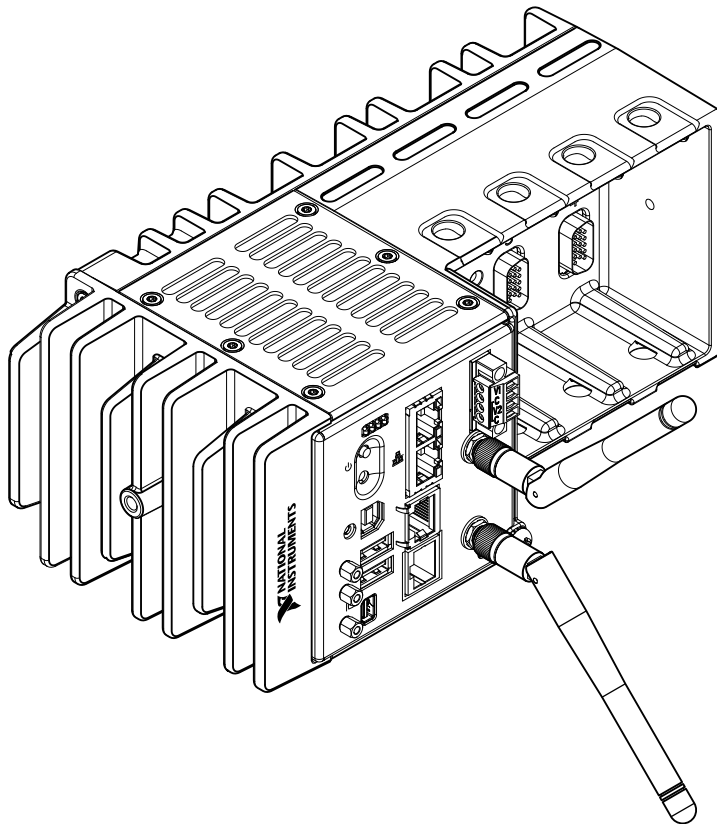# NI cRIO-9032

Embedded CompactRIO Controller with Real-Time Processor and Reconfigurable FPGA

This document describes how to begin using the National Instruments cRIO-9032.

NATIONAL INSTRUMENTS

Safety Guidelines

⚠ **Caution** Do not operate the cRIO-9032 in a manner not specified in this document. Product misuse can result in a hazard. You can compromise the safety protection built into the product if the product is damaged in any way. If the product is damaged, return it to NI for repair.

Safety Guidelines for Hazardous Locations

The cRIO-9032 is suitable for use in Class I, Division 2, Groups A, B, C, D, T4 hazardous locations; Class I, Zone 2, AEx nA IIC T4 Gc and Ex nA IIC T4 Gc hazardous locations; and nonhazardous locations only. Follow these guidelines if you are installing the cRIO-9032 in a potentially explosive environment. Not following these guidelines may result in serious injury or death.

⚠ **Caution** Do not disconnect the power supply wires and connectors from the controller unless power has been switched off.

⚠ **Caution** Do not disconnect I/O-side wires or connectors unless power has been switched off or the area is known to be nonhazardous.

⚠ **Caution** Do not remove modules unless power has been switched off or the area is known to be nonhazardous.

⚠ **Caution** Substitution of components may impair suitability for Class I, Division 2, or Zone 2.

⚠ **Caution** The system must be installed in an enclosure certified for the intended hazardous (classified) location, having a tool secured cover/door, where a minimum protection of at least IP54 is provided.

⚠ **Caution** The USB host ports, USB device port, and mini DisplayPort require the retention accessories listed in the following table for hazardous locations. All cables must be used in a conduit or cable gland to wire to a nonhazardous location. Do not disconnect a cable unless the cRIO-9032 is powered off or the area is known to be nonhazardous.

Table 1. Hazardous Location Retention Accessories

Port	Required Accessory	Part Number
USB Host Port	NI Industrial USB Extender Cable	152166-xx
USB Device Port	NI Locking USB Cable	157788-01
Mini DisplayPort	Mini DisplayPort Cable Retention Bracket	156866-01

Special Conditions for Hazardous Locations Use in Europe and Internationally

The cRIO-9032 has been evaluated as Ex nA IIC T4 Gc equipment under DEMKO 12 ATEX 1202658X and is IECEx UL 14.0089X certified. Each device is marked ⟨Ex⟩ II 3G and is suitable for use in Zone 2 hazardous locations, in ambient temperatures of -20 °C ≤ Ta ≤ 55 °C.

