NI CompactRIO

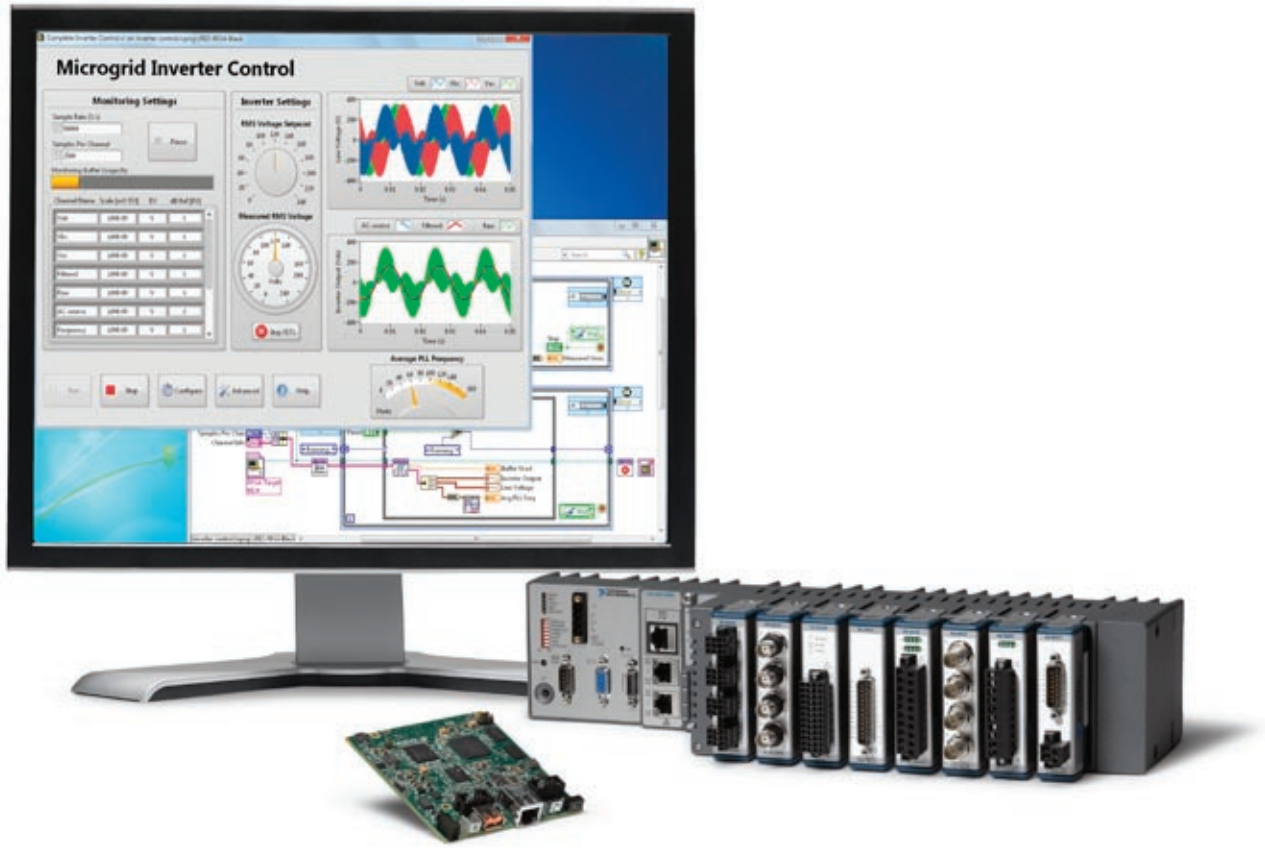
Precision and Accuracy | Flexibility | Quality and Ruggedness

ni.com/compactrio

NATIONAL INSTRUMENTS

Graphical System Design

Graphical system design combines NI LabVIEW system design software with commercial off-the-shelf hardware to simplify development and shorten time to market when designing advanced embedded control and monitoring systems.



NI RIO Hardware

All NI reconfigurable I/O (RIO) hardware components are programmed with LabVIEW software to give engineers the ability to rapidly create custom timing, signal processing, and control for I/O without requiring expertise in low-level hardware description languages or board-level design. The CompactRIO system's rugged hardware architecture includes I/O modules, a reconfigurable field-programmable gate array (FPGA) chassis, and an embedded controller.

