NI-7931R Getting Started Guide

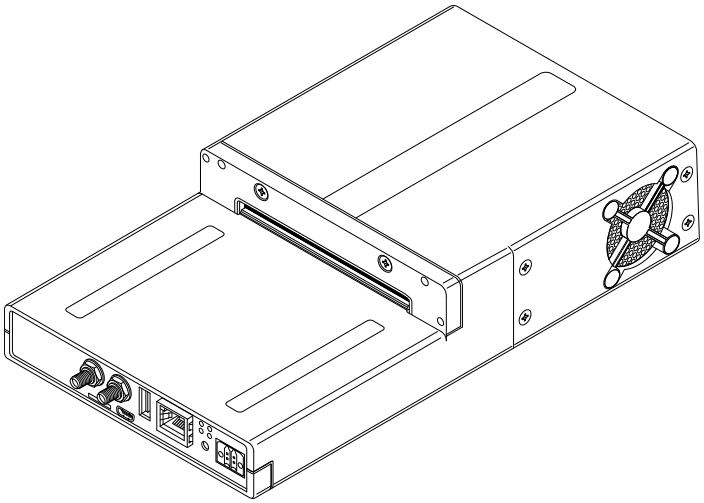
2025-03-20

Contents

GSG Purpose

This document describes how to begin using the NI-7931R.

Figure 1. NI-7931R



Related information:

- For information about the device specifications, refer to the NI-7931R Specifications at ni.com/manuals.

FlexRIO Documentation

Table 1. FlexRIO Documentation Locations and Descriptions

Document	Location	Description
Getting started guide for your controller for FlexRIO	Available from the Start menu and at ni.com/manuals.	Contains installation instructions for your FlexRIO system.
Specifications document for your controller for FlexRIO	Available from the Start menu and at ni.com/manuals.	Contains specifications for your controller for FlexRIO.
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.

Document	Location	Description
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 about LabVIEW features on real-time operating systems.
FlexRIO Help	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.

Related reference:

- Programming with LabVIEW

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.

Safety Guidelines

Caution You can impair the protection provided by the NI-7931R if you use it in a manner not described in this document.

Electromagnetic Compatibility 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 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 changes or 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. The DC power input cables may be unshielded.

Caution To ensure the specified EMC performance, the length of any cable connected to the TRIG ports and REF CLK ports must be no longer than 3 m(10 ft). The length of cables connected to the USB device ports or host ports must be no longer than 30 m(100 ft). The length of Ethernet cables is not limited.

Caution The USB device port is intended only for use in device configuration, application deployment, debug, and maintenance.

Verifying the System Requirements

To use the NI-7931R, 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.

What You Need to Get Started

- The NI-7931R shipping kit, which includes the following components:
  - The NI-7931R device
  - FlexRIO Support DVD

    Note FlexRIO Support 15.1 is the earliest supported driver for the NI-7931R.

  - ***NI-7931R Getting Started Guide*** (this document)
  - Power screw terminal connector plug
  - A to Mini-B device port USB cable
- A host computer running Windows, with NI software installed in the following order:

  Note Visit ni.com/info and enter the Info Code `rdsoftwareversion` to determine which software versions you need to use the NI-7931R and supported FlexRIO adapter modules.

  - LabVIEW
  - LabVIEW Real-Time
  - LabVIEW FPGA
  - FlexRIO Support[1]
- A DC power supply as described in the ***NI-7931R Specifications***
- A FlexRIO adapter module or custom adapter module (optional)
- A number 2 Phillips screwdriver
- A number 1 Phillips screwdriver
- A small flat-blade screwdriver
- Straight through shielded Ethernet cable (if connecting to a network) or crossover shielded Ethernet cable (if connecting directly to a PC)

Unpacking the Kit

1. LabVIEW 2015, FlexRIO Support 2015, LabVIEW Real-Time 2015, and LabVIEW FPGA 2015 are the earliest versions of software that support the NI-7931R.

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.

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

Preparing the Environment

Ensure that the environment where you are using the NI-7931R 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 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.

Wiring Power to the NI-7931R

The NI-7931R requires a 9 V to 30 V external power supply that meets the specifications in the ***NI-7931R Specifications***. The NI-7931R filters and regulates the supplied power and provides power for the I/O modules.

