
NI PXIe-7971R

Getting Started

Guide

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GSG Purpose

This document describes how to install, configure, and begin using the NI PXIe-7971R (NI 7971R). The NI 7971R is a FlexRIO FPGA module designed to work with your FlexRIO adapter module to create a FlexRIO system.

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FlexRIO Documentation

Table 1. FlexRIO Documentation Locations and Descriptions

Document	Location	Description
Getting started guide for your FPGA module	Available from the Start menu and at ni.com/manuals .	Contains installation instructions for your FlexRIO system.
Specifications document for your FPGA module	Available from the Start menu and at ni.com/manuals .	Contains specifications for your FPGA module.
Getting started guide for your adapter module	Available from the Start menu and at ni.com/manuals .	Contains signal information, examples, and CLIP details for your adapter module.
Specifications document for your adapter module	Available from the Start menu and at ni.com/manuals .	Contains specifications for your adapter module.
LabVIEW FPGA Module Help	Embedded in LabVIEW Help and at ni.com/manuals .	Contains information about the basic functionality of the LabVIEW FPGA Module.
Real-Time Module Help	Embedded in LabVIEW Help and at ni.com/manuals .	Contains information about real-time programming concepts, step-by-step instructions for using LabVIEW with the Real-Time Module, reference information about Real-Time Module VIs and functions, and information

Document	Location	Description
		about LabVIEW features on real-time operating systems.
<i>FlexRIO Help</i>	Available from the Start menu and at ni.com/manuals .	Contains information about the FPGA module front panel connectors and I/O, controller for FlexRIO front panel connectors and I/O, programming instructions, and adapter module component-level IP (CLIP).
LabVIEW Examples	Available in NI Example Finder. In LabVIEW, click Help » Find Examples » Hardware Input and Output » FlexRIO .	Contains examples of how to run FPGA VIs and Host VIs on your device.
IPNet	Located at ni.com/ipnet .	Contains LabVIEW FPGA functions and intellectual property to share.
FlexRIO product page	Located at ni.com/flexrio .	Contains product information and data sheets for FlexRIO devices.

FlexRIO Examples

FlexRIO includes several example applications for LabVIEW. These examples serve as interactive tools, programming models, and as building blocks in your own applications.

Accessing FlexRIO Examples

FlexRIO examples are available in LabVIEW's NI Example Finder. Complete the following steps to access the examples by task.

1. In LabVIEW, click **Help » Find Examples**.
2. In the NI Example Finder window that appears, click **Hardware Input and Output » FlexRIO**.

Click on an example and refer to the Information window for a description of the example. Refer the Requirements window for a list of hardware that can run the example.

You can also click the Search tab to search all installed examples by keyword. For example, search for `FlexRIO` to locate all FlexRIO examples.

Online examples are also available to demonstrate FlexRIO basics, such as using DRAM, acquiring data from adapter modules, and performing high throughput streaming. To access these examples, search `FlexRIO examples` in the **Search the community** field at ni.com/examples.

EMC Guidelines

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 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 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 changes or modifications to the product not expressly approved by NI could void your authority to operate it under your local regulatory rules.



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



Note 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.



Note When exposed to transient electromagnetic phenomena such as electrostatic discharge (ESD) or power surges, this product may experience a temporary upset or other performance degradation that requires more than 10 seconds for self-recovery.



Note The FlexRIO FPGA module front panel interface is sensitive to electrostatic discharge. Use caution when handling the FlexRIO FPGA module to prevent damage to the internal components exposed by this interface.



Note Using the NI 7971R in a manner not described in this document may impair the protection the NI 7971R provides.

Verifying the System Requirements

To use the NI 7971R, your system must meet certain requirements. For more information about minimum system requirements, recommended system, and supported application development environments (ADEs), refer to the readme, which is installed or available at ni.com/manuals.

