CompactRIO[™] Reference and Procedures (Scan Interface)

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Use this book as a reference for information about using LabVIEW, CompactRIO devices, and C Series modules with the <u>NI Scan Engine</u>.

To view related topics, click the **Locate** button, shown at left, in the toolbar at the top of this window. The *LabVIEW Help* highlights this topic in the **Contents** tab so you can navigate the related topics.

To comment on National Instruments documentation, refer to the <u>National</u> <u>Instruments Web site</u>.

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CompactRIO Related Documentation (Scan Interface)

CompactRIO includes the following documentation.

Help Resources

- LabVIEW Help—Use this help file to access reference information about C Series modules and instructions for using LabVIEW with CompactRIO devices. Using the Contents tab, navigate to Real-Time Module»CompactRIO Reference and Procedures (Scan Interface). You can find help topics for the module you are using by navigating on the Contents tab to Real-Time Module»CompactRIO Reference and Procedures (Scan Interface)»Module Type»NI 9xxx.
- Measurement & Automation Explorer (MAX) Help for CompactRIO—Use this help file to access instructions for configuring the CompactRIO controller and enabling the cRIO-910x Reconfigurable Embedded chassis for use with LabVIEW. After you launch MAX, select Help»MAX Help and navigate to Measurement & Automation Explorer Help»Installed Products»MAX Help for CompactRIO on the Contents tab.

PDF Documents

These documents are available as PDFs in the CompactRIO\manuals directory. The latest versions of these documents are online at <u>ni.com/manuals</u>. You must have Adobe Reader with Search and Accessibility 5.0.5 or later installed to view the PDFs. You must have Adobe Reader with Search and Accessibility 6.*x* or later installed to <u>search PDF versions</u> of these manuals. Refer to the <u>Adobe Systems</u> Incorporated Web site to download Acrobat Reader.

- <u>CompactRIO Reconfigurable Embedded System Installation</u> <u>Instructions</u>—Use these installation instructions to learn how to install the cRIO-910*x* Reconfigurable Embedded chassis.
- <u>CompactRIO cRIO-9012/9014 Operating Instructions and</u> <u>Specifications</u>—Use these operating instructions to learn how to connect the controller to the network and use the features of the controller.
- CompactRIO cRIO-9072/9074 Operating Instructions and Specifications—Use these operating instructions to learn how to connect the integrated chassis/controller to the network and use the features of the integrated chassis/controller.
- Getting Started with CompactRIO and LabVIEW—Use this tutorial to learn how to develop a CompactRIO application in LabVIEW. While developing the application, you can learn concepts and techniques that you can apply when you develop your own CompactRIO application. This tutorial is available online at <u>ni.com/manuals</u>.
- NI 9xxx Operating Instructions and Specifications—Use the operating instructions for the C Series module to learn about module specifications and how to use the module. For example, use the <u>NI 9403 Operating Instructions and Specifications</u> to learn about the NI 9403.

Readme Documents

- *NI-RIO Readme*—Use this file to learn important last-minute information about NI-RIO, including installation instructions and descriptions of known issues for installing and using NI-RIO. Access the *NI-RIO Readme* on the NI-RIO installation CD.
- Software Support for CompactRIO, CompactDAQ, and R Series Devices—Use this NI Developer Zone document to determine what versions of the NI-RIO software, the LabVIEW Real-Time Module, and the LabVIEW FPGA Module you need for the C Series modules, CompactRIO chassis, CompactRIO controllers, Single-Board RIO devices, and R Series devices you are using.

Searching PDF Versions of CompactRIO Manuals (Scan Interface)

Use Adobe Reader with Search and Accessibility 6.*x* or later to search PDF versions of all the <u>CompactRIO manuals</u>. Refer to the <u>Adobe</u> <u>Systems Incorporated Web site</u> to download Acrobat Reader.

Complete the following steps to search all the PDF versions of CompactRIO manuals.

- 1. In Adobe Reader, select **Edit**»**Search** to display the **Search PDF** window.
- 2. Enter a word or phrase in the **What word or phrase would you like to search for** text box.
- 3. Click the **All PDF Documents in** button and select **Browse for Location** from the drop-down list. The **Browse for Folder** dialog box appears.
 - a. Navigate to the CompactRIO\manuals directory.
 - b. Click the **OK** button to close the dialog box and return to the **Search PDF** window.
- 4. Click the **Search** button.

Refer to the Adobe Reader Help for more information about searching all the PDF documents in a directory for a word or phrase.

Using CompactRIO (Scan Interface)

Use this book as a reference for information about using LabVIEW with CompactRIO devices.

To view related topics, click the **Locate** button, shown at left, in the toolbar at the top of this window. The *LabVIEW Help* highlights this topic in the **Contents** tab so you can navigate the related topics.

CompactRIO Chassis Properties Dialog Box

Right-click a CompactRIO chassis in the **Project Explorer** window and select **Properties** from the shortcut menu to display this dialog box.

Use this dialog box to configure a CompactRIO chassis.

This dialog box includes the following components:

- Name—Specifies the name of the chassis, which appears in the **Project Explorer** window. You can use this field to give the chassis a descriptive name.
- **Type**—Specifies the type of chassis. You cannot change this value.
- **Programming Mode**—You can specify the programming mode for the chassis here.
 - **Scan Interface**—Enables you to use C Series modules directly from LabVIEW Real-Time. Modules that you use in Scan Interface mode appear directly under the chassis item in the **Project Explorer** window.
 - LabVIEW FPGA Interface—Enables you to use C Series modules from LabVIEW FPGA VIs. Modules that you use in LabVIEW FPGA Interface mode appear directly under the FPGA Target in the Project Explorer window.
 - Note Changing the programming mode will take effect the next time you deploy setting to the chassis. To deploy settings, right-click the chassis item in the **Project Explorer** window and select **Deploy** from the shortcut menu.

CompactRIO Discovery Status Dialog Box

When you add a CompactRIO controller or chassis or a Single-Board RIO device to a LabVIEW project, LabVIEW finds all C Series modules in the new system. This dialog box appears when LabVIEW returns errors while looking for C Series modules installed in the system. The dialog box lists any errors that occur during the discovery process. The **Description** field of the dialog box contains a detailed description of each type of error condition.

CompactRIO Error Codes

<u>I/O variables</u> can return the following error codes for CompactRIO.

Code	Description
-65580	The FPGA personality running on the RIO target does not have enough specialty digital resources to support this module.
-65537	The module that was detected is different than the module that was expected. Make sure the slot the module is configured for in software matches the physical location of the module.
-65407	Too many specialty digital slots. In Scan Interface mode, you can configure only two slots for specialty digital I/O. If you want more specialty digital slots, add an FPGA target under the chassis to put the chassis in LabVIEW FPGA interface mode.
65000	Unable to mount drive. The given device is either not present or not recognizable as a mountable device.
65001	No partitions found. The partition table on the device is corrupt or the device has zero partitions on it.
65002	Invalid drive handle. The given handle does not represent an active mounted drive.
65003	Drive already mounted. The given device is already mounted as a drive.
65004	The channel, slot, or connector number you wired to the method input is invalid. Change the method input to match the configuration of the CompactRIO system.
65005	The C Series module at the specified location does not support TEDS or TEDS access is not enabled for the module.
65006	Communication with the module timed out. The module is busy performing another action or LabVIEW is unable to communicate with the module.
65007	No TEDS sensor was detected on the specified channel. Make sure that the C Series module and sensor are properly connected. Make sure the specified location matches the sensor location.
65008	CompactRIO does not support the TEDS sensor connected to this channel.