Embedded Control and Monitoring Applications

NI reconfigurable hardware platforms can meet your embedded monitoring and control application challenges in a way that outperforms other off-the-shelf solutions and eliminates the need for costly custom designs. This high-precision, ultrarugged CompactRIO and NI Single-Board RIO hardware, coupled with LabVIEW, delivers the benefits of customization and the convenience of an off-the-shelf platform.

Oil Well Fracture Pump Monitoring and Analysis Using LabVIEW and NI RIO Technology

"While our prototype monitoring system is built using CompactRIO, since CompactRIO and NI Single-Board RIO have the same hardware architecture, we can switch easily between the two form factors without any major coding changes."

—Robert Stewart, Senior Vice President, **LIME Instruments**

Embedded FedEx Fire Suppression System Using LabVIEW and NI Single-Board RIO

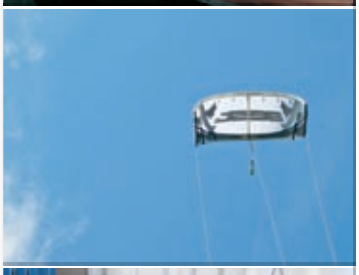
"We were able to rapidly prototype our system for FedEx with LabVIEW and CompactRIO and create a final deployed solution with NI Single-Board RIO—all in under one year."

—Jeremy Snow, President, **Ventura Aerospace Inc.**

Using Graphical System Design to Rapidly Develop a Low-Cost Device for Helping Premature Infants Learn to Oral Feed

"With LabVIEW and NI CompactRIO, we were able to reduce our development cost by $250,000. In addition, we were able to reduce our development time from four months to four weeks and avoid the necessity of developing custom control software and drivers."

—Daryl Farr, Manager, **KCBioMedix**



Powering Remote Villages With Revolutionary Wind Technology Using NI CompactRIO

"The seamless interface between the CompactRIO hardware and the NI LabVIEW development environment offers a turnkey hardware/software solution with very little learning required."

—Matt Bennett, Vice President, **Windlift**

Controlling the Movement of 20 Tons of Concrete With Precise Accuracy Using CompactRIO

"We developed this application in just two months. Since we developed the software modularly, we can reuse most of the content and adapt the software for new systems within weeks."

—Stijn Schacht, Head of R&D Department, **VAPO Hydraulics**

LabVIEW System Design Software

LabVIEW system design software is used by engineers and scientists to efficiently design, prototype, and deploy embedded control and monitoring applications. It combines hundreds of prewritten libraries, close integration with NI RIO hardware, and a variety of programming approaches.

LabVIEW Development Environment

Use a single embedded system development tool with support for a variety of RIO-based embedded hardware devices and the flexibility to reuse existing .m file scripts as well as graphical, ANSI C, and HDL code.

LabVIEW Real-Time Module

Extend LabVIEW to target the NI RIO embedded system processor for creating, debugging, and deploying reliable, stand-alone control and monitoring applications.

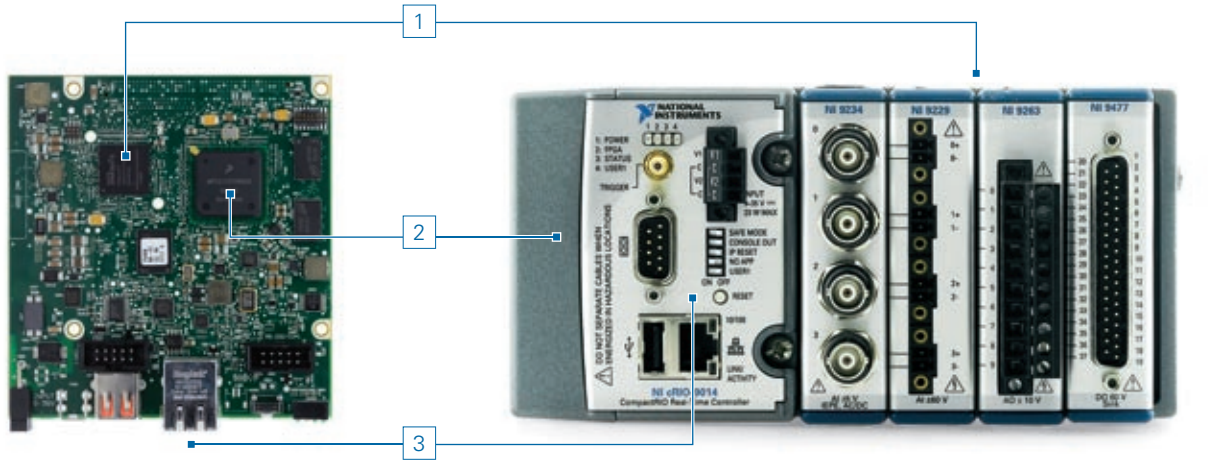
LabVIEW FPGA Module

Extend LabVIEW to take advantage of hardware-timed speed and FPGA reliability on NI RIO embedded hardware.

