

New CompactRIO Real-Time Controllers Offer More Performance for Industrial & Embedded Applications

Overview

Now engineers can take advantage of a new high performance real-time embedded controller for the reconfigurable [CompactRIO](#) platform. The new [NI cRIO-9014](#) and the new [NI cRIO-9012](#) real-time controllers integrate Freescale and Wind River technologies and have 2X the processor speed, 2X the memory and up to 4X the non-volatile storage compared to their predecessors, giving engineers another step up in performance when designing embedded systems for applications such as machine control and monitoring, in-vehicle acquisition and control and embedded system prototyping and is used in a variety of industries such as automotive, military, industrial equipment and energy and environmental.

Real-Time Controllers Features the Freescale MPC5200 Real-Time Processor

The new [NI cRIO-9014](#) and [cRIO-9012](#) controllers have an embedded Freescale MPC5200 processor that is built on Power Architecture™ technology resulting in a high-performance alternative that is ideal for applications requiring a rugged, low-power solution. The cRIO-901x controllers feature:

- Small, rugged, high-reliability embedded real-time processor for intelligent standalone operation
- Executes powerful floating-point algorithms with deterministic real-time performance
- 400 MHz Freescale MPC5200 real-time processor
- 10/100BaseT Ethernet port with built-in FTP/HTTP servers and LabVIEW remote panel Web server
- Full-speed USB host port for USB-based storage media
- RS 232 serial port for peripheral devices
- Fault-tolerant file system
- Low power consumption with dual 9-35 VDC power supply inputs
- -40 to 70 °C temperature range

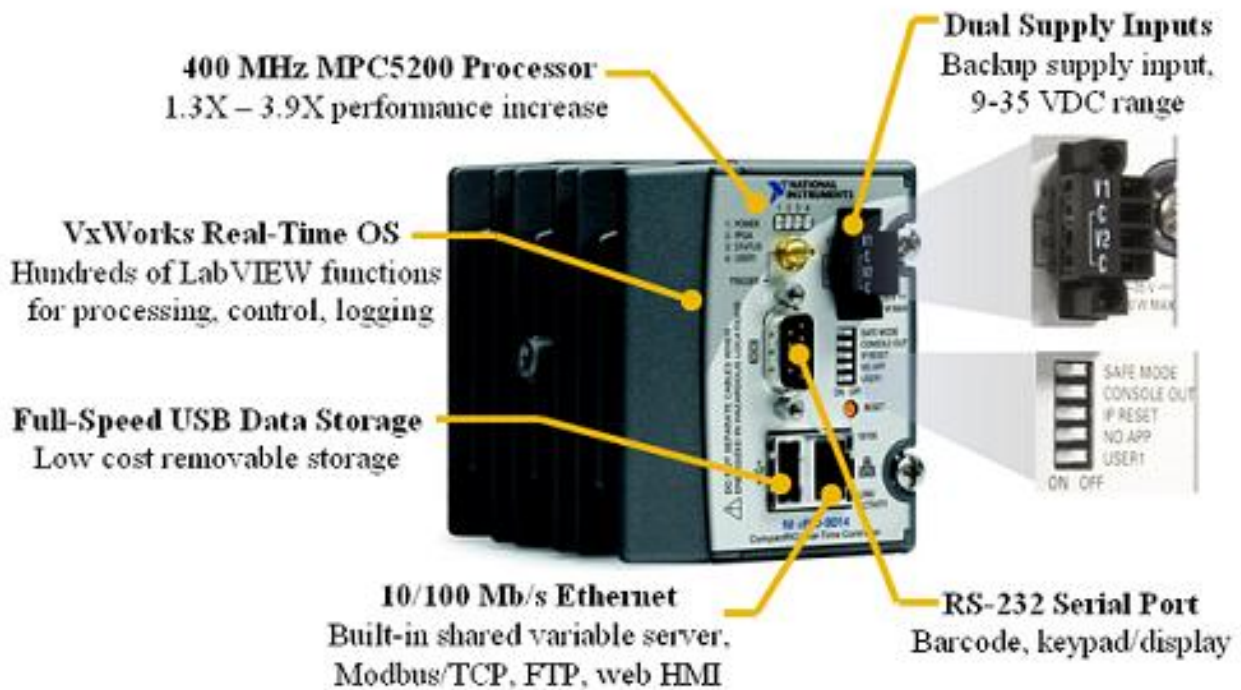


Figure 1. The New cRIO-901x CompactRIO Real-Time Embedded Controllers

The 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.

With the 10/100 Mb/s Ethernet port, you can conduct programmatic communication over the network and built-in Web (HTTP) and file (FTP) servers. For additional storage capability, the cRIO-901x controllers have 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 additional storage. Also, there is a fault-tolerant file system embedded in the cRIO-901x controllers that provides increased reliability for data-logging applications.

“Engineers require a development platform that helps them create embedded system solutions more quickly, with higher quality and with lower costs. Our collaboration with National Instruments is bringing the benefits of Power Architecture technology and Freescale’s MPC5200 processors to the CompactRIO graphical system design platform, which gives engineers a more streamlined approach to embedded system development.”

