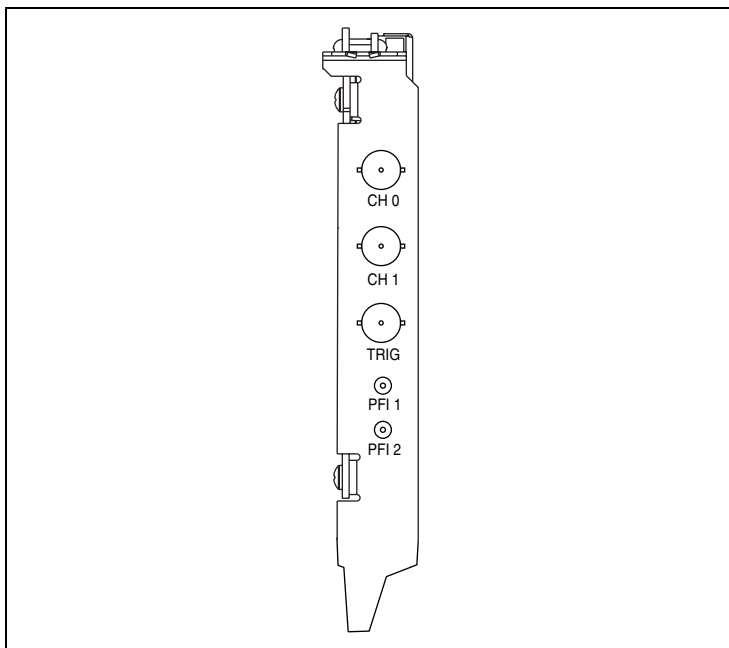


Figure 10. NI PCI/AT-5102 Front Panel Connectors

Table 2 describes the signal connections for all NI 5102 digitizer buses except PXI.

Table 2. NI PCI/AT/PCMCIA/USB-5102 Front Panel Connector Signals

| Connector | Description | Function |
|------------|-------------------------------|--|
| CH 0, CH 1 | Standard BNC female connector | Analog input connection; digitizes data and triggers acquisitions. |
| TRIG | Standard BNC female connector | External analog trigger connection; signals on the TRIG connector cannot be digitized. |
| PFI 1 | Standard SMB jack connector | Multipurpose digital timing and triggering signal. |
| PFI 2 | Standard SMB jack connector | Multipurpose digital timing and triggering signal. |



Note When used as inputs, NI 5102 PFI lines can trigger an acquisition, and/or allow an external sample clock connection.

- ◆ **NI PCMCIA-5102 Front Panel**—Use the cable assembly provided with your digitizer for the connections on the NI PCMCIA-5102, as shown in Figure 11.

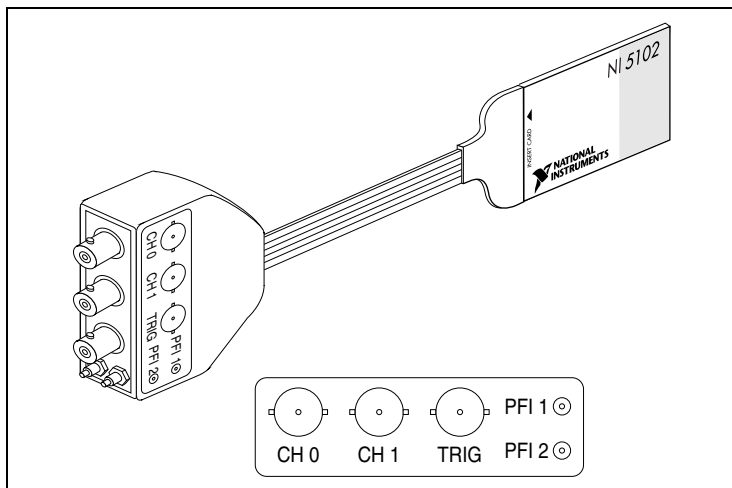


Figure 11. NI PCMCIA-5102 Front Panel Connectors

- ◆ **NI USB-5102 Front Panel**—Figure 12 shows the front panel of the NI USB-5102.

