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cRIO-9036

MAINTAINING HARDWARE

NI CMS-9036

NI Monitoring Device for NI InsightCM™

This document describes how to maintain the CMS-9036 NI Condition Monitoring Device. The CompactRIO-based CMS-9036 is a bundle of hardware and software that includes the following components and features:

- cRIO-9036 controller
- NI C Series modules installed in the chassis
- Pre-installed NI InsightCM Application software
- Network configuration via USB drive



Note Complete the steps in the *NI InsightCM Monitoring Device Quick Start* before using this document.



Note The chassis and modules included in the cRIO-9036 have been individually certified and rated for safety, environmental, and regulatory information. Refer to ni.com/manuals for complete hardware documentation for each device, including safety, environmental, and regulatory information.

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Safety Guidelines



Caution Do not operate the cRIO-9036 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-9036 is suitable for use in Class I, Division 2, Groups A, B, C, D, T4 hazardous locations; Class I, Zone 2, Class I, Division 2, Groups A, B, C, D, T4 and Class 1, Zone 2, AEx nA IIC T4 hazardous locations; and nonhazardous locations only. Follow these guidelines if you are installing the cRIO-9036 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-9036 has been evaluated as Ex nA IIC T4 equipment under DEMKO 07 ATEX 0626664X and is IECEx UL 14.0089X certified. Each device is marked Ⓢ II 3G and is suitable for use in Zone 2 hazardous locations, in ambient temperatures of $-40\text{ °C} \leq T_a \leq 70\text{ °C}$.



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.

Special Conditions for Marine Applications

Some products are approved for marine (shipboard) applications. To verify marine approval certification for a product, visit ni.com/certification and search for the certificate.



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-9036 meets the following specifications.

Operating temperature (IEC 60068-2-1, IEC 60068-2-2)	-40 °C to 70 °C
Operating humidity (IEC 60068-2-78)	10% RH to 90% RH, noncondensing
Pollution Degree	2
Maximum altitude	5,000 m

Indoor use only.

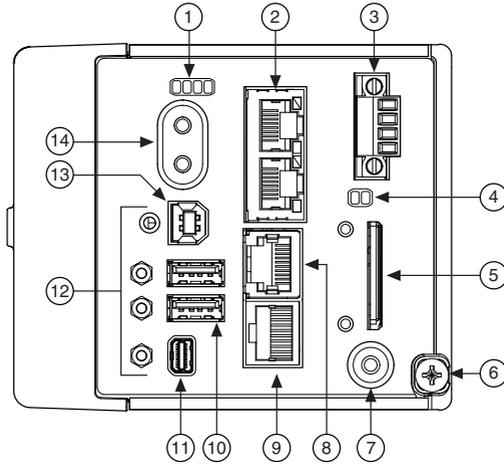


Note Refer to the device specifications on ni.com/manuals for complete specifications.

Controller Front Panel

The following figure shows the I/O ports and other features of the cRIO-9036 controller.

Figure 1. cRIO-9036 Controller Front Panel

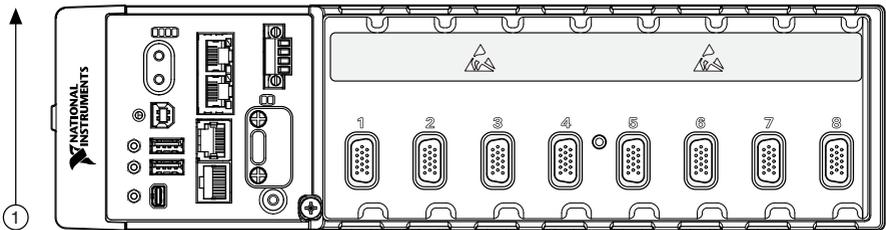


- | | |
|------------------------------|---------------------------------|
| 1. LEDs | 8. RS-232 Serial Port |
| 2. Ethernet Ports | 9. RS-485/422 (DTE) Serial Port |
| 3. Power Connector | 10. USB Host Ports |
| 4. SD LEDs | 11. Mini DisplayPort |
| 5. SD Card Removable Storage | 12. Cable Retention Mounts |
| 6. Ground Screw | 13. USB Device Port |
| 7. USER1 Button | 14. Power and Reset Buttons |

Mounting the Device

To obtain the maximum allowable ambient temperature of 70 °C, you must mount the cRIO-9036 horizontally on a flat, metallic, vertical surface such as a panel or wall. You can mount the cRIO-9036 directly to the surface or use the NI Panel Mounting Kit. The following figure shows the cRIO-9036 mounted horizontally.

Figure 2. cRIO-9036 Horizontal Mounting



1. Up

You can also mount the cRIO-9036 in other orientations, on a nonmetallic surface, on a 35-mm DIN rail, on a desktop, or in a rack. Mounting the cRIO-9036 in these or other configurations can reduce the maximum allowable ambient temperature and can affect the typical accuracy of modules in the cRIO-9036. 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 `criotypicaljp`.