Required Components

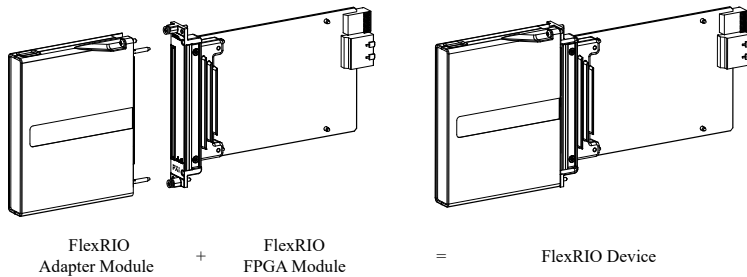
The following items are necessary to set up and use your FlexRIO system:

- The FlexRIO hardware device, comprised of the following items:
 - NI 7971R
 - FlexRIO adapter module



Note You can use the FlexRIO FPGA module without an adapter module for coprocessing or peer-to-peer streaming. The adapter module installation instructions in this document do not apply to these circumstances.

The following figure shows the combined module.

Figure 1. Combining Your Adapter Module and FPGA Module

- The following software packages:

- LabVIEW
- LabVIEW FPGA Module
- FlexRIO Support



Note The most recent version of FlexRIO Support is available at ni.com/downloads. Search for `flexrio` to download the latest version of FlexRIO Support.

- FlexRIO Adapter Module Support^[1]



Note The most recent version of FlexRIO Adapter Module Support is available at ni.com/downloads. Search for `flexrio adapter module support` to download the latest version of FlexRIO Adapter Module Support. You do not need this software if you are not using an adapter module.

- (Optional) LabVIEW Real-Time Module.
- One of the following chassis:
 - PXI/CompactPCI chassis
 - PXI Express/CompactPCI Express chassis
- One of the following controllers:
 - PXI/CompactPCI embedded controller
 - PXI Express/CompactPCI Express embedded controller
 - MXI kit and a PC
- One of the following operating systems:
 - Windows 10
 - Windows 8.1

- At least one cable for connecting signals to the FlexRIO device. Refer to your adapter module documentation for a list of applicable cables and accessories for your FlexRIO system.

Related tasks:

- [Installing the Application Software and Driver](#)

Installing the Application Software and Driver

Before installing your hardware, you must install the application software and instrument driver. Visit ni.com/info and enter `rdsoftwareversion` as the Info Code to determine which minimum software versions you need for your device. Install the software in the following order:

1. Install LabVIEW.

Refer to the **LabVIEW Installation Guide** for installation instructions for LabVIEW and system requirements for the LabVIEW software. Refer to the **LabVIEW Upgrade Notes** for additional information about upgrading to the most recent version of LabVIEW for Windows. Documentation for LabVIEW is available at ni.com/manuals and by selecting **Start » All Programs » National Instruments » LabVIEW » LabVIEW Manuals**.

2. Install the 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. Documentation for the LabVIEW FPGA Module is available at ni.com/manuals and by selecting **Start » All Programs » National Instruments » LabVIEW » LabVIEW Manuals**.

3. (Optional) Install the LabVIEW Real-Time Module.

Refer to the **LabVIEW Real-Time Module Release and Upgrade Notes** for system requirements, installation instructions, and additional information about using the LabVIEW Real-Time Module.

4. Install NI FlexRIO.

Refer to the **NI FlexRIO Readme** on the NI FlexRIO installation media for system requirements and installation instructions for NI FlexRIO Support. Documentation for NI FlexRIO Support is available at ni.com/manuals and by selecting **Start » All Programs » National Instruments » NI FlexRIO**.



Note If you are not using an adapter module, skip step 5.

5. Install NI FlexRIO Adapter Module Support.

Refer to the ***NI FlexRIO Adapter Module Support Readme*** on the NI FlexRIO Adapter Module Support installation media for system requirements and installation instructions. Documentation for NI FlexRIO Adapter Module Support is available at ni.com/manuals and by selecting **Start » All Programs » National Instruments » NI FlexRIO » NI FlexRIO Adapter Module Documentation**.

Related tasks:

- [Installing the FlexRIO FPGA Module](#)

Related reference:

- [Required Components](#)
- [NI 7971R Module Signals](#)

Unpacking the Kit



Notice 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.



