NI cRIO-9111

4-Slot Reconfigurable Embedded Chassis

In Stock

Used and in Excellent Condition

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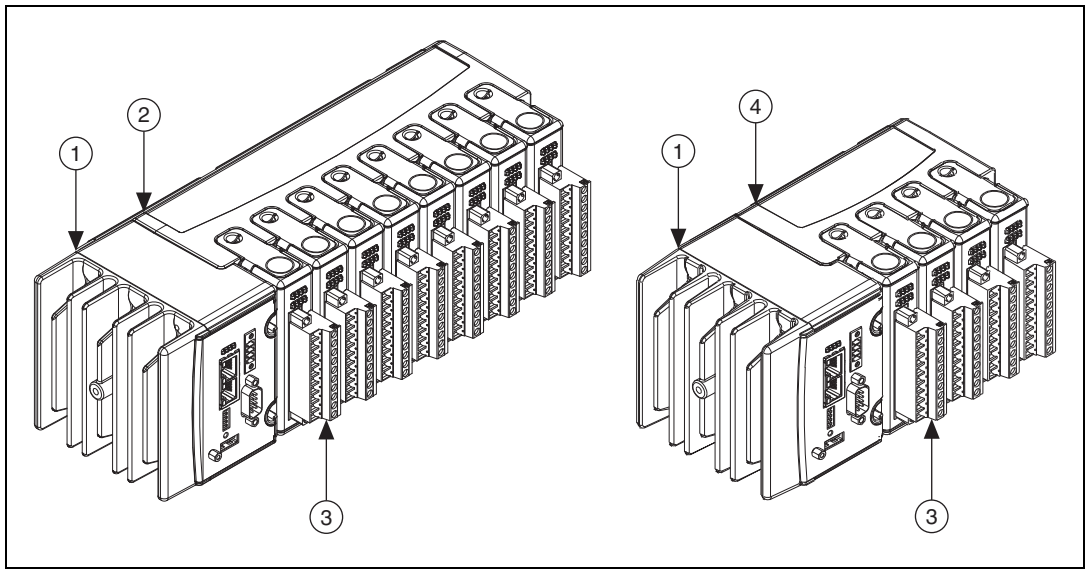
INSTALLATION INSTRUCTIONS

CompactRIO™ Reconfigurable Embedded Chassis

cRIO-9111/9112/9113/9114/9116/9118



1	Controller	3	C Series I/O Module
2	Eight-Slot Reconfigurable Embedded Chassis (cRIO-9112/9114/9116/9118)	4	Four-Slot Reconfigurable Embedded Chassis (cRIO-9111/9113)

Figure 1. CompactRIO Four-Slot and Eight-Slot Reconfigurable Embedded Systems

NATIONAL INSTRUMENTS™

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These installation instructions describe how to install a National Instruments CompactRIO Reconfigurable Embedded System consisting of a CompactRIO controller, C Series I/O modules, and a cRIO-9111, cRIO-9112, cRIO-9113, cRIO-9114, cRIO-9116, or cRIO-9118 reconfigurable embedded chassis (referred to inclusively as the cRIO-911*x*).

Safety Guidelines

Operate the cRIO-911*x* only as described in this document.

Safety Guidelines for Hazardous Locations

The cRIO-911*x* 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 and Ex nA IIC T4 hazardous locations; and nonhazardous locations only. Follow these guidelines if you are installing the cRIO-911*x* in a potentially explosive environment. Not following these guidelines may result in serious injury or death.

Caution Do *not* disconnect I/O-side wires and 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.

Caution For Zone 2 applications, install the CompactRIO system in an enclosure rated to at least IP 54 as defined by IEC 60529 and EN 60529.

Special Conditions for Hazardous Locations Use in Europe

This equipment has been evaluated as Ex nA IIC T4 equipment under DEMKO Certificate No. 07 ATEX 0626664X. Each chassis is marked ⟨Ex⟩ II 3G and is suitable for use in Zone 2 hazardous locations, in ambient temperatures of –40 °C ≤ Ta ≤ 70 °C.

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Special Conditions for Marine Applications

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

Caution To meet radio-frequency emission requirements for marine applications, use shielded cables and install the system in a metal enclosure. Suppression ferrites must be installed on power supply inputs near power entries to modules and controllers. Power supply and module cables must be separated on opposite sides of the enclosure and must enter and exit through opposing enclosure walls.

What You Need to Install the CompactRIO System

- ❑ CompactRIO reconfigurable embedded chassis
- ❑ CompactRIO intelligent real-time embedded controller
- ❑ C Series I/O modules
- ❑ Mounting hardware if needed (available from NI)
- ❑ Two M4 or number 10 panhead screws (for panel mounting only)
- ❑ Number 2 Phillips screwdriver
- ❑ Power supply
- ❑ Ethernet cable
- ❑ Documentation
  - Operating instructions for the controller (shipped with the hardware and available at `ni.com/manuals`)—Use this document to learn how to connect the controller to a network and configure the controller.
  - Operating instructions for the C Series I/O modules (shipped with the hardware and available at `ni.com/manuals`)—Use these documents to learn about module specifications and how to use the modules.
  - Installation instructions for mounting hardware (shipped with the hardware and available at `ni.com/manuals`)—Use this document to learn how to mount the CompactRIO system on a DIN rail, panel, rack, or desktop.