Note You can latch the power plug to the NI-7931R using two screws tightened to 0.20 to 0.25 N · m (1.8 to 2.2 lb · in.) of torque.

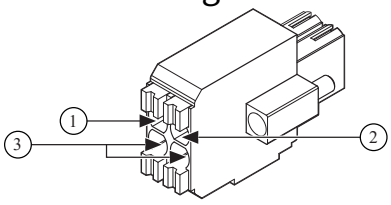
The maximum wire gage accepted by the power connector plug is 16 AWG. You must use a stripped wire length of 10 mm (.394 in).

When the POWER LED on the front panel is lit green, the device is powered.

The NI-7931R has reverse-voltage protection.

Complete the following steps to connect a power supply to the NI-7931R.

1. Ensure the power source is turned off.
2. Connect a positive wire to the positive terminal of the power connector plug, and connect a negative wire to the negative terminal of the power connector plug.



   1. Positive terminal
   2. Negative terminal
   3. No connect
3. Install the power connector on the front panel of the NI-7931R.
4. Turn on the external power source(s).

Powering on the NI-7931R

When you apply power for the first time to the NI-7931R, the controller boots into safe mode. The POWER LED illuminates, the STATUS LED illuminates briefly, and then the STATUS LED blinks twice every few seconds.

After you install software on the controller, subsequent reboots will boot the controller into the NI Linux Real-Time operating system.

You can optionally configure the NI-7931R to launch an embedded stand-alone LabVIEW Real-Time application each time you boot the controller.

Connecting the NI-7931R to the Host Computer Using the USB Device Port

Complete the following steps to connect the NI-7931R to the host computer using the USB device port.

1. Power on the host computer.
2. Connect the NI-7931R to the host computer using the USB A-to-B cable.

   > **Notice** NI requires the use of a locking USB cable (157788-01) to meet the shock and vibration specifications, as listed in the specifications for your controller.

   The device driver software automatically detects the NI-7931R. If the device driver software does not detect the NI-7931R, verify that you installed the appropriate NI software in the correct order on the host computer.

Related concepts:

- Troubleshooting the NI-7931R

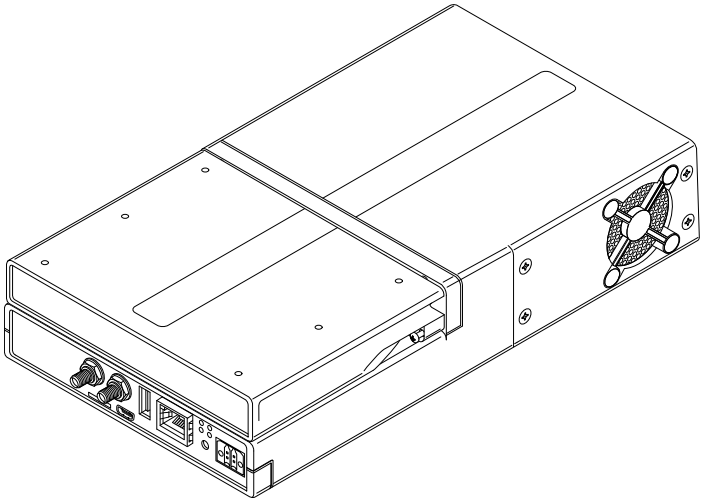
Installing the FlexRIO Adapter Module

Skip this section if you are not using a 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 NI-7931R.
   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 NI-7931R.

The following figure shows the NI-7931R with the FlexRIO adapter module connected.

Figure 1. NI-7931R with FlexRIO Adapter Module



Refer to the getting started guide for your adapter module for more information about your adapter module, including programming information.

Configuring the System in Measurement & Automation Explorer (MAX)

After connecting the NI-7931R to the host computer, complete the following steps to configure the system for the first time in MAX.

1. Launch MAX on the host computer.
2. Expand **Remote Systems** in the MAX configuration tree and select the system. MAX lists the system as the model name followed by the serial number, such as NI-7931R-030521C9.

Related reference:

- Why Doesn't the Device Appear in MAX?

Setting a System Password

Complete the following steps to set a system password.

> **Note** The default username for the NI-7931R is `admin`. There is no default password for the NI-7931R, so you must leave the password field blank when logging in until you set a system password.

