NATIONAL INSTRUMENTS™

Introduction to LabVIEW for FRC

April Riddett

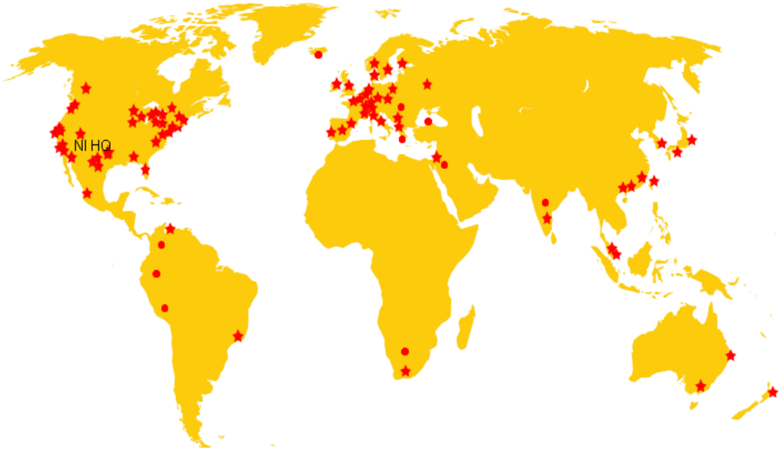
Applications Engineer

NATIONAL INSTRUMENTS™

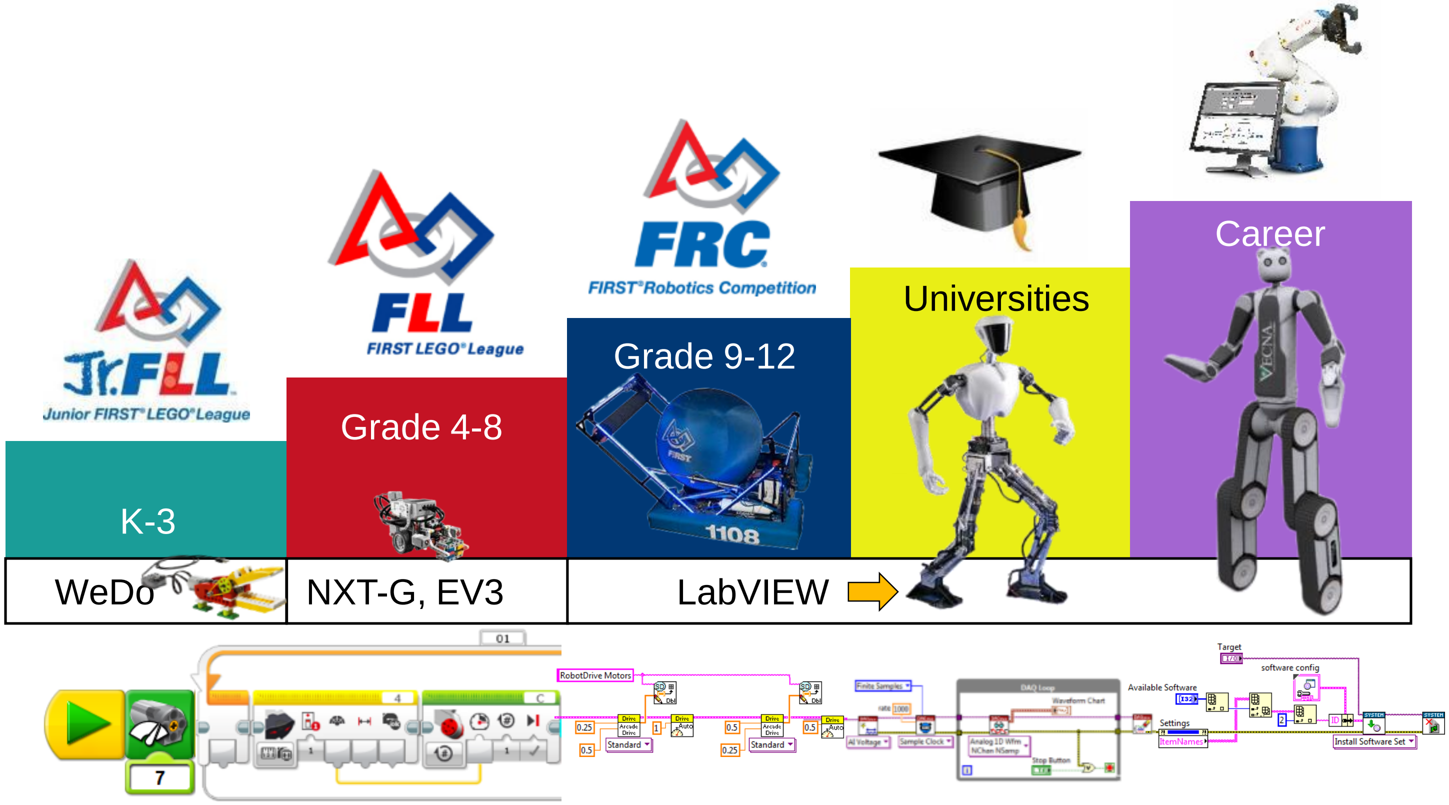
LabVIEW Usage in Universities

110
Countries

7000+
Universities



The LabVIEW Continuum



Jr.FLL Junior FIRST® LEGO® League

K-3

FLL FIRST LEGO® League

Grade 4-8

FRC FIRST® Robotics Competition

Grade 9-12

Universities

Career

WeDo	NXT-G, EV3	LabVIEW

Companies that use LabVIEW

hp
SIEMENS
GE
Honeywell
xerox
Kodak
AMD
ERICSSON
ANALOG DEVICES
DEPARTMENT OF DEFENSE UNITED STATES OF AMERICA
VW
CNN
DEPARTMENT OF ENERGY UNITED STATES OF AMERICA
ALCOA
LOCKHEED MARTIN
Ford
DOW
Rockwell Automation
AstraZeneca
JDSU
intel Leap ahead
P&G
TRW
IBM
Alcatel·Lucent
Schlumberger
NOKIA
ALTERA
TERADYNE
MOTOROLA
SONY
BOEING
CORNING
SPACEX
GOODYEAR
YOKOGAWA
Tektronix
Agilent Technologies
HONDA
LEGO
PHILIPS
KRAFT
Seagate
ABB
at&t
cisco
3com
HALLIBURTON
3M
TOSHIBA
SAMSUNG
ALTERA
XILINX
CERN
Microsoft
NASA
Shiner
EXXON
EMBRAER
bp
ROHDE&SCHWARZ
DUPONT
NISSAN
SPECIALIZED
LG Life's Good
TOYOTA
TEXAS INSTRUMENTS
FISHER-ROSEMOUNT
Fuji Electric

More than 35,000 companies use NI Tools

NATIONAL INSTRUMENTS
LabVIEW
Mission Elapsed Time
T+ 00:11:44
MCC Time
231/ 18:11:44 UTC
Dragon GPS Time
00/ 00:00:00 UTC
231/ 17:22:24 UTC: Dragon Command Counter updated to: 15
231/ 17:28:14 UTC: Dragon Telemetry Source Changed to Ground Stations
231/ 17:36:23 UTC: Dragon Telemetry Source Changed to TDRSS A
231/ 17:37:01 UTC: Command Canceled: Command Buffer Cleared
231/ 17:55:36 UTC: Dragon Telemetry Source Changed to Ground Stations
231/ 18:00:03 UTC: Dragon Telemetry Source Changed to TDRSS A
Active Alarms
Tripped at:
Parameter
Alarm State
Currently:
SPACEX

FRC LabVIEW Quick Start Guide

Setup

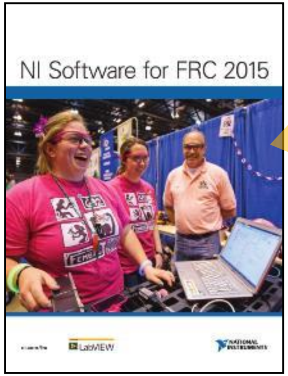
NI LabVIEW Basics

- Software Setup Overview
- FRC Software Orientation
- roboRIO Introduction and Set Up
- Basics of the Robot Project
- Deploying and Driving

FRC Software Overview

NI Software for FRC

- LabVIEW
- LabVIEW Real-Time
- Vision Development Module
- IMAQdx (vision driver)
- NI-RIO (roboRIO driver)
- FRC Simulation Viewer


NI Software for FRC 2015

Included in Kit of Parts
or
Download at ni.com/frc

FRC Update Suite

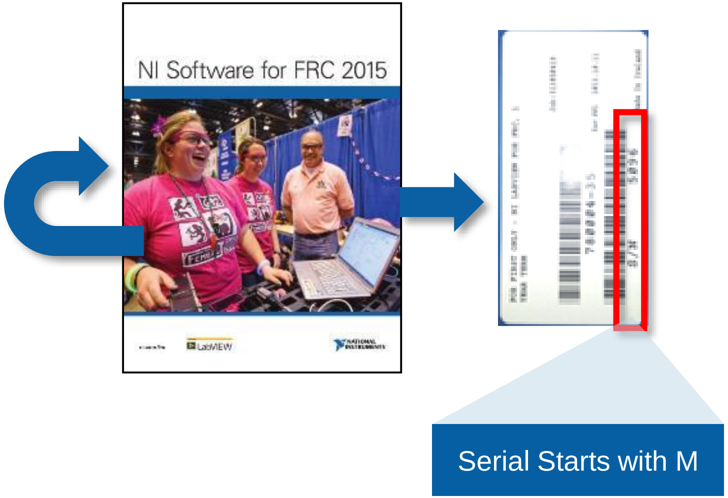
- Driver Station
- roboRIO Utilities
- WPI Library
- FRC LabVIEW Templates
- FRC LabVIEW Examples

Required for ALL FRC Teams
Download Only

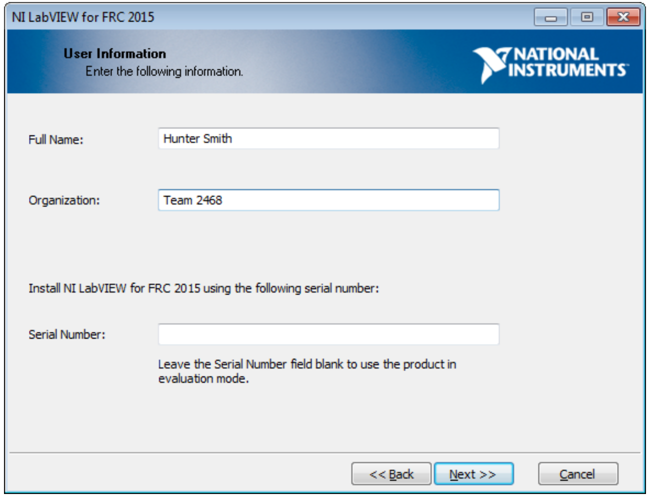
All download links available at ni.com/frc.

2. Activate

- Activate LabVIEW using the serial number on the back of the DVD envelope.



Serial Starts with M



User Information
Enter the following information.

Full Name: Hunter Smith

Organization: Team 2468

Install NI LabVIEW for FRC 2015 using the following serial number:

Serial Number:

Leave the Serial Number field blank to use the product in evaluation mode.

3. Install FRC 2017 Update Suite

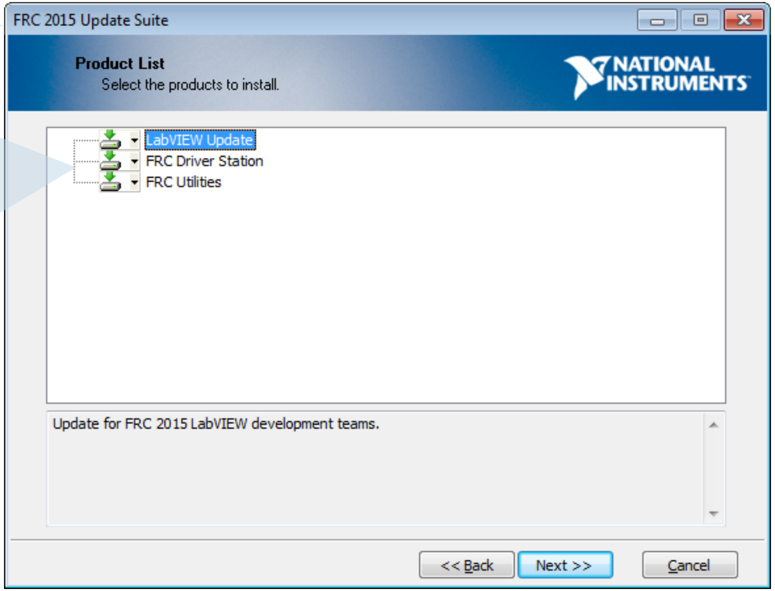
All teams must install the Update Suite.

Install Update after LabVIEW

Install Components

LabVIEW Teams : Everything

Java/C Teams: Driver Station & Utilities



FRC 2015 Update Suite

Product List

Select the products to install.

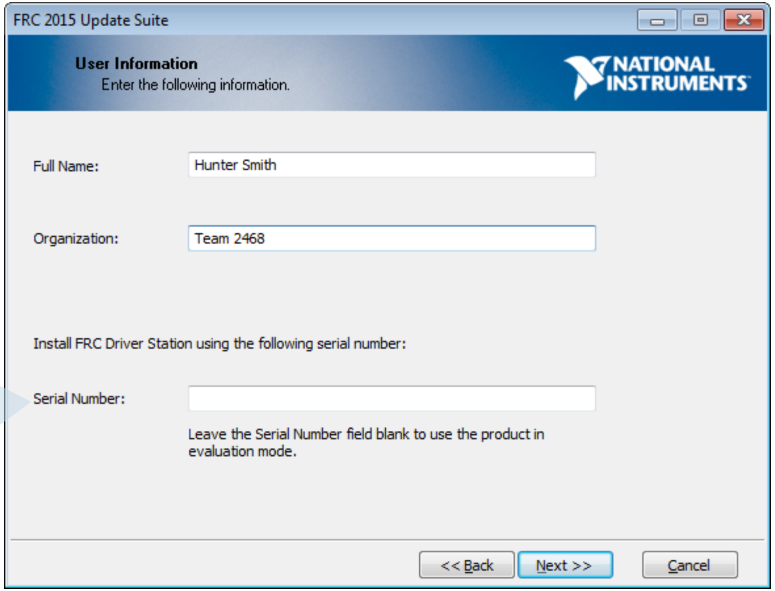
- LabVIEW Update
- FRC Driver Station
- FRC Utilities

Update for FRC 2015 LabVIEW development teams.

3. Install FRC 2015 Update Suite

All teams must install the Update Suite.

Activate with the same serial number from the DVD Envelope


FRC 2015 Update Suite

User Information

Enter the following information.