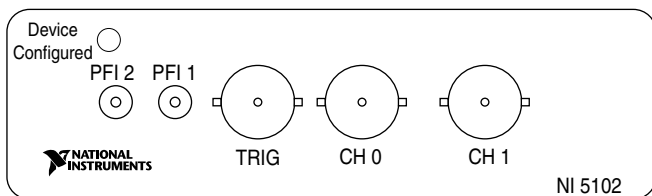


Figure 12. NI USB-5102 Front Panel Connectors

NI 5112 Front Panels

The NI 5112 is available for both PXI and PCI buses. Figures 13 and 14 show the front panels for the NI PXI-5112 and the NI PCI-5112, respectively. Refer to Figure 9 for the AUX connector pinout information.

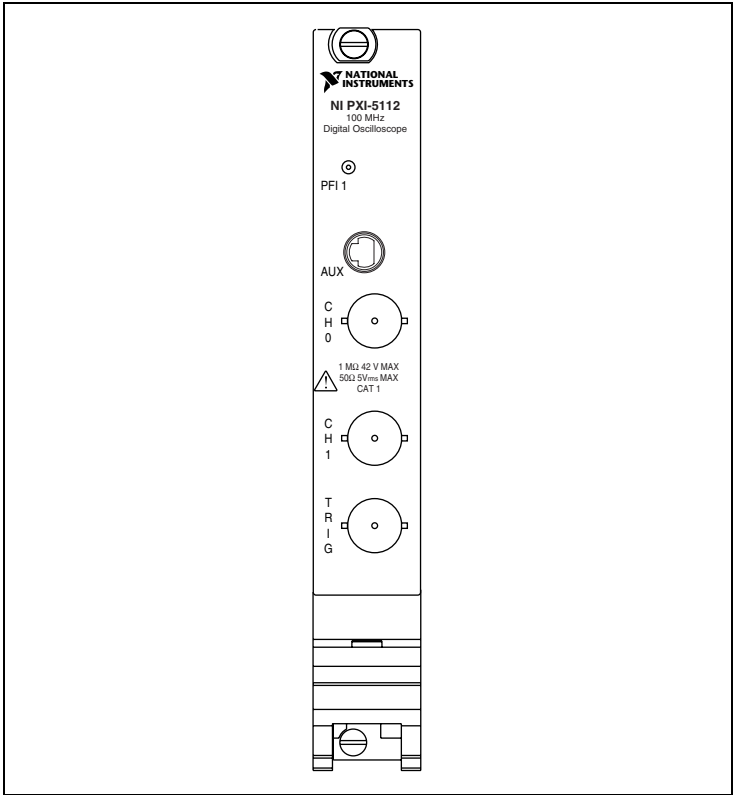


Figure 13. NI PXI-5112 Front Panel Connectors

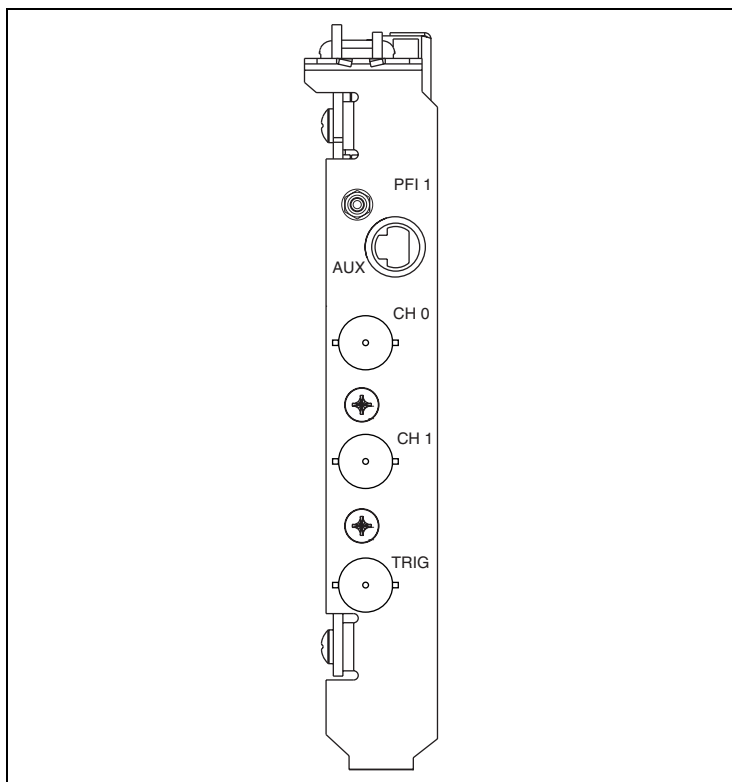


Figure 14. NI PCI-5112 Front Panel Connectors

Table 3 describes the signal connections on the NI PXI/PCI 5112.

Table 3. NI PXI/PCI-5112 Front Panel Connector Signals

| Connector | Description | Function |
|------------|-----------------------------------|--|
