

PRODUCT FLYER

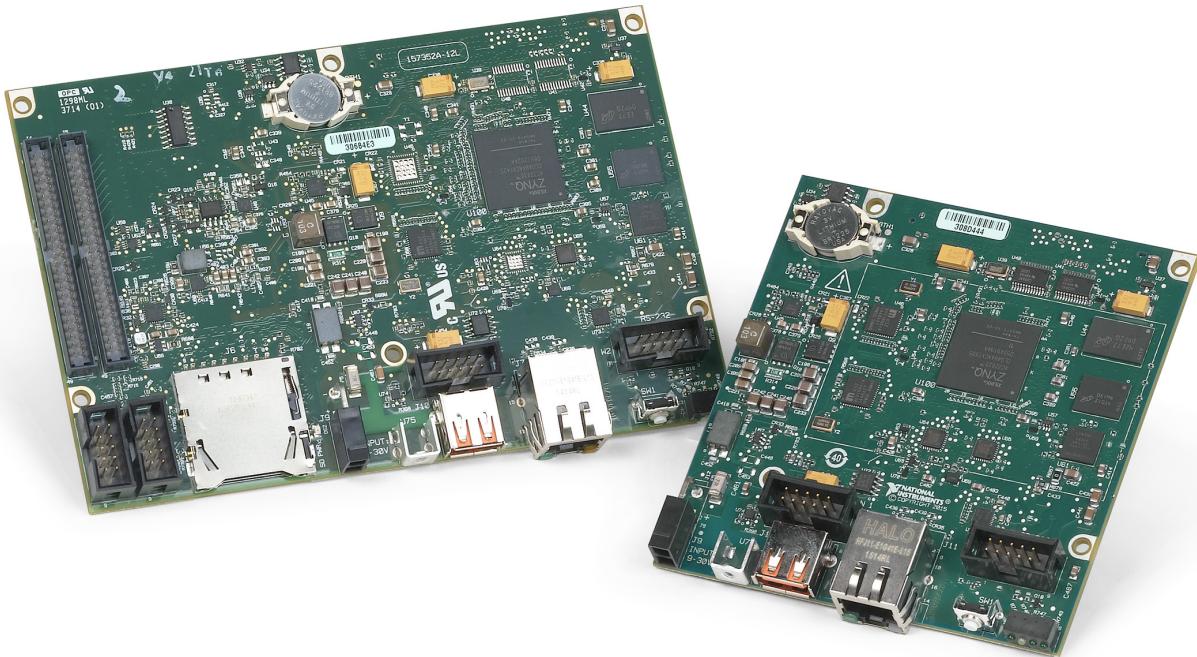
CompactRIO Single-Board Controllers

CONTENTS

- [CompactRIO Single-Board Controllers](#)
- [Detailed View of sbRIO-9627](#)
- [Key Features](#)
- [Integrated Software](#)
- [Deployment-Ready Hardware](#)
- [RIO Mezzanine Card \(RMC\) Connectors](#)
- [Development Kit Contents and Additional Accessories](#)
- [Platform-Based Approach to Control and Monitoring](#)
- [Hardware Services](#)

CompactRIO Single-Board Controllers

sbRIO-9607, sbRIO-9627, and sbRIO-9637



- Single-board computer (SBC) with an integrated and fully validated middleware solution saves design time and risk
- Deployment-ready Linux Real-Time OS with a large set of validated drivers
- 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
- Graphical development platform eliminates the need for HDL expertise to use reconfigurable FPGA hardware

Built for Accelerated Custom Embedded Design

The CompactRIO Single-Board Controller is an embedded control system for rapid commercial development and deployment.