	LabVIEW Development System	LabVIEW Real-Time	LabVIEW FPGA
Included Libraries	▪ Third-party libraries ▪ Network communication ▪ Enterprise connectivity ▪ UI components	▪ Deterministic timing and control ▪ Data logging ▪ Deployment and replication	▪ Custom protocols ▪ Custom DAQ ▪ Signal processing ▪ Xilinx math and analysis
Included Middleware	▪ Driver interface to FPGA and C Series I/O ▪ Peripheral connectivity ▪ Multicore support		▪ DMA and register-level communication with real-time applications ▪ Clock management ▪ Low-level pin I/O

CompactRIO and NI Single-Board RIO

The CompactRIO system consists of an embedded controller for communication and processing, a reconfigurable chassis housing the user-programmable FPGA, hot-swappable I/O modules, and graphical LabVIEW system design software. NI Single-Board RIO provides the same RIO architecture in a board-level form factor for high-volume and OEM embedded control and monitoring applications.



1 Reconfigurable FPGA

- High-speed control
- Customizable timing, triggering, and processing
- Reuse of existing hardware description language (HDL) code

2 Real-Time Processor

- Deterministic processing and control
- User interface data logging and communication
- Built-in web and FTP servers

3 Built-In Peripherals

- USB and SD for extended data storage
- Serial, CAN, Ethernet, VGA, and MXI-Express ports for communication and expansion

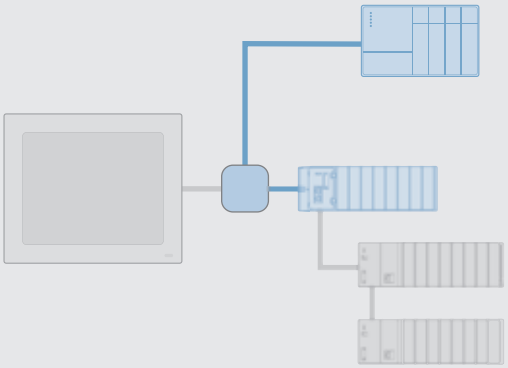


	Value	Ultrarugged	Performance
Processor Performance	Up to 400 MHz	Up to 800 MHz	Up to 1.33 GHz dual-core
FPGA Performance	Up to 43,661 logic cells, up to 58 multipliers	Up to 110,592 logic cells, up to 64 multipliers	Up to 147,443 logic cells, up to 180 multipliers
Operating System	Real-time OS	Real-time OS	Windows/real-time OS
I/O	Up to 8 I/O module slots, 100 Mbit/s Ethernet USB, RS232	Up to 8 I/O module slotss, Up to 1000 Mbit/s Ethernet USB, RS232	8 I/O module slots, 1000 Mbit/s Ethernet, USB, RS232/RS485, VGA
Power	Up to 9 to 30 VDC supply range, 6 to 25 W consumption	6 to 35 VDC supply range, 6 to 35 W consumption	9 to 30 VDC supply range, 20 to 75 W consumption
Ruggedness	-20 °C to 55 °C*, up to 50 g shock	-40 °C to 70 °C, 50 g shock	0 °C to 55° C, 50 g shock
Size	Starts at 17.8 x 9.3 x 8.7 cm^3*	Starts at 18 x 9.3 x 8.7cm^3	Starts at 40.4x13.4 x 8.7 cm^3
Certification Ratings	Product Safety: 2006/95/EC, EN61010-1, IEC 61010-1, CSA 61010-1 Hazardous Locations: Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, AEx nC IIC T4, Ex nL IIC T4 Shock and Vibration: IEC 60068-2-64, IEC 60068-2-27, IEC 60068-2-6 Mean Time Before Failure (MTBF): Bellcore Issue 6, Method 1, Case 3, MIL-HDBK-217F Marine: Lloyd's Register (LR Type Approval System Test Spec No. 1) Quality/Environmental Management System (QMS/EMS): ISO 9001/14001 Typical Certifications: Actual specifications vary from product to product. Visit **ni.com/certification** for complete details.		

