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

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CompactRIO Real-Time Embedded Controllers

NI cRIO-9002, NI cRIO-9004

- Small, rugged, high-reliability embedded real-time processor for intelligent stand-alone operation
- Executes powerful floating-point algorithms with deterministic real-time performance
- Low power consumption with dual DC supply inputs for redundancy
- RS232 serial port for peripheral devices
- 10/100BASE-T Ethernet port with built-in LabVIEW remote panel Web server and FTP file sharing server

Overview

NI cRIO-900x real-time embedded controllers offer powerful stand-alone embedded execution for deterministic LabVIEW Real-Time applications. The NI cRIO-9002 includes 32 MB of DRAM memory and 64 MB of nonvolatile flash storage for file storage. The NI cRIO-9004 includes 64 MB of DRAM memory and 512 MB of nonvolatile flash storage for data-logging applications. Both 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 temperature range. A 195 MHz industrial processor balances low power consumption with powerful real-time floating-point signal processing and analysis capabilities for deterministic control loops exceeding 1 kHz.

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Requirements and Compatibility

OS Information

- ETS

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 Memory (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
cRIO-9002	32	64	yes	yes	9 to 35 VDC	7 W max	yes	yes	yes
cRIO-9004	64	512	yes	yes	9 to 35 VDC	7 W max	yes	yes	yes

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Application and Technology

System Configuration

The CompactRIO real-time controller connects 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 controller through a local PCI bus, using built-in communication functions.
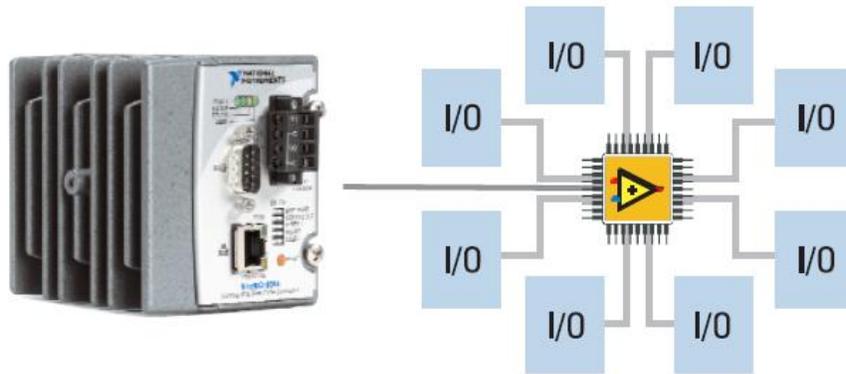

Figure 1. CompactRIO Hardware Architecture

Embedded Software

You can synchronize embedded code execution to an FPGA-generated interrupt request (IRQ) or an internal millisecond real-time clock source. The 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.
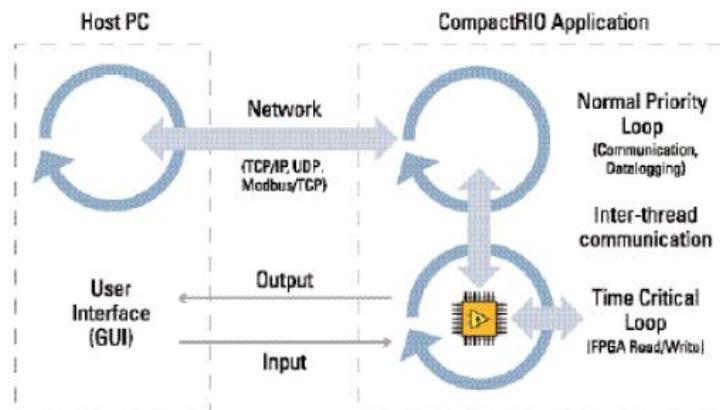

Figure 2. CompactRIO Software Architecture

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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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
- Tight integration with a wide range of hardware
- Advanced measurement analysis and digital signal processing
- Open connectivity with DLLs, ActiveX, and

NI LabVIEW FPGA Module

- Create your own I/O hardware without VHDL coding or board design
- Graphically configure FPGAs on NI reconfigurable I/O (RIO) hardware targets
- Define your own control algorithms with loop rates up to 200 MHz
- Execute multiple tasks simultaneously and deterministically
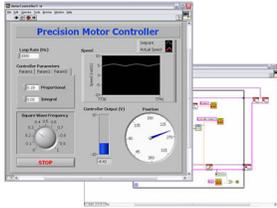- Implement custom timing and triggering logic,
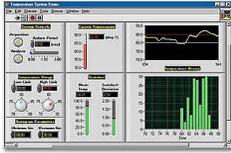
.NET objects

- Capability to build DLLs, executables, and MSI installers
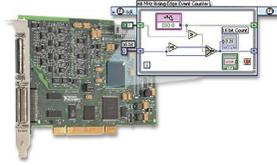
digital protocols, and DSP algorithms

- Incorporate existing HDL code and third-party IP including Xilinx CORE Generator functions

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 operating system (RTOS), development and debugging support, and board support
- Purchase individually or as part of an NI Developer Suite bundle

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. NI offers a number of calibration services to help maintain the ongoing accuracy of your measurement hardware. These services allow you to be completely confident in your measurements, and help you maintain compliance to standards like ISO 9001, ANSI/NCSL Z540-1 and ISO/IEC 17025. 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.

