

GETTING STARTED GUIDE

NI USRP™ -29xx

This document explains how to install, configure, and set up the National Instruments Universal Software Radio Peripheral (USRP) 2920, 2921, 2922, 2930, or 2932 (NI 29xx) device. The NI USRP-29xx is a software-defined radio (SDR), which can send and receive signals for use in communications applications. This device ships with the NI-USRP instrument driver, which you can use to program the device.

For more information about device features, programming, and examples, refer to the *NI-USRP Help* at **Start»All Programs»National Instruments»NI-USRP»Documentation»NI-USRP Help**. Individual device specifications are available at **Start»All Programs»National Instruments»NI-USRP»Documentation»Specifications**.

For the most current versions of product documents, visit ni.com/manuals. For the latest version of NI-USRP driver software, visit ni.com/updates.

Quick Start Steps

The following steps are an overview of the NI USRP-29xx getting started process. Follow these steps to use the NI USRP-29xx *after* you install LabVIEW on your computer:

1. **Install the NI USRP Software Suite DVD.** The software suite adds the following items to your LabVIEW installation: the NI-USRP driver, LabVIEW Modulation Toolkit, LabVIEW MathScript RT Module, and LabVIEW Digital Filter Design Toolkit. For more information, refer to section [4. Installing the Software](#) on page 5.
2. **Connect the Device.** Attach the antenna or cable to the front of the NI USRP-29xx device. Connect the device directly to your computer with the enclosed Ethernet cable and connect the power. For more information, refer to section [5. Installing and Configuring the Hardware](#) on page 6.
3. **Change the IP address of your 1 Gigabit Ethernet Port to a static IP.** NI recommends a static IP address of 192.168.10.1 because NI USRP-29xx devices have a default address of 192.168.10.2. For more information, refer to section [5. Installing and Configuring the Hardware](#) on page 6.
4. **Run an example.** Examples are located in LabVIEW. Navigate to the **Functions** Palette and select **Start»All Programs»National Instruments»NI-USRP»Examples**. For more information, refer to section [6. Programming the NI 29xx](#) on page 11.
5. **Update the firmware using the NI-USRP Configuration Utility.** Select **Start»All Programs»NI-USRP»NI-USRP Configuration Utility** to open the NI-USRP Configuration Utility. For more information, refer to section [7: Updating Device Firmware and FPGA Images](#) on page 12.

If you have trouble with any of these steps, refer to the detailed sections of this guide or the video at ni.com/usrp/gettingstarted/.

Electromagnetic Compatibility Guidelines

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

This product is intended for use in industrial locations. There is no guarantee that harmful interference will not occur in a particular installation, when the product is connected to a test object, or if the product is used in residential areas. To minimize the potential for the product to cause interference to radio and television reception or to experience 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.



Caution The protection provided by the NI USRP-29xx can be impaired if it is used in a manner not described in this document.

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1. Verifying the System Requirements

To use the NI-USRP instrument driver, the system must meet certain requirements. For more information about minimum system requirements, recommended system, and supported application development environments (ADEs), refer to the *NI-USRP Readme*, which is available on the on the NI-USRP software media.



Note Prior to installation, you can access the *NI-USRP Readme* online at ni.com/updates. After you install NI-USRP, you can access the *NI-USRP Readme* at **Start»All Programs»National Instruments»NI-USRP»Documentation**.

2. Unpacking

The device ships in an antistatic package to prevent damage from electrostatic discharge (ESD). ESD can damage several components of the device. Store the device in the antistatic package when not in use.



Caution *Never* touch the exposed pins of connectors.

To avoid ESD damage when handling the device, take the following precautions:

- Ground yourself with a grounding strap or by touching a grounded object.
- Touch the antistatic package to a metal part of your computer chassis before removing the device from the package.

Remove the device from the package and inspect it for loose components or any sign of damage. Notify NI if the device appears damaged in any way. Do not install a damaged device.

3. Verifying the Kit Contents

Verify that the kit contains the following items required to set up and use the device:

- Driver software media—Installs the NI-USRP driver software and electronic documentation, including the *NI-USRP Help*, the *NI-USRP Readme*, and device specifications. After installation, you can find these documents at **Start»All Programs»National Instruments»NI-USRP»Documentation**.
- NI 29xx device
- AC/DC power supply and power cable
- Shielded Ethernet cable
- SMA (m)-to-SMA (m) cable



Caution If you connect a signal generator to your device, or connect multiple USRP devices to each other, you must connect a 30 dB attenuator to the RF input (RX1 or RX2) of each receiving USRP device.

- 30 dB SMA attenuator
- NI USRP-29xx Getting Started Guide* (this document)

Other Required Items

In addition to the kit contents, you must provide the following additional items:

- Computer with available gigabit Ethernet interface
- LabVIEW 2009, 2010, 2011, or later
- One or more of the recommended antennae shown in the following table.

Device	Antenna	NI Part Number
NI USRP-2920/2922/2930	VERT 400—144 MHz, 400 MHz, and 1,200 MHz tri-band vertical antenna	781915-01
NI USRP-2921/2922/2932	VERT 2450—2.4 GHz to 2.48 GHz and 4.9 GHz to 5.9 GHz dual-band vertical antenna	781913-01

Optional Items

- LabVIEW Modulation Toolkit (MT), included on the NI-USRP instrument driver software media, which includes MT VIs and functions, examples, and documentation



Note You must install the LabVIEW Modulation Toolkit for proper operation of the NI-USRP Modulation Toolkit example VIs.

- LabVIEW Digital Filter Design Toolkit, included on the NI-USRP instrument driver software media
- LabVIEW MathScript RT Module, included on the NI-USRP instrument driver software media
- NI USRP-29xx MIMO sync and data transfer cable, NI part number 781916-01, to synchronize clock sources
- Additional SMA (m)-to-SMA (m) cables to connect both channels with external devices under test (DUTs) or to use the REF IN and PPS IN signals

4. Installing the Software

You *must* install all the software you plan to use with the device before installing the device.

