

NI SOURCES GETTING STARTED GUIDE

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October 2002
323313A-01

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. Bold text also denotes parameter names.
- italic* Italic text denotes variables, emphasis, a cross reference, or an introduction to a key concept. This font also denotes text that is a placeholder for a word or value that you must supply.
- monospace Text in this font denotes text or characters that you should enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames and extensions, and code excerpts.
- NI source module Function generator or arbitrary waveform generator—refers to a NI PXI/PCI-5401, PXI-5404, PXI/PCI-5411, or PXI/PCI-5431.

Introduction

This document explains how to install, configure, test, and set up an NI source module to generate various waveforms. For more information on your NI source module and programming, refer to *NI Sources Help* at **Program Files»National Instruments»NI-FGEN»NI Sources Help**.

For more information about additional features of your NI source module and how to use these features, refer to **Devices»<Your Source> Functional Overview** in the *NI Sources Help*. Detailed specifications about your NI source module are available in the specifications document included with your NI source module.

FCC/Canada Radio Frequency Interference Compliance

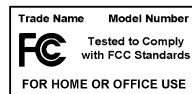
Determining FCC Class

The Federal Communications Commission (FCC) has rules to protect wireless communications from interference. The FCC places digital electronics into two classes. These classes are known as Class A (for use in industrial-commercial locations only) or Class B (for use in residential or commercial locations). Depending on where it is operated, this product could be subject to restrictions in the FCC rules. (In Canada, the Department of Communications (DOC), of Industry Canada, regulates wireless interference in much the same way.)

Digital electronics emit weak signals during normal operation that can affect radio, television, or other wireless products. By examining the product you purchased, you can determine the FCC Class and therefore which of the two FCC/DOC Warnings apply in the following sections. (Some products may not be labeled at all for FCC; if so, the reader should then assume these are Class A devices.)

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

FCC Class B products display either a FCC ID code, starting with the letters **EXN**, or the FCC Class B compliance mark that appears as shown below.



Consult the FCC Web site at <http://www.fcc.gov> for more information.

FCC/DOC Warnings

This equipment generates and uses radio frequency energy and, if not installed and used in strict accordance with the instructions in this manual and the CE Marking Declaration of Conformity¹, may cause interference to

¹ The CE Marking Declaration of Conformity will contain important supplementary information and instructions for the user or installer.

radio and television reception. Classification requirements are the same for the Federal Communications Commission (FCC) and the Canadian Department of Communications (DOC).

Changes or modifications not expressly approved by National Instruments could void the user's authority to operate the equipment under the FCC Rules.

Class A

Federal Communications Commission

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Canadian Department of Communications

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Class B

Federal Communications Commission

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the

equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Canadian Department of Communications

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

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 Mark compliance scheme. The Manufacturer includes a DoC for most every hardware product except for those bought for OEMs, if also available from an original manufacturer that also markets in the EU, or where compliance is not required as for electrically benign apparatus or cables.

To obtain the DoC for this product, click **Declaration of Conformity** 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 Instructions

This section contains important safety instructions that you *must* follow when installing and using the product.

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

¹ The CE Marking Declaration of Conformity will contain important supplementary information and instructions for the user or installer.

Do *not* substitute parts or modify the product except as described in the product documentation.

Do *not* operate the product in an explosive atmosphere or where there may be flammable gases or fumes. Operate the product only at or below the pollution degree stated in the hardware specifications. 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 that 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, condensation can cause temporary conductivity.
- Pollution Degree 3 means that conductive pollution occurs, or dry, nonconductive pollution occurs that becomes conductive due to condensation.

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

You *must* insulate signal connections for the maximum voltage for which the product is rated. Do *not* exceed the maximum ratings for the product. Remove power from signal lines before connecting them to or disconnecting them from the product.

Operate this product only at or below the installation category stated in the hardware specifications.

The following is a description of installation categories:

- Installation Category I is for measurements performed on circuits not directly connected to MAINS¹. This category includes signals such as voltages on a printed wire board (PWB) on the secondary of an isolation transformer.

Examples of Installation Category I are measurements on circuits not derived from MAINS and on specially protected (internal) MAINS-derived circuits.

