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GETTING STARTED GUIDE

NI High-Speed Digitizers

This document contains English and Japanese language instructions.

Français Deutsch 日本語 한국어 简体中文

ni.com/manuals

This document explains how to install, configure, and test NI high-speed digitizers and accessories, and how to begin programming them using the NI-SCOPE instrument driver software. This document applies to the following digitizers and accessories: NI 5105, NI 5114, NI 5122, NI 5124, NI 5132, NI 5133, NI 5142, NI 5152, NI 5153, NI 5154, NI 5160, NI 5162, NI 5185, NI 5186, NI 5620, NI 5621, NI 5622, NI 5900, and NI 5922.

For more information on features and programming, refer to the *NI High-Speed Digitizers Help*. For device specifications, refer to the specifications document included with your device. To access these documents, select **Start»All Programs»National Instruments»NI-SCOPE» Documentation**. **(Windows 8)** Click **NI Launcher** and select **NI-SCOPE»Documentation** in the window that appears.

For the most current versions of documentation, visit `ni.com/manuals`. For the latest version of NI-SCOPE, visit `ni.com/downloads`.

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NATIONAL INSTRUMENTS

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Safety and Electromagnetic Compatibility

Refer to the *Read Me First: Safety and Electromagnetic Compatibility* document for important safety and electromagnetic compatibility information. To obtain a copy of this document online, visit `ni.com/manuals`, and search for the document title.

For additional and electromagnetic compatibility information, including any product-specific installation or configuration requirements necessary to achieve the specified level of electromagnetic compatibility performance, refer to the individual product specifications.

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1. Verifying System Requirements

Your system must meet certain requirements to use NI high-speed digitizers with NI-SCOPE. For more information on minimum system, recommended system, and supported application development environments (ADEs), refer to the *NI-SCOPE Readme*, which is available on the NI-SCOPE media.

Note After you install NI-SCOPE, you can access the *NI-SCOPE Readme* at **Start»All Programs»National Instruments»NI-SCOPE»Documentation**. **(Windows 8)** Click **NI Launcher** and select **NI-SCOPE»Documentation** in the window that appears.

2. Unpacking

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 the chassis to remove any built up static charge.

Caution When handling the digitizer, make sure that you are grounded with a grounding strap or you are 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 (PXI/PXI Express devices only), and inspect the digitizer for loose components or signs 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.

3. Verifying the Kit Contents

The following items are included in the NI high-speed digitizer kit:

- ☐ The NI high-speed digitizer or accessory you ordered
- ☐ NI-SCOPE instrument driver case, which contains the NI-SCOPE driver software media
- ☐ Other included items:
  - The specifications document for the device
  - *Read Me First: Safety and Electromagnetic Compatibility*
  - *NI High-Speed Digitizers Getting Started Guide* (this document)
  - *Maintain Forced-Air Cooling Note to Users* (SMC-based devices only)
  - NI Spectral Measurements Toolkit media (available in selected SMC-based device kits only)

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- USB cable (USB devices only)
- NI SignalExpress media (USB devices only)

Note SMC-based devices are based on the National Instruments Synchronization and Memory Core architecture. For more information, refer to the *NI High-Speed Digitizers Help*.

Other Required Items

In addition to the items contained in the kit, you need the following items:

☐ 1/8 in. flat-head screwdriver

☐ One of the following configurations:

- **(PXI Devices)** A PXI chassis, a PXI/SCXI combination chassis, or a PXI/CompactPCI chassis with a controller and the chassis documentation
- **(PXI Express Devices)** A PXI Express chassis with a controller and the chassis documentation
- **(USB Devices)** A desktop or laptop computer and its documentation
- **(PCI Devices)** A desktop computer and its documentation

Note If your application uses NI-TClk synchronization for PCI Devices, you must use a RTSI cable to connect the PCI Devices. For more information, refer to **NI High-Speed Digitizers Help»Programming»Reference»NI-TClk Synchronization Help**.

4. Installing the Software

Caution Make sure you install the software *before* you install the hardware.

To install the software, complete the following steps:

1. (Optional) If you are using an application development environment (ADE) such as LabVIEW or if you are using a third-party tool, install it now. You *must* install the ADE before installing the NI-SCOPE instrument driver.
2. Install NI-SCOPE by inserting the NI-SCOPE media into the DVD drive. Click **Install Software** in the displayed window.

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

3. Follow the instructions in the installation prompts.

Note You may see access and security messages during installation. Accept the prompts to complete the installation.

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4. When the installer completes, a dialog box prompts you to Restart, Shut Down, or Restart Later. Select **Restart**.
5. If you are using a system running the LabVIEW Real-Time Module, download NI-SCOPE to the target using Measurement &Automation Explorer (MAX). For more information, refer to the *MAX Remote Systems Help* by selecting **Help»Help Topics»Remote Systems** in MAX.

5. Installing the Hardware

This section describes how to install hardware for PXI/PXI Express, PCI, and USB platforms.

Note You must install the software *before* you install the hardware.

To prevent damage to the device caused by ESD or contamination, handle the device using the edges or the metal bracket. For more information, refer to the *Read Me First: Safety and Electromagnetic Compatibility* document.

Caution Unless you are using a USB device, you *must* power off and unplug your PC or chassis before installing the hardware.

PXI/PXI Express Modules

NI PXI and PXI Express modules are sensitive instruments that 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 device with any solvents or liquids.

You can install PXI modules in any PXI slot marked with a peripheral slot compatibility glyph (a circle containing the slot number).

You can install PXI Express modules in a PXI Express slot of the chassis. Refer to the chassis documentation for information about the markings that denote PXI Express slots.

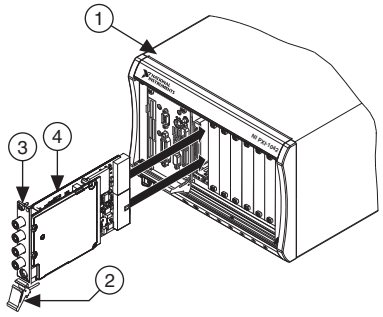
To install a PXI/PXI Express module, complete the following steps:

1. Power off and unplug the PXI/PXI Express chassis before installing the module.
2. If the PXI/PXI Express chassis has multiple fan speed settings, make sure that the fans are set to high.
3. Position the PXI/PXI Express chassis so that inlet and outlet vents are not obstructed. For more information, refer to the chassis documentation.
4. Make sure that the ejector handle of the module is in the unlatched (downward) position.
5. Holding the module by the ejector handle, slide it into an empty slot as shown in Figure 1 (PXI modules) or Figure 2 (PXI Express modules), or Figure 3 (NI PXIe-5185/5186 modules). Make sure that the base engages with the guides in the chassis.
6. Slide the module completely into the chassis and latch it by pulling up on the ejector handle.

