PRODUCT FLYER

CompactRIO System on Module

CONTENTS

NATIONAL INSTRUMENTS

CompactRIO System on Module

NI sbRIO-9651
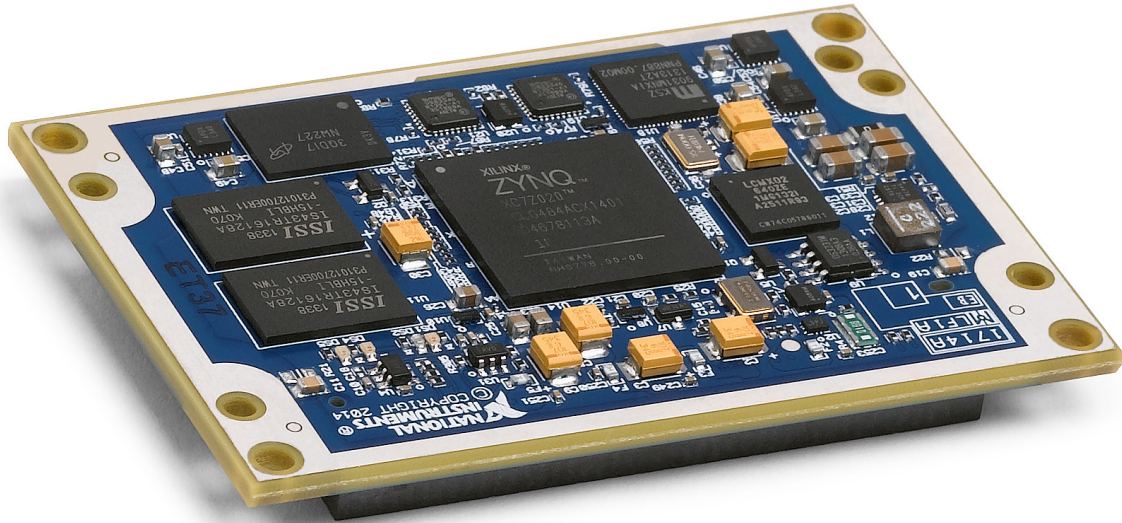
- Integrated and fully validated middleware solution reduces design time and risk

- Industrial-grade Zynq-7020 All Programmable SoC with 220 DSP blocks

- Rugged design for long-term deployment in harsh, high temperature, high EMC environments

- Backed by NI's 15-year hardware product lifecycle

- Deployment-ready Linux Real-Time OS with large set of validated drivers

- Development kit features a reference carrier board and design files for reuse

- Graphical development platform eliminates the need for HDL expertise to leverage reconfigurable hardware

Built for Accelerated Custom Embedded Design

The CompactRIO System on Module (SOM), based on the Xilinx Zynq All Programmable SoC, combines a fully tested and validated hardware design with a complete middleware solution and NI Linux Real-Time OS.

Unlike other SOMs, which offer limited deployment-ready software, the NI SOM integrates a validated board support package (BSP) and device drivers with the NI Linux Real-Time OS. As an alternative to hardware description languages (HDLs), LabVIEW system design software provides a graphical development environment with thousands of functions and IP blocks for both processor and FPGA logic development.

By leveraging a pre-validated hardware and software platform, you can focus your efforts on your core IP and minimize development time and risk for any embedded control or monitoring application.

sbRIO-9651 Specifications	
Processor SoC	Xilinx Zynq-7020
	667 MHz Dual-Core ARM Cortex-A9
	Artix-7 FPGA Fabric
Size	50.8 mm x 78.2 mm (2 in. x 3 in.)
Power	Typical: 3W to 5 W | Max: 10W
Dedicated Processor I/O	Gigabit Ethernet, USB 2.0 Host, USB 2.0 Host/Device, SDHC, RS232 TX/RX
Memory	Nonvolatile: 512 MB
	DRAM: 512 MB
Operating Temperature	-40 ˚C to 85 ˚C Local Ambient

FPGA I/O	160 Digital I/O Channels
	    16 Single-Ended 3.3V
	    144 Single-Ended / 72 Differential (3 banks with user-supplied voltage)

