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cRIO-9081 Getting Started

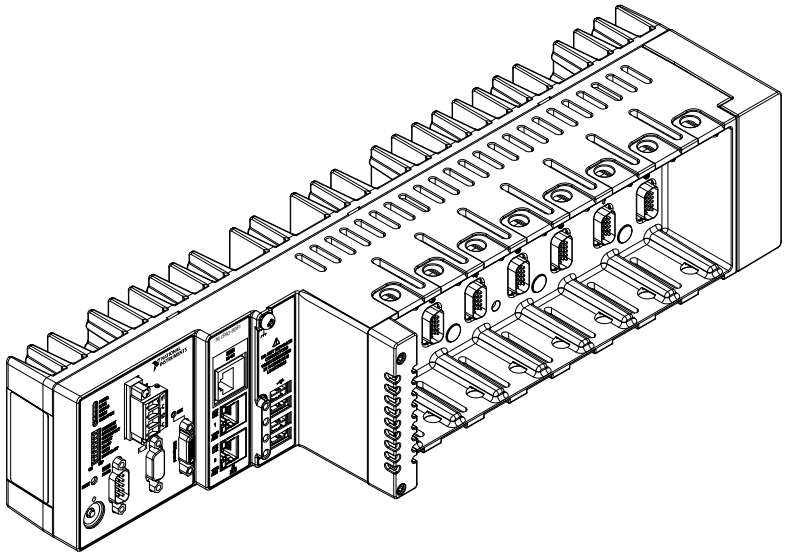
2022-07-15

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Overview

This document describes how to begin using the NI cRIO-9081.



Safety Guidelines

Caution Observe all instructions and cautions in the user documentation. Using the model in a manner not specified can damage the model and compromise the built-in safety protection. Return damaged models to NI for repair.

Attention Suivez toutes les instructions et respectez toutes les mises en garde de la documentation utilisateur. L'utilisation d'un modèle de toute autre façon que celle spécifiée risque de l'endommager et de compromettre la protection de sécurité intégrée. Renvoyez les modèles endommagés à NI pour réparation.

Safety Guidelines for Hazardous Locations

The cRIO-9081 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-9081 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.

Special Conditions for Hazardous Locations Use in Europe and Internationally

The cRIO-9081 has been evaluated as Ex nA IIC T4 Gc equipment under DEMKO 07ATEX 0626664X 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 0 °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.

Special Conditions for Marine Applications

Some products are approved for marine (shipboard) applications. To verify marine approval certification for a product, visit ni.com/product-certifications, search by model number, and click the appropriate link.

Notice 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-9081 meets the following specifications.

Operating temperature (IEC 60068-2-1, IEC 60068-2-2)	0 °C to 55 °C
Operating humidity (IEC 60068-2-78)	10% RH to 90% RH, noncondensing
Pollution Degree	2
Maximum altitude	2,000 m

Indoor use only.

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

Unpacking the Kit

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

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

   Notice Never touch the exposed pins of connectors.

   Note Do not install a device if it appears damaged in any way.
3. Unpack any other items and documentation from the kit.

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

Verifying the Kit Contents

Verify that the following items are included in the cRIO-9081 kit.

Installing Software on the Host Computer

Before using the cRIO-9081, you must install the following application software and device drivers on the host computer in this order:

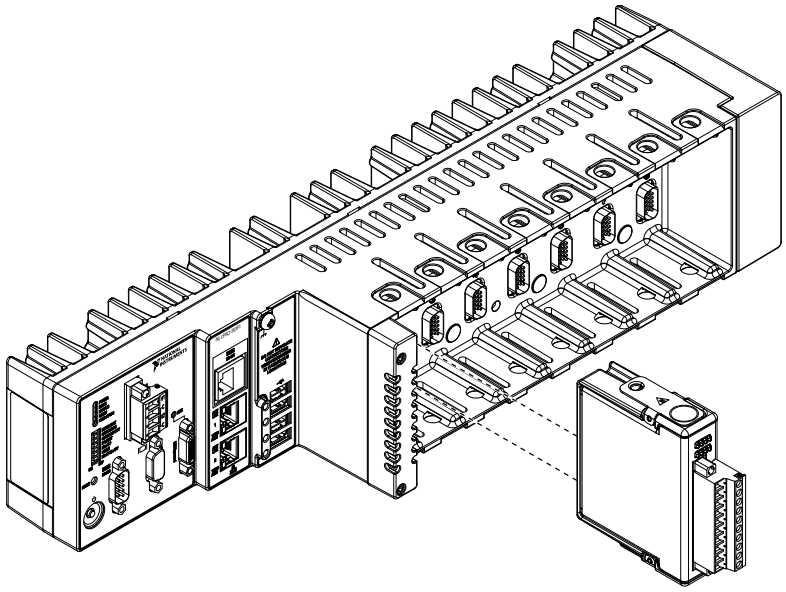
1. LabVIEW 2011 or later
2. LabVIEW Real-Time Module 2011 or later
3. LabVIEW FPGA Module 2011 or later[1]
4. NI CompactRIO Device Drivers 4.0 or later

