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GETTING STARTED GUIDE

NI PXI/PXIe/PCI-5105

12-Bit 60 MS/s Oscilloscope

This document explains how to install, configure, and test the NI PXI/PXIe/PCI-5105 (NI 5105). The NI 5105 is an 8-channel, 60 MHz oscilloscope. The NI 5105 ships with the NI-SCOPE instrument driver, which you use to program the device.

Note Before you begin, install and configure your chassis and controller.

To access NI 5105 documentation, navigate to **Start»All Programs»National Instruments»NI-SCOPE»Documentation**.

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Safety and Electromagnetic Compatibility

Caution 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 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.

Verifying the System Requirements

To use the NI 5105, your system must meet certain requirements.

For more information about minimum system requirements, recommended system requirements, and supported ADEs, refer to the readme for your selected software support. Readmes are available on the driver software DVD and online at *ni.com/updates*.

Unpacking the Kit

Caution To prevent electrostatic discharge from damaging the device, ground yourself using a grounding strap or by holding a grounded object, such as your computer chassis.

1. Touch the antistatic package to a metal part of the computer chassis.
2. Remove the device from the package and inspect the device for loose components or any other sign of damage.

   Caution Never touch the exposed pins of connectors.

   Notify NI if the device appears damaged in any way. Do not install a damaged device.
3. Unpack any other items and documentation from the kit.

Store the device in the antistatic package when the device is not in use.

Preparing the Environment

Ensure that the environment in which you are using the NI 5105 meets the following specifications:

PXI Express Modules

Operating Environment

- Ambient temperature range—0 °C to 55 °C (Tested in accordance with IEC-60068-2-1 and IEC-60068-2-2. Meets MIL-PRF-28800F Class 3 low temperature limit and MIL-PRF-28800F Class 2 high temperature limit.)
- Relative humidity range—10% to 90%, noncondensing (Tested in accordance with IEC-60068-2-56.)

Maximum altitude—2,000 m (800 mbar) (at 25 °C ambient temperature)

Pollution Degree—2

Indoor use only.

PXI Modules

Operating Environment

- Ambient temperature range—0 °C to 55 °C (Tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.)
- Relative humidity range—10% to 90%, noncondensing (Tested in accordance with IEC-60068-2-56.)

Maximum altitude—2,000 m (at 25 °C ambient temperature)

Pollution Degree—2

Indoor use only.

PCI Modules

Operating Environment

- Ambient temperature range—0 °C to 45 °C (Tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.)
- Relative humidity range—10% to 90%, noncondensing (Tested in accordance with IEC-60068-2-56.)

Maximum altitude.....2,000 m (at 25 °C ambient temperature)

Pollution Degree.....2

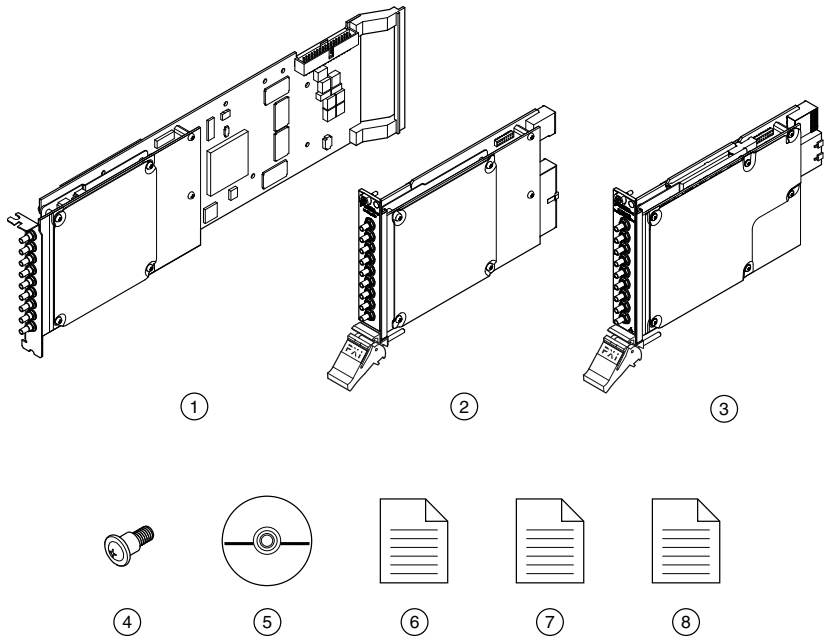
Indoor use only.

Caution Clean the hardware with a soft, nonmetallic brush. Make sure that the hardware is completely dry and free from contaminants before returning it to service.