- Installation Category II is for measurements performed on circuits directly connected to the low-voltage installation. This category refers to local-level distribution such as that provided by a standard wall outlet.

¹ MAINS is defined as the electricity supply system to which the equipment concerned is designed to be connected either for powering the equipment or for measurement purposes.

Examples of Installation Category II are measurements on household appliances, portable tools, and similar equipment.

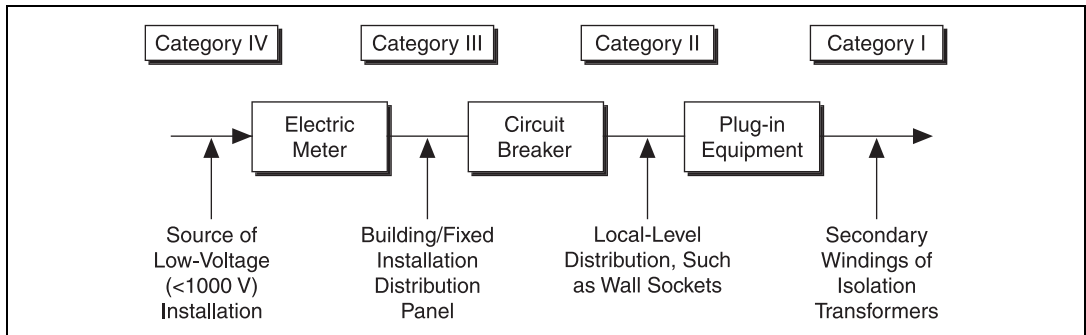
- Installation Category III is for measurements performed in the building installation. This category is a distribution level referring to hardwired equipment that does not rely on standard building insulation.

Examples of Installation Category III include measurements on distribution circuits and circuit breakers. Other examples of Installation Category III are wiring including cables, bus-bars, junction boxes, switches, socket outlets in the building/fixed installation, and equipment for industrial use, such as stationary motors with a permanent connection to the building/fixed installation.

- Installation Category IV is for measurements performed at the source of the low-voltage (<1,000 V) installation.

Examples of Installation Category IV are electric meters, and measurements on primary overcurrent protection devices and on ripple-control units.

Below is a diagram of a sample installation.



Getting Started

To set up and use the NI source module, you need the following:

- NI PXI/PCI-5401/5411/5431 or NI PXI-5404
- NI-FGEN 1.6 software
- [NI Sources Getting Started Guide](#)
- NI Sources Help* located at **Programs»National Instruments»NI-FGEN»NI Sources Help**
- The specifications document included with the NI source module

- ❑ 1/8-in. flathead screwdriver
- ❑ One of the following software packages and documentation, if you plan to program an application using NI-FGEN:
 - NI LabVIEW
 - NI Measurement Studio
 - Visual C/C++
 - Visual Basic
- ❑ A PXI chassis and controller or desktop computer

Unpacking

The NI source module ships in an antistatic package to prevent electrostatic damage. Electrostatic discharge (ESD) can damage several components on the NI source module.



Caution *Never* touch the exposed pins of connectors.

To avoid damage in handling the NI source module, take the following precautions:

- Ground yourself using a grounding strap or by holding a grounded object.
- Touch the antistatic package to a metal part of your computer chassis before removing the NI source module from the package.

Remove the NI source module from the package and inspect it for loose components or any sign of damage. Notify NI if the NI source module appears damaged in any way. Do *not* install a damaged NI source module into your computer.

Store the NI source module in the antistatic envelope when not in use.

Installing the Software

Complete the following steps to install the software before you install the NI source module.

1. Install an application development environment (ADE), such as NI LabVIEW or NI Measurement Studio.



Note Install an ADE only if you need programmatic support of the NI source module.

2. Install NI-FGEN according to the instructions on the CD included with the NI source module.
 - ◆ NI 5431 modules only, complete the following step:
 1. Insert the NI Video Generator CD into your CD drive.
 2. Click **Install** in the installation window that appears.

Installing the Hardware

To prevent damage to the NI source module due to ESD or contamination, handle the device using the edges or the metal bracket. Refer to the [Safety Instructions](#) section for more information.



Note You *must* install the NI-FGEN software before installing the hardware.