*Some NI Single-Board RIO versions operate from -40°C to 85 °C and start at 10.3 x 9.7 x 2.4 cm^3

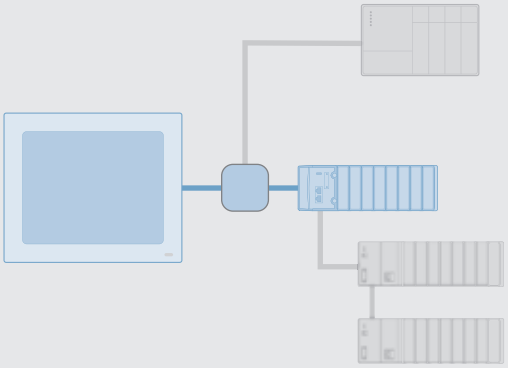
Flexible System Configuration With CompactRIO

Designing a complete system solution with CompactRIO is simplified through a flexible array of configuration and expansion options. You can easily operate CompactRIO as a stand-alone embedded system or network it to a human machine interface (HMI) device. Integration with existing systems is achieved through a wide range of industrial protocols.



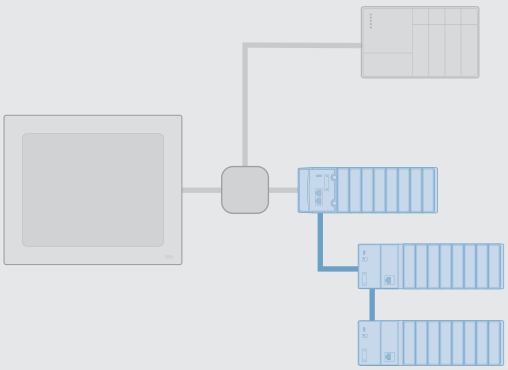
Connectivity to Existing Systems

CompactRIO supports industrial protocols including Modbus, OPC Classic, OPC UA, EtherNet/IP, DNP3, IEC 60870-5, PROFIBUS, CAN, LIN, EtherCAT, RS232, and RS485/RS422 for smooth integration with existing systems.



Stand-Alone or Networked Operation

The embedded processor used in CompactRIO enables stand-alone and headless operation for tasks like condition monitoring. Networking a computer or laptop provides an HMI for applications like high—performance manufacturing machines.



I/O Expansion

You can increase the C Series modular I/O in a system with a range of CompactRIO expansion chassis that provide options for deterministic, high—performance, and scalable I/O configurations. Each expansion chassis offers an additional FPGA target.

NI C Series Modular I/O

C Series hardware from National Instruments features more than 50 hot-swappable modules and over 50 third-party modules. C Series I/O modules provide measurement-quality I/O and communication for desktop, portable, remote, industrial, and embedded applications. For a complete list of C Series modules, visit **ni.com/compactrio.**