For complete specifications, refer to specifications document for your device at *ni.com/manuals*.

Kit Contents

Figure 1. NI 5105 Kit Contents



1. NI PCI-5105 Device
2. NI PXI-5105 Device
3. NI PXIe-5105 Device
4. Screw Kit, part number 191306A-01 (ships only with PCI kit)
5. Driver Software DVD
6. NI PXI/PXIe/PCI-5105 Getting Started Guide (this document)
7. Read Me First: Safety and Electromagnetic Compatibility
8. Maintain Forced-Air Cooling Note to Users

Other Equipment

There are several required items not included in your device kit that you need to install or operate the NI 5105.

- **(PXI Express Devices)** A PXI Express chassis with a controller and the chassis documentation
- **(PXI Devices)** A PXI chassis, a PXI/SCXI combination chassis, or a PXI/CompactPCI chassis with a controller and the chassis 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**.

Installing the Software

You must be an Administrator to install NI software on your computer.

1. Install an ADE, such as LabVIEW or LabWindows™/CVI™.
2. Insert the driver software media into your computer. The installer should open automatically.

   If the installation window does not appear, navigate to the drive, double-click it, and double-click `autorun.exe`.
3. Follow the instructions in the installation prompts.

   Note Windows users may see access and security messages during installation. Accept the prompts to complete the installation.
4. When the installer completes, select **Restart** in the dialog box that prompts you to restart, shut down, or restart later.

Installing the Hardware

Installing the NI PXI/PXIe-5105

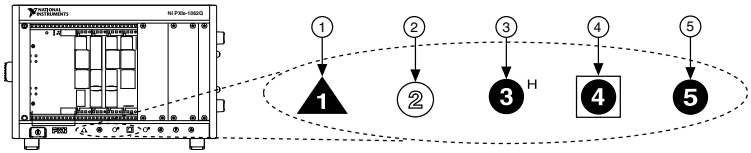
Caution To prevent damage to the device caused by ESD or contamination, handle the device using the edges or the metal bracket.

1. Ensure the AC power source is connected to the chassis before installing the modules.

   The AC power cord grounds the chassis and protects it from electrical damage while you install the modules.
2. Power off the chassis.
3. Inspect the slot pins on the chassis backplane for any bends or damage prior to installation. Do not install a module if the backplane is damaged.

4. Remove the black plastic connectors from all the captive screws on the module front panel.
5. Identify a supported slot in the chassis. The following figure shows the symbols that indicate the slot types.

Figure 2. Chassis Compatibility Symbols

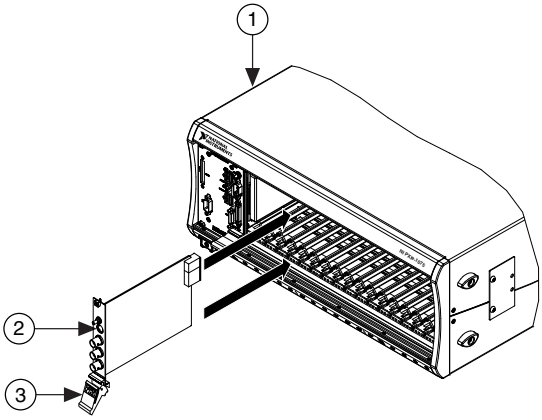


1. PXI Express System Controller Slot
2. PXI Peripheral Slot
3. PXI Express Hybrid Peripheral Slot
4. PXI Express System Timing Slot
5. PXI Express Peripheral Slot

PXI modules can be placed in PXI peripheral slots or PXI Express Hybrid peripheral slots. PXI Express modules can be placed in PXI Express peripheral slots, PXI Express Hybrid peripheral slots, or PXI Express System Timing slots.

6. Touch any metal part of the chassis to discharge static electricity.
7. Ensure that the ejector handle is in the unlatched (downward) position.
8. Place the module edges into the module guides at the top and bottom of the chassis. Slide the device into the slot until it is fully inserted.

Figure 3. Module Installation



1. Chassis
2. Hardware Module
3. Ejector Handle in Down (Unlatched Position)

9. Latch the module in place by pulling up on the ejector handle.
10. Secure the device front panel to the chassis using the front-panel mounting screws.

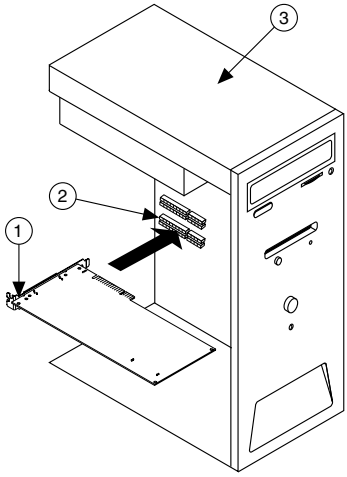
11. Cover all empty slots using filler panels or slot blockers to maximize cooling air flow.
12. Power on the chassis.