Steve Rosebaugh, senior product manager for Freescale’s Infotainment, Multimedia and Telematics operation

The new cRIO-901x controllers represents a dramatic increase in performance compared to their predecessors, the cRIO-900x controllers, giving users 2X the processor speed, 2X the memory and at least 2X the nonvolatile storage all at the same price allowing for higher performance for single-point control, data logging and data streaming applications. This makes it even easier for engineers to create cost-effective embedded solutions with COTS hardware.

Table 1. Hardware Specifications Comparison (New cRIO-901x vs. cRIO-900x)

	NEW cRIO-9014	cRIO-9004	NEW cRIO-9012	cRIO-9002	Change
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Processor Speed	400 MHz	200 MHz	400 MHz	200 MHz	2X
RAM Memory	128 MB	64 MB	64 MB	32 MB	2X
Non-Volatile Storage	2 GB	512 MB	128 MB	64 MB	up to 4X
Price	\$2699	\$2699	\$1499	\$1499	None

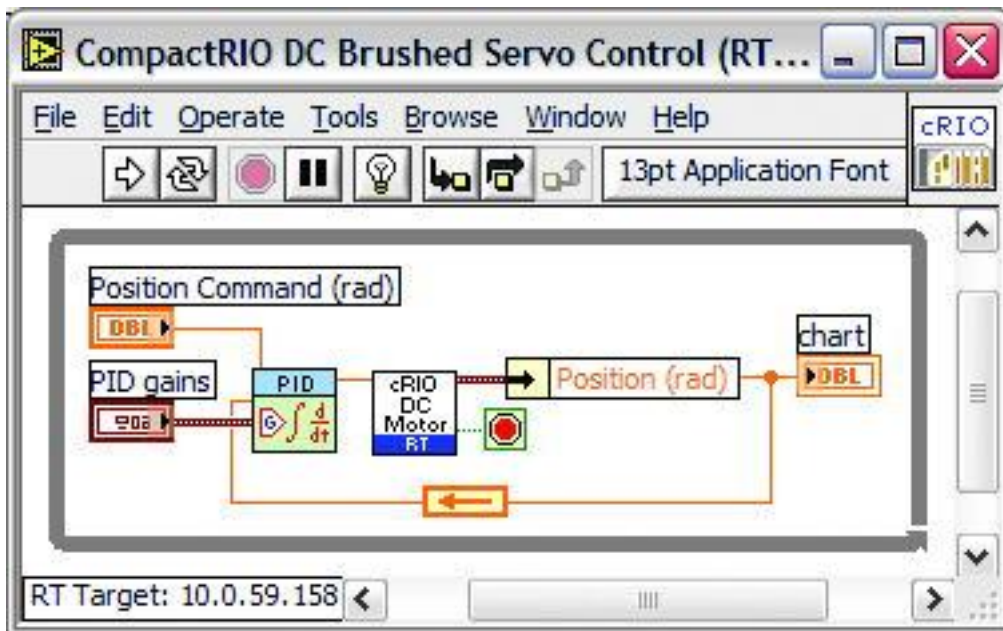
“The CompactRIO embedded system and LabVIEW tools allow us to use a single hardware platform to create multiple, high-performance machine testing and monitoring solutions. The increased performance of the new cRIO-9012 and cRIO-9014 controllers allow us to perform significantly more of the signal processing of our monitoring applications directly on distributed CompactRIO systems.”

Don Owen, software engineer at Xerox

Software Features LabVIEW Real-Time on Reliable VxWorks RTOS

The cRIO-9014 and cRIO-9012 are programmed using the [LabVIEW Real-Time Module](#) and execute applications on Wind River’s VxWorks real-time operating system (RTOS) for extreme reliability and determinism. For the first time, with the cRIO-901x real-time controllers, engineers can leverage the leading VxWorks RTOS technology and quickly design, prototype, and deploy a customizable COTS embedded system using LabVIEW graphical programming tools. LabVIEW developers can utilize the hundreds of built-in LabVIEW function blocks on the new processor providing for an efficient design path for embedded system development. The LabVIEW Real-Time Module includes software features such as:

- LabVIEW shared variable technology for easy networking of real-time targets and PCs
- Deterministic timing with microsecond resolution
- Over 600 analysis functions
- Integration of existing C/C++ code
- Support for data logging on external USB disks
- Optimized algorithms for Single-point Data Acquisition
- More efficient Interthread Communication
- System Replication Tools to quickly duplicate existing systems
- Faster PID Algorithms from the PID Toolkit
- FPGA Wizard to quickly architect Real-Time and FPGA code



“Device software has been exponentially increasing in complexity, which makes it much more challenging for engineers to be productive. We see graphical system design as a valuable methodology for moving customized device software from design to deployment quickly. The combination of state-of-the-art VxWorks RTOS technology, easy-to-use LabVIEW rapid development programming tools and the CompactRIO platform provides device software engineers with a powerful and flexible foundation for their design, so they can focus on the complete system and delivering the features their customers care about most.”

Warren Kurisu, director of product management at Wind River

With the new processor and new RTOS, there are significant increases in software performance compared to the cRIO-901x’s predecessors.