Caution Make sure that no C Series modules are in the cRIO-9036 before mounting it.



Tip Before using any of these mounting methods, record the serial number from the back of the cRIO-9036 so that you can identify the cRIO-9036 in the NI InsightCM web application. You will be unable to read the serial number after you mount the cRIO-9036.

Dimensions

The following figures show the front and side dimensions of the cRIO-9036. For detailed dimensional drawings and 3D models, visit ni.com/dimensions and search for the module number.

Figure 3. cRIO-9036 Front Dimensions

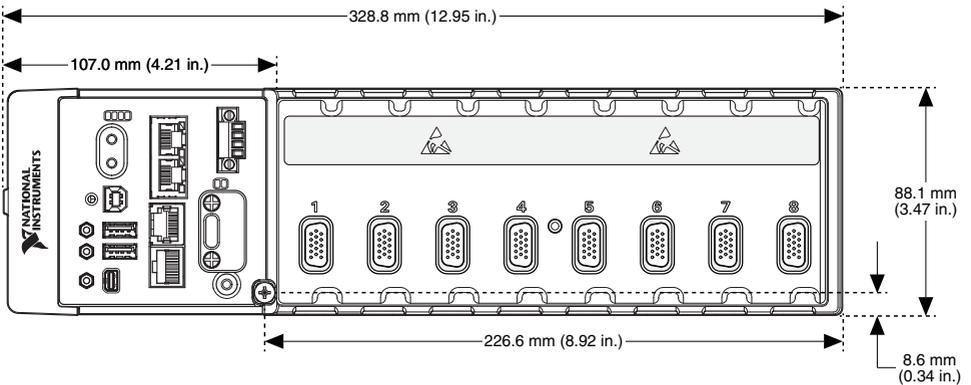
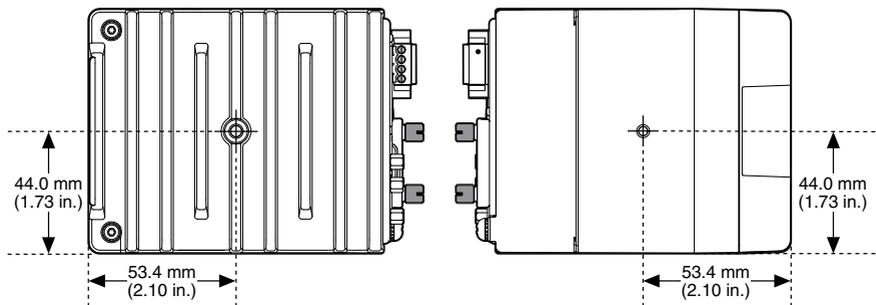


Figure 4. cRIO-9036 Side Dimensions

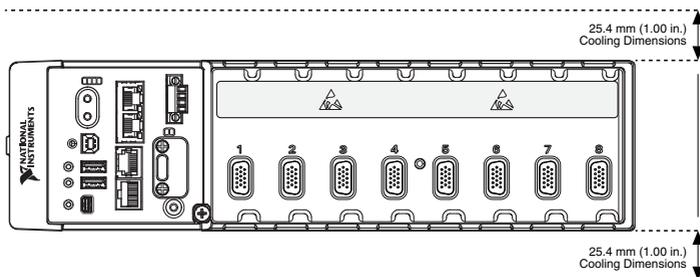


Mounting Requirements

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

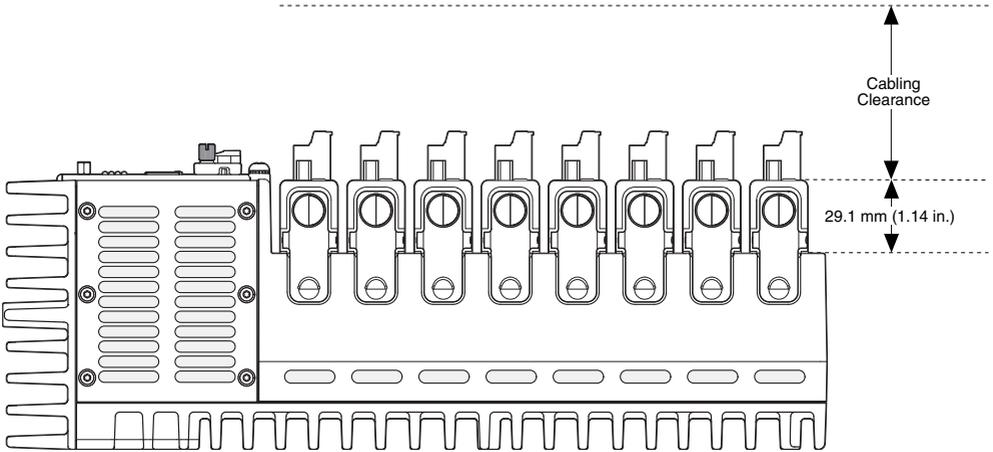
Allow 25.4 mm (1.00 in.) on the top and the bottom of the cRIO-9036 for air circulation, as shown in the following figure.