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What You Need to Start Using the CompactRIO System

After you install the CompactRIO chassis, controller, and C Series modules, you need the following things to start using the CompactRIO system:

- ❑ Windows computer with LabVIEW and NI-RIO software installed
- ❑ *Getting Started with CompactRIO and LabVIEW*—Use this document to learn how to configure the CompactRIO system in MAX and start programming and using the system in LabVIEW. This document contains tutorials that show how to develop projects and VIs for process-control applications. This document is available online at `ni.com/manuals`.

Related Documentation

The following documents contain information that you may find helpful when you are using the CompactRIO system:

- *LabVIEW Help*—Use the *LabVIEW Help* to access information about LabVIEW programming concepts, step-by-step instructions for using LabVIEW, and reference information about LabVIEW VIs, functions, palettes, menus, tools, properties, methods, events, dialog boxes, and so on. The *LabVIEW Help* also lists the LabVIEW documentation resources available from National Instruments. Access the *LabVIEW Help* by selecting **Help»Search the LabVIEW Help**.
- *Getting Started with LabVIEW*—Use this document as a tutorial to familiarize yourself with the LabVIEW graphical programming environment and the basic LabVIEW features you use to build data acquisition and instrument control applications. Access the *Getting Started with LabVIEW* PDF by selecting **Start»All Programs» National Instruments»LabVIEW»LabVIEW Manuals» LV_Getting_Started.pdf**.
- *Getting Started with the LabVIEW Real-Time Module*—Use this document to learn how to develop a real-time project and VIs, from setting up RT targets to building, debugging, and deploying real-time applications. Access the *Getting Started with the LabVIEW Real-Time Module* PDF by selecting **Start»All Programs»National Instruments»LabVIEW» LabVIEW Manuals»RT_Getting_Started.pdf**.

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- *CompactRIO Reference and Procedures (Scan Interface)*—Use this help file to learn about using the CompactRIO system in Scan Interface programming mode. To access this help file from LabVIEW, select **Help»Search the LabVIEW Help**, then expand **Real-Time Module** on the **Contents** tab and select **CompactRIO Reference and Procedures (Scan Interface)**.
- *CompactRIO Reference and Procedures (FPGA Interface)*—Use this help file to learn about using the CompactRIO system in FPGA Interface programming mode. To access this help file from LabVIEW, select **Help»Search the LabVIEW Help**, then expand **FPGA Module** on the **Contents** tab and select **CompactRIO Reference and Procedures (FPGA Interface)**.
- *FPGA Module*—Use this help file to learn about using the LabVIEW FPGA Module. To access this help file from LabVIEW, select **Help»Search the LabVIEW Help**, then expand **FPGA Module** on the **Contents** tab.

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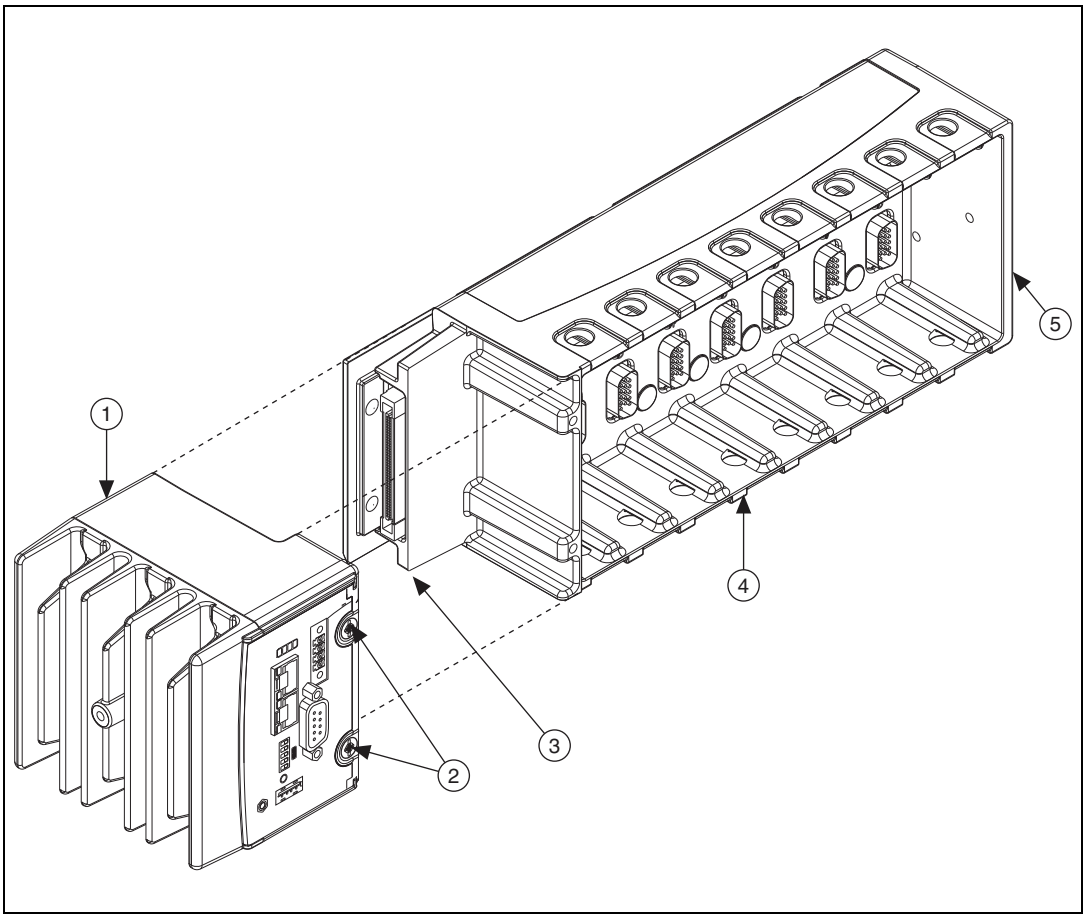
Installing the Controller on the Chassis