65009	The PXI trigger that you have selected to reserve or unreserve is invalid. Valid PXI triggers are 0 through 7, inclusive.
65200	DIO Line Access Conflict. Invalid module configuration. A single physical DIO line cannot be accessed by multiple types of output nodes when the Number of Synchronizing Registers=0 and any of the output accesses is in a Single-Cycle Timed Loop. Either change the number of Synchronizing Registers to 1 in the module's properties dialog, or access the resource exclusively as a port or an individual line, not both.
65201	Duplicate Terminals In The Same Node. An FPGA I/O Node has duplicate terminals. Delete the duplicate terminal from the I/O Node.
65202	Digital Resource Access Conflict. The digital I/O resource cannot be accessed in a Single-Cycle Timed Loop from both a Digital Output function and a Digital Port Output function. If you need to access this resource in a Single-Cycle Timed Loop, please exclusively use just the Digital Output function or Digital Port Output function, not both.
65203	Module Timebase Configuration Error. LabVIEW detected an invalid configuration for an FPGA I/O Node that contains channels from a module with a configurable timebase. If channels of multiple modules with a configurable timebase are in the same FPGA I/O Node, make sure you configure the modules to share the same timebase. Use the C Series Module Properties dialog box to configure the module timebase. Refer to the LabVIEW Help for information about how to synchronize multiple C Series modules.
65204	Digital Resource Access Conflict. The digital I/O resource cannot be accessed from both a Digital Output function and a Digital Port Output function if the Never Arbitrate option is used. Please change the arbitration of the Digital Line and/or Digital Port to something other than Never Arbitrate, or exclusively use just the Digital Output function or Digital Port Output function, not both.
65205	Invalid C Series Module Configuration. Possible reasons for the invalid configuration include that the master timebase source module is unable to be identified, the master timebase source

	module is not configured to export its timebase, or the master timebase source module is not a valid module type. Use the C Series Module Properties dialog box to configure the module timebase. Refer to the LabVIEW Help for information about how to synchronize multiple C Series modules.
65206	Invalid top-level clock. You must use a top-level clock of 40 MHz when using this module. To change the top-level clock, right click on your FPGA target in the LabVIEW Project Explorer and select properties. From the Top-Level Clock category, choose a 40 MHz clock.
65207	The digital output resource cannot be accessed from both a Digital Output function and a Digital Port Output function. Please exclusively use just the Digital Output function or Digital Port Output function, not both.
65208	The cRIO-9151 R Series Expansion chassis no longer supports synchronizing multiple NI 9225/9229/923x modules. Use the C Series Module Properties dialog box to set the master timebase source of the slave module(s) to the onboard clock. Right-click the module in the project and select Properties to display the C Series Module Properties dialog box. Contact National Instruments technical support with questions or concerns.
65209	You cannot write to the Sleep channel if you are using the Scan Interface with any modules in the system.
65400	The FPGA target is either running an FPGA VI or has loaded an FPGA VI.
65401	One or more discovered C Series modules are not supported by the current versions of LabVIEW and NI-RIO.
65402	An internal software error in NI-RIO has occurred. Please contact National Instruments technical support at ni.com/support.
65403	An unexpected error occurred when Discovering C Series Modules. Make sure the LabVIEW Project is set up properly.
65404	The controller you selected has an unconfigured (0.0.0.0) IP address. If the controller is online, configure it in Measurement & Automation Explorer (MAX), then make sure the IP address in

	LabVIEW matches the IP address in MAX. If it is offline, you cannot discover connected targets and devices, but you can add new, offline targets and devices.
65405	Module not found. The module whose configuration you deployed is not present in the chassis.
65406	Different module. The module whose configuration you deployed does not match the model currently in the chassis.
65407	Too many specialty digital slots. In Scan Interface mode, you can configure only two slots for specialty digital I/O. If you want more specialty digital slots, add an FPGA target under the chassis to put the chassis in LabVIEW FPGA Interface mode.
65536	Unable to communicate with the module. Reinsert the module and check connections.
65537	The module that was detected is different than the module that was expected. Make sure the slot the module is configured for in software matches the physical location of the module.
65538	The operation failed to complete in time. Make sure the module is not busy and the system is configured properly.
65539	The input function missed one or more data points. Make sure the loop can execute as fast as the module data rate.
65540	The I/O Resource is not in communication mode. You must start communication mode before you can perform this operation.
65541	The I/O Resource is in communication mode. You must stop communication mode before you can perform this operation.
65542	One or more channels have detected an open current loop. Check the module connections.
65543	The power supply voltage level is out of range. Check the supply voltage and the module connections.
65544	One or more channels are in overcurrent protection mode. The device connected to the channel is passing more current than is allowed through the channel. Check for possible shorts or external device failure.
65545	An input parameter, or a combination of parameters, is invalid.
65546	Your application uses a feature that is not supported by your C

	Series hardware.
65547	Too many CAN bus error frames are detected. Please refer to the description of the 'Error Terminals' for more information.
65548	One or more channels are in overcurrent or overvoltage protection mode. Check the terminals for any fault condition that could be causing an out-of-range voltage or current on the channels.
65549	A general or undefined error has occurred. Verify that the card is inserted properly and that the door is closed. If the error occurs again, run CHKDSK on the card.
65550	A problem was found in the file system. Remove the SD card and run CHKDSK.
65551	The SD card is in use by RT. Try again after RT unmounts the card.
65552	The SD card is not ready. Verify that the card is inserted properly and that the door is closed.
65553	The SD card door was opened while a file on the card was open.
65554	The specified file does not exist on the card.
65555	The Open method tried to open a new file for writing, but a file with the same name already exists on the disk.
65556	A Read or Write method tried to access a file that was not opened in the required mode.
65558	A Close method tried to close a file that was not open.
65559	A method tried to open a file on the SD card when a file was already open. This device supports only one file open at a time. This error is also returned when an illegal attempt to call the Delete File or Get File Size method is made when a file is open on the card.
65560	An attempt to allocate storage failed because the file system is full.
65561	Attempted to exceed the limit of 512 root directory entries.
65562	A Read method tried to read beyond the end of a file. This may have occurred when the method read the end of a file using a

	U16 or U32 data type when the actual number of bytes in the file (as reported by the directory) was not an integer multiple of the number of bytes in the read data type.
65563	A problem was found with the format of the SD card. Verify that the SD card is formatted with a valid FAT16 file system.
65577	An open thermocouple was detected on at least one channel. Check the module connections.
65578	The common-mode voltage is outside of acceptable limits on at least one channel. Check the terminals for any fault condition that could be causing an out-of-range voltage on the channels.

Configuring a Project for a CompactRIO Reconfigurable or Integrated System (Scan Interface)

Complete the following steps to add a <u>cRIO-910x Reconfigurable</u> <u>Embedded system</u> or cRIO-9074 Integrated controller and chassis system to a new or existing project.

Configuring a Project with Connected Hardware

Complete the following steps to configure the project if you have hardware installed. The controller must be attached to a chassis with C Series modules installed, connected to the same subnet as the host computer, and powered on. Refer to the <u>controller operating instructions</u> for information about installing the controller on a chassis, connecting the controller to a network, and wiring power to the controller. The controller also must be configured in Measurement & Automation Explorer (MAX). Refer to the <u>Measurement & Automation Explorer (MAX)</u>. Refer to the <u>Measurement & Automation Explorer</u> (MAX).

- 1. <u>Create a new project</u> or open an existing project.
- 2. Right-click the project root in the **Project Explorer** window and select **New**»**Targets and Devices** from the shortcut menu to display the <u>Add Targets and Devices</u> dialog box.
- 3. Select the appropriate controller under **Real-Time CompactRIO** and click the **OK** button. If you are using a controller and chassis that are supported in Scan Interface mode, the <u>Select</u> <u>Programming Mode</u> dialog box appears.
- 4. If the **Select Programming Mode** dialog box appears, select **Scan Interface** and click the **Continue** button to put the system into Scan Interface mode.
- Click the Discover button in the Discover C Series Modules? dialog box that appears. LabVIEW adds items for the controller, the chassis, and all installed C Series modules to the project. LabVIEW also adds <u>I/O variables</u> to the project for all installed C Series module I/O channels.
- 6. Right-click a module item in the Project Explorer window and select Properties from the shortcut menu to configure modulespecific settings in the C Series Module Properties dialog box. Some modules do not have any settings to configure other than the module name and chassis slot location. Click the Help button on the C Series Module Properties dialog box for information about the module settings.

Configuring a Project with Offline Hardware

Complete the following steps to configure the project if you do not have hardware installed.

