NI PXIe-7972R Getting Started Guide

Contents

GSG Purpose

This document describes how to install, configure, and begin using the NI PXIe-7972R (NI 7972R). The NI 7972R 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.
FlexRIO Help	Available from the Start menu and at <u>ni.com/manuals</u>.	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 <u>ni.com/ipnet</u>.	Contains LabVIEW FPGA functions and intellectual property to share.
FlexRIO product page	Located at <u>ni.com/flexrio</u>.	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 7972R in a manner not described in this document may impair the protection the NI 7972R provides.

Verifying the System Requirements

To use the NI 7972R, 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 7972R
  - 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

| FlexRIO Adapter Module | + | FlexRIO FPGA Module | = | FlexRIO Device |
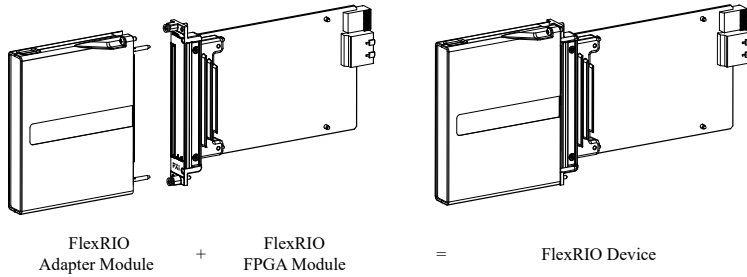
- The following software packages:
  - LabVIEW
  - LabVIEW FPGA Module
  - FlexRIO Support

    > ✎ **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 Software and Driver Using NI Package Manager

Installing the Software and Driver Using NI Package Manager

Before installing your hardware, you must install the application software and instrument driver. 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.
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.
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-RIO.

   Refer to the **FlexRIO Readme** for system requirements and installation instructions for NI-RIO. Documentation for NI-RIO is available at ni.com/manuals.

Related tasks:

- Installing the FlexRIO FPGA Module

Related reference:

- Required Components
- NI 7972R 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 7972R 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 7972R Specifications** at <u>ni.com/manuals</u> 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
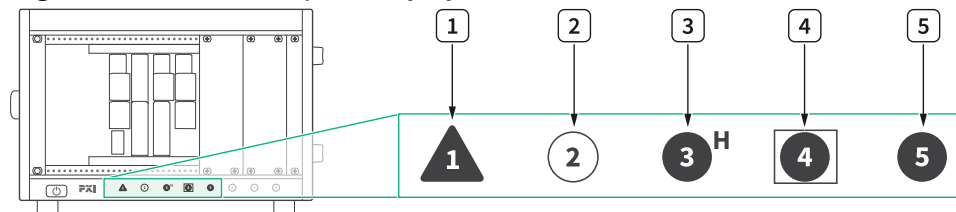
   1. PXI Express System Controller Slot
   2. PXI Peripheral Slot

   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
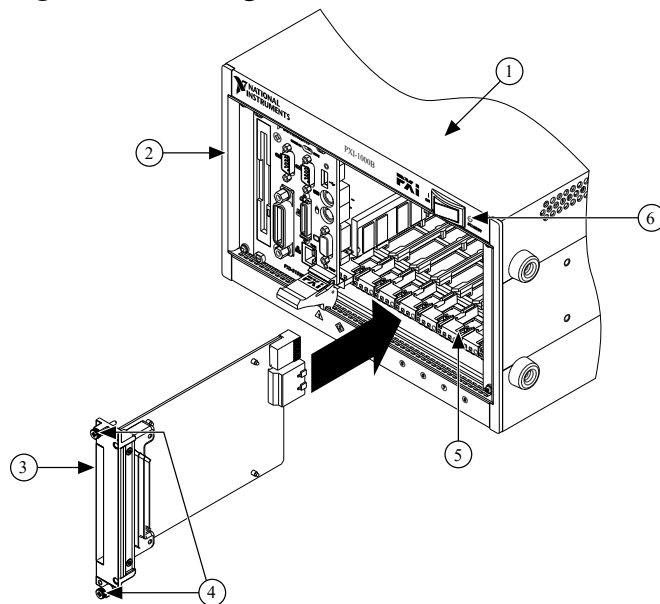
   1. PXI Express Chassis
   2. PXI Express System Controller
   3. FlexRIO FPGA Module
   4. Front-Panel Mounting Screws
   5. Module Guides
   6. Power Switch