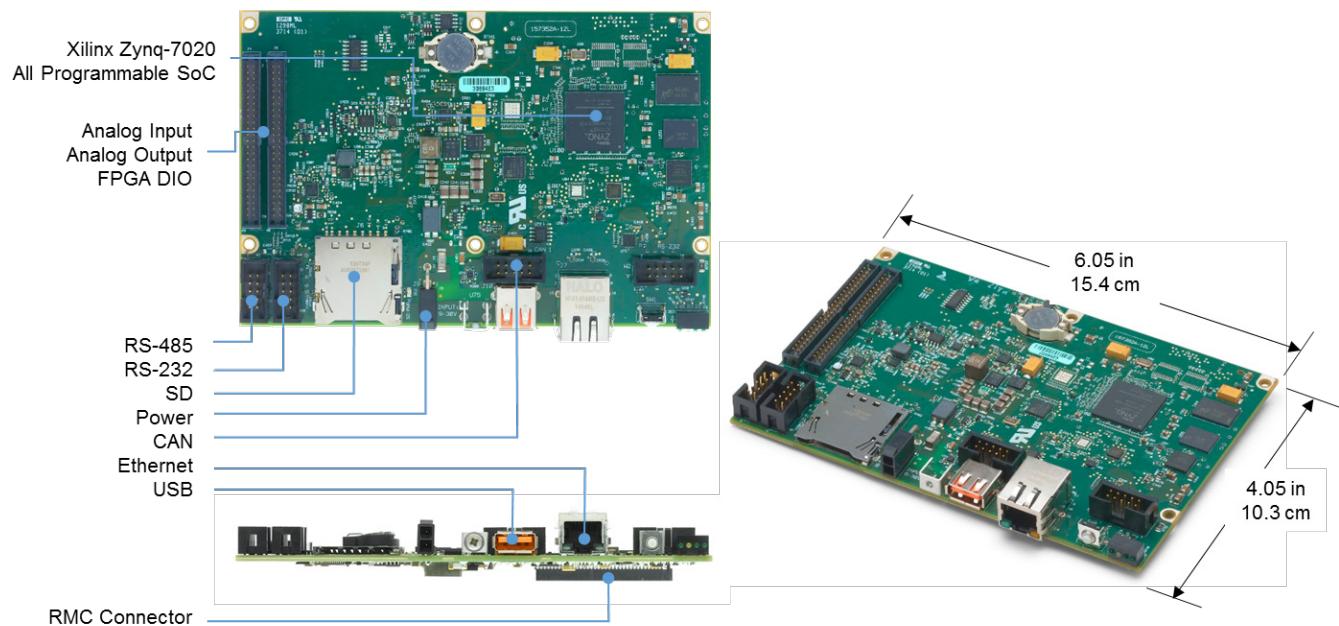
It is designed for high-volume and OEM embedded control and analysis applications that require high performance and reliability. Featuring an open embedded architecture and compact size, this flexible, customizable, commercial off-the-shelf (COTS) hardware device is part of an accelerated custom design platform that can help you get your custom embedded control system to market quickly.

With the CompactRIO platform, you can take advantage of FPGA performance, real-time determinism, and reliability with relatively low nonrecurring engineering compared with custom hardware design.

	sbRIO-9607	sbRIO-9627	sbRIO-9637
Description	Digital I/O	Multifunction I/O	
Processor		667 MHz dual-core ARM Cortex-A9	
RTOS		NI Linux Real-Time	
FPGA		Xilinx Zynq-7000 (Z-7020)	
Temperature		-40 °C to 85 °C local ambient	
Power		9 V- 30 V DC supply range, up to 29 W max	
Ethernet ¹	1/2	1/2	1
RS232 ¹	1/5	2/6	2
RS485 ¹	0/2	1/3	1
CAN ¹	1/2	1/3	1
USB ¹	1/2	1/2	1
SD ¹	0/1	1/2	1
Digital I/O	96	100	28
Analog Input	-	16 ch, 16-bit	16 ch, 16-bit
Analog Output	-	4 ch, 16-bit	4 ch, 16-bit
High-Density Connector	RMC (96 DIO)	RMC (96 DIO)	-

¹Built-in/total equals the built-in onboard ports versus total available ports when using a high-density RMC connector.

Detailed View of sbRIO-9627



Key Features

Integrated and Validated Middleware Solution

CompactRIO Single-Board Controllers are shipped with a complete and validated middleware solution, including the NI Linux Real-Time OS, 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 onboard and modular 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.