| CH 0, CH 1 | Standard BNC female connector | Analog input connection; digitizes data and triggers acquisitions. |
| TRIG | Standard BNC female connector | External analog trigger connection; signals on the TRIG connector cannot be digitized. |
| PFI 1 | Standard SMB jack connector | Multipurpose digital timing and triggering signal. |
| AUX | 9-pin mini-circular DIN connector | Access to PFI 2 (with optional cable). Refer to Figure 9 for pinout information. |

NI 5122 Front Panel

Figure 15 shows the front panel of the NI PXI-5122. Refer to Figure 16 for the AUX connector pinout information.

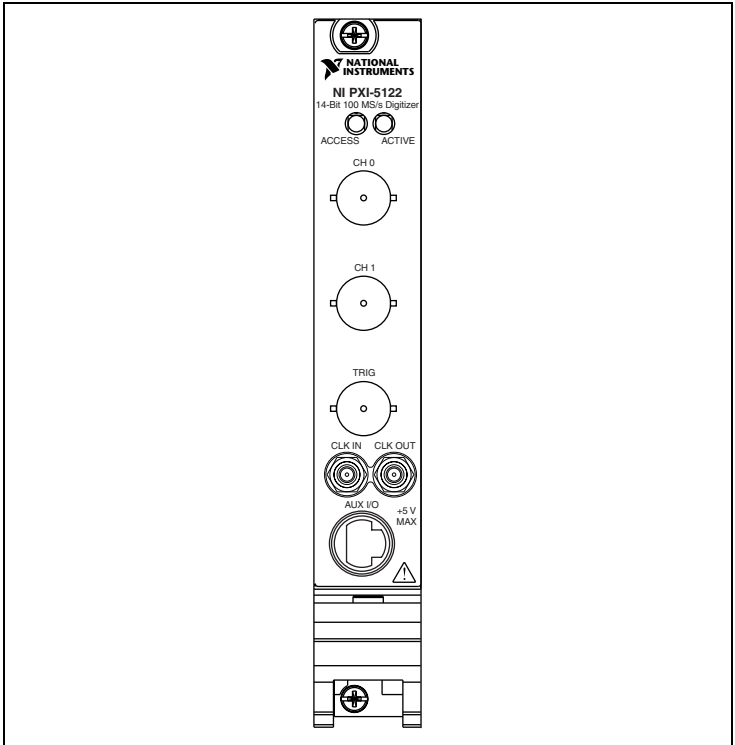


Figure 15. NI PXI-5122 Front Panel Connectors

Table 4 describes the signal connections on the NI 5122.