	Configurable Peripherals: Gigabit Ethernet, RS232 x3, RS485 x2, CAN x2

Detailed View of sbRIO-9651

Dedicated Processor I/O
- Gigabit Ethernet
- USB Host
- USB Host/Device
- SDHC
- Serial TX/RX (console out)

FPGA I/O
- 16 SE fixed at 3.3V
- 144 SE/72 diff pairs with IO level selection
  - 3 Banks with user supplied voltage
- Configurable Peripherals: Gigabit Ethernet, RS232 x3, RS485 x2, CAN x2

NATIONAL INSTRUMENTS
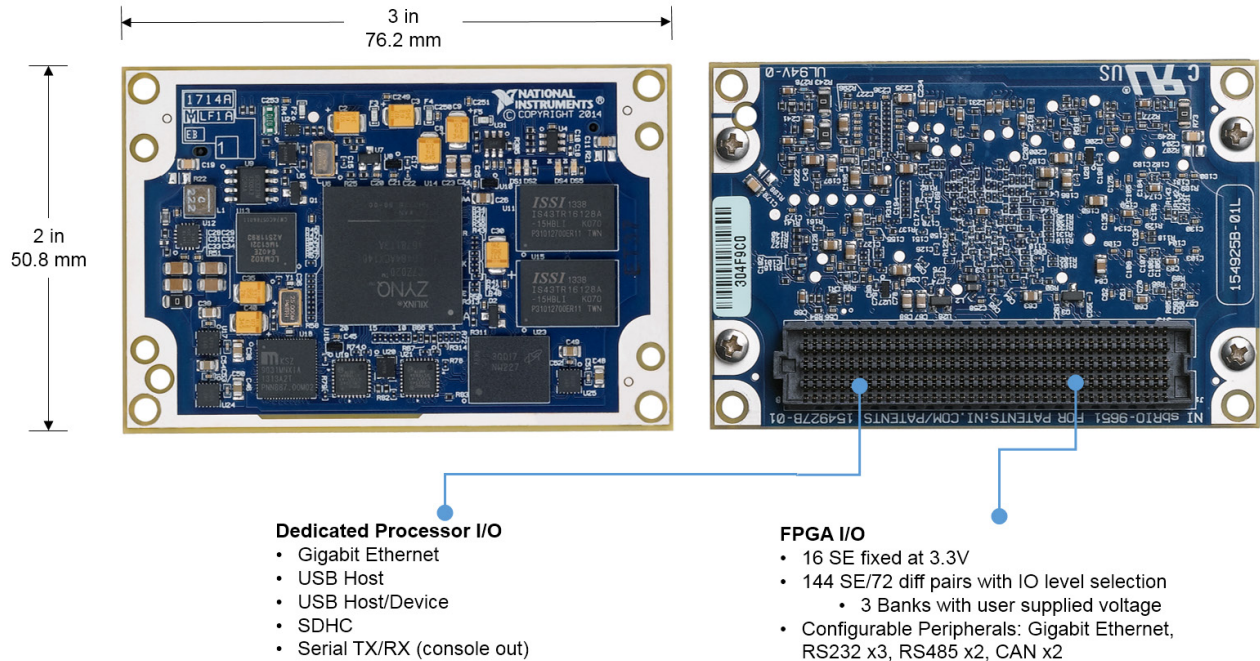
Key Features

Integrated and Validated Middleware Solution

The CompactRIO SOM is shipped with a complete and validated middleware solution, including NI Linux Real-Time, drivers, and support for multiple programming languages. The complete solution provides out-of-the-box support for peripherals such as USB or Ethernet, the communication interface between the processor and FPGA, and drivers to the onboard and C Series module I/O. The complete integrated software solution reduces the time and risk of a new project, and gives your team the ability to focus on the application development.
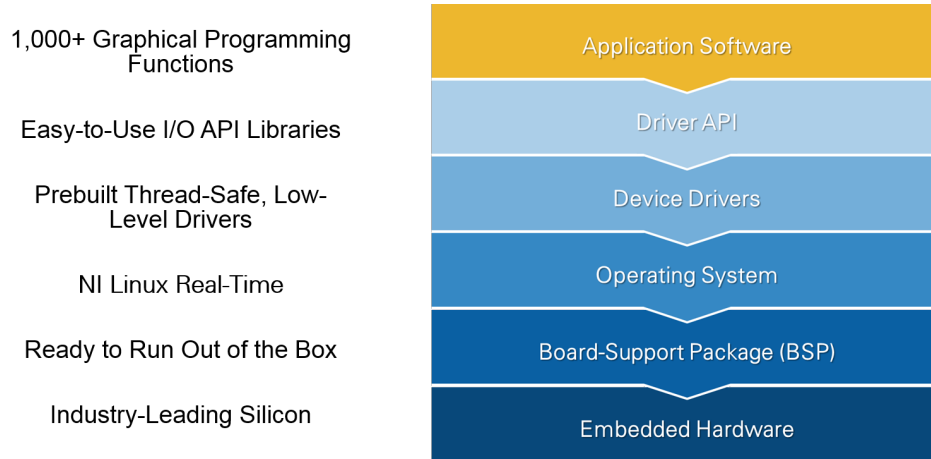