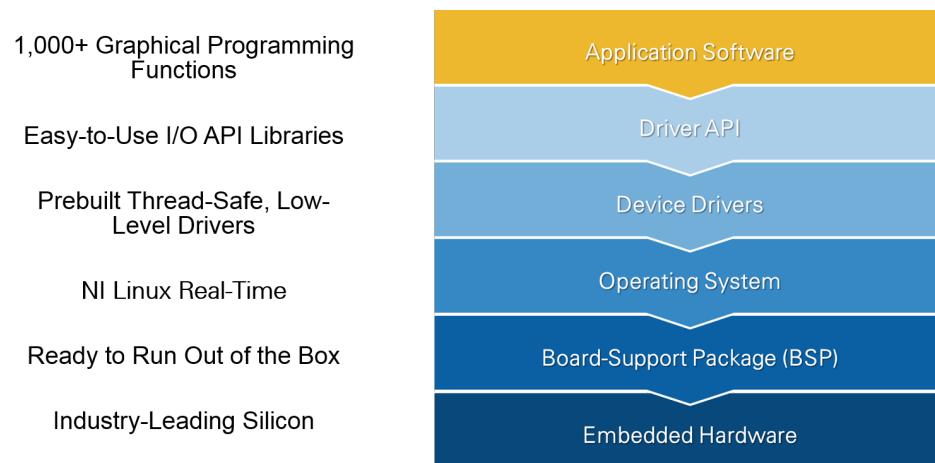


Figure 1. Complete Deployment-Ready Software Stack

Heterogeneous Architecture

CompactRIO Single-Board Controllers feature 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.

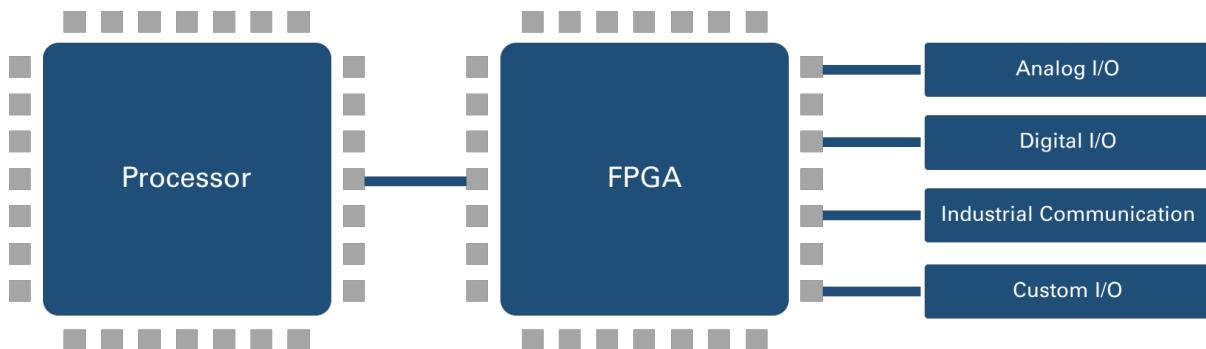


Figure 2. Use the heterogeneous architecture of CompactRIO to meet your processing needs.

Processor

The Zynq-7020 contains a 667 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.

