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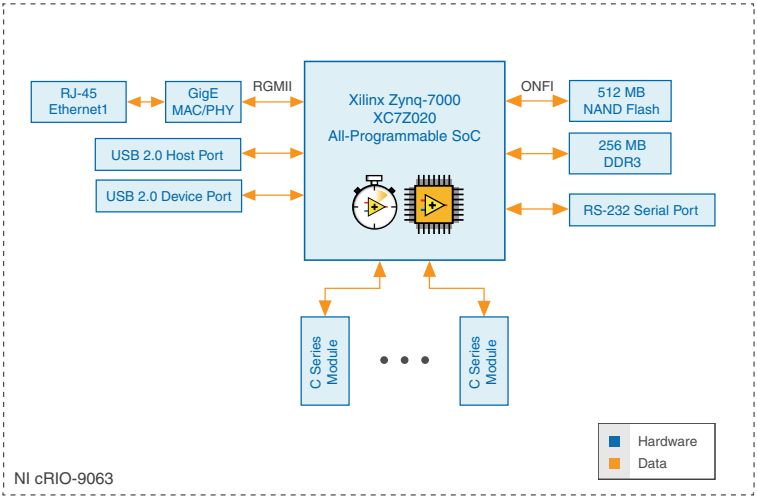
Find the *National Instruments cRIO-9063* at our website: ***Click HERE***

USER MANUAL

NI cRIO-9063

Embedded Real-Time Controller with Reconfigurable FPGA for C Series Modules

This document describes the features of the NI cRIO-9063 and contains information about mounting and operating the device.



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Configuring the cRIO-9063

You can connect the cRIO-9063 to a host computer or network and configure the startup options using the USB device port or the RJ-45 Gigabit Ethernet port 1.

Tip Refer to the getting started guide on *ni.com/manuals* for basic configuration instructions and information about connecting to a host computer using the USB device port. NI recommends using the USB device port for configuration, debug, and maintenance.

Connecting the cRIO-9063 to the Host Computer or Network Using Ethernet

Complete the following steps to connect the cRIO-9063 to a host computer or Ethernet network using the RJ-45 Gigabit Ethernet port 1. NI recommends using the RJ-45 Gigabit Ethernet port 1 for communication with deployed systems.

1. Power on the host computer or Ethernet hub.
2. Connect the RJ-45 Gigabit Ethernet port 1 on the cRIO-9063 to the host computer or Ethernet hub using a standard Category 5 (CAT-5) or better shielded, twisted-pair Ethernet cable.

   Caution To prevent data loss and to maintain the integrity of your Ethernet installation, do not use a cable longer than 100 m (328 ft).

   The cRIO-9063 attempts to initiate a DHCP network connection the first time you connect using Ethernet. The cRIO-9063 connects to the network with a link-local IP address with the form 169.254.*x.x* if it is unable to initiate a DHCP connection.

Finding the cRIO-9063 on the Network (DHCP)

Complete the following steps to find the cRIO-9063 on a network using DHCP.

1. Disable secondary network interfaces on the host computer, such as a wireless access card on a laptop.

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2. Ensure that any anti-virus and firewall software running on the host computer allows connections to the host computer.

Note MAX uses UDP 44525. Refer to the documentation of your firewall software for information about configuring the firewall to allow communication through the UDP 44525.

3. Launch MAX on the host computer.
4. Expand **Remote Systems** in the configuration tree and locate your system.

Tip MAX lists the system under the model number followed by the serial number, such as NI-cRIO-9063-1856AAA.

Configuring Startup Options

Complete the following steps to configure the cRIO-9063 startup options in MAX.

1. In MAX, expand your system under Remote Systems.
2. Select the **Startup Settings** tab to configure the startup settings.

cRIO-9063 Startup Options

You can configure the following cRIO-9063 startup options.

Table 1. cRIO-9063 Startup Options

Startup Option	Description
Force Safe Mode	Rebooting the cRIO-9063 with this setting on starts the cRIO-9063 without launching LabVIEW Real-Time or any startup applications. In safe mode, the cRIO-9063 launches only the services necessary for updating configuration and installing software.
Enable Console Out	Rebooting the cRIO-9063 with this setting on redirects the console output to the RS-232 serial port. You can use a serial-port terminal program to read the IP address and firmware version of the cRIO-9063. Use a null-modem cable to connect the RS-232 serial port to a computer. Make sure that the serial-port terminal program is configured to the following settings: • 115,200 bits per second • Eight data bits • No parity • One stop bit • No flow control
Disable RT Startup App	Rebooting the cRIO-9063 with this setting on prevents any LabVIEW startup applications from running.