Table 4. NI 5122 Front Panel Connector Signals

| Connector | Description | Function |
|------------|-----------------------------------|---|
| CH 0, CH 1 | Standard BNC female connector | Analog input connection; digitizes data and triggers acquisitions. |
| TRIG | Standard BNC female connector | External analog trigger connection; signals on the TRIG connector cannot be digitized. |
| CLK IN | Standard SMB jack connector | Input for an external reference or sample clock to the digitizer. |
| CLK OUT | Standard SMB jack connector | Output for the reference or sample clock. |
| AUX I/O | 9-pin mini-circular DIN connector | Provides access to the multipurpose digital timing and triggering lines, PFI 0 and PFI 1 (with optional cable). |

Figure 16 shows the pin assignments for the 9-pin DIN connector on the NI 5122.

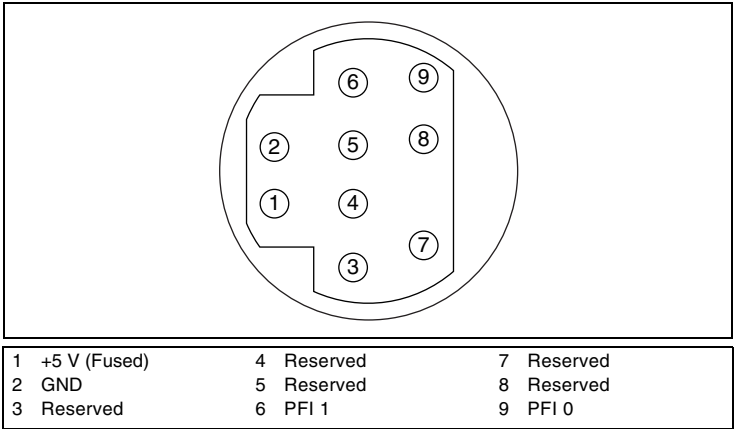


Figure 16. 9-Pin DIN Connector for the NI 5122

NI 5620/5621 Front Panels

Figure 17 shows the NI PXI-5620/5621 front panels.

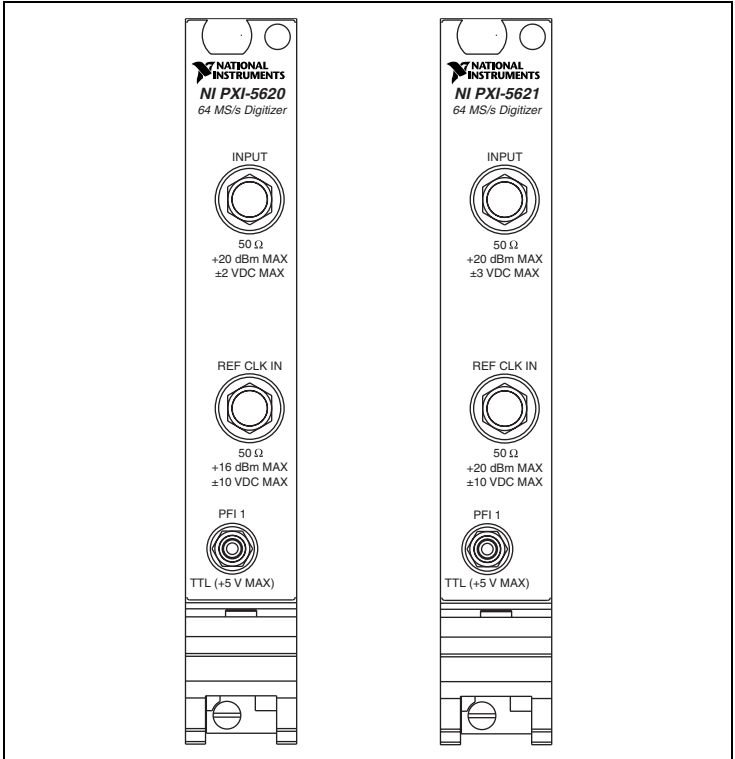


Figure 17. NI PXI-5620/5621 Front Panel Connectors

Table 5 describes the signal connections on the NI 5620/5621.