1. Install the latest service packs for your operating system.
2. Verify that LabVIEW is installed on your system.
3. Insert the NI-USRP media into the DVD drive and follow the instructions in the installation window.



Note If the installation window does not appear, navigate to the DVD drive, double-click the drive, and double-click `setup.exe`.

4. (Optional) Install the LabVIEW Modulation Toolkit (available on the driver software media) and other modules or toolkits you plan to use with the device.
5. Follow the instructions in the installation prompts. For troubleshooting information, contact NI technical support or visit ni.com/support.

(Windows 7/Vista) Users may see access and security messages during installation. Accept the prompts to complete the installation.

6. When the installer completes, if a dialog box asks if you want to restart, shut down, or restart later, select **Restart**.

5. Installing and Configuring the Hardware

Install all the software you plan to use with the hardware before installing the hardware. The device connects to a host computer using a standard gigabit Ethernet interface. Refer to the documentation for your gigabit Ethernet interface for installation and configuration instructions.

Installing NI 29xx Devices

1. Use the Ethernet cable to connect the device to the computer. For maximum throughput, NI recommends that you connect each device to its own dedicated gigabit Ethernet interface on the host computer.
2. Connect the AC/DC power supply to the device.
3. Plug the power supply into a wall outlet. Windows automatically recognizes the new device.

For device front panel diagrams and connector descriptions, refer to [Appendix A: Front Panels, Backplanes, and Connectors](#). Device specifications are available at **Start»All Programs»National Instruments»NI-USRP»Documentation»Specifications**.

Setting Up the Network

The device communicates with a host computer over gigabit Ethernet. Set up the network to enable communication with the device.



Note The IP addresses for the computer and each connected USRP device must be unique.

Refer to the [Configuring Multiple Devices](#) section for information about connecting multiple devices.

Default IP Address

The default IP address for the NI 29xx is 192 . 168 . 10 . 2. You must configure the host Ethernet interface with a static IP address on the same subnet as the connected device to enable communication, as shown in the following table.

Component	Address
Host Ethernet interface static IP address	192 . 168 . 10 . 1
Host Ethernet interface subnet mask	255 . 255 . 255 . 0
Default USRP device IP address	192 . 168 . 10 . 2



Note NI-USRP uses user datagram protocol (UDP) broadcast packets to locate the device. On some systems, the firewall blocks UDP broadcast packets. NI recommends that you change or disable the firewall settings to allow communication with the device.

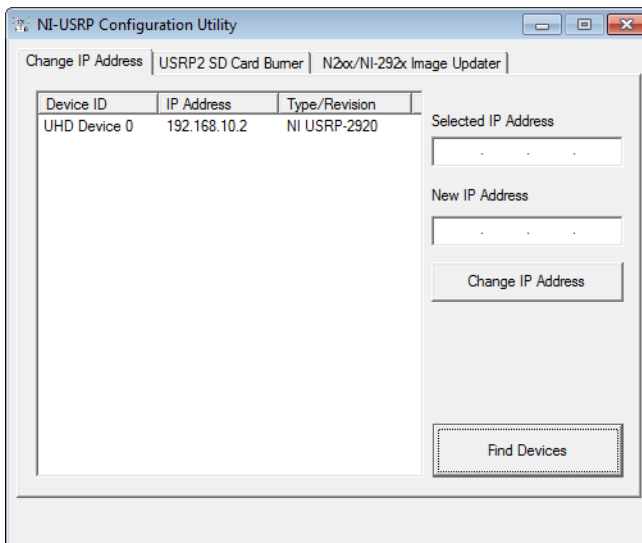


Tip Make sure the host computer is using a static IP address. You may need to modify the network settings for the local area connection using the Control Panel on the host computer. Specify the static IP address in the **Properties** page for Internet Protocol Version 4 (TCP/IPv4).

Confirming Network Connection

1. Select **Start»All Programs»National Instruments»NI-USRP»NI-USRP Configuration Utility** to open the NI-USRP Configuration Utility.
2. Select the **Change IP Address** tab of the utility. Your device should appear in the list on the left side of the tab, similar to Figure 1.

Figure 1. Confirm Network Connection



Note If your device is not listed, verify that your device is powered on and correctly connected, then click the **Find Devices** button to scan for USRP devices. Your device should appear in the list on the left side of the tab. If the NI-USRP Configuration

Utility does not return a listing for your device, refer to [Appendix B: Network Troubleshooting](#) for information about troubleshooting the network connection.

Configuring Multiple Devices

You can connect multiple devices in the following ways:

- Multiple Ethernet interfaces—One device for each interface
- Single Ethernet interface—One device connected to the interface, with additional devices connected using an optional MIMO cable
- Single Ethernet interface—Multiple devices connected to an unmanaged switch



Tip Sharing a single gigabit Ethernet interface among devices may reduce overall signal throughput. For maximum signal throughput, NI recommends that you connect no more than one device per Ethernet interface.

Multiple Host Ethernet Interfaces

To configure multiple devices connected to separate gigabit Ethernet interfaces, assign each Ethernet interface a separate subnet, and assign the corresponding device an address in that subnet, as shown in the following table.

Table 1. Multiple Host Ethernet Interface Configuration

Device	Host IP Address	Host Subnet Mask	Device IP Address
USRP Device 0	192.168.10.1	255.255.255.0	192.168.10.2
USRP Device 1	192.168.11.1	255.255.255.0	192.168.11.2

Single Host Ethernet Interface—MIMO

You can configure multiple devices using a single host Ethernet interface when the devices are connected to each other using a MIMO cable. Assign each device a separate IP address in the subnet of the host Ethernet interface, as shown in the following table. Connect Device 0 to the Ethernet interface and connect Device 1 to Device 0 using a MIMO cable.