⚠ **Caution** Transient protection shall be provided that is set at a level not exceeding 140% of the peak rated voltage value of 85 V at the supply terminals to the equipment.

⚠ **Caution** The system shall only be used in an area of not more than Pollution Degree 2, as defined in IEC/EN 60664-1.

⚠ **Caution** The system shall be mounted in an ATEX/IECEx-certified enclosure with a minimum ingress protection rating of at least IP54 as defined in IEC/EN 60079-15.

⚠ **Caution** The enclosure must have a door or cover accessible only by the use of a tool.

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, you must use an isolated cable with the RS-485 serial port, such as NI part number 184428-01.

⚠ **Caution** To ensure the specified EMC performance, the length of any cable connected to the video and V2 ports must be no longer than 3 m (10 ft). The length of any cable connected to the RS-232 and RS-485 ports must be no longer than

30 m (100 ft). The length of any cable connected to the USB host ports must be no longer than 5 m (16 ft).

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

⚠️ **Caution** To ensure the specified EMC performance, product installation requires either special considerations or user-installed, add-on devices. Refer to the following sections for more information.

Related Information

Special Conditions for Marine Applications

Some products are Lloyd's Register (LR) Type Approved for marine (shipboard) applications. To verify Lloyd's Register certification for a product, visit *ni.com/certification* and search for the LR certificate, or look for the Lloyd's Register mark on the product.

⚠️ **Caution** In order to meet the EMC requirements for marine applications, install the product in a shielded enclosure with shielded and/or filtered power and input/output ports. In addition, take precautions when designing, selecting, and installing measurement probes and cables to ensure that the desired EMC performance is attained.

Preparing the Environment

Ensure that the environment in which you are using the cRIO-9032 meets the following specifications.

Operating temperature (IEC 60068-2-1, IEC 60068-2-2)	-20 °C to 55 °C
Operating humidity (IEC 60068-2-78)	10% RH to 90% RH, noncondensing
Pollution Degree	2
Maximum altitude	5,000 m

Indoor use only.

📝 **Note** Refer to the device specifications on *ni.com/manuals* for complete specifications.

Unpacking the Kit

⚠️ **Caution** To prevent electrostatic discharge (ESD) from damaging the device, ground yourself using a grounding strap or by holding a grounded object, such as your computer chassis.

1. Touch the antistatic package to a metal part of the computer chassis.
2. Remove the device from the package and inspect the device for loose components or any other sign of damage.

⚠️ **Caution** Never touch the exposed pins of connectors.

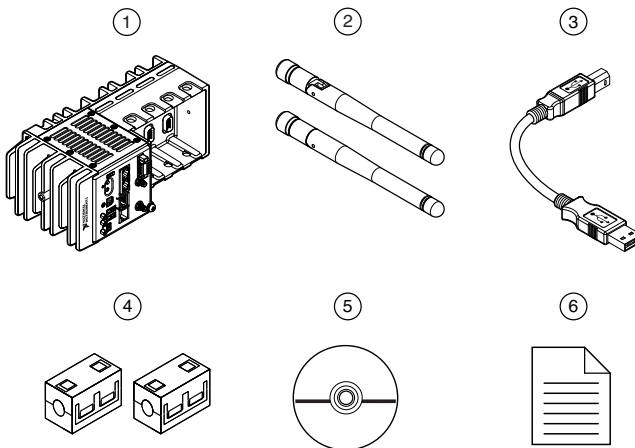📝 **Note** Do not install a device if it appears damaged in any way.

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

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

Verifying the Kit Contents

Verify that the following items are included in the cRIO-9032 kit.

Figure 1. cRIO-9032 Kit Contents

|	
1. cRIO Device with Power Connector	4. Ferrite (x2)
2. Antenna (x2)	5. cRIO Device Drivers Media
3. USB A-to-B Cable	6. Getting Started Guide

Installing Software on the Host Computer

Before using the cRIO-9032, you must install the following application software and device drivers on the host computer in this order:

1. LabVIEW 2015 SP1 or later
2. LabVIEW Real-Time Module 2015 SP1 or later
3. LabVIEW FPGA Module 2015 SP1 or later[1]
4. NI CompactRIO Device Drivers August 2016 or later

For minimum software support information, visit *ni.com/info* and enter the Info Code swsupport.