1. Right-click your system and select **Web Configuration**.
   The NI Web-Based Configuration and Monitoring utility opens in your default browser and is where you set the password. If you have not installed Microsoft Silverlight, NI Web-based Configuration & Monitoring prompts you to do so.
2. Enter a unique name for your system in the **Hostname** field.
3. Click the **Security Configuration** icon.
4. Click **Login**.
5. In the **Login** dialog box, enter the username `admin` and leave the password field blank.
6. Click **OK**.
7. Click **Change Password**.
8. Enter and re-enter a new password.
9. Click **OK**.
10. Click **Save**.
11. Click **OK** to confirm you are changing the password.

> **Notice** NI cannot recover lost system passwords. If you forget the password, you must contact NI and reformat the controller.

Installing Software on the NI-7931R

1. Open Measurement & Automation Explorer (MAX).
2. Expand the system under **Remote Systems** by clicking the arrow beside it.

3. Select **Software**.
4. Click **Add/Remove Software** at the top of the **Software** tab to launch the LabVIEW Real-Time Software Wizard.

> **Note** A login window appears if you set a system password.

5. Select a recommended software set to install.
6. Click **Next**.
7. The recommended software set is preselected from the list of software add-ons. Check any additional software add-ons you want. The System State Publisher, for example, makes monitoring system performance simple.

> **Note** You can use the LabVIEW Real-Time Software Wizard to install more software add-ons later. The FlexRIO Recommended Software Set is enough to get started.

8. Click **Next**.
9. Review the summary of software to install. Click **Next** to begin the update.
10. Wait for the installation to finish, and then click **Finish**.

Adding the NI-7931R to a LabVIEW Project

1. Launch LabVIEW. The LabVIEW Getting Started window appears.
2. Click **Create Project** or open an existing project.
3. Right-click the project root in the Project Explorer window and select **New » Targets and Devices** from the shortcut menu to display the **Add Targets and Devices** dialog box.
   a. If the hardware is connected to the host, select **Existing target or device**. Select the NI-7931R under **Real-Time FlexRIO** and click **OK**.
   b. If the hardware is not connected to the host, select **New target or device**. Select the NI-7931R under **Real-Time FlexRIO** and click **OK**.
4. Right-click the target and select **New » FPGA Target**.
   The FPGA target appears in the project under the Real-Time target.

Adding a FlexRIO Adapter Module to the Target

Skip this section if you are not using an adapter module.

1. Expand the FPGA target by clicking the **+** button, then right-click **IO Module** and select **Properties**.
2. Select the **General** category and check the **Enable IO Module** box.
3. Select your I/O module from the **IO Modules** list, and select the CLIP you want to use from the **Component Level IP** box.
4. Click **OK**.

Programming Options

Refer to the following table for information about how to program the NI-7931R.

Component	Programming Option(s)
Real-Time controller	To set up a C/C++ based toolchain, visit `ni.com/info` and enter the info code ***NILRTCrossCompile*** for more information.
FPGA	LabVIEW FPGA

Programming with LabVIEW

The Controller for FlexRIO examples provide a starting point for programming with LabVIEW. To access these examples, open LabVIEW and select **Help » Find Examples » Hardware Input and Output » Controller for FlexRIO**.

For more detailed instructions about programming the NI-7931R with LabVIEW, refer to the ***NI-7931R/7932R/7935R User Manual***.

Related reference:

- FlexRIO Documentation

Text-based Programming

You can target the NI-7931R Linux Real-Time operating system from text-based development environments such as C and C++.

Related information:

- For more information about text-based programming, refer to the Getting Started with C/C++ Development Tools for NI Linux Real-Time, Eclipse Edition tutorial.

Removing the Adapter Module

Complete the following steps to remove an adapter module from the NI-7931R.

1. Disconnect all cables to the adapter module.
2. Power off the NI-7931R.[2]
3. Unscrew the adapter module.
4. Remove the adapter module.

Troubleshooting the NI-7931R

Related tasks:

- Connecting the NI-7931R to the Host Computer Using the USB Device Port

Why Can't the NI-7931R Communicate with the Network?

1. Connect cables from your device to the host computer.
   a. If you are using the USB port, use a USB cable to connect the NI-7931R USB device port to a host computer.
      The USB driver creates a virtual network interface and assigns an IP address to the NI-7931R in the format of 172.22.11.x.
   b. If you are using the ethernet port, use an ethernet to connect the ethernet port to the host computer.
2. In MAX, expand your system under Remote Systems.
3. Select the **Network Settings** tab to configure the IP and other network settings.