Figure 5. cRIO-9036 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`.

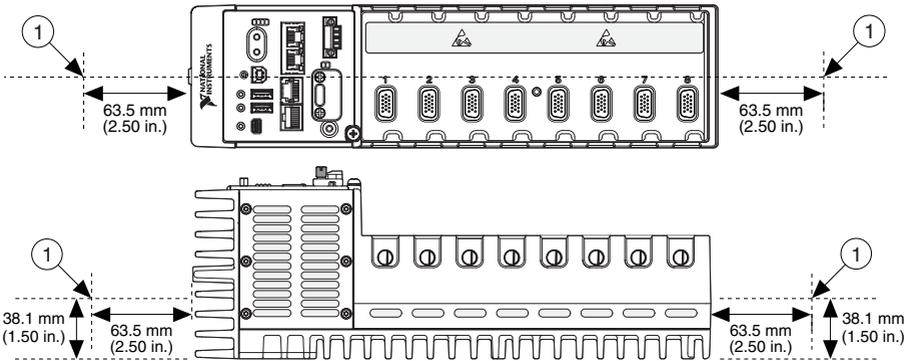
Figure 6. cRIO-9036 Cabling Clearance



Ambient Temperature

Measure the ambient temperature at each side of the cRIO-9036, 63.5 mm (2.5 in.) from the side and 25.4 mm (1 in.) forward from the rear of the cRIO-9036, as shown in the following figure.

Figure 7. cRIO-9036 Ambient Temperature Location



1. Location for measuring the ambient temperature

Mounting the Device Directly on a Flat Surface

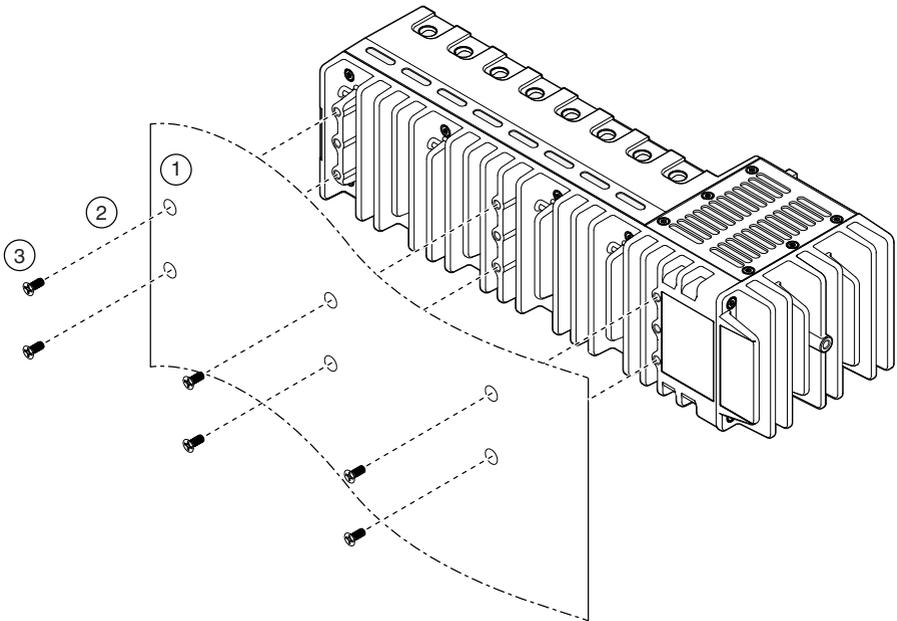
For environments with high shock and vibration, NI recommends mounting the cRIO-9036 directly on a flat, rigid surface using the mounting holes in the cRIO-9036.

What to Use

- cRIO-9036
- M4 screw (x6), user provided, which must not exceed 8 mm of insertion into the cRIO-9036

What to Do

Complete the following steps to mount the cRIO-9036 directly on a flat surface.

