

## Lab Exercise 01 Introduction

The objectives of this lab exercise are for students:

1. to organize into groups,
2. to be introduced to myRIO boards,
3. to be introduced to LabVIEW,
4. to be introduced to  $\LaTeX$ ,
5. to begin reading technical documents, and
6. to begin writing summaries of technical documents.

### Lab 01.1 Materials

The following materials are required for each lab station:

1. a PC with LabVIEW installed,<sup>1</sup>
2. a myRIO configured with LabVIEW,<sup>2</sup> and
3. headphones.

### Lab 01.2 Groups

Form groups of three.<sup>3</sup> This will be your group for the remainder of the term.

#### Box 01.1 Task rotation

The following three tasks should be completed individually by rotating group members in 45-minute intervals.<sup>a</sup>

<sup>a</sup>A group of four students will need to shorten these to about 30 minutes and may require additional lab time to complete all tasks.

### Lab 01.3 Task I: LabVIEW and the myRIO

Find a Robotics Lab station to perform this task. Log in to your student account.

<sup>1</sup>See [Resource 2](#) for more details on the LabVIEW software configuration.

<sup>2</sup>See [Resource 3](#) for more details on the myRIO software configuration.

<sup>3</sup>In the event of the total number of students not being divisible by three, the maximum number of groups of three should be formed, minimizing groups of two and especially four.

### Lab 01.3.1 Introduction to LabVIEW

LabVIEW is a graphics-oriented software and programming language for rapidly controlling measurement and control instruments. It gives students the power to capture data; create “virtual instruments” that can, for instance, graph data acquisition, live; and interface with external instruments. We’ll use it in most of our lab exercises! It runs on desktop computers and also on the myRIO boards, described in the next section.

Launch LabVIEW and open in a web browser the National Instruments site *Learn LabVIEW*:

[www.ni.com/academic/students/learn-labview](http://www.ni.com/academic/students/learn-labview).

Watch the following videos and follow along in LabVIEW!

#### Box 01.2 Open-lab tasks

The Robotics Lab is available for you to work on some of these tasks outside of the designated lab times—that is, it’s an “open lab.” Due to time-and-space constraints, you will need to come in outside of lab time to complete tasks with the **OL** stamp.

Time estimates for working through the tutorial exclude pause-and-play time.

1. LabVIEW Environment (10 minutes)
  - Introduction to the LabVIEW Programming Environment
  - Charts and Graphs
  - Building a Graphical User Interface (GUI)
2. Loops and Structures (15 minutes)
  - While Loops
  - For Loops
  - Case Structures
  - Shift Registers
3. **OL** Data Types and Structures (8 minutes)
  - **OL** LabVIEW Data Types
  - **OL** Arrays
4. **OL** Graphical Programming (4 minutes)
5. **OL** Programming Tools (3 minutes)
6. **OL** Debugging and Handling Errors (4 minutes)

### Lab 01.3.2 Introduction to myRIO

The myRIO is a powerful real-time input-output device that gives you the power to measure data from sensors and control signals to actuators. It is similar to certain high-end [Arduino](#) boards,<sup>4</sup> which can also be used for these tasks. We'll use the myRIO for data acquisition in most of our lab exercises!

A distinct feature of the myRIO is that it (and its FPGA) can be programmed in the graphical LabVIEW programming language. In this course, we will use this graphical language, but in certain advanced courses the C programming language is used to program the myRIO.

Download the myRIO *User Guide and Specifications* at

[www.ni.com/pdf/manuals/376047c.pdf](http://www.ni.com/pdf/manuals/376047c.pdf)

and skim it (skipping the boring parts).

Visit the National Instruments site *Learn to Use myRIO* at

[www.ni.com/academic/students/learn-rio/applications](http://www.ni.com/academic/students/learn-rio/applications).

Watch the first video, *Getting started with NI myRIO* (8 minute).

Plug in the myRIO to power and connect it to the computer via the USB cable. A dialog should appear. Select the `Getting Started Wizard`. Proceed, but *do not* change the name of the myRIO. Once you have reached the `Test Panel`, move the myRIO around and view the response of the indicators. Also test the buttons that toggle the myRIO LEDs and the `Button0` button on the myRIO.

Proceed in the wizard until you can select the option to `Start My First Project`. This will launch a tutorial. Work through the tutorial.

#### Box 01.3 Go deeper

Although it is not required, one can later explore the other videos on the *Learn to Use myRIO* page. There's even a tutorial (*Data Dashboard and NI myRIO*) on wireless real-time data display on a mobile device. In addition to displaying data, you can *control the myRIO* on wireless mobile devices. This could make a nice user interface for senior design projects! Additionally, the [myRIO Project Essentials Guide](#) has several cool project tutorials.

<sup>4</sup>Recently, Arduino has released [boards with FPGAs](#), which improve their competitiveness with the myRIO for high-speed signal processing and control.

### Lab 01.4 Task II: L<sup>A</sup>T<sub>E</sub>X for reports

If you brought your own laptop, find a seat in the Robotics Lab. If not, log in to a workstation in Cebula 101 (CAD Lab) computer.

L<sup>A</sup>T<sub>E</sub>X is a document preparation system for scientific and engineering documents. Read thoroughly and follow along with the instructions in [Resource 1](#).

### Lab 01.5 Task III: Writing and reading

For this task, find a seat in the Robotics Lab that isn't at a lab station.

Download and read [this article](#) (password: me316). It's from a scientific engineering journal, and it will give you a good feel for how technical documents should be written.

### Lab 01.6 What to turn in next week

Submit to me a pdf of the report template that you have edited to include the names of your group. You can leave the instructions in the file. Read them.

Also, write a paragraph or two summary of the the Fedrizzi article. Include it under a new, first section in the report named "Summary of Fedrizzi Article". Somewhere in this paragraph, cite the article. Here is the BibTeX citation for it.

```
@article{Fedrizzi2015,
  Author = {Marcus Fedrizzi and Julio Soria},
  Journal = {Measurement Science and Technology},
  Number = {9},
  Pages = {095302},
  Title = {Application of a single-board computer
as a low-cost pulse generator},
  Url = {http://stacks.iop.org/0957-0233/26/i=9/a=095302},
  Volume = {26},
  Year = {2015}}
```