Complete the following steps to install the controller on the chassis.

1. Make sure that no power is connected to the controller or the chassis.
2. Align the controller with the chassis as shown in Figure 2.



1	Controller	4	Reconfigurable Embedded Chassis
2	Captive Screws	5	Grounding Screw
3	Controller Slot		

Figure 2. Installing the Controller on the Chassis (Eight-Slot Chassis Shown)

3. Slide the controller onto the controller slot on the chassis. Press firmly to ensure the chassis connector and the controller connector are mated.
4. Using a number 2 Phillips screwdriver, tighten the two captive screws on the front of the controller to 1.3 N · m (11.5 lb · in.) of torque.

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Mounting the CompactRIO Reconfigurable Embedded Chassis

You can mount the chassis on a panel, on a 35 mm DIN rail, on a rack, in an enclosure, or on a desktop. Use the DIN rail mounting method if you already have a DIN rail configuration or if you need to be able to quickly remove the CompactRIO chassis. Use the panel mount method for high shock and vibration applications. Use an enclosure for harsh, dirty, or wet environments.

Caution If the ambient temperature is 56 °C to 70 °C, you must mount the chassis on a thermally conductive material. For information about how mounting configuration can affect the accuracy of C Series modules, go to `ni.com/info` and enter the info code `rdcriotemp`. Measure the ambient temperature at each side of the CompactRIO system, 63.5 mm (2.5 in.) from the side, and 25.4 mm (1 in.) from the rear cover of the system.

Go to `ni.com/info` and enter the info code `criomounting` to learn more about the different mounting methods for CompactRIO.

Before using any of the mounting methods, record the serial number from the back of the chassis. You will be unable to read the serial number after you have mounted the chassis.

Caution Before you mount the chassis, make sure that I/O modules are not in the chassis.

Caution Your installation must meet the following requirements for space and cabling clearance:

- Allow 25.4 mm (1 in.) on the top and the bottom of the chassis for air circulation.
- Allow 50.8 mm (2 in.) in front of modules for cabling clearance for common connectors, such as the 10-terminal, detachable screw-terminal connector, as shown in Figure 3.

Go to `ni.com/info` and enter `rdcrioconn` to find the minimum cabling clearance for C Series modules with other connector types.

Note Go to `ni.com/dimensions` for more information about the dimensions of the CompactRIO system, including detailed dimensional drawings.

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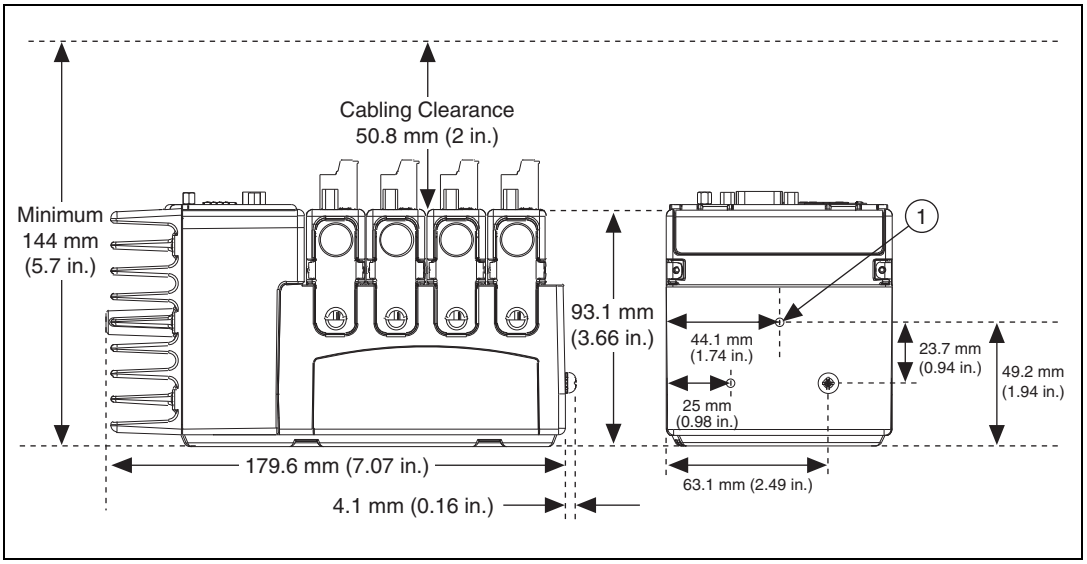
The following figures show the dimensions of the four- and eight-slot chassis. Refer to the controller operating instructions for the dimensions of the controller.