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Table 1. cRIO-9063 Startup Options (Continued)

Startup Option	Description
Disable FPGA Startup App	Rebooting the cRIO-9063 with this setting on prevents autoloading of any FPGA application.  **Note** When you reset the cRIO-906x controller either programmatically or by using the RESET button, you also reset the FPGA. All FPGA I/O lines are tri-stated after a reset, and will enter predefined states once loaded.
Enable Secure Shell (SSH) Logins	Rebooting the cRIO-9063 with this setting on starts sshd on the cRIO-9063. Starting sshd enables logins over SSH, an encrypted communication protocol.  **Note** Visit *ni.com/info* and enter the Info Code `openssh` for more information about SSH.
LabVIEW Project Access	Rebooting the cRIO-9063 with this setting on enables you to add the target to a LabVIEW project.

cRIO-9063 Features

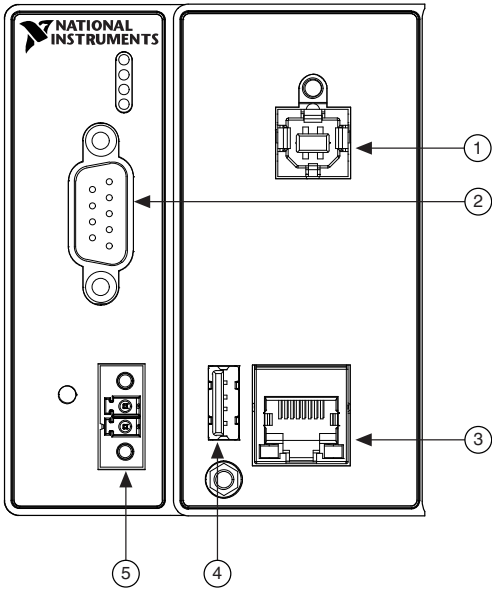
The cRIO-9063 provides the following features.

Ports and Connectors

The cRIO-9063 provides the following ports and connectors.

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Figure 1. cRIO-9063 Ports and Connectors



1. USB Device Port
2. RS-232 Serial Port
3. RJ-45 Ethernet Port 1
4. USB Host Port
5. Power Connector

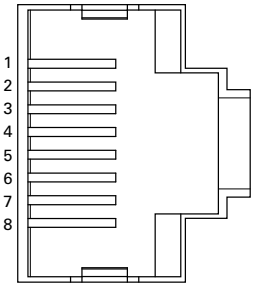
RJ-45 Gigabit Ethernet Port

The cRIO-9063 has one tri-speed RJ-45 Gigabit Ethernet port. By default, the Ethernet port is enabled and configured to obtain an IP address automatically. The Ethernet port can be configured in MAX.

The following table shows the pinout for the RJ-45 Gigabit Ethernet port.

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Table 2. RJ-45 Gigabit Ethernet Port Pinout

Fast Ethernet Signal	Gigabit Ethernet Signal	Pin	Pinout
TX+	TX_A+	1	
TX-	TX_A-	2	
RX+	RX_B+	3	
No Connect	TX_C+	4	
No Connect	TX_C-	5	
RX-	RX_B-	6	
No Connect	RX_D+	7	
No Connect	RX_D-	8	

Note The Ethernet port performs automatic crossover configuration so you do not need to use a crossover cable to connect to a host computer.

The following NI Ethernet cables are available for the cRIO-9063.

Table 3. RJ-45 Gigabit Ethernet Cables

Cables	Length	Part Number
CAT-5E Ethernet Cable, shielded	2 m	151733-02
	5 m	151733-05
	10 m	151733-10

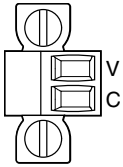
Related Information

Ethernet LED Indicators on page 13

Power Connector

The cRIO-9063 has a power connector to which you can connect a power supply. The following table shows the pinout for the power connector.

Table 4. Power Connector Pinout

Pinout	Pin	Description
	V	Power input
	C	Common

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The cRIO-9063 has reverse-voltage protection.

The following NI power supplies and accessories are available for the cRIO-9063.

Table 5. Power Accessories

Accessory	Part Number
NI PS-10 Desktop Power Supply, 24 VDC, 5 A, 100-120/200-240 VAC Input	782698-01
NI PS-14 Industrial Power Supply, 24 to 28 VDC, 3.3 A, 100-240 VAC Input	783167-01
NI PS-15 Industrial Power Supply, 24 to 28 VDC, 5 A, 100/230 VAC Input	781093-01
NI PS-16 Industrial Power Supply, 24 to 28 VDC, 10 A, 115/230 VAC Input	781094-01
NI PS-17 Industrial Power Supply, 24 to 28 VDC, 20 A, 85-276 VAC Input	781095-01

Related Information

POWER LED Indicators on page 11

RS-232 Serial Port

The cRIO-9063 has an RS-232 serial port to which you can connect devices such as displays or input devices. Use the Serial VIs to read from and write to the serial port. Refer to the *LabVIEW Help* for information about the Serial VIs.

Find examples on how to use NI-Serial or NI-VISA to perform serial communication in the NI Example Finder. The NI Example Finder is located on the Help menu in the *LabVIEW Help*.

Note The RS-232 serial port cannot be accessed by the user application when the Console Out startup option is enabled.

The following table shows the pinout for the RS-232 serial port.