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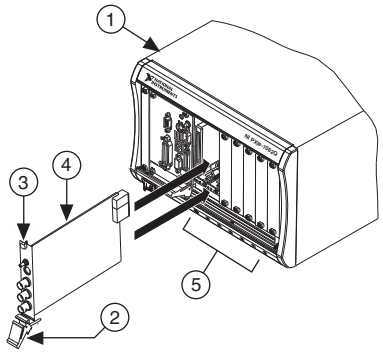
7. Tighten the captive screws at the top and bottom of the module front panel. Performance may suffer if both screws are not tightened properly.
8. Verify that the PXI/PXI Express chassis fans are operable and free of dust and other contaminants that may restrict airflow.
9. Before operating the module, cover all empty chassis slots using filler panels or slot blockers, which you can purchase at `ni.com`.
10. Plug in and power on the chassis.

Figure 1. PXI Module Installation



1	PXI Chassis	3	Screws
2	Ejector Handle in Downward Position	4	NI PXI Module

Figure 2. PXI Express Module Installation



1	PXI Express Chassis	3	Screws	5	Chassis Slot Markings
2	Ejector Handle	4	NI PXI Express Module		

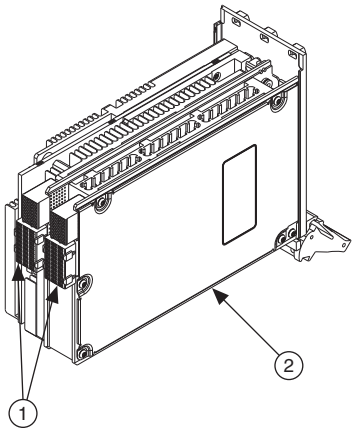
NI PXIe-5185/5186 Modules

Follow the installation instructions in the *PXI/PXI Express Modules* section to install the NI PXIe-5185/5186 module in PXI Express slots of the chassis.

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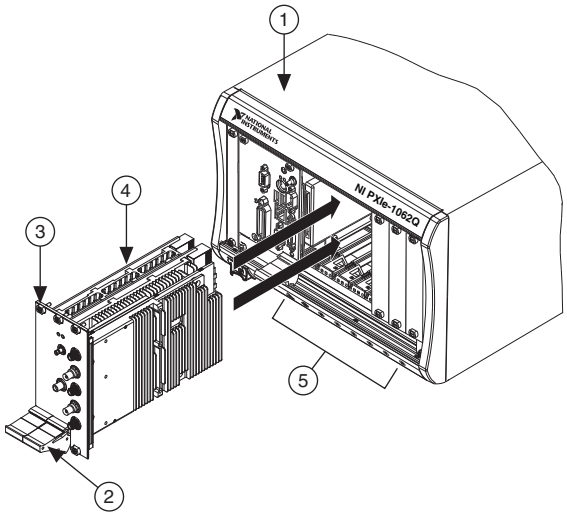
Note The two PXI Express connectors on the NI 5185/5186 module, shown in Figure 3, must be connected to the chassis backplane in two adjacent PXI Express slots.

Figure 3. NI PXIe-5185/5186 Connector



1	PXI Express Connectors	2	NI PXIe-5186 Module

Figure 4. NI 5185/5186 Installation



1	PXI Express Chassis	3	Screws	5	Chassis Slot Markings
2	Ejector Handles	4	NI PXIe-5185/5186 Module		

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NI PXIe-5185/5186 Startup Behavior

The first time you install the NI 5185/5186 in the chassis, the NI-SCOPE driver launches a device recognition wizard. After the wizard completes, the NI 5185/5186 module goes through an initialization procedure that lasts approximately 5 to 10 minutes. You must wait until the initialization procedure completes before using the module.

Note The Access LED turns green when the module is ready to be configured.

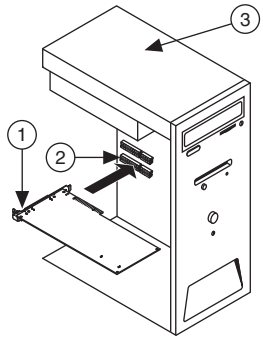
The initialization procedure will occur on each subsequent use of the NI 5185/5186, although the device recognition wizard is not repeated on each subsequent boot cycle. The module will begin the initialization procedure after the NI-SCOPE driver has been loaded by the operating system.

PCI Devices

To install a 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 5.

Figure 5. PCI Installation



1	NI PCI Device	2	PCI Slot	3	PC

Tip To maximize airflow and extend the life of the PCI device, leave any adjacent PCI slots empty.

4. Secure the device to the PCI chassis with a screw.

Caution It is important to completely screw the device front panel into the PCI slot, both for mechanical stability and to create a solid ground connection. Improperly secured devices may affect the accuracy of the device.

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(SMC-Based Devices) Some computer manufacturers use a securing lever made of plastic to secure PCI devices; such a lever is unacceptable and *must* be removed. Use the screw provided in the kit to screw down the digitizer. Otherwise, you must use a different computer chassis.

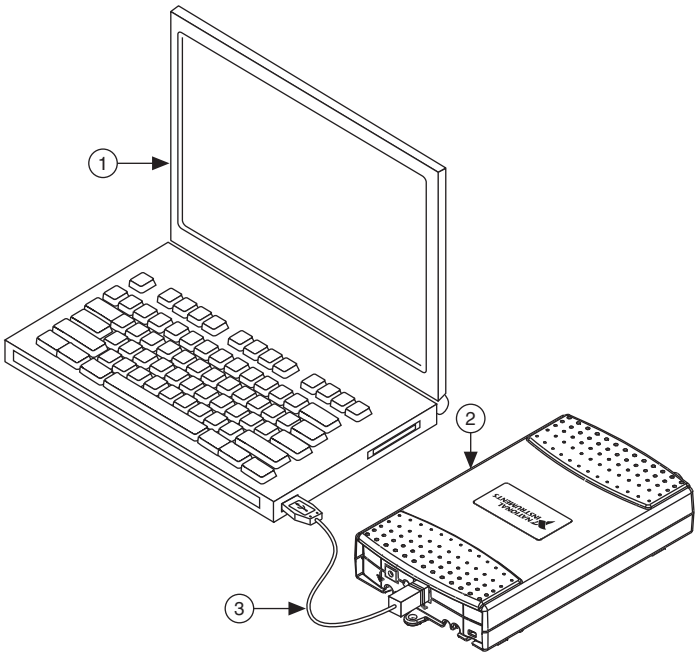
5. Replace the PC cover.
6. Plug in and power on the PC.
7. **(SMC-Based Devices)** Verify that spread-spectrum clocking is enabled in the PC BIOS. For information about how to verify this setting, refer to the PC user documentation.

