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**PXIe-5624**

## GETTING STARTED GUIDE

# NI PXIe-5624R

## 2 GS/s, 12-Bit IF Digitizer



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

This document explains how to install, configure, and test the NI PXIe-5624R (NI 5624R). The NI 5624R is an IF digitizer with a user-programmable FPGA. The NI 5624R ships with NI LabVIEW Instrument Design Libraries for IF Digitizers, which you can use to program the device.

Programming the NI 5624R requires NI LabVIEW. Customizing the FPGA requires the NI LabVIEW FPGA Module.

To access NI 5624R documentation, navigate to **Start»All Programs»National Instruments»IF Digitizers»IF Digitizers Documentation**



**Note** The NI 5624R can be used on its own or as a component of certain NI vector signal analyzers. Refer to the documentation for your vector signal analyzer for information about using the NI 5624R in an NI vector signal analyzer.

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# Electromagnetic Compatibility Guidelines

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This product was tested and complies with the regulatory requirements and limits for electromagnetic compatibility (EMC) stated in the product specifications. These requirements and limits are designed to provide reasonable protection against harmful interference when the product is operated in the intended operational electromagnetic environment.

This product is intended for use in industrial locations. However, harmful interference may occur in some installations, when the product is connected to a peripheral device or test object, or if the product is used in residential or commercial areas. To minimize interference with radio and television reception and prevent unacceptable performance degradation, install and use this product in strict accordance with the instructions in the product documentation.

Furthermore, any modifications to the product not expressly approved by National Instruments could void your authority to operate it under your local regulatory rules.



**Caution** To ensure the specified EMC performance, operate this product only with shielded cables and accessories.



**Caution** To ensure the specified EMC performance, the length of all I/O cables must be no longer than 3 m (10 ft).

## Verifying the System Requirements

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To use the NI 5624R, your system must meet certain requirements.

For information about minimum system requirements, recommended system requirements, and supported ADEs, refer to the readme for the NI LabVIEW Instrument Design Libraries for IF Digitizers. When using the NI 5624R as a component of an NI vector signal analyzer, refer to the *NI-RFSA Readme*. Readmes are available on the driver software DVD and online at [ni.com/updates](http://ni.com/updates).

## Unpacking the Kit

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**Caution** To prevent electrostatic discharge (ESD) 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.

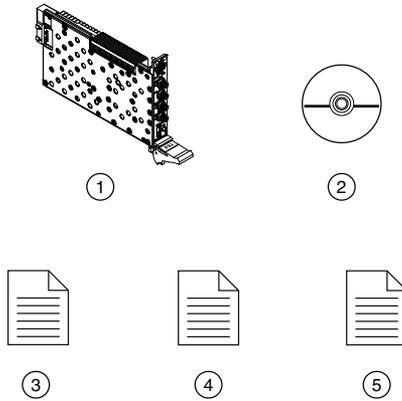
Notify NI if the device appears damaged in any way. Do not install a damaged device.

3. Unpack any other items and documentation from the kit.

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

# NI 5624R Kit Contents

Figure 1. NI 5624R Kit Contents



- 
1. NI PXIe-5624R IF Digitizer Module
  2. Driver Software DVD
  3. Read Me First: Safety and Electromagnetic Compatibility
  4. Maintain Forced-Air Cooling Note to Users
  5. NI 5624R Getting Started Guide (This Document)
- 

## Other Equipment

There are several required items not included in your device kit that you need to operate the NI 5624R. Your application may require additional items not included in your kit to install or operate your device.

### Required Items

- A PXI Express chassis and chassis documentation. The NI PXIe-1085 chassis is one available option for your PXI Express device. For more information about compatible chassis options, visit [ni.com/info](http://ni.com/info) and enter the Info Code `pxiechassis`.
- A PXI Express embedded controller or PC with MXI controller system that meets the system requirements specified in this guide and chassis documentation.

### Optional Items

- PXI Chassis Slot Blocker kit (NI part number 199198-01)
- SMA (m)-to-SMA (m) cables
- NI SHH19-H19-AUX DIGITAL I/O cable (NI part number 152629-01 or 152629-02)
- NI SCB-19 DIGITAL I/O accessory for connecting to external signals (NI part number 782444-01)

# Preparing the Environment

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Ensure that the environment you are using the NI 5624R in meets the following specifications.

Operating ambient temperature.....0 °C to 55 °C  
(IEC-60068-2-1, IEC-60068-2-2)

Operating relative humidity.....10% to 90%, noncondensing  
(IEC-60068-2-56)

Maximum altitude.....2,000 m (800 mbar) (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.



