

# 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. A well-designed application for a CompactRIO target consists of three fundamental components:

- 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
- Series Expansion system
- High-Speed PCI Interface system
- Accessories and modules

### 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/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

### 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:

- Defining FPGA Logic with LabVIEW
- FPGA VI Development Process
- Developing the FPGA VI
- Modular Code
- Testing with the Emulator
- Interactive Front Panel Communication
- Wiring the Modules
- Compiling the FPGA VI
- Downloading the application to Flash Memory

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## Day 2

### FPGA Optimization

This lesson looks at the techniques that make code take up less space on the FPGA and run more quickly. In this lesson you will take an application that is too large to compile and turn it into an efficient and effectively running application. Topics include:

- Optimization Techniques
- Benchmarking FPGA VIs
- Basic Optimization Techniques
- Architecture Optimizations
- Advanced Optimizations

### 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
- Converting binary representations

### Windows PC Host

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

- Network-Shared Variable Communications

## Day 3

### Data Transfer and Synchronization

Use data transfer techniques to create a complete application. In this lesson you will create a full application that continuously acquires, analyzes 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
- Accelerometer Data
- Fan Speed PID Control