Installing C Series Modules

Complete the following steps to install a C Series module.
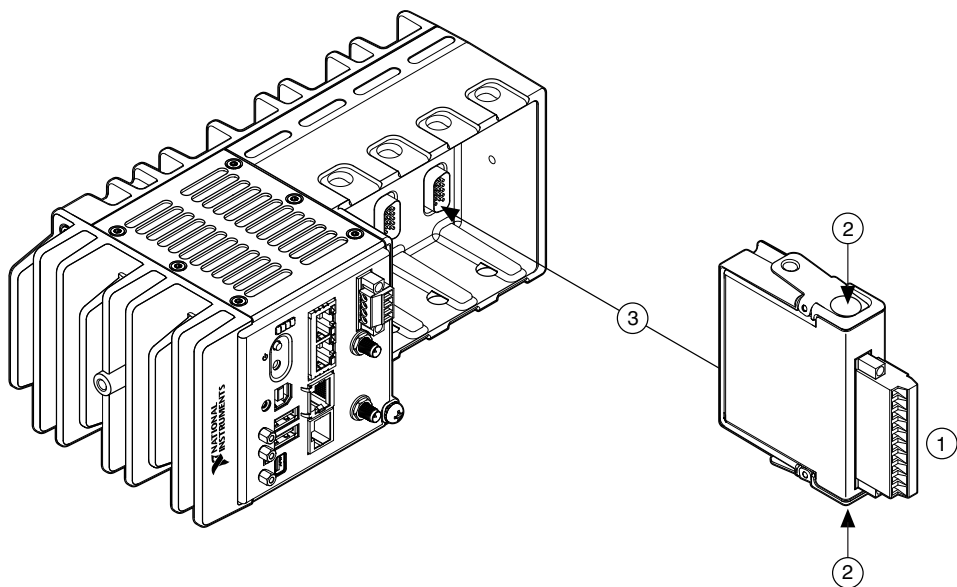
1. Verify that power is not connected to the I/O connector(s) on the C Series module. If the system is in a nonhazardous location, the cRIO-9032 can be powered on when you install modules.
2. Press the latches on the C Series module.
3. Align the C Series module with a slot and seat it in the slot until the latches lock in place.

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[1] LabVIEW FPGA Module is not required when using Scan Interface mode. To program the user-accessible FPGA on the cRIO-9032, LabVIEW FPGA Module is required.

Removing C Series Modules

Verify that power is not connected to the I/O connector(s) on the C Series module before you remove a module from the cRIO-9032. If the system is in a nonhazardous location, the cRIO-9032 can be powered on when you remove modules.

Installing the Antennas

Complete the following steps to install the antennas on the cRIO-9032.

> **Note** NI recommends connecting both antennas for optimal wireless performance and reliability.
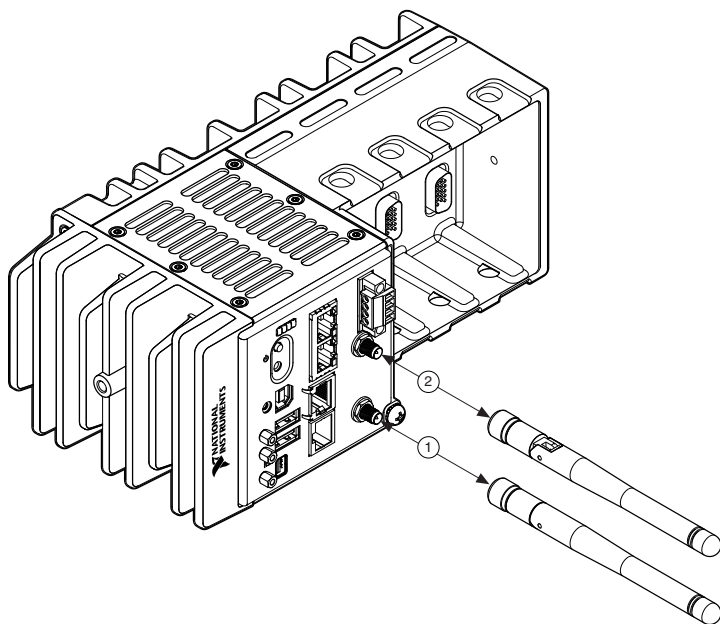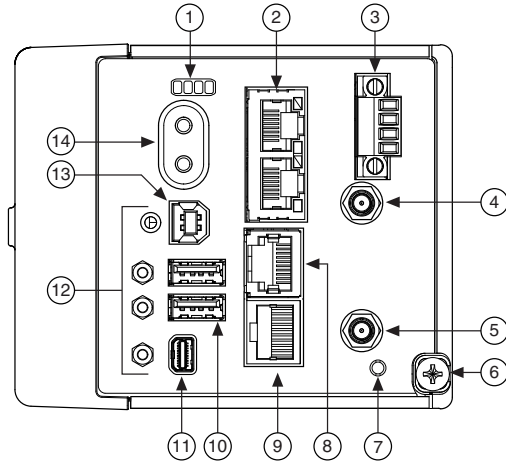