**Note** Refer to the *NI PXIe-5624R Specifications* at [ni.com/manuals](http://ni.com/manuals) for complete specifications.

# Programming the NI 5624R

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You can use the NI LabVIEW Instrument Design Libraries for IF Digitizers and the LabVIEW FPGA Module to customize the behavior of your NI 5624R.

You can use the instrument design libraries to control or customize your NI 5624R device to suit the needs of your application. This software offers many LabVIEW libraries to assist you in controlling your device.

Use the NI LabVIEW Instrument Design Libraries for IF Digitizers with the LabVIEW FPGA Module to customize the behavior of the device FPGA to create application-specific instrument designs. The NI LabVIEW Instrument Design Libraries for IF Digitizers installation includes sample projects. You can use sample projects as a starting point for customizing the device FPGA or to operate the device as a standard IF digitizer.

# Installing the Software

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Close all programs before installing the software. NI recommends installing your software before installing the NI 5624R hardware.

Install your software in the following order:

1. Install the latest service packs for your operating system.
2. Install NI LabVIEW.

Refer to the *LabVIEW Installation Guide* for installation instructions for LabVIEW and system requirements for LabVIEW software. Refer to the *LabVIEW Upgrade Notes* for additional information about upgrading to the most recent version of LabVIEW for Windows.

- (Recommended) Install NI LabVIEW FPGA Module.

Refer to the *LabVIEW FPGA Module Release and Upgrade Notes* for installation instructions and information about getting started with the LabVIEW FPGA Module.



**Note** Installation of the LabVIEW FPGA Module is required to customize the device FPGA using the instrument design libraries.

- (Recommended) Install the latest service pack for LabVIEW and any LabVIEW modules you are using.
- Insert the driver software DVD into the DVD drive.

The driver software installer should open automatically. If the installation window does not appear, navigate to the DVD drive, double-click the drive, and double-click `autorun.exe`.



**Note** You can also download the software from [ni.com/downloads](https://ni.com/downloads).

- Follow the instructions in the installation prompts to install the default installation.

Windows users may see access and security messages during installation. Accept the prompts to complete the installation.



**Note** The default installation installs NI LabVIEW Instrument Design Libraries for IF Digitizers, documentation, and device specifications.



**Note** For troubleshooting information, contact NI technical support or visit [ni.com/support](https://ni.com/support).

- When the installer completes, restart your system.

## Installing the NI 5624R

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

NI recommends installing the software before installing the hardware.

Before you install the hardware, refer to the guidelines in the *Maintain Forced-Air Cooling Note to Users* included with the module to ensure that the device can cool itself effectively. This document is also available at [ni.com/manuals](https://ni.com/manuals).

- Ensure the AC power source is connected to the chassis before installing the NI 5624R.

The AC power cord grounds the chassis and protects it from electrical damage while you install the NI 5624R.

- Power off the chassis.

3. Inspect the slot pins on the chassis backplane for any bends or damage prior to installation. Do not install the module if the backplane is damaged.
4. If the chassis has multiple fan speed settings, ensure the fans are set to the highest setting.



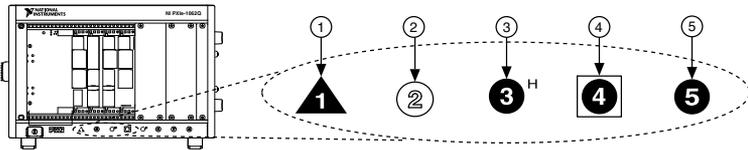
**Note** Inadequate air circulation could cause the temperature inside the chassis to rise above the optimal operating temperature for the device, potentially causing thermal shutdown, shorter lifespans, or improper performance.

5. Position the chassis so that inlet and outlet vents are not obstructed.

For more information about optimal chassis positioning, refer to the chassis documentation.

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

**Figure 2. Chassis Compatibility Symbols**

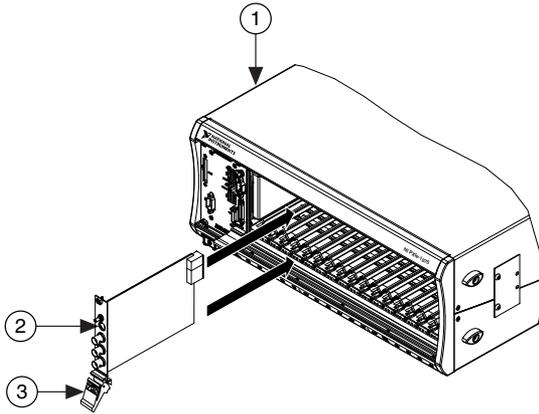


- |                                       |                                   |
|---------------------------------------|-----------------------------------|
| 1. PXI Express System Controller Slot | 4. PXI Express System Timing Slot |
| 2. PXI Peripheral Slot                | 5. PXI Express Peripheral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

The NI 5624R module can be placed in PXI Express peripheral slots or PXI Express Hybrid peripheral slots.