Full Name: Hunter Smith

Organization: Team 2468

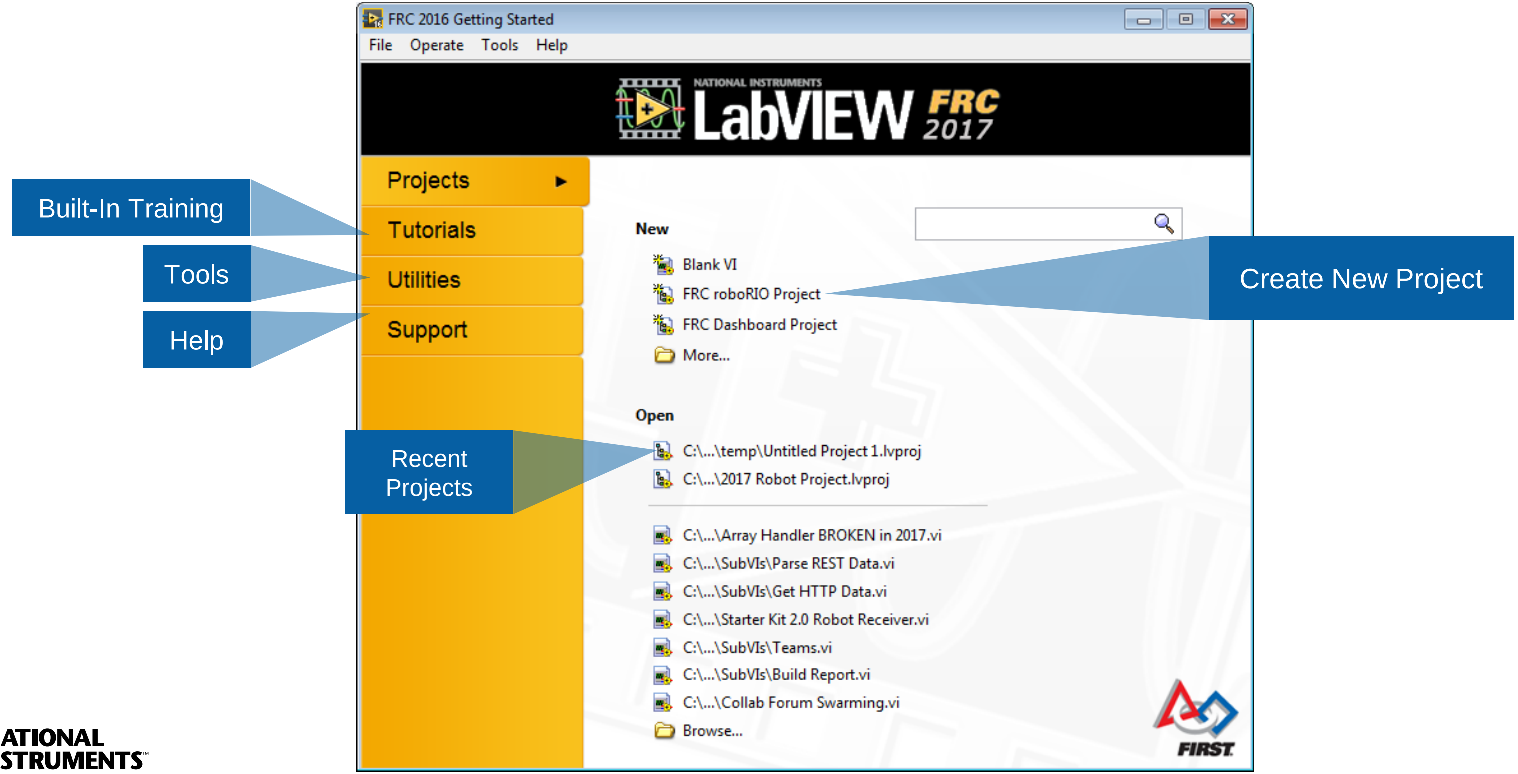
Install FRC Driver Station using the following serial number:

Serial Number:

Leave the Serial Number field blank to use the product in evaluation mode.

Software Orientation: Getting Started Window

This window opens when you start FRC LabVIEW.



FRC 2016 Getting Started
File Operate Tools Help
NATIONAL INSTRUMENTS LabVIEW FRC 2017
Projects
Tutorials
Utilities
Support
New
Blank VI
FRC roboRIO Project
FRC Dashboard Project
More...
Open
C:\...\temp\Untitled Project 1.lvproj
C:\...\2017 Robot Project.lvproj
C:\...\Array Handler BROKEN in 2017.vi
C:\...\SubVIs\Parse REST Data.vi
C:\...\SubVIs\Get HTTP Data.vi
C:\...\Starter Kit 2.0 Robot Receiver.vi
C:\...\SubVIs\Teams.vi
C:\...\SubVIs\Build Report.vi
C:\...\Collab Forum Swarming.vi
Browse...
FIRST

Built-In Training

Tools

Help

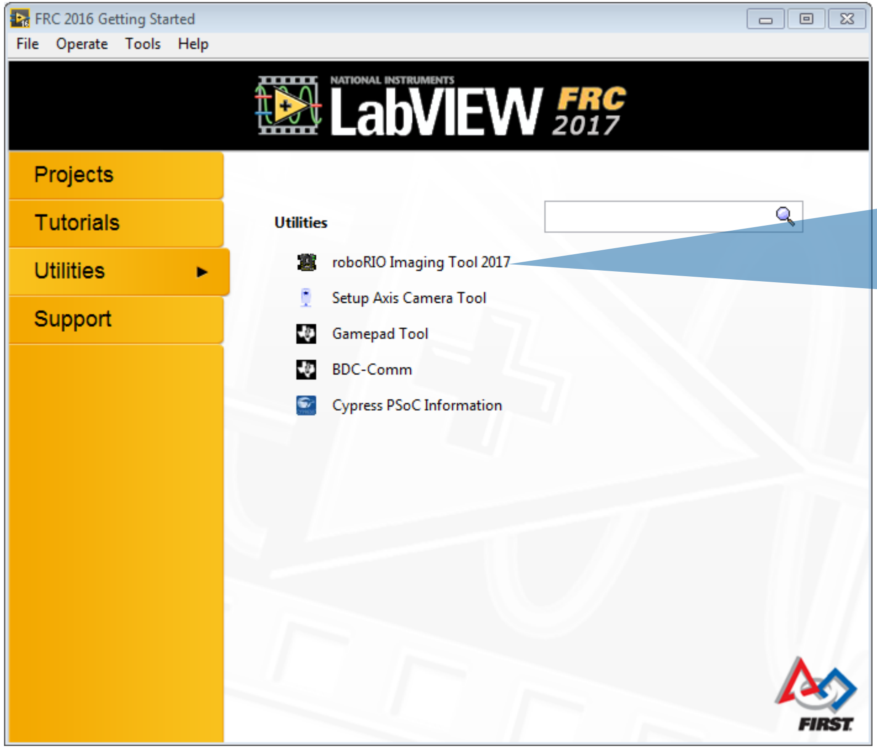
Recent Projects

Create New Project

Setup

Software Orientation: Getting Started Window

This window opens when you start FRC LabVIEW.

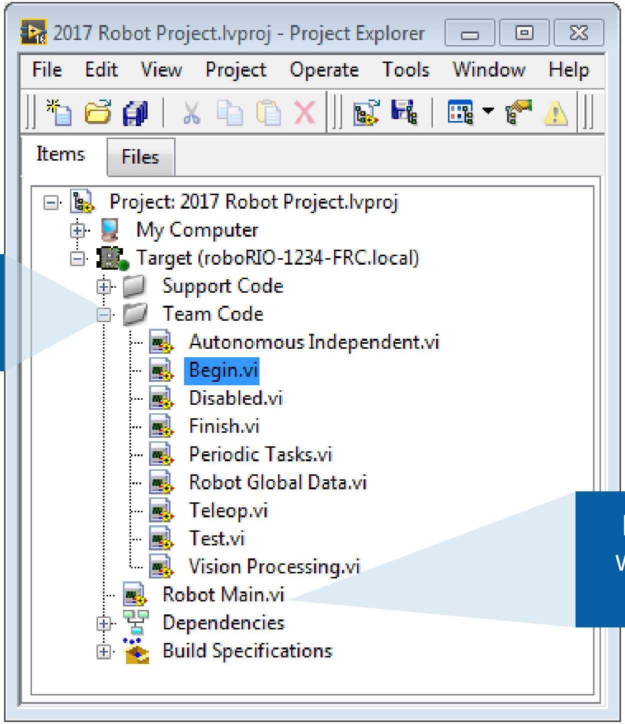


Imaging Tool

Setup

Software Orientation: roboRIO Robot Project

- With the LabVIEW project window, you can see all of the code that will run on your robot. The FRC software includes a template project with everything you need to start.



2017 Robot Project.lvproj - Project Explorer

```
Project: 2017 Robot Project.lvproj
  My Computer
  Target (roboRIO-1234-FRC.local)
    Support Code
    Team Code
      Autonomous Independent.vi
      Begin.vi
      Disabled.vi
      Finish.vi
      Periodic Tasks.vi
      Robot Global Data.vi
      Teleop.vi
      Test.vi
      Vision Processing.vi
    Robot Main.vi
    Dependencies
    Build Specifications
```

All the code you need to change is in the Team Code folder

Robot Main communicates with the field control system and runs your team code

Software Orientation: Driver Station

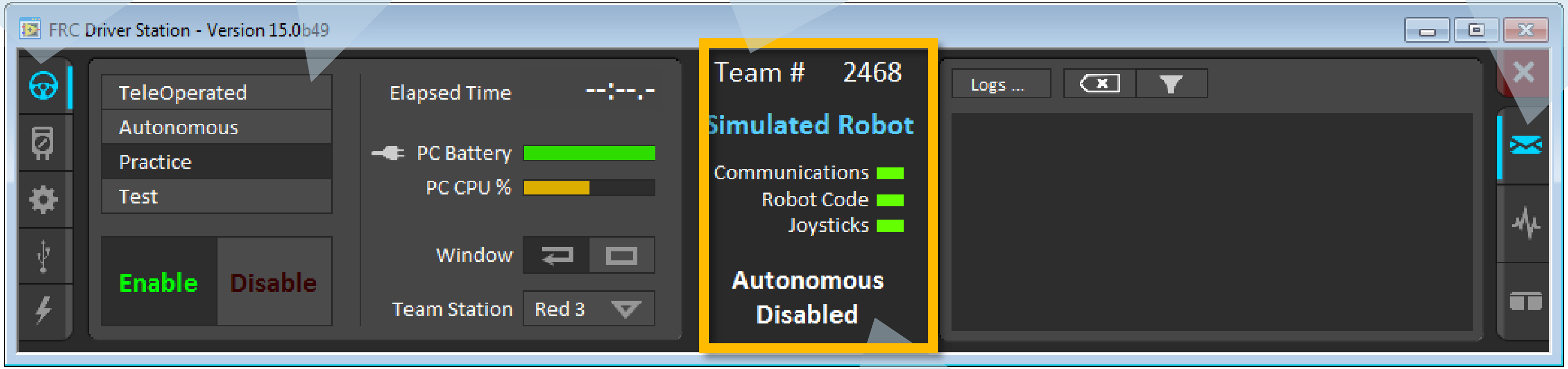
The Driver Station is the robot control utility for practice and competition for all FRC teams. Open this to connect to your robot and run your code you wrote.

Operation Tab

Mode

Robot Info Section

Messages Mode


FRC Driver Station - Version 15.0b49

Elapsed Time --:--.-

PC Battery 🟩

PC CPU % 🟨

Team Station Red 3

Team # 2468

Simulated Robot

Communications 🟩

Robot Code 🟩

Joysticks 🟩

Autonomous

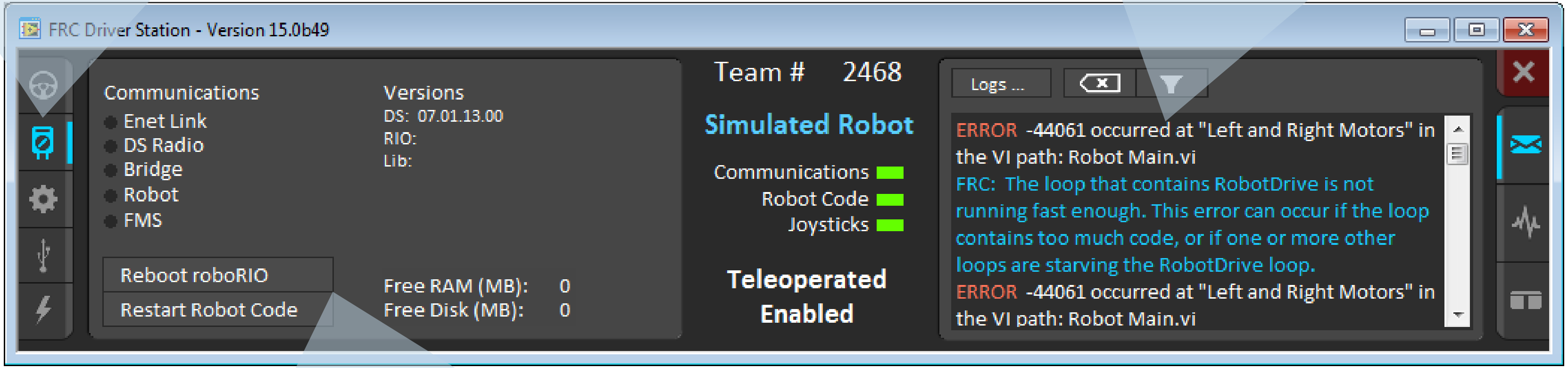
Disabled

All lights should be green to run

Software Orientation: Driver Station

Diagnostics Tab

Error Messages



FRC Driver Station - Version 15.0b49

Communications
- ● Enet Link
- ● DS Radio
- ● Bridge
- ● Robot
- ● FMS

Versions

DS: 07.01.13.00

RIO:

Lib:

Reboot roboRIO

Restart Robot Code

Free RAM (MB): 0

Free Disk (MB): 0

Team # 2468

Simulated Robot

Communications 🟩

Robot Code 🟩

Joysticks 🟩

Teleoperated Enabled

```
ERROR -44061 occurred at "Left and Right Motors" in
the VI path: Robot Main.vi
FRC: The loop that contains RobotDrive is not
running fast enough. This error can occur if the loop
contains too much code, or if one or more other
loops are starving the RobotDrive loop.
ERROR -44061 occurred at "Left and Right Motors" in
the VI path: Robot Main.vi
```