1. Screw an antenna to the primary wireless connector. Hand tighten the antenna to the connector.
2. Screw an antenna to the secondary wireless connector. Hand tighten the antenna to the connector.

Connecting the cRIO-9032

The cRIO-9032 has the following connectors, LEDs, and buttons.

Figure 2. cRIO-9032 Front Panel

1. LEDs
2. Ethernet Ports
3. Power Connector
4. Antenna Port 2
5. Antenna Port 1
6. Ground Screw
7. WLAN LED
8. RS-232 Serial Port
9. RS-485/422 (DTE) Serial Port
10. USB Host Ports
11. Mini DisplayPort
12. Cable Retention Mounts
13. USB Device Port
14. Power and Reset Buttons

Connecting the cRIO-9032 to Ground

You must connect the cRIO-9032 grounding terminal to the grounding electrode system of the facility.

What to Use

- Ring lug
- Wire, 1.3 mm^2 (16 AWG) or larger
- Screwdriver, Phillips #2

What to Do

Complete the following steps to ground the cRIO-9032.

1. Attach the ring lug to the wire.
2. Remove the grounding screw from the grounding terminal on the cRIO-9032.
3. Attach the ring lug to the grounding terminal.
4. Tighten the grounding screw to 0.5 N · m (4.4 lb · in.) of torque.
5. Attach the other end of the wire to the grounding electrode system of your facility using a method that is appropriate for your application.

> ⚠ **Caution** If you use shielded cabling to connect to a C Series module with a plastic connector, you must attach the cable shield to the chassis grounding terminal using 1.3 mm² (16 AWG) or larger wire. Attach a ring lug to the wire and attach the wire to the chassis grounding terminal. Solder the other end of the wire to the cable shield. Use shorter wire for better EMC performance.

For more information about ground connections, visit *ni.com/info* and enter the Info Code emcground.

Connecting the cRIO-9032 to Power

The cRIO-9032 requires a 9 V to 30 V external power supply. The cRIO-9032 filters and regulates the supplied power and provides power for the C Series modules. The cRIO-9032 has a primary power input, V1, and a secondary power input, V2.

The POWER LED on the cRIO-9032 indicates which power input is in use, as shown in the following table.

Table 2. POWER LED Indicators

LED Color	LED Pattern	Indication
Green	Solid	The cRIO-9032 is powered from the V1 input.
Yellow	Solid	The cRIO-9032 is powered from the V2 input.
—	Off	The cRIO-9032 is powered off.

> ⚠ **Caution** Do not connect V2 to a DC mains supply or to any supply that requires a connecting cable longer than 3 m (10 ft). A DC mains supply is a local DC electricity supply network in the infrastructure of a site or building.

What to Use

- Ferrite
- Screwdriver, 2.54 mm (0.10 in.) flathead
- Primary power supply, 9 V to 30 V, 40 W minimum
- (Optional) Secondary power supply, 9 V to 30 V, 40 W minimum

NI recommends the power supplies listed in the following table for the cRIO-9032.

Table 3. NI Power Supplies

Power Supply	Part Number
NI PS-15 Industrial Power Supply (24 VDC, 5 A, 100 VAC to 120 VAC/200 VAC to 240 VAC input)	781093-01
NI PS-10 Desktop Power Supply (24 VDC, 5 A, 100 VAC to 120 VAC/200 VAC to 240 VAC input)	782698-01

What to Do

Complete the following steps to connect a power supply to the cRIO-9032.

1. Ensure that your power supply is powered off.
2. Install the ferrite on the negative and positive leads of the power supply, as shown in the following figure.

