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Technical Sales

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Requirements and Compatibility | Ordering Information | Detailed Specifications | Pinouts/Front Panel Connections
For user manuals and dimensional drawings, visit the product page resources tab on ni.com.

Last Revised: 2014-11-06 07:14:17.0

NI CompactRIO High-Performance Real-Time Controllers

NI cRIO-9012, NI cRIO-9014





- Small and rugged embedded real-time controllers
- Execution target for NI LabVIEW Real-Time applications
- 400 MHz Freescale MPC5200 real-time processor
- -40 to 70 °C operating temperature range
- Reliable and deterministic operation for stand-alone control, monitoring, and logging
- Full-Speed USB host port for connection to USB flash and memory devices
- 10/100BASE-T Ethernet port with embedded Web and file servers with remote-panel user interface
- RS232 serial port for connection to peripherals; dual 9 to 35 VDC supply inputs

Overview

NI cRIO-901x controllers feature an industrial 400 MHz Freescale MPC5200 real-time processor for deterministic and reliable real-time applications. Both embedded controllers are designed for extreme ruggedness, reliability, and low power consumption with dual 9 to 35 VDC supply inputs that deliver isolated power to the CompactRIO chassis/modules and a -40 to 70 °C operating temperature range. The cRIO-901x controllers accept 9 to 35 VDC power supply inputs on power-up and 6 to 35 VDC power supply inputs during operation, so they can function for long periods of time in remote applications using a battery or solar power.

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Requirements and Compatibility

OS Information

- VxWorks

Driver Information

- NI-RIO

Software Compatibility

- LabVIEW
- LabVIEW FPGA Module
- LabVIEW Professional Development System
- LabVIEW Real-Time Module

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Comparison Tables

Product	DRAM (MB)	Internal Nonvolatile Storage (MB)	10/100BASE-TX Ethernet Port	RS232 Serial Port	Power Supply Input Range	Power Consumption	Backup Power Input	Remote Panel Web Server	FTP Server
NI cRIO-9012	64	128	yes	yes	9 to 35 VDC	6 W max	yes	yes	yes
NI cRIO-9014	128	2000	yes	yes	9 to 35 VDC	6 W max	yes	yes	yes

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Application and Technology

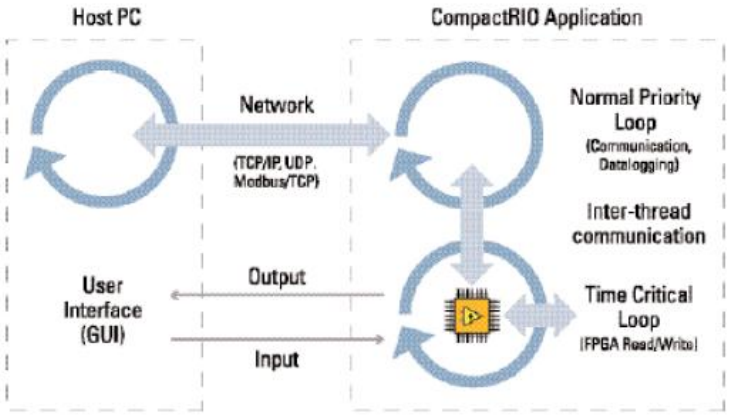
System Configuration

These NI CompactRIO real-time controllers connect to any four- or eight-slot CompactRIO reconfigurable chassis. The user-defined field-programmable gate array (FPGA) circuitry in the chassis controls each I/O module and passes data to the controllers through a local PCI bus using built-in communication functions.

With the 10/100 Mbits/s Ethernet and serial ports, you can communicate via TCP/IP, UDP, Modbus/TCP, and serial protocols. The cRIO-901x controllers also feature built-in Web (HTTP) and file (FTP) servers. For additional storage capability, cRIO-901x controllers incorporate a Full-Speed USB host port to which you can connect external USB-based storage media (flash drives and hard drives) for embedded logging applications requiring more storage. Also, cRIO-901x controllers include an embedded fault-tolerant file system that provides increased reliability for data logging.