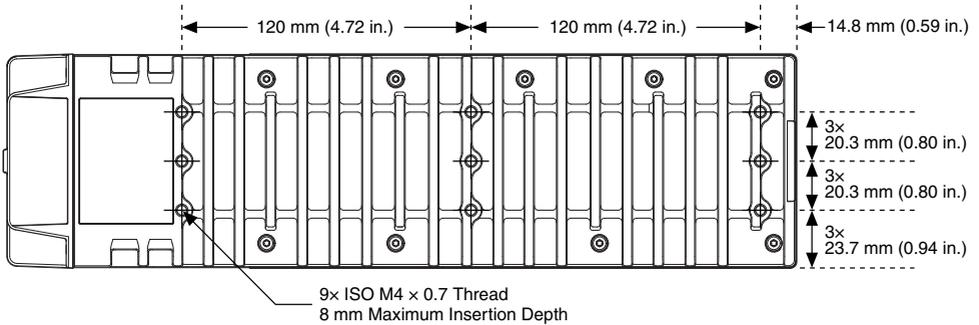


1. Prepare the surface for mounting the cRIO-9036 using the [Surface Mounting Dimensions](#).
2. Align the cRIO-9036 on the surface.
3. Fasten the cRIO-9036 to the surface using the M4 screws appropriate for the surface. Screws must not exceed 8 mm of insertion into the cRIO-9036. Tighten the screws 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-9036.

Figure 8. cRIO-9036 Surface Mounting Dimensions



Mounting the Device on a Panel

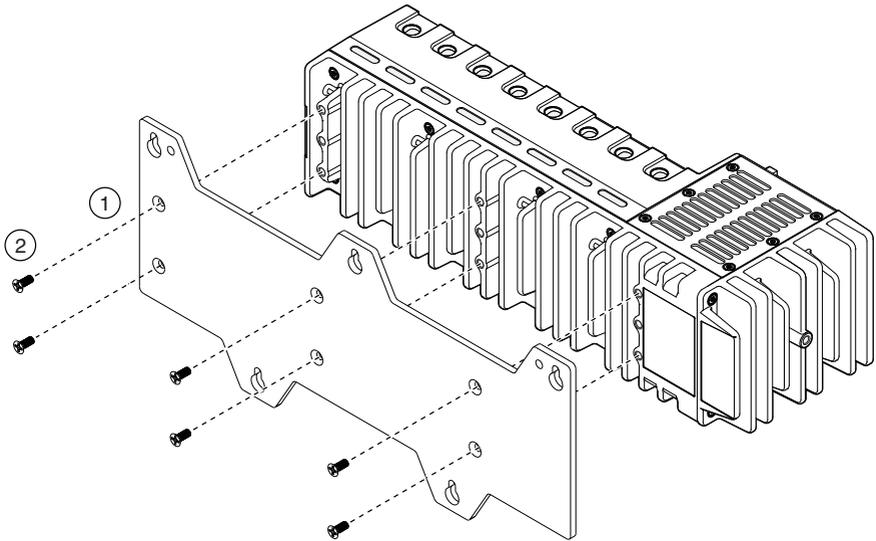
You can use the NI panel mounting kit to mount the cRIO-9036 on a panel.

What to Use

- cRIO-9036
- Screwdriver, Phillips #2
- NI panel mounting kit, 157253-01
 - Panel mounting plate
 - M4 x 22 screw (x6)

What to Do

Complete the following steps to mount the cRIO-9036 on a panel.



1. Align the cRIO-9036 and the panel mounting plate.
2. Fasten the panel mounting plate to the cRIO-9036 using the screwdriver and M4 × 22 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.).



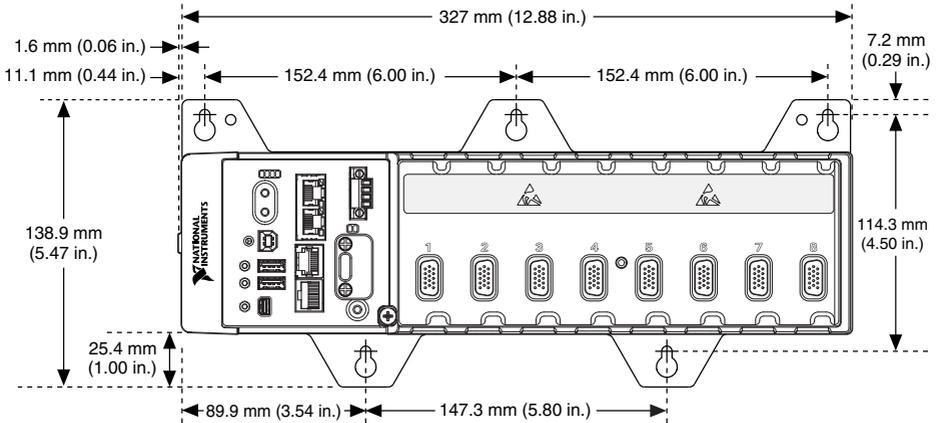
Note You must use the screws provided with the NI panel mounting kit because they are the correct depth and thread for the panel mounting plate.

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-9036.