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Table 6. RS-232 Serial Port Pinout

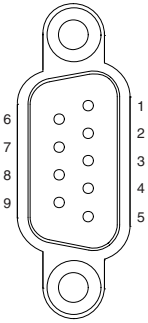
Pinout	Pin	Signal
	1	DCD
	2	RxD
	3	TxD
	4	DTR
	5	GND
	6	DSR
	7	RTS
	8	CTS
	9	RI

Table 7. RS-232 Serial Port Accessories

Accessory	Length	Part Number
RS-232, Null-Modem Serial Cable, 9-Pin DSUB (Female) to 9-Pin DSUB (Female)	1 m	182238-01
	2 m	182238-02
	4 m	182238-04

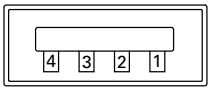
USB Host Ports

The USB host ports on the cRIO-9063 support common USB mass-storage devices such as USB Flash drives, USB-to-IDE adapters, keyboards, mice, and USB cameras.

Caution Do not hot-swap USB devices while the cRIO-9063 is in a hazardous location or connected to high voltages. If the cRIO-9063 is not in a hazardous location, you can connect and disconnect USB devices without affecting operation.

The following table shows the pinout for the USB host ports.

Table 8. USB Host Port Pinout

Pinout	Pin	Signal	Description
	1	VCC	Cable power (5 V)
	2	D-	USB data-
	3	D+	USB data+
	4	GND	Ground

The following NI cable is available for the cRIO-9063.

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Table 9. USB Host Port Cable

Cable	Length	Part Number
USB Extension with Retention, Type A Connectors	0.5 m	152166-0R5
	2 m	152166-02

Related Information

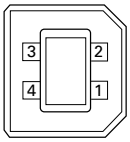
File System on page 14

USB Device Port

The cRIO-9063 USB device port is intended for device configuration, application deployment, debugging, and maintenance. For example, you can use the USB device port to install software or driver updates during field maintenance instead of interrupting communication on the RJ-45 Ethernet ports.

Caution Do not hot-swap USB devices while the cRIO-9063 is in a hazardous location or connected to high voltages. If the cRIO-9063 is not in a hazardous location, you can connect and disconnect USB devices without affecting operation.

The following table shows the pinout for the USB device port.

Description	Signal	Pin	Pinout	Pin	Signal	Description
USB data+	D+	3		2	D-	USB data-
Ground	GND	4		1	VCC	Cable power (5 V)

The following NI cable is available for the cRIO-9063.

Table 10. USB Device Port Cable

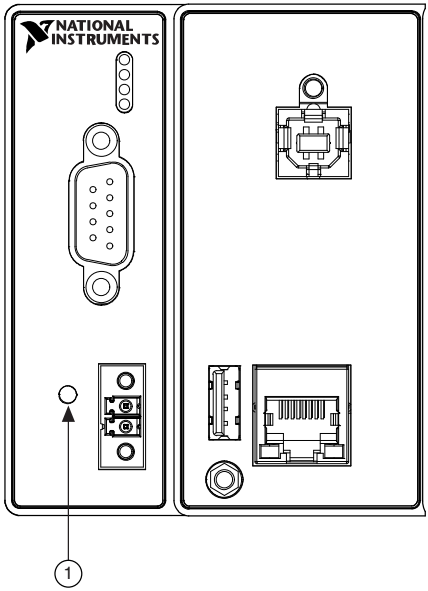
Cable	Length	Part Number
NI Locking USB Cable	1 m	157788-01

Buttons

The cRIO-9063 provides the following buttons.

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Figure 2. cRIO-9063 Buttons



1. RESET Button

RESET Button

Press the RESET button to reset the processor in the same manner as cycling power.

Troubleshooting Network Connectivity

You can use the RESET button to troubleshoot network connectivity.

Complete the following steps to reset the network adapters to default settings.

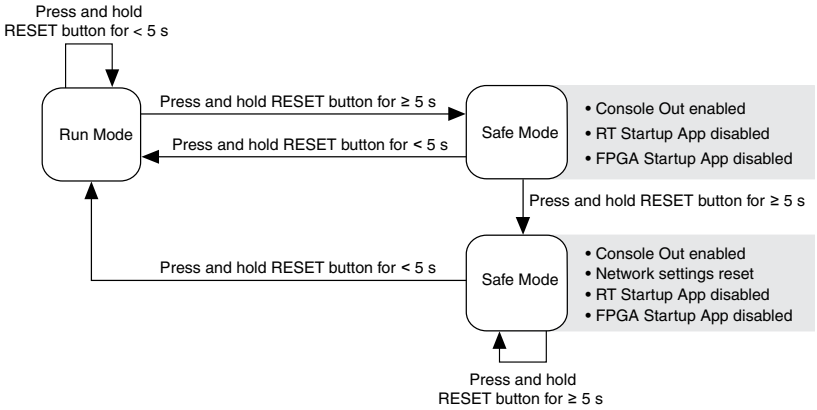
1. Hold the RESET button for 5 seconds, and then release it to boot the controller in safe mode and enable Console Out.
2. Hold the RESET button again for 5 seconds to boot the controller into safe mode, enable Console Out, and reset network adapters to default settings.

System Reset

The following figure shows the reset behavior of the cRIO-9063.