Embedded Software

You can synchronize embedded code execution to an FPGA-generated interrupt request (IRQ) or an internal millisecond real-time clock source. The NI LabVIEW Real-Time ETS OS provides reliability and simplifies the development of complete embedded applications that include time-critical control and acquisition loops in addition to lower-priority loops for postprocessing, data logging, and Ethernet/serial communication. Built-in elemental I/O functions such as the FPGA Read/Write function provide a communication interface to the highly optimized reconfigurable FPGA circuitry. Data values are read from the FPGA in integer format and then converted to scaled engineering units in the controller.



CompactRIO Software Architecture

Built-In Servers

In addition to programmatic communication via TCP/IP, UDP, Modbus/TCP, IrDA, and serial protocols, the CompactRIO controllers include built-in servers for Virtual Instrument Software Architecture (VISA), HTTP, and FTP. The VISA server provides remote download and communication access to the reconfigurable I/O (RIO) FPGA over Ethernet. The HTTP server provides a Web browser user interface to HTML pages, files, and the user interface of embedded LabVIEW applications through a Web browser plug-in. The FTP server provides access to logged data or configuration files.

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Ordering Information

For a complete list of accessories, visit the product page on ni.com.

Products	Part Number	Recommended Accessories	Part Number
NI cRIO-9014			
cRIO-9014 Real-Time PowerPC Controller for cRIO, 2 GB Storage Requires:	779564-01	**Connector Block:** Not Applicable - NI 9978 4-pos screw terminal power supply plugs ***Also Available: Screw Terminal*	196938-01
		Connector Block: Not Applicable - NI 9979 Strain relief kit for 4-pos power connector	196939-01
NI cRIO-9012			
cRIO-9012 Real-Time PowerPC Controller for cRIO, 128 MB Storage Requires:	779563-01	**Connector Block:** Not Applicable - NI 9978 4-pos screw terminal power supply plugs (quantity 5)	196938-01

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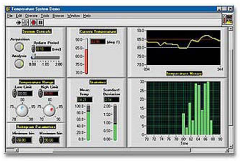
Software Recommendations

LabVIEW Professional Development System for Windows

- Advanced software tools for large project development
- Automatic code generation using DAQ Assistant and Instrument I/O Assistant

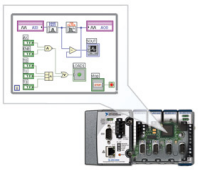
NI LabVIEW FPGA Module

- Design FPGA applications for NI reconfigurable I/O (RIO) hardware targets



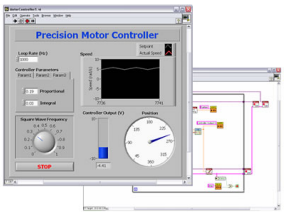
Tight integration with a wide range of hardware

- Advanced measurement analysis and digital signal processing
- Open connectivity with DLLs, ActiveX, and .NET objects
- Capability to build DLLs, executables, and MSI installers



- Program with the same graphical environment used for desktop and real-time applications
- Execute control algorithms with loop rates up to 300 MHz
- Implement custom timing and triggering logic, digital protocols, and DSP algorithms
- Incorporate existing HDL code and third-party IP including Xilinx CORE Generator functions
- Included in the LabVIEW Embedded Control and Monitoring Suite

NI LabVIEW Real-Time Module



- Design deterministic real-time applications with LabVIEW graphical programming
- Download to dedicated NI or third-party hardware for reliable execution and a wide selection of I/O
- Take advantage of built-in PID control, signal processing, and analysis functions
- Automatically take advantage of multicore CPUs or set processor affinity manually
- Includes real-time OS, development and debugging support, and board support
- Purchase individually or as part of a LabVIEW suite

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Support and Services

System Assurance Programs

NI system assurance programs are designed to make it even easier for you to own an NI system. These programs include configuration and deployment services for your NI PXI, CompactRIO, or Compact FieldPoint system. The NI Basic System Assurance Program provides a simple integration test and ensures that your system is delivered completely assembled in one box. When you configure your system with the NI Standard System Assurance Program, you can select from available NI system driver sets and application development environments to create customized, reorderable software configurations. Your system arrives fully assembled and tested in one box with your software preinstalled. When you order your system with the standard program, you also receive system-specific documentation including a bill of materials, an integration test report, a recommended maintenance plan, and frequently asked question documents. Finally, the standard program reduces the total cost of owning an NI system by providing three years of warranty coverage and calibration service. Use the online product advisors at ni.com/advisor to find a system assurance program to meet your needs.