- 1. <u>Create a new project</u> or open an existing project.
- 2. Right-click the project root in the **Project Explorer** window and select **New**»**Targets and Devices** from the shortcut menu to display the <u>Add Targets and Devices</u> dialog box.
- 3. Click the **New target or device** radio button, select a <u>controller</u> <u>that supports the Scan Interface</u> under **Real-Time CompactRIO**, and click the **OK** button. LabVIEW adds an RT target item for the controller to the project.
- 4. Right-click the **RT CompactRIO Target** in the **Project Explorer** window and select **New»Targets and Devices** from the shortcut menu to display the **Add Targets and Devices** dialog box.
- 5. Click the **New target or device** radio button, select a <u>chassis that</u> <u>supports the Scan Interface</u> under **CompactRIO Chassis**, and click the **OK** button. LabVIEW adds a chassis item to the project.



- 6. Right-click the chassis item in the **Project Explorer** window and select **New**»**C Series Modules** from the shortcut menu to display the **Add Targets and Devices** dialog box.
- 7. Click the **New target or device** radio button, select **C Series Module**, and click the **OK** button to display the **New C Series Module** dialog box.
- 8. Select the appropriate C Series module from the **Module Type** pull-down menu and click the **OK** button. LabVIEW adds a module item and <u>I/O variables</u> for the module I/O channels to the project.
- 9. Repeat steps 6 through 8 to add additional C Series modules to the project.
- 10. Right-click a module item in the **Project Explorer** window and select **Properties** from the shortcut menu to configure module-specific settings in the **C Series Module Properties** dialog box.

Some modules do not have any settings to configure other than the module name and chassis slot location. Click the **Help** button on the **C Series Module Properties** dialog box for information about the module settings.

New C Series Module Dialog Box

Right-click the chassis in the **Project Explorer** window and select **New»C Series Modules** from the shortcut menu to display the <u>Add</u> <u>Targets and Devices on Chassis</u> dialog box. Select **New target or device**, select **C Series Module**, and click the **OK** button to display the **New C Series Module** dialog box.

Use this dialog box to select a module name, the type of module, and the chassis slot in which the module is installed.

This dialog box includes the following components:

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module you want to add to the chassis in the **Project Explorer** window.
- Location—Specifies a slot in the chassis for the C Series module.

Reading from CompactRIO Channels (Scan Interface)

Complete the following steps to read data from a CompactRIO channel.

- 1. <u>Configure</u> the CompactRIO system.
- 2. Make sure the <u>I/O variable</u> for the input channel appears under the module item in the **Project Explorer** window.
- 3. Right-click the RT target item for the controller in the **Project Explorer** window and select **New»VI** from the shortcut menu to add a new LabVIEW Real-Time VI to the CompactRIO system.
- 4. Place a <u>Timed Structure</u> on the block diagram of the VI.
- 5. Configure the Timed Structure as needed.
- 6. Place the I/O variable for the channel in the Timed Structure.
- 7. Right-click the output terminal of the I/O variable and select **Create»Indicator**.
- 8. Right-click the **error out** terminal of the I/O variable and select **Create»Indicator**.
- 9. Run the VI.

Select Programming Mode Dialog Box

Use this dialog box to select the programming mode you want to start programming the system with. You can change the programming mode later using the <u>CompactRIO Chassis Properties</u> dialog box. The **Select Programming Mode** dialog box appears when you add a chassis that supports the Scan Interface to your project and you have the LabVIEW FPGA Module installed on the host computer.

Scan Interface Mode

Scan Interface mode enables you to use C Series modules directly from LabVIEW Real-Time. Modules that you use in Scan Interface mode appear directly under the Chassis item in the **Project Explorer** window and I/O channels appear as I/O variables under the modules. <u>To use I/O variables</u>, you drag and drop them to LabVIEW Real-Time VIs.

In Scan Interface mode, you do not need to do any LabVIEW FPGA development or program communication between FPGA and Host VIs. You also do not need to wait for VIs to be compiled to the FPGA before deploying and running them. In Scan Interface mode, LabVIEW programs the FPGA on the CompactRIO target to work with the variables.

LabVIEW FPGA Interface Mode

LabVIEW FPGA Interface mode enables you to use C Series modules from LabVIEW FPGA VIs. Modules that you use in LabVIEW FPGA Interface mode appear directly under the FPGA Target item in the **Project Explorer** window and I/O channels appear as FPGA I/O items under the FPGA Target. To access the I/O channels, you configure FPGA I/O Nodes in FPGA VIs.

In LabVIEW FPGA Interface mode, you can use LabVIEW FPGA programming to add more flexibility, customization, and deterministic timing to your applications. To use the CompactRIO system in LabVIEW FPGA Interface mode, you must either have the LabVIEW FPGA Module installed on the host computer, or have access to a compiled bitfile that you can download to the FPGA. In either case, you use the Open FPGA VI Reference function in a host VI to access the FPGA VI or bitfile.

In LabVIEW FPGA Interface mode, you can still use the Scan Interface for some modules. Drag and drop a module to the **Chassis** item to use the Scan Interface for that module, and drag and drop a module to the **FPGA Target** item to develop FPGA VIs for that module. You may want to use the chassis in FPGA Interface mode and some modules in Scan Interface mode if, for example, you need more than two modules to do <u>specialty digital</u> functions. When you compile the FPGA VIs, the resulting bitfile downloaded to the chassis includes the logic needed to communicate with modules using the Scan Interface. You must ensure that the bitfile is running on the FPGA before accessing I/O variables.

Note If the chassis is in LabVIEW FPGA Interface mode, you must always use the Open FPGA VI Reference function to download a compiled bitfile to the FPGA before using the I/O variables of modules that are directly under the Chassis item.



Note If the chassis is in LabVIEW FPGA Interface mode, having modules directly under the Chassis item uses two <u>DMA channels</u>.

Supported CompactRIO Hardware (Scan Interface)

Scan Interface mode supports the following CompactRIO hardware.

CompactRIO Controllers

- cRIO-9074 Integrated Real-Time Controller and Chassis
- cRIO-9012 Intelligent Real-Time Controller
- cRIO-9014 Intelligent Real-Time Controller

CompactRIO Chassis

- cRIO-9074 Integrated Real-Time Controller and Chassis
- cRIO-9103 Reconfigurable Embedded Chassis
- cRIO-9104 Reconfigurable Embedded Chassis

C Series Modules

Analog Input

- <u>NI 9201</u>
- <u>NI 9203</u>
- <u>NI 9205</u>
- <u>NI 9206</u>
- <u>NI 9211</u>
- <u>NI 9213</u>
- <u>NI 9215</u>
- <u>NI 9217</u>
- <u>NI 9219</u>
- <u>NI 9221</u>
- <u>NI 9229</u>
- <u>NI 9233</u>
- <u>NI 9234</u>
- <u>NI 9237</u>
- <u>NI 9239</u>

Analog Output

- <u>NI 9263</u>
- <u>NI 9264</u>
- <u>NI 9265</u>

Digital Input

- <u>NI 9401</u>
- <u>NI 9403</u>
- <u>NI 9411</u>
- <u>NI 9421</u>
- <u>NI 9422</u>
- <u>NI 9423</u>
- <u>NI 9425</u>
- <u>NI 9426</u>
- <u>NI 9435</u>

Digital Output

- <u>NI 9401</u>
- <u>NI 9403</u>
- <u>NI 9472</u>
- <u>NI 9474</u>
- <u>NI 9475</u>
- <u>NI 9476</u>
- <u>NI 9477</u>
- <u>NI 9481</u>
- <u>NI 9485</u>

Motion

- <u>NI 9512</u>
- <u>NI 9514</u>
- <u>NI 9516</u>

Using the RIO Device I/O Control

Place the RIO Device I/O control on the front panel of a VI. Use the I/O control pull-down menu to select a RIO device.

Selecting a RIO Device in a Project VI Targeted to My Computer

If the VI is part of a project and is targeted to My Computer, the I/O control pull-down menu shows the following sections from top to bottom.

- RIO devices in the project
- Local RIO devices and local RIO aliases
- Browse, which opens the Browse RIO Devices dialog box
- Recently used RIO devices

Selecting a RIO Device in a Project VI Targeted to an RT Controller

If the VI is part of a project and is targeted to an RT controller, the I/O control pull-down menu shows the following section.