8. Touch any metal part of the chassis to discharge static electricity.
9. Ensure that the ejector handle is in the unlatched (downward) position.
10. 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)

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



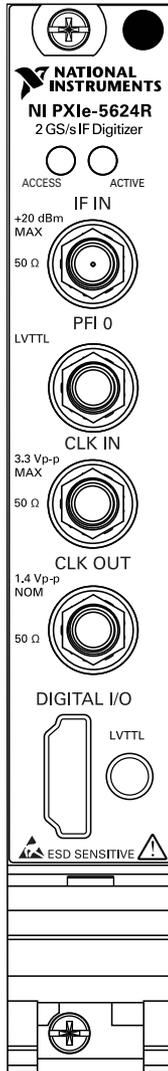
**Note** Tightening the top and bottom mounting screws increases mechanical stability and also electrically connects the front panel to the chassis, which can improve the signal quality and electromagnetic performance.

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

# NI 5624R Front Panel

The NI 5624R front panel contains five connectors and two LEDs.

**Figure 4.** NI 5624R IF Digitizer Module Front Panel



**Table 1. Device Front Panel Icon Definitions**

	Refer to the user documentation for required maintenance measures to ensure user safety and/or preserve the specified EMC performance.
	The signal pins of this product's input/output ports can be damaged if subjected to Electrostatic Discharge (ESD). To prevent damage, turn off power to the product before connecting cables and employ industry-standard ESD prevention measures during installation, maintenance, and operation.

**Table 2. NI 5624R IF Digitizer Front Panel Connectors**

Label	Connector Type	Function
IF IN	SMA connector	Analog input terminal for intermediate frequency (IF) signals.
PFI 0	SMA connector	Programmable function digital I/O (DIO) connector for triggers or events.
CLK IN	SMA connector	Input for an external ADC Clock (Sample Clock) or Reference Clock to the digitizer.
CLK OUT	SMA connector	Output for an ADC Clock (Sample Clock) or PLL Reference Clock from the digitizer.
DIGITAL I/O	HDMI™ connector	DIO terminal that contains 12 general-purpose DIO signals. DIO lines are direction configurable as input or output.



**Caution** The DIGITAL I/O connector accepts a standard, third-party HDMI cable, but the DIGITAL I/O port is not an HDMI interface. Do not connect the DIGITAL I/O port on the NI 5624R to the HDMI port of another device. NI is not liable for any damage resulting from such signal connections.

The following table provides information about the module front panel LEDs and the device states they indicate.

**Table 3.** The NI 5624R IF Digitizer Front Panel LEDs

LED	Indication
ACCESS	<p>Indicates the basic hardware status of the NI 5624R module.</p> <ul style="list-style-type: none"> <li>• OFF—The module is not yet functional, or the module has detected a problem with a PXI Express power rail.</li> <li>• AMBER—The module is being accessed. <i>Accessed</i> means that the device setup registers are being written to in order to control the device.</li> <li>• GREEN—The module is ready to be programmed.</li> </ul>
ACTIVE	<p>Indicates the NI 5624R module state.</p> <ul style="list-style-type: none"> <li>• OFF—User has not turned on LED.</li> <li>• AMBER—User defined.</li> <li>• GREEN—User defined.</li> <li>• RED—The module has detected a PLL unlock or an error state, such as a clock fault, a power shutdown condition, or a thermal shutdown condition. The behavior of this LED can also be user-defined.</li> </ul>

## Configuring the NI 5624R 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 LabVIEW Instrument Design Libraries for IF Digitizers.

1. Launch MAX.
2. In the configuration tree, 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 device 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 5624R.
5. Self-test the device by selecting the device in the configuration tree and clicking **Self-Test** in the MAX toolbar.

The MAX self-test performs a basic verification of hardware resources.

# Self-Calibration

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Self-calibration adjusts the NI 5624R for variations in the module environment using an onboard high-precision calibration tone. Perform a complete self-calibration after first installing your module and letting it warm up for 20 minutes.