Calibration

NI measurement hardware is calibrated to ensure measurement accuracy and verify that the device meets its published specifications. To ensure the ongoing accuracy of your measurement hardware, NI offers basic or detailed recalibration service that provides ongoing ISO 9001 audit compliance and confidence in your measurements. To learn more about NI calibration services or to locate a qualified service center near you, contact your local sales office or visit ni.com/calibration.

Technical Support

Get answers to your technical questions using the following National Instruments resources.

- **Support** - Visit ni.com/support to access the NI KnowledgeBase, example programs, and tutorials or to contact our applications engineers who are located in NI sales offices around the world and speak the local language.
- **Discussion Forums** - Visit forums.ni.com for a diverse set of discussion boards on topics you care about.
- **Online Community** - Visit community.ni.com to find, contribute, or collaborate on customer-contributed technical content with users like you.

Repair

While you may never need your hardware repaired, NI understands that unexpected events may lead to necessary repairs. NI offers repair services performed by highly trained technicians who quickly return your device with the guarantee that it will perform to factory specifications. For more information, visit ni.com/repair.

Training and Certifications

The NI training and certification program delivers the fastest, most certain route to increased proficiency and productivity using NI software and hardware. Training builds the skills to more efficiently develop robust, maintainable applications, while certification validates your knowledge and ability.

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- **Course kits** - lowest-cost, self-paced training that you can use as reference guides.
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Visit ni.com/training for more information.

Extended Warranty

NI offers options for extending the standard product warranty to meet the life-cycle requirements of your project. In addition, because NI understands that your requirements may change, the extended warranty is flexible in length and easily renewed. For more information, visit ni.com/warranty.

OEM

NI offers design-in consulting and product integration assistance if you need NI products for OEM applications. For information about special pricing and services for OEM customers, visit ni.com/oem.

Alliance

Our Professional Services Team is comprised of NI applications engineers, NI Consulting Services, and a worldwide National Instruments Alliance Partner program of more than 700 independent consultants and integrators. Services range from start-up assistance to turnkey system integration. Visit ni.com/alliance.

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Detailed Specifications

The following specifications are typical for the range – 40 to 70 °C unless otherwise noted.

Network	
Network interface	10BaseT and 100BaseTX Ethernet
Compatibility	IEEE 802.3
Communication rates	10 Mbps, 100 Mbps, auto-negotiated
Maximum cabling distance	100 m/segment
SMB Connector	
Output Characteristics	
Logic high	3.3 V
Logic low	0 V
Driver type	CMOS
Sink/source current	±50 mA
3-state output leakage current	±5 µA
Input Characteristics	
Minimum input level	–500 mV
Maximum input low level	990 mV
Minimum input high level	2.31 V
Maximum input level	5.5 V
Input capacitance	2.5 pF
Resistive strapping	1 kΩ to 3.3 V
USB Port	
Maximum data rate	12 Mb/s
Maximum current	500 mA
Memory	
Nonvolatile	
cRIO-9012	128 MB
cRIO-9014	2 GB
For information about the life span of the nonvolatile memory and about best practices for using nonvolatile memory, go to ni.com/info and enter the info code SSDBP.	
DRAM	
cRIO-9012	64 MB
cRIO-9014	128 MB
Internal Real-Time Clock	
Accuracy	200 ppm; 35 ppm at 25 °C

Power Requirements

Caution You must use a National Electric Code (NEC) UL Listed Class 2 power supply with the cRIO-9012/9014.

Recommended power supply	48 W secondary, 18 VDC to 24 VDC
Power consumption	
Controller only	6 W
Controller supplying power to eight CompactRIO modules	20 W
Power supply	
On powerup	9 to 35 V
After powerup	6 to 35 V

Note The cRIO-9012/9014 is guaranteed to power up when 9 V is applied to V and C. After powerup, it can operate on as little as 6 V.