- **Classroom training in cities worldwide** - the most comprehensive hands-on training taught by engineers.
- **On-site training at your facility** - an excellent option to train multiple employees at the same time.
- **Online instructor-led training** - lower-cost, remote training if classroom or on-site courses are not possible.
- **Course kits** - lowest-cost, self-paced training that you can use as reference guides.
- **Training memberships** and training credits - to buy now and schedule training later.

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 600 independent consultants and integrators. Services range from start-up assistance to turnkey system integration. Visit ni.com/alliance.

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

Memory	
cRIO-9002	
Nonvolatile	64 MB
DRAM	32 MB
cRIO-9004	
Nonvolatile	512 MB
DRAM	64 MB

MTBF	
The following MTBF specifications apply to the cRIO-9002 and cRIO-9004.	
MTBF	1,253,788 hours at 25 °C; Bellcore Issue 6, Method 1, Case 3, Parts Count Method

Note Contact NI for Bellcore MTBF specifications at other temperatures or for MIL-HDBK-217F specifications. Go to ni.com/certification and search by model number or product line for more information about MTBF and other product certifications.

Power Requirements	
You must use a National Electric Code (NEC) Class 2 power source with the cRIO-9002/9004.	
Recommended power supply	48 W secondary, 18 VDC to 24 VDC
Power consumption	
Controller only	7 W max
Controller supplying power to 8 CompactRIO modules	17 W
Power supply	
On power up	9 to 35 V
After power up	6 to 35 V

Note The cRIO-9002 and cRIO-9004 power up only at 9 V or higher, but when these devices are powered on, they can run 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	
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 V and C terminals to signals within Measurement Categories II, III, or IV.

Safety Standards

The cRIO-9002/9004 is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- EN 61010-1, IEC 61010-1
- UL 61010-1
- CAN/CSA-C22.2 No. 61010-1

Note For UL and other safety certifications, refer to the product label, or visit ni.com/certification, search by model number or product line, and click the appropriate link in the Certification column.

Hazardous Locations

U.S. (UL)	Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, AEx nC IIC T4
Canada (C-UL)	Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, Ex nC IIC T4
Europe (DEMKO)	EEx nC IIC T4

Environmental

The cRIO-9002/9004 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 and affix ferrules to the end of the terminal wires.

Operating vibration, random (IEC 60068-2-64)	5 g_{rms}, 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
Operating vibration, sinusoidal (IEC 60068-2-6)	5 g, 10 to 500 Hz

Electromagnetic Compatibility

Emissions	EN 55011 Class A at 10 m FCC Part 15A above 1 GHz
Immunity	Industrial levels per EN 61326:1997 + A2:2001, Table A.1
EMC/EMI	CE, C-Tick, and FCC Part 15 (Class A) Compliant

Note For EMC compliance, operate this device with shielded cabling.

CE Compliance

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

Low-Voltage Directive (safety)	73/23/EEC
Electromagnetic Compatibility Directive (EMC)	89/336/EEC

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

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

Ethernet Cable Wiring Connections			
Pin	Connector 1	Connector 2 (Normal)	Connector 2 (Crossover)
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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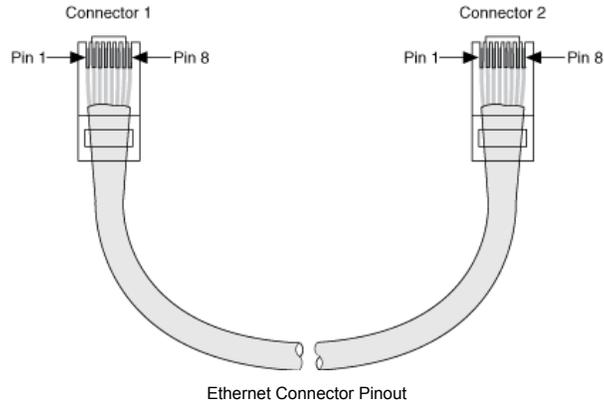
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