Table 2. Benchmark Performance Results (New cRIO-901x vs. cRIO-900x)

Benchmark	Improvement
Single-Point Real-Time PID (single channel)	1.3X
Single-Point Real-Time PID (16 channels)	3.6X
Software Jitter	2.2X
Interrupt Response Time	1.8X
DMA Transfer	2.4X

Applications

Because of its performance, flexibility, ruggedness and size, the CompactRIO system provides a flexible solution for applications such as embedded system prototyping, machine control and monitoring, in-vehicle logging and is used in a

variety of industries such as automotive, military, industrial equipment and energy and environmental.



In-Vehicle Acquisition and Control

CompactRIO provides a rugged, flexible, intelligent embedded system for a variety of in-vehicle acquisition and control applications such as data logging, noise, vibration and harshness (NVH) testing, rapid control prototyping and for a variety of vehicles such as automotive, military, aerospace, railroad and more.

[View an In-Vehicle Customer Solution](#)

Machine Control

By combining reliable real-time technology with reconfigurable, high-speed and FPGA technology, CompactRIO creates an ideal solution for developing a custom machine control applications in industries such as industrial equipment, energy and environmental, semiconductor and biomedical.

[View a Machine Control Solution](#)

Embedded System Prototyping

Using high-level LabVIEW programming tools, embedded system engineers are using CompactRIO COTS hardware tools to quickly prototyping and even deploy a variety of custom embedded systems.

[View an Embedded System Prototyping Solution](#)

Industrial Machine Monitoring

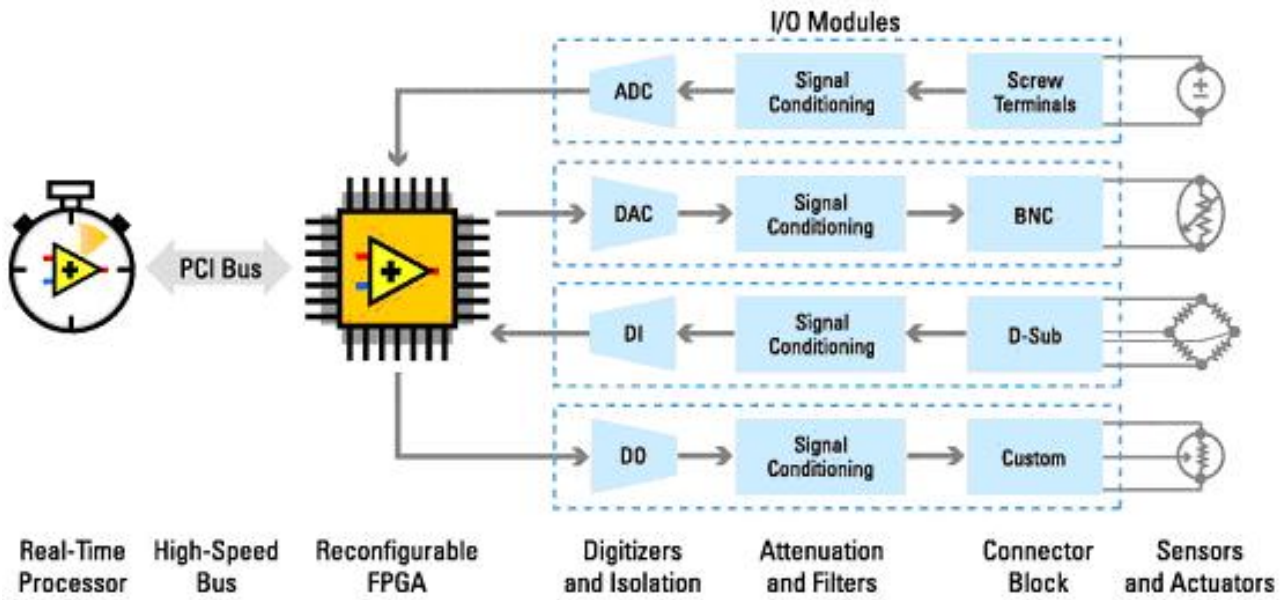
With its ruggedness, high-speed I/O and real-time processing capabilities, engineers are utilizing CompactRIO within a variety of industrial machinery monitoring applications to create flexible vibration analysis and logging solutions. With real-time processor and FPGA, users are also using the platform for machine protection applications as well.

[View an Industrial Machine Monitoring Solution](#)

About Graphical System Design

Graphical system design is a revolutionary approach to solving design challenges that blends intuitive graphical programming and flexible commercial-off-the-shelf (COTS) hardware to help engineers and scientists more efficiently design, prototype, and deploy embedded systems. Using the graphical system design approach will enable you to use a single environment across all stages of design to increase productivity, save money and bring embedded technology to the domain expert. The CompactRIO graphical system design architecture combines modular I/O with built-in signal

conditioning, a reconfigurable FPGA for custom control, timing, triggering and synchronization of I/O, and a real-time processor for stand-alone, deterministic floating-point analysis, control and logging.



About CompactRIO

[View the 3-Minute Video Introduction to CompactRIO](#)

[Configure and Build Your CompactRIO System Now](#)