Notice Never touch the exposed pins of connectors.



Note Do not install a device if it appears damaged in any way.

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 you are using the NI 7971R in meets the following specifications.

Operating temperature (IEC 60068-2-1, IEC 60068-2-2)	0 °C to 55 °C
Operating humidity (IEC 60068-2-56)	10% to 90% RH, noncondensing
Pollution Degree	2
Maximum altitude	2,000 m at 25 °C ambient temperature

Indoor use only.



Note Refer to the *NI 7971R Specifications* at ni.com/manuals for complete specifications.



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.

Installing the FlexRIO FPGA Module

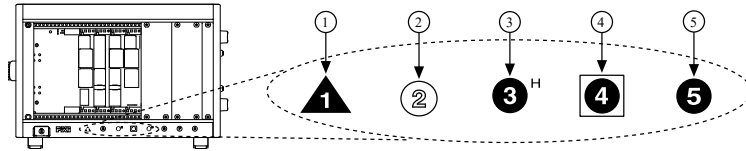


Note You must install the software before you install the hardware.

1. Ensure the AC power source is connected to the chassis before installing the module.
The AC power cord grounds the chassis and protects it from electrical damage while you install the module.
2. Power off the chassis.

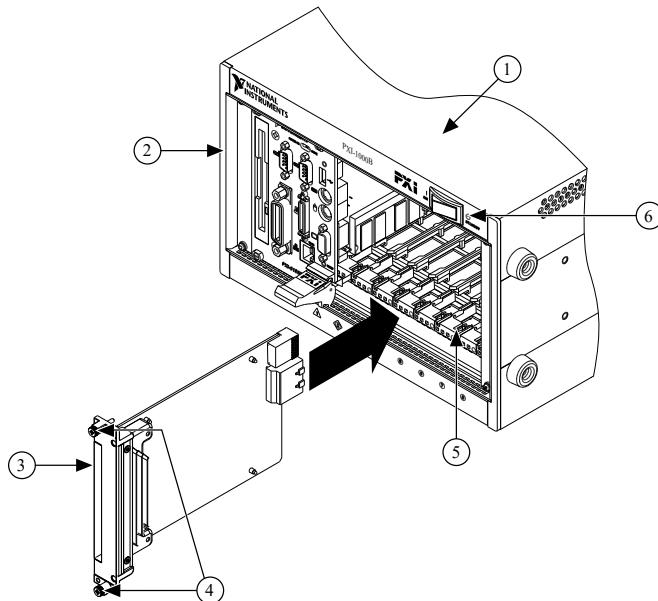
3. Inspect the slot pins on the chassis backplane for any bends or damage prior to installation. Do not install a module if the backplane is damaged.
4. Remove the black plastic covers from all the captive screws on the module front panel.
5. Identify a supported slot in the chassis. The following figure 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
6. Touch any metal part of the chassis to discharge static electricity.
 7. Place the PXI/PXI Express module edges into the module guides at the top and bottom of the chassis, and slide the module into the chassis until the module is fully inserted, as shown in the figure below.

Figure 3. Installing a FlexRIO FPGA Module in the PXI/PXI Express Chassis



1. PXI Express Chassis
2. PXI Express System Controller
3. FlexRIO FPGA Module
4. Front-Panel Mounting Screws

5. Module Guides
6. Power Switch
8. Secure the module 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.

9. Cover all empty slots using either filler panels (standard or EMC) or slot blockers with filler panels, depending on your application.



Note For more information about installing slot blockers and filler panels, go to ni.com/r/pxiblocker.

10. Power on the chassis.

Related tasks:

- [Installing the Application Software and Driver](#)

Confirming that Measurement & Automation Explorer (MAX) Recognizes the Device

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

1. Launch MAX by navigating to **Start » All Programs » National Instruments » NI MAX** or by clicking the NI MAX desktop icon.
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. (PXI and PXI Express devices only) Expand your **Chassis** tree item. MAX lists all devices installed in the chassis. Your default device names may vary.