PXI Installation

To install the NI source module, refer to Figure 1 and complete the following steps:

1. Power off the PXI chassis.
2. Insert the NI source module into an available slot until the ejector handle locks in the up position.
3. Tighten the screw provided in the kit.
4. Power on the PXI chassis.

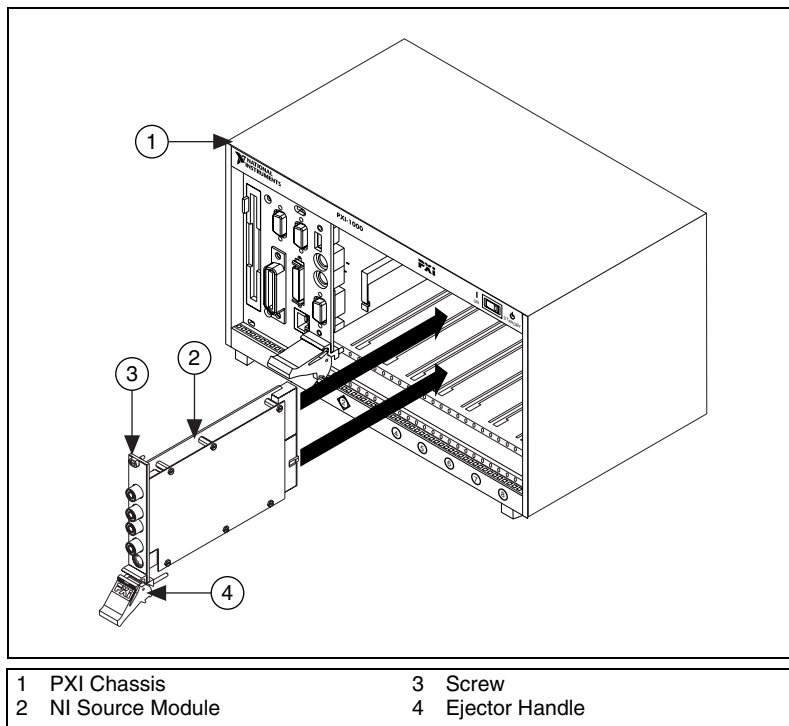


Figure 1. PXI Installation

PCI Installation

To install the NI source module for PCI, refer to Figure 2 and complete the following steps:

1. Power off the PC and remove the cover.
2. Insert the NI source module into an open PCI slot.
3. Secure the NI source module with the screw provided in the kit.
4. Power on the PC.

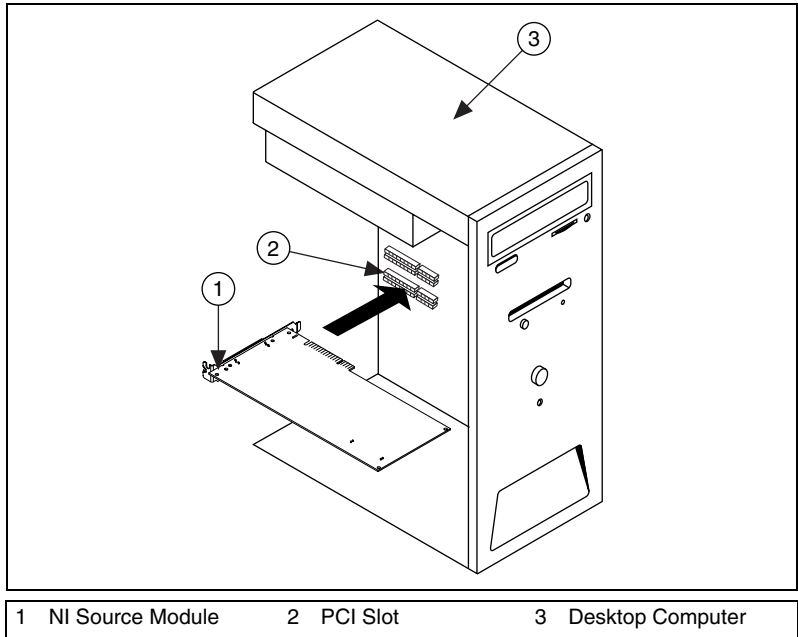


Figure 2. PCI Installation

Configuring the NI Source Module in MAX

Launch Measurement & Automation Explorer (MAX) to configure and test the NI source module. MAX detects the NI source module you installed.