Table 2. Single Host Ethernet Interface—MIMO Configuration

Device	Host IP Address	Host Subnet Mask	Device IP Address
USRP Device 0	192.168.10.1	255.255.255.0	192.168.10.2
USRP Device 1	192.168.10.1	255.255.255.0	192.168.10.3

Single Host Ethernet Interface—Unmanaged Switch

You can connect multiple USRP devices to a host computer through an unmanaged gigabit Ethernet switch that allows a single gigabit Ethernet adapter on the computer to interface with

multiple USRP devices connected to the switch. Assign the host Ethernet interface a subnet, and assign each device an address in that subnet, as shown in the following table.

Table 3. Single Host Ethernet Interface—Unmanaged Switch Configuration

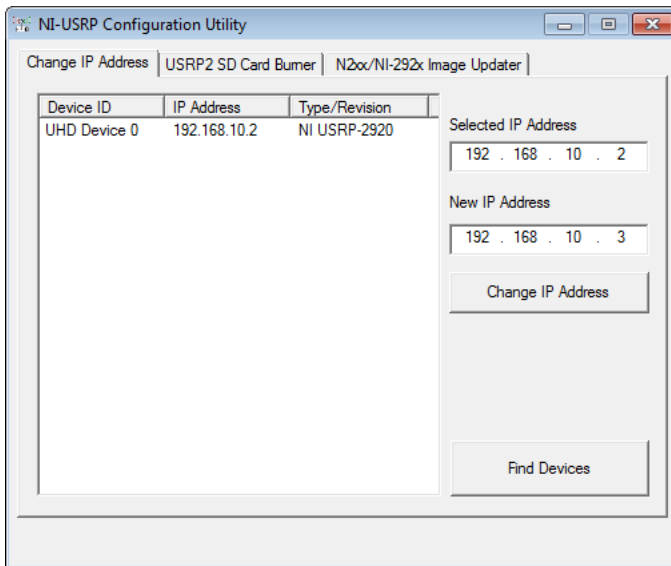
Device	Host IP Address	Host Subnet Mask	Device IP Address
USRP Device 0	192.168.10.1	255.255.255.0	192.168.10.2
USRP Device 1	192.168.10.1	255.255.255.0	192.168.10.3

Changing the IP Address

To change the NI 29xx device IP address, you must know the current address of the device, and you must configure the network as described in the [Default IP Address](#) section.

1. Verify that your device is powered on and connected to your computer using the gigabit Ethernet interface.
2. Select **Start»All Programs»National Instruments»NI-USRP»NI-USRP Configuration Utility** to open the NI-USRP Configuration Utility.
3. Select the **Change IP Address** tab of the utility. Your device should appear in the list on the left side of the tab. If your device is not listed, refer to the [Confirming Network Connection](#) section.
4. In the list, select the device for which you want to change the IP address. The IP address of the device you selected displays in the **Selected IP Address** textbox. If you have multiple devices, verify that you selected the correct device.
5. Enter the new IP address for the device in the **New IP Address** textbox. The utility should appear similar to Figure 2.

Figure 2. Specify New IP Address



6. Click the **Change IP Address** button or press <Enter> to change the IP address.
7. The utility prompts you to confirm your selection. Click **OK** if your selection is correct; otherwise, click **Cancel**.

- The utility displays a confirmation to indicate the process is complete. Click **OK**.

Figure 3. IP Address Changed



- Power cycle the device to apply the changes.



Note After you change the IP address, you must power cycle the device and click **Find Devices** in the utility to update the list of devices.

6. Programming the NI 29xx

Use the NI-USRP instrument driver to create communications applications for the NI 29xx.

NI-USRP Instrument Driver

NI-USRP features a set of VIs and properties that exercise the functionality of the NI 29xx, including configuration, control, and other device-specific functions. Refer to the *NI-USRP Help* for information about using the instrument driver in your applications.

NI-USRP Examples

The instrument driver examples are instructional tools that demonstrate some of the functionality of the NI 29xx. You can use these examples separately or integrate them into your systems. NI-USRP includes examples for getting started and other SDR functionality. You can access NI-USRP examples at **Start»All Programs»National Instruments»NI-USRP»Examples** or from the LabVIEW functions palette at **Instrument I/O»Instrument Drivers»NI-USRP»Examples**. Additional examples are available at ni.com/usrp.



Note The NI Example Finder does not include NI-USRP examples.

7: Updating Device Firmware and FPGA Images

USRP devices contain firmware and FPGA images that provide compatibility with driver software. The NI 29xx devices ship with firmware and FPGA images compatible with NI-USRP driver software. You may need to update the device for compatibility with the latest version of the software.

To use NI-USRP with Ettus Research USRP N2xx and USRP2 devices, you may need to update the device firmware and FPGA images. If you have used the USRP N2xx and USRP2 devices with GNU Radio, you may not have compatible images. Refer to www.ettus.com for more information about Ettus Research devices.

NI-USRP includes compatible firmware and FPGA images for USRP devices. The driver software media also includes the NI-USRP Configuration Utility, which you can use to update the devices. Refer to the following sections for instructions to update the NI 29xx/USRP N2xx and USRP2 devices for compatibility with NI-USRP.

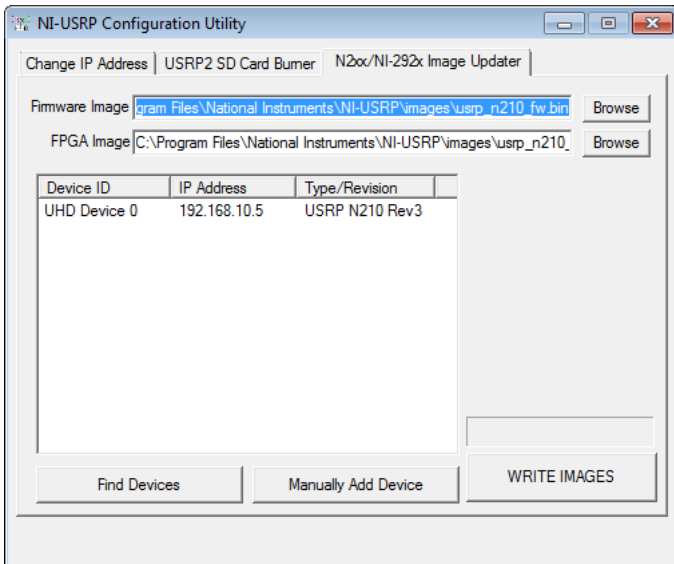
Updating USRP N2xx/NI 29xx Firmware and FPGA Images

The firmware and FPGA images for the USRP N2xx and NI 29xx devices are stored in the device internal memory. You can program the device over the network to update or change the firmware and FPGA images.