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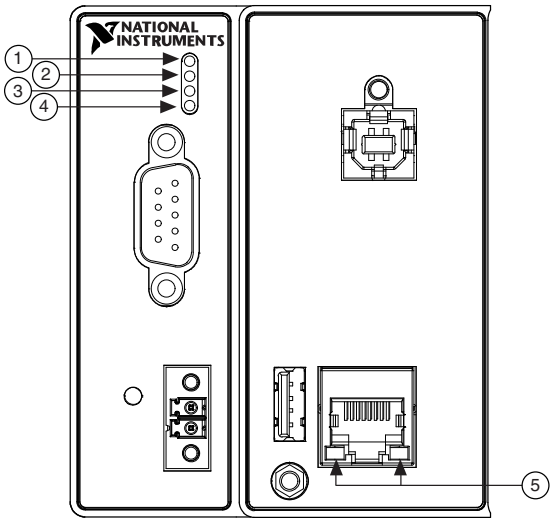
Figure 3. Reset Button Behavior



LEDs

The cRIO-9063 provides the following LEDs.

Figure 4. cRIO-9063 LEDs



1. POWER LED
2. STATUS LED
3. USER1 LED
4. USER FPGA1 LED
5. RJ-45 Ethernet LEDs

POWER LED Indicators

The following table lists the POWER LED indicators.

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Table 11. POWER LED Indicators

LED Pattern	Indication
Solid	The cRIO-9063 is powered on.
Off	The cRIO-9063 is powered off.

STATUS LED Indicators

The following table describes the STATUS LED indicators.

Table 12. STATUS LED Indicators

LED Pattern	Indication
Blinks twice and pauses	The cRIO-9063 is in safe mode. Software is not installed, which is the factory default state, or software has been improperly installed on the cRIO-9063. An error can occur when an attempt to upgrade the software is interrupted. Reinstall software on the cRIO-9063. Refer to the *Measurement & Automation Explorer (MAX) Help* for information about installing software on the cRIO-9063.
Blinks three times and pauses	The cRIO-9063 is in user-directed safe mode, or the cRIO-9063 is in install mode to indicate that software is currently being installed. This pattern may also indicate that the user has forced the cRIO-9063 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-9063 is in safe mode. The software has crashed twice without rebooting or cycling power between crashes.
Continuously blinks	The cRIO-9063 has not booted into NI Linux Real-Time. The cRIO-9063 either booted into an unsupported operating system, was interrupted during the boot process, or detected an unrecoverable software error.
On momentarily	The cRIO-9063 is booting. No action required.
Off	The cRIO-9063 is in run mode. Software is installed and the operating system is running.

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User LEDs

You can define the USER1 and USER FPGA1 LEDs to meet the needs of your application. The following table lists the USER1 and USER FPGA1 LED indicators.

Table 13. User LEDs

LED	LED Color	Description
USER1	Green	Use LabVIEW Real-Time to define the USER1 LED with the RT LEDs VI. For more information about the RT LEDs VI, refer to the *LabVIEW Help*.
USER FPGA1	Green	Use the LabVIEW FPGA Module and NI-RIO Device Drivers software to define the USER FPGA1 LED. Use the USER FPGA1 LED to help debug your application or retrieve application status. Refer to the *LabVIEW Help* for information about programming this LED.

Ethernet LED Indicators

The following table lists the Ethernet LED indicators.

Table 14. Ethernet LED Indicators

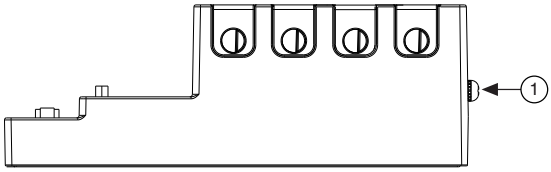
LED	LED Color	LED Pattern	Indication
ACT/LINK	—	Off	LAN link not established
	Green	Solid	LAN link established
		Flashing	Activity on LAN
10/100/1000	Yellow	Solid	1,000 Mbit/s data rate selected
	Green	Solid	100 Mbit/s data rate selected
	—	Off	10 Mbit/s data rate selected

Chassis Grounding Screw

The cRIO-9063 provides a chassis grounding screw.

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Figure 5. cRIO-9063 Chassis Grounding Screw



1. Chassis grounding screw

For EMC compliance, you must connect the cRIO-9063 to earth ground through the chassis ground screw. Use wire that is 2.1 mm^2 (14 AWG) solid copper wire with a maximum length of 1.5 m (5 ft). Attach the wire to the earth ground of the electrode system of the facility.

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 2.1 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`.

Internal Real-Time Clock

The cRIO-9063 contains an internal real-time clock that maintains system time when the cRIO-9063 is powered off. The system clock of the cRIO-9063 is synchronized with the internal real-time clock at startup. You can set the real-time clock using MAX, or you can set the clock programmatically using LabVIEW.

Refer to the specifications on *ni.com/manuals* for the real-time clock accuracy specifications.

Battery

The cRIO-9063 contains a lithium cell battery that stores the system clock information when the cRIO-9063 is powered off. There is only a slight drain on the battery when power is applied to the cRIO-9063 power connector. The rate at which the battery drains when power is disconnected depends on the ambient storage temperature. For longer battery life, store the cRIO-9063 at a cooler temperature and apply power to the power connector. Refer to the specifications on *ni.com/manuals* for the expected battery lifetime.