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 Software and Driver Using NI Package Manager](#)

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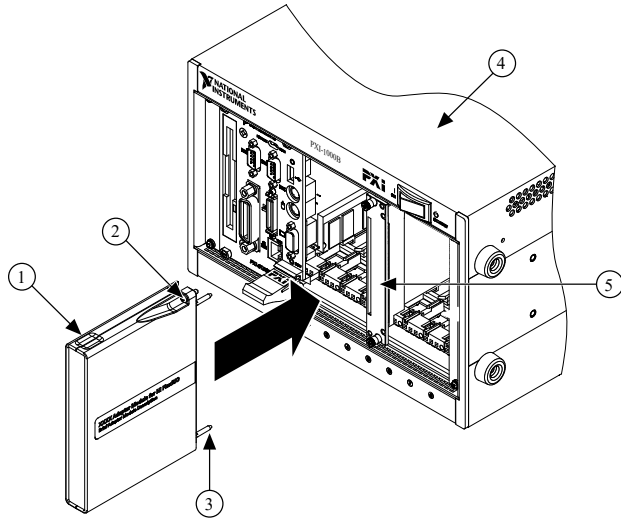
1. FlexRIO Adapter Module
2. Captive Screw
3. Guide Pin
4. PXI/PXI Express Chassis
5. FlexRIO FPGA Module

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 7972R 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
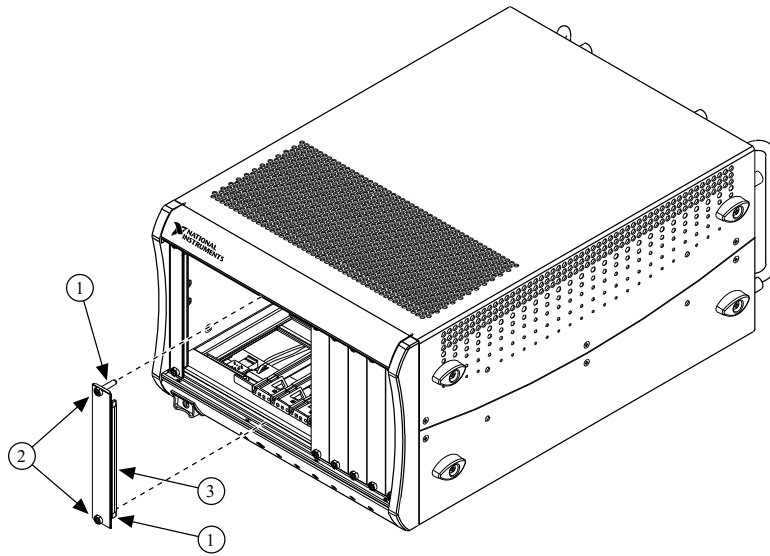
1. Captive Screw Covers
2. Captive Mounting Screws
3. EMC Gasket