1. Verify that the host Ethernet interface is configured as specified in section [5. *Installing and Configuring the Hardware*](#).
2. Select **Start»All Programs»National Instruments»NI-USRP»NI-USRP Configuration Utility** to open the NI-USRP Configuration Utility.
3. Select the **N2xx/NI-29xx Image Updater** tab. The utility should automatically populate the **Firmware Image** and **FPGA Image** fields with the paths to the default firmware and FPGA image files. If you want to use different files, click the **Browse** button next to the file you want to change, and navigate to the file you want to use.

- The utility updates the firmware and FPGA images in a single operation. Verify that the firmware and FPGA image paths are entered correctly. The utility should appear similar to Figure 4.

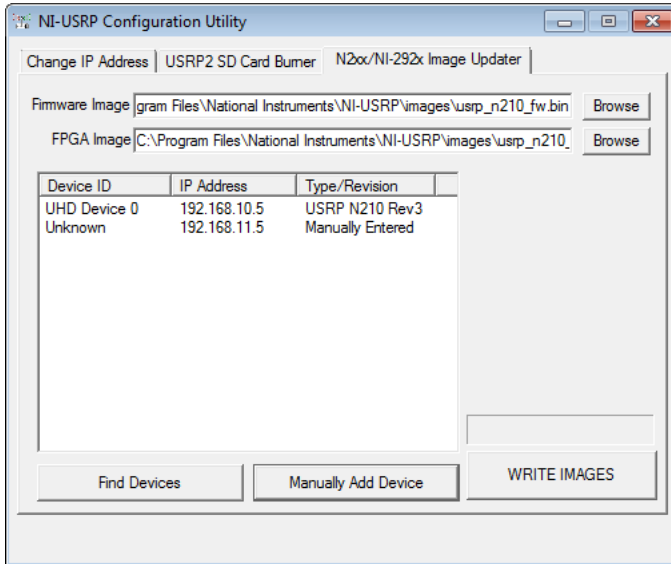
Figure 4. N2xx/NI-29xx Image Updater



5. Click the **Find Devices** button to scan for USRP devices and update the device list. If your device does not appear in the list, verify that the device is on and correctly connected to the computer.

If your device still does not appear in the list, you can manually add the device to the list. Click the **Manually Add Device** button, enter the IP address of the device in the dialog box that displays, and click **OK**. The manually added device appears in the device list, similar to Figure 5.

Figure 5. Manually Added Device



6. Select the device to update from the device list, and verify that you selected the correct device.
7. Verify that the version of the FPGA image file matches the board revision for the device you are updating. On Ettus devices, locate the board revision on a label on the back of the device.
8. To update the device, click the **WRITE IMAGES** button.
9. A confirmation dialog box displays. Confirm your selections, and click **OK** to continue.
10. A progress bar indicates the status of the update.
11. When the update completes, a dialog box prompts you to reset the device. A device reset applies the new images to the device. Click **OK** to reset the device.



Note The utility is unresponsive while it verifies that the device reset correctly.

12. Close the utility.

13. Verify that the D LED is lit on the device front panel to confirm that the firmware and FPGA images loaded successfully.

Refer to the *Load the images onto the on-board flash (USRP-N Series only)* section of the *UHD - USRP2 and N Series Application Notes* at files.ettus.com/uhd_docs/manual/html/usrp2.html for more information about updating the USRP N2xx device firmware and FPGA images.

Updating USRP2 Firmware and FPGA Images

The firmware and FPGA images for the USRP2 device are stored on a secure digital (SD) card. After you power on the USRP2, the device loads firmware and FPGA images from the SD card plugged into the SD card slot.



Note NI recommends you use the SD card that shipped with the USRP2 device. Compatibility issues may result if you use a third-party SD card. However, the following SD cards are compatible:

- Patriot Signature 2 GB SD Flash Card Model PSF2G40SD
- Kingston 2 GB SD Flash Card W/E Tail Clamshell Model SD/2GBET



Note To update the USRP2 device firmware and FPGA images, you need an SD card interface with read/write capability, such as the IOGEAR GFR281.

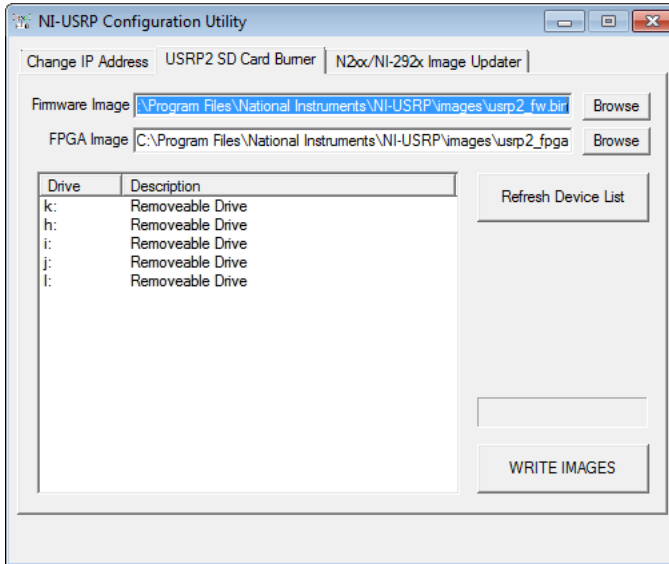


Caution If the SD card interface prompts you to format the disk, click **Cancel**. Do not format the disk.