1	M4 Thread

Figure 3. Four-Slot Reconfigurable Embedded Chassis with the Controller and I/O Modules Installed, Bottom and Side View with Dimensions

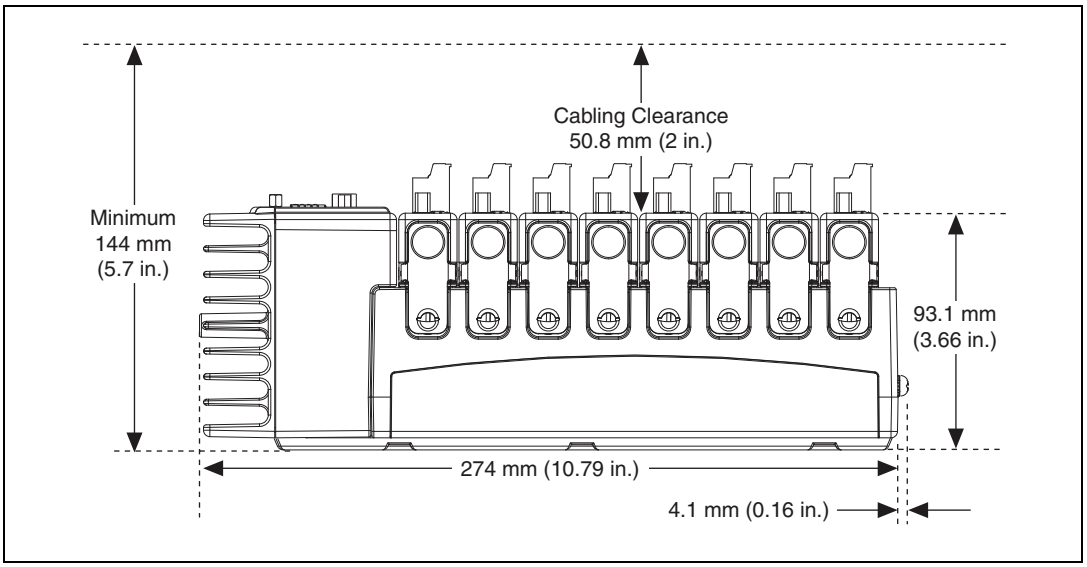


Figure 4. Eight-Slot Reconfigurable Embedded Chassis with the Controller and I/O Modules Installed, Bottom View with Dimensions

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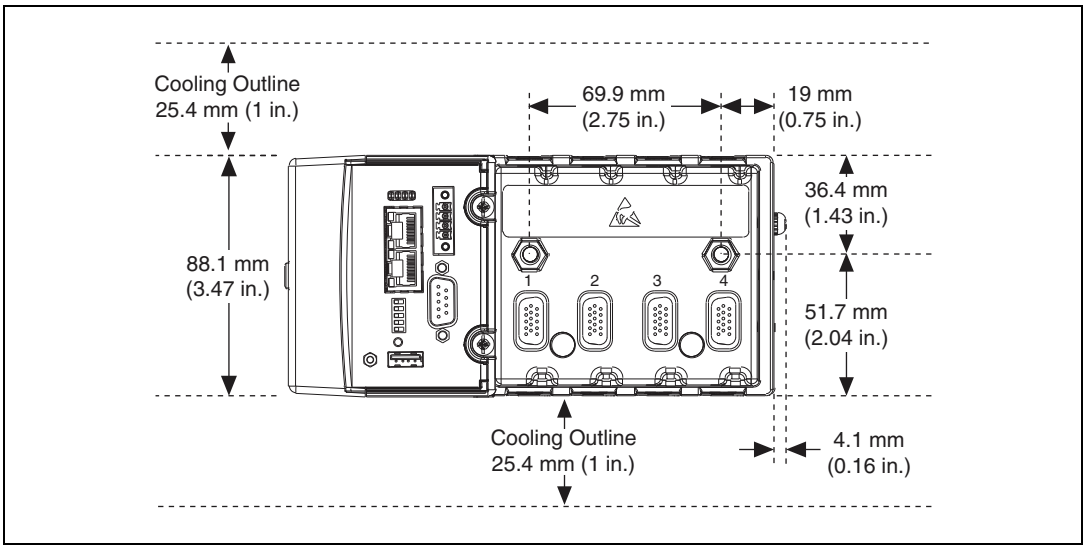

Figure 5. Four-Slot Reconfigurable Embedded Chassis with the Controller Installed, Front View with Dimensions