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

[1] LabVIEW FPGA Module is not required when using Scan Interface mode. To program the user-accessible FPGA on the cRIO-9081, LabVIEW FPGA Module is required.

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-9081 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.

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-9081. If the system is in a nonhazardous location, the cRIO-9081 can be powered on when you remove modules.

Connecting the cRIO-9081

The cRIO-9081 has the following connectors, LEDs, and buttons.

Connecting the cRIO-9081 to Ground

You must connect the cRIO-9081 grounding terminal to the grounding electrode system of the facility.

What to Use

- Ring lug
- Wire, 1.6 mm^2 (14 AWG) or larger
- Screwdriver, Phillips #2

What to Do

Complete the following steps to ground the cRIO-9081.

1. Attach the ring lug to the wire.
2. Remove the grounding screw from the grounding terminal on the cRIO-9081.
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 1.6 mm^2 (14 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-9081 to Power

The cRIO-9081 requires a 9 V to 30 V external power supply. The cRIO-9081 filters and regulates the supplied power and provides power for the C Series modules. The cRIO-9081 has a primary power input, V1, and a secondary power input, V2.

The POWER LED on the cRIO-9081 indicates which power input is in use, as shown in the following table.

LED Color	LED Pattern	Indication
Green	Solid	The cRIO-9081 is powered from the V1 input.
Yellow	Solid	The cRIO-9081 is powered from the V2 input.
—	Off	The cRIO-9081 is powered off.

Table 1. POWER LED Indicators

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, 46 W minimum
- (Optional) Secondary power supply, 9 V to 30 V, 46 W minimum

NI recommends the power supplies listed in the following table for the cRIO-9081.

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

Table 2. NI Power Supplies

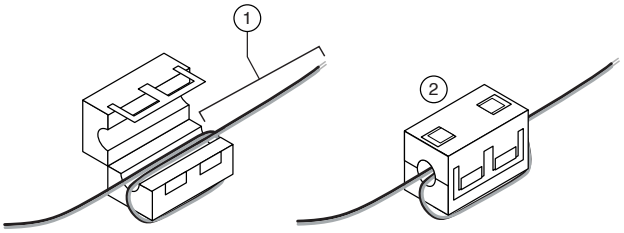
What to Do

Complete the following steps to connect a power supply to the cRIO-9081.

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 1. 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-9081.

   Caution Do not tighten or loosen the terminal screws on the power connector while the cRIO-9081 is powered on.
4. Connect the primary power supply and optional secondary power supply to the power connector.

   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-9081.
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-9081

To power on the cRIO-9081, ensure that the power source is turned on and press the power button on the front panel of the cRIO-9081. You can use the cRIO-9081 BIOS setup utility to configure the cRIO-9081 to start immediately when power is applied or to respond to the front-panel power button. Refer to the device user manual on

ni.com/manuals for information about the different powerup behaviors you can configure. The power button is enabled by default so that the cRIO-9081 does not power on until the power button is pressed. When the cRIO-9081 powers on, the Power LED turns on and the controller runs a power-on self test (POST).
When the POST is complete, the operating system is loaded and the cRIO-9081 is ready for use. The cRIO-9081 as shipped either includes a pre-installed operating system such as Windows, or has the hard drive partitioned for LabVIEW Real-Time. In order for the system to boot into LabVIEW Real-Time, the DISABLE RT DIP switch must be in the OFF position. In order for the system to boot into any other operating system, the DISABLE RT DIP switch must be in the ON position. Refer to the device user manual on ni.com/manuals for more information about the DIP switches.