• RIO devices local to the controller

Selecting a RIO Device in a Non-Project VI

If the VI is not part of a project, the I/O control pull-down menu shows the following sections from top to bottom.

- Local RIO devices and local RIO aliases
- Browse, which opens the Browse RIO Devices dialog box
- Recently used RIO devices

Writing to CompactRIO Channels (Scan Interface)

Complete the following steps to write to a CompactRIO channel.

- 1. <u>Configure</u> the CompactRIO system.
- 2. Make sure the <u>I/O variable</u> for the output channel appears under the module item in the **Project Explorer** window.
- 3. Right-click the RT target item for the controller in the **Project Explorer** window and select **New»VI** from the shortcut menu to add a new LabVIEW Real-Time VI to the CompactRIO system.
- 4. Place a <u>Timed Structure</u> on the block diagram of the VI.
- 5. Configure the Timed Structure as needed.
- 6. Place the I/O variable for the channel in the Timed Structure.
- 7. Right-click the input terminal of the I/O variable and select **Create**»**Control**.
- 8. Right-click the **error out** terminal of the I/O variable and select **Create»Indicator**.
- 9. Run the VI.

NI 9201 (Scan Interface)

CompactRIO 8-Channel, ±10 V, 12-Bit Analog Input Module

Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables for the channels return calibrated floating-point data in volts.
The NI 9201 has the following channels.

Channel	Description
Alx	Analog input channel x, where x is the number of the channel. For the NL 9201 x is 0 to 7

C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9201. Right-click the NI 9201 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.

Hardware Documentation

Refer to the <u>NI 9201/9221 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9203 (Scan Interface)

CompactRIO 8-Channel, ±20 mA, 16-Bit Analog Input Module

Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables for the channels return calibrated floating-point data in amps.

The NI 9203 has the following channels.

Channel	Description
Alx	Analog input channel x , where x is the number of the channel.

C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9203. Right-click the NI 9203 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.
- **Channel Configuration**—You can specify the input range for each channel.
 - **Channels**—Specifies the channel(s) for which you want to select the input range.
 - **Input Range**—Specifies the input range for the selected channel(s) as either 0–20 mA or ±20 mA.

Hardware Documentation

Refer to the <u>NI 9203 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9205 (Scan Interface)

CompactRIO 32-Channel Single-Ended/16-Channel Differential, ± 200 mV to ± 10 V, 16-Bit Analog Input Module

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Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables for the channels return calibrated floating-point data in volts.

The NI 9205 has the following channels.

Channel	Description
Alx	Analog input channel x , where x is the number of the channel.
	For the NI 9205, X IS 0 to 31.

C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9205. Right-click the NI 9205 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.
- **Channel Configuration**—You can specify the input range for each channel.
 - **Channels**—Specifies the channel(s) for which you want to select the input range.
 - Input Range—Specifies the input range for the selected channel(s) as ±10 V, ±5 V, ±1 V, or ±200 mV.
 - Terminal Mode—Specifies the terminal mode for the selected channel(s) as RSE (referenced single-ended), NRSE (nonreferenced single-ended), or DIFF (differential).

Hardware Documentation

Refer to the <u>NI 9205 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9206 (Scan Interface)

CompactRIO 32-Channel Single-Ended/16-Channel Differential, ± 200 mV to ± 10 V, 16-Bit Analog Input Module

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Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables for the channels return calibrated floating-point data in volts.

The NI 9206 has the following channels.

Channel	Description
Alx	Analog input channel x , where x is the number of the channel. For the NI 9206, x is 0 to 31.

C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9206. Right-click the NI 9206 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.
- **Channel Configuration**—You can specify the input range for each channel.
 - **Channels**—Specifies the channel(s) for which you want to select the input range.
 - Input Range—Specifies the input range for the selected channel(s) as ±10 V, ±5 V, ±1 V, or ±200 mV.
 - Terminal Mode—Specifies the terminal mode for the selected channel(s) as RSE (referenced single-ended), NRSE (nonreferenced single-ended), or DIFF (differential).

Hardware Documentation

Refer to the <u>NI 9206 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9211 (Scan Interface)

CompactRIO 4-Channel, ±80 mV, 24-Bit Thermocouple Input Module

Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables for the channels return calibrated floating-point data in units as specified on the **C Series Module Properties** dialog box.

The NI 9211 has the following channels.

Channel	Description
Alx	Analog input channel x , where x is the number of the channel. For the NI 9211, x is 0 to 3.

C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9211. Right-click the NI 9211 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.
- **Thermocouple Type**—Specifies the type of thermocouple connected to the channel.
- Measurement Units—Specifies the units you want data to be returned in for the channel. You can select Raw Volts, Degrees Kelvin, Degrees Celsius, Degrees Fahrenheit, or Degrees Rankine.

Hardware Documentation

Refer to the <u>NI 9211 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9213 (Scan Interface)

CompactRIO 16-Channel, ±78 mV, 24-Bit Thermocouple Input Module

Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables for the channels return calibrated floating-point data in units as specified on the **C Series Module Properties** dialog box.

The NI 9213 has the following channels.

Channel	Description
Alx	Analog input channel x , where x is the number of the channel. For the NI 9213, x is 0 to 15.

C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9213. Right-click the NI 9213 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.
- **Conversion Time**—Determines the time it takes to acquire one point of data from one or more channels. You can select **High Speed** or **High Resolution**. Refer to the *NI 9213 Operating Instructions and Specifications* for more information about the **High Speed** and **High Resolution** conversion times.
- **Channels**—Specifies the channel(s) for which you want to configure settings.
- **Thermocouple Type**—Specifies the type of thermocouple connected to the channel.
- Measurement Units—Specifies the units you want data to be returned in for the channel. You can select Raw Volts, Degrees Kelvin, Degrees Celsius, Degrees Fahrenheit, or Degrees Rankine.

Hardware Documentation

Refer to the *NI 9213 Operating Instructions and Specifications*, shipped with the NI 9213, to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface</u>) topic for further information about CompactRIO documentation.

NI 9215 (Scan Interface)

CompactRIO 4-Channel, ± 10 V, 16-Bit Simultaneous Analog Input Module

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Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables for the channels return calibrated floating-point data in volts.

The NI 9215 has the following channels.

Channel	Description
Alx	Analog input channel x , where x is the number of the channel.

C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9215. Right-click the NI 9215 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.

Hardware Documentation

Refer to the <u>NI 9215 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9217 (Scan Interface)

CompactRIO 4-Channel, 24-Bit, 100Ω RTD Analog Input Module

Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables for the channels return calibrated floating-point data in units as specified on the **C Series Module Properties** dialog box.

The NI 9217 has the following channels.

Channel	Description
Alx	Analog input channel x , where x is the number of the channel. For the NI 9217, x is 0 to 3.
Use this dialog box to configure the NI 9217. Right-click the NI 9217 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.
- **Conversion Time**—Specifies the time it takes to acquire one point of data from all channels. You can select **200 ms** or **2.5 ms**.
- Measurement Units—Specifies the units you want data to be returned in for the channel. You can select Raw Ohms, Degrees Kelvin, Degrees Celsius, Degrees Fahrenheit, or Degrees Rankine. If the RTD does not have a temperature coefficient of resistance (TCR) of 3851, you must select Raw Ohms and use the Convert RTD Reading VI to convert values to temperature units.

Hardware Documentation

Refer to the <u>NI 9217 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9219 (Scan Interface)

CompactRIO 4-Channel, 24-Bit Universal Analog Input Module

Module I/O Variables

To use I/O from this module in a VI, drag and drop I/O variables from the **Project Explorer** window to the block diagram of the VI. The I/O variables for the channels return calibrated floating-point data or Boolean data in units determined by the measurement mode you select on the **C Series Module Properties** dialog box. The following table shows the units for the different modes.

Mode	Data Units
Voltage	Volts
Current	Amps
Resistance	Ohms
Thermocouple	Volts or Temperature Units
RTD	Ohms or Temperature Units
Bridge	Volts/Volt
Digital In	Boolean
Open Contact	Boolean

Module Channels

The NI 9219 has the following channels.