Table 5. NI 5620/5621 Front Panel Connector Signals

| Connector | Description | Function |
|------------|-------------------------------|--|
| INPUT | Standard SMA female connector | Analog input connection; digitizes data and triggers acquisitions. NI 5620—50 Ω , AC-coupled NI 5621—50 Ω , DC-coupled |
| REF CLK IN | Standard SMA female connector | 50 Ω , 10 MHz, AC-coupled reference input. |
| PFI 1 | Standard SMB jack connector | External digital trigger connection. |

NI 5911 Front Panel

Figure 18 shows the NI 5911 front panel. Refer to Figure 9 for the PFI 2 (AUX) connector pinout information.

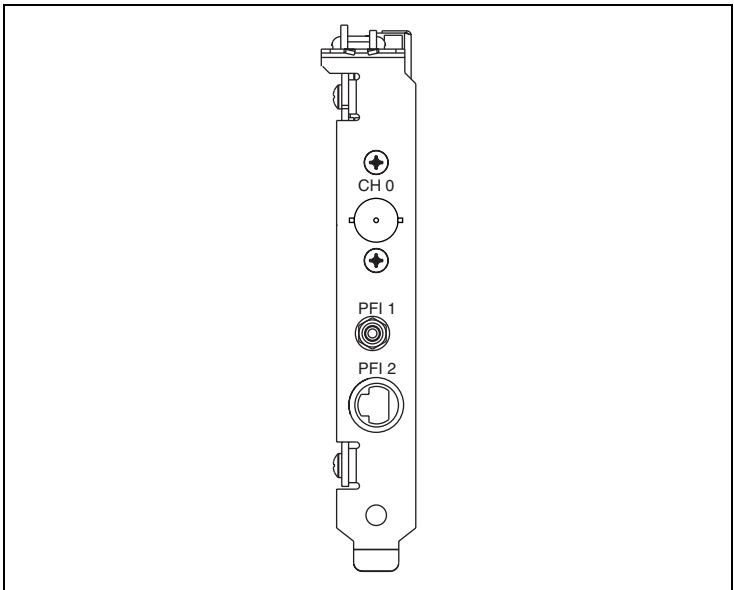


Figure 18. NI PCI-5911 Front Panel Connectors

Table 6. NI 5911 Front Panel Connector Signals

| Connector | Description | Function |
|-------------|-----------------------------------|--|
| CH 0 | Standard BNC female connector | Analog input connection; digitizes data and triggers acquisitions. |
| PFI 1 | Standard SMB jack connector | Multipurpose digital timing and triggering signal. |
| PFI 2 (AUX) | 9-pin mini-circular DIN connector | Access to PFI 2 (with optional cable). Refer to Figure 9 for pinout information. |

Acquiring Data

You can control your digitizer interactively with the Scope Soft Front Panel or programmatically with an ADE using the supplied NI-SCOPE Interchangeable Virtual Instrument (IVI) driver. The two options for controlling your digitizer are described in the following sections.

Acquiring Data Interactively

Launch the Scope Soft Front Panel from **Start»Programs»National Instruments»NI-SCOPE»NI-SCOPE Soft Front Panel**. The Scope SFP provides context-sensitive help for using its controls. You can also find more information in the *Scope Soft Front Panel Help*.

Acquiring Data Programmatically

You can use NI-SCOPE to begin programming the digitizer in your ADE. Programming examples using NI-SCOPE are located at **Start»Programs»National Instruments»NI-SCOPE»Examples**.

For more information about programming with NI-SCOPE, refer to the *NI High-Speed Digitizers Help* at **Start»Programs»National Instruments»NI-SCOPE»Documentation**.