Connecting the cRIO-9081 to a Network

Connect the cRIO-9081 to an Ethernet network using RJ-45 Ethernet port 1 on the controller front panel. Use a standard Category 5 (CAT-5) or better shielded, twisted-pair Ethernet cable to connect the cRIO-9081.



Note To prevent data loss and to maintain the integrity of your Ethernet installation, do not use a cable longer than 100 m.

For Windows systems, the network behavior is determined by the Windows network drivers.
For RT systems, the cRIO-9081 attempts to initiate a DHCP network connection at powerup. If the cRIO-9081 is unable to obtain an IP address, it connects to the network with a link-local IP address with the form 169.254.x.x.
After powerup, you can install software on the cRIO-9081. For RT systems, you can also change the network settings using Measurement & Automation Explorer (MAX) on a host computer.



Note Installing software may change the network behavior of the cRIO-9081. For information about network behavior by installed software version, go to ni.com/info and enter the Info Code ipconfigcrio.

The host computer communicates with the cRIO-9081 over a standard Ethernet connection.

Configuring IP Settings and Installing LabVIEW Real-Time Software

This section describes how to configure IP settings and install LabVIEW Real-Time software on the cRIO-908x. If your system has a version of Windows installed on it, refer to the Windows documentation for information about configuring IP settings. Systems shipped with Windows pre-installed also have a compatible version of the NI-RIO software pre-installed.

When you power on the controller for the first time, it boots into safe mode if there is no software installed on it. Complete the following steps to configure IP settings and install software.

1. Power on the system with the DISABLE RT DIP switch in the OFF position.
2. Launch MAX on the host computer and expand Remote Systems in the MAX configuration tree. MAX lists the cRIO controller as the model name of the controller followed by the MAC address, for example, NI-cRIO-908100802f108562.
   The controller automatically attempts to connect to the network using DHCP. If the controller is unable to obtain an IP address, it connects to the network with a link-local IP address with the form 169.254.x.x.
3. Enter a name for the Real-Time target in the Name field in the System Settings tab.
4. Select the controller under Remote Systems to see the Network Settings tab in the middle pane of MAX.
5. Select settings for the Real-Time target in the IP Settings section, then click Apply.



Note For information about configuring network settings, refer to the **Configuring Network Settings** book of the **MAX Remote Systems Help**. In MAX, click Help » Help Topics » Remote Systems. On the Contents tab, browse to LabVIEW Real-Time Target Configuration » Configuring Network Settings.

6. When you click Apply, you are prompted to reboot the controller for the changes to take effect. Click Yes. You can also reboot the controller by right-clicking the name under Remote Systems and selecting Reboot.
7. After rebooting, the controller appears under Remote Systems with the assigned name. Expand the controller and select Software.
8. Click Add/Remove Software in the toolbar to launch the LabVIEW Real-Time Software Wizard.
9. Install LabVIEW Real-Time software and device drivers on the controller.

After software installation, the controller automatically reboots. You can now program it using LabVIEW Real-Time. For information about configuring the controller to launch an embedded stand-alone application at startup, refer to the **LabVIEW Help**.

System Reset Options

The following table lists the reset options available on the cRIO-9081. These options determine how the system behaves when the controller is reset in various conditions. Use the RIO Device Setup utility to select reset options. Launch the RIO Device Setup utility by selecting Start » All Programs » National Instruments » NI-RIO » RIO Device Setup.

Chassis Reset Option	Behavior
Do not autoload VI	Does not load the FPGA bit stream from flash memory.
Autoload VI on device powerup	Loads the FPGA bit stream from flash memory to the FPGA when the controller powers on.
Autoload VI on device reboot	Loads the FPGA bit stream from flash memory to the FPGA when you reboot the controller either with or without cycling power.