1. Verify that the host Ethernet interface is configured as specified in section 5. *Installing and Configuring the Hardware*.
2. Insert the SD card from your device in the SD card interface connected to your system.
3. Select **Start»All Programs»National Instruments»NI-USRP»NI-USRP Configuration Utility** to open the NI-USRP Configuration Utility.
4. Select the **USRP2 SD Card Burner** tab. The utility should automatically populate the **Firmware Image** and **FPGA Image** fields with the paths to the default firmware and FPGA image files. If you want to use different files, click the **Browse** button next to the file you want to change, and navigate to the file you want to use.

5. Verify that the firmware and FPGA image paths are entered correctly, as the utility updates both files in the same operation. The utility should appear similar to Figure 6.

Figure 6. USRP2 SD Card Burner



6. Click the **Refresh Device List** button, and select the drive letter that corresponds to the SD card interface connected to your computer. If the drive letter for the SD card interface does not appear in the list, verify that the SD card interface appears in My Computer and the SD card is inserted in the SD card interface.



Caution Ensure that you select the correct drive letter to update.

7. Click the **WRITE IMAGES** button or press <Enter> to write the firmware and images to your SD card. A progress bar indicates the status of the update.
8. A dialog box displays to indicate the completion of the update.
9. Click **OK** to close the dialog box.
10. Close the utility.
11. Return the SD card to the USRP2 device.
12. Power cycle the USRP2 device.
13. Verify that the D LED is lit on the device front panel to confirm that the firmware and FPGA images loaded successfully.

Appendix A: Front Panels, Backplanes, and Connectors

NI USRP-2920

Figure 7. NI USRP-2920 Front Panel

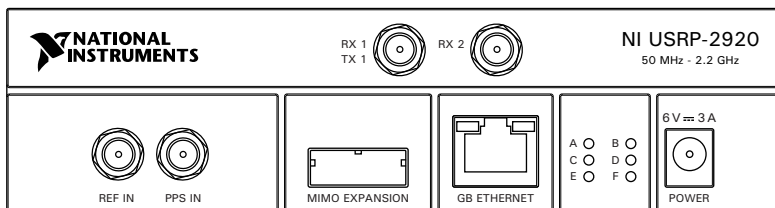


Table 4. NI USRP-2920 Module Front Panel Connectors

Connector	Use
RX1 TX1	RF signal input and output terminal. RX1 TX1 is an SMA (f) connector with an impedance of 50 Ω and is a single-ended input or output channel.
RX2	RF signal input terminal. RX2 is an SMA (f) connector with an impedance of 50 Ω and is a single-ended input channel.
REF IN	Input terminal for an external reference signal for the local oscillator (LO). REF IN is an SMA (f) connector with an impedance of 50 Ω and is a single-ended reference input. REF IN accepts a 10 MHz signal with a minimum input power of 0 dBm (.632 V) and a maximum input power of 15 dBm (3.56 V) for a square wave or sine wave.
PPS IN	Pulse per second (PPS) timing reference input terminal. PPS IN is an SMA (f) connector with an impedance of 50 Ω and is a single-ended input. PPS IN accepts 0 V to 3.3 V TTL and 0 V to 5 V TTL signals.
MIMO EXPANSION	The multiple-input, multiple-output (MIMO) EXPANSION interface port connects two USRP devices using a compatible MIMO cable.
GB ETHERNET	The gigabit Ethernet port accepts an RJ-45 connector (Category 5, Category 5e, or Category 6).
POWER	The power input accepts a 6 V, 3 A external DC power connector.

Table 5. NI USRP-2920 Module LEDs

LED	Indication
A	Indicates the transmit status of the NI USRP-2920 module: OFF—The module is not transmitting data. GREEN—The module is transmitting data.
B	Indicates the status of the physical MIMO cable link: OFF—The modules are not connected using the MIMO cable. GREEN—The modules are connected using the MIMO cable.
C	Indicates the receive status of the NI USRP-2920 module: OFF—The module is not receiving data. GREEN—The module is receiving data.
D	Indicates the firmware status of the NI USRP-2920 module: OFF—The firmware is not loaded. GREEN—The firmware is loaded.
E	Indicates the reference lock status of the local oscillator (LO) on the NI USRP-2920 module: OFF—There is no reference signal, or the LO is not locked to a reference signal. BLINKING—The LO is not locked to a reference signal. GREEN—The LO is locked to a reference signal.
F	Indicates the power status of the NI USRP-2920 module: OFF—The module is powered off. GREEN—The module is powered on.

Figure 8. NI-2921 Front Panel

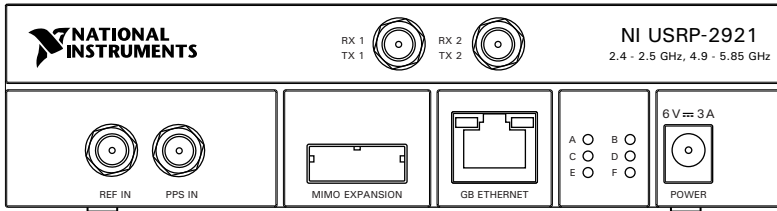


Table 6. NI USRP-2921 Module Front Panel Connectors

Connector	Use
RX1 TX1	RF signal input and output terminal. RX1 TX1 is an SMA (f) connector with an impedance of 50 Ω and is a single-ended input or output channel.
RX2 TX2	RF signal input and output terminal. RX2 is an SMA (f) connector with an impedance of 50 Ω and is a single-ended input or output channel.
REF IN	Input terminal for an external reference signal for the local oscillator (LO). REF IN is an SMA (f) connector with an impedance of 50 Ω and is a single-ended reference input. REF IN accepts a 10 MHz signal with a minimum input power of 0 dBm (.632 V) and a maximum input power of 15 dBm (3.56 V) for a square wave or sine wave.
PPS IN	Pulse per second (PPS) timing reference input terminal. PPS IN is an SMA (f) connector with an impedance of 50 Ω and is a single-ended input. PPS IN accepts 0 V to 3.3 V TTL and 0 V to 5 V TTL signals.
MIMO EXPANSION	The multiple-input, multiple-output (MIMO) EXPANSION interface port connects two USRP devices using a compatible MIMO cable.
GB ETHERNET	The gigabit Ethernet port accepts an RJ-45 connector (Category 5, Category 5e, or Category 6).
POWER	The power input accepts a 6 V, 3 A external DC power connector.