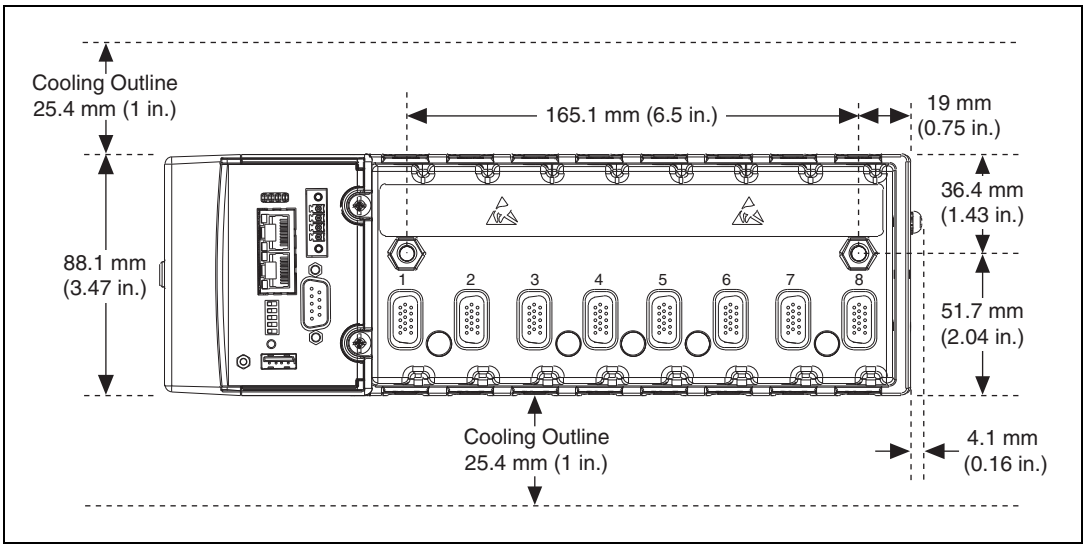

Figure 6. Eight-Slot Reconfigurable Embedded Chassis with the Controller Installed, Front View with Dimensions

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Mounting the Chassis on a Panel

Complete the following steps to mount the chassis on a panel.

1. Align the chassis on the panel.
2. Bolt or screw the chassis to the panel using two M4 or number 10 panhead screws. National Instruments does not provide the screws with the chassis.

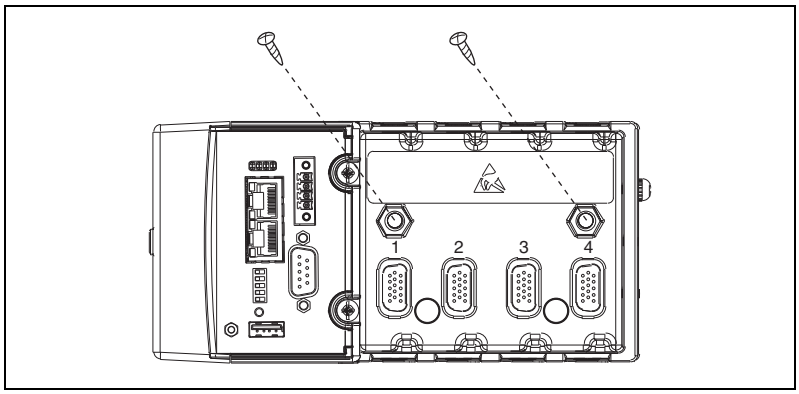

Figure 7. Mounting a Four-Slot Chassis on a Panel

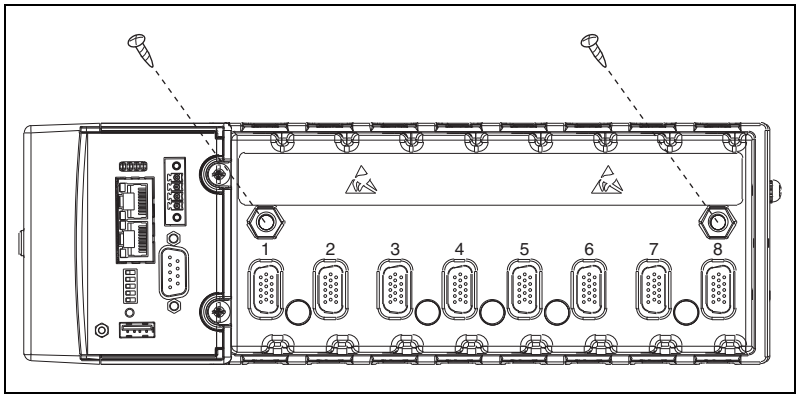

Figure 8. Mounting an Eight-Slot Chassis on a Panel

Caution If you are using the NI 9904/9905 panel mount kit, you *must* use the M4 × 22 screws included in the kit to attach the cRIO-911*x* to the kit.

Caution Remove the I/O modules from the chassis before removing the chassis from the panel.

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Mounting the Chassis on a DIN Rail

You can order the NI 9912 DIN rail mount kit if you want to mount a four-slot CompactRIO chassis on a DIN rail, or the NI 9915 DIN rail mount kit if you want to mount an eight-slot CompactRIO chassis on a DIN rail. You need one clip for mounting the chassis on a standard 35 mm DIN rail. Complete the following steps to mount the chassis on a DIN rail.

1. Fasten the DIN rail clip to the chassis using a number 2 Phillips screwdriver and two M4 × 22 screws. The screws are included in the DIN rail mount kit.