Table 3. cRIO-9081 Reset Options

Troubleshooting the cRIO-9081

Troubleshooting Network Communication for LabVIEW Real-Time Systems

If the controller cannot communicate with the network, you can use the IP RESET switch to manually restore the controller to the default network settings. When you reboot the controller with the IP RESET switch in the ON position, the controller attempts to connect to the network using DHCP. If the controller is unable to obtain an IP address, it connects to the network with a link-local IP address with the form 169.254.x.x.

Complete the following steps to restore the controller to the default network settings.

1. Move the IP RESET switch to the ON position.
2. Push the RESET button to cycle power to the chassis.
3. Configure the IP and other network settings in MAX from the host computer.
4. Move the IP RESET switch to the OFF position.

For more information about troubleshooting network communication, go to ni.com/info and enter the Info Code rdcriostartup.

STATUS LED Indicators

The STATUS LED is off during normal operation. The cRIO-9081 indicates specific software error conditions by flashing the STATUS LED yellow a certain number of times every few seconds, as shown in the following table.

Number of Yellow Flashes Every Few Seconds	Indication
1	The chassis is unconfigured. Use MAX to configure the chassis. Refer to the **Measurement & Automation Explorer Help** for information about configuring the chassis.
2	The chassis has detected an error in its software. This usually occurs when an attempt to upgrade the software is interrupted. Reinstall software on the chassis. Refer to the **Measurement & Automation Explorer Help** for information about installing software on the chassis.

Number of Yellow Flashes Every Few Seconds	Indication
3	The chassis is in safe mode because the SAFE MODE DIP switch is in the ON position or there is no software installed on the chassis.
4	The software has crashed twice without rebooting or cycling power between crashes. This usually occurs when the chassis runs out of memory. Review your RT VI and check the memory usage. Modify the VI as necessary to solve the memory usage issue.
Continuously Flashing	The chassis has detected an unrecoverable error. Contact National Instruments.
Continuously Flashing or Solid	The device may be configured for DHCP but unable to get an IP address because of a problem with the DHCP server. Check the network connection and try again. If the problem persists, contact National Instruments.

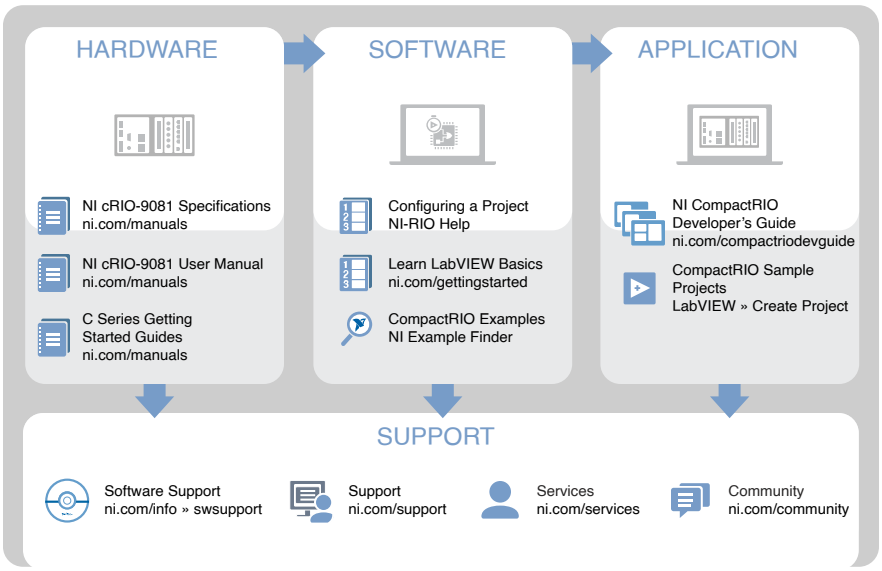
Table 4. STATUS LED Software Indicators

The cRIO-9081 indicates specific hardware error conditions by flashing the STATUS LED red a certain number of times every few seconds, as shown in the following table.

Pattern of Red Flashes	Indication
Continuously Flashing	An internal power supply has failed. Check front-panel I/O, CXM, and C Series module connections for shorts. Remove any shorts and power cycle the controller. If the problem persists, contact National Instruments.
Solid	The cRIO-9081 internal temperature has exceeded a critical threshold. If the problem persists, contact National Instruments.

Table 5. STATUS LED Hardware Indicators

Where to Go Next



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.

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