The battery is not user-replaceable. If you need to replace the battery, contact NI. Refer to the specifications on *ni.com/manuals* for information about battery disposal.

File System

LabVIEW mounts USB devices to the `media/sdx1` directory and creates symbolic links `/u`, `/v`, `/w`, or `/x` to the media mount point, starting with `/u` if it is available. To prevent any file corruption to external storage devices, verify that any file IO operations with the specific drive finish before removing the device. Refer to the *LabVIEW Help* for more information.

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The file system of the cRIO-9063 follows conventions established for UNIX-style operating systems. Other LabVIEW Real-Time targets follow Microsoft Windows-style conventions. In order to facilitate the porting of applications from those targets, this target supports the Windows-style `/C` home directory. This path is bound to the UNIX-style directory `/home/lvuser`.

Various LabVIEW Real-Time system files which would be accessible from `C:` (or `/C`) on other LabVIEW Real-Time targets are found in different locations on this target.

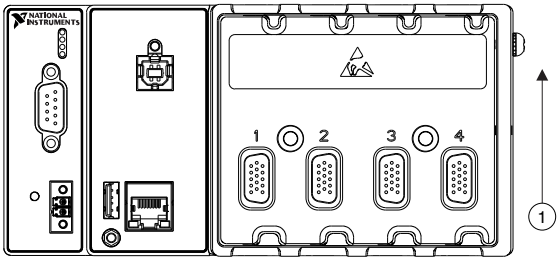
UNIX-style file systems support the concept of a symbolic link, which allows access to a file using an alternative file path. For example, it is possible to link `/C/ni-rt/system`, where dynamic libraries are deployed on other LabVIEW Real-Time targets, to `/usr/local/lib`, where they are stored on the cRIO-9063, if the application requires this.

For more information, visit *ni.com/info* and enter the Info Code `RT_Paths`.

Mounting the Device

To obtain the maximum allowable ambient temperature of 55 °C, you must mount the cRIO-9063 horizontally on a flat, metallic, vertical surface such as a panel or wall. You can mount the cRIO-9063 directly to the surface or use the NI Panel Mounting Kit. The following figure shows the cRIO-9063 mounted horizontally.

Figure 6. cRIO-9063 Horizontal Mounting



1. Up

You can also mount the cRIO-9063 in other orientations, on a nonmetallic surface, on a 35-mm DIN rail, on a desktop, or in a rack. Mounting the cRIO-9063 in these or other configurations can reduce the maximum allowable ambient temperature and can affect the typical accuracy of modules in the cRIO-9063. For more information about typical accuracy specifications for C Series modules and temperature deratings caused by different mounting configurations, visit *ni.com/info* and enter the Info Code `criotypical`.

Caution Make sure that no C Series modules are in the cRIO-9063 before mounting it.

Tip Before using any of these mounting methods, record the serial number from the back of the cRIO-9063 so that you can identify the cRIO-9063 in MAX. You will be unable to read the serial number after you mount the cRIO-9063.

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Dimensions

The following figures show the front and side dimensions of the cRIO-9063. For detailed dimensional drawings and 3D models, visit *ni.com/dimensions* and search for the module number.

Figure 7. cRIO-9063 Front Dimensions

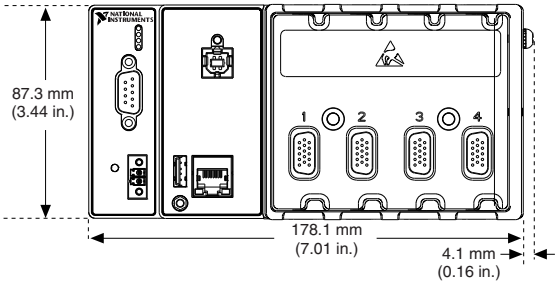
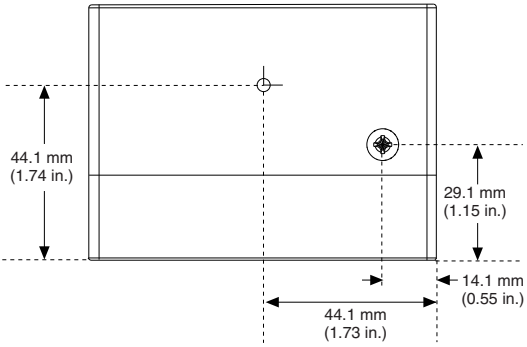


Figure 8. cRIO-9063 Side Dimensions



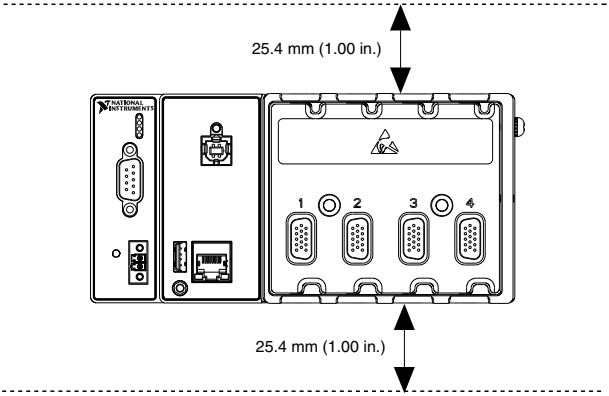
Mounting Requirements

Your installation must meet the following requirements for cooling and cabling clearance.