Channel	Description
CHx	Analog input channel x , where x is the number of the channel. For the NI 9219, x is 0 to 3.

Use this dialog box to configure the NI 9219. Right-click the NI 9219 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.
- **Channels**—Specifies the channel(s) for which you want to configure settings.
- **Mode**—Specifies the measurement mode for the selected channel(s).
- **Range**—Specifies the range for the selected channel(s).
- **Type**—Specifies the type of thermocouple connected to a channel in thermocouple mode.
- **Measurement Units**—Specifies the units for data to be returned from the selected channel(s) configured for thermocouple or RTD mode.
- **Threshold**—Specifies the minimum high level in volts for the selected channel(s) configured for Digital In mode. The range of valid threshold values is 0–60.
- Conversion Time—Determines the time it takes to read all channels of the module. You can select High Speed, Best 60 Hz Rejection, Best 50 Hz Rejection, or High Resolution. Refer to the NI 9219 Operating Instructions and Specifications for more information about these conversion times.

Hardware Documentation

Refer to the <u>NI 9219 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9221 (Scan Interface)

CompactRIO 8-Channel, ±60 V, 12-Bit Analog Input Module

Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables for the channels return calibrated floating-point data in volts.

Module Channels

The NI 9221 has the following channels.

Channel	Description
Alx	Analog input channel x , where x is the number of the channel. For the NI 9221, x is 0 to 7.

Use this dialog box to configure the NI 9221. Right-click the NI 9221 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.

Hardware Documentation

Refer to the <u>NI 9201/9221 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9229 (Scan Interface)

CompactRIO 4-Channel, ± 60 V, 24-Bit Simultaneous Analog Input Module

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Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables for the channels return calibrated floating-point data in volts.

Module Channels

The NI 9229 has the following channels.

Channel	Description
Alx	Analog input channel x , where x is the number of the channel. For the NI 9229, x is 0 to 3.

Use this dialog box to configure the NI 9229. Right-click the NI 9229 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.

Hardware Documentation

Refer to the <u>NI 9229/9239 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9233 (Scan Interface)

CompactRIO 4-Channel, ±5 V, 24-Bit IEPE Analog Input Module

Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables for the channels return calibrated floating-point data in volts.

Module Channels

The NI 9233 has the following channels.

Channel	Description
Alx	Analog input channel x , where x is the number of the channel. For the NI 9233, x is 0 to 3.

Use this dialog box to configure the NI 9233. Right-click the NI 9233 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.

Hardware Documentation

Refer to the <u>NI 9233 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9234 (Scan Interface)

CompactRIO 4-Channel, ± 5 V, 51.2 KS/s, 24-Bit Software Selectable IEPE and AC/DC Analog Input Module

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Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables for the channels return calibrated floating-point data in volts.

Module Channels

The NI 9234 has the following channels.

Channel	Description
Alx	Analog input channel x , where x is the number of the channel. For the NI 9234, x is 0 to 3.

Use this dialog box to configure the NI 9234. Right-click the NI 9234 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.
- **Channels**—Specifies the channel(s) for which you want to select the input configuration.
- Input Configuration—Specifies the input configuration for the selected channel(s). You can select one of three modes: AC coupled, DC coupled, or IEPE AC coupled.

Hardware Documentation

Refer to the <u>NI 9234 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9237 (Scan Interface)

CompactRIO 4-Channel, 24-Bit Half/Full-Bridge Analog Input Module

Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables for the channels return calibrated floating-point data in volts/volts (channel voltage/excitation voltage).

Module Channels

The NI 9237 has the following channels.

Channel	Description
Alx	Analog input channel x , where x is the number of the channel. For the NI 9237, x is 0 to 3.

Use this dialog box to configure the NI 9237. Right-click the NI 9237 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.
- **Excitation Voltage**—Specifies the excitation voltage for the module to output to bridges, or specifies external excitation.
- **Enable Half-Bridge Completion**—Enables half-bridge completion for individual channels.

Hardware Documentation

Refer to the <u>NI 9237 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9239 (Scan Interface)

CompactRIO 4-Channel, ±10 V, 24-Bit Simultaneous Analog Input Module

Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables for the channels return calibrated floating-point data in volts.

Module Channels

The NI 9239 has the following channels.

Channel	Description
Alx	Analog input channel x , where x is the number of the channel.
	For the NI 9239, X is 0 to 3.

Use this dialog box to configure the NI 9239. Right-click the NI 9239 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.
Hardware Documentation

Refer to the <u>NI 9229/9239 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9263 (Scan Interface)

CompactRIO 4-Channel, ± 10 V, 16-Bit Simultaneous Analog Output Module

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Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables write floating-point values to the channels in volts.

Module Channels

The NI 9263 has the following channels.

Channel	Description
AO <i>x</i>	Analog output channel <i>x</i> , where <i>x</i> is the number of the channel. For the NI 9263, <i>x</i> is 0 to 3.

C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9263. Right-click the NI 9263 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.

Hardware Documentation

Refer to the <u>NI 9263 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9264 (Scan Interface)

CompactRIO 16-Channel, ± 10 V, 16-Bit Simultaneous Analog Voltage Output Module

Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables write floating-point values to the channels in volts.

Module Channels

The NI 9264 has the following channels.

Channel	Description
AOx	Analog output channel <i>x</i> , where <i>x</i> is the number of the channel. For the NI 9264, <i>x</i> is 0 to 15.

C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9264. Right-click the NI 9264 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.

Hardware Documentation

Refer to the <u>NI 9264 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9265 (Scan Interface)

CompactRIO 4-Channel, 0–20 mA, 16-Bit Simultaneous Analog Current Output Module

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Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables write floating-point values to the channels in amps.

Module Channels

The NI 9265 has the following channels.

Channel	Description
AOx	Analog output channel <i>x</i> , where <i>x</i> is the number of the channel. For the NI 9265, <i>x</i> is 0 to 3.

C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9265. Right-click the NI 9265 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.

Hardware Documentation

Refer to the <u>NI 9265 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9401 (Scan Interface)

CompactRIO 8-Channel, TTL Digital Input/Output Module

Module I/O Variables

To use I/O from this module in a VI, drag and drop I/O variables from the **Project Explorer** window to the block diagram of the VI. The I/O variables for the channels read and write Boolean values.

Module Channels

The NI 9401 has the following channels.

Channel	Description
DIOx	Digital input/output channel <i>x</i> , where <i>x</i> is the number of the channel. For the NI 9401, <i>x</i> is 0 to 7.

C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9401. Right-click the NI 9401 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- **Location**—Specifies a slot in the chassis for the C Series module.
- Initial Line Direction—Specifies the initial line direction of each four-channel port as input or output.

Specialty Digital Configuration

You can use the <u>Specialty Digital Configuration</u> page of the **C Series Module Properties** dialog box to configure channels of this module for <u>pulse-width modulation</u> output, <u>counter</u> input, or <u>quadrature</u> input.

Hardware Documentation

Refer to the <u>NI 9401 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9403 (Scan Interface)

CompactRIO 32-Channel, TTL Digital Input/Output Module

Module I/O Variables

To use I/O from this module in a VI, drag and drop I/O variables from the **Project Explorer** window to the block diagram of the VI. The I/O variables for the channels read and write Boolean values.

Module Channels

The NI 9403 has the following channels.

Channel	Description
DIOx	Digital input/output channel <i>x</i> , where <i>x</i> is the number of the channel. For the NI 9403, <i>x</i> is 0 to 31.

C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9403. Right-click the NI 9403 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.
- **Channels**—Specifies the channel(s) for which you want to configure settings.
- Initial Line Direction—Specifies the initial line direction of the selected channel(s) as input or output.

Hardware Documentation

Refer to the <u>NI 9403 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9411 (Scan Interface)

CompactRIO 6-Channel, Differential or TTL Digital Input Module

Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables for the channels return data as Boolean values.

Module Channels

The NI 9411 has the following channels.

Channel	Description
DIx	Digital input channel <i>x</i> , where <i>x</i> is the number of the channel. For the NI 9411, <i>x</i> is 0 to 5.