Table 7. NI USRP-2921 Module LEDs

LED	Indication
A	Indicates the transmit status of the NI USRP-2921 module: OFF—The module is not transmitting data. GREEN—The module is transmitting data.
B	Indicates the status of the physical MIMO cable link: OFF—The modules are not connected using the MIMO cable. GREEN—The modules are connected using the MIMO cable.
C	Indicates the receive status of the NI USRP-2921 module: OFF—The module is not receiving data. GREEN—The module is receiving data.
D	Indicates the firmware status of the NI USRP-2921 module: OFF—The firmware is not loaded. GREEN—The firmware is loaded.
E	Indicates the reference lock status of the local oscillator (LO) on the NI USRP-2921 module: OFF—There is no reference signal, or the LO is not locked to a reference signal. BLINKING—The LO is not locked to a reference signal. GREEN—The LO is locked to a reference signal.
F	Indicates the power status of the NI USRP-2921 module: OFF—The module is powered off. GREEN—The module is powered on.

Figure 9. NI USRP-2922 Front Panel

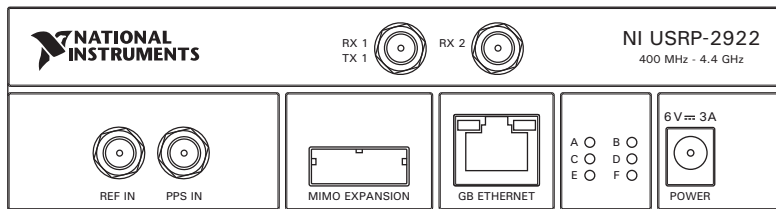


Table 8. NI USRP-2922 Module Front Panel Connectors

Connector	Use
RX1 TX1	RF signal input and output terminal. RX1 TX1 is an SMA (f) connector with an impedance of 50 Ω and is a single-ended input or output channel.
RX2	RF signal input terminal. RX2 is an SMA (f) connector with an impedance of 50 Ω and is a single-ended input channel.
REF IN	Input terminal for an external reference signal for the local oscillator (LO). REF IN is an SMA (f) connector with an impedance of 50 Ω and is a single-ended reference input. REF IN accepts a 10 MHz signal with a minimum input power of 0 dBm (.632 V) and a maximum input power of 15 dBm (3.56 V) for a square wave or sine wave.
PPS IN	Pulse per second (PPS) timing reference input terminal. PPS IN is an SMA (f) connector with an impedance of 50 Ω and is a single-ended input. PPS IN accepts 0 V to 3.3 V TTL and 0 V to 5 V TTL signals.
MIMO EXPANSION	The multiple-input, multiple-output (MIMO) EXPANSION interface port connects two USRP devices using a compatible MIMO cable.
GB ETHERNET	The gigabit Ethernet port accepts an RJ-45 connector (Category 5, Category 5e, or Category 6).
POWER	The power input accepts a 6 V, 3 A external DC power connector.

Table 9. NI USRP-2922 Module LEDs

LED	Indication
A	Indicates the transmit status of the NI USRP-2922 module: OFF—The module is not transmitting data. GREEN—The module is transmitting data.
B	Indicates the status of the physical MIMO cable link: OFF—The modules are not connected using the MIMO cable. GREEN—The modules are connected using the MIMO cable.
C	Indicates the receive status of the NI USRP-2922 module: OFF—The module is not receiving data. GREEN—The module is receiving data.
D	Indicates the firmware status of the NI USRP-2922 module: OFF—The firmware is not loaded. GREEN—The firmware is loaded.
E	Indicates the reference lock status of the local oscillator (LO) on the NI USRP-2922 module: OFF—There is no reference signal, or the LO is not locked to a reference signal. BLINKING—The LO is not locked to a reference signal. GREEN—The LO is locked to a reference signal.
F	Indicates the power status of the NI USRP-2922 module: OFF—The module is powered off. GREEN—The module is powered on.

Figure 10. NI USRP-2930 Front Panel

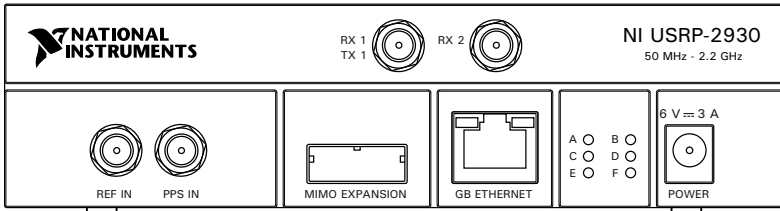


Table 10. NI USRP-2930 Module Front Panel Connectors

Connector	Use
RX1 TX1	RF signal input and output terminal. RX1 TX1 is an SMA (f) connector with an impedance of 50 Ω and is a single-ended input or output channel.
RX2	RF signal input terminal. RX2 is an SMA (f) connector with an impedance of 50 Ω and is a single-ended input channel.
REF IN	Input terminal for an external reference signal for the local oscillator (LO). REF IN is an SMA (f) connector with an impedance of 50 Ω and is a single-ended reference input. REF IN accepts a 10 MHz signal with a minimum input power of 0 dBm (.632 V) and a maximum input power of 15 dBm (3.56 V) for a square wave or sine wave.
PPS IN	Pulse per second (PPS) timing reference input terminal. PPS IN is an SMA (f) connector with an impedance of 50 Ω and is a single-ended input. PPS IN accepts 0 V to 3.3 V TTL and 0 V to 5 V TTL signals.
MIMO EXPANSION	The multiple-input, multiple-output (MIMO) EXPANSION interface port connects two USRP devices using a compatible MIMO cable.
GB ETHERNET	The gigabit Ethernet port accepts an RJ-45 connector (Category 5, Category 5e, or Category 6).
POWER	The power input accepts a 6 V, 3 A external DC power connector.