Figure 9. cRIO-9036 Panel Mounting Dimensions



Mounting the Device on a DIN Rail

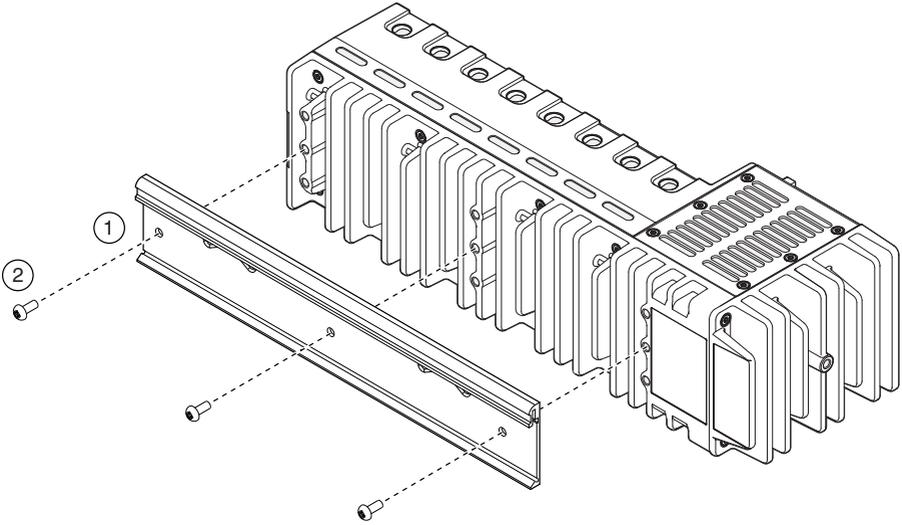
You can use the NI DIN rail mounting kit to mount the cRIO-9036 on a standard 35-mm DIN rail.

What to Use

- cRIO-9036
- Screwdriver, Phillips #2
- NI DIN rail mounting kit, 157254-01
 - DIN rail clip
 - M4 × 22 screw (x3)

What to Do

Complete the following steps to mount the cRIO-9036 on a DIN rail.



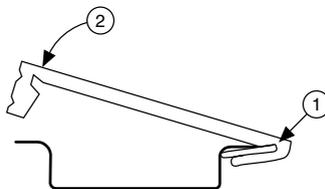
1. Align the cRIO-9036 and the DIN rail clip.
2. Fasten the DIN rail kit to the cRIO-9036 using the screwdriver and M4 × 22 screws. NI provides these screws with the DIN rail mounting kit. Tighten the screws to a maximum torque of 1.3 N · m (11.5 lb · in.).



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-9036 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-9036 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-9036 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, 779018-01, in addition to a rack-mounting kit.

Mounting the Device on a Desktop

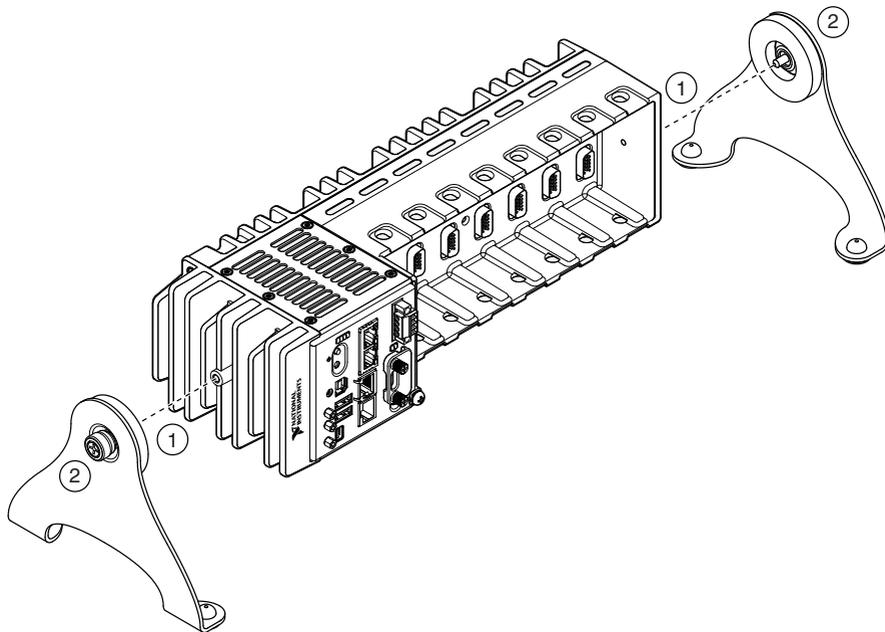
You can use the NI desktop mounting kit to mount the cRIO-9036 on a desktop.

What to Use

- cRIO-9036
- Screwdriver, Phillips #2
- NI desktop mounting kit, 779473-01
 - Desktop mounting brackets (x2)

What to Do

Complete the following steps to mount the cRIO-9036 on a desktop.



1. Align the brackets with the mounting holes on the ends of the cRIO-9036.
2. Use the screwdriver to tighten the captive screws on the end of the brackets.