Make Your First Measurement

To begin making measurements with an NI high-speed digitizer, complete the following steps:

1. Open your ADE.
2. Navigate to the example programs for your ADE and open one of the examples. If you are not sure which example to choose, start with the *Getting Started* example.
3. Enter the correct string into the resource name control or parameter. This string varies depending on whether the digitizer is a Traditional NI-DAQ device or an NI-DAQmx device. You can refer to any of the following resources for more information about device names.
 - The *Configure and Test Your Digitizer in MAX* section of this guide
 - **NI-SCOPE VI Reference Help»niScope Initialize**
 - **NI-SCOPE C Function Reference Help»niScope_init**
4. Adjust the parameters, if necessary, to capture the input signal that you want to acquire.
5. Connect the signal you want to acquire to one of the input channels of the digitizer. Refer to the *Connect Signals* section for the appropriate connection.
6. Run the example.

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). All NI products are FCC Class A products.

Depending on where it is operated, this Class A 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.

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

Consult the FCC Web site at 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 marking Declaration of Conformity¹, may cause interference to radio and television reception. Classification requirements are the same for the FCC and the Canadian DOC.

Changes or modifications not expressly approved by NI 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

¹ The CE marking Declaration of Conformity contains important supplementary information and instructions for the user or installer.

interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user is required to correct the interference at their 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.

Compliance to EU Directives

Readers in the European Union (EU) must refer to the manufacturer's Declaration of Conformity (DoC) for information¹ pertaining to the CE marking compliance scheme. The manufacturer includes a DoC for most hardware products except for those bought from OEMs. In addition, DoCs are usually not provided if compliance is not required, for example electrically benign apparatus or cables.

To obtain the DoC for this product, click **Declarations of Conformity Information** at ni.com/hardref.nsf/. This Web site lists the DoCs by product family. Select the appropriate product family, followed by your product, and a link to the DoC appears in Adobe Acrobat format. Click the Acrobat icon to download or read the DoC.

Safety Information

This section contains important safety information that you *must* follow when installing and using an NI digitizer.

Do *not* operate the device in a manner not specified in this document. Misuse of the device can result in a hazard. You can compromise the safety protection built into the device if the device is damaged in any way. If the device is damaged, return it to National Instruments (NI) for repair.

Do *not* substitute parts or modify the device except as described in this document. Use the device only with the chassis, devices, accessories, and cables specified in the installation instructions. You *must* have all covers and filler panels installed during operation of the device.

Do *not* operate the device in an explosive atmosphere or where there may be flammable gases or fumes. If you must operate the device in such an environment, it must be in a suitably rated enclosure.

¹ The CE marking Declaration of Conformity contains important supplementary information and instructions for the user or installer.

If you need to clean the device, use a soft, nonmetallic brush. Make sure that the device is completely dry and free from contaminants before returning it to service.

Operate the device only at or below Pollution Degree 2. Pollution is foreign matter in a solid, liquid, or gaseous state that can reduce dielectric strength or surface resistivity. The following is a description of pollution degrees:

- Pollution Degree 1 means no pollution or only dry, nonconductive pollution occurs. The pollution has no influence.
- Pollution Degree 2 means that only nonconductive pollution occurs in most cases. Occasionally, however, a temporary conductivity caused by condensation must be expected.
- Pollution Degree 3 means that conductive pollution occurs, or dry, nonconductive pollution occurs that becomes conductive due to condensation.

You *must* insulate signal connections for the maximum voltage for which the device is rated. Do *not* exceed the maximum ratings for the device. Do not install wiring while the device is live with electrical signals. Do not remove or add connector blocks when power is connected to the system. Avoid contact between your body and the connector block signal when hot swapping devices. Remove power from signal lines before connecting them to or disconnecting them from the device.

Operate the device at or below the *installation category*¹ marked on the hardware label. Measurement circuits are subjected to *working voltages*² and transient stresses (over voltage) from the circuit to which they are connected during measurement or test. Installation categories establish standard impulse withstand voltage levels that commonly occur in electrical distribution systems. The following is a description of installation categories:

- Installation Category I is for measurements performed on circuits not directly connected to the electrical distribution system referred to as MAINS³ voltage. This category is for measurements of voltages from specially protected secondary circuits. Such voltage measurements include signal levels, special equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.