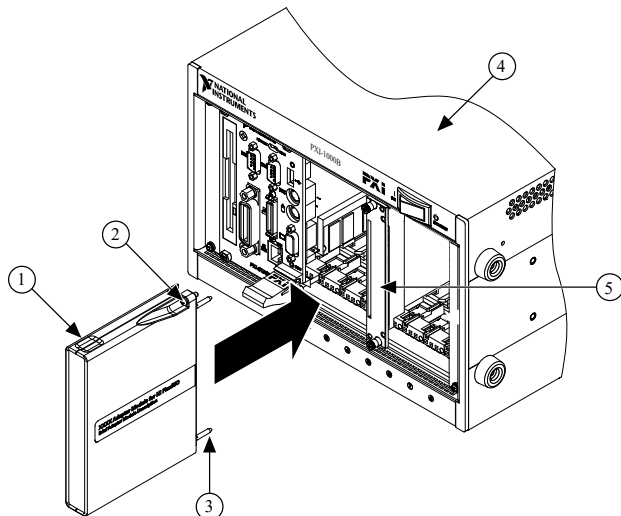
Note If you do not see your hardware listed, press <F5> to refresh the list of installed devices. If the device is still not listed, power off the system, ensure the device is correctly installed, and restart.

4. (Controllers for FlexRIO only) Your device appears under the **Remote Devices** section.

Installing the FlexRIO Adapter Module

1. Gently insert the guide pins and the high-density card edge of the FlexRIO adapter module into the corresponding connectors of the FlexRIO FPGA module, as shown in the figure below.

Figure 4. Installing the FlexRIO Adapter Module



1. FlexRIO Adapter Module
2. Captive Screw
3. Guide Pin
4. PXI/PXI Express Chassis
5. FlexRIO FPGA Module

The connection may be tight, but do not force the adapter module into place.

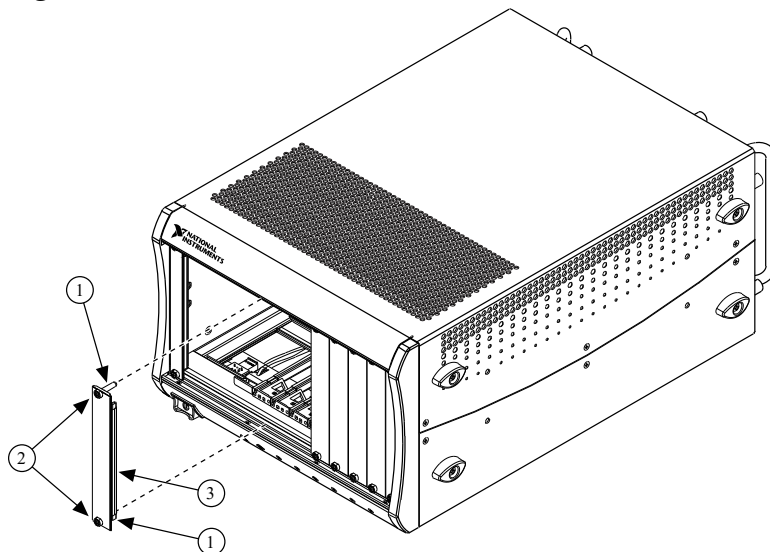
2. Tighten the captive screws on the FlexRIO adapter module to secure it to the FlexRIO FPGA module.
NI recommends using the laser-tipped screwdriver (part number 748677-01) included in the NI 7971R packaging.
3. Launch LabVIEW to begin configuring your FlexRIO system.

Installing PXI EMC Filler Panels

To ensure specified EMC performance, PXI EMC filler panels must be properly installed in your FlexRIO system. The PXI EMC filler panels (National Instruments part number 778700-01) must be purchased separately.

1. Remove the captive screw covers.
2. Install the PXI EMC filler panels by securing the captive mounting screws to the chassis, as shown in the figure below. Make sure that the EMC gasket is on the right side of the PXI EMC filler panel.