Note For more information about maximizing cooling air flow, refer to the *Maintain Forced-Air Cooling Note to Users* included in your kit.

Installing the NI PCI-5105

1. Power off and unplug the computer.
2. Access the computer system expansion slots. This step might require you to remove one or more access panels on the computer case.
3. Locate a compatible slot and remove the corresponding slot cover on the computer back panel. NI 5105 modules can be inserted only into PCI slots.
4. Touch any metal part of the computer to discharge any static electricity.
5. Insert the module into the slot you selected. Gently rock the module in to place without forcing it.

Figure 4. Module Installation



1. Module
2. System Expansion Slot
3. PC

6. Secure the module mounting bracket to the computer back panel rail.

Caution It is important to completely screw the device into the slot, both for mechanical stability and for creating a solid ground connection, which reduces signal noise. Improperly secured devices may affect the accuracy of device specifications.

7. Replace any access panels on the computer case.
8. Plug in and power on your computer.

Hardware Front Panel Connectors

Refer to the following figure and table for the NI 5105 front panels and signal connections.

Figure 5. NI 5105 Front Panels

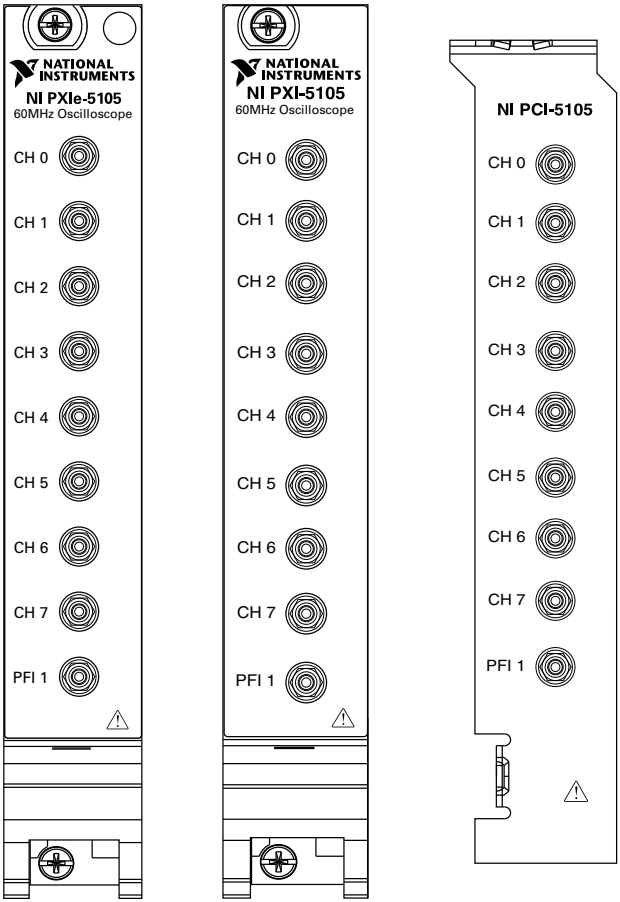


Table 1. NI 5105 Front Panel Signal Connections

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

Configuring the Hardware in MAX

Use Measurement & Automation Explorer (MAX) to configure your National Instruments hardware. MAX informs other programs about which devices reside in the system and how they are configured. MAX is automatically installed with NI-SCOPE .

1. Launch Measurement & Automation Explorer (MAX).

   MAX should automatically detect the device you installed.
2. In the Configuration pane, double-click **Devices and Interfaces** to see the list of installed devices. Installed devices appear under the name of their associated chassis.
3. Expand your **Chassis** tree item. MAX lists all devices installed in the chassis. Your default device names may vary.

   Note If you do not see your hardware listed, press <F5> to refresh the list of installed devices. If the device is still not listed, power off the system, ensure the device is correctly installed, and restart.
4. Record the device identifier MAX assigns to the hardware. Use this identifier when programming the NI 5105.
5. The MAX self-test performs a basic verification of hardware resources. To self-test a module in MAX, right click the module and select **Self-Test**.
6. Run the test panels on the device to verify the signal.
   a) To access the test panels, right-click the device and select **Test Panels**. The NI-SCOPE Soft Front Panel (SFP) launches automatically.
   b) Do one of the following to connect a signal to the device:
      - Connect an external signal by clicking **Auto** or by selecting the appropriate device parameters for the signal.
      - Connect a cable from PFI 1 to an input channel and select **Utility»Probe Compensation** from the SFP menu.