Note For SMC-based devices, spread-spectrum clocking varies the clock signal to spread the timing clock signal over a small frequency range. Disabling spread-spectrum clocking may affect the accuracy of device specifications.

USB Devices

To install a USB device, connect the USB cable to the PC and the digitizer, as shown in Figure 6.

Figure 6. USB Installation



1	Laptop Computer	2	NI USB High-Speed Digitizer	3	USB Cable

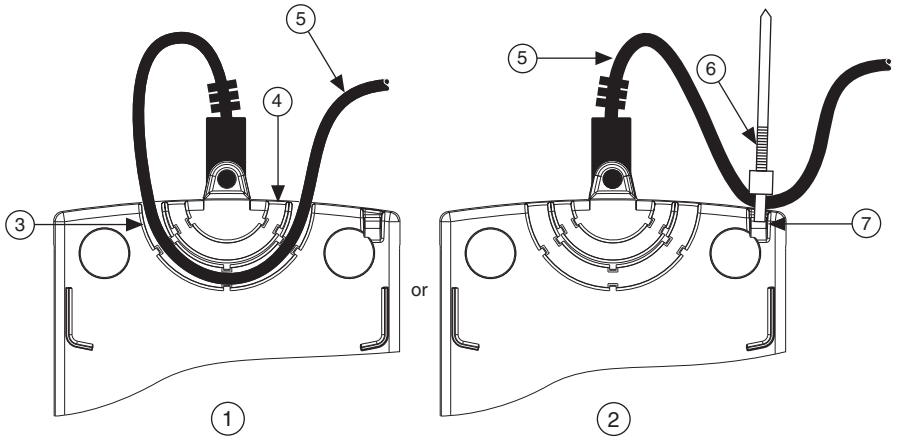
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USB Cable Strain Relief

The two strain relief options for your USB cable are as follows:

- **Groove Method**—Press the USB cable into one of the two grooves on the underside of the USB device. Choose the USB cable groove that matches your USB cable size, as shown in Figure 7.
- **Zip Tie Method**—Thread a zip tie through the zip tie bar on the underside of the USB device and tighten around the USB cable, as shown in Figure 7.

Figure 7. USB Cable Strain Relief Options



1	Groove Method	5	USB Cable
2	Zip Tie Method	6	Zip Tie
3	USB Cable Strain Relief Groove (Large)	7	Zip Tie Bar
4	USB Cable Strain Relief Groove (Small)		

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Mounting the USB-5132/5133

You can use the NI USB-5132/5133 on a desktop or mount it to a standard DIN rail or a panel.

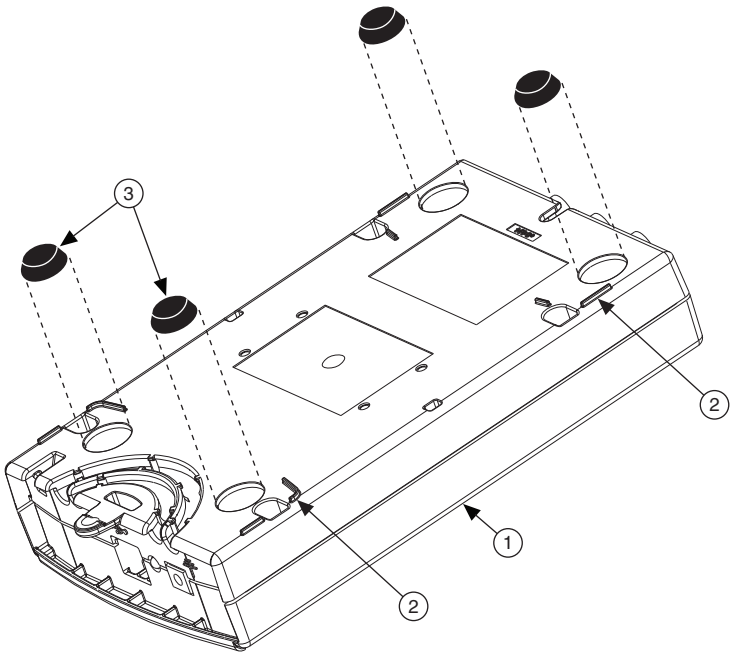
Desktop Use

The NI USB-5132/5133 has plastic guides on the underside that allow it to be stacked on top of other NI USB-5132/5133 devices.

For secure desktop use, you can adhere the supplied rubber non-skid feet to the underside of the device, as shown in Figure 8.

Note Do not apply the rubber feet if you are panel mounting the NI USB-5132/5133 or stacking it on top of another NI USB-5132/5133 device.

Figure 8. Applying Rubber Feet to the USB-513*x*



1	NI USB High-Speed Digitizer	2	Plastic Guides	3	Rubber Feet

DIN Rail Mounting

The DIN rail mounting kit (part number 779689-01, not included in your USB-513x kit) is an accessory you can use to mount the USB-513x family of products to a standard DIN rail.

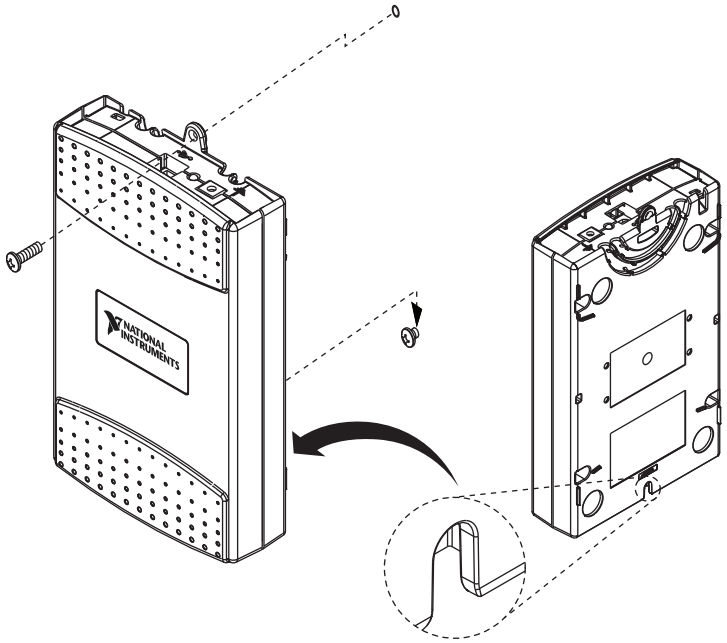
Note Apply strain relief, as described in the *USB Cable Strain Relief* section, *before* mounting the USB-513x to a DIN rail.

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Panel Mounting

To mount the USB-513x to a board or panel, complete the following steps while referring to Figure 9.