1,000+ Graphical Programming Functions	Application Software
Easy-to-Use I/O API Libraries	Driver API
Prebuilt Thread-Safe, Low-Level Drivers	Device Drivers
NI Linux Real-Time	Operating System
Ready to Run Out of the Box	Board-Support Package (BSP)
Industry-Leading Silicon	Embedded Hardware

Figure 1. Complete Deployment-Ready Software Stack

Heterogeneous Architecture

The CompactRIO SOM features an All-Programmable System on Chip (SoC) that contains two processing units: (1) a real-time processor for communication and signal processing and (2) an FPGA for implementing high-speed control and custom timing and triggering directly in hardware.
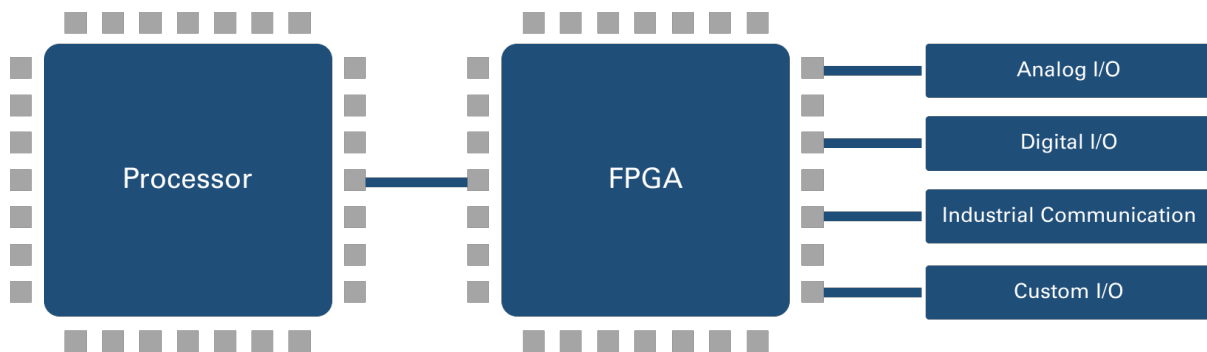

Figure 2. Use the heterogeneous architecture of CompactRIO to meet your processing needs.

Processor
The Zynq-7020 contains a 66 MHz dual-core ARM Cortex-A9 processor for high performance with lower power consumption.

FPGA
The Artix-7 FPGA fabric (Zynq-7000 SoC) contains 85,000 logic cells and 220 DSP slices. With FPGA technology, you can implement more advanced control, signal processing, filtering, advanced timing, and other logic than ever before.