2. If you cannot power down the NI-7931R, use the System Configuration application programming interface (API) to disable power to the adapter module.

4. (Optional) Use the RJ-45 Ethernet port 1 to reconnect the NI-7931R to the host computer. The NI-7931R attempts to initiate a DHCP network connection at powerup.
   If the NI-7931R cannot contain an IP address, it connects to the network with a link-local IP address with the form 169.254.x.x. The host computer communicates with the NI-7931R over a standard Ethernet connection.

Why Doesn't the Device Appear in MAX?

If you cannot find the NI-7931R in MAX, complete the following steps.

- Ensure you have the correct version of FlexRIO Support installed on the host computer.
- Check the USB cable connections at the NI-7931R and host computer. Check the Ethernet cable connections at the host computer and router.
- If you have network firewalls or other security software enabled, try temporarily turning them off. You may also need to add an exception for MAX. In Windows 7, select **Start** » **Control Panel** » **System and Security** » **Windows Firewall** » **Allow a program through Windows Firewall**. Click **Allow another program**, select **Measurement & Automation**, click **Add**, then click **OK**.
- Ensure that UDP port 44525 is open to communication on the host computer. If you are using an intelligent switch on the network, ensure that it is not disabling UDP port 44525.
- Hold down the RESET button for 5 seconds to reboot the target into safe mode. This prevents a real-time app from running. Sometimes a malfunctioning real-time app prevents network communication.
- Check the Device Manager to ensure the National Instruments USBLAN adapter is recognized. In Windows 7, select **Start** » **Control Panel** » **Device Manager** » **Network adapters** » **National Instruments** » **USBLAN adapter**. If the USBLAN adapter is not recognized, you must reinstall FlexRIO Support.
- Ensure that the Ethernet cable is connected correctly.

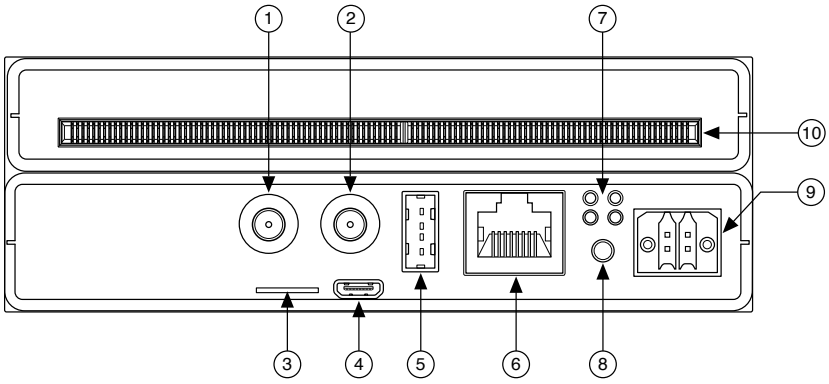
Related tasks:

- Configuring the System in Measurement & Automation Explorer (MAX)

NI-7931 Front Panel

The following figure shows the NI-7931 front panel connectors, buttons, and LEDs.

Figure 3. NI-7931



1. TRIG
2. REF CLK
3. Storage (µSD card)
4. USB device port
5. USB host
6. 1 Gigabit Ethernet
7. LED indicators
8. Reset
9. DC power source
10. FlexRIO adapter module connector

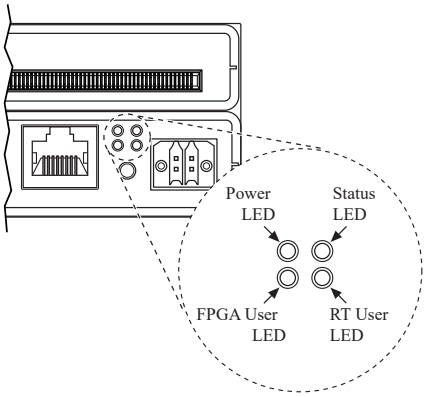
Related information:

- For more information about the NI-7931R front panel connectors, buttons, and LEDs, refer to the FlexRIO Help.