1. Press <F5> to refresh the device configuration.
2. Double-click **Devices and Interfaces** to see the list of installed devices.



Note If you do not see your device listed, press <F5>. If your device is still not listed, complete the steps in the *Installing the Hardware* section again.

3. Right-click on your source module, and select **Properties** to launch the Configuring Device window.
4. Note the device number and resources assigned to the NI source module.
5. In the Configuring Device window, click **Test Resources** to test the NI source module resources. A dialog box appears and indicates if the NI source module has passed the resource test.



Note If the device does not pass the test, power off the PC, remove the NI source module, and repeat the appropriate installation procedure. If the device still does not pass the test, visit NI Technical Support at ni.com/support.

6. Click **Close** when you finish testing the NI source module.
7. Click **OK** in the Configuring Device window to return to the MAX main window.
8. Exit MAX.

Connecting Signals

This section explains cabling and connection options for NI source modules.

NI PXI/PCI-5401

The front panels for the NI 5401 are shown in Figure 3.

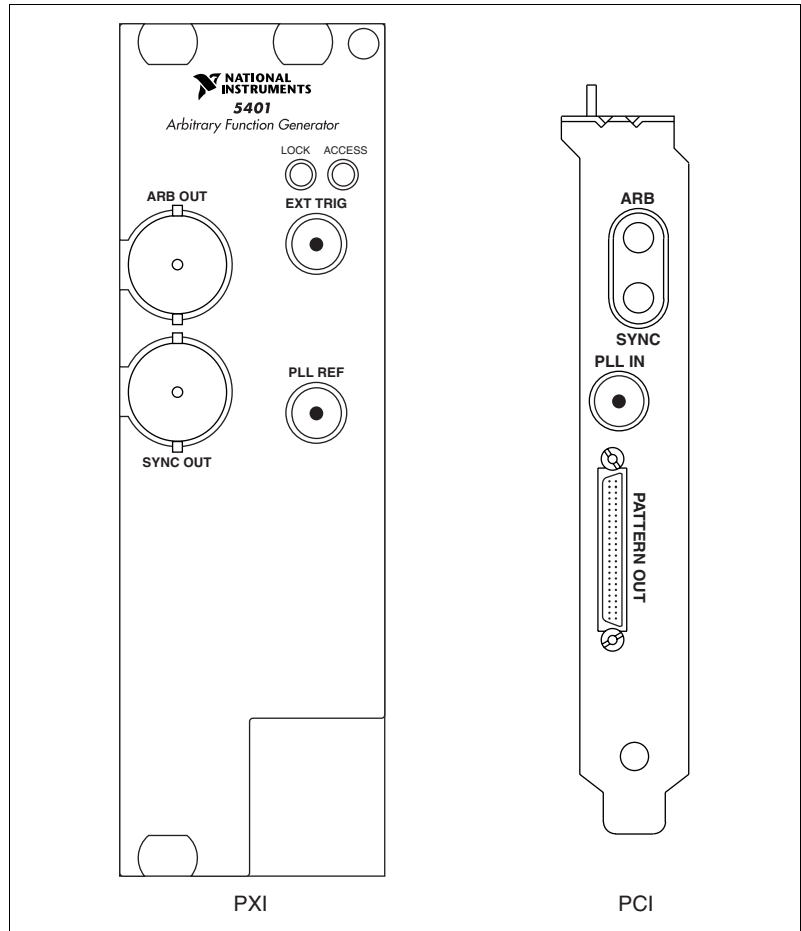


Figure 3. NI PXI/PCI-5401 Front Panel Connectors

◆ NI PXI-5401

The NI PXI-5401 contains four connectors—two BNC connectors and two SMB connectors, as listed in Table 1.

Table 1. NI PXI-5401 Connectors

Connector	Function
ARB OUT	Provides the waveform output.
SYNC OUT	Provides a TTL version of the sine waveform being generated at the output.
EXT TRIG	An input that accepts a TTL-level signal that you can use to start or step through a waveform generation.
PLL REF	A phase-locked loop (PLL) input connector that can accept a reference clock from an external source and frequency lock the NI PXI-5401 internal clock to this external clock.