Allow 25.4 mm (1.00 in.) on the top and the bottom of the cRIO-9063 for air circulation, as shown in the following figure.

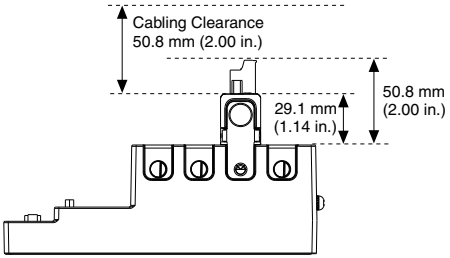
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Figure 9. cRIO-9063 Cooling Dimensions



Allow the appropriate space in front of C Series modules for cabling clearance, as shown in the following figure. The different connector types on C Series modules require different cabling clearances. For a complete list of cabling clearances for C Series modules, visit *ni.com/info* and enter the Info Code `crioconn`.

Figure 10. cRIO-9063 Cabling Clearance

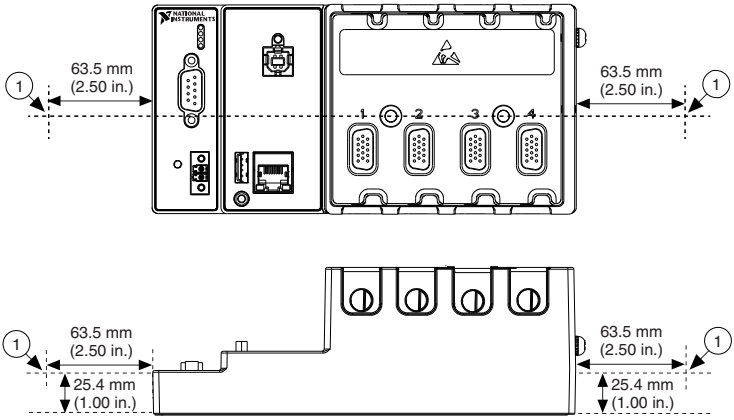


Ambient Temperature

Measure the ambient temperature at each side of the cRIO-9063, 63.5 mm (2.50 in.) from the side and 25.4 mm (1.00 in.) forward from the rear of the cRIO-9063, as shown in the following figure.

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Figure 11. cRIO-9063 Ambient Temperature Location



1. Location for measuring the ambient temperature

Mounting the Device Directly on a Flat Surface

For environments with high shock and vibration, NI recommends mounting the cRIO-9063 directly on a flat, rigid surface using the mounting holes in the cRIO-9063.

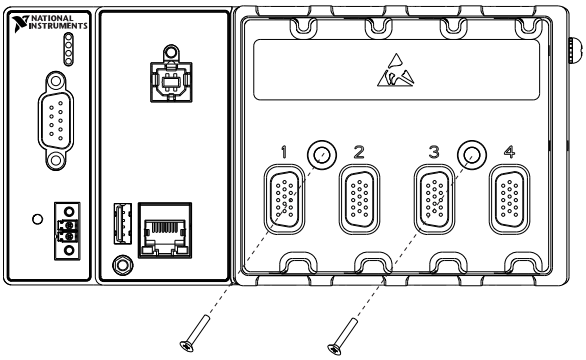
What to Use

- cRIO-9063
- Screwdriver, Phillips #2
- M4 or number 8 screw (x2), user-provided, longer than 23.00 mm (0.91 in.) to pass all the way through the cRIO-9063

What to Do

Complete the following steps to mount the cRIO-9063 directly on a flat surface.

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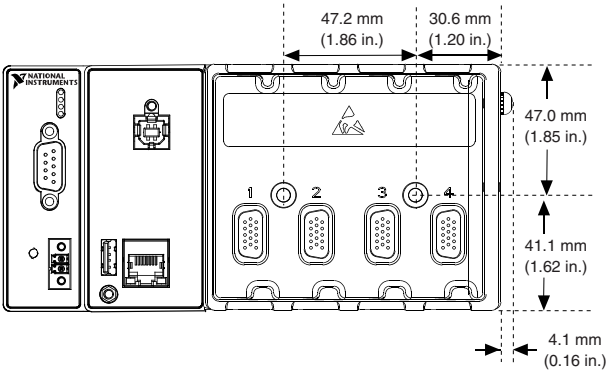


1. Prepare the surface for mounting the cRIO-9063 using the *Surface Mounting Dimensions*.
2. Align the cRIO-9063 on the surface.
3. Fasten the cRIO-9063 to the surface using the M4 or number 8 screws appropriate for the surface. Tighten the screws to a maximum torque of 1.3 N · m (11.5 lb · in.).

Surface Mounting Dimensions

The following figure shows the surface mounting dimensions for the cRIO-9063.

Figure 12. cRIO-9063 Surface Mounting Dimensions



Mounting the Device on a Panel

You can use the NI panel mounting kit to mount the cRIO-9063 on a panel.