Figure 3. Installing a Ferrite on the Power Leads
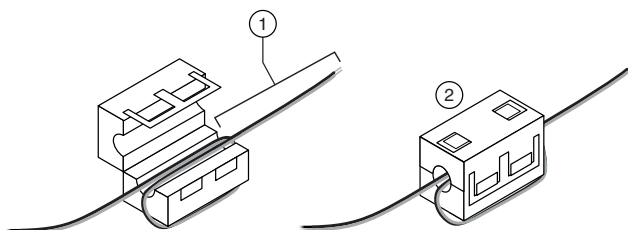
1. Pass the leads through the ferrite twice, leaving 50 mm to 75 mm (2 in. to 3 in.) between the ferrite and the end of the leads.
2. Close the ferrite around the leads.

3. Remove the power connector from the cRIO-9032.

⚠ **Caution** Do not tighten or loosen the terminal screws on the power connector while the cRIO-9032 is powered on.

4. Connect the primary power supply and optional secondary power supply to the power connector, as shown in the following figure.

Figure 4. cRIO-9032 Power Connections
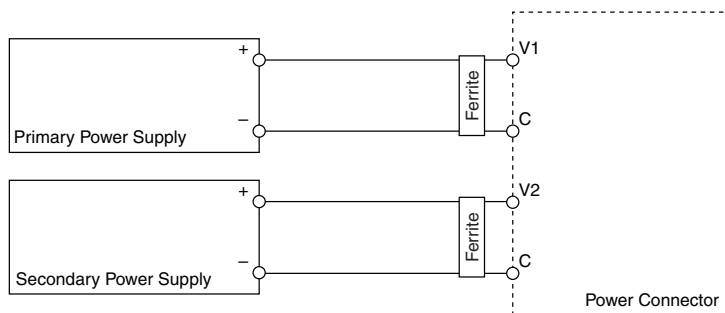
> **Note** The C terminals are internally connected to each other.

5. Tighten the terminal screws on the power connector to 0.20 N · m to 0.25 N · m
   (1.8 lb · in. to 2.2 lb · in.) of torque.
6. Install the power connector on the front panel of the cRIO-9032.
7. Tighten the power connector screw flanges to 0.20 N · m to 0.25 N · m (1.8 lb · in. to
   2.2 lb · in.) of torque.
8. Power on the primary power supply and optional secondary power supply.

Powering On the cRIO-9032

When you power on the cRIO-9032 for the first time, the device boots into safe mode. The
POWER LED illuminates, the STATUS LED illuminates briefly, and then the STATUS LED
blinks twice every few seconds.

Related Information

STATUS LED Indicators on page 17

Installing a Ferrite on the USB Cables

You must install a ferrite around all USB cables connected to the USB host ports to ensure that
the cRIO-9032 meets all EMC standards applicable to your country.

What to Use

• Ferrite (711849-01), included with the cRIO-9032
• USB cables

What to Do

Install the ferrite on the USB cables, as shown in the following figure.
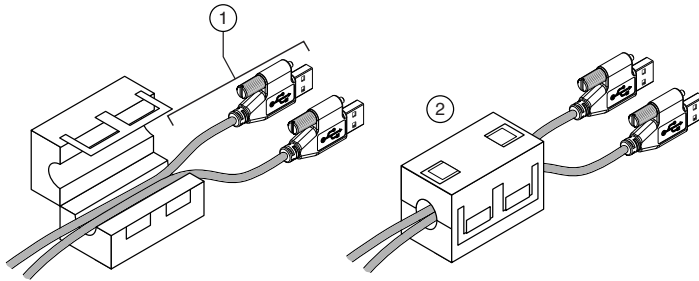
Figure 5. Installing a Ferrite on the USB Cables

1. Pass the cables through the ferrite, leaving 50 mm to 75 mm (2 in. to 3 in.) between the ferrite and the end of the cables. The ferrite can accommodate up to two USB cables depending on the diameter of each cable.
2. Close the ferrite around the cables.

Connecting the cRIO-9032 to the Host Computer

Complete the following steps to connect the cRIO-9032 to the host computer using the USB device port.

1. Power on the host computer.
2. Connect the cRIO-9032 to the host computer using the USB A-to-B cable.

> ⚠ **Caution** NI requires the use of a locking USB cable (157788-01) to meet the shock and vibration specifications. Refer to the specifications on *ni.com/manuals* for shock and vibration specifications.