Figure 5. PXI EMC Filler Panels and Chassis



1. Captive Screw Covers
2. Captive Mounting Screws
3. EMC Gasket



Note You must populate all slots with a module or a PXI EMC filler panel to ensure proper module cooling. Do not over tighten screws (2.5 lb · in. maximum). For additional information about the use of PXI EMC filler panels in your PXI system, visit ni.com/info and enter `emcpanels`.

Uninstalling the Module



Note If the module has been in use, it may exceed safe handling temperatures and cause burns. Allow the module to cool before removing it

from the chassis.

1. Disconnect any cables from the module front panel connectors.



Caution Disconnect any external clock or digital connections to the device front panel. Applying external signals while the device is powered off may cause damage.

2. Power off the chassis.
3. Ground yourself with a grounding strap or touch a grounded metal surface.
4. Unlatch the module by pushing down on the ejector handle.
5. Hold the module by the ejector handle and remove it from the slot.

Store the module in the original antistatic packaging when not in use to avoid damage.

Uninstalling the Adapter Module



Caution If the module has been in use, it may exceed safe handling temperatures and cause burns. Allow the module to cool before removing it from the chassis.

To properly remove an adapter module from the FlexRIO FPGA module, you must disable the adapter module within the LabVIEW FPGA user interface. To disable the adapter module within LabVIEW, complete the following steps.

1. In your LabVIEW Project Explorer window, right-click the **IO Module** item under the FPGA Target and select **Properties** to display the IO Module Properties dialog box.
2. Click the **Status** category to view the adapter module Status dialog.
3. Deselect the checkbox for **Enable IO Module Power**. When this option is deselected, firmware tristates the FlexRIO I/O and disables all adapter module power rails.
4. Click **OK**.
5. Disconnect any cables from the module front panel connectors.



Caution Disconnect any external clock or digital connections to the device front panel. Applying external signals while the device is powered

off may cause damage.

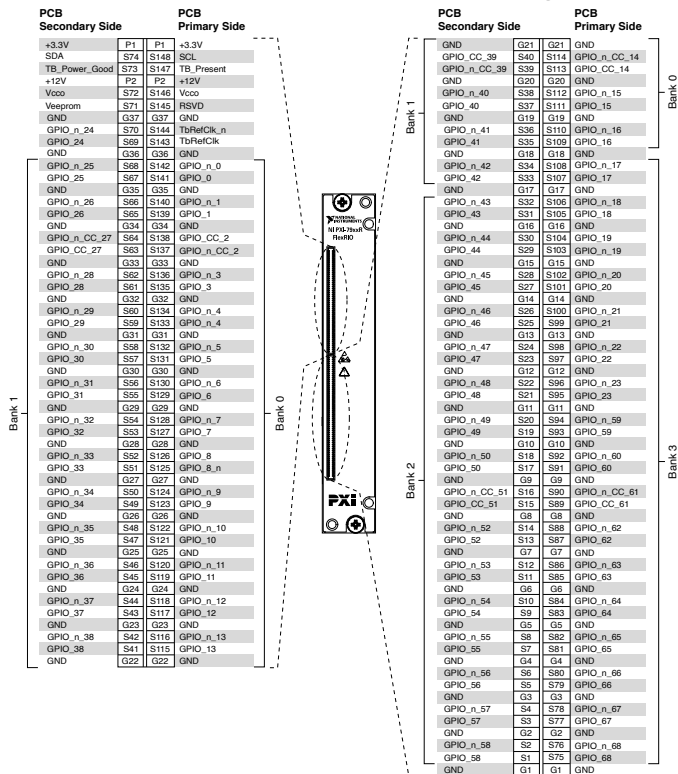
6. Power off the chassis.
7. Ground yourself with a grounding strap or touch a grounded metal surface.
8. Unscrew the adapter module.
9. Remove the adapter module.

Store the module in the original antistatic packaging when not in use to avoid damage.

NI 7971R Module Signals

The following figure shows the available signals on the NI 7971R.

Figure 1. Front Panel Connector Pin Assignments and Locations



Note Pins S72 and S146 are shorted together.

Related tasks:

- [Installing the Application Software and Driver](#)