Integrated Software

Define—and redefine—the functionality of your CompactRIO system with intuitive software, and use a single toolchain for every phase of your design cycle: from modeling and simulation, to prototyping and validation, to deployment and beyond. NI software reduces risk, enhances productivity, and eliminates the need to create and maintain I/O drivers, OSs, and other middleware.
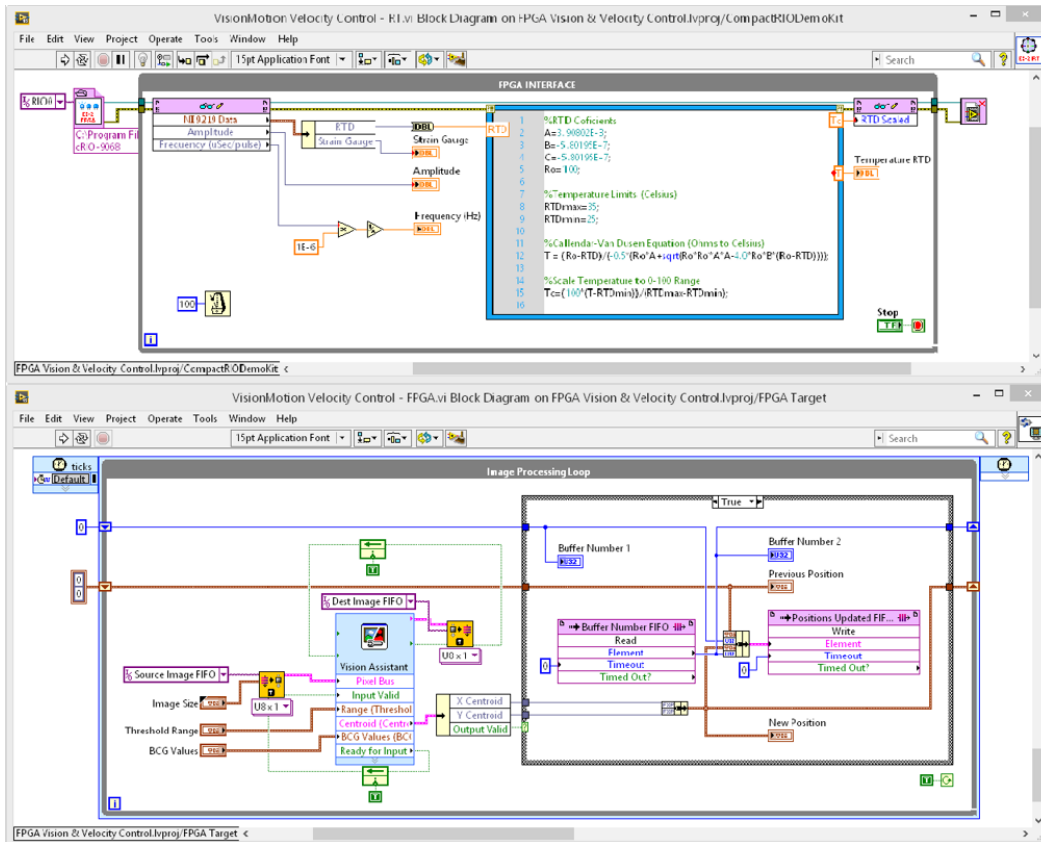

Figure 3. Intuitive and Cohesive Software Programming Environment

Reduced Development Time
Focus on solving problems, not low-level programming tasks, with built-in constructs to manage timing and memory in an intuitive programming environment

Open Software Interoperability
Leverage other programming approaches alongside or within LabVIEW to reuse existing IP and take advantage of existing expertise.

Built-In Libraries
LabVIEW contains over 950 built-in signal processing, analysis, control, and mathematics functions to accelerate the development of embedded control and monitoring systems.

User-Programmable FPGA
Implement high-speed signal and image processing, custom timing and triggering, and control algorithms directly in hardware to maximize reliability and determinism.

Remote System Management
Transfer data between systems or remotely update hundreds of controllers at once with built-in system management utilities.

LabVIEW Tools Network
Extend the capabilities of your system with a vast ecosystem of certified, application-specific add-ons.

Leverage the Openness of NI Linux Real-Time: A Prebuilt, Validated RTOS

Development Tool Options
Program the real-time processor with LabVIEW, C/C++, or textural math and reuse code from past projects to save development time.

Linux Ecosystem
Access thousands of open-source applications, IP, and examples and collaborate with an active community of users and developers.