Physical Characteristics

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

Screw-terminal wiring	12 to 24 AWG copper conductor wire with 10 mm (0.39 in.) of insulation stripped from the end
Torque for screw terminals	0.5 to 0.6 N · m (4.4 to 5.3 lb · in.)
Weight	Approx. 488 g (17.2 oz)

Safety Voltages

Connect only voltages that are within these limits.

V-to-C	35 V max, Measurement Category I

Measurement Category I is for measurements performed on circuits not directly connected to the electrical distribution system referred to as MAINS voltage. MAINS is a hazardous live electrical supply system that powers equipment. This category is for measurements of voltages from specially protected secondary circuits. Such voltage measurements include signal levels, special equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.

Caution Do not connect to signals or use for measurements within Measurement Categories II, III, or IV.

Safety Standards

This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

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

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

Electromagnetic Compatibility

This product is designed to meet the requirements of the following standards of EMC for electrical equipment for measurement, control, and laboratory use:

- EN 61326 EMC requirements; Industrial Immunity
- EN 55011 Emissions; Group 1, Class A
- CE, C-Tick, ICES, and FCC Part 15 Emissions; Class A

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

CE Compliance CE

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

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

Online Product Certification

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

Environmental Management

National Instruments is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial not only to the environment but also to NI customers.

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

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EU Customers At the end of the product life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers, National Instruments WEEE initiatives, and compliance with WEEE Directive 2002/96/EC on Waste Electrical and Electronic Equipment, visit ni.com/environment/weee.htm.

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(For information about China RoHS compliance, go to ni.com/environment/rohs_china.)

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

Environmental	
The cRIO-9012/9014 is intended for indoor use only. For outdoor use, mount the CompactRIO system in a suitably rated enclosure.	
(Operating temperature IEC 60068-2-1, IEC 60068-2-2)	– 40 to 70 °C
Note To meet this operating temperature range, follow the guidelines in the installation instructions for your CompactRIO system.	
Storage temperature (IEC 60068-2-1, IEC 60068-2-2)	– 40 to 85 °C
Ingress protection	IP 40
Operating humidity (IEC 60068-2-56)	10 to 90% RH, noncondensing
Storage humidity (IEC 60068-2-56)	5 to 95% RH, noncondensing
Maximum altitude	2,000 m
Pollution Degree (IEC 60664)	2

Shock and Vibration	
To meet these specifications, you must panel mount the CompactRIO system, affix ferrules to the ends of the terminal wires, and install a tie wrap on the USB cable for strain relief. You can use the tie wrap to attach the USB cable to the Ethernet cable.	
Operating vibration	
Random (IEC 60068-2-64)	5 g_{rms}, 10 to 500 Hz
Sinusoidal (IEC 60068-2-6)	5 g, 10 to 500 Hz
Operating shock (IEC 60068-2-27)	30 g, 11 ms half sine 50 g, 3 ms half sine, 18 shocks at 6 orientations

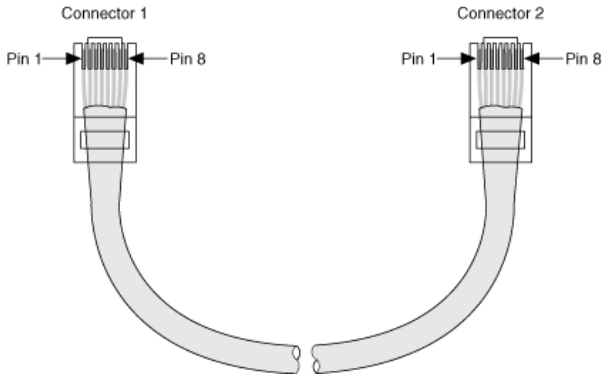
Cabling			
The following table shows the standard Ethernet cable wiring connections for both normal and crossover cables.			

Ethernet Cable Wiring Connections

Pin	Connector 1	Connector 2 (Normal)	Connector 2 (Crossover)
1	white/orange	white/orange	white/green
2	orange	orange	green
3	white/green	white/green	white/orange
4	blue	blue	blue
5	white/blue	white/blue	white/blue
6	green	green	orange
7	white/brown	white/brown	white/brown
8	brown	brown	brown

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Pinouts/Front Panel Connections



Ethernet Connector Pinout

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