◆ NI PCI-5401

The NI PCI-5401 contains four connectors—three SMB connectors and one 50-pin digital connector, as listed in Table 2.

Table 2. NI PCI-5401 Connectors

Connector	Function
ARB	Provides the waveform output.
SYNC	Provides a TTL version of the sine waveform being generated at the output.
PATTERN OUT	The connector used on the NI PCI-5401 to supply the external trigger input to the device.
PLL IN	A phase-locked loop (PLL) input connector that can accept a reference clock from an external source and frequency lock the NI PCI-5401 internal clock to this external clock.

NI PXI-5404

The front panel for the NI PXI-5404 is shown in Figure 4.

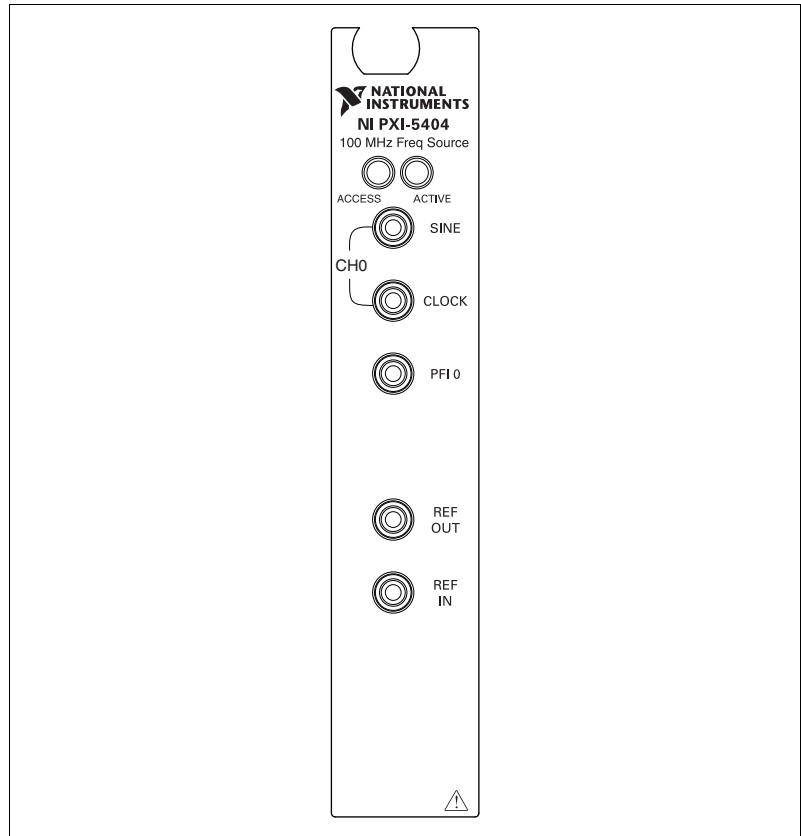


Figure 4. NI PXI-5404 Front Panel Connectors

The NI PXI-5404 contains five SMB connectors, as listed in Table 3.

Table 3. NI PXI-5404 Connectors

Connector	Function
SINE	Provides the sine waveform of the desired frequency output.
CLOCK	Provides a TTL version of the sine waveform being generated at the SINE output.
PFI0	A bi-directional connector that can either accept a TTL signal to start waveform generation or provide a trigger to synchronize or trigger other devices at a certain time within waveform generation.

Table 3. NI PXI-5404 Connectors (Continued)

Connector	Function
REF IN	A phase-locked loop (PLL) input connector that can accept a reference clock from an external source and frequency lock it to the NI PXI-5404 internal clock.
REF OUT	An output connector to which the PXI back plane clock, RTSI lines or a divided down version of the internal NI PXI-5404 board clock can be routed.

NI PXI-5411/5431

The front panels for the NI PXI/PCI-5411/5431 are shown in Figure 5.