LED Indicators

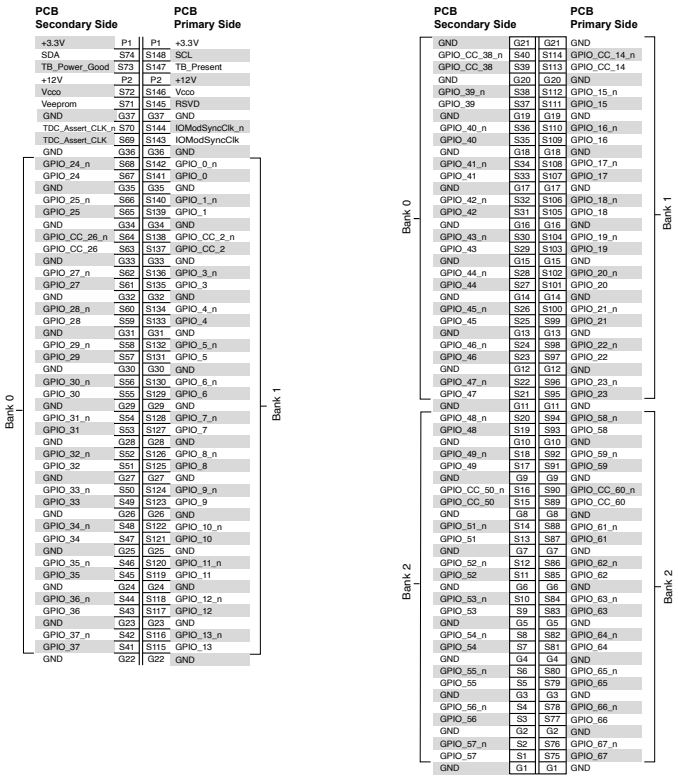
The following figure shows the NI-7931R LEDs in more detail.

Figure 4. NI-7931R LEDs



NI-7931R Module Signals

The following figure shows the available signals on the NI-7931R.



PCB Secondary Side			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	
TDC_Assert_CLK_n	S70	S144	IOModSyncClk_n	
TDC_Assert_CLK	S69	S143	IOModSyncClk	
GND	G36	G36	GND	
GPIO_24_n	S68	S142	GPIO_0_n	Bank 0
GPIO_24	S67	S141	GPIO_0	Bank 0
GND	G35	G35	GND	Bank 0
GPIO_25_n	S66	S140	GPIO_1_n	Bank 0
GPIO_25	S65	S139	GPIO_1	Bank 0
GND	G34	G34	GND	Bank 0
GPIO_CC_26_n	S64	S138	GPIO_CC_2_n	Bank 0
GPIO_CC_26	S63	S137	GPIO_CC_2	Bank 0
GND	G33	G33	GND	Bank 0
GPIO_27_n	S62	S136	GPIO_3_n	Bank 0
GPIO_27	S61	S135	GPIO_3	Bank 0
GND	G32	G32	GND	Bank 0
GPIO_28_n	S60	S134	GPIO_4_n	Bank 0
GPIO_28	S59	S133	GPIO_4	Bank 0
GND	G31	G31	GND	Bank 0
GPIO_29_n	S58	S132	GPIO_5_n	Bank 0
GPIO_29	S57	S131	GPIO_5	Bank 0
GND	G30	G30	GND	Bank 0
GPIO_30_n	S56	S130	GPIO_6_n	Bank 0
GPIO_30	S55	S129	GPIO_6	Bank 0
GND	G29	G29	GND	Bank 0
GPIO_31_n	S54	S128	GPIO_7_n	Bank 0
GPIO_31	S53	S127	GPIO_7	Bank 0
GND	G28	G28	GND	Bank 1
GPIO_32_n	S52	S126	GPIO_8_n	Bank 1
GPIO_32	S51	S125	GPIO_8	Bank 1
GND	G27	G27	GND	Bank 1
GPIO_33_n	S50	S124	GPIO_9_n	Bank 1
GPIO_33	S49	S123	GPIO_9	Bank 1
GND	G26	G26	GND	Bank 1
GPIO_34_n	S48	S122	GPIO_10_n	Bank 1
GPIO_34	S47	S121	GPIO_10	Bank 1
GND	G25	G25	GND	Bank 1
GPIO_35_n	S46	S120	GPIO_11_n	Bank 1
GPIO_35	S45	S119	GPIO_11	Bank 1
GND	G24	G24	GND	Bank 1
GPIO_36_n	S44	S118	GPIO_12_n	Bank 1
GPIO_36	S43	S117	GPIO_12	Bank 1
GND	G23	G23	GND	Bank 1
GPIO_37_n	S42	S116	GPIO_13_n	Bank 1
GPIO_37	S41	S115	GPIO_13	Bank 1
GND	G22	G22	GND	Bank 1