Figure 9. Mounting the USB-513*x* on a Panel



Note Do not apply the rubber feet to the USB-513x when panel mounting the device.

Note Apply strain relief, as described in the *USB Cable Strain Relief* section, *before* panel mounting the USB-513x.

1. Download and print the panel mounting template PDF attached in the KnowledgeBase document, *USB-4065/5132/5133/6509 Panel Mounting Template*. Go to `ni.com/info` and enter the Info Code `rd3233` to locate the KnowledgeBase document.
2. Using the template, mark the bottom point and top point on the panel. The points will be 162 mm (6.375 in.) apart.
3. Remove the USB cable from the connector on the USB-513x.
4. Screw a #8 or M4 screw into the bottom point on the panel.
5. Set the USB-513x on the screw by fitting it into the bottom screw notch on the underside of the USB-513x.
6. Screw a #8 or M4 screw through the USB-513x top screw hole into the panel.

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Windows Device Recognition

Windows recognizes any newly installed device the first time the computer reboots after hardware is installed. On some Windows systems, the Found New Hardware wizard opens with a dialog box for every NI device installed. **Install the software automatically (Recommended)** is selected by default. Click **Next** or **Yes** to install the software for each device.

Note **(USB devices)** When you first install an NI USB-5132/5133, Windows will recognize a new device. Click **Next** on any dialog boxes that appear to complete the installation.

After Windows recognizes the newly installed device, a dialog box prompts you to select from the following options, which may vary depending on the devices and software installed on your system:

- **Begin a Measurement with This Device Using NI SignalExpress** opens SignalExpress.
- **Use This Device Interactively** launches the NI-SCOPE Soft Front Panel (SFP).
- **Begin an Application with This Device** launches LabVIEW.
- **Configure and Test This Device** opens MAX to your device so you can configure settings.
- **Take No Action** leaves your device in the system but does not launch an application.

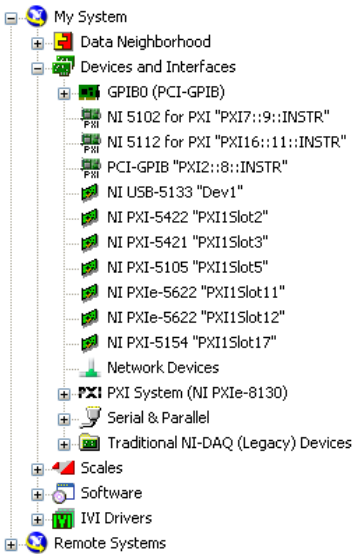
6. Configuring and Testing in MAX

Note **(NI 5185/5186)** After you install the NI 5185/5186 in the chassis, the Access LED will remain amber while the NI 5185/5186 is configuring device firmware and initializing the device. During this time, the device is not available for user access. When the Access LED changes to solid green, you can begin configuring the device in MAX.

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1. Launch MAX by double-clicking the **Measurement & Automation** icon on the desktop. Figure 10 shows the MAX Configuration Pane.

Figure 10. MAX Configuration Pane



2. Expand **Devices and Interfaces** to see the list of installed devices. If you are using a digitizer with the LabVIEW Real-Time Module, expand **Remote Systems**. Find your target IP address or name, expand it, and then expand **Devices and Interfaces**.
3. If your device is not listed, press <F5> to refresh. If the device is still not listed, repeat the steps in section *5. Installing the Hardware*. For more information about using MAX, refer to the help files available within MAX.

Note Windows 8 (64-bit), Windows 7 (64-bit) and Windows Vista (64-bit) do not support Traditional NI-DAQ (Legacy) devices. Refer to the NI-SCOPE Readme to determine which operating system is compatible with your digitizer.

4. Record the device number or device name assigned by MAX. You need this identifier when you program your device.
5. Perform a self-test on the device to verify installation.
   - Right-click the device and select **Self-Test**.
   - **(Traditional NI-DAQ [Legacy] Devices)** Right-click the device, select **Configure**, and click **Test Resources**.

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

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Note If the device does not pass the self-test, repeat the instructions in section *5. Installing the Hardware*. If the device still does not pass, visit NI Technical Support at `ni.com/support`.

6. Run the test panels on the device to verify the signal.
   a. Connect a signal to the digitizer and select the appropriate device parameters for this signal such as range, input limits, sample rate, and sample mode.
   b. Access the test panel.
      - Right-click the device and select **Test Panels**.
      - **(Traditional NI-DAQ [Legacy] Devices)** Click **Run Test Panels** in the Configure window.

Note All NI digitizers have self-calibration capabilities. You can access this feature programmatically with NI-SCOPE and your ADE, or you can use either the NI-SCOPE Soft Front Panel (SFP) or MAX. Traditional NI-DAQ (Legacy) devices cannot be self-calibrated using MAX.

7. Exit MAX when you have finished configuring and testing the digitizer.

7. Programming the Device

You can acquire data interactively using the NI-SCOPE Soft Front Panel or programmatically using the NI-SCOPE instrument driver in your application. You can also run the NI-SCOPE examples to demonstrate the functionality of the digitizer.

Acquiring Data Interactively

Launch the NI-SCOPE SFP from **Start»All Programs»National Instruments»NI-SCOPE» SCOPE Soft Front Panel**. **(Windows 8)** Click **NI Launcher** and select **NI-SCOPE»SCOPE Soft Front Panel** in the window that appears. The NI-SCOPE SFP provides context-sensitive help for its controls.

Acquiring Data Programmatically

You can use NI-SCOPE to begin programming the digitizer in your ADE. For detailed instructions about how to acquire data in a specific ADE, refer to the *Getting Started with NI-SCOPE* section of the *NI High-Speed Digitizers Help* located at **Start»All Programs» National Instruments»NI-SCOPE»Documentation»NI High-Speed Digitizers Help. (Windows 8)** Click **NI Launcher** and select **NI-SCOPE»Documentation»NI High-Speed Digitizers Help** in the window that appears.

Tip You can modify an NI-SCOPE C example to create an application with Microsoft Visual C/C++, and all required include and library files are automatically added to the project. Refer to the *Creating an Application with Microsoft Visual C and C++* topic of the *NI High-Speed Digitizers Help* if you prefer to manually add all required include and library files to the project.

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NI-SCOPE Examples

Examples demonstrate the functionality of the device, serving as programming models and building blocks for your own applications. The NI Example Finder is a utility available for some software applications that organizes examples into categories and allows you to easily browse and search installed examples. You can see descriptions and compatible hardware models for each example or see all the examples compatible with one particular hardware model.

To locate examples, refer to the following table.