   Note The NI 5105 has self-calibration capabilities, which you can access programmatically with NI-SCOPE and your ADE, or interactively with NI-SCOPE SFP or MAX.

Related Information

Making a Measurement on page 11

Programming the NI 5105

You can acquire data interactively using the NI-SCOPE SFP, or you can use the NI-SCOPE instrument driver to program your device in the supported ADE of your choice.

Table 2. NI 5105 Programming Options

Application Programming Interface (API)	Location	Description
NI-SCOPE SFP	Available from the start menu at **Start»All Programs»National Instruments»NI-SCOPE»NI-SCOPE Soft Front Panel**	The NI-SCOPE SFP acquires, controls, analyzes, and presents data, similar to stand-alone oscilloscopes. The NI-SCOPE SFP operates on the PC, so you can view and control waveforms directly from your computer. You can also run multiple sessions of the NI-SCOPE SFP simultaneously.
NI-SCOPE Instrument Driver	LabVIEW—Available on the LabVIEW Functions palette at **Measurement I/O»NI-SCOPE**.	NI-SCOPE configures and operates the device hardware and performs basic waveform acquisition and measurement options using LabVIEW VIs or LabWindows/CVI functions.
	C or LabWindows/CVI—Available at **Program Files»IVI Foundation»IVI»Drivers»niScope**.	
	Microsoft Visual C/C++—Use examples located in the `<NIDocDir>\NI-SCOPE\examples` directory, where `<NIDocDir>` is one of the following directories: • Windows 8/7/Vista—`Users\Public\Documents\National Instruments` • Windows XP—`Documents and Settings\All Users\Shared Documents\National Instruments`	You can modify an NI-SCOPE C example to create an application with Microsoft Visual C/C++. Copy an NI-SCOPE example to copy required project settings for include paths and library files. Alternatively, refer to the *Creating an Application with Microsoft Visual C and C++* topic of the *NI High-Speed Digitizers Help* to manually add all required include and library files to your project.

NI-SCOPE Examples

Examples demonstrate the functionality of the device and serve as programming models and building blocks for your own applications. The NI Example Finder is a utility available for some ADEs 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.

Table 3. Locating NI-SCOPE Examples

Application Development Environment (ADE)	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 8/7/Vista—`Users\Public\Public Documents\National Instruments` • Windows XP—`Documents and Settings\All Users\Shared Documents\National Instruments`

Making a Measurement

You can make a measurement interactively using the NI-SCOPE SFP or programmatically using LabVIEW.

Making a Measurement with NI-SCOPE SFP

1. Connect CH 0 to input signal PFI 1 using an SMB cable.
2. Launch the NI-SCOPE SFP from the **Start** menu.
3. In the **Select Device** dialog box, select the device name assigned to the device in MAX.
4. To enable signal output on PFI 1, activate the probe compensation by selecting **Utility**» **Probe Compensation**.
5. Click **Auto** to display the data as a square wave.
6. If the SFP is not already running, click **Run**.

Making a Measurement with LabVIEW

1. Launch LabVIEW.
2. Select **Help**»**Find Examples**.
3. Open the example VI that you want to use by selecting **Hardware Input and Output**» **Modular Instruments**»**NI-SCOPE (High-Speed Digitizers)**.



Tip If you are not sure which example to run, use the Quick Start VI, which is found under **Hardware Input and Output**»**Modular Instruments**»**NI-SCOPE (High-Speed Digitizers)**»**Demos**»**niScope EX Quick Start.vi**.

4. Follow any setup instructions in the VI.
5. In the **Resource Name** drop-down menu, select the device name assigned to the device in MAX.

6. Click **Run** to run the example program.

Setting Up SMC-Based Devices for Synchronization

The following steps are required for any type of synchronization involving an SMC-based device, including NI-TClk synchronization.



Note 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 Modules

You must identify the PXI system controller by completing the following steps:

1. Launch MAX.
2. In the MAX configuration pane, expand the chassis tree.
3. Right-click the name of the chassis you are using, and select **Identify As**.
4. Select your controller from the list. For example, select **External PC** if you are using an MXI controller in an external PC.

PXI Express Modules

Your device should automatically be configured for synchronization. If your device is not automatically configured, contact NI Technical Support at *ni.com/support*.