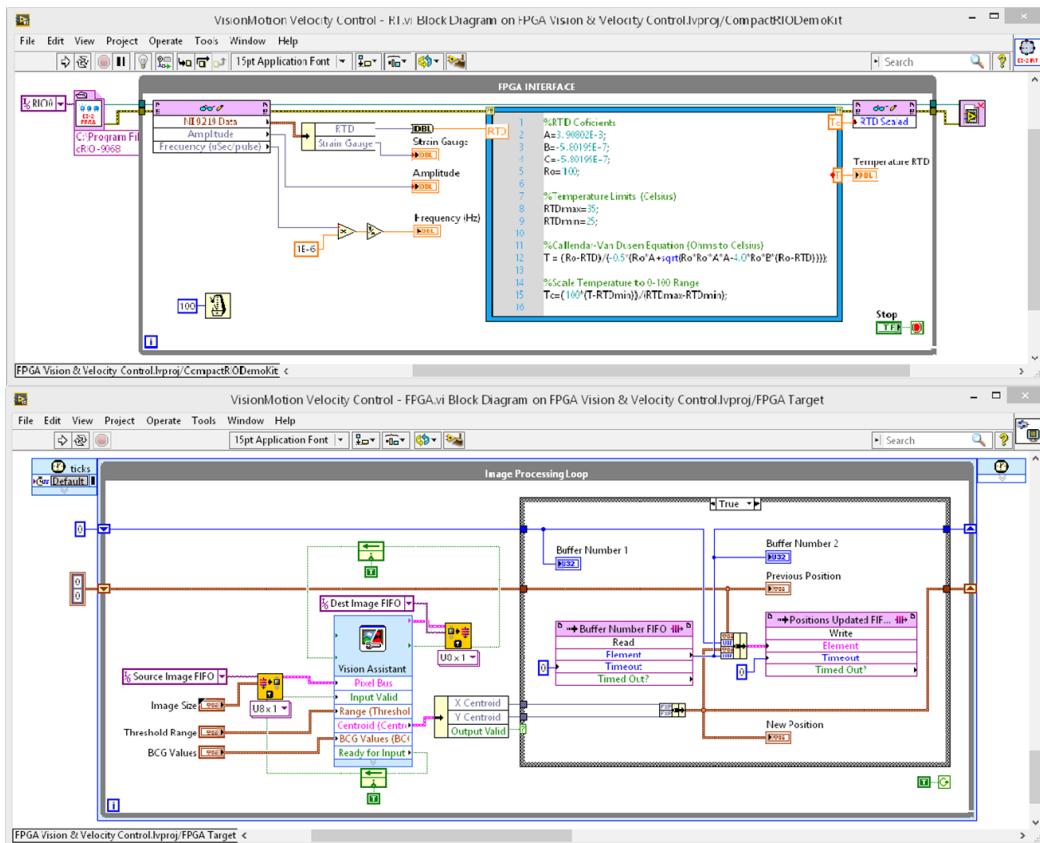


Figure 3. Intuitive and Cohesive Software Programming Environment

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 IP and take advantage of existing expertise.

Built-In Libraries

LabVIEW contains nearly 1,000 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

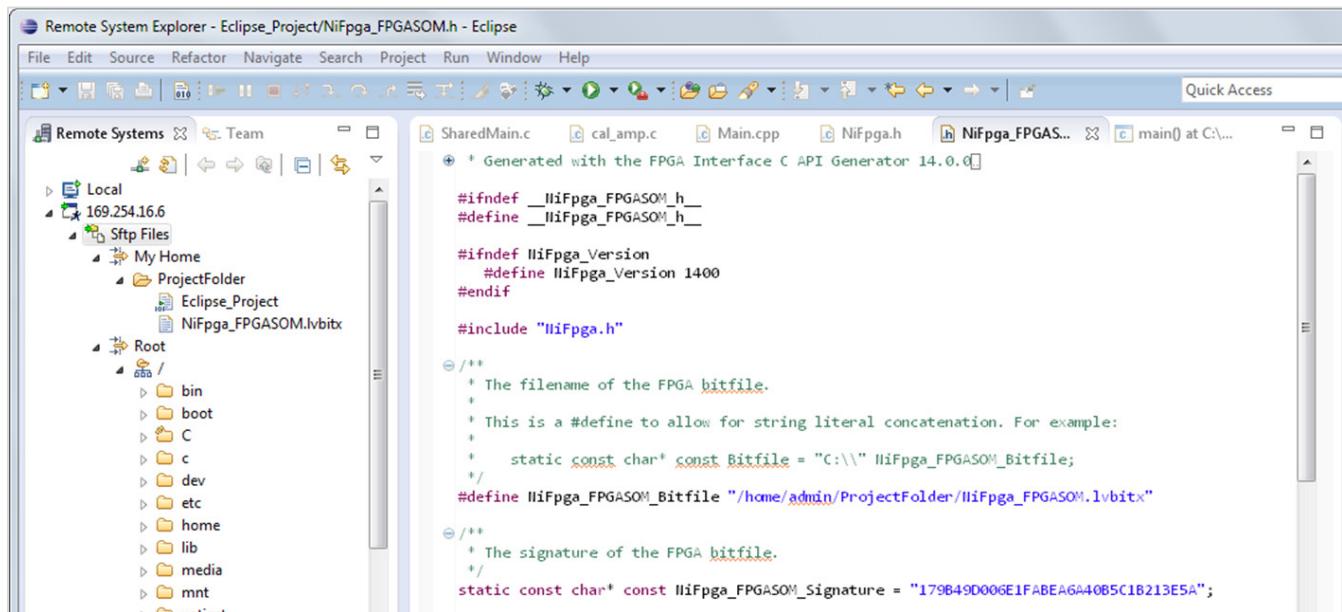
Program the real-time processor with LabVIEW, C/C++, or textual math and reuse code from past projects to save development time.

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.