Software Application	Locating Examples
LabVIEW or LabWindows™/CVI™	Locate examples with the NI Example Finder. Within LabVIEW or LabWindows/CVI, select **Help»Find Examples** and navigate to **Hardware Input and Output»Modular Instruments**.
ANSI C or Visual Basic	Locate examples in the `<NIDocDir>\NI-SCOPE\examples` directory, where `<NIDocDir>` is one of the following directories: • **(Windows 2000/XP)** `Documents and Settings\All Users\Shared Documents\National Instruments` • **(Windows Vista)** `Users\Public\Documents\National Instruments` • **(Windows 7/8)** `Users\Public\Public Documents\National Instruments`

8. Making Your First Measurement

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

1. Launch your ADE.
2. Navigate to **Start»All Programs»National Instruments»NI-SCOPE»Examples** and open one of the examples. **(Windows 8)** Click **NI Launcher** and select **NI-SCOPE» Examples**. If you are not sure which example to run, begin with the Getting Started example.
3. Enter the correct string into the **resource name** control or parameter. This string varies if the digitizer is a Traditional NI-DAQ device. For more information about device names, refer to any of the following resources.
   - Section *6. Configuring and Testing in MAX* of this document
   - **NI High-Speed Digitizers Help»Programming»Reference»NI-SCOPE LabVIEW Reference»VIs»niScope Initialize**
   - **NI High-Speed Digitizers Help»Programming»Reference»NI-SCOPE Function Reference Help»Functions»niScope_init**
4. Adjust the parameters, if necessary, to capture the input signal that you want to acquire.

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5. Connect the signal that you want to acquire to one of the input channels of the digitizer. For information about the appropriate connections, refer to *Appendix A: Front Panels for SMC-Based Devices and USB Devices* or to *Appendix B: Front Panels for Traditional NI-DAQ (Legacy) Devices*.
6. Run the example program.

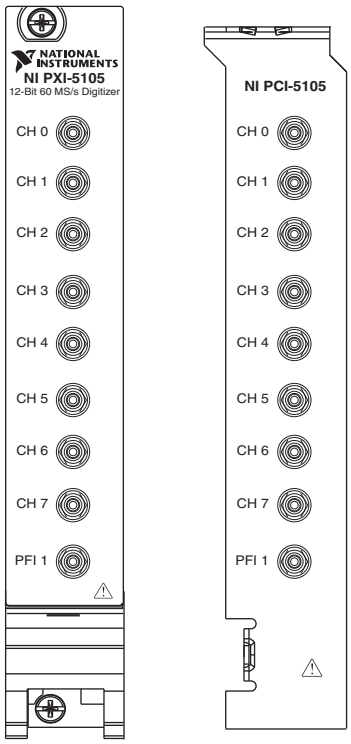
Appendix A: Front Panels for SMC-Based Devices and USB Devices

This appendix describes digitizer front panels and signal connections for SMC-based devices and USB devices: NI 5105, NI 5114, NI 5122, NI 5124, NI 5132, NI 5133, NI 5142, NI 5152, NI 5153, NI 5154, NI 5160, NI 5162, NI 5185, NI 5186, NI 5622, and NI 5922.

NI 5105 Front Panels

Figure 11 shows the NI PXI-5105 and NI PCI-5105 front panels.

Figure 11. NI 5105 Front Panels



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Table 1 describes the signal connections for the NI 5105.

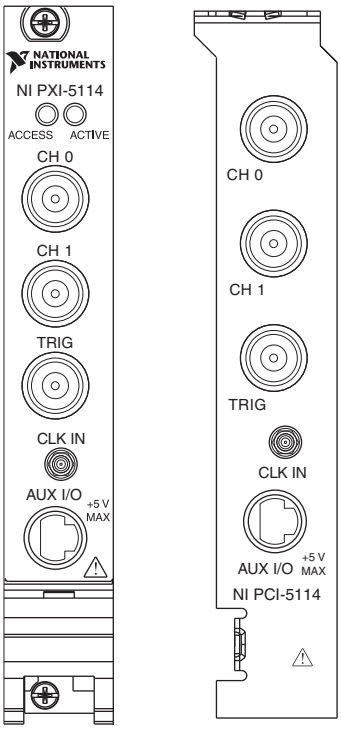
Table 1. NI 5105 Front Panel Signal Connections

Connector	Description	Function
CH 0 ... CH 7	Standard SMB jack connector	Analog input connection; digitizes data and triggers acquisitions.
PFI 1	Standard SMB jack connector	Multipurpose PFI line for digital trigger in/out, external clock in, reference clock in/out, and timebase out.

NI 5114 Front Panels

Figure 12 shows the NI PXI-5114 and NI PCI-5114 front panels. For the AUX connector pinout information, refer to Figure 14.

Figure 12. NI 5114 Front Panels



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Table 2 describes the signal connections for the NI 5114.

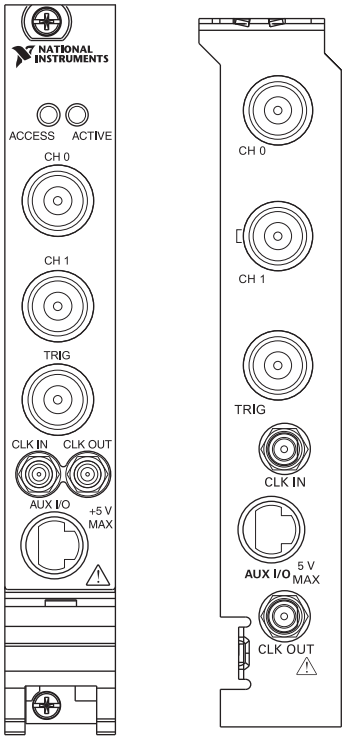
Table 2. NI 5114 Front Panel Signal Connections

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 clock or sample clock to the digitizer.
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). For pinout information, refer to Figure 14.

NI 5122/5124/5142/5922 Front Panels

Figure 13 shows the NI PXI-5122/5124/5142/5922 and NI PCI-5122/5124/5142/5922 front panels. The NI PXIe-5122 front panels are identical.

Figure 13. NI 5122/5124/5142/5922 Front Panels



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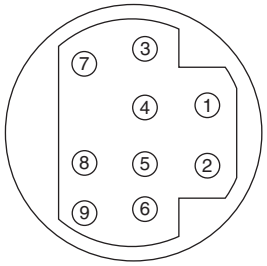
Table 3 describes the signal connections for the NI 5122/5124/5142/5922.

Table 3. NI 5122/5124/5142/5922 Front Panel Signal Connections

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	**(NI 5122/5124/5142)** Input for an external reference clock or sample clock to the digitizer. **(NI 5922)** Input for an external reference clock to the digitizer.
CLK OUT	Standard SMB jack connector	**(NI 5122/5124/5142)** Output for the reference clock or sample clock. **(NI 5922)** Output for the reference 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). For pinout information, refer to Figure 14.