Easily Reboot or Restart from the dashboard

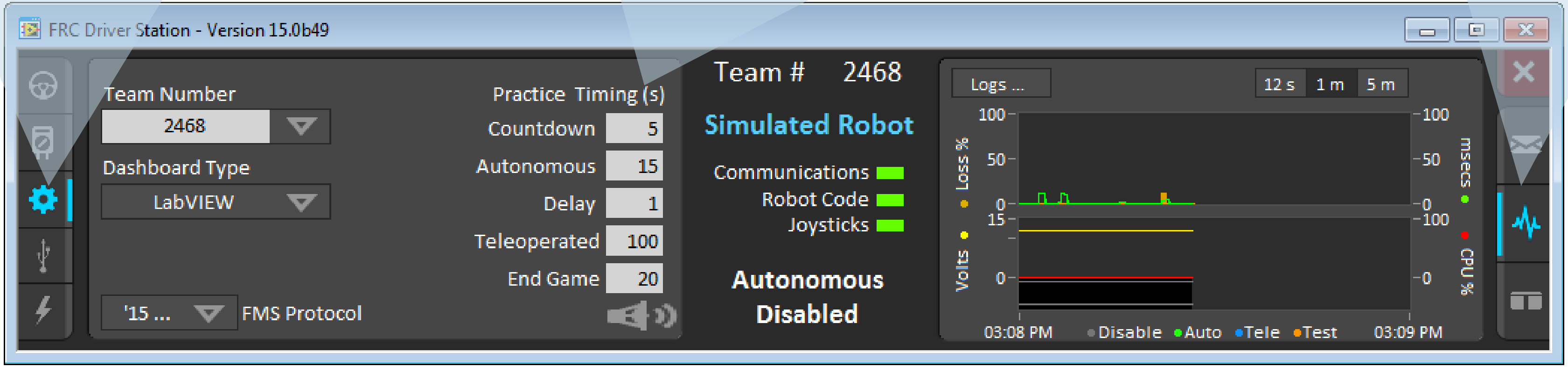
NATIONAL INSTRUMENTS

Software Orientation: Driver Station

Set Up Tab

Configure Match Settings

Chart Mode



FRC Driver Station - Version 15.0b49

Team Number: 2468

Dashboard Type: LabVIEW

'15 ... FMS Protocol

Practice Timing (s)

Countdown	5
Autonomous	15
Delay	1
Teleoperated	100
End Game	20

Team # 2468

Simulated Robot

Communications 🟩
Robot Code 🟩
Joysticks 🟩

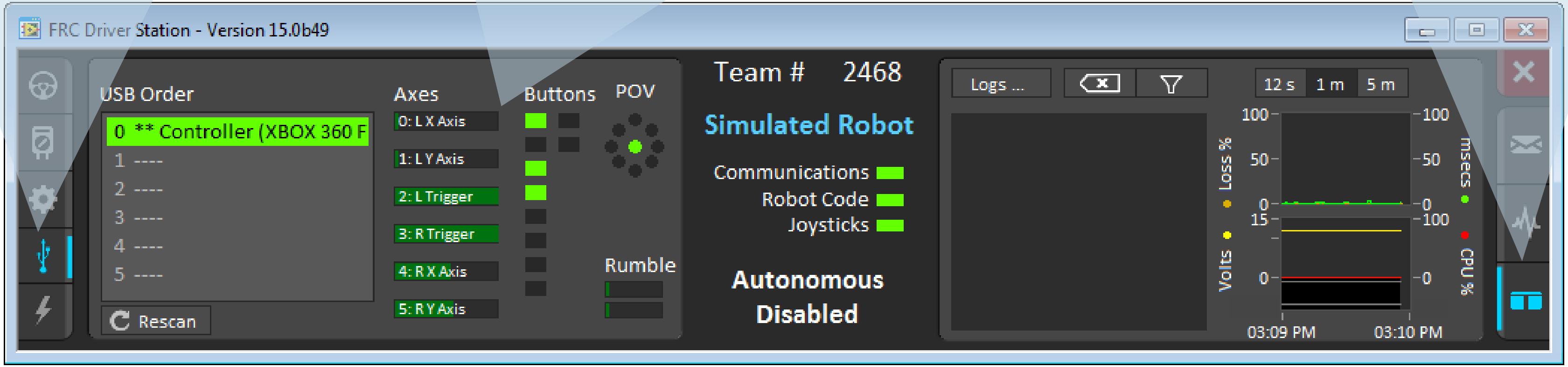
Autonomous Disabled

Software Orientation: Driver Station

USB Devices Tab

Live Joystick Inputs

Messages & Chart Mode



FRC Driver Station - Version 15.0b49

USB Order

0 ** Controller (XBOX 360 F
1 ----
2 ----
3 ----
4 ----
5 ----

Team # 2468

Simulated Robot

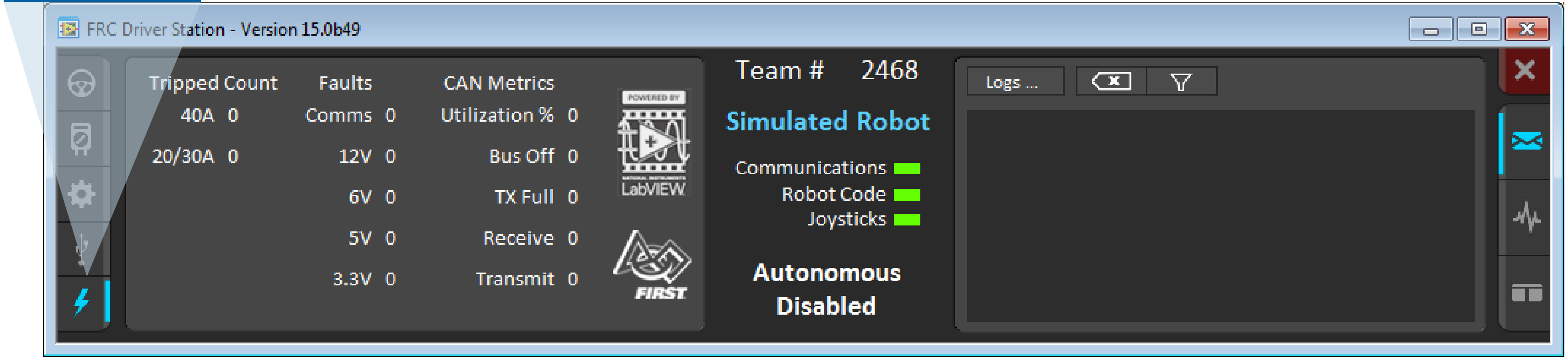
Communications 🟩
Robot Code 🟩
Joysticks 🟩

Autonomous
Disabled

Setup

Software Orientation: Driver Station

Power & CAN Tab



FRC Driver Station - Version 15.0b49

Tripped Count		Faults		CAN Metrics	
40A	0	Comms	0	Utilization %	0
20/30A	0	12V	0	Bus Off	0
		6V	0	TX Full	0
		5V	0	Receive	0
		3.3V	0	Transmit	0

Team # 2468

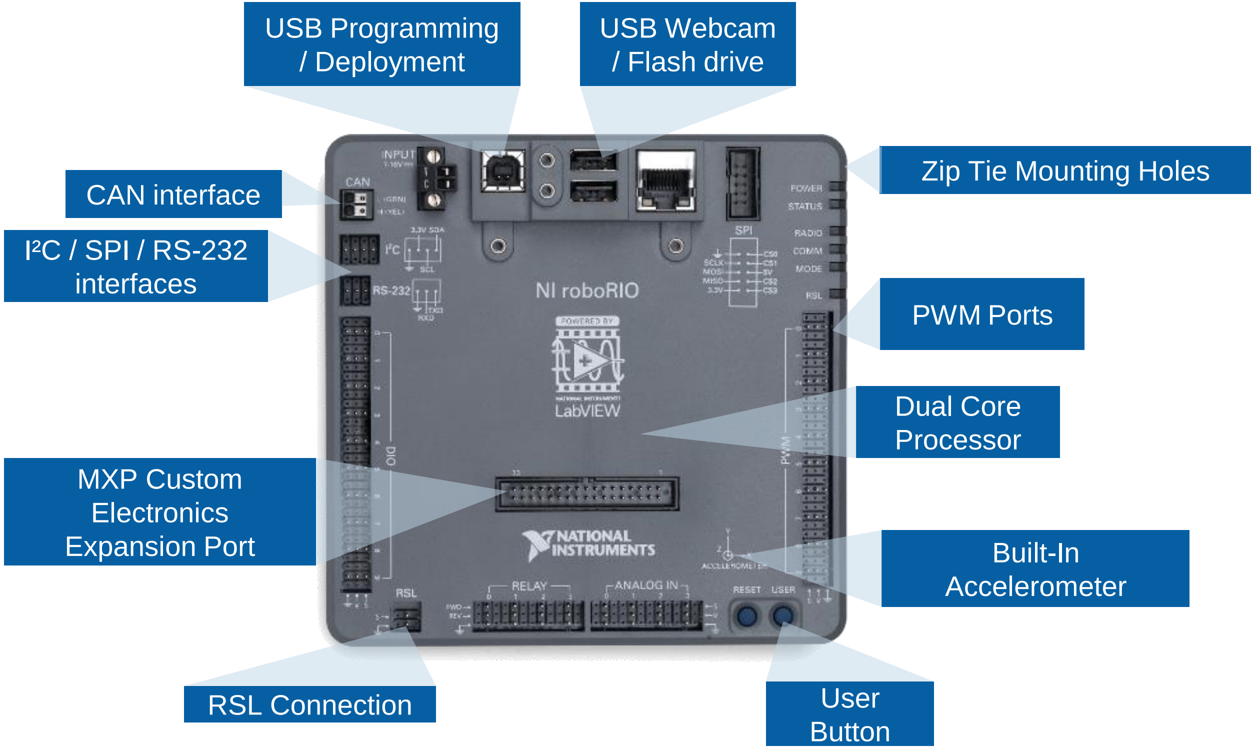
Simulated Robot

Communications 🟩
Robot Code 🟩
Joysticks 🟩

Autonomous
Disabled

roboRIO

Controller for FRC 2015-2019



MXP – myRIO Expansion Port

Create your own expansion board for roboRIO

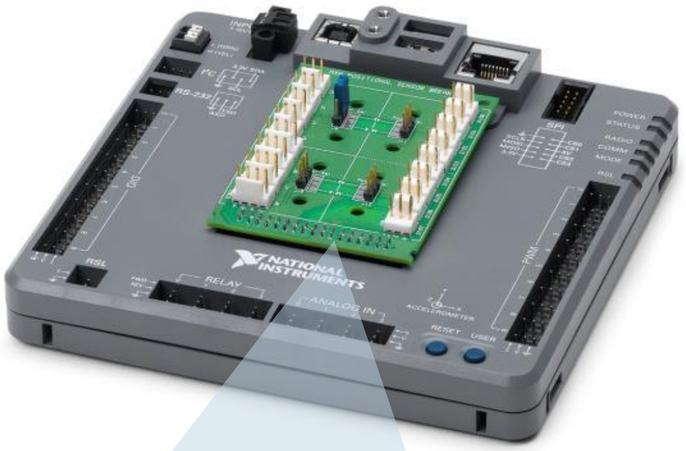
MXP Developer’s Guide: bit.ly/roboRIO-MXP

All FRC Teams get a Free License for the NI Circuit Suite

Ultiboard PCB Design & Layout

Multisim Circuit SPICE & Simulation

Be sure to check the official rules from FIRST to make sure your accessories are competition legal



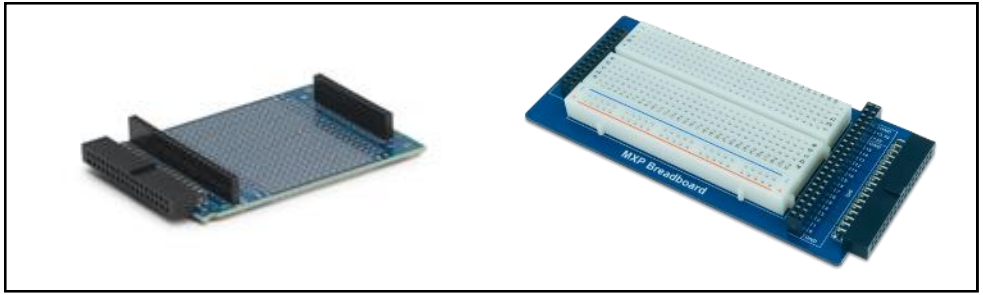
MXP I/O

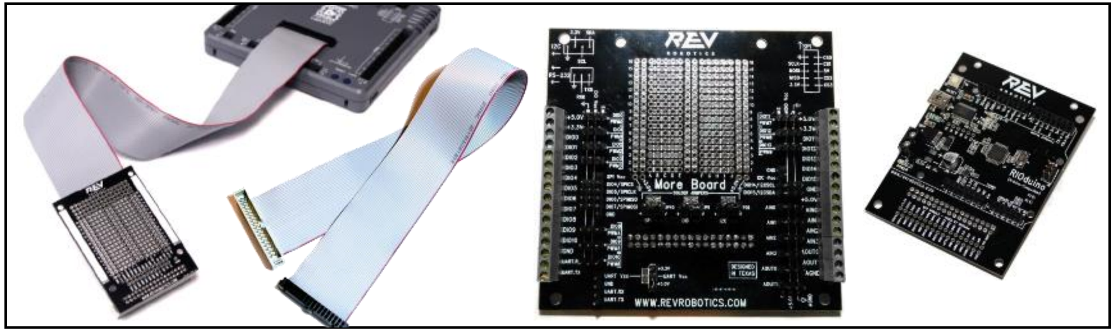
10 PWM / DIO
I2C / SPI / UART
3.3V / 5V / GND
2 Analog Outputs
4 Analog Inputs