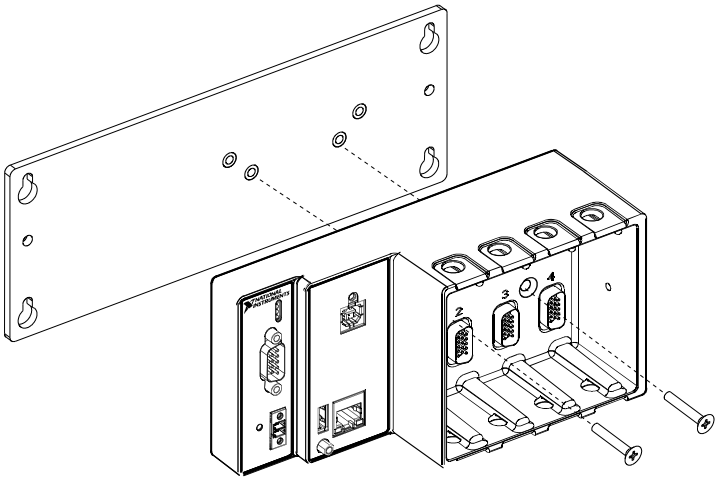
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What to Use

- cRIO-9063
- Screwdriver, Phillips #2
- NI panel mounting kit, 779097-01
  - Panel mounting plate
  - M5 or number 10 screw (x4)

What to Do

Complete the following steps to mount the cRIO-9063 on a panel.



1. Align the cRIO-9063 and the panel mounting plate.
2. Fasten the panel mounting plate to the cRIO-9063 using the screwdriver and M5 or number 10 screws. NI provides these screws with the panel mounting kit. Tighten the screws to a maximum torque of 1.3 N · m (11.5 lb · in.).

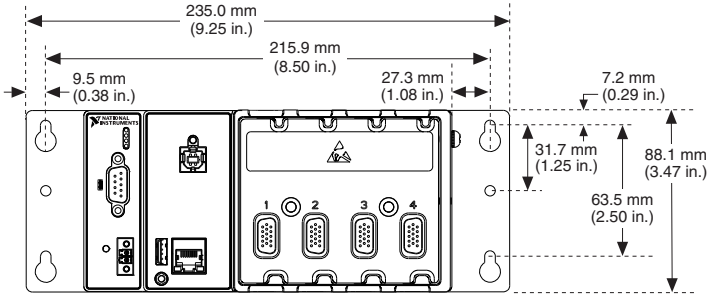
   Note You must use the screws provided with the NI panel mounting kit because they are the correct depth and thread for the panel mounting plate.
3. Fasten the panel mounting plate to the surface using the screwdriver and screws that are appropriate for the surface. The maximum screw size is M5 or number 10.

Panel Mounting Dimensions

The following figure shows the panel mounting dimensions for the cRIO-9063.

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Figure 13. cRIO-9063 Panel Mounting Dimensions



Mounting the Device on a DIN Rail

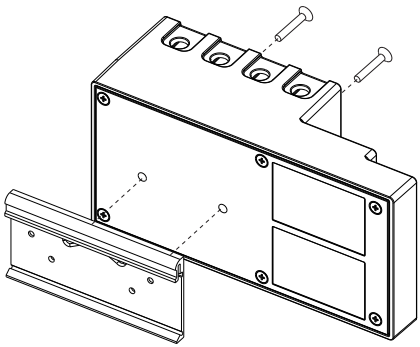
You can use the NI DIN rail mounting kit to mount the cRIO-9063 on a standard 35-mm DIN rail.

What to Use

- cRIO-9063
- Screwdriver, Phillips #2
- NI DIN rail mounting kit, 779019-01
  - DIN rail clip
  - M4 × 25 flathead screw (x2)

What to Do

Complete the following steps to mount the cRIO-9063 on a DIN rail.



1. Align the cRIO-9063 and the DIN rail clip.

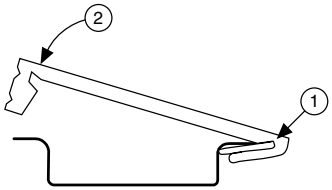
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2. Fasten the DIN rail kit to the cRIO-9063 using the screwdriver and M4 × 25 flathead screws. NI provides these screws with the DIN rail mounting kit. Tighten the screws to a maximum torque of 1.3 N · m (11.5 lb · in.).

Note You must use the screws provided with the NI DIN rail mounting kit because they are the correct depth and thread for the DIN rail clip.

Clipping the Device on a DIN Rail

Complete the following steps to clip the cRIO-9063 on a DIN rail.



1. Insert one edge of the DIN rail into the deeper opening of the DIN rail clip.
2. Press down firmly to compress the spring until the clip locks in place on the DIN rail.

Caution Ensure that no C Series modules are in the cRIO-9063 before removing it from the DIN rail.

Mounting the Device on a Rack

You can use the following rack mount kits to mount the cRIO-9063 and other DIN rail-mountable equipment on a standard 482.6 mm (19 in.) rack.

- NI Sliding Rack-Mounting Kit, 779102-01
- NI Rack-Mounting Kit, 781989-01

Note You must use the NI DIN rail mounting kit, 779019-01, in addition to a rack-mounting kit.