**Note** Warm up begins when the PXI Express chassis has been powered on and the operating system has completely loaded.

The NI 5624R modules are externally calibrated at the factory; however, you should perform a self-calibration in any of the following situations:

- After first installing the NI 5624R into your chassis
- After any module in the chassis is installed, uninstalled, or moved
- When the system is in an environment where the ambient temperature varies or the module temperature has drifted more than  $\pm 5$  °C from the temperature at the last self-calibration
- To periodically adjust for small performance drifts that occur with product aging

You can run self-calibration in one of two ways:

- In MAX, select your NI 5624R module and select **Self-Calibrate** on the device toolbar.
- In LabVIEW, select the Self-Calibrate VI located at **FPGA Interface»Software-Designed Instruments»IF Digitizers»Calibration**.

## Making a Measurement with a Sample Project

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You can verify proper installation and configuration of your device by making a measurement using a LabVIEW sample project.

This measurement requires installation of the instrument design libraries.

1. Launch LabVIEW.
2. Select **File»Create Project**.
3. On the left side of the **Create Project** window, select **IF Digitizer**.
4. On the right side of the **Create Project** window, select the **Multirecord Acquisition** sample project and click **Next**.
5. Specify a name and location for the project in the **Create Project** window and click **Finish**.

LabVIEW creates, configures, and opens a new Multirecord Acquisition project.



**Note** This step may take several minutes.

6. In the project tree, navigate to **My Computer»Project Documentation**, open **Multirecord Acquisition.html**, and navigate to the *Running this Sample Project* section of the documentation.
7. Follow the instructions in the project documentation for making the measurement.

# Troubleshooting

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If an issue persists after you complete a troubleshooting procedure, contact NI technical support or visit [ni.com/support](http://ni.com/support).

## What Should I Do if the NI 5624R Doesn't 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
<b>Windows 7</b>	Select <b>Start»Control Panel»Device Manager</b> .
<b>Windows Vista</b>	Select <b>Start»Control Panel»System and Maintenance»Device Manager</b> .
<b>Windows XP</b>	Select <b>Start»Control Panel»System»Hardware»Device Manager</b> .

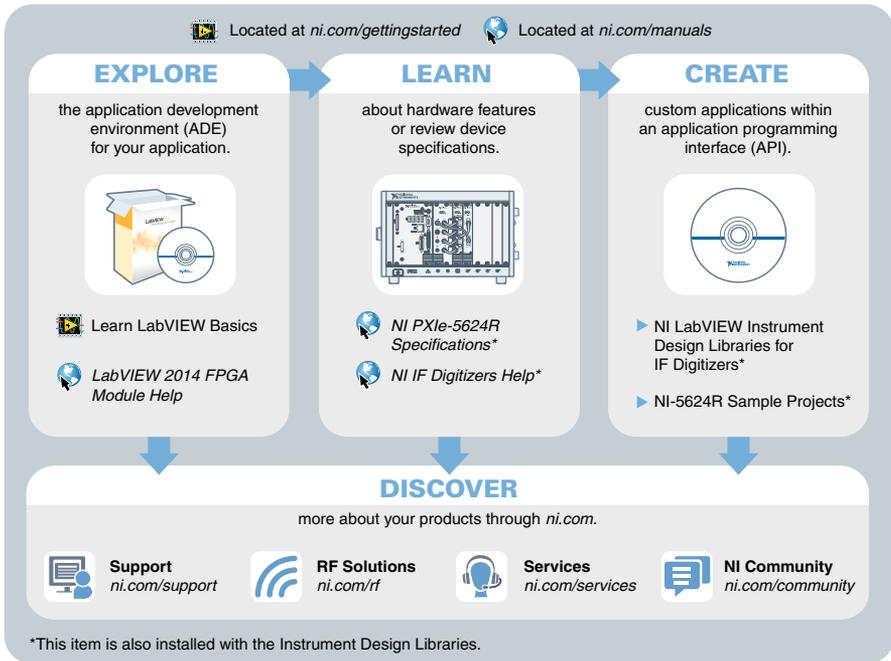
5. If you are using a PXI controller, verify that a **National Instruments** entry appears in the system device list. Reinstall NI LabVIEW Instrument Design Libraries for IF Digitizers and the device if error conditions appear in the list. If you are using a MXI controller, right-click **PCI-to-PCI Bridge**, 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 or Self-Calibration?

1. Restart the system.
2. Launch MAX, and perform the self-test or self-calibration 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.

# Where to Go Next

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



**Note** The *NI IF Digitizers Help* is an HTML version of a traditional user manual that includes detailed information about device features and programming with the NI LabVIEW Instrument Design Libraries for IF Digitizers.

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