> **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.
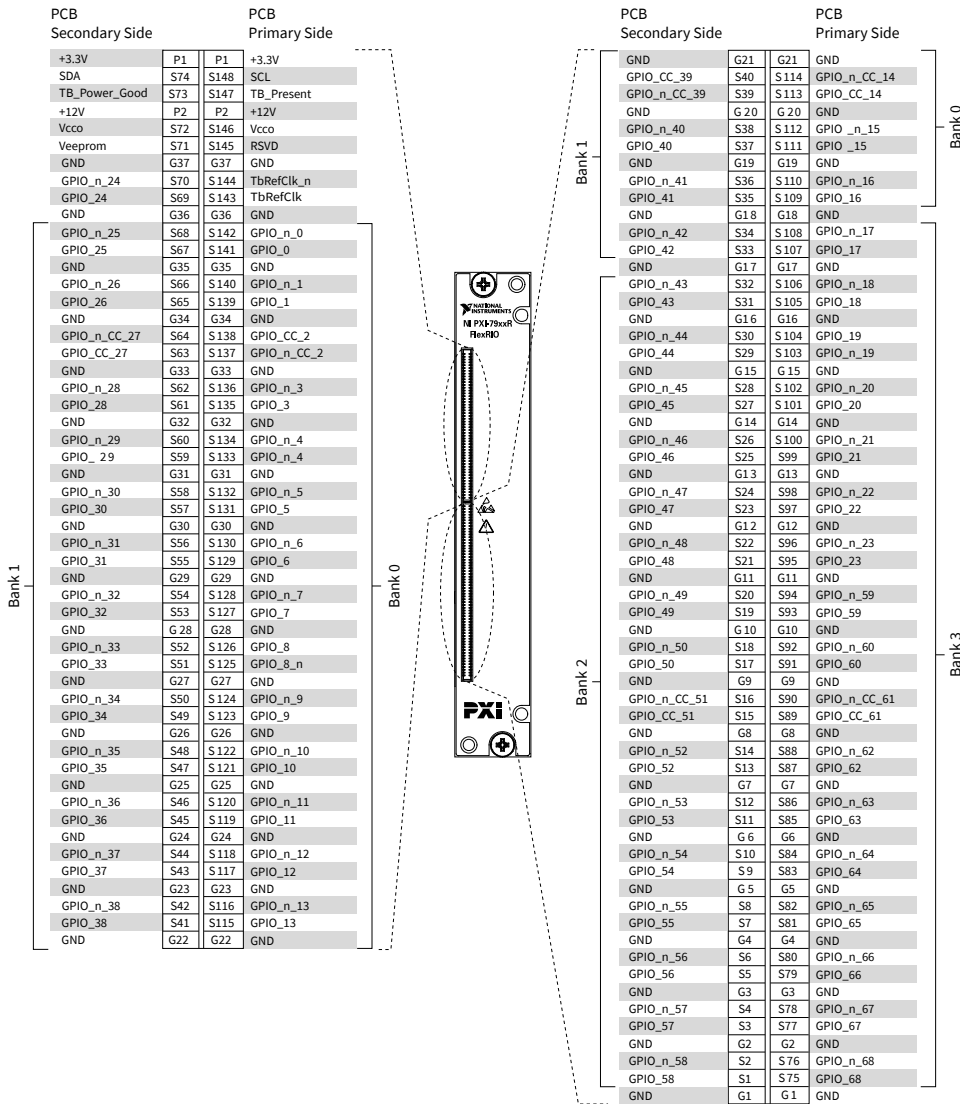8. Unscrew the adapter module.
9. Remove the adapter module.

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

NI 7972R Module Signals

The following figure shows the available signals on the NI 7972R.

Figure 6. Front Panel Connector Pin Assignments and Locations

Bank 1 / Bank 0 (left connector):

PCB Secondary Side	Pin	Pin	PCB Primary Side
+3.3V	P1	P1	+3.3V
SDA	S74	S148	SCL
TB_Power_Good	S73	S147	TB_Present
+12V	P2	P2	+12V
Vcco	S72	S146	Vcco
Veeprom	S71	S145	RSVD
GND	G37	G37	GND
GPIO_n_24	S70	S144	TbRefClk_n
GPIO_24	S69	S143	TbRefClk
GND	G36	G36	GND
GPIO_n_25	S68	S142	GPIO_n_0
GPIO_25	S67	S141	GPIO_0
GND	G35	G35	GND
GPIO_n_26	S66	S140	GPIO_n_1
GPIO_26	S65	S139	GPIO_1
GND	G34	G34	GND
GPIO_n_CC_27	S64	S138	GPIO_CC_2
GPIO_CC_27	S63	S137	GPIO_n_CC_2
GND	G33	G33	GND
GPIO_n_28	S62	S136	GPIO_n_3
GPIO_28	S61	S135	GPIO_3
GND	G32	G32	GND
GPIO_n_29	S60	S134	GPIO_n_4
GPIO_ 29	S59	S133	GPIO_n_4
GND	G31	G31	GND
GPIO_n_30	S58	S132	GPIO_n_5
GPIO_30	S57	S131	GPIO_5
GND	G30	G30	GND
GPIO_n_31	S56	S130	GPIO_n_6
GPIO_31	S55	S129	GPIO_6
GND	G29	G29	GND
GPIO_n_32	S54	S128	GPIO_n_7
GPIO_32	S53	S127	GPIO_7
GND	G28	G28	GND
GPIO_n_33	S52	S126	GPIO_8
GPIO_33	S51	S125	GPIO_8_n
GND	G27	G27	GND
GPIO_n_34	S50	S124	GPIO_n_9
GPIO_34	S49	S123	GPIO_9
GND	G26	G26	GND
GPIO_n_35	S48	S122	GPIO_n_10
GPIO_35	S47	S121	GPIO_10
GND	G25	G25	GND
GPIO_n_36	S46	S120	GPIO_n_11
GPIO_36	S45	S119	GPIO_11
GND	G24	G24	GND
GPIO_n_37	S44	S118	GPIO_n_12
GPIO_37	S43	S117	GPIO_12
GND	G23	G23	GND
GPIO_n_38	S42	S116	GPIO_n_13
GPIO_38	S41	S115	GPIO_13
GND	G22	G22	GND