The device driver software automatically detects the cRIO-9032. If the device driver software does not detect the cRIO-9032, verify that you installed the appropriate NI software in the correct order on the host computer.

> 💡 **Tip** You can also use the Ethernet port to connect directly to the host computer or network. Refer to the user manual on *ni.com/manuals* for more information about Ethernet connections.

Configuring the System in Measurement & Automation Explorer (MAX)

Complete the following steps to find the system in MAX.

1. Launch MAX on the host computer.
2. Expand **Remote Systems** in the configuration tree and locate your system.
3. Select your target.

> 💡 **Tip** MAX lists the system under the model number followed by the serial number, such as NI-cRIO-9032-1856AAA.

Setting a System Password

Complete the following steps to set a system password.

> 📝 **Note** The default username for the cRIO-9032 is `admin`. There is no default password for the cRIO-9032, 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.

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

Installing Software on the cRIO-9032

Complete the following steps to install software on the cRIO-9032.

1. In MAX, expand your system under Remote Systems.

2. Select the **Systems Settings** tab.

3. Click **Update Firmware**.

4. Select the latest firmware version.

5. Click **Open**.

6. Right-click **Software**.

7. Select **Add/Remove Software** to launch the LabVIEW Real-Time Software Wizard.

> 💡 **Tip** You must log in if you set a system password.

8. Select the recommended software set for your LabVIEW and NI CompactRIO Device Drivers versions.

9. Click **Next**.

10. Select **NI Scan Engine** from the software add-ons.

Select any additional software to install. If you plan on using the cRIO-9032 with the LabVIEW FPGA Module, you can click **Next**. Click **NI Scan Engine** if you plan on using the cRIO-9032 without the LabVIEW FPGA Module.

> **Tip** You can use this wizard at anytime to install additional software.

11. Click **Next**.
12. Verify that the summary of software to install is correct.
13. Click **Next** to start the installation.
14. Click **Finish** when the installation is complete.

Connecting the cRIO-9032 to a Wireless Network

Complete the following steps to connect the cRIO-9032 to a wireless network.

1. Launch MAX on the host computer.
2. Expand Remote Systems in the configuration tree and locate your system.
3. Select your target.

> **Tip** MAX lists the system under the model number followed by the serial number, such as NI-cRIO-9032-1856AAA.

4. Click the **Network Settings** tab.
5. Select your country.
6. Select **Connect to a wireless network** as the Wireless Mode.

   You may need to upload a certificate by clicking **Certificate Management**. Contact your IT department for information about your network settings and configuration details.

7. Click **Wireless Network** to add a network from the scanned list or click **Other Network** and enter settings for your network.
8. Click **Save**.

   The Wireless Adapter wlan0 section displays the search status.

9. Click the **System Settings** tab and verify that the chassis has a wireless IP address (along with the Ethernet IP address); if the System State reads Connected - Running, the cRIO-9032 is connected to the wireless network.

Creating a Wireless Network with the cRIO-9032

Complete the following steps to connect the cRIO-9032 to a wireless network.

1. Launch MAX on the host computer.
2. Expand Remote Systems in the configuration tree and locate your system.

3. Select your target.

> 💡 **Tip** MAX lists the system under the model number followed by the serial number, such as NI-cRIO-9032-1856AAA.

4. Click the **Network Settings** tab.
5. Select your country.
6. Select **Create wireless network** as the Wireless Mode.
7. Enter the SSID, Channel, and Security type for the wireless network you are creating.
8. Select **DHCP Only** in the **Configure IPv4 Address** drop-down menu.
9. Click **Save**.
10. Verify that the Status reads **Broadcasting**.

Troubleshooting the cRIO-9032

The cRIO-9032 is Not Communicating with the Network

- Ensure that the USB connections between the cRIO-9032 and the host computer and the Ethernet connections between the host computer and the router are secure.
- Configure the IP and other network settings by completing the following steps.
  1. Use a USB A-to-B cable to connect the cRIO-9032 USB device port to a host computer. The USB driver creates a virtual network interface card and assigns an IP address to the cRIO-9032 in the format of 172.22.11.x.
  2. In MAX, expand your system under Remote Systems.
  3. Select the **Network Settings** tab to configure the IP and other network settings.
  4. (Optional) Use the RJ-45 Ethernet port 1 to reconnect the cRIO-9032 to the host computer. The cRIO-9032 attempts to initiate a DHCP network connection at powerup.