Desktop Mounting Dimensions

The following figures show the desktop mounting dimensions for the cRIO-9036.

Figure 10. cRIO-9036 Desktop Mounting Front Dimensions

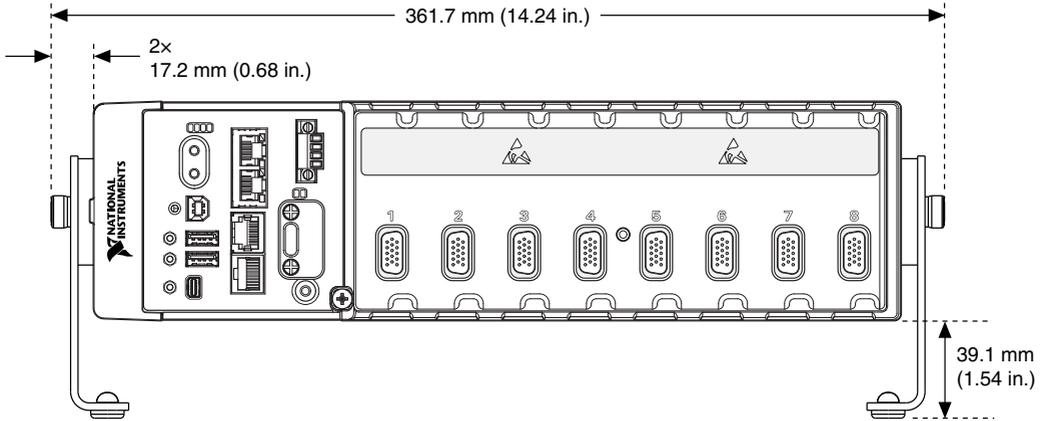
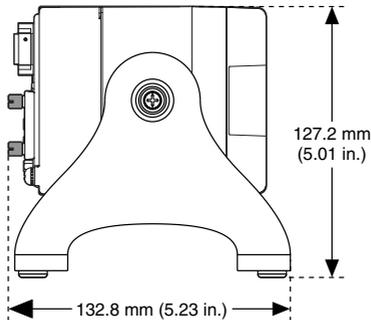


Figure 11. cRIO-9036 Desktop Mounting Side Dimensions



Installing C Series I/O Modules in the Chassis

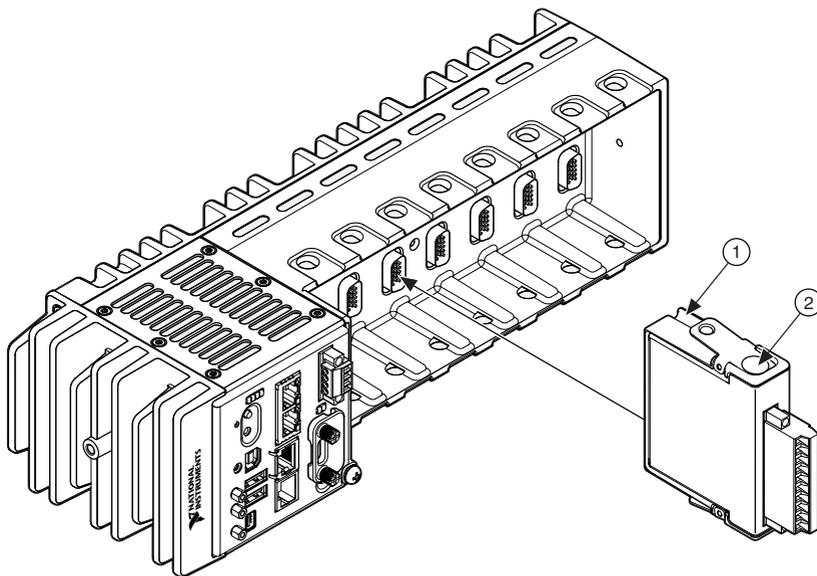


Note Before you install a C Series I/O module in the chassis, ensure that no I/O-side power is connected to the module. If the device is in a nonhazardous location, the chassis power can be on when you install modules.

Complete the following steps to install a C Series I/O module in the chassis.

1. Align the module with a slot in the chassis, as shown in the following figure. The module slots are labeled 1 to 8, left to right.

Figure 12. Installing a C Series I/O Module in the Chassis



1. Insertion groove
2. Latch

2. Squeeze the latches and insert the module into the slot.
3. Press firmly on the connector side of the module until the latches lock the module into place.
4. Repeat these steps to install additional modules.

I/O Module Arrangements

For the cRIO-9036, NI InsightCM supports only dynamic C Series I/O modules, such as the NI 9232. You must fill at least slot 1 and 2. After slot 2, fill module slots in ascending order. You cannot skip any slots but you do not have to use every slot.