Security
Boost security and reliability with native support for Security-Enhanced Linux, which delivers mandatory access control through custom policy creation.
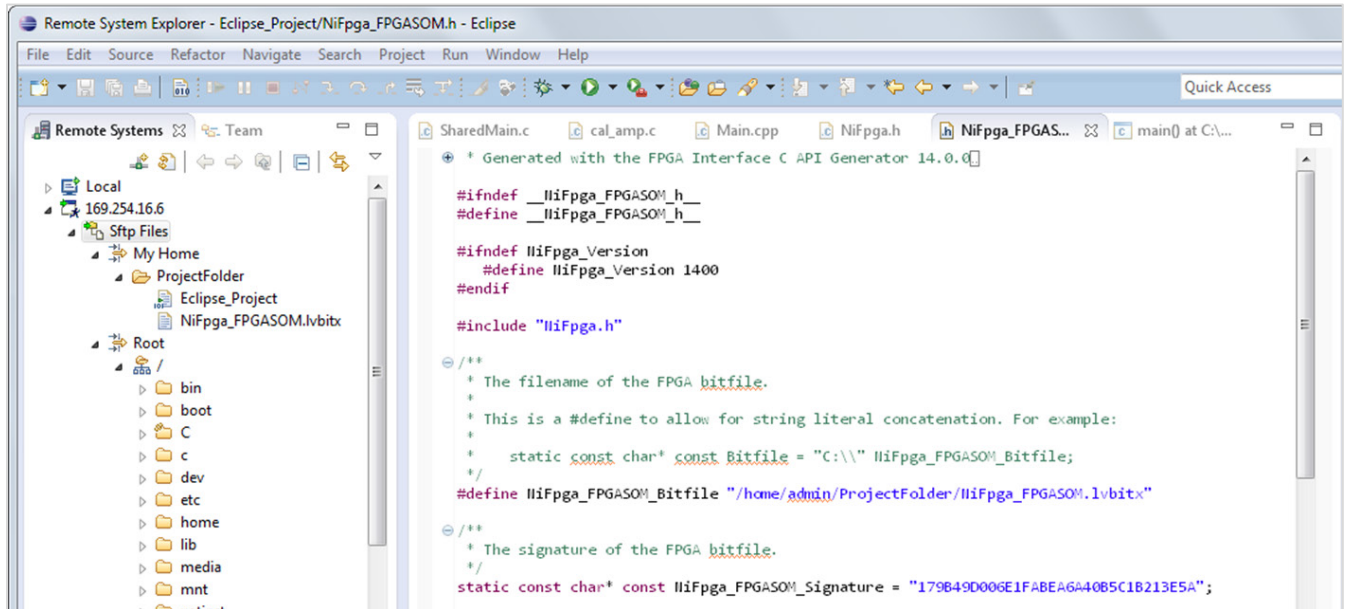

Figure 4. NI Linux Real-Time targets allow you to develop, deploy, and debug C/C++ code using Eclipse or your IDE of choice

Customize Programmable Hardware With LabVIEW FPGA

Take advantage of the graphical LabVIEW environment to program the onboard FPGA and unlock the incredible power of these devices—even without any knowledge of HDLs like VHDL or Verilog. The LabVIEW FPGA Module not only removes the requirement for HDL programming, but also eliminates the need to think through timing constraints, I/O configuration, and place and route settings, which are notoriously complex tasks.

- Built-in language constructs to manage clocks/timing, memory, I/O, and data transfer (DMA)

- Cycle-accurate simulation and debugging capabilities

- Cloud compile support to reduce compile times

- Support for HDL code integration

- Access to free IP for complex mathematics, high-speed control, image processing, signal analysis, and more in the FPGA IPNet community

Deployment-Ready Hardware

Modern, high-end embedded design is challenging. When you consider high clock-rate CPUs, FPGAs, complex DRAM interfacing, and high-density chips with high-speed analog and digital I/O, getting a product out the door that is certified for real-world, harsh industrial environments becomes more complicated.

NI embraces a demanding approach to how it designs, develops, validates, qualifies and certifies its products. By leveraging and re-using NI products, customers increase their efficiency while reducing costs, time, and risk and retain the capability to customize and innovate to differentiate themselves in the marketplace.