The screenshot shows the Eclipse IDE interface with the "Remote System Explorer" perspective selected. On the left, the "Remote Systems" view displays a tree structure of a remote host (169.254.16.6) containing "Local", "Sftp Files", and "Root" directories. Under "Sftp Files", there is a "My Home" folder containing a "ProjectFolder" with an "Eclipse_Project" folder and a file named "NiFpga_FPGASOM.lvbitx". On the right, the main editor area shows the source code for "NiFpga_FPGASOM.h". The code includes preprocessor directives to define the header file and its version, and it defines a constant for the bitfile signature.

```
#ifndef __NiFpga_FPGASOM_h__
#define __NiFpga_FPGASOM_h__

#ifndef NiFpga_Version
#define NiFpga_Version 1400
#endif

#include "NiFpga.h"

/** 
 * The filename of the FPGA bitfile.
 *
 * This is a #define to allow for string literal concatenation. For example:
 *
 * static const char* const Bitfile = "C:\\\\NiFpga_FPGASOM_Bitfile";
 */
#define NiFpga_FPGASOM_Bitfile "/home/admin/ProjectFolder/NiFpga_FPGASOM.lvbitx"

/** 
 * The signature of the FPGA bitfile.
 */
static const char* const NiFpga_FPGASOM_Signature = "170B49D006E1FABEA6A40B5C1B213E5A";
```

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 hardware description languages (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.

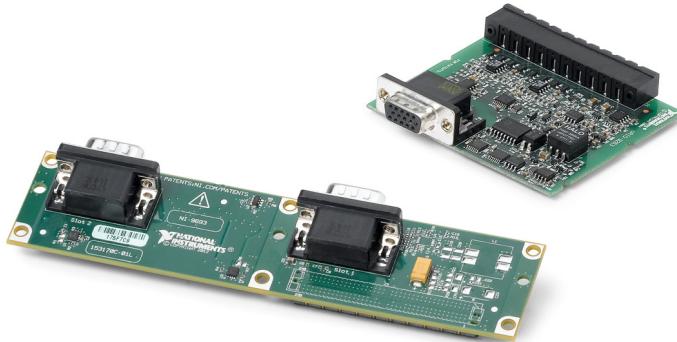
In addition, all NI board-level controllers undergo the same test procedures as NI's [packaged controllers](#) for shock and vibration, temperature, EMC, safety, and hazardous locations. Many of these certifications require an appropriate enclosure to obtain, but CompactRIO Single-Board Controllers have 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.

RIO Mezzanine Card (RMC) Connectors

The RMC connector is a high-density, high-throughput connector that features 96 single-ended DIO lines directly connected to the FPGA.

Board-Only C Series Modules

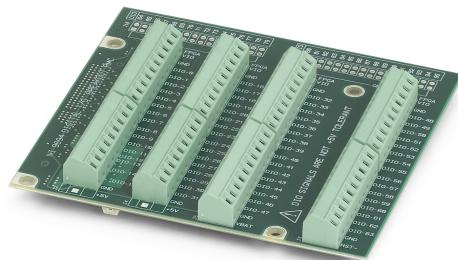
Save time by integrating high-quality off-the-shelf I/O using C Series modules. CompactRIO Single-Board Controllers that feature an RMC connector can integrate up to two C Series modules with the [2-slot C Series RMC](#).



C Series modules provide measurement-specific signal conditioning, bank or channel-to-channel isolation, and support for wide temperature ranges to meet a variety of application and environmental needs. With more than 100 C Series modules available for measurement, control, and communication, you can connect your application to any sensor or bus.

RIO Mezzanine Card

Digital I/O Breakout RMC
NI 9694



The sbRIO-9607 and sbRIO-9627 controllers include a high-density, high-throughput RMC connector that features 96 single-ended digital I/O (DIO) lines directly connected to the FPGA with the ability to add up to two C Series modules and more peripherals.

Analog and Digital I/O RMC
NI 9684, NI 9683



These RMCs come bundled with the sbRIO-9607 as part of the [CompactRIO General Purpose Inverter Controller \(GPIC\)](#), but you can purchase it separately as well.

They contain 16 high-speed simultaneous analog inputs, 8 low-speed analog inputs and outputs, 14 high-speed digital outputs, 32 LVTTL digital I/O channels, and, 28 sinking digital output channels.

Developing Custom RMCs

If the off-the-shelf options do not meet your application requirements, you can develop a custom RMC to integrate your own specific analog I/O, DIO, communication capabilities, and signal conditioning.

See the [RIO Mezzanine Card Design Guide](#) for custom design recommendations.

Development Kit Contents and Additional Accessories

In addition to OEM kits for high volume orders, NI offers development kits, which include cables, power supplies, and other accessories for quicker development.