Figure 14 shows the pin assignments for the 9-pin DIN connector.

Figure 14. 9-Pin DIN Connector Pin Assignments for NI 5114/5122/5124/5142/5922



1	+5 V (Fused)	4	Reserved	7	Reserved
2	GND	5	Reserved	8	Reserved
3	Reserved	6	PFI 1	9	PFI 0

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NI 5132/5133 Front Panels

Figure 15 shows the NI USB-5132 and NI USB-5133 front panels.

Figure 15. NI 5132/5133 Front Panels

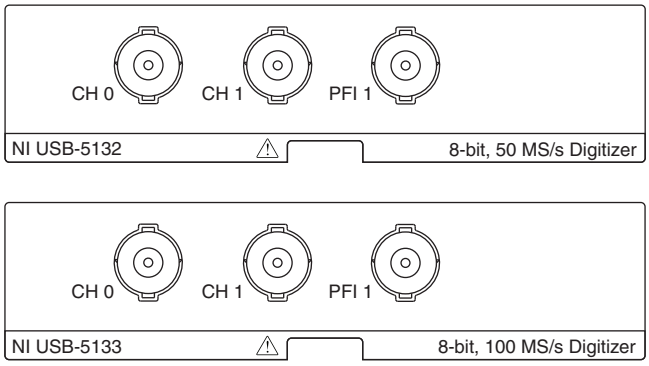
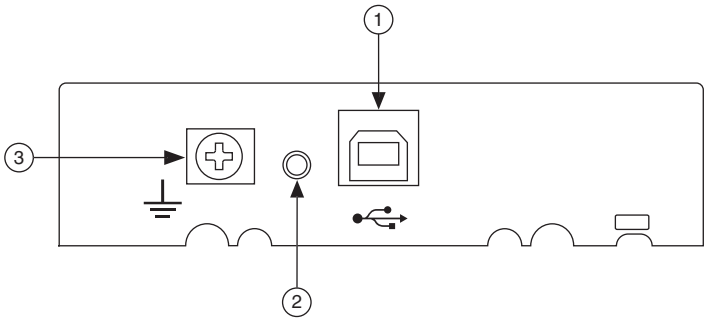


Figure 16 shows the NI 5132/5133 back panel.

Figure 16. NI 5132/5133 Back Panel



1 Recessed USB port 2 LED 3 Ground

Table 4 describes the signal connections for the NI 5132/5133.

Table 4. NI 5132/5133 Front Panel Signal Connections

Connector	Description	Function
CH 0, CH 1	Standard BNC female connector	Analog input connection; digitizes data and triggers acquisitions.
PFI 1	Standard BNC female connector	Multipurpose PFI line for sample clock in, digital trigger in/out, and probe compensation.

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NI 5152/5153/5154 Front Panels

Figure 17 shows the NI PXI-5152/5153/5154 and NI PCI-5152/5153/5154 front panels.

Figure 17. NI 5152/5153/5154 Front Panels

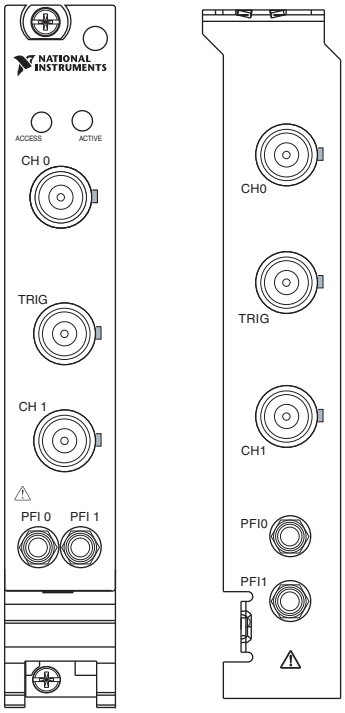


Table 5 describes the signal connections for the NI 5152/5153/5154.

Table 5. NI 5152/5153/5154 Front Panel Signal Connections

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 0	Standard SMB jack connector	Multipurpose PFI line for reference clock in, sample clock in, and digital trigger in/out.
PFI 1	Standard SMB jack connector	Multipurpose PFI line for reference clock out, probe compensation, and digital trigger in/out.

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NI 5160/5162 Front Panels

NI 5160/5162 (2 CH)

Figure 18 shows the NI 5162 (2 CH) front panel.

Figure 18. NI 5160/5162 (2 CH) Front Panel

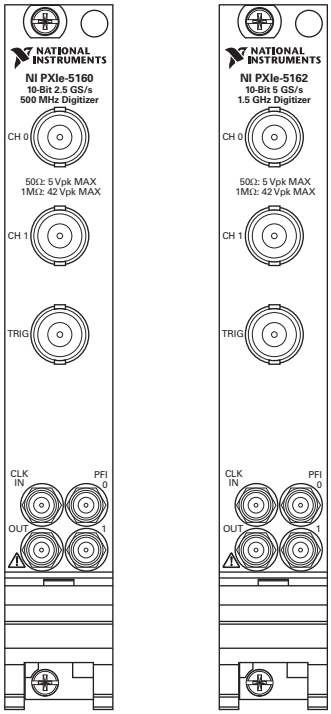


Table 6 describes the signal connections for the NI 5160/5162 (2 CH).

Table 6. NI 5160/5162 (2 CH) Front Panel Signal Connections

Connector	Description	Function
CH 0, CH 1	Standard BNC connector	Analog input connection; digitizes data and triggers acquisitions.
TRIG	Standard BNC connector	External analog trigger connection; signals on the TRIG connector cannot be digitized.
CLK IN	Standard SMB jack	Reference clock in, sample clock in.
CLK OUT	Standard SMB jack	Reference clock out.

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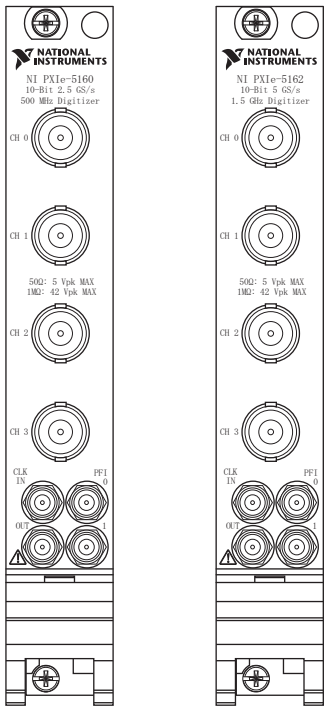
Table 6. NI 5160/5162 (2 CH) Front Panel Signal Connections (Continued)

Connector	Description	Function
PFI 0	Standard SMB jack	Digital trigger in/out.
PFI 1	Standard SMB jack	Digital trigger in/out, probe compensation.