Signal	Channels	Special Features
Analog Input		
Small signal (±80 mV)	4, 32	16- to 24-bit, 100 to 250 kS/s, differential
Voltage (±10 V)	4, 8, 32	12- to 24-bit, 100 kS/s to 1 MS/s, up to 250 V_{rms} ch-ch to 600 VDC CAT I bank isolation
High voltage (±60 V to 300 V_{rms})	3, 4, 8	12- to 24-bit, 100 to 800 kS/s, 250 V_{rms} to 2300 V_{rms} ch-ch isolation
Thermocouple	4, 16	24-bit, 15 to 100 S/s (J, K, R, S, T, N, E, and B thermocouple types), differential
Thermocouple (high accuracy)	16	Isothermal design for accuracy down to 0.36 °C
RTD	4	24-bit, 100 to 400 S/s, 3- and 4-wire measurements
IEPE and proximity probes	3, 4	24-bit, 51.2 kS/s/ch to 102.4 kS/s/ch, 5 to 30 V input range
Bridge-based sensors (strain gages/load cells)	4, 8	24-bit, 10 to 100 kS/s (±125 mV to ±60 V; ±25 mA; TC; 3- and 4-wire RTD; ¼-, ½-, and full-bridge)
Analog Output		
Voltage (±10 V)	4, 16	16-bit, 25 to 100 kS/s/ch
Current 0 to 20 mA	4	16-bit, 100 kS/s/ch, open-loop detection
Digital Input		
Bidirectional 5 V TTL	8	50 ns, 5 V TTL, ultrahigh-speed, bidirectional, 30 V protection
24 V sinking	8, 32	100 to 7 µs, up to 60 V protection
250 AC/DC universal	4	3 ms, ±5 to 250 VDC, 10 to 250 VAC, universal, sink/source
Differential or TTL	6	500 ns, ±5 to 24 V, single-ended TTL or differential, regulated 5 V supply output
Digital Output		
Bidirectional 5 V TTL	8	100 ns, 5 V TTL, ultrahigh-speed, bidirectional, 30 V protection
24 V sourcing	8, 32	1 to 500 µs, 750 mA/ch max to 1 A/ch max, short-circuit-proof
24 V sinking	32	8 µs, 5 to 60 V, sinking, isolation, up to 20 A per module
Relay Output		
Form A (SPST)	4	1 s, 30 VDC (2 A), 60 VDC (1 A), 250 VAC (2 A) electromechanical Form A (SPST)
Solid-state relay	8	60 VDC, SSR Form A, up to 750 mA/ch, 5 ms set and reset time, ch-ch isolation
Counter, Pulse Generation		
Counter/timer (24 V)	8, 32	1 µs, 7 µs, 30 to 60 V, single-ended and differential
Counter/timer (TTL)	6, 8	100 to 500 ns, ±5 to 24 V, single-ended and differential
Quadrature encoder (differential)	2	500 ns, ±5 to 24 V, six digital inputs for two encoders (phase A, phase B, and index inputs)
PWM/pulse generation (24 V, TTL)	8, 32	1 to 500 µs, 5 to 60 V output, short-circuit-proof
Serial Interface		
RS232, RS485	4	—
Removable Storage		
Secure digital module	2	2-slot, up to 4 GB added storage, read/write at 2 MB/s
Motion		
H-bridge	1	5 A continuous current at 40 °C (1 A at 70 °C, built-in encoder interface and current sensor)
Drive interface	1	Stepper and servo drive signals, incremental encoder feedback, motion I/O
Controller Area Network (CAN)		
High-speed CAN, low-speed CAN	2	125 kbit/s to 1 Mbit/s transfer rate, ISO 11519 compliance

Customize CompactRIO and NI Single-Board RIO

The CompactRIO Module Development Kit and RIO Mezzanine Card (RMC) connector offers the option to customize CompactRIO and NI Single-Board RIO hardware to meet your specifications. Use these resources to help you develop custom C Series modules for CompactRIO and mate custom RMCs to NI Single-Board RIO. Visit **ni.com/compact/mdk** and **ni.com/rmc** for more information.

NI Global Services and Support

Professional Services

The NI professional services team, comprising NI engineers and worldwide National Instruments Alliance Partners, can help you with prototyping, feasibility analysis, consulting, and systems integration. Visit **ni.com/services** for more information.

Software Maintenance and Support

Visit **ni.com/ssp** to learn how, as a National Instruments Standard Service Program (SSP) member, you can receive free software upgrades and maintenance releases, direct mail and phone support from NI applications engineers, and access to exclusive software training modules.

Hardware Services

Make the most of your hardware investment by using NI hardware services including flexible and renewable extended warranties, time-critical repair services, and hardware recalibration options. Visit **ni.com/services** for more information.

Training and Certification

The NI training and certification program is the most effective way to increase application development proficiency and productivity using NI software and hardware. Visit **ni.com/training** for more information.

NI Volume Licensing

Designed for organizations with five or more licenses of the same software program, the NI Volume License Program features services such as centralized license management, flexible budget purchasing, customized on-site training, and more. Visit **ni.com/vlp** for more information.

Technical Support

NI provides superior worldwide technical resources. Visit **ni.com/support** and **ni.com/zone** to access volumes of self-help technical information including

- Application tips and case studies
- Example programs and frequently asked questions
- Troubleshooting wizards, user forums, and developer communities

For those who have software maintenance memberships or volume license agreements, qualified NI applications engineers are available for technical support directly via email or phone.

U.S. Corporate Headquarters
11500 N Mopac Expwy Austin, TX 78759-3504
T: 512 683 0100 F: 512 683 9300 info@ni.com

International Branch Offices—**ni.com/global**