Bank 1 / Bank 2 / Bank 0 / Bank 3 (right connector):

PCB Secondary Side	Pin	Pin	PCB Primary Side
GND	G21	G21	GND
GPIO_CC_39	S40	S114	GPIO_n_CC_14
GPIO_n_CC_39	S39	S113	GPIO_CC_14
GND	G20	G20	GND
GPIO_n_40	S38	S112	GPIO_n_15
GPIO_40	S37	S111	GPIO_15
GND	G19	G19	GND
GPIO_n_41	S36	S110	GPIO_n_16
GPIO_41	S35	S109	GPIO_16
GND	G18	G18	GND
GPIO_n_42	S34	S108	GPIO_n_17
GPIO_42	S33	S107	GPIO_17
GND	G17	G17	GND
GPIO_n_43	S32	S106	GPIO_n_18
GPIO_43	S31	S105	GPIO_18
GND	G16	G16	GND
GPIO_n_44	S30	S104	GPIO_19
GPIO_44	S29	S103	GPIO_n_19
GND	G15	G15	GND
GPIO_n_45	S28	S102	GPIO_n_20
GPIO_45	S27	S101	GPIO_20
GND	G14	G14	GND
GPIO_n_46	S26	S100	GPIO_n_21
GPIO_46	S25	S99	GPIO_21
GND	G13	G13	GND
GPIO_n_47	S24	S98	GPIO_n_22
GPIO_47	S23	S97	GPIO_22
GND	G12	G12	GND
GPIO_n_48	S22	S96	GPIO_n_23
GPIO_48	S21	S95	GPIO_23
GND	G11	G11	GND
GPIO_n_49	S20	S94	GPIO_n_59
GPIO_49	S19	S93	GPIO_59
GND	G10	G10	GND
GPIO_n_50	S18	S92	GPIO_n_60
GPIO_50	S17	S91	GPIO_60
GND	G9	G9	GND
GPIO_n_CC_51	S16	S90	GPIO_n_CC_61
GPIO_CC_51	S15	S89	GPIO_CC_61
GND	G8	G8	GND
GPIO_n_52	S14	S88	GPIO_n_62
GPIO_52	S13	S87	GPIO_62
GND	G7	G7	GND
GPIO_n_53	S12	S86	GPIO_n_63
GPIO_53	S11	S85	GPIO_63
GND	G6	G6	GND
GPIO_n_54	S10	S84	GPIO_n_64
GPIO_54	S9	S83	GPIO_64
GND	G5	G5	GND
GPIO_n_55	S8	S82	GPIO_n_65
GPIO_55	S7	S81	GPIO_65
GND	G4	G4	GND
GPIO_n_56	S6	S80	GPIO_n_66
GPIO_56	S5	S79	GPIO_66
GND	G3	G3	GND
GPIO_n_57	S4	S78	GPIO_n_67
GPIO_57	S3	S77	GPIO_67
GND	G2	G2	GND
GPIO_n_58	S2	S76	GPIO_n_68
GPIO_58	S1	S75	GPIO_68
GND	G1	G1	GND

Center label: NI PXI-79xxR FlexRIO — PXI

Note Pins S72 and S146 are shorted together.

Related tasks:

- [Installing the Software and Driver Using NI Package Manager](#)

NI Services

Visit ni.com/support to find support resources including documentation, downloads, and troubleshooting and application development self-help such as tutorials and examples.

Visit ni.com/services to learn about NI service offerings such as calibration options, repair, and replacement.

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