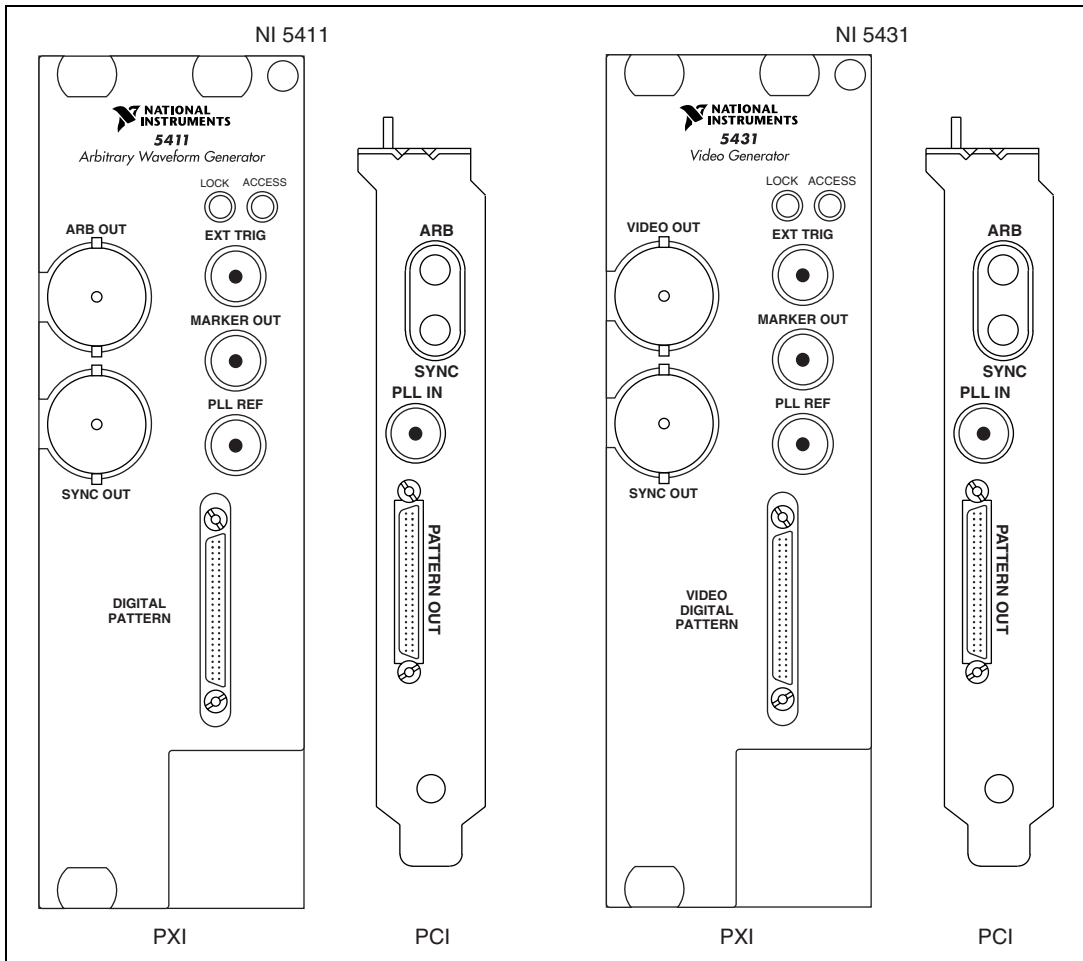


Figure 5. NI PXI/PCI-5411/5431 Front Panel Connectors

◆ NI PXI-5411/5431

The NI PXI-5411/5431 contains six connectors—two BNC connectors, three SMB connectors, and one 50-pin digital connector, as shown in Table 4.

Table 4. NI PXI-5411/5431 Connectors

Connector	Function
ARB/VIDEO OUT	Provides the waveform output.
SYNC OUT	Provides a TTL version of the sine waveform being generated at the output.
EXT TRIG	An input that accepts a TTL-level signal that you can use to start or step through a waveform generation.
MARKER OUT	A TTL-level output signal that you can set up at any point in the waveform being generated. You can use this signal to synchronize or trigger other devices at a certain time within waveform generation.
PLL REF	A phase-locked loop (PLL) input connector that can accept a reference clock from an external source and frequency lock the NI 5401 internal clock to this external clock.
DIGITAL PATTERN/VIDEO DIGITAL PATTERN	A 16-bit digital I/O connector that contains the 16-bit digital pattern outputs, digital pattern clock output, marker output, external trigger input, and +5 V power output.

◆ NI PCI-5411/5431

The NI PCI-5411/5431 contains four connectors—three SMB connectors and one 50-pin digital connector, as shown in Table 5.