     > 📝 **Note** If the cRIO-9032 cannot obtain 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 cRIO-9032 over a standard Ethernet connection.

- Ensure that you have the correct version of NI CompactRIO Device Drivers installed on the host computer. Visit *ni.com/info* and enter the Info Code swsupport for the minimum supported versions of LabVIEW and NI CompactRIO Device Drivers.

  > 💡 **Tip** If you have recently upgraded LabVIEW, you must reinstall NI CompactRIO Device Drivers.

- Ensure that the NI USBLAN adapter is recognized in the Device Manager. On Windows 7, select **Start**»**Control Panel**»**Device Manager**»**Network adapters**»**National Instruments**»**USBLAN adapter**. If the USBLAN adapter is not recognized, you must reinstall NI CompactRIO Device Drivers.
- Temporarily disable any network firewalls or other security software.

Verify the System IP Configuration

1. Put the cRIO-9032 in safe mode and enable the RS-232 serial port by holding the RESET button down for 5 seconds.

    The STATUS LED starts blinking three times every few seconds.

2. Use the RS-232 serial port terminal to read the IP address, or connect a monitor to the mini DisplayPort to view the IP address.

    📝 **Note** Refer to the user manual on *ni.com/manuals* for more information about serial port configuration.

3. Set a new DHCP connection by holding the RESET button down for 5 seconds. The STATUS LED repeats the same behavior from *Step 1*.

    If the cRIO-9032 fails to set a new DHCP address, it assigns itself a link-local IP address. If the DHCP connection is successful and appropriate for your application, skip to *Step 6*.

4. In MAX, expand your system under Remote Systems.

5. Select the **Network Settings** tab to configure the IP and other network settings.

6. Reboot the cRIO-9032 by pressing the RESET button.

Configure the Windows Firewall

-   Add an exception for MAX to your network firewall or other security software by completing the following steps:
    1. On Windows 7, select **Start**»**Control Panel**»**System and Security**»**Windows Firewall**»**Allow a program through Windows Firewall**.
    2. Click **Allow another program**.
    3. Select **Measurement & Automation**.
    4. Click **Add**.
    5. 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.

System Reset

The following figure shows the reset behavior of the cRIO-9032.

Figure 6. Reset Button Behavior
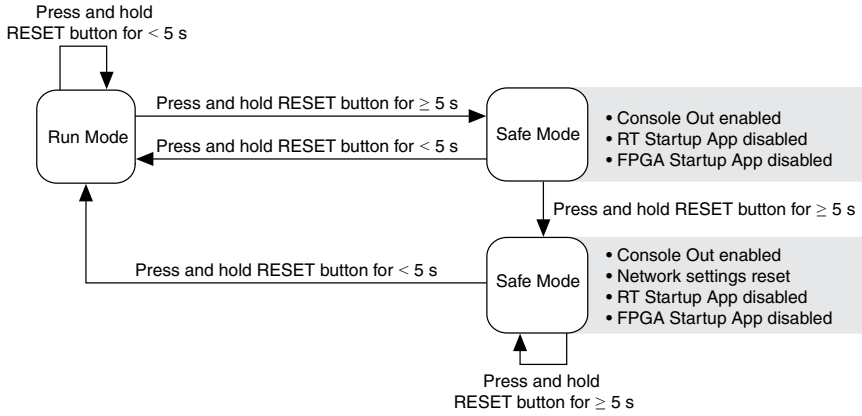
STATUS LED Indicators

The following table describes the STATUS LED indicators.