Table 11. NI USRP-2930 Module LEDs

LED	Indication
A	Indicates the transmit status of the NI USRP-2930 module: OFF—The module is not transmitting data. GREEN—The module is transmitting data.
B	Indicates the status of the physical MIMO cable link: OFF—The modules are not connected using the MIMO cable. GREEN—The modules are connected using the MIMO cable.
C	Indicates the receive status of the NI USRP-2930 module: OFF—The module is not receiving data. GREEN—The module is receiving data.
D	Indicates the firmware status of the NI USRP-2930 module: OFF—The firmware is not loaded. GREEN—The firmware is loaded.
E	Indicates the reference lock status of the local oscillator (LO) on the NI USRP-2930 module: OFF—There is no reference signal, or the LO is not locked to a reference signal. BLINKING—The LO is not locked to a reference signal. GREEN—The LO is locked to a reference signal.
F	Indicates the power status of the NI USRP-2930 module: OFF—The module is powered off. GREEN—The module is powered on.

Figure 11. NI USRP-2930 Backplane

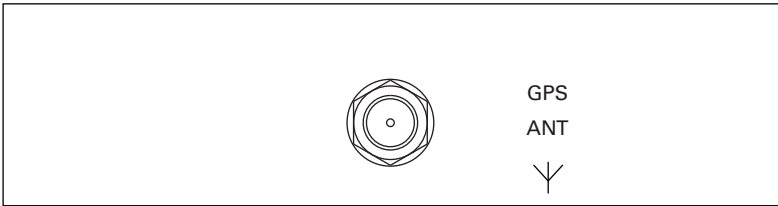


Table 12. NI USRP-2930 Module Backplane Connector

Connector	Use
GPS ANT	Input terminal for the GPS antenna signal SMA (f) with 50 Ω impedance.

Figure 12. NI USRP-2932 Front Panel

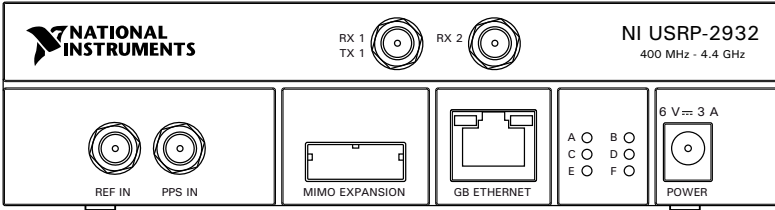


Table 13. NI USRP-2932 Module Front Panel Connectors

Connector	Use
RX1 TX1	RF signal input and output terminal. RX1 TX1 is an SMA (f) connector with an impedance of 50 Ω and is a single-ended input or output channel.
RX2	RF signal input terminal. RX2 is an SMA (f) connector with an impedance of 50 Ω and is a single-ended input channel.
REF IN	Input terminal for an external reference signal for the local oscillator (LO). REF IN is an SMA (f) connector with an impedance of 50 Ω and is a single-ended reference input. REF IN accepts a 10 MHz signal with a minimum input power of 0 dBm (.632 V) and a maximum input power of 15 dBm (3.56 V) for a square wave or sine wave.
PPS IN	Pulse per second (PPS) timing reference input terminal. PPS IN is an SMA (f) connector with an impedance of 50 Ω and is a single-ended input. PPS IN accepts 0 V to 3.3 V TTL and 0 V to 5 V TTL signals.
MIMO EXPANSION	The multiple-input, multiple-output (MIMO) EXPANSION interface port connects two USRP devices using a compatible MIMO cable.
GB ETHERNET	The gigabit Ethernet port accepts an RJ-45 connector (Category 5, Category 5e, or Category 6).
POWER	The power input accepts a 6 V, 3 A external DC power connector.

Table 14. NI USRP-2932 Module LEDs

LED	Indication
A	Indicates the transmit status of the NI USRP-2932 module: OFF—The module is not transmitting data. GREEN—The module is transmitting data.
B	Indicates the status of the physical MIMO cable link: OFF—The modules are not connected using the MIMO cable. GREEN—The modules are connected using the MIMO cable.
C	Indicates the receive status of the NI USRP-2932 module: OFF—The module is not receiving data. GREEN—The module is receiving data.
D	Indicates the firmware status of the NI USRP-2932 module: OFF—The firmware is not loaded. GREEN—The firmware is loaded.
E	Indicates the reference lock status of the local oscillator (LO) on the NI USRP-2932 module: OFF—There is no reference signal, or the LO is not locked to a reference signal. BLINKING—The LO is not locked to a reference signal. GREEN—The LO is locked to a reference signal.
F	Indicates the power status of the NI USRP-2932 module: OFF—The module is powered off. GREEN—The module is powered on.

Figure 13. NI USRP-2932 Backplane

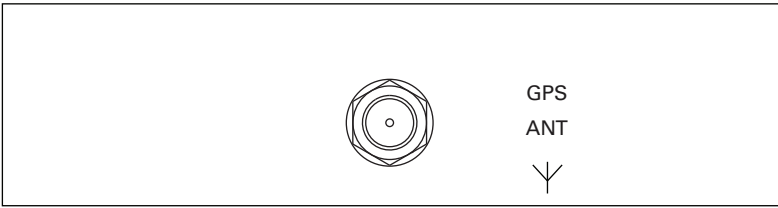


Table 15. NI USRP-2932 Module Backplane Connector

Connector	Use
GPS ANT	Input terminal for the GPS antenna signal SMA (f) with 50 Ω impedance.