Table 5. NI PCI-5411/5431 Connectors

Connector	Function
ARB	Provides the waveform output.
SYNC	Provides a TTL version of the sine waveform being generated at the output.

Table 5. NI PCI-5411/5431 Connectors (Continued)

Connector	Function
PATTERN OUT	A 16-bit digital I/O connector that contains the 16-bit digital pattern outputs, digital pattern clock output, marker output, external trigger input, and +5 V power output.
PLL IN	A PLL input connector that can accept a reference clock from an external source and frequency lock the NI 5411/5431 internal clock to this external clock.

Generating Standard Functions

To test the functionality of an NI source module, use the Sources SFP to generate a sine wave from the applicable output signal connector. Use the Sources SFP to interactively control the NI source module just as you would a desktop function generator.

NI-5431 video functionality also can be tested using the Video Generator Wizard. To test the NI source video module, complete the steps in the [Generating a Video Signal](#) section.

Generating a Waveform

To test your NI source module, complete the following steps:

1. Launch MAX.
2. Verify that the NI source module that you want to test appears under Devices and Interfaces.
3. Select **Programs»National Instruments»NI-FGEN»NI-FGEN Soft Front Panel**.

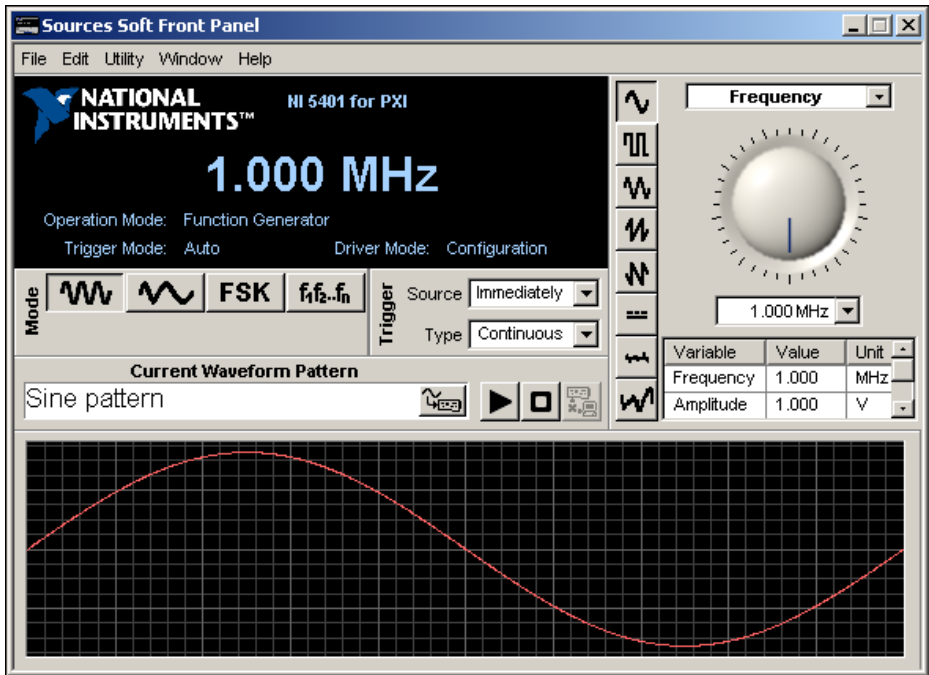


Figure 6. Sources SFP



Note Ensure that the NI source module you have installed appears on the display of the Sources SFP. If your device is not listed, or if you have installed more than one of the specific devices in your computer system, select the correct device from the Device tab in the Device Configuration dialog box shown in Figure 7.

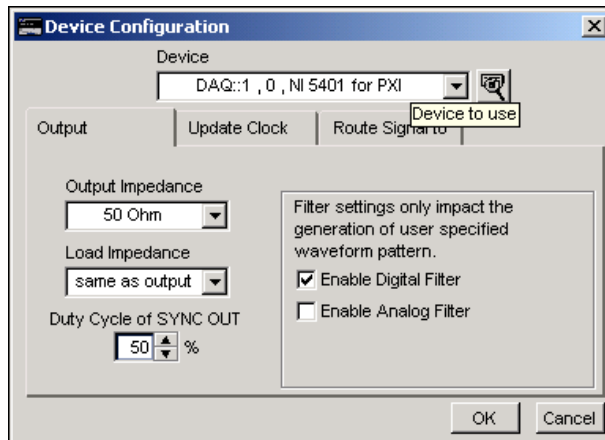


Figure 7. Configuring the NI Source Module

4. Use the Sources SFP to control the frequency, amplitude, offset, and type of waveform generated.
5. Click **Run** to initiate waveform generation.