C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9411. Right-click the NI 9411 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.

Specialty Digital Configuration

You can use the <u>Specialty Digital Configuration</u> page of the **C Series Module Properties** dialog box to configure channels of this module for <u>counter</u> input or <u>quadrature</u> input.

Hardware Documentation

Refer to the <u>NI 9411 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9421 (Scan Interface)

CompactRIO 8-Channel, 24 V, Sinking Digital Input Module

Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables for the channels return data as Boolean values.

Module Channels

The NI 9421 has the following channels.

Channel	Description
DIx	Digital input channel <i>x</i> , where <i>x</i> is the number of the channel. For the NI 9421, <i>x</i> is 0 to 7.
C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9421. Right-click the NI 9421 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.

Specialty Digital Configuration

You can use the <u>Specialty Digital Configuration</u> page of the **C Series Module Properties** dialog box to configure channels of this module for <u>counter</u> input or <u>quadrature</u> input.

Hardware Documentation

Refer to the <u>NI 9421/9423 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9422 (Scan Interface)

CompactRIO 8-Channel, 24 V, Sinking/Sourcing Digital Input Module

Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables for the channels return data as Boolean values.

Module Channels

The NI 9422 has the following channels.

Channel	Description
DIx	Digital input channel <i>x</i> , where <i>x</i> is the number of the channel. For the NI 9422, <i>x</i> is 0 to 7.

C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9422. Right-click the NI 9422 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.

Specialty Digital Configuration

You can use the <u>Specialty Digital Configuration</u> page of the **C Series Module Properties** dialog box to configure channels of this module for <u>counter</u> input or <u>quadrature</u> input.

Hardware Documentation

Refer to the <u>NI 9422 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9423 (Scan Interface)

CompactRIO 8-Channel, 24 V, High-Speed Digital Input Module

Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables for the channels return data as Boolean values.

Module Channels

The NI 9423 has the following channels.

Channel	Description
DIx	Digital input channel <i>x</i> , where <i>x</i> is the number of the channel. For the NI 9423, <i>x</i> is 0 to 7.

C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9423. Right-click the NI 9423 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.

Specialty Digital Configuration

You can use the <u>Specialty Digital Configuration</u> page of the **C Series Module Properties** dialog box to configure channels of this module for <u>counter</u> input or <u>quadrature</u> input.

Hardware Documentation

Refer to the <u>NI 9421/9423 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9425 (Scan Interface)

CompactRIO 32-Channel, 24 V, Sinking Digital Input Module

Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables for the channels return data as Boolean values.

Module Channels

The NI 9425 has the following channels.

Channel	Description
DIx	Digital input channel <i>x</i> , where <i>x</i> is the number of the channel. For the NI 9425, <i>x</i> is 0 to 31.

C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9425. Right-click the NI 9425 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.

Hardware Documentation

Refer to the <u>NI 9425 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9426 (Scan Interface)

CompactRIO 32-Channel, 24 V, Sourcing Digital Input Module

Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables for the channels return data as Boolean values.

Module Channels

The NI 9426 has the following channels.

Channel	Description
DIx	Digital input channel <i>x</i> , where <i>x</i> is the number of the channel. For the NI 9426, <i>x</i> is 0 to 31.

C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9426. Right-click the NI 9426 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.

Hardware Documentation

Refer to the <u>NI 9426 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9435 (Scan Interface)

CompactRIO 4-Channel, AC/DC Universal Digital Input Module

Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables for the channels return data as Boolean values.

Module Channels

The NI 9435 has the following channels.

Channel	Description
DIx	Digital input channel x , where x is the number of the channel.
	For the NI 9435, x is 0 to 3.

C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9435. Right-click the NI 9435 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.

Specialty Digital Configuration

You can use the <u>Specialty Digital Configuration</u> page of the **C Series Module Properties** dialog box to configure channels of this module for <u>counter</u> input or <u>quadrature</u> input.

Hardware Documentation

Refer to the <u>NI 9435 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9472 (Scan Interface)

CompactRIO 8-Channel, 24 V, Sourcing Digital Output Module

Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables write Boolean values to the channels.

Module Channels

The NI 9472 has the following channels.

Channel	Description
DOx	Digital output channel x , where x is the number of the channel. For the NI 9472, x is 0 to 7.

C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9472. Right-click the NI 9472 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.

Specialty Digital Configuration

You can use the <u>Specialty Digital Configuration</u> page of the **C Series Module Properties** dialog box to configure channels of this module for <u>counter-driven</u> output or <u>pulse-width modulation</u> output.
Hardware Documentation

Refer to the <u>NI 9472/9474 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9474 (Scan Interface)

CompactRIO 8-Channel, 24 V, High-Speed, Sourcing Digital Output Module

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Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables write Boolean values to the channels.

Module Channels

The NI 9474 has the following channels.

Channel	Description
DOx	Digital output channel x , where x is the number of the channel. For the NI 9474, x is 0 to 7.

C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9474. Right-click the NI 9474 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.

Specialty Digital Configuration

You can use the <u>Specialty Digital Configuration</u> page of the **C Series Module Properties** dialog box to configure channels of this module for <u>counter-driven</u> output or <u>pulse-width modulation</u> output.

Hardware Documentation

Refer to the <u>NI 9472/9474 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9475 (Scan Interface)

CompactRIO 8-Channel, 60 V, High-Speed, Sourcing Digital Output Module

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Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables write Boolean values to the channels.

Module Channels

The NI 9475 has the following channels.

Channel	Description
DOx	Digital output channel x , where x is the number of the channel. For the NI 9475, x is 0 to 7.

C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9475. Right-click the NI 9475 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.

Specialty Digital Configuration

You can use the <u>Specialty Digital Configuration</u> page of the **C Series Module Properties** dialog box to configure channels of this module for <u>counter-driven</u> output or <u>pulse-width modulation</u> output.

Hardware Documentation

Refer to the <u>NI 9475 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9476 (Scan Interface)

CompactRIO 32-Channel, 24 V, High-Speed, Sourcing Digital Output Module

Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables write Boolean values to the channels.

Module Channels

The NI 9476 has the following channels.

Channel	Description
DOx	Digital output channel x , where x is the number of the channel. For the NI 9476, x is 0 to 31.

C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9476. Right-click the NI 9476 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.

Hardware Documentation

Refer to the <u>NI 9476 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9477 (Scan Interface)

CompactRIO 32-Channel, 5–60 V, Sinking Digital Output Module

Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables write Boolean values to the channels.

Module Channels

The NI 9477 has the following channels.

Channel	Description
DOx	Digital output channel x , where x is the number of the channel. For the NI 9477, x is 0 to 31.

C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9477. Right-click the NI 9477 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.

Hardware Documentation

Refer to the <u>NI 9477 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9481 (Scan Interface)

CompactRIO 4-Channel, Form A Electromechanical Relay Module

Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables write Boolean values to the channels.

Module Channels

The NI 9481 has the following channels.

Channel	Description
DOx	Digital output channel x , where x is the number of the channel. For the NI 9481, x is 0 to 3.

C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9481. Right-click the NI 9481 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.

Hardware Documentation

Refer to the <u>NI 9481 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

NI 9485 (Scan Interface)

CompactRIO 8-Channel, Solid-State Relay (SSR) Module

Module I/O Variables

To use I/O from this module in a VI, drag and drop <u>I/O variables</u> from the **Project Explorer** window to the block diagram of the VI. The I/O variables write Boolean values to the channels.

Module Channels

The NI 9485 has the following channels.

Channel	Description
DOx	Digital output channel x , where x is the number of the channel. For the NI 9485, x is 0 to 7.

C Series Module Properties Dialog Box

Use this dialog box to configure the NI 9485. Right-click the NI 9485 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.

Hardware Documentation

Refer to the <u>NI 9485 Operating Instructions and Specifications</u> to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface)</u> topic for further information about CompactRIO documentation.

Motion Modules (Scan Interface)

Use this book as a reference for information about configuring C Series motion modules on the **C Series Module Properties** dialog box.