Mounting the Device on a Desktop

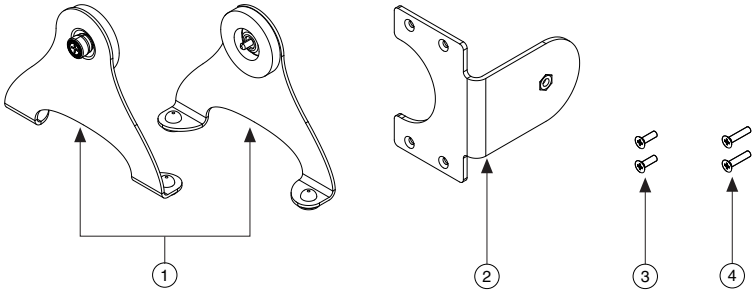
You can use the NI desktop mounting kit to mount the cRIO-9063 on a desktop.

What to Use

- cRIO-9063
- Screwdriver, Phillips #1
- Screwdriver, Phillips #2
- NI desktop mounting kit, 779473-01

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Figure 14. Components of the NI Desktop Mount Kit

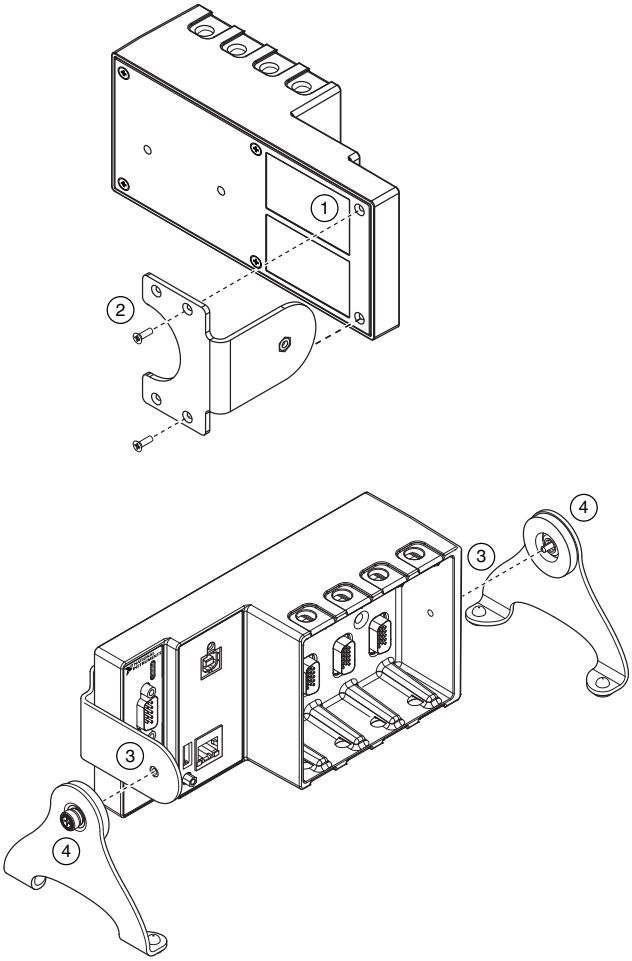


1. Desktop mounting brackets (x2)
2. Adapter bracket
3. M3x14 screws (x2)
4. M3x20 screws (x2)

What to Do

Complete the following steps to mount the cRIO-9063 on a desktop.

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1. Use a #1 Phillips screwdriver to remove the two screws from the back of the chassis on the front-panel side.
2. Use the screwdriver and the two M3x20 screws to attach the adapter bracket to the chassis.
3. Align one of the end brackets with the mounting hole at one of the ends of the chassis.
4. Use a #2 Phillips screwdriver to tighten the captive screw on the end bracket.
5. Repeat steps 2 and 3 to attach the other end bracket to the other end of the chassis.

Desktop Mounting Dimensions

The following figures show the desktop mounting dimensions for the cRIO-9063.

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Figure 15. cRIO-9063 Desktop Mounting Front Dimensions

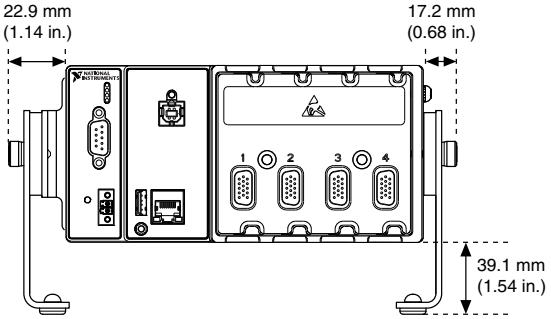
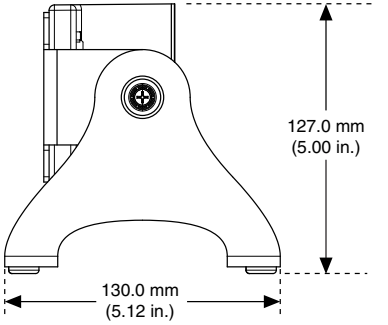


Figure 16. cRIO-9063 Desktop Mounting Side Dimensions



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