Single-Board RIO Kit	Contents
sbRIO-9607 Development Kit	sbRIO-9607 Desktop power supply NI 9694 digital I/O breakout RMC Hi-Speed USB host-to-host bridge cable CAN/serial cable for 10-position IDC headers (qty. 2) Power cable kit 9.65 mm standoffs (qty. 4) 4.5 mm standoffs (qty. 4) M3x5 mm screws (qty. 4)
sbRIO-9627 Development Kit	sbRIO-9627 Desktop power supply NI 9694 digital I/O breakout RMC 2mm IDC connector breakout for Single-Board RIO Hi-Speed USB host-to-host bridge cable 50-pin ribbon cable CAN/serial cable for 10-position IDC headers (qty. 4) Power cable kit 9.65 mm standoffs (qty. 4) 4.5 mm standoffs (qty. 6) M3x5 mm screws (qty. 6)
sbRIO-9637 Development Kit	sbRIO-9637 Desktop power supply 2mm IDC connector breakout for Single-Board RIO Hi-Speed USB host-to-host bridge cable 50-pin ribbon cable (qty. 2) CAN/serial cable for 10-position IDC headers (qty. 4) Power cable kit 4.5 mm standoffs (qty. 6) M3x5 mm screws (qty. 6)
sbRIO-96xx OEM Kit	sbRIO-96xx Single-Board RIO Quick Reference Guide

Accessories

Category	PN	Description
Power Supplies	154169-01	Desktop power supply with 2-position plug for sbRIO controllers, 12 V DC, 1.5 A
Cables	152834-01	Power cable for sbRIO controllers, 2-position Mini-Fit JR to pigtail
	153158-10	RS-232/RS-485/CAN cable, 10-position IDC female to 9-position DSUB male
	154041-12	50 pin IDC header ribbon cable, 50-position IDC, 2mm pitch, pull tabs, 12 in.
	140254-02	Hi-Speed USB host-to-host bridge for target discovery and development, 2 m
Standoffs	153166-12	9.65 mm standoff for RIO Mezzanine Cards (qty. 12)
Thermal Kit	153901-02	Thermal kit for sbRIO-9607/27/37, heat spreader, gap pad, standoff (qty. 6), screw (qty. 4)
I/O Breakout	784507-01	Onboard I/O breakout for 50-pos 2 mm IDC header (includes qty. 2, 6 in. 2 mm IDC ribbon cables)

Platform-Based Approach to Control and Monitoring

What Is the CompactRIO Platform?

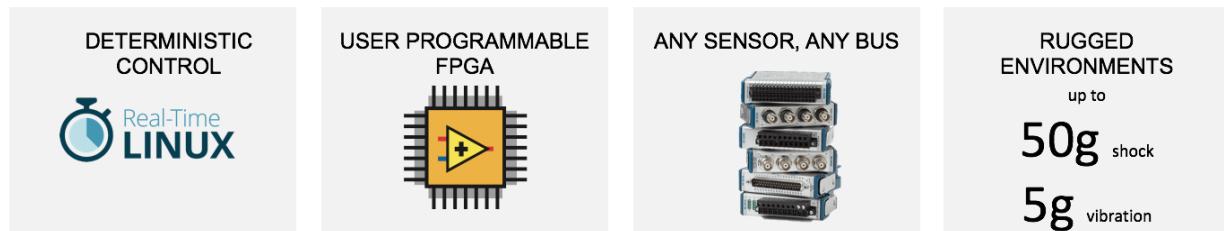
Every CompactRIO device is built on three pillars: productive software, reconfigurable hardware, and an expansive ecosystem. This results in a hardware platform that allows your business to standardize, customize, and accelerate productivity.

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.



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



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.

¹This option is only available for PXI, CompactRIO, and CompactDAQ systems.

²This option is not available for all products in all countries. Contact your local NI sales engineer to confirm availability.

³Expedited 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](#).

©2019 National Instruments. All rights reserved. CompactRIO, LabVIEW, National Instruments, NI, ni.com, and NI CompactDAQ are trademarks of National Instruments. The registered trademark Linux® is used pursuant to a sublicense from LMI, the exclusive licensee of Linus Torvalds, owner of the mark on a worldwide basis. Other product and company names listed are trademarks or trade names of their respective companies. The contents of this Site could contain technical inaccuracies, typographical errors or out-of-date information. Information may be updated or changed at any time, without notice. Visit ni.com/manuals for the latest information.

12 July 2019