Table 4. STATUS LED Indicators

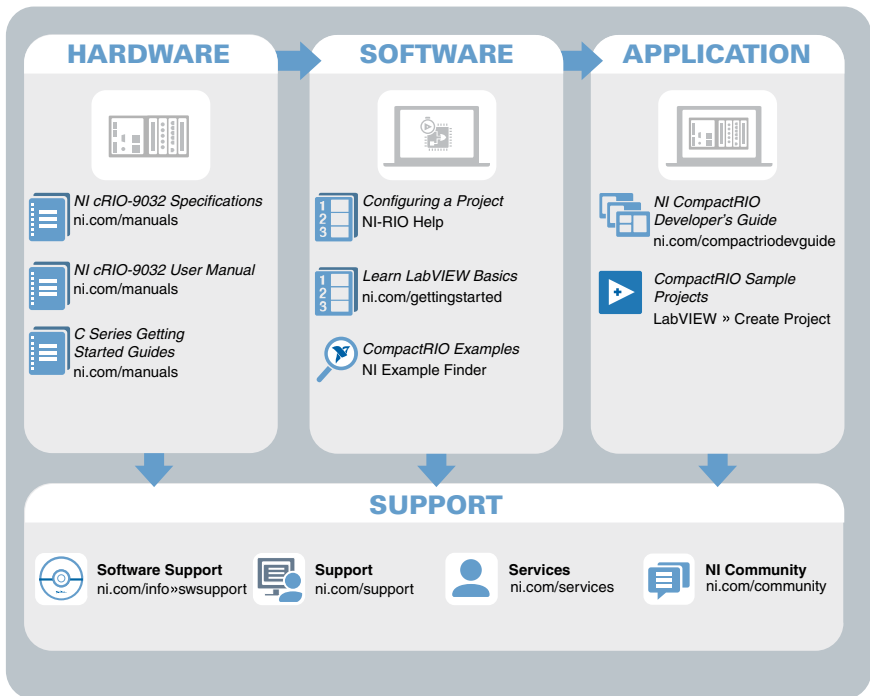| LED Color	LED Pattern	Indication
Yellow	Blinks twice and pauses	The cRIO-9032 is in safe mode. Software is not installed, which is the factory default state, or software has been improperly installed on the cRIO-9032. An error can occur when an attempt to upgrade the software is interrupted. Reinstall software on the cRIO-9032. Refer to the *Measurement & Automation Explorer (MAX) Help* for information about installing software on the cRIO-9032.
	Blinks three times and pauses	The cRIO-9032 is in user-directed safe mode, or the cRIO-9032 is in install mode to indicate that software is currently being installed. This pattern may also indicate that the user has forced the cRIO-9032 to boot into safe mode by pressing the reset button for longer than five seconds or by enabling safe mode in MAX. Refer to the *Measurement & Automation Explorer (MAX) Help* for information about safe mode.
	Blinks four times and pauses	The cRIO-9032 is in safe mode. The software has crashed twice without rebooting or cycling power between crashes.
	Continuously blinks	The cRIO-9032 has not booted into NI Linux Real-Time. The cRIO-9032 either booted into an unsupported operating system, was interrupted during the boot process, or detected an unrecoverable software error.
	On momentarily	The cRIO-9032 is booting. No action required.
Red	Continuously blinks	This indicates a hardware error. An internal power supply has failed. Check front-panel I/O and C Series module connections for shorts. Remove any shorts and cycle power the cRIO-9032. If the problem persists, contact NI.
—	Off	The cRIO-9032 is in run mode. Software is installed and the operating system is running.

WLAN Status LED Indicators

The following table describes the WLAN Status LED indicators.

Table 5. WLAN Status LED Indicators

LED Color	LED Pattern	Indication
Green	Continuously blinks	The cRIO-9032 is attempting to connect to an existing wireless network.
	Solid	The cRIO-9032 is connected to an existing wireless network.
Yellow	Solid	The cRIO-9032 is operating as a wireless access point.
—	Off	The cRIO-9032 wireless radio is disabled.

Where to Go Next

HARDWARE

NI cRIO-9032 Specifications
ni.com/manuals

NI cRIO-9032 User Manual
ni.com/manuals

C Series Getting Started Guides
ni.com/manuals

SOFTWARE

Configuring a Project
NI-RIO Help

Learn LabVIEW Basics
ni.com/gettingstarted

CompactRIO Examples
NI Example Finder

APPLICATION

NI CompactRIO Developer's Guide
ni.com/compactriodevguide

CompactRIO Sample Projects
LabVIEW » Create Project

SUPPORT

Software Support
ni.com/info»swsupport

Support
ni.com/support

Services
ni.com/services

NI Community
ni.com/community

Worldwide Support and Services

The NI 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.

Visit *ni.com/services* for NI Factory Installation Services, repairs, extended warranty, and other services.

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

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*.

NI corporate headquarters is located at 11500 North Mopac Expressway, Austin, Texas, 78759-3504. NI also has offices located around the world. For telephone support in the United States, create your service request at *ni.com/support* or dial 1 866 ASK MYNI (275 6964). For telephone support outside the United States, visit the *Worldwide Offices* section of *ni.com/niglobal* to access the branch office websites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.