To view related topics, click the **Locate** button, shown at left, in the toolbar at the top of this window. The *LabVIEW Help* highlights this topic in the **Contents** tab so you can navigate the related topics.

NI 9512 (Scan Interface)

One-axis stepper drive interface module with quadrature encoder feedback

Use the NI SoftMotion Controller, installed with the NI-Motion software, to configure axes for this module. Refer to the *NI-Motion LabVIEW Help* for information about configuring and using this module. You can find the *NI-Motion LabVIEW Help* by selecting **HelpNI-Motion LabVIEW Help** from within LabVIEW.

C Series Module Properties Dialog Box

Right-click the NI 9512 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.
Hardware Documentation

Refer to the *NI 9512 Operating Instructions and Specifications* and the *NI 951x User Manual* to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface</u>) topic for further information about CompactRIO documentation.

NI 9514 (Scan Interface)

One-axis servo drive interface module with quadrature encoder feedback

Use the NI SoftMotion Controller, installed with the NI-Motion software, to configure axes for this module. Refer to the *NI-Motion LabVIEW Help* for information about configuring and using this module. You can find the *NI-Motion LabVIEW Help* by selecting **HelpNI-Motion LabVIEW Help** from within LabVIEW.

C Series Module Properties Dialog Box

Right-click the NI 9514 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.

Hardware Documentation

Refer to the *NI* 9514 Operating Instructions and Specifications and the *NI* 951x User Manual to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface</u>) topic for further information about CompactRIO documentation.

NI 9516 (Scan Interface)

One-axis servo drive interface module with dual quadrature encoder feedback

Use the NI SoftMotion Controller, installed with the NI-Motion software, to configure axes for this module. Refer to the *NI-Motion LabVIEW Help* for information about configuring and using this module. You can find the *NI-Motion LabVIEW Help* by selecting **HelpNI-Motion LabVIEW Help** from within LabVIEW.

C Series Module Properties Dialog Box

Right-click the NI 9516 in the **Project Explorer** window and select **Properties** to display this dialog box. You can configure the following options.

- Name—Specifies the name of the C Series module, which appears in the **Project Explorer** window. LabVIEW assigns a default name to the module based on the slot number. You can use this field to give the module a descriptive name.
- **Module Type**—Specifies the type of C Series module. You cannot change this value.
- Location—Specifies a slot in the chassis for the C Series module.

Hardware Documentation

Refer to the *NI* 9516 Operating Instructions and Specifications and the *NI* 951x User Manual to learn about module specifications and how to use the module. Refer to the <u>CompactRIO Related Documentation (Scan Interface</u>) topic for further information about CompactRIO documentation.

Specialty Digital Configuration (Scan Interface)

You can use the Specialty Digital Configuration page of the **C Series Module Properties** dialog box to configure some C Series digital input and output modules for specialty digital functions. Specialty digital functions include <u>count input</u>, <u>counter-driven output</u>, <u>pulse-width</u> <u>modulation output</u>, and <u>quadrature input</u>.

If the chassis is in <u>Scan Interface</u> mode, you can configure modules in up to two slots for specialty digital functions. If you want to configure more than two modules for specialty digital functions, you must change the programming mode of the chassis to FPGA Interface mode. You still use the Scan Interface for the modules that you configure for specialty digital functions.

The maximum update rate for modules configured for specialty digital functions is approximately 4 mHz.

Configuring Counters (Scan Interface)

You can configure channels of some C Series digital input modules as counters. Counters measure digital signals. Counters are used commonly to count edges and for time measurements, such as measuring the frequency or period of a signal.

Configuring the Input Filter

You can add an input filter to all input channels of the module. A filter removes noise, glitches, and spikes on inputs by rejecting signals with periods shorter than the specified length. You can select one of the following options.

- **Disabled**—The hardware synchronizes the digital inputs using a 4 MHz timebase. Pulses longer than 250 ns are always detected. Pulses shorter than 250 ns may be rejected.
- 1 μs—Pulses shorter than 1 μs are rejected. Pulses between 1 μs and 2 μs are sometimes detected. Pulses longer than 2 μs are always detected.
- 16 μs—Pulses shorter than 16 μs are rejected. Pulses between 16 μs and 32 μs are sometimes detected. Pulses longer than 32 μs are always detected.
- **256 \mus**—Pulses shorter than 256 μ s are rejected. Pulses between 256 μ s and 512 μ s are sometimes detected. Pulses longer than 512 μ s are always detected.
- **4096 \mus**—Pulses shorter than 4096 μ s are rejected. Pulses between 4096 μ s and 8192 μ s are sometimes detected. Pulses longer than 8192 μ s are always detected.

Selecting the Measurement Mode

You can select one of four counter measurement modes for each counter channel: <u>Count Edges</u>, <u>Period Measurement</u>, <u>Pulse-Width Measurement</u>, or <u>Frequency Measurement</u>.

Configuring a Counter to Count Edges (Scan Interface)

You can configure a counter to count signal edges and perform an action on another channel when the count reaches a specified number, the terminal count. You can configure the following options for edge counting.

Configuring the Input Filter

You can add an input filter to all input channels of the module. A filter removes noise, glitches, and spikes on inputs by rejecting signals with periods shorter than the specified length. You can select one of the following options.

- **Disabled**—The hardware synchronizes the digital inputs using a 4 MHz timebase. Pulses longer than 250 ns are always detected. Pulses shorter than 250 ns may be rejected.
- 1 μs—Pulses shorter than 1 μs are rejected. Pulses between 1 μs and 2 μs are sometimes detected. Pulses longer than 2 μs are always detected.
- 16 μs—Pulses shorter than 16 μs are rejected. Pulses between 16 μs and 32 μs are sometimes detected. Pulses longer than 32 μs are always detected.
- **256 \mus**—Pulses shorter than 256 μ s are rejected. Pulses between 256 μ s and 512 μ s are sometimes detected. Pulses longer than 512 μ s are always detected.
- **4096 \mus**—Pulses shorter than 4096 μ s are rejected. Pulses between 4096 μ s and 8192 μ s are sometimes detected. Pulses longer than 8192 μ s are always detected.

Terminal Count

You can specify a terminal count up to a maximum of 2^{32} = 4,294,967,296. When the counter reaches the terminal count, it resets and starts counting again from zero.

Terminal Count Output Mode

You can select one of the following four actions to perform on a digital output channel on another module when the counter reaches the specified terminal count.

- **Toggle, Reset Off**—The counter-driven channel starts in the off state and changes state each time the counter channel reaches the terminal count.
- **Toggle, Reset On**—The counter-driven channel starts in the on state and changes state each time the counter channel reaches the terminal count.
- **On Pulse**—The counter-driven channel turns on each time the counter channel reaches the terminal count and remains on until the next counter increment.
- **Off Pulse**—The counter-driven channel turns off each time the counter channel reaches the terminal count and remains off until the next counter increment.
- **Note** In order for the counter to drive an output channel, you must configure the module that the output channel is on for <u>counter-driven output</u>. The counter-driven output channel has the same number as the counter channel that drives it. For example, CTR3 drives DO3 on an eight-channel digital output module in another slot in the same chassis.

Counter Event

- **Rising Edge**—The counter counts rising edges.
- Falling Edge—The counter counts falling edges.
- Any Edge—The counter counts all edges.

Count Down

If this box is checked, the counter counts backward from the terminal count. When the counter reaches zero, it resets and starts counting again from the terminal count.

Counter Source

You can select **This Channel** to count edges on an input signal connected to this channel, or **Terminal Count of Previous Channel** to increment the counter when the previous channel reaches the terminal count. You can use this option to create counters with terminal counts larger than 4,294,967,296.

Gate Mode

You can select **Always Enabled**, which means that the counter always counts edges, or **Next Channel**, which means that the counter increments only when the next higher channel is in the on state.

Configuring a Counter to Measure Period (Scan Interface)

You can configure a digital input channel as a counter to measure the period of a signal connected to the channel. The counter returns data in μ s. You can configure the following options for a period measurement counter. Use the **Measurement Edge** control to specify **Rising Edge** or **Falling Edge**.