Note You must connect tachometers to the module in slot 1. Do not connect any other sensors to the module in slot 1.

Removing I/O Modules from the Chassis



Note Before you remove a C Series I/O module from the chassis, ensure that no I/O-side power is connected to the module. If the device is in a nonhazardous location, the chassis power can be on when you install modules.

To remove a C Series I/O module from the chassis, squeeze the latches on both sides of the module and pull the module from the chassis.

Connecting to a Network

Use a standard Category 5 (CAT-5) or better shielded, twisted-pair Ethernet cable to connect the RJ-45 Ethernet port on the cRIO-9036 to an Ethernet hub.



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

The first time you power up the cRIO-9036, it attempts to initiate a DHCP network connection. If the cRIO-9036 cannot initiate a DHCP connection, it connects to the network with a link-local IP address with the form `169.254.x.x`. After the chassis powers up, refer to [Resetting the Network Configuration of the NI InsightCM cRIO Controller](#).

Grounding the Chassis

Complete the following steps to connect the chassis grounding terminal to the grounding electrode system of your facility.

1. Attach a ring lug to a 2.0 mm² (14 AWG) or larger wire.
2. Remove the grounding screw from the grounding terminal on the right side of the chassis.
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 appropriate for the application.



Note If you use shielded cabling to connect to a C Series I/O module with a plastic connector, 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.

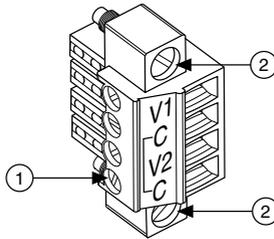
For more information about ground connections, visit ni.com/info and enter the Info Code `emcground`.

Wiring Power to the Controller

The cRIO-9036 requires an external power supply that meets device specifications. The cRIO-9036 filters and regulates the supplied power and provides power for all I/O modules installed in the chassis. The cRIO-9036 has one layer of reverse-voltage protection.

The following figure shows the terminal screws, which secure the wires in the screw terminals, and the connector screws, which secure the power connector on the front panel.

Figure 13. COMBICON Power Connector

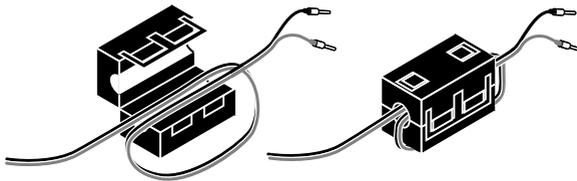


1. Terminal screws
2. Connector screws

Complete the following steps to connect a power supply to the chassis.

1. Install the ferrite provided with the controller across the negative and positive leads of the power supply, approximately 50–75 mm (2–3 in.) from the ends of the leads near the controller, as shown in the following figure.

Figure 14. Installing a Ferrite on the Power Supply Wires



2. Connect the positive lead of the power supply to the V1 or V2 terminal of the COMBICON power connector installed on the front panel of the cRIO-9036 and tighten the terminal screw.
3. Connect the negative lead of the power supply to one of the C terminals of the power connector and tighten the terminal screw.
4. Optionally, connect the positive lead of another power supply to the other V terminal and the negative lead to one of the C terminals.
5. Tighten the connector screws.

Precautions to Take When Wiring Power to the Controller

Take note of the following when wiring power to the controller.

- If you connect power to both the V1 and V2 terminals, ensure that the voltage difference between the two power inputs, measured at the controller power connector, is at least 500 mV.
- The controller draws power from either the V1 or V2 terminals depending on which terminal has a higher voltage. The controller does not draw power from both terminals. The controller switches between the V1 and V2 terminals without affecting operation.



Caution The C terminals are internally connected to each other. If you use two power supplies, ensure that they share a common ground.



Caution The C terminals are internally connected to the controller to prevent a faulty ground connection from causing the chassis ground to float. If you reverse the input voltage, the positive input voltage is connected directly to the chassis. The controller provides built-in reversed-voltage protection, but reversed voltage can damage connected peripherals if the chassis ground is not reliably connected to earth ground.



Caution Do not tighten or loosen the terminal screws on the power connector while the power connector is plugged in to the controller or while the power supply is on.

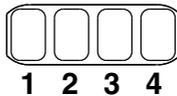
Powering On the Controller

When you apply power to the CompactRIO device, the controller runs a power-on self test (POST). The Power and Status LEDs turn on briefly. When the Status LED turns off, the POST is complete. If the LEDs do not behave in this way when the device powers on, refer to the information in this document about understanding LED indications.

Understanding LED Indications on the Controller

The following figure shows the LEDs on the cRIO-9036.

Figure 15. LEDs on the cRIO-9036



1. POWER	3. STATUS
2. FPGA	4. USER1

POWER LED

The POWER LED is lit while the cRIO-9036 is powered on. This LED indicates that the power supply connected to the controller is adequate.