MXP Accessories

Adaptors and prototyping tools

Available from ni.com





COMING SOON

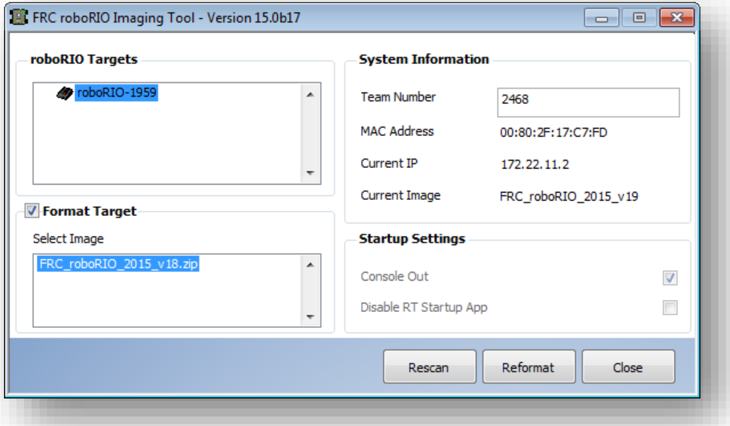
Available from AndyMark

Create a roboRIO accessory? Let us know @NIFIRSTRobotics

roboRIO Set Up

1. Install the FRC 2017 Update Suite
2. Connect roboRIO to a power supply
3. Connect roboRIO to your PC over USB
4. Run the roboRIO Imaging Tool

roboRIO_ImagingTool.exe



FRC roboRIO Imaging Tool - Version 15.0b17

roboRIO Targets

roboRIO-1959

☑ **Format Target**

Select Image

FRC_roboRIO_2015_v18.zip

System Information

Team Number: 2468

MAC Address: 00:80:2F:17:C7:FD

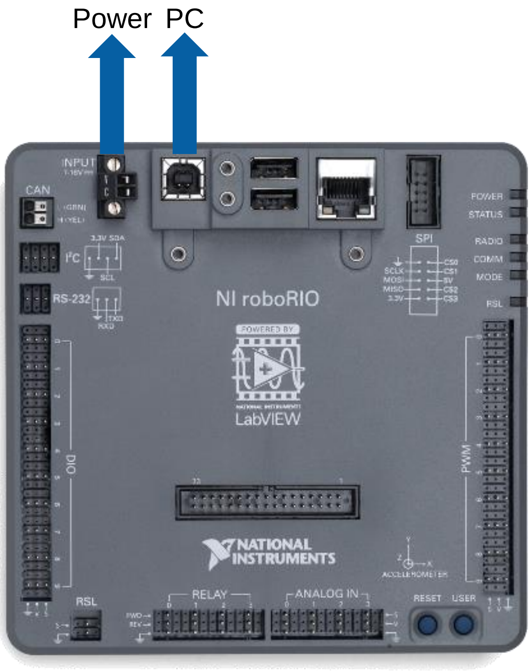
Current IP: 172.22.11.2

Current Image: FRC_roboRIO_2015_v19

Startup Settings

Console Out ☑

Disable RT Startup App □

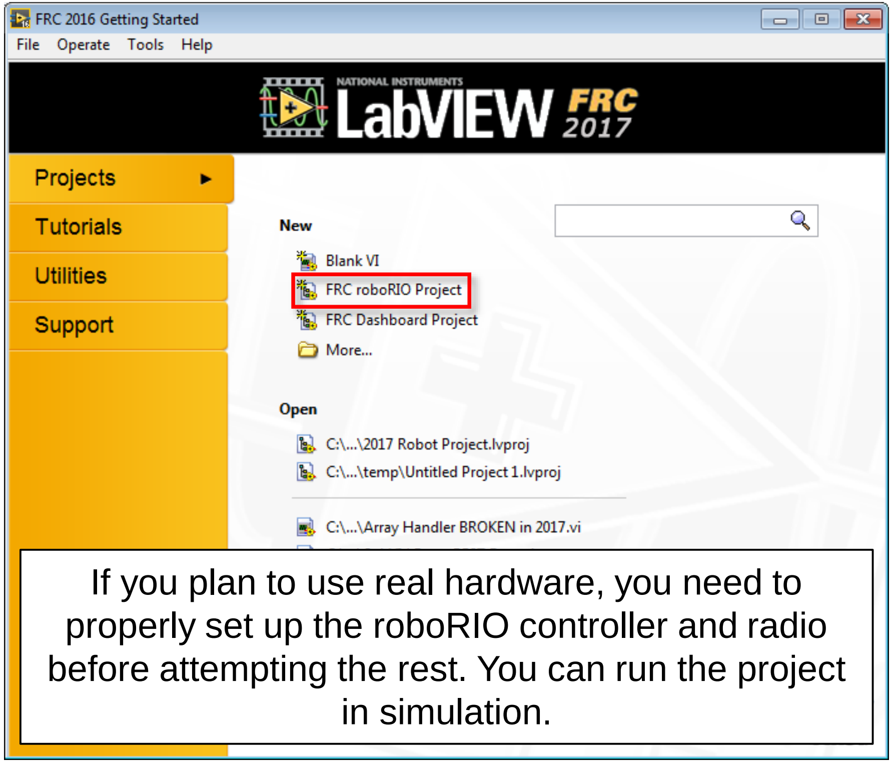


Share your unboxing experience using #roboRIO

Drive a Robot: Step 1
Open the Template Project

Setup

Step 1: From the LabVIEW Getting Started window, select **New»FRC roboRIO Robot Project** to create a new roboRIO Robot Project



FRC 2016 Getting Started

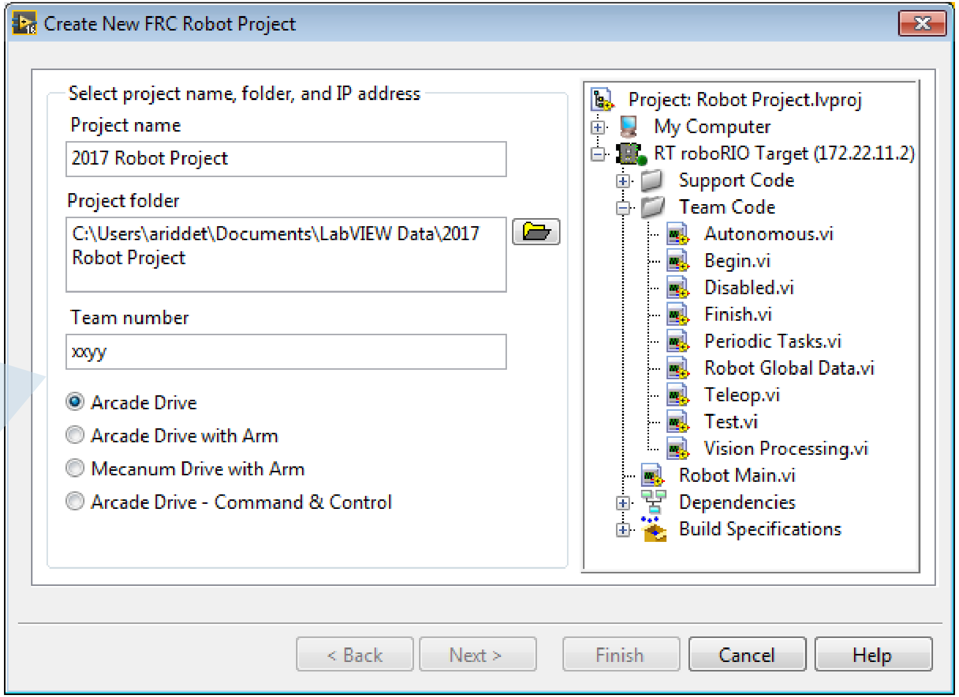
File Operate Tools Help

NATIONAL INSTRUMENTS LabVIEW FRC 2017
Projects
Tutorials
Utilities
Support
New
Blank VI
FRC roboRIO Project
FRC Dashboard Project
More...
Open
C:\...\2017 Robot Project.lvproj
C:\...\temp\Untitled Project 1.lvproj
C:\...\Array Handler BROKEN in 2017.vi

If you plan to use real hardware, you need to properly set up the roboRIO controller and radio before attempting the rest. You can run the project in simulation.

Drive a Robot: Step 2
Configure Your roboRIO Robot Project

Step 2: Fill in the New Project dialog box. Give the project a meaningful name, set your team number and pick the type of project you want to make.



Create New FRC Robot Project

Select project name, folder, and IP address

Project name: 2017 Robot Project

Project folder: C:\Users\ariddet\Documents\LabVIEW Data\2017 Robot Project

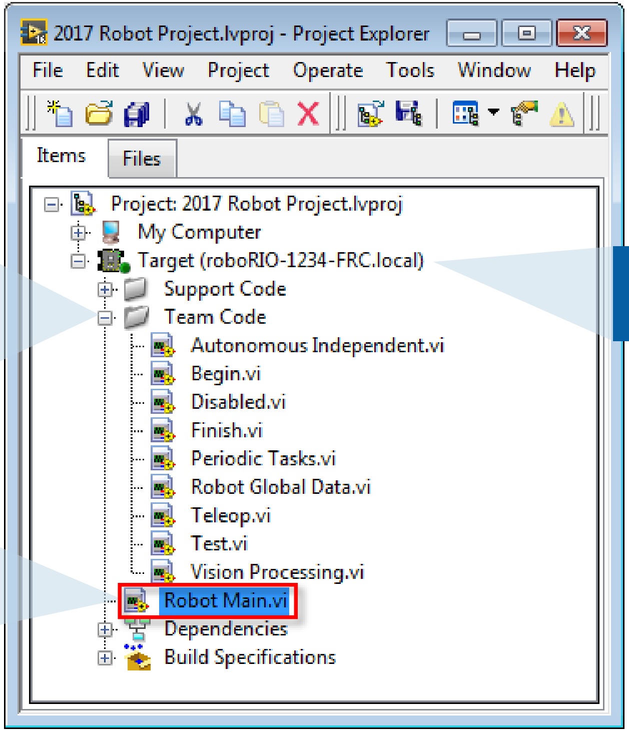
Team number: xxyy

● Arcade Drive
○ Arcade Drive with Arm
○ Mecanum Drive with Arm
○ Arcade Drive - Command & Control

Select project type based on your drive style and accessories

Drive a Robot: Step 3
Open the Template Project

Step 3: To open **Robot Main.vi**, double-click on it in the project window. The front panel should launch. Select **<Ctrl-E>** to open the block diagram and look at the code.



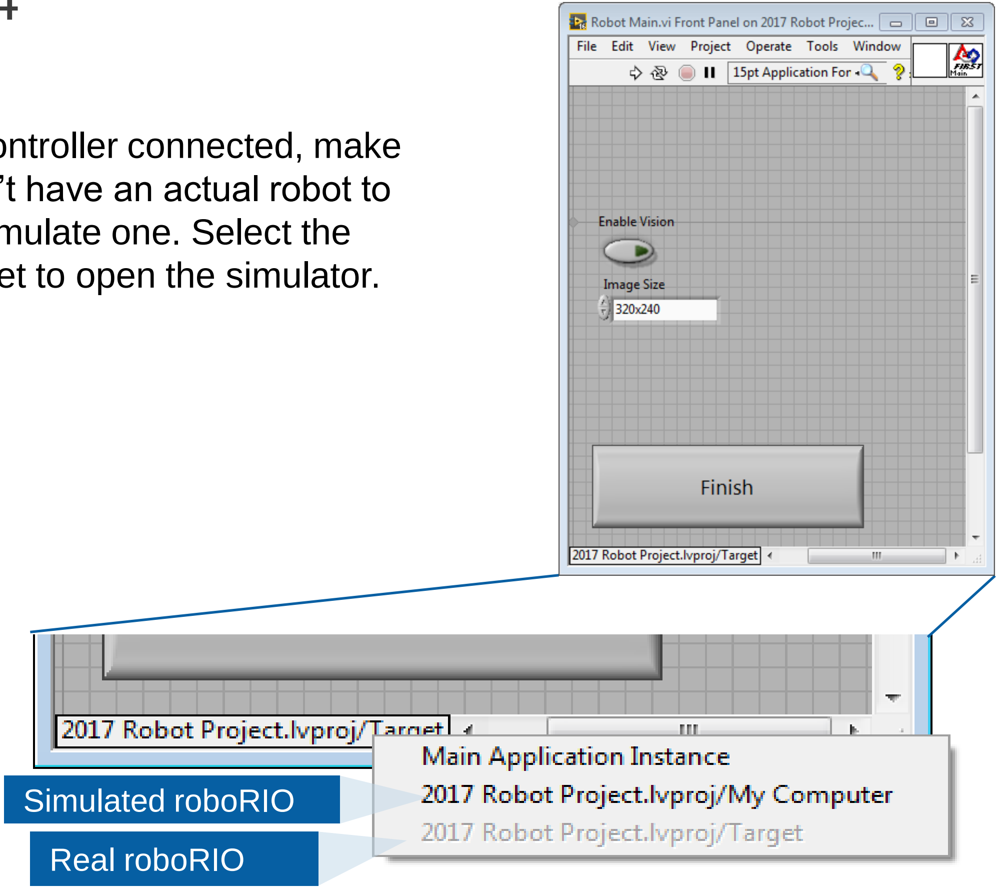
The code you need to edit is in the Team Code folder

If you add new VIs, be sure they are under the roboRIO target

To drive your robot, open Robot Main

Drive a Robot: Step 4
Select a Target

Step 4: If you have a roboRIO controller connected, make sure you select it. If you don’t have an actual robot to drive around, you can still simulate one. Select the **…lvproj/My Computer** target to open the simulator.

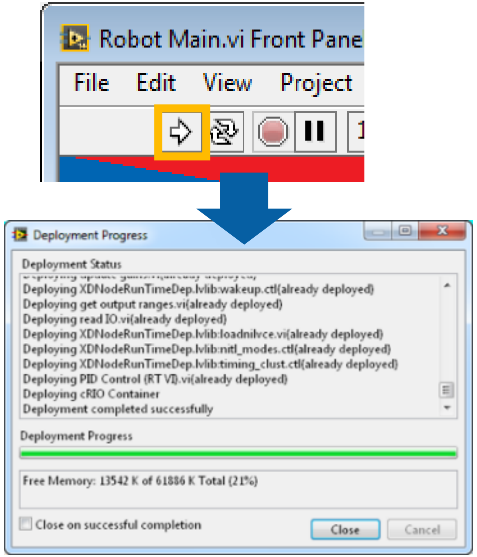

Robot Main.vi Front Panel on 2017 Robot Projec...
File
Edit
View
Project
Operate
Tools
Window
15pt Application For
Enable Vision
Image Size
320x240
Finish
2017 Robot Project.lvproj/Target
2017 Robot Project.lvproj/Target
Main Application Instance
2017 Robot Project.lvproj/My Computer
2017 Robot Project.lvproj/Target

Simulated roboRIO

Real roboRIO

Driving a Robot: Step 5
Deploy Code

Step 5: Click on the **white run arrow** at the top left of Robot Main. The robot project is deployed to the roboRIO controller/simulator. Once LabVIEW is finished deploying the code, open the Driver Station. The LEDs should all be green. Click **TeleOp** and then **Start**.