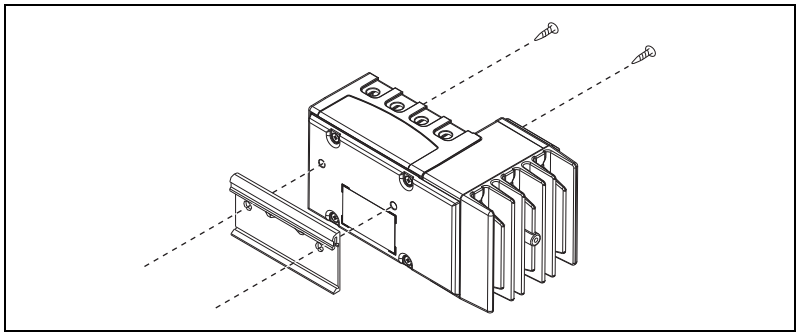

Figure 9. Fastening the DIN Rail Clip to a Four-Slot Chassis

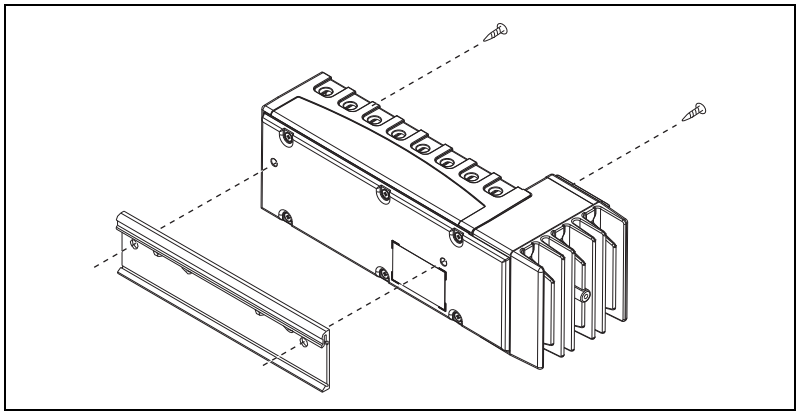

Figure 10. Fastening the DIN Rail Clip to an Eight-Slot Chassis

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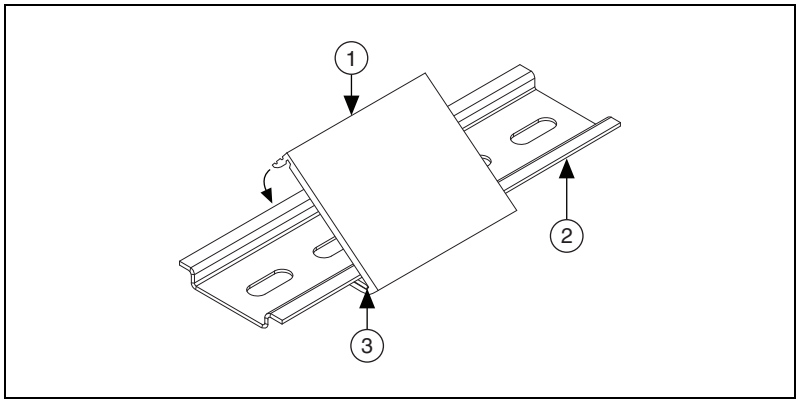
2. Insert one edge of the DIN rail into the deeper opening of the DIN rail clip, as shown in Figure 11.



1 DIN Rail Clip 2 DIN Rail 3 DIN Rail Spring

Figure 11. Attaching the DIN Rail Clip to the DIN Rail

3. Press down firmly on the chassis to compress the spring until the clip locks in place on the DIN rail.

Caution Remove the I/O modules before removing the chassis from the DIN rail.

Installing C Series I/O Modules in the Chassis

Figure 12 shows the mechanical dimensions of C Series I/O modules.

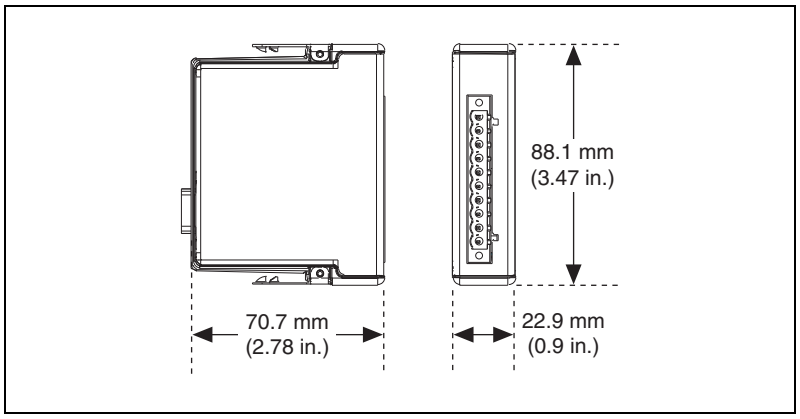


Figure 12. C Series I/O Module, Side and Front View with Dimensions

Note Modules with different connector types have different dimensions. Go to `ni.com/info` and enter `rdcrioconn` for more information about the different connector types.