¹ Installation categories, also referred to as *measurement categories*, are defined in electrical safety standard IEC 61010-1.

² Working voltage is the highest rms value of an AC or DC voltage that can occur across any particular insulation.

³ MAINS is defined as a hazardous live electrical supply system that powers equipment. Suitably rated measuring circuits may be connected to the MAINS for measuring purposes.

- Installation Category II is for measurements performed on circuits directly connected to the electrical distribution system. This category refers to local-level electrical distribution, such as that provided by a standard wall outlet (for example, 115 AC voltage for U.S. or 230 AC voltage for Europe). Examples of Installation Category II are measurements performed on household appliances, portable tools, and similar devices.
- Installation Category III is for measurements performed in the building installation at the distribution level. This category refers to measurements on hard-wired equipment such as equipment in fixed installations, distribution boards, and circuit breakers. Other examples are wiring, including cables, bus bars, junction boxes, switches, socket outlets in the fixed installation, and stationary motors with permanent connections to fixed installations.
- Installation Category IV is for measurements performed at the primary electrical supply installation (<1,000 V). Examples include electricity meters and measurements on primary overcurrent protection devices and on ripple control units.

Technical Support Resources

NI Web Support

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

A Declaration of Conformity (DoC) is our claim of compliance with the Council of the European Communities using the manufacturer's declaration of conformity. This system affords the user protection for electronic compatibility (EMC) and product safety. You can obtain the DoC for your product by visiting ni.com/hardref.nsf. If your product supports calibration, you can obtain the calibration certificate for your product at ni.com/calibration.

Worldwide Support

National Instruments has offices located around the world to help address your support needs. You can access our branch office Web sites from the Worldwide Offices section of ni.com. Branch office Web sites provide up-to-date contact information, support phone numbers, email addresses, and current events.

If you have searched the technical support resources on our Web site and still cannot find the answers you need, contact your local office or National Instruments corporate. For telephone support in the United States, dial 512 795 8248. For telephone support outside the United States, contact your local branch office:

Australia 1800 300 800, Austria 43 0 662 45 79 90 0,
Belgium 32 0 2 757 00 20, Brazil 55 11 3262 3599,
Canada (Calgary) 403 274 9391, Canada (Montreal) 514 288 5722,
Canada (Ottawa) 613 233 5949, Canada (Québec) 514 694 8521,
Canada (Toronto) 905 785 0085, Canada (Vancouver) 514 685 7530,
China 86 21 6555 7838, Czech Republic 420 2 2423 5774,
Denmark 45 45 76 26 00, Finland 385 0 9 725 725 11,
France 33 0 1 48 14 24 24, Germany 49 0 89 741 31 30,
Greece 30 2 10 42 96 427, India 91 80 51190000,
Israel 972 0 3 6393737, Italy 39 02 413091, Japan 81 3 5472 2970,
Korea 82 02 3451 3400, Malaysia 603 9131 0918,
Mexico 001 800 010 0793, Netherlands 31 0 348 433 466,
New Zealand 0800 553 322, Norway 47 0 66 90 76 60,
Poland 48 0 22 3390 150, Portugal 351 210 311 210,
Russia 7 095 783 68 51, Singapore 65 6226 5886, Slovenia 386 3 425 4200,
South Africa 27 0 11 805 8197, Spain 34 91 640 0085,
Sweden 46 0 8 587 895 00, Switzerland 41 56 200 51 51,
Taiwan 886 2 2528 7227, Thailand 662 992 7519,
United Kingdom 44 0 1635 523545

CVI™, IVI™, LabVIEW™, National Instruments™, NI™, ni.com™, and NI-DAQ™ are trademarks of National Instruments Corporation. Product and company names mentioned herein are trademarks or trade names of their respective companies. For patents covering National Instruments products, refer to the appropriate location: **Help»Patents** in your software, the `patents.txt` file on your CD, or `ni.com/patents`.

© 2003 National Instruments Corp. All rights reserved.