Deployment Status

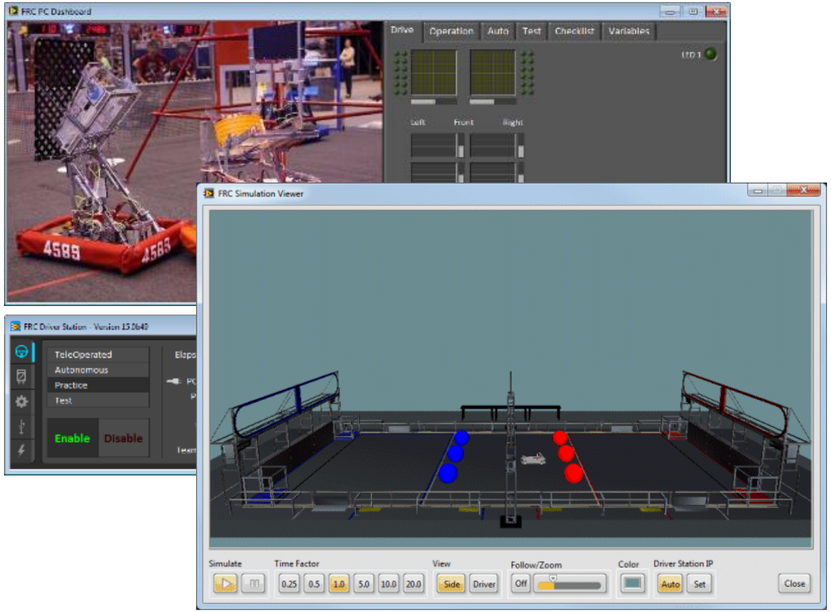
```
Deploying XDNodeRunTimeDep.lvlib:wakeup.ctl(already deployed)
Deploying get output ranges.vi(already deployed)
Deploying read IO.vi(already deployed)
Deploying XDNodeRunTimeDep.lvlib:loadnilvce.vi(already deployed)
Deploying XDNodeRunTimeDep.lvlib:nitl_modes.ctl(already deployed)
Deploying XDNodeRunTimeDep.lvlib:timing_clust.ctl(already deployed)
Deploying PID Control (RT VI).vi(already deployed)
Deploying cRIO Container
Deployment completed successfully
```

Deployment Progress

Free Memory: 13542 K of 61886 K Total (21%)

□ Close on successful completion

Close Cancel



Setup Resources

- Software Setup Guide
- LabVIEW Development Suite for FRC 2015
- Imaging roboRIO and Windows IP Configuration
- Troubleshooting roboRIO Connections
- Driver Station Tutorial
- Custom Dashboard Tutorial
- Robotics Framework Tutorial
- Robot Simulation Tutorial

- Forum Support (year round)
  - ni.com/frc
- Phone Support (during build season only)
  - (866) 511-6285 from 1:00 to 7:00 p.m. (Central Time)

All links available at ni.com/frc

FRC LabVIEW Quick Start Guide

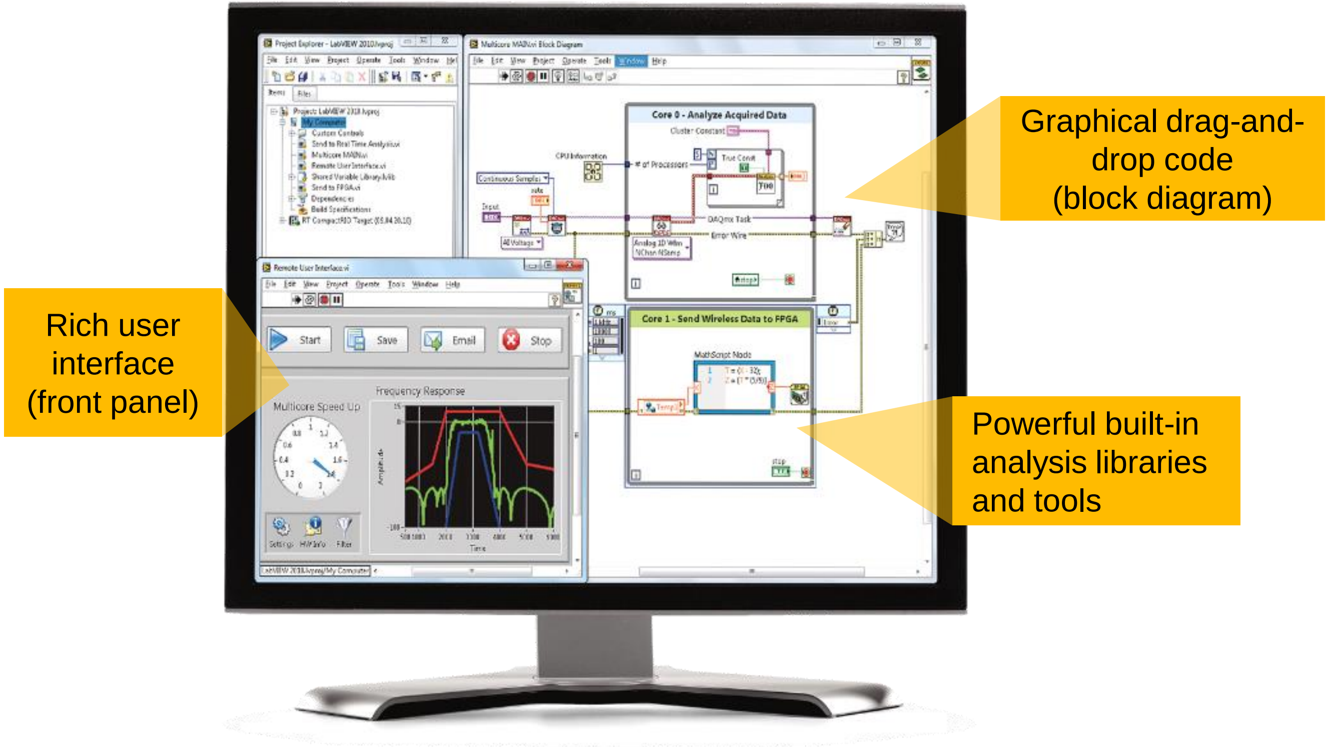
Setup

NI LabVIEW Basics

- What Is LabVIEW?
- LabVIEW Development Environment
- LabVIEW Programming Fundamentals
- Tools and Troubleshooting
- Teleop and Autonomous Code

What Is LabVIEW?

- A graphical programming environment used to develop sophisticated measurement, test, and control systems



Graphical drag-and-drop code (block diagram)

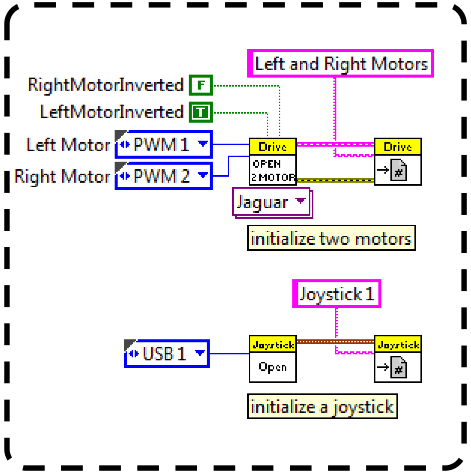
Rich user interface (front panel)

Powerful built-in analysis libraries and tools

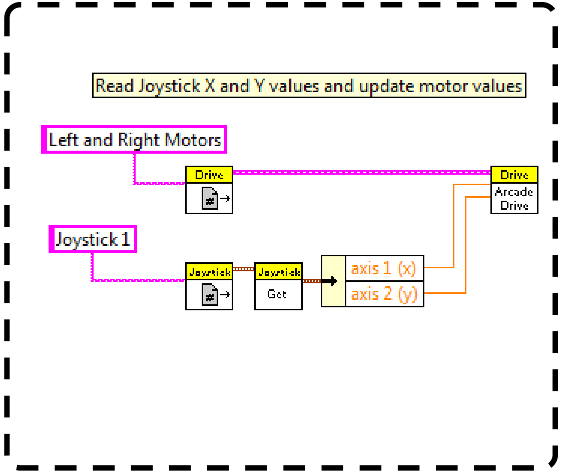
Teleop Code

- When modifying the FRC Robot Project template, do **not** modify Robot Main.vi.

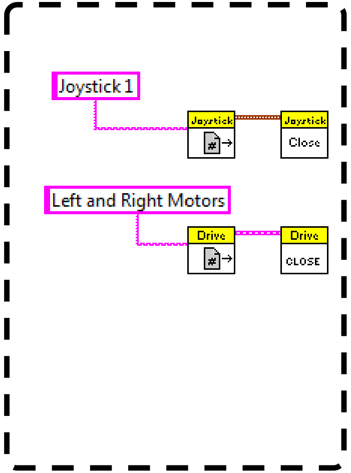
- Modify the code within the Team Code folder within the project. This code is called on in Robot Main.vi



Begin.vi



Teleop.vi

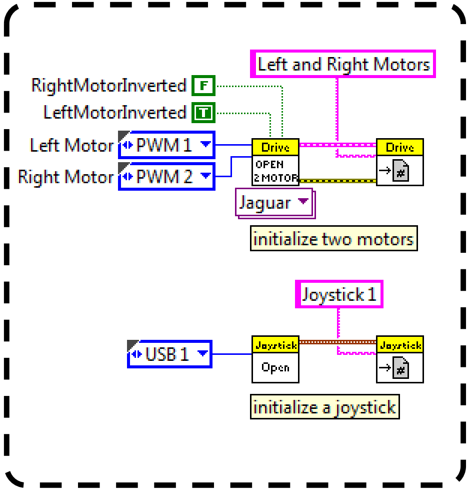


Finish.vi

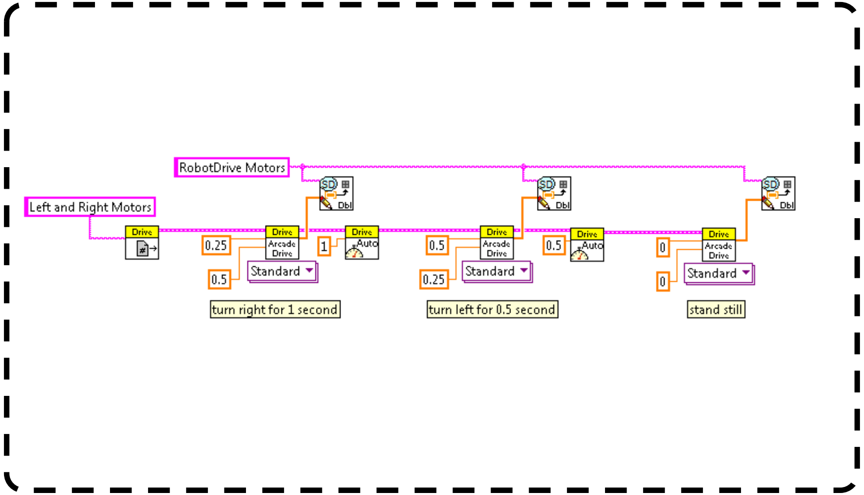
LabVIEW Basics

Autonomous Code

- Similar to Teleop, Autonomous executes code by references.

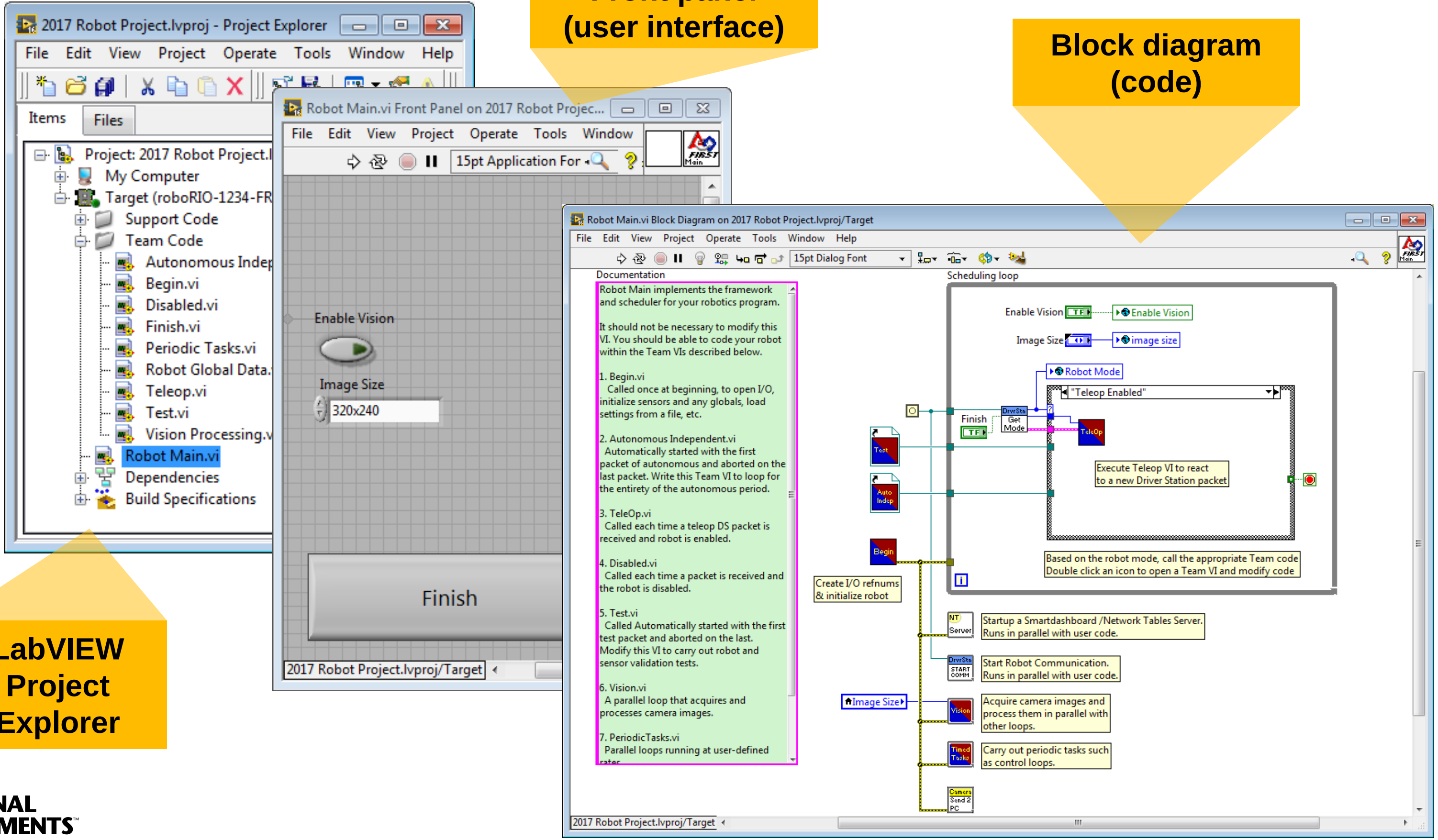


Begin.vi



Autonomous Independent.vi

Parts of Robot Main.vi



Robot Main implements the framework and scheduler for your robotics program.

It should not be necessary to modify this VI. You should be able to code your robot within the Team VIs described below.