The default settings of the Sources SFP instruct the NI source module to generate a continuous sine wave with a frequency of 1 MHz, with a peak-to-peak amplitude of 1 V into a 50 Ω load, and no offset. Adjust the sine waveform settings in the Sources SFP to match your needs. For more information about the Sources SFP, refer to the *NI Sources Help*.

Generating a Video Signal

To generate a video signal, complete the following steps:

1. Launch MAX.
2. Verify that the NI source module that you want to test appears under Devices and Interfaces, and take note of the device number.
3. Open the Video Generator Wizard by selecting **Start»Programs»National Instruments VideoGen»VideoGen-Wizard**.

To generate a video signal based on a bitmap image using the factory settings, use the following steps to select the proper options in the upper, middle, and bottom sections in the Video Generator Wizard dialog box, as shown in Figure 8.

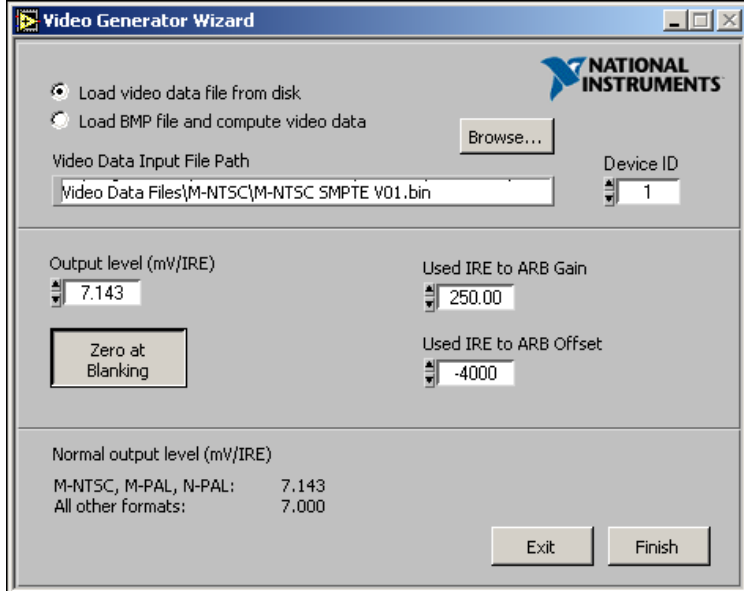


Figure 8. Video Generator Wizard Dialog Box

In the upper section, complete the following steps:

1. Make sure that the Device ID is set to the correct value (the device number previously configured in MAX).
2. Select **Load BMP file and compute video data**.
3. Click **Browse**.
4. Double-click the appropriate directory from the choices below:
 - For NTSC users, double-click the 640x480 or the 1044x480 directory.
 - For PAL and SECAM users, double-click the 768x576 or the 1040x576 directory.
5. Double-click any of the example .bmp files. The bitmap image file path now appears in the BMP Input File Path control.

In the middle section, complete the following steps:

1. On the left side, select **Use factory settings**. This option applies the default video parameters to the video signal you are going to generate.
2. On the right side, select **M-NTSC**, **Standard-PAL**, or **SECAM**, depending on the video format you want to generate.

In the bottom section, complete the following steps:

1. Select **Download video data file**. This option downloads the binary video data from your computer to the NI 5431 module.
2. Click **Finish**. A Processing dialog box appears to show you the processing status.



Note If you enable Display BMP next to Browse when you click **Finish** in step 2, you also see the .bmp file displayed on your computer monitor.

Based on the .bmp file you selected, the Video Generator Wizard calculates an NTSC, PAL, or SECAM video data, downloads the calculated data to the NI 5431 module, and automatically starts the generation of the video signal on your analog video output connector.