NI 5160/5162 (4 CH)

Figure 19 shows the NI 5160/5162 (4 CH) front panel.

Figure 19. NI 5160/5162 (4 CH) Front Panel



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Table 7 describes the signal connections for the NI 5160/5162 (4 CH).

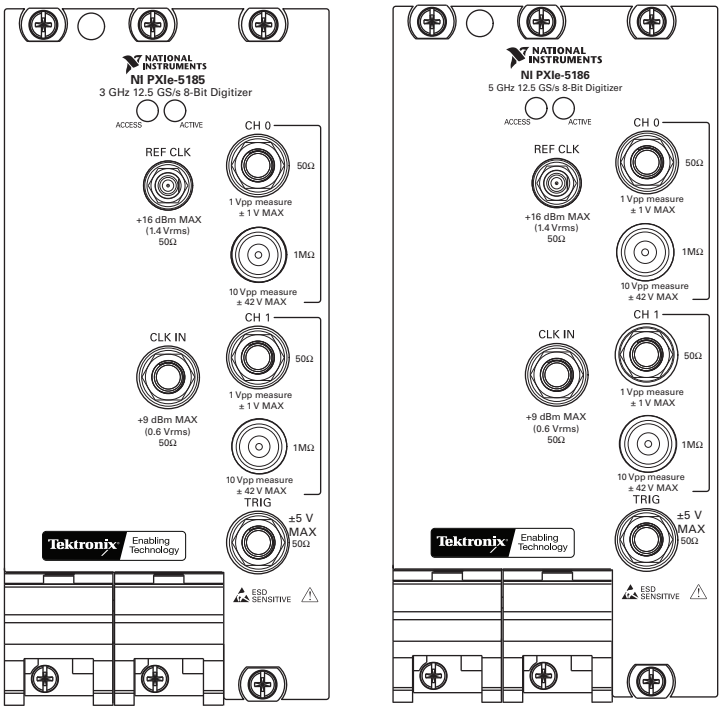
Table 7. NI 5160/5162 (4 CH) Front Panel Signal Connections

Connector	Description	Function
CH 0 ... CH 3	Standard BNC connector	Analog input connection; digitizes data and triggers acquisitions.
CLK IN	Standard SMB jack	Reference clock in, sample clock in.
CLK OUT	Standard SMB jack	Reference clock out.
PFI 0	Standard SMB jack	Digital trigger in/out.
PFI 1	Standard SMB jack	Digital trigger in/out, probe compensation.

NI 5185/5186 Front Panels

Figure 20 shows the NI 5185/5186 front panels.

Figure 20. NI 5185/5186 Front Panels



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Table 8 describes the signal connections for the NI 5185/5186.

Table 8. NI 5185/5186 Front Panel Signal Connections

Connector	Description	Function
REF CLK	Standard SMB jack connector	Imports an external reference clock to the digitizer.
CLK IN	SMA female connector	Imports an external sample clock to the digitizer.
CH 0	50 Ω, SMA female connector	Analog input connection; digitizes data and triggers acquisitions.
CH 0	1 MΩ, BNC female connector	Analog input connection; digitizes data and triggers acquisitions.
CH 1	50 Ω, SMA female connector	Analog input connection; digitizes data and triggers acquisitions.
CH 1	1 MΩ, BNC female connector	Analog input connection; digitizes data and triggers acquisitions.
TRIG	SMA female connector	External analog trigger connection.

Previous NI 5185/5186 Modules

Early versions of the NI 5185/5186 only support 50 Ω input impedance. If the front panel of your NI 5185/5186 looks different from the front panels shown above, you may have an earlier version of the device. Check the part number of your device to be sure:

- NI 5185 module part numbers 199363*x*-0*z*L and NI 5186 module part numbers 193537*x*-0*z*L (where *x* is any letter and *z* is any number) only support 50 Ω input impedance.
- NI 5185 module part numbers 152962*x*-0*z*L and NI 5186 module part numbers 152961*x*-0*z*L (where *x* is any letter and *z* is any number) support both 50 Ω and 1 MΩ input impedance.

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NI 5622 Front Panels

Figure 21 shows the NI PXIe-5622 front panels.

Figure 21. NI 5622 Front Panel

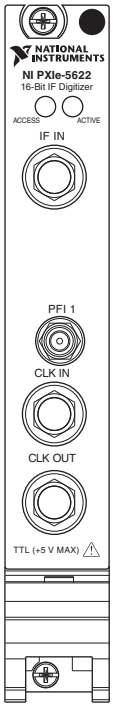


Table 9 describes the signal connections for the NI 5622.

Table 9. NI 5622 Front Panel Signal Connections

Connector	Description	Function
IF IN	SMA female connector	Analog input connection; digitizes data and triggers acquisitions.
PFI 1	SMB jack connector	Digital trigger connection. (Multipurpose PFI line for reference clock in, sample clock in, and digital trigger in/out.)
CLK IN	SMA female connector	Imports an external reference clock or sample clock to the digitizer.
CLK OUT	SMA jack connector	Exports the digitizer reference clock or sample clock.

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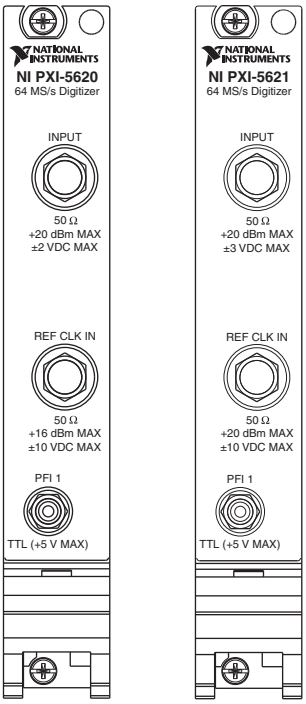
Appendix B: Front Panels for Traditional NI-DAQ (Legacy) Devices

This appendix describes digitizer front panels and signal connections for the Traditional NI-DAQ (Legacy) device, NI 5620/5621.

NI 5620/5621 Front Panels

Figure 22 shows the NI PXI-5620/5621 front panels.

Figure 22. NI 5620/5621 Front Panels



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Table 10 describes the signal connections for the NI 5620/5621.

Table 10. NI 5620/5621 Front Panel Signal Connections

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 clock input.
PFI 1	Standard SMB jack connector	External digital trigger connection.

Appendix C: Accessory Front Panels

This appendix describes the front panel and signal connections for the digitizer accessory.

NI 5900 Front Panel

Figure 23 shows the NI PXI-5900 differential amplifier front panel and the connections to the NI 5922.