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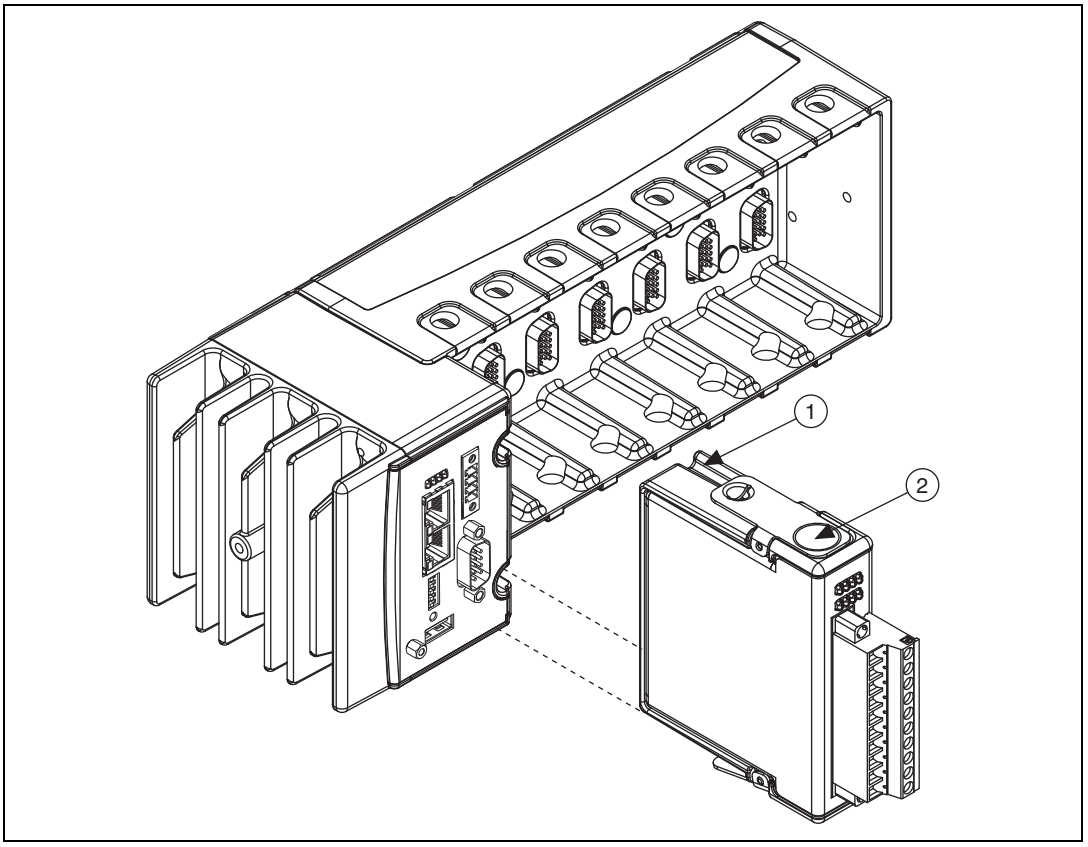
Complete the following steps to install a C Series I/O module in the chassis.

1. Make sure that no I/O-side power is connected to the I/O module. If the system is in a nonhazardous location, the chassis power can be on when you install I/O modules.
2. Align the I/O module with an I/O module slot in the chassis as shown in Figure 13. The module slots are labeled 1 to 8, left to right.



1	Insertion Groove	2	Latch

Figure 13. Installing an I/O Module in the Chassis (Eight-Slot Chassis Shown)

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

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Removing I/O Modules from the Chassis

Complete the following steps to remove a C Series I/O module from the chassis.

1. Make sure that no I/O-side power is connected to the I/O module. If the system is in a nonhazardous location, the chassis power can be on when you remove I/O modules.
2. Squeeze the latches on both sides of the module and pull the module out of the chassis.

Connecting the Chassis to Earth Ground

You must connect the panhead screw at the end of the chassis to ground using shielded cables.

Where to Go from Here

You have completed installing the CompactRIO hardware. Now you need to connect the controller to your network and configure the controller and chassis in National Instruments Measurement & Automation Explorer (MAX). For information about connecting the controller to the network, refer to the controller operating instructions. For information about configuring the controller and chassis in MAX, refer to the *Measurement & Automation Explorer Help* or to the *Getting Started with CompactRIO and LabVIEW* document.

Chassis Reset Options

Table 1 lists the reset options available on the CompactRIO chassis. These options determine how the chassis behaves when the controller is reset in various conditions. Use the RIO Device Setup utility to select reset options. Access the RIO Device Setup utility by selecting **Start»All Programs» National Instruments»NI-RIO»RIO Device Setup**.

Chassis Sleep Mode

The cRIO-911*x* supports a low-power sleep mode. Refer to the software documentation for information about enabling sleep mode.

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Table 1. CompactRIO Reset Options

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.

Refer to the *LabVIEW Help (FPGA Module)* for information about configuring FPGA VIs to run automatically after they are loaded.

Specifications

The following specifications are typical for the range –40 °C to 70 °C unless otherwise noted. These specifications are for the cRIO-911*x* reconfigurable embedded chassis only. For the controller and I/O module specifications, refer to the operating instructions for the controller and I/O modules you are using.