Appendix B: Network Troubleshooting

The Device Does Not Connect to the Host Ethernet Interface

The host Ethernet interface must be a gigabit Ethernet interface to connect to the USRP device. Ensure the connection between the host network interface card and the device cable connection is valid and both the device and computer are powered on. A lit green LED in the upper left corner of the gigabit Ethernet connection port on the device front panel indicates a gigabit Ethernet connection.

The Device Does Not Respond to a Ping (ICMP Echo Request)

The device should reply to an internet control message protocol (ICMP) echo request. Open a Windows command prompt and enter `ping 192.168.10.2`, where `192.168.10.2` is the IP address for your USRP device, to ping the device. If you do not receive a response, verify that the host network interface card is set to a static IP address corresponding to the same subnet as the IP address of the corresponding device. Also verify that the device IP address is set as described in the [Changing the IP Address](#) section.

The NI-USRP Configuration Utility Does Not Return a Listing for My Device

If the NI-USRP Configuration Utility does not return a listing for your device, search for a specific IP address.

1. Navigate to `Program Files\National Instruments\NI-USRP\`.
2. <Shift>-right-click the `utilities` folder, and select **Open command window here** from the shortcut menu to open a Windows command prompt.
3. Enter `uhd_find_devices --args=addr=192.168.10.2` in the command prompt, where `192.168.10.2` is the IP address for your USRP device.
4. Press <Enter>. If the `uhd_find_devices` command does not return the listing for your device, the firewall may be blocking replies to UDP broadcast packets. Windows installs and enables a firewall by default. To allow UDP communication with a device, disable any firewall software associated with the network interface for the device.

The Device IP Address Does Not Reset to the Default

If you cannot reset the default device IP address as described in the [Changing the IP Address](#) section, your device may be on a different subnet than the host network adapter. You can power cycle the device in a safe (read-only) image, which sets the device to the default IP address of `192.168.10.2`.

1. Open the device enclosure, making sure to take appropriate static precautions.
2. Locate the safe-mode button, a push-button switch (S2), inside the enclosure.
3. Press and hold the safe-mode button while you power cycle the device.

4. Continue to press the safe-mode button until the front-panel LEDs blink and remain solid.
5. While in safe-mode, run the NI USRP Configuration Utility to change the IP address from the default, 192 . 168 . 10 . 2, to a new value, as described in the [Changing the IP Address](#) section.
6. Power cycle the device without holding the safe-mode button to return to normal mode.



Note NI recommends that you use a dedicated network with no other USRP devices connected to the host computer to avoid the possibility of an IP address conflict. Also, verify that the static IP address of the host network adapter on the computer that runs the NI USRP Configuration Utility is different from the device default IP address of 192 . 168 . 10 . 2 and different from the new IP address to which you want to set the device.



Note If the device IP address is on a different subnet from the host network adapter, the host system and configuration utility cannot communicate with and configure the device. For example, the utility recognizes, but cannot configure a device with an IP address of 192 . 168 . 11 . 2 connected to a host network adaptor with a static IP address of 192 . 168 . 10 . 1 and a subnet mask of 255 . 255 . 255 . 0. To communicate with and configure the device, change the host network adaptor to a static IP address on the same subnet as the device, such as 192 . 168 . 11 . 1, or change the subnet mask of the host network adapter to recognize a wider range of IP addresses, such as 255 . 255 . 0 . 0.

Appendix C: Compliance and Certifications

Safety

This product is designed to meet the requirements of the following electrical equipment safety standards for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UIL 61010-1, CSA 61010-1



Note For UL and other safety certifications, refer to the product label or the [Online Product Certification](#) section.

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

- EN 61326-1 (IEC 61326-1): Class A emissions; Basic immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- AS/NZS CISPR 11: Group 1, Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions



Note In the United States (per FCC 47 CFR), Class A equipment is intended for use in commercial, light-industrial, and heavy-industrial locations. In Europe, Canada, Australia and New Zealand (per CISPR 11) Class A equipment is intended for use only in heavy-industrial locations.



Note Group 1 equipment (per CISPR 11) is any industrial, scientific, or medical equipment that does not intentionally generate radio frequency energy for the treatment of material or inspection/analysis purposes.



Note For EMC declarations and certifications, refer to the *Online Product Certification* section.

CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

Online Product Certification

To obtain product certifications and the DoC for this product, visit ni.com/certification, search by model number or product line, and click the appropriate link in the Certification column.

Environmental Management

NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to NI customers.

For additional environmental information, refer to the *Minimize Our Environmental Impact* web page at ni.com/environment. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

Waste Electrical and Electronic Equipment (WEEE)



EU Customers At the end of the product life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers, National Instruments WEEE initiatives, and compliance with WEEE Directive 2002/96/EC on Waste and Electronic Equipment, visit ni.com/environment/weee.htm.

电子信息产品污染控制管理办法（中国 RoHS）



中国客户 National Instruments 符合中国电子信息产品中限制使用某些有害物质指令 (RoHS)。关于 National Instruments 中国 RoHS 合规性信息，请登录 ni.com/environment/rohs_china。(For information about China RoHS compliance, go to ni.com/environment/rohs_china.)

Appendix D: Where to Go for Support

The National Instruments website is your complete resource for technical support. At ni.com/support you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

A Declaration of Conformity (DoC) is our claim of compliance with the Council of the European Communities using the manufacturer's declaration of conformity. This system affords the user protection for electromagnetic compatibility (EMC) and product safety. You can obtain the DoC for your product by visiting ni.com/certification. If your product supports calibration, you can obtain the calibration certificate for your product at ni.com/calibration.

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