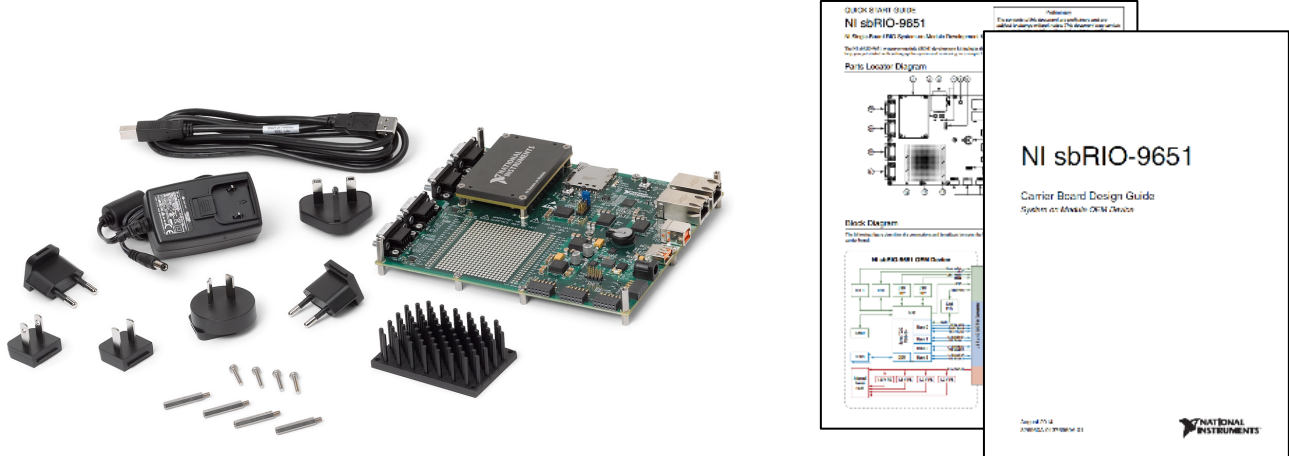*Table 1. Best-in-Class Quality for Industrial Embedded Applications*

Certifications
KCC: Korean EMC Certification
UL: North American Product Safety Certification
RoHS: Restriction of the Use of Certain Hazardous Substances

Standards		
Safety Standards		
North America UL 61010-1 and CSA-C22.2 No. 61010-1	**Europe** EN 61010-1	**International** IEC 61010-1
EMC Standards		
North America FCC Part15-Class A and ICES-001	**Europe** EN 61326-1	**Australia/New Zealand** AS/NZS CISPR 11

NI uses industry standards to validate, qualify, and certify its products. Its New Product Introduction process is certified for the ISO 9001 and ISO 14001 standards, and its CompactRIO Single-Board Controllers are certified as shown in Table 1.

In addition, all NI board-level controllers undergo the same test procedures as NI's packaged controllers for shock and vibration, temperature, EMC, safety, and hazardous locations. Many of these certifications require an appropriate enclosure to obtain, but CompactRIO Single-Board Controllers have been tested to comply with these standards. Therefore, when you integrate CompactRIO Single-Board Controllers appropriately in your design, you can be confident that your end product is certifiable.

NATIONAL INSTRUMENTS

Development Kit Contents

Because the CompactRIO SOM requires custom hardware design, NI offers a development kit to help you accelerate your design cycle. This kit includes a reference carrier board, accessories, and over 70 pages of extensive documentation including reference board schematics as well as mechanical design documentation.


Bundle	What's Included?	

sbRIO-9651 SOM Development Kit	sbRIO-9651 SOM
	Reference Carrier Board
	    Includes PMODs: 3-Axis MEMs
	    Accelerometer, 16-Bit ADC, 12-Bit DAC
	Power Supply (12 V)
	Heat Spreader
		Heat Sink
		Standoffs
		USB Cable
		Design Documentation and Schematics
		    Includes BOM, Gerber Files, PDF
		    Schematics

sbRIO-9651 SOM OEM Kit	sbRIO-9651 SOM Heat Spreader	

Reference Carrier Board

The reference carrier board allows you to power on, configure, and begin application software development. It exposes all the available peripherals and provides the design files to integrate them in your own custom carrier board design.

The reference carrier board also features a digital prototyping area to communicate with specific chip sets as well as four PMOD connectors to help accelerate your I/O selection and integration in LabVIEW.