Reconfigurable FPGA

cRIO-9111 and cRIO-9112

- FPGA type Virtex-5 LX30
- Number of flip-flops 19,200
- Number of 6-input LUTs 19,200
- Number of DSP48 slices (25 × 18 multipliers) 32
- Embedded block RAM ..... 1,152 kbits

cRIO-9113 and cRIO-9114

- FPGA type Virtex-5 LX50
- Number of flip-flops 28,800
- Number of 6-input LUTs 28,800
- Number of DSP48 slices (25 × 18 multipliers) 48
- Embedded block RAM ..... 1,728 kbits

cRIO-9116

- FPGA type Virtex-5 LX85
- Number of flip-flops 51,840

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Number of 6-input LUTs.....51,840

Number of DSP48 slices
(25 × 18 multipliers).....48

Embedded block RAM.....3,456 kbits

cRIO-9118

FPGA type.....Virtex-5 LX110

Number of flip-flops.....69,120

Number of 6-input LUTs.....69,120

Number of DSP48 slices
(25 × 18 multipliers).....64

Embedded block RAM.....4,608 kbits

Timebases.....40, 80, 120, 160, or 200 MHz

Accuracy.....±100 ppm (max)

Frequency-dependent jitter (peak-to-peak, max)

40 MHz.....250 ps

80 MHz.....422 ps

120 MHz.....422 ps

160 MHz.....402 ps

200 MHz.....402 ps

Power Requirements

These power requirements are for a fully loaded chassis and exclude the power requirements of the controller and the I/O modules in the chassis. For more information about the controller and the I/O module power requirements, refer to the operating instructions for the controller and for each I/O module.

Chassis power consumption/dissipation

cRIO-9111 and cRIO-9112

+5 VDC.....500 mW (max)

+3.3 VDC.....2,100 mW (max)

Total chassis
power consumption.....2,600 mW (max)

cRIO-9113 and cRIO-9114

+5 VDC.....500 mW (max)

+3.3 VDC.....2,800 mW (max)

Total chassis
power consumption.....3,300 mW (max)

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cRIO-9116

+5 VDC..... 500 mW (max)

+3.3 VDC..... 4,600 mW (max)

Total chassis
power consumption..... 5,100 mW (max)

cRIO-9118

+5 VDC..... 500 mW (max)

+3.3 VDC..... 5,400 mW (max)

Total chassis
power consumption..... 5,900 mW (max)

Note The power consumption specifications in this document are maximum values for a LabVIEW FPGA application compiled at 80 MHz. Your application power requirements may be different. To calculate the power requirements of the CompactRIO system, add the power consumption/dissipation for the chassis, the controller, and the I/O modules you are using. Keep in mind that the resulting total power consumption is a maximum value and that the CompactRIO system may require less power in your application.

Physical Characteristics

If you need to clean the chassis, wipe it with a dry towel.

Chassis weight

cRIO-9111 and cRIO-9113..... Approx. 581 g (20 oz)

cRIO-9112, cRIO-9114,
cRIO-9116, and cRIO-9118..... Approx. 880 g (31 oz)

Environmental

CompactRIO systems are intended for indoor use only. For outdoor use, mount the CompactRIO system in a suitably rated enclosure.

Operating temperature
(IEC-60068-2-1 and IEC-60068-2-2) .... –40 °C to 70 °C

Caution If the ambient temperature is 56 °C to 70 °C, you must mount the chassis on a thermally conductive material. For information about how mounting configuration can affect the accuracy of C Series modules, go to `ni.com/info` and enter the info code `rdcriotemp`. Measure the ambient temperature at each side of the CompactRIO system, 63.5 mm (2.5 in.) from the side, and 25.4 mm (1 in.) from the rear cover of the system.

Storage temperature
(IEC-60068-2-1 and IEC-60068-2-2) .... –40 °C to 85 °C

Ingress protection..... IP 40

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Operating humidity (IEC-60068-2-56) ....10 to 90% RH, noncondensing

Storage humidity (IEC-60068-2-56) .....5 to 95% RH, noncondensing

Maximum altitude.....2,000 m

Pollution Degree 2

Shock and Vibration

To meet these specifications, you must panel mount the CompactRIO system and affix ferrules to the ends of the terminal lines.

Operating vibration,
random (IEC 60068-2-64) .....5 g_{rms}, 10 to 500 Hz

Operating vibration,
sinusoidal (IEC 60068-2-6) .....5 g, 10 to 500 Hz

Operating shock (IEC 60068-2-27) .....30 g, 11 ms half sine,
50 g, 3 ms half sine,
18 shocks at 6 orientations

Safety

Safety Standards

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

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1

Note For UL and other safety certifications, refer to the product label or to the *Online Product Certification* section of this document.

Hazardous Locations

U.S. (UL) .....Class I, Division 2,
Groups A, B, C, D, T4;
Class I, Zone 2, AEx nA IIC T4

Canada (C-UL) .....Class I, Division 2,
Groups A, B, C, D, T4;
Class I, Zone 2, Ex nA IIC T4

Europe (DEMKO) .....Ex nA IIC T4

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Electromagnetic Compatibility

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

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

Note For the standards applied to assess the EMC of this product, refer to the *Online Product Certification* section.

Note For EMC compliance, operate this product according to the documentation.

CE Compliance CE

This product meets the essential requirements of applicable European Directives as follows:

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

Online Product Certification

Refer to Declaration of Conformity (DoC) for this product for additional regulatory compliance information. To obtain product certifications and the DoC for this product, visit `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.

Environmental Management

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

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

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Waste Electrical and Electronic Equipment (WEEE)

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