FPGA LED

NI Monitoring Devices do not use the FPGA LED.

STATUS LED

The STATUS LED is off during normal operation. After the device powers on, the cRIO-9036 indicates specific error conditions by flashing the STATUS LED a certain number of times

every few seconds. If you observe this behavior after the device powers on, contact NI support.

USER1 LED

The USER1 LED can display the indications described in the following table:

Table 1. USER1 LED Indications

Indication	Description
Flashing rapidly	Indicates an error condition. Open the InsightCM web application to the Devices tab on the Dashboard page to see the device status.
Flashing steadily	Indicates normal operation.
Solid	Indicates that USB operations are in progress, such as reading or writing the connection information file. You can safely remove the USB drive when this LED resumes blinking steadily.  Note This device polls USB drives every 15 seconds, so you might need to wait up to 15 seconds after a USB operation begins for the LED to light.

Troubleshooting Network Communication

If the CMS-9036 does not connect to NI InsightCM Application with a status of Online, try the following troubleshooting tips:

- Check the Ethernet cable connections on the CMS-9036, host computer, and router.
- If you have network firewalls or other security software enabled, try temporarily turning them off. You might also need to add an exception for NI InsightCM Application by completing the following steps:
 1. Navigate to the standard Microsoft Windows Control Panel utility for managing firewall settings.
 2. Click **Allow a program or feature through Windows Firewall**.
 3. Click **Allow another program**.
 4. Select **NI InsightCM** and click **Add**.
 5. Click **OK** and close the firewall settings.
- Ensure that the ports are open to communication on the host computer. If you are using an intelligent switch on the network, ensure that the switch is not disabling these ports. Refer to the *NI InsightCM Readme* on ni.com/manuals for more information about host computer ports.
- If you have multiple network cards on the host computer, ensure that you use the Windows Control Panel to disable all other network adapters, such as wireless adapters. Turning off the wireless antenna is insufficient.

Resetting the Network Configuration of the Controller

Complete the following steps to reset the IP address and connection type of the controller.

1. Insert the USB drive into the USB port on the controller front panel. Within 20 seconds, the USER1 LED lights solid, which indicates that the device is reading from or writing to the settings file.



Tip You can use the blank USB drive included in the NI InsightCM Application kit, if available.

2. Remove the USB drive when the USER1 LED returns to blinking steadily.
3. Insert the USB drive into a USB port on a computer.
4. Browse the file structure of the drive to the `<RootLevel>:\InsightCM\download\NI-cRIO-ModelNumber-SerialNumber` directory.
5. To view the current IP address, skip to step 6. To change the IP address or set the IP address to be static, copy the JSON file beginning with `networkInfo_` followed by the device hostname, such as `networkInfo_NI-cRIO-ModelNumber-SerialNumber.json`, to the `<RootLevel>:\InsightCM\upload` directory on the USB drive. You might need to create the `upload` folder.
6. Open the JSON file beginning with `networkInfo_` followed by the device hostname.
7. In the array that contains the line `"IsPrimary":true`, the following line displays the current IP address:

```
"IP Address": "x.x.x.x"
```

where `x.x.x.x` is the IP address.

8. To change the IP address, enter the value you want to use. Otherwise, record the IP address.
9. (Optional) To assign a static IP address, configure the following line in the array as shown:

```
"IP Address Request Mode": "1"
```

10. Save and close the file.
11. If you made changes to the file, insert the USB drive back into the USB port on the controller front panel. The USER1 LED lights solid, which indicates that the device is reading network and connection properties. You can remove the USB drive when the USER1 LED returns to blinking steadily.



Tip To verify that the device successfully applied changes you made to the file, reinsert the USB drive in a computer and browse to the `<RootLevel>:\InsightCM` directory. If the changes were successfully applied, the `upload` folder no longer contains the JSON file you edited, instead, a folder named `applied` contains the file.

Where to Go Next

The following figure describes additional documentation and resources as you use the CMS-9036.

Figure 16. Where to Go Next

1	<i>NI InsightCM™ Configuration and Monitoring Help</i>		Help system with instructions for configuring the NI InsightCM application and monitoring NI Monitoring devices. To launch this help, open the InsightCM web application in a web browser and click the Help link in the top-right corner of the page.
2	CompactRIO Controller and Chassis Datasheets		Device specifications, including power requirements, physical characteristics, safety and environmental information, and other important information. Visit ni.com/manuals and search your device.
3	C Series Module Documentation		Operating instructions and device specifications for C Series modules that you can install in a CompactRIO chassis. These documents describe how to connect sensors, actuators, and other devices to C Series modules. Visit ni.com/info and enter the Info Code <code>insightcmdocs</code> to access documentation for C Series modules that are compatible with NI InsightCM.

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.

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