1. Begin.vi
Called once at beginning, to open I/O, initialize sensors and any globals, load settings from a file, etc.

2. Autonomous Independent.vi
Automatically started with the first packet of autonomous and aborted on the last packet. Write this Team VI to loop for the entirety of the autonomous period.

3. TeleOp.vi
Called each time a teleop DS packet is received and robot is enabled.

4. Disabled.vi
Called each time a packet is received and the robot is disabled.

5. Test.vi
Called Automatically started with the first test packet and aborted on the last. Modify this VI to carry out robot and sensor validation tests.

6. Vision.vi
A parallel loop that acquires and processes camera images.

7. PeriodicTasks.vi
Parallel loops running at user-defined rates

Execute Teleop VI to react to a new Driver Station packet

Based on the robot mode, call the appropriate Team code
Double click an icon to open a Team VI and modify code

Create I/O refnums & initialize robot

Startup a Smartdashboard /Network Tables Server. Runs in parallel with user code.

Start Robot Communication. Runs in parallel with user code.

Acquire camera images and process them in parallel with other loops.

Carry out periodic tasks such as control loops.

Front panel (user interface)

Block diagram (code)

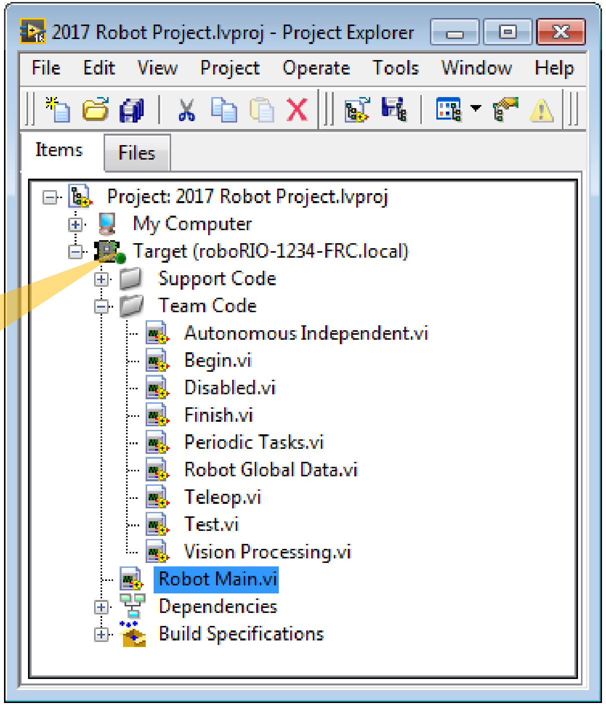
LabVIEW Project Explorer

LabVIEW Project Explorer

LabVIEW File Extensions

- LabVIEW project—.lvproj
- Virtual instrument (VI)—.vi
- Custom control—.ctl

Right-click to connect to roboRIO target



Project: 2017 Robot Project.lvproj
- My Computer
- Target (roboRIO-1234-FRC.local)
  - Support Code
  - Team Code
    - Autonomous Independent.vi
    - Begin.vi
    - Disabled.vi
    - Finish.vi
    - Periodic Tasks.vi
    - Robot Global Data.vi
    - Teleop.vi
    - Test.vi
    - Vision Processing.vi
  - Robot Main.vi
  - Dependencies
  - Build Specifications

Parts of a VI: Front Panel

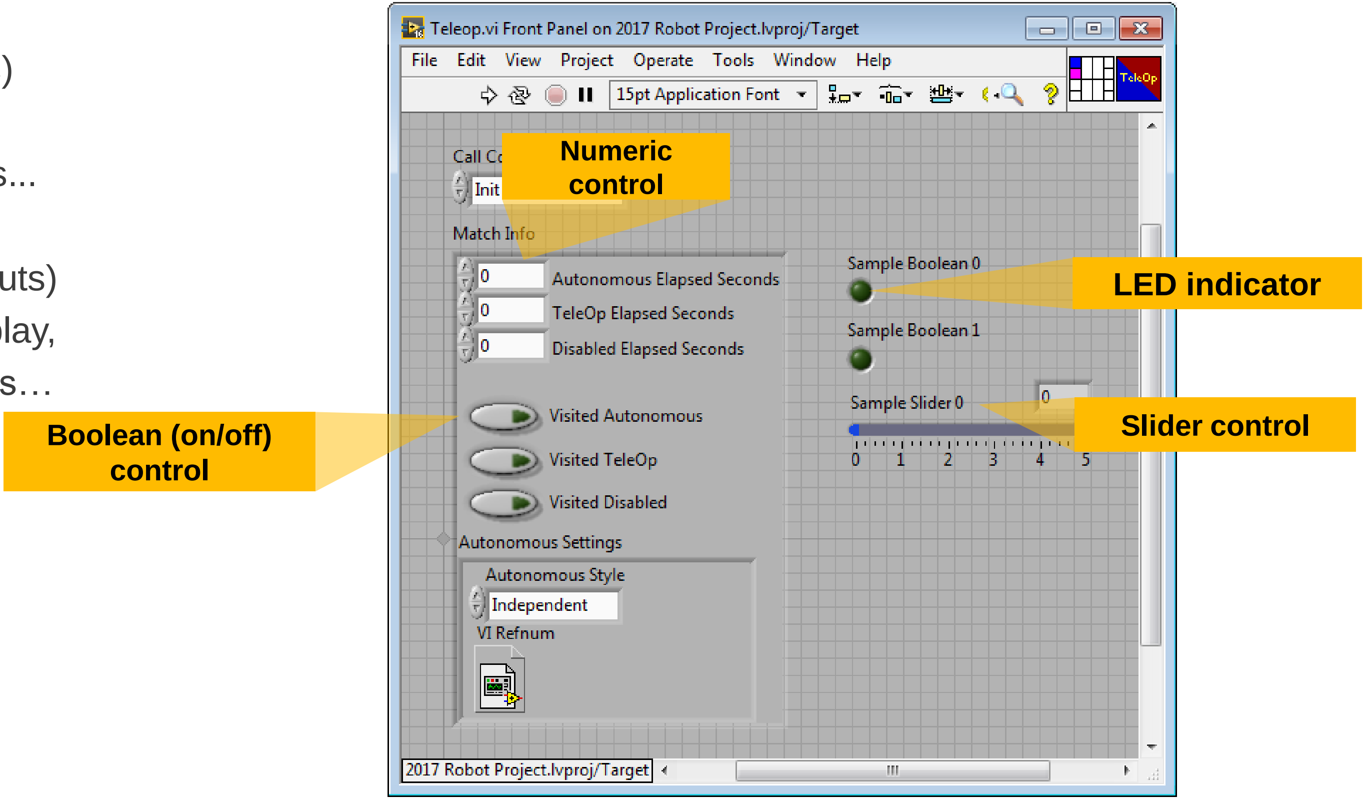
The front panel is the VI's graphical user interface with inputs and outputs.

Controls (inputs)

- buttons,
- knobs, slides...

Indicators (outputs)

- numeric display,
- graphs, LEDs…



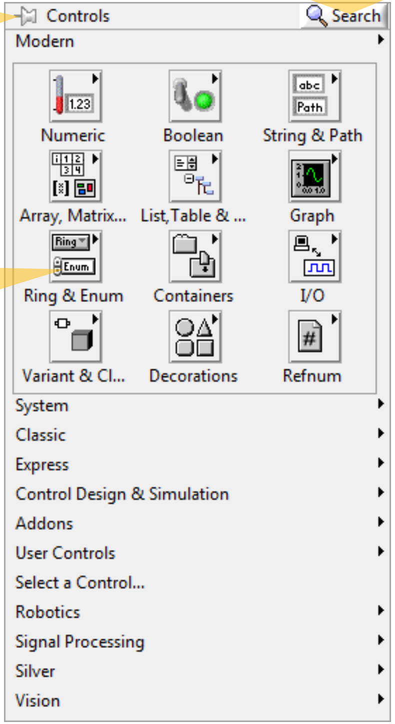
Controls Palette

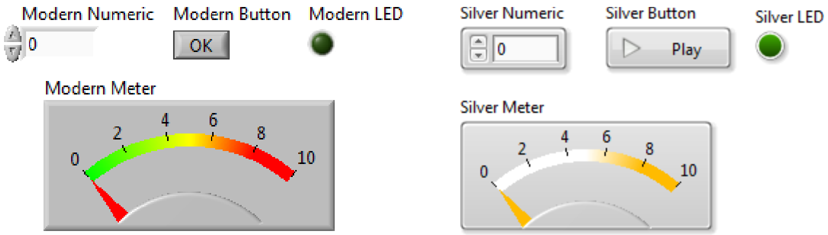
Right-click on the **front panel** (not the block diagram) to open the Controls Palette

Search for controls

Pin to keep open

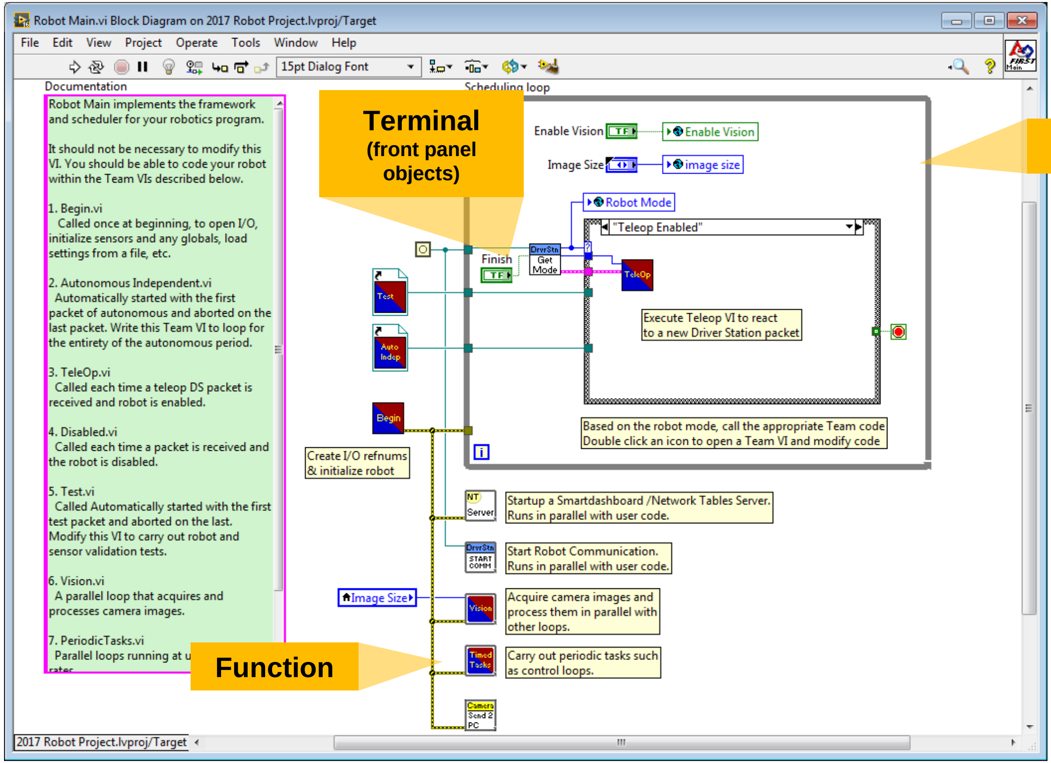
Browse subpalettes





Parts of a VI: Block Diagram

- The block diagram is the code for each VI. In LabVIEW, graphical blocks are connected with wires to control the execution.



Robot Main.vi Block Diagram on 2017 Robot Project.lvproj/Target

Documentation

Robot Main implements the framework and scheduler for your robotics program.

It should not be necessary to modify this VI. You should be able to code your robot within the Team VIs described below.

1. Begin.vi
 Called once at beginning, to open I/O, initialize sensors and any globals, load settings from a file, etc.

2. Autonomous Independent.vi
 Automatically started with the first packet of autonomous and aborted on the last packet. Write this Team VI to loop for the entirety of the autonomous period.

3. TeleOp.vi
 Called each time a teleop DS packet is received and robot is enabled.

4. Disabled.vi
 Called each time a packet is received and the robot is disabled.

5. Test.vi
 Called Automatically started with the first test packet and aborted on the last. Modify this VI to carry out robot and sensor validation tests.

6. Vision.vi
 A parallel loop that acquires and processes camera images.

7. PeriodicTasks.vi
 Parallel loops running at u
rates

Execute Teleop VI to react to a new Driver Station packet

Based on the robot mode, call the appropriate Team code
Double click an icon to open a Team VI and modify code

Create I/O refnums & initialize robot

Startup a Smartdashboard /Network Tables Server. Runs in parallel with user code.

Start Robot Communication. Runs in parallel with user code.

Acquire camera images and process them in parallel with other loops.

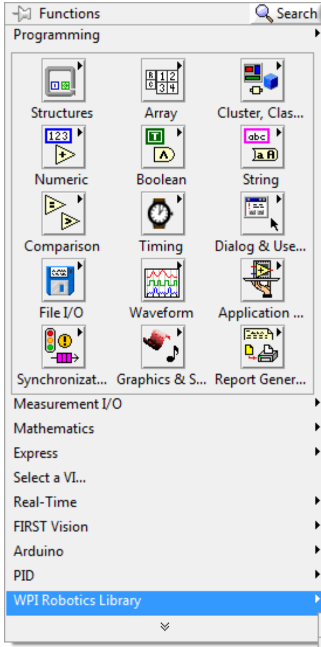
Carry out periodic tasks such as control loops.

Terminal (front panel objects)

Loop

Function

Functions Palette

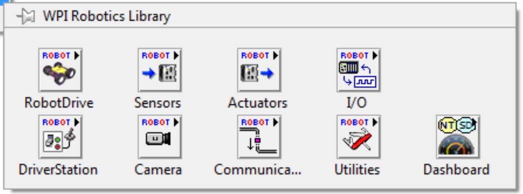


Search for functions by name

•Right-click on the **block diagram** (not the front panel) to open the Functions Palette

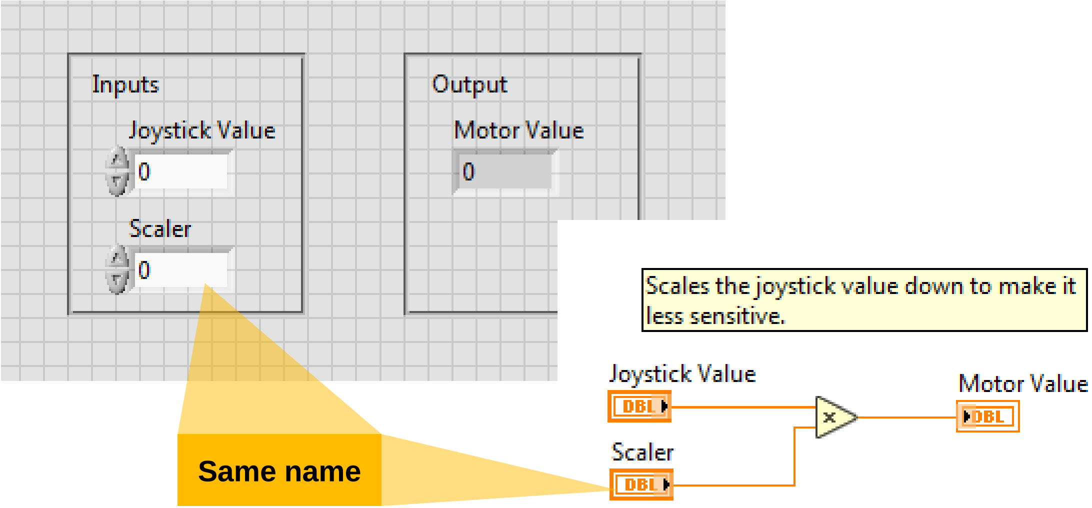
•Contains the VIs, functions, and constants you use to create the block diagram

•FRC-specific palettes include the WPI Robotics Library, *FIRST* Vision, and PID



Terminals

- With terminals, you can read and write to front panel controls and indicators.