PCB Secondary Side			PCB Primary Side	
GND	G21	G21	GND	
GPIO_CC_38_n	S40	S114	GPIO_CC_14_n	Bank 1
GPIO_CC_38	S39	S113	GPIO_CC_14	Bank 1
GND	G20	G20	GND	Bank 1
GPIO_39_n	S38	S112	GPIO_15_n	Bank 1
GPIO_39	S37	S111	GPIO_15	Bank 1
GND	G19	G19	GND	Bank 1
GPIO_40_n	S36	S110	GPIO_16_n	Bank 1
GPIO_40	S35	S109	GPIO_16	Bank 1
GND	G18	G18	GND	Bank 1
GPIO_41_n	S34	S108	GPIO_17_n	Bank 1
GPIO_41	S33	S107	GPIO_17	Bank 1
GND	G17	G17	GND	Bank 1
GPIO_42_n	S32	S106	GPIO_18_n	Bank 1
GPIO_42	S31	S105	GPIO_18	Bank 1
GND	G16	G16	GND	Bank 1
GPIO_43_n	S30	S104	GPIO_19_n	Bank 1
GPIO_43	S29	S103	GPIO_19	Bank 1
GND	G15	G15	GND	Bank 1
GPIO_44_n	S28	S102	GPIO_20_n	Bank 1
GPIO_44	S27	S101	GPIO_20	Bank 1
GND	G14	G14	GND	Bank 1
GPIO_45_n	S26	S100	GPIO_21_n	Bank 1
GPIO_45	S25	S99	GPIO_21	Bank 1
GND	G13	G13	GND	Bank 1
GPIO_46_n	S24	S98	GPIO_22_n	Bank 1
GPIO_46	S23	S97	GPIO_22	Bank 1
GND	G12	G12	GND	Bank 1
GPIO_47_n	S22	S96	GPIO_23_n	Bank 1
GPIO_47	S21	S95	GPIO_23	Bank 1
GND	G11	G11	GND	
GPIO_48_n	S20	S94	GPIO_58_n	Bank 2
GPIO_48	S19	S93	GPIO_58	Bank 2
GND	G10	G10	GND	Bank 2
GPIO_49_n	S18	S92	GPIO_59_n	Bank 2
GPIO_49	S17	S91	GPIO_59	Bank 2
GND	G9	G9	GND	Bank 2
GPIO_CC_50_n	S16	S90	GPIO_CC_60_n	Bank 2
GPIO_CC_50	S15	S89	GPIO_CC_60	Bank 2
GND	G8	G8	GND	Bank 2
GPIO_51_n	S14	S88	GPIO_61_n	Bank 2
GPIO_51	S13	S87	GPIO_61	Bank 2
GND	G7	G7	GND	Bank 2
GPIO_52_n	S12	S86	GPIO_62_n	Bank 2
GPIO_52	S11	S85	GPIO_62	Bank 2
GND	G6	G6	GND	Bank 2
GPIO_53_n	S10	S84	GPIO_63_n	Bank 2
GPIO_53	S9	S83	GPIO_63	Bank 2
GND	G5	G5	GND	Bank 2
GPIO_54_n	S8	S82	GPIO_64_n	Bank 2
GPIO_54	S7	S81	GPIO_64	Bank 2
GND	G4	G4	GND	Bank 2
GPIO_55_n	S6	S80	GPIO_65_n	Bank 2
GPIO_55	S5	S79	GPIO_65	Bank 2
GND	G3	G3	GND	Bank 2
GPIO_56_n	S4	S78	GPIO_66_n	Bank 2
GPIO_56	S3	S77	GPIO_66	Bank 2
GND	G2	G2	GND	Bank 2
GPIO_57_n	S2	S76	GPIO_67_n	Bank 2
GPIO_57	S1	S75	GPIO_67	Bank 2
GND	G1	G1	GND	

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.

Visit ni.com/register to register your NI product. Product registration facilitates technical support and ensures that you receive important information updates from NI.

NI corporate headquarters is located at 11500 N Mopac Expwy, Austin, TX, 78759-3504, USA.

Where to Go Next

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