Reference Carrier Board

PMODs
3-axis MEMs accelerometer

16-bit ADC

12-bit DAC
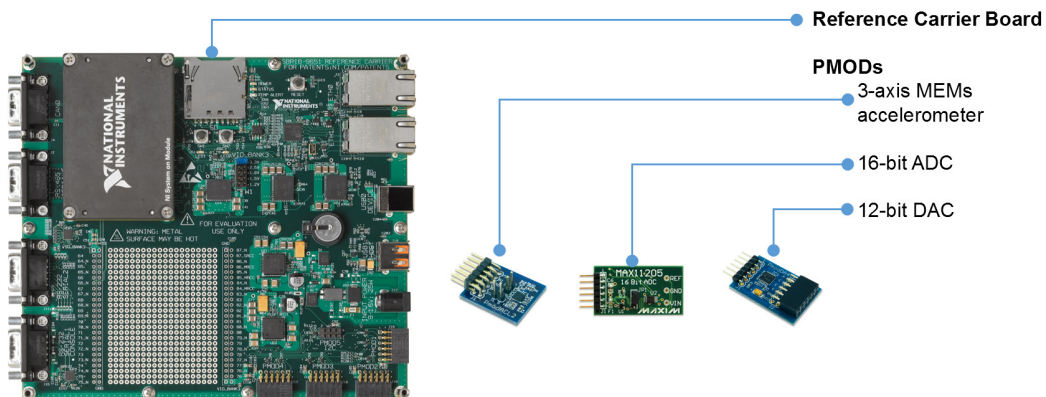
Platform-Based Approach to Control and Monitoring

What Is the CompactRIO Platform?

Every CompactRIO device is built on three pillars: productive software, reconfigurable hardware, and an expansive ecosystem. This results in a hardware platform that allows your business to standardize, customize, and accelerate productivity.

NI's integrated run-time software, development environments, IP libraries, drivers, middleware, and enterprise and systems management tools, along with high-quality hardware and global services and support, provide the capabilities to meet your business needs.

Software
Take advantage of NI Linux Real-Time using LabVIEW or C/C++. Simplify FPGA programming using LabVIEW FPGA.

Modules
Over 200+ IO types supported by the CompactRIO family.

Form Factor
Choose between packaged and board-level controllers

Integration
Supports expansion I/O, vision, motion, industrial communication protocols, and HMIs

Monetize Your Efforts

Focus on the core expertise of your business while leaving the foundational elements of your embedded design to NI. Spend time delivering innovation, competitive differentiation, and value add features to your customers by customizing a pre-built, pre-validated embedded system from NI. Get your equipment or machines shipping faster, with less engineering expense and risk, and more features.

DETERMINISTIC CONTROL
Real-Time LINUX

USER PROGRAMMABLE FPGA

ANY SENSOR, ANY BUS

RUGGED ENVIRONMENTS
up to
50g shock
5g vibration

NATIONAL INSTRUMENTS

Hardware Services

All NI hardware includes a one-year warranty for basic repair coverage, and calibration in adherence to NI specifications prior to shipment. PXI systems also include basic assembly and a functional test. NI offers additional entitlements to improve uptime and lower maintenance costs with service programs for hardware. Learn more at ni.com/services/hardware.

	Standard	Premium	Description
Program Duration	1, 3, or 5 years	1, 3, or 5 years	Length of service program
Extended Repair Coverage	•	•	NI restores your device's functionality and includes firmware updates and factory calibration.
System Configuration, Assembly, and Test[1]	•	•	NI technicians assemble, install software in, and test your system per your custom configuration prior to shipment.
Advanced Replacement[2]		•	NI stocks replacement hardware that can be shipped immediately if a repair is needed.
System Return Material Authorization (RMA)[1]		•	NI accepts the delivery of fully assembled systems when performing repair services.
Calibration Plan (Optional)	Standard	Expedited[3]	NI performs the requested level of calibration at the specified calibration interval for the duration of the service program.

[1]This option is only available for PXI, CompactRIO, and CompactDAQ systems.
[2]This option is not available for all products in all countries. Contact your local NI sales engineer to confirm availability.
[3]Expedited calibration only includes traceable levels.

PremiumPlus Service Program

NI can customize the offerings listed above, or offer additional entitlements such as on-site calibration, custom sparing, and life-cycle services through a PremiumPlus Service Program. Contact your NI sales representative to learn more.

Technical Support

Every NI system includes a 30-day trial for phone and e-mail support from NI engineers, which can be extended through a Software Service Program (SSP) membership. NI has more than 400 support engineers available around the globe to provide local support in more than 30 languages. Additionally, take advantage of NI's award winning online resources and communities.

27 December 2017