Configuring the Input Filter

You can add an input filter to all input channels of the module. A filter removes noise, glitches, and spikes on inputs by rejecting signals with periods shorter than the specified length. You can select one of the following options.

- **Disabled**—The hardware synchronizes the digital inputs using a 4 MHz timebase. Pulses longer than 250 ns are always detected. Pulses shorter than 250 ns may be rejected.
- 1 μs—Pulses shorter than 1 μs are rejected. Pulses between 1 μs and 2 μs are sometimes detected. Pulses longer than 2 μs are always detected.
- 16 μs—Pulses shorter than 16 μs are rejected. Pulses between 16 μs and 32 μs are sometimes detected. Pulses longer than 32 μs are always detected.
- **256 \mus**—Pulses shorter than 256 μ s are rejected. Pulses between 256 μ s and 512 μ s are sometimes detected. Pulses longer than 512 μ s are always detected.
- **4096 \mus**—Pulses shorter than 4096 μ s are rejected. Pulses between 4096 μ s and 8192 μ s are sometimes detected. Pulses longer than 8192 μ s are always detected.

Selecting the Measurement Edge

- **Rising Edge**—The counter measures the time from one rising edge to the next rising edge.
- Falling Edge—The counter measures the time from one falling edge to the next falling edge.

Configuring a Counter to Measure Pulse Width (Scan Interface)

You can configure a digital input channel as a counter to measure the pulse width of a signal connected to the channel. The counter returns data in μ s. You can configure the following options for a pulse-width measurement counter.

Configuring the Input Filter

You can add an input filter to all input channels of the module. A filter removes noise, glitches, and spikes on inputs by rejecting signals with periods shorter than the specified length. You can select one of the following options.

- **Disabled**—The hardware synchronizes the digital inputs using a 4 MHz timebase. Pulses longer than 250 ns are always detected. Pulses shorter than 250 ns may be rejected.
- 1 μs—Pulses shorter than 1 μs are rejected. Pulses between 1 μs and 2 μs are sometimes detected. Pulses longer than 2 μs are always detected.
- 16 μs—Pulses shorter than 16 μs are rejected. Pulses between 16 μs and 32 μs are sometimes detected. Pulses longer than 32 μs are always detected.
- **256 \mus**—Pulses shorter than 256 μ s are rejected. Pulses between 256 μ s and 512 μ s are sometimes detected. Pulses longer than 512 μ s are always detected.
- **4096 \mus**—Pulses shorter than 4096 μ s are rejected. Pulses between 4096 μ s and 8192 μ s are sometimes detected. Pulses longer than 8192 μ s are always detected.

Selecting the Measurement Type

- **High Pulse**—The counter returns the time that the connected signal is high.
- Low Pulse—The counter returns the time that the connected signal is low.
- **Most Recent**—The counter returns the lengths of the most recent high and low pulses.

Configuring a Counter to Measure Frequency (Scan Interface)

You can configure a counter to measure the frequency of a signal connected to the channel. The counter counts the number of rising or falling signal edges during the length of the Frequency Timebase, divides that number by the Frequency Timebase in μ s, and returns the frequency in kHz. You can configure the following options for a frequency measurement counter.

Configuring the Input Filter

You can add an input filter to all input channels of the module. A filter removes noise, glitches, and spikes on inputs by rejecting signals with periods shorter than the specified length. You can select one of the following options.

- **Disabled**—The hardware synchronizes the digital inputs using a 4 MHz timebase. Pulses longer than 250 ns are always detected. Pulses shorter than 250 ns may be rejected.
- 1 μs—Pulses shorter than 1 μs are rejected. Pulses between 1 μs and 2 μs are sometimes detected. Pulses longer than 2 μs are always detected.
- 16 μs—Pulses shorter than 16 μs are rejected. Pulses between 16 μs and 32 μs are sometimes detected. Pulses longer than 32 μs are always detected.
- **256 \mus**—Pulses shorter than 256 μ s are rejected. Pulses between 256 μ s and 512 μ s are sometimes detected. Pulses longer than 512 μ s are always detected.
- **4096 \mus**—Pulses shorter than 4096 μ s are rejected. Pulses between 4096 μ s and 8192 μ s are sometimes detected. Pulses longer than 8192 μ s are always detected.

Selecting the Measurement Edge

- **Rising**—The counter counts rising edges.
- Falling—The counter counts falling edges.

Selecting the Frequency Timebase

Selecting a **Frequency Timebase** is a tradeoff between resolution and response speed. A shorter timebase provides lower resolution but the data it returns is more up to date. A longer timebase provides higher resolution but may lag behind or miss changes in signal frequency.



Note For frequencies lower than 1 kHz, configure a counter to measure period and calculate the frequency using the inverse of the measurement.

Configuring Counter-Driven Outputs (Scan Interface)

Counter-driven output channels respond in a predetermined way when a counter channel on a digital input module reaches the terminal count. You must configure a digital input channel on another module for <u>edge</u> <u>counting</u> and select an action for the Terminal Count Output Mode. Then you select the digital output channel with the same channel number and configure it as a counter-driven output. You can configure the following options for a counter-driven output.

Drive from Slot

Use this control to select a slot with a digital input module that has at least one channel configured to count edges. Refer to the **Project Explorer** window and select a slot that has a channel called CTRx, where x is the number of the selected output channel.

Drive Channel from Counter

Place a check in this box to drive the selected channel using the counter channel selected with the **Drive from Slot** control. If this box is checked, LabVIEW removes the I/O variable for the selected channel from the **Project Explorer** window. If an I/O variable for the selected channel is used in a block diagram of a VI, the VI will not run.

Configuring a Channel for Pulse-Width Modulation (Scan Interface)

You can configure a digital output channel to output a signal with a set frequency and period. Use a control on the front panel of a VI to control the on time (also called the active time or duty cycle) of the pulse.

Configuring a Module for Quadrature Input (Scan Interface)

You can configure a digital input module for quadrature input. A quadrature input returns position and velocity data based on the values of three channels. In quadrature input mode, channels 0, 1, and 2 are the A, B, and Index channels, respectively, of Quadrature0. If the module has six or more channels, channels 3, 4, and 5 can form a second quadrature input, Quadrature1. A C Series module can have only two quadrature inputs. Quadrature inputs return dimensionless position data and velocity in counts per second. You can configure the following options for quadrature input.

Configuring the Input Filter

You can add an input filter to all input channels of the module. A filter removes noise, glitches, and spikes on inputs by rejecting signals with periods shorter than the specified length. You can select one of the following options.

- **Disabled**—The hardware synchronizes the digital inputs using a 4 MHz timebase. Pulses longer than 250 ns are always detected. Pulses shorter than 250 ns may be rejected.
- 1 μs—Pulses shorter than 1 μs are rejected. Pulses between 1 μs and 2 μs are sometimes detected. Pulses longer than 2 μs are always detected.
- 16 μs—Pulses shorter than 16 μs are rejected. Pulses between 16 μs and 32 μs are sometimes detected. Pulses longer than 32 μs are always detected.
- **256 \mus**—Pulses shorter than 256 μ s are rejected. Pulses between 256 μ s and 512 μ s are sometimes detected. Pulses longer than 512 μ s are always detected.
- **4096 \mus**—Pulses shorter than 4096 μ s are rejected. Pulses between 4096 μ s and 8192 μ s are sometimes detected. Pulses longer than 8192 μ s are always detected.

Selecting the Velocity Timebase

Selecting a **Velocity Timebase** is a tradeoff between resolution and response speed. A shorter timebase provides lower resolution but the data it returns is more up to date. A longer timebase provides higher resolution but may lag behind or miss changes in velocity.
Selecting the Index Mode

If you enable an Index Mode, the position is reset to zero when A and B have the specified values and the Index is in the on state.

- **Disabled**—The position is never reset to zero.
- **Phase B0 A0**—The position is reset to zero when B and A are both in the off state and the Index is in the on state.
- **Phase B0 A1**—The position is reset to zero when B is in the off state and A and the Index are both in the on state.
- **Phase B1 A0**—The position is reset to zero when B is in the on state, A is in the off state, and the Index is in the on state.
- **Phase B1 A1**—The position is reset to zero when A, B, and the Index are all in the on state.