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Figure 23. NI 5900 Front Panel

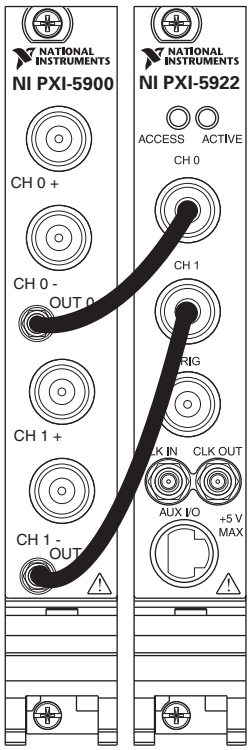


Table 11 describes the signal connections for the NI 5900.

Table 11. NI 5900 Front Panel Signal Connections

Connector	Description	Function
CH 0+	Standard BNC female connector	Differential analog input signal for channel 0
CH 0-	Standard BNC female connector	Differential analog input signal for channel 0
CH 0 OUT	Standard SMB jack connector	Single-ended analog output for channel 0; approximately ((CH0+) - (CH0-)) / 4
CH 1+	Standard BNC female connector	Differential analog input signal for channel 1
CH 1-	Standard BNC female connector	Differential analog input signal for channel 1
CH 1 OUT	Standard SMB jack connector	Single-ended analog output for channel 0; approximately ((CH1+) - (CH1-)) / 4

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Appendix D: Troubleshooting

Front Panel ACCESS LED on PXI/PXI Express Module is Off when PXI/PXI Express Chassis is On

If the ACCESS LED on the digitizer is not lit after you power on the PXI/PXI Express chassis, a problem may exist with the PXI/PXI Express power rails, a hardware device, or the LED.

Note The LEDs may not light until the device has been configured in MAX. Before troubleshooting this issue, verify that the device appears in MAX.

Complete the following steps to troubleshoot this issue:

1. Power off your PXI chassis.
2. Disconnect any signals from the PXI module front panel.
3. Remove the PXI module and inspect for signs of damage. Do *not* reinstall a damaged device.
4. Reinstall the PXI module as described in section *5. Installing the Hardware*.
5. Power on the PXI chassis.
6. Verify that the device appears in MAX.
7. Reset the device in MAX and perform a self-test. For information about performing device resets and self-tests in MAX, refer to section *6. Configuring and Testing in MAX*.
8. If the ACCESS LED still fails to light, contact NI Technical Support at `ni.com/support`.

Back Panel LED on USB Module is Off when Device is Plugged In

If the LED on the digitizer is not lit after it has been plugged into the USB port, a problem may exist with the software installation, the hardware device, or the LED.

Note The LEDs may not light until the device has been configured in MAX. Before troubleshooting this issue, verify that the device appears in MAX.

Complete the following steps to troubleshoot this issue:

1. Unplug the USB digitizer.
2. Disconnect any signals from the USB digitizer front panel.
3. Reinstall the USB device as described in section *5. Installing the Hardware*.
4. Verify that the device appears in MAX.
5. Reset the device in MAX and perform a self-test. For information about performing device resets and self-tests in MAX, refer to section *6. Configuring and Testing in MAX*.
6. If the back panel LED still fails to light, contact NI Technical Support at `ni.com/support`.

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Device Does Not Appear in MAX

Complete the following steps if the device does not appear in MAX:

1. In the MAX Configuration pane, click **Devices and Interfaces** to expand the category.
2. Press <F5> to refresh the list of installed devices.
3. If the device is still not listed, power off the system, verify that the device is correctly installed, and restart.
4. If the device still does not appear under **Devices and Interfaces**, contact NI Technical Support at `ni.com/support`.

Device Failed the Self-Test

The MAX self-test performs a brief test of device resources. If the device does not pass the self-test, complete the following steps:

1. Restart your system.
2. Launch MAX and perform the self-test again. If the device still fails the self-test, proceed to step 3.
3. Uninstall and reinstall NI-SCOPE.
4. If the device still fails the self-test, contact NI Technical Support at `ni.com/support`.

Thermal Shutdown Error

If you receive an over temperature (or thermal shutdown) error and your device shuts down, complete the following steps to re-enable your device:

1. Power off the computer or chassis that contains the device.
2. Review the procedure in section *5. Installing the Hardware* and make any necessary adjustments to make sure that your device is effectively cooled.
3. Power on the computer or chassis.

Note The thermal shutdown error is reported until the device has cooled to an acceptable operating temperature and has been successfully reset.

Performance Issues Using MXI Connections

If you are using a MXI interface to control a PXI chassis and you encounter performance or initialization issues, refer to the MXI documentation to verify that the MXI interface is properly set up. Software optimization might be necessary.

- **(MXI-3)** For optimization, select **Start»All Programs»National Instruments MXI-3» MXI-3 Optimization**. Using a MXI-3 connection without running this application may result in an error message such as the following:
  - **`maximum amount of time exceeded`**
  - **`internal software error`**

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If the software optimization application is not installed on your system, use the MXI software media or the *National Instruments Driver* media included with your kit to install the software. After installation, you may need to restart your computer before running the MXI Optimization Application.

- **(MXI-4 and MXI-Express)** Optimization is performed automatically by the hardware.

If you continue to have initialization or performance issues, refer to the MXI documentation at **Start»All Programs»National Instruments MXI**, or visit NI Technical Support at `ni.com/support`.

Setting Up SMC-Based Devices for Synchronization

Note The following step is required for any type of synchronization involving an SMC-based device, including NI-TClk synchronization. For information about NI-TClk synchronization, refer to **NI High-Speed Digitizers Help»Programming» Reference»NI-TClk Synchronization Help**.

If you plan to share triggers and/or clocks for the purpose of synchronizing SMC-based devices, you must identify or configure certain components in MAX.

(PXI and PXI Express Modules) You must identify the PXI/PXI Express system controller by completing the following steps:

1. In the MAX configuration tree,
   a. Right-click **PXI System»Identify As**.
   b. Select your controller from the list. For example, select External PC if you are using a MXI controller in an external PC.
2. Expand the PXI System tree and right-click the name of the chassis you are using.

(PCI Devices) You must configure the RTSI cable by completing the following steps:

1. Connect a RTSI cable between the PCI devices to physically share triggers and/or clocks.
2. In the MAX configuration tree,
   a. Right-click **NI-DAQmx Devices**.
   b. Select **Create New NI-DAQmx Device»RTSI Cable**.
   c. Right-click the RTSI cable, then select the device to add to the RTSI cable.

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Appendix E: Where to Go for Support

The National Instruments Web site is your complete resource for technical support. At `ni.com/support` you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

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