

# CompactRIO and LabVIEW Development Fundamentals Course

## Overview

The CompactRIO and LabVIEW Development Fundamentals course teaches you to develop deterministic control and monitoring systems with LabVIEW software and National Instruments Compact RIO hardware. During this course, you learn about the three fundamental components of a CompactRIO application:

- A host program to interact with a user
- A Real-Time program to perform processing and communication
- A Field Programmable Gate Array (FPGA) program to perform deterministic I/O and control functions.

This course teaches you how to set up and configure the hardware and software for your system and then demonstrates fundamental programming techniques and best practices for each of the three components of a system. After completing the course, one can quickly develop and maintain highly-dependable, deterministic applications for CompactRIO targets.

## Duration

Three (3) Days

## Audience

- Users planning to program CompactRIO hardware using LabVIEW Real Time
- Users and technical managers evaluating CompactRIO

## Prerequisites

- LabVIEW Basics I and II or equivalent experience

## NI Products Used During the Course

- LabVIEW Professional Development System
- CompactRIO hardware

## After attending this course, you will be able to:

- Develop a fully functioning CompactRIO application in LabVIEW
- Properly allocate different types of processing to the most appropriate target

## Registration

Register online at [ni.com/training](http://ni.com/training) or call (800)433-3488 Fax: (512)683-9300 [info@ni.com](mailto:info@ni.com)

Outside North America, contact your local NI Office. Worldwide Contact Info: [ni.com/global](http://ni.com/global)

## Part Number

910768-xx  
-01 NI Corporate or Branch  
-11Regional  
-21 Onsite (at your facility)

## Suggested Next Course

LabVIEW Intermediate I: Successful Programming Practice

# CompactRIO and LabVIEW Development Fundamentals Course Outline

## Day 1

### Introduction

The lesson looks at what the CompactRIO hardware is and how the components work together. Topics include:

- Application architecture
- Components of the CompactRIO system
- R Series Expansion system
- Star-Fabric High-Speed PCI Interface system
- Accessories and modules
- Operation

### Configuring CompactRIO

Setup the CompactRIO target in Measurement and Automation Explorer and prepare the target for use in the LabVIEW development environment. Topics include:

- Detect the remote target
- Configure network settings
- View devices and interfaces
- Add and remove software

### Implementing Application Architecture

Create a LabVIEW Project for CompactRIO development and detect all hardware components to be used in the final application. Topics include:

- Create a LabVIEW project
- Add the CompactRIO target

### CompactRIO Scan Mode

Learn to communicate with I/O modules without having to develop FPGA code. In this lesson, you learn how to test module functionality and create a VI to read data directly from the module. Topics include:

- Using CompactRIO Scan Mode
- NI Distributed System Manager
- Programming with CompactRIO Scan Mode

## Day 2

### FPGA

Learn how to use the FPGA to create LabVIEW applications including a look at the limitations and advantages of the parallel nature of the FPGA application. In this lesson you will create an FPGA VI and compile the application so that it can be used by the FPGA hardware. Topics include:

- Fixed-Point math
- Defining FPGA logic with LabVIEW
- Developing the FPGA VI
- Testing with the development machine
- Interactive Front Panel Communication
- Wiring the modules
- Compiling the FPGA VI
- Downloading the application to flash memory
- Using LabVIEW FPGA with CompactRIO Scan Mode

### Real-Time Controller

Use the Real-Time controller to communicate with and enhance FPGA VI output by taking advantage of the Real-Time controller's more powerful processor. Topics include:

- Deterministic operating systems
- Timing methods
- Developing an RT Host VI
- Rebooting the CompactRIO RT controller
- Reusing code in multiple targets

### Windows PC Host

Use the host PC to communicate with VIs running on the target by passing data across the local network using shared variables. Topics include:

- Network-shared variable communications

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## Day 3

### Data Transfer and Synchronization

Use data transfer techniques to create a complete application. In this lesson you will create an application that continuously acquires and analyzes data and controls a system using the data transfer methods learned in the course. Topics include:

- Avoiding race conditions
- Buffering data transfers and synchronization techniques
- FPGA FIFOs
- Handshaking methods
- Interrupt requests for communication
- Direct Memory Access
- Hardware-timed data acquisition
- PID control overview

### FPGA Optimization

Learn techniques to reduce the size of your code on the FPGA and to increase application speed. In this lesson you take an application that is too large to compile and turn it into an efficient application. Topics include:

- Optimization techniques
- Benchmarking FPGA VIs
- Basic optimization techniques
- Architecture optimizations
- Advanced optimizations