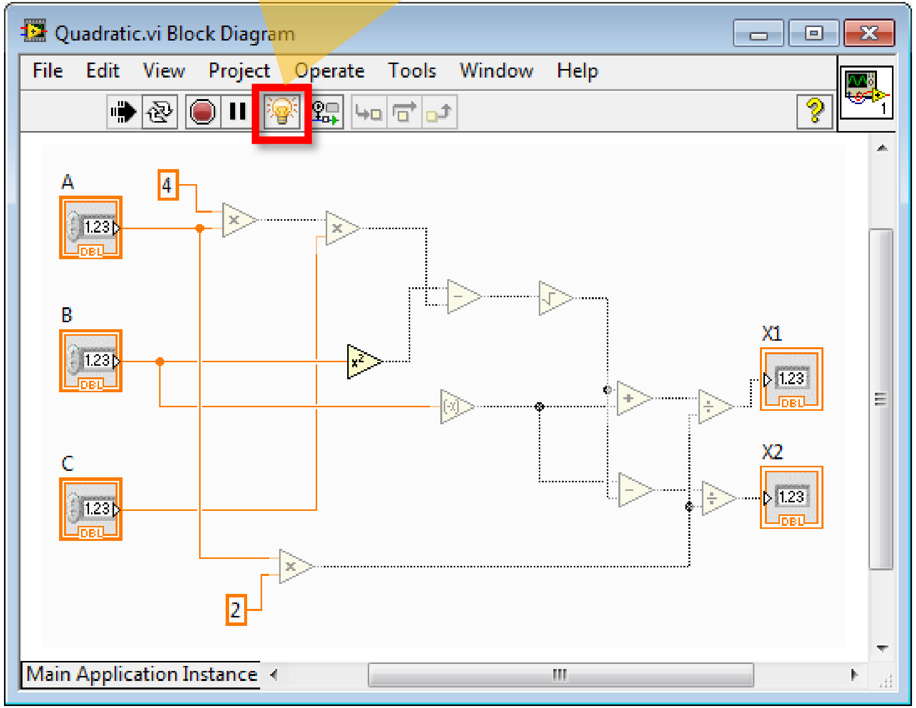
Scales the joystick value down to make it less sensitive.

Same name

Dataflow Programming

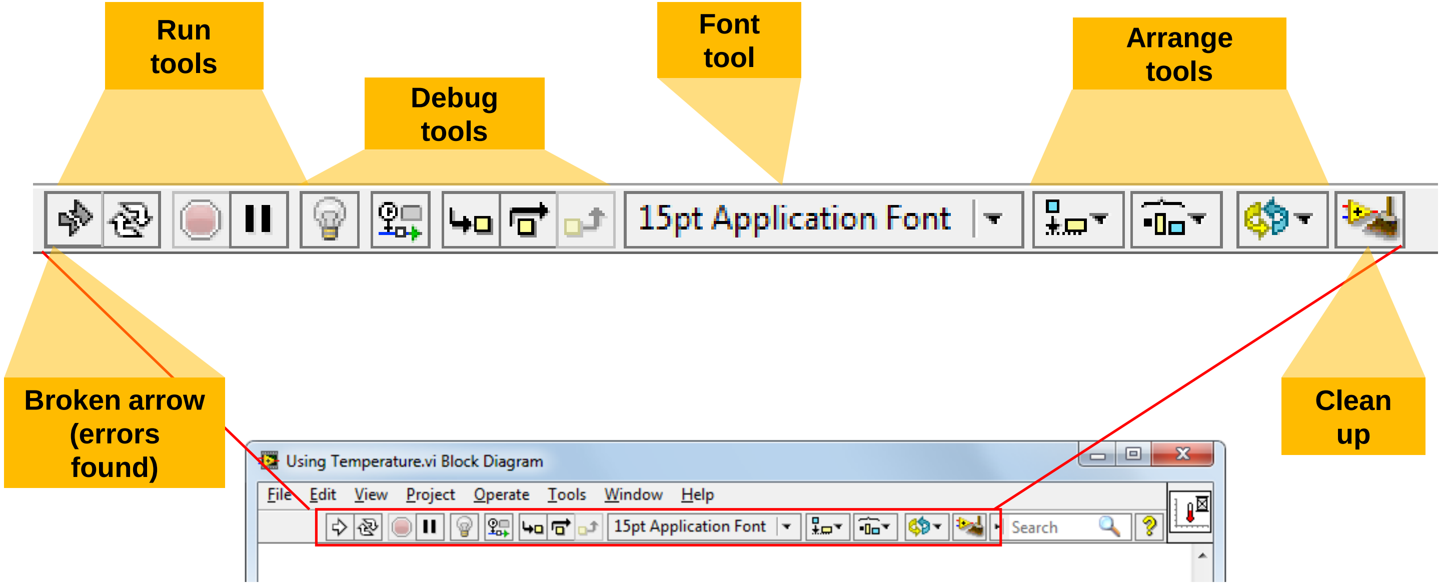
- Order of execution is controlled by how the wires are connected
- Each function executes when all of the inputs are ready
- Parallel code executes at the same time

Turn on highlight execution



LabVIEW Toolbar

- The tools you need to run, debug, clean up, and edit your code



Run tools

Debug tools

Font tool

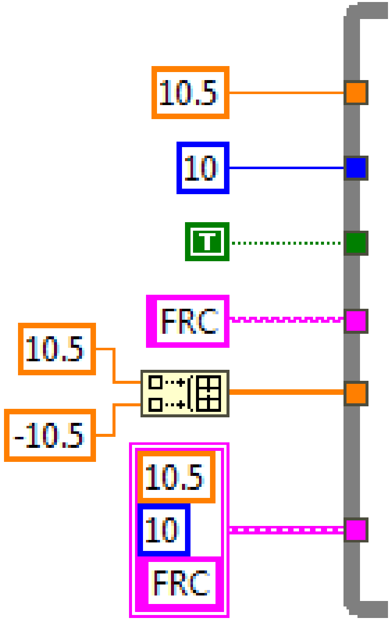
Arrange tools

Broken arrow (errors found)

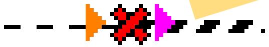
Clean up

Wires (Data Types)

- Other examples of wires in LabVIEW



- Floating point
- Integer
- Boolean
- String
- Array—note the wire thickness
- Cluster (group of other data types)

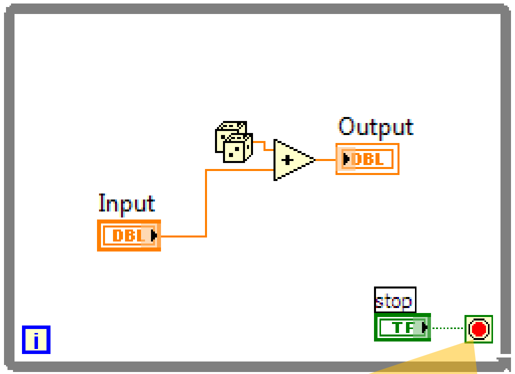


Broken wire (type mismatch)

Loops

- Allow the same piece of code to run multiple times
- Exit conditions are different for each

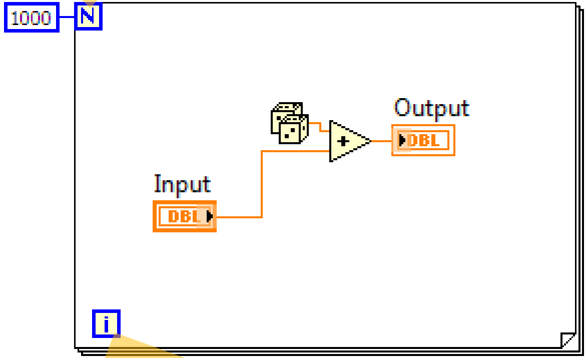
While Loop



Run until stop condition met

Run N times

For Loop

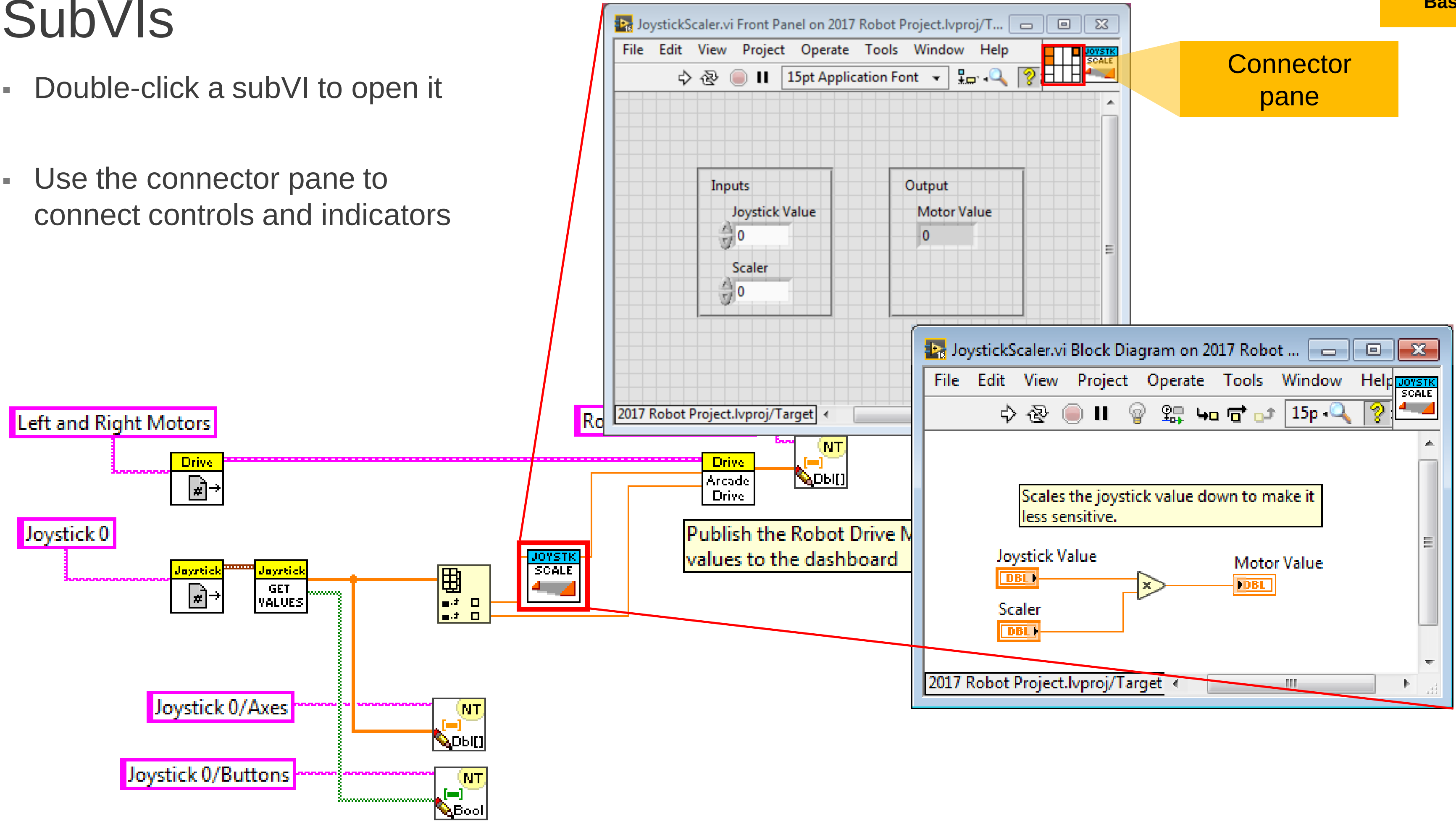


Iteration counter

LabVIEW Basics

SubVIs

- Double-click a subVI to open it
- Use the connector pane to connect controls and indicators



Connector pane

Scales the joystick value down to make it less sensitive.