PCI Devices

You must configure the RTSI cable by completing the following steps:

1. Connect an RTSI cable between the PCI devices to physically share triggers and/or clocks.
2. Launch MAX.
3. In the MAX configuration pane, right-click **Devices and Interfaces**, and select **Create New**.
4. In the dialog box that opens, select **NI-RTSI Cable**.
5. Click **Finish**.
6. In the MAX configuration pane, right-click the NI-RTSI cable, select **Add Device to NI-RTSI Cable**, and select the device you want to add.

For more information about connecting PCI devices, refer to **NI High-Speed Digitizers Help**»**Programming**»**Reference**»**NI-TClk Synchronization Help**.

Troubleshooting

NI 5105 Does Not Appear in MAX

1. In the MAX Configuration pane, click **Devices and Interfaces**.
2. Expand the **Chassis** tree to see the list of installed devices, and press <F5> to refresh the list.
3. If the module is still not listed, power off the system, ensure that all hardware is correctly installed, and restart the system.
4. Navigate to the Device Manager.

Option	Description
Windows 8	Right-click the Start screen, and select **All apps»Control Panel» Hardware and Sound»Device Manager**.
Windows 7	Select **Start»Control Panel»Device Manager**.
Windows Vista	Select **Start»Control Panel»System and Maintenance»Device Manager**.
Windows XP	Select **Start»Control Panel»System»Hardware»Device Manager**.

5. If you are using a PXI controller, verify that a **National Instruments** entry appears in the system device list. Reinstall NI-SCOPE and the device if error conditions appear in the list. If you are using a MXI controller, right-click **PCI-to-PCI Bridge**, and select **Properties** from the shortcut menu to verify that the bridge is enabled.

What Should I Do if the Module Fails the Self-Test?

1. Restart the system.
2. Launch MAX, and perform the self-test again.
3. Power off the chassis.
4. Reinstall the failed module in a different slot.
5. Power on the chassis.
6. Perform the self-test again.

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. Reinstall the device and make any necessary adjustments to make sure that the 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.

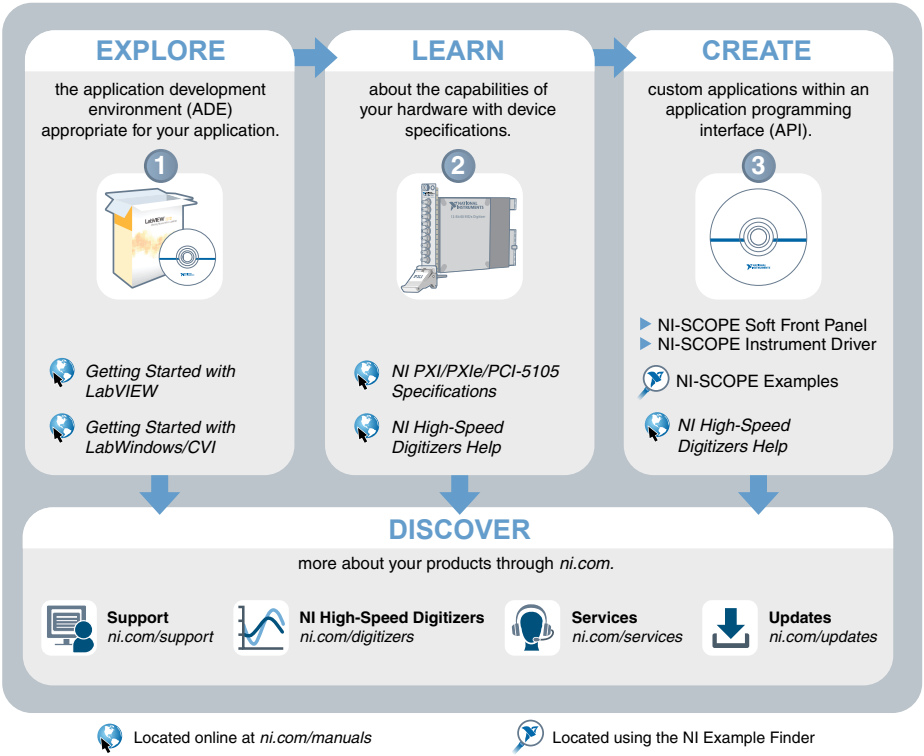
For more information about cooling the device, refer to the *Maintain Forced-Air Cooling Note to Users* included in your kit.

Related Information

Installing the NI PXI/PXIe-5105 on page 5

Where To Go Next

Refer to the following figure for information about other product tasks and associated resources for those tasks.



Tip The *NI Digitizers Help* is an HTML version of a traditional user manual that includes detailed information about oscilloscope fundamentals, device features, and programming with NI-SCOPE.

Worldwide Support and Services

The National Instruments website 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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