# NI MXI-Express RIO—High-Performance Expansion I/O for CompactRIO

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## Overview

An extension of the National Instruments RIO platform, MXI-Express RIO is a 8 or 14-slot FPGA-enabled chassis for NI CompactRIO. As with all NI reconfigurable I/O (RIO) devices, MXI-Express RIO combines a customizable field-programmable gate array (FPGA) and modular I/O with a high-performance processor. It is well suited for hardware-in-the-loop, real-time test, and complex research applications.

MXI-Express RIO differs from the other devices in the NI RIO platform in that it decouples the FPGA and I/O from the processor and allows multiple chassis to communicate to the same controller over a x1 cabled PCI Express connection.

Like the rest of the RIO platform, MXI-Express RIO is powered by NI LabVIEW graphical system design software, which gives you the ability to design, program, and customize all the components in an embedded system from one environment to deliver a configurable integrated solution that rivals the performance and optimization of custom hardware.

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### NI MXI-Express RIO Chassis

**Figure 1.** *MXI-Express RIO chassis combine the advantages of the RIO platform with the speed and power of best-in-class PXI and industrial controllers.*

### Scalable FPGA and I/O Capability for Your Application

Featuring a high-performance Xilinx Virtex-5 FPGA and a PCI Express x1 cabled interface, MXI-Express RIO chassis for NI C Series I/O augment the RIO platform for large applications requiring high channel counts and a variety of signal conditioning and custom processing and control algorithms.

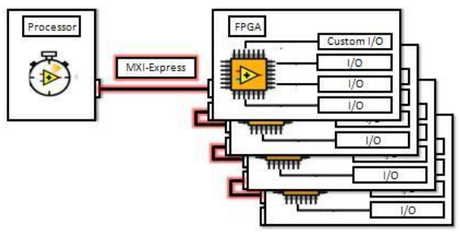


**Figure 2.** *MXI-Express RIO Hardware Architecture*

The three MXI-Express RIO chassis are differentiated only by FPGA capability and number of C Series I/O slots as shown in Table 1. High-performance FPGAs give you the capacity to implement custom measurement, logic, and control hardware circuitry for the high channel counts possible with MXI-Express RIO hardware.

| Chassis | Slots | FPGA | Flip-Flops | 6-Input LUTs | DSP48 Slices | Embedded Block RAM (kbits) |
|---|---|---|---|---|---|---|
| NI 9154 | 8 | Virtex-5 LX50 | 28,800 | 28,800 | 48 | 1,728 |
| NI 9155 | 8 | Virtex-5 LX85 | 51,840 | 51,840 | 48 | 3,456 |
| NI 9157 | 14 | Virtex-5 LX85 | 51,840 | 51,840 | 48 | 3,456 |
| NI 9159 | 14 | Virtex-5 LX110 | 69,120 | 69,120 | 64 | 4,608 |

**Table 1.** *NI MXI-Express RIO Chassis Varieties*

The ability to daisy chain MXI-Express RIO systems provides a streamlined solution for expansion I/O for hundreds or even thousands of signal-conditioned measurements. Currently, there are more than 100 NI and third-party C Series modules for different measurements including thermocouple, voltage, resistance temperature detector (RTD), current, resistance, strain, digital (TTL and other), accelerometers, and microphones. Channel counts on the individual modules range from three to 32 channels to accommodate a wide range of system requirements.

**Figure 3.** *MXI-Express RIO chassis are compatible with the more than 100 NI and third-party C Series modules to meet your specific I/O needs.*

## Designed for Demanding Applications

MXI-Express is an interface based on a cabled PCI Express standard. MXI-Express RIO chassis have a x1 cabled PCI Express interface with 250 MB/s theoretical bandwidth from up to six daisy chained chassis.

This expandable I/O capability in a rugged form factor with a clean high-speed cabled interface makes MXI-Express RIO systems an effective solution for demanding applications such as hardware-in-the-loop testing, industrial machine monitoring, and complex control system research.

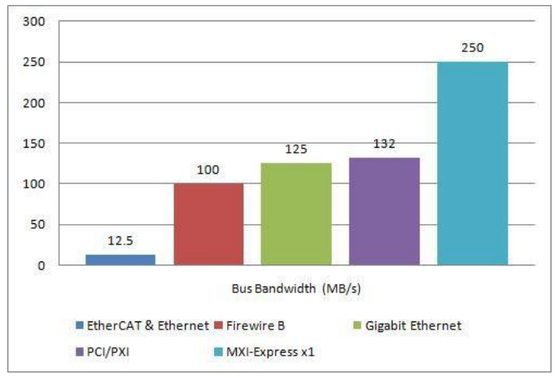


**Figure 4.** *Bus Speed Comparison*

## System Configuration

While you can program MXI-Express RIO chassis to operate independently of a controller, they are usually connected to a MXI-Express compatible controller for processing, data-logging, and communication purposes. You can pair a MXI-Express RIO chassis with real-time or Windows OS controllers with a built-in MXI-Express controller, or with compatible PC and laptop computers, using a MXI-Express interface.

**Figure 5.** *A MXI-Express RIO Chassis Paired with the NI 3110 Dual-Core Industrial Controller*

Pair a MXI-Express RIO chassis with multicore CompactRIO for a rugged system that meets extended temperature, shock, and vibration standards. Choose a PXI controller, such as the NI PXIe-8115, for high-processor performance and integration with PXI modular instruments. Or connect MXI-Express RIO chassis to an ExpressCard and a PC or laptop for a portable custom solution.

**Note:** If you are using a third-party controller, it must adhere to the clock specifications for the cabled PCI Express standard to ensure compatibility with the MXI-Express RIO chassis.

## Learn More

MXI-Express RIO products