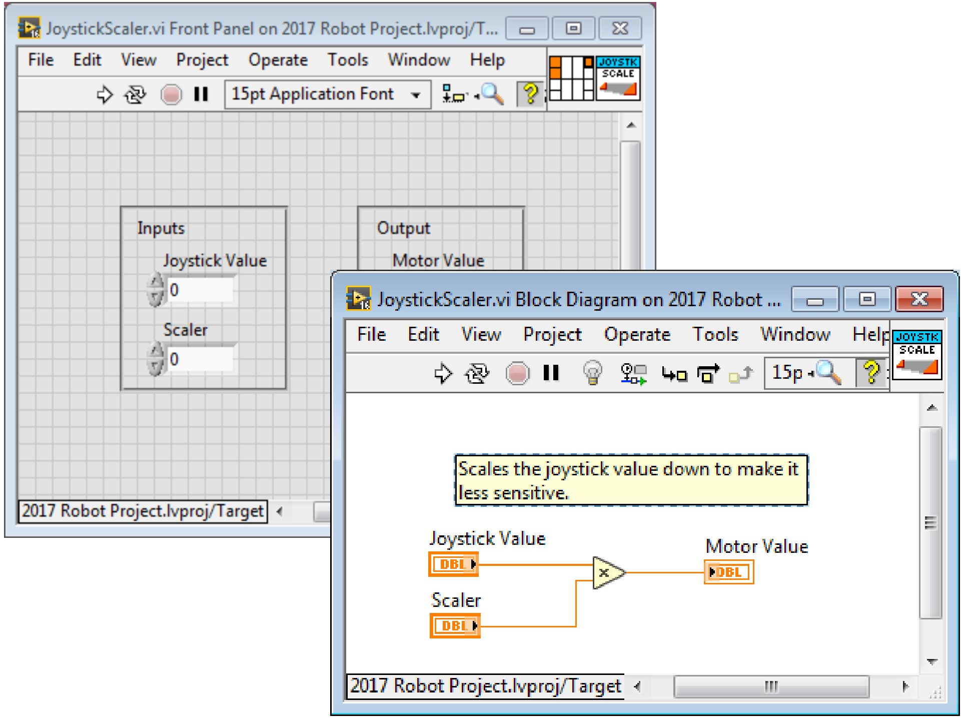
Publish the Robot Drive M values to the dashboard

JoystickScaler.vi Front Panel on 2017 Robot Project.lvproj/T...
File Edit View Project Operate Tools Window Help
15pt Application Font
JOYSTK SCALE
Inputs
Joystick Value
0
Scaler
0
Output
Motor Value
0
2017 Robot Project.lvproj/Target
JoystickScaler.vi Block Diagram on 2017 Robot ...
File Edit View Project Operate Tools Window Help
15p
Joystick Value
DBL
Scaler
DBL
Motor Value
DBL
2017 Robot Project.lvproj/Target
Left and Right Motors
Drive
Joystick 0
Joystick
Joystick GET VALUES
JOYSTK SCALE
Ro
Drive Arcade Drive
NT
Dbl[]
Joystick 0/Axes
Dbl[]
Joystick 0/Buttons
Bool

LabVIEW Programming Demonstration

Programming Demonstration

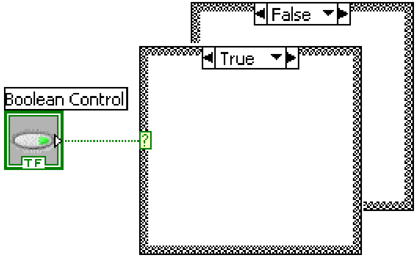
- Front panel/block diagram
- Tools/functions palettes
- Controls/terminals
- Wiring
- Constants
- Dropping functions
- Run/run continuously
- Loops
- Data types
- Highlight execution


JoystickScaler.vi Front Panel on 2017 Robot Project.lvproj/T...
File Edit View Project Operate Tools Window Help
15pt Application Font
JOYSTK SCALE
Inputs
Joystick Value
0
Scaler
0
Output
Motor Value
2017 Robot Project.lvproj/Target
JoystickScaler.vi Block Diagram on 2017 Robot ...
File Edit View Project Operate Tools Window Help
15p
JOYSTK SCALE
Joystick Value
DBL
Scaler
DBL
Motor Value
DBL
2017 Robot Project.lvproj/Target

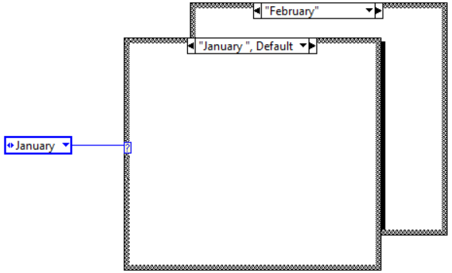
Scales the joystick value down to make it less sensitive.

How Do I Make Decisions in LabVIEW?

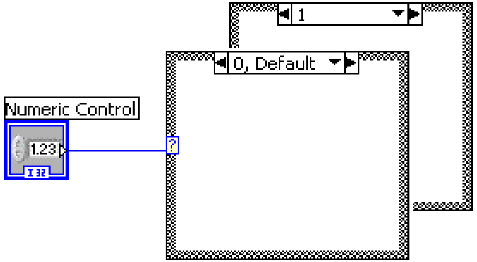
Case Structures



(a)

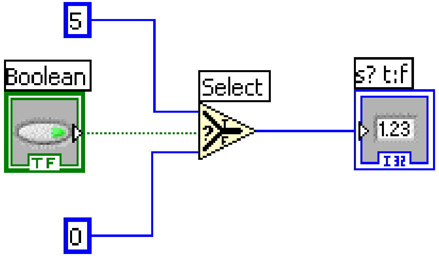


(b)



(c)

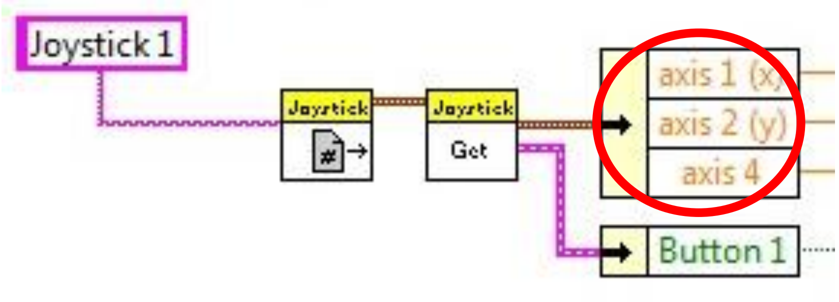
Select



Introduction to Clusters

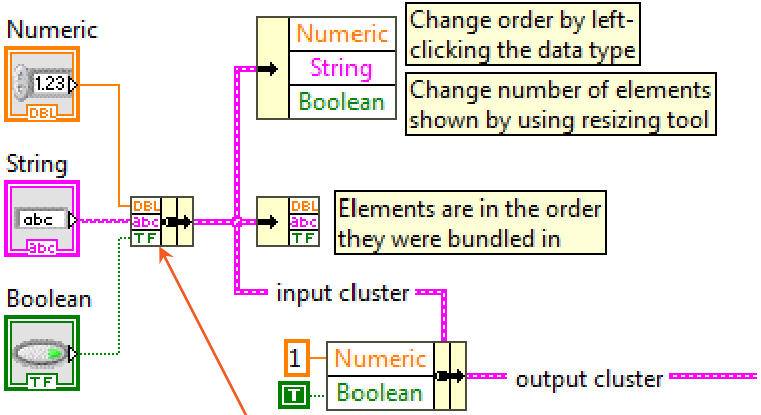
- Data structure that groups data together
- Data may be of different types
- Elements must be either all controls or all indicators
- Thought of as wires bundled into a cable

  Easier to bundle wires together and pass around as a group than wire each individually
- **Use Unbundle By Name/Bundle By Name**



Cluster Functions

- In the Cluster & Variant subpalette of the Programming functions palette
- Can also be accessed by right-clicking the cluster terminal



Change order by left-clicking the data type

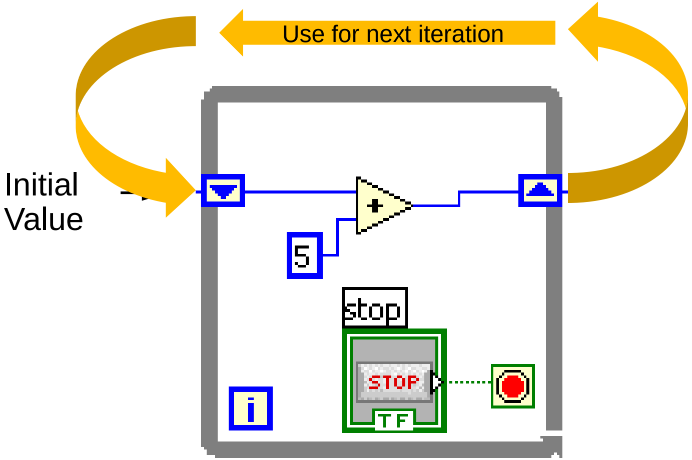
Change number of elements shown by using resizing tool

Elements are in the order they were bundled in

(terminal labels reflect data type)

Shift Register: Access Previous Loop Data

- Available at left or right border of loop structures
- Right-click the border and select Add Shift Register
- Right terminal stores data on completion of iteration
- Left terminal provides stored data at beginning of next iteration

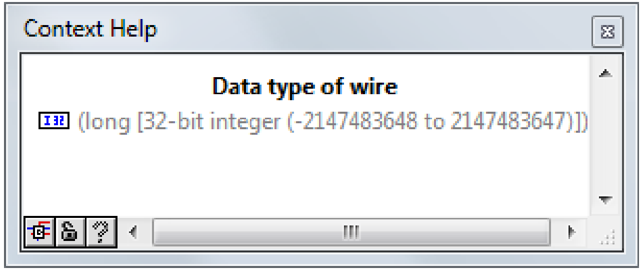


Context Help

- Displays basic information about wires and nodes when you hover over with your mouse

- Turn context help on/off
  - Click the yellow ? on the top right corner of your VI
  - Press <Ctrl-H>
  - Select **Help»Show Context Help** from the LabVIEW menu

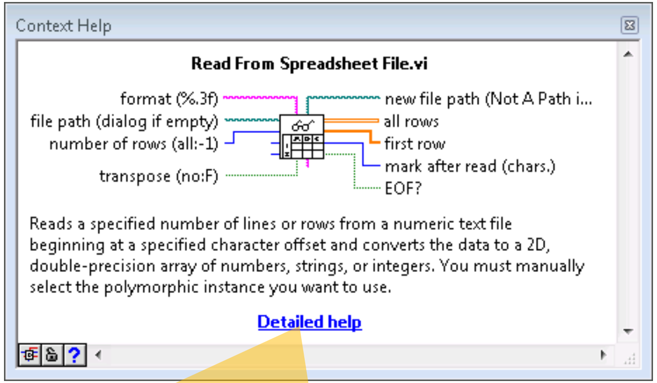
Click ? to open context help



Context Help

Data type of wire

I32 (long [32-bit integer (-2147483648 to 2147483647)])



Context Help

Read From Spreadsheet File.vi

Reads a specified number of lines or rows from a numeric text file beginning at a specified character offset and converts the data to a 2D, double-precision array of numbers, strings, or integers. You must manually select the polymorphic instance you want to use.

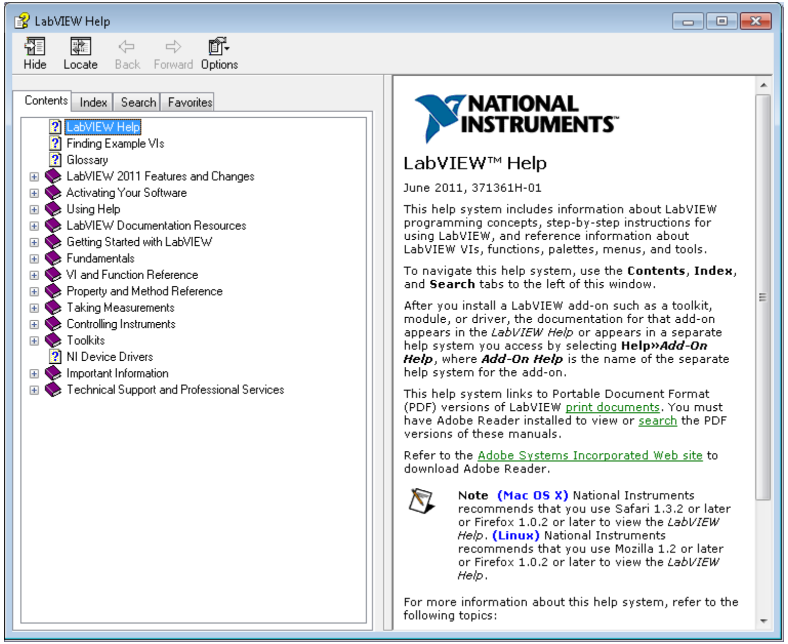
Detailed help

Click for more info

LabVIEW Help

- Contains detailed descriptions and instructions for most palettes, menus, tools, VIs, and functions.

- Open LabVIEW Help by
  - ○ Selecting **Help»LabVIEW Help** from the menu
  - ○ Clicking the **Detailed help** link in the **Context Help** window
  - ○ Right-clicking an object and selecting **Help** from the shortcut menu
  - ○ Pressing **F1**



- LabVIEW Help
- Finding Example VIs
- Glossary
- LabVIEW 2011 Features and Changes
- Activating Your Software
- Using Help
- LabVIEW Documentation Resources
- Getting Started with LabVIEW
- Fundamentals
- VI and Function Reference
- Property and Method Reference
- Taking Measurements
- Controlling Instruments
- Toolkits
- NI Device Drivers
- Important Information
- Technical Support and Professional Services

NATIONAL INSTRUMENTS

LabVIEW™ Help

June 2011, 371361H-01

This help system includes information about LabVIEW programming concepts, step-by-step instructions for using LabVIEW, and reference information about LabVIEW VIs, functions, palettes, menus, and tools.

To navigate this help system, use the **Contents**, **Index**, and **Search** tabs to the left of this window.

After you install a LabVIEW add-on such as a toolkit, module, or driver, the documentation for that add-on appears in the *LabVIEW Help* or appears in a separate help system you access by selecting **Help»*Add-On Help***, where ***Add-On Help*** is the name of the separate help system for the add-on.

This help system links to Portable Document Format (PDF) versions of LabVIEW print documents. You must have Adobe Reader installed to view or search the PDF versions of these manuals.

Refer to the Adobe Systems Incorporated Web site to download Adobe Reader.

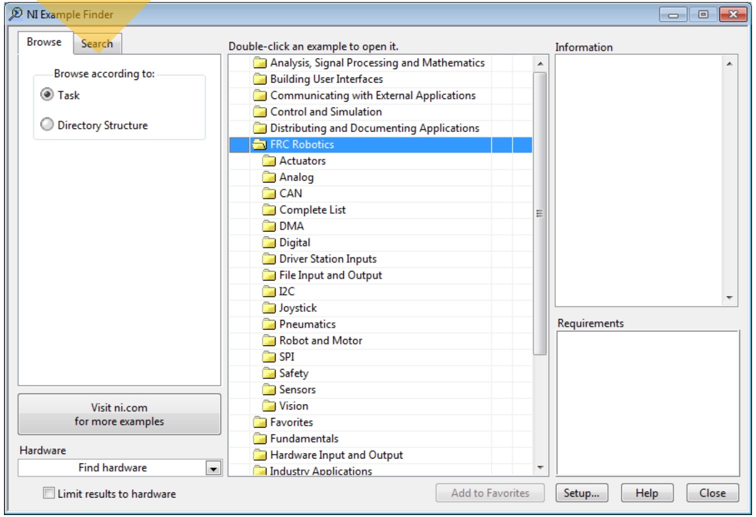
Note **(Mac OS X)** National Instruments recommends that you use Safari 1.3.2 or later or Firefox 1.0.2 or later to view the *LabVIEW Help*. **(Linux)** National Instruments recommends that you use Mozilla 1.2 or later or Firefox 1.0.2 or later to view the *LabVIEW Help*.

For more information about this help system, refer to the following topics:

Find Examples

- Find FRC templates in the Support Tab»Find FRC Examples…
- Or Help»Find Examples and browse to the FRC Robotics Folder

Search by keyword



NI Example Finder

Browse | Search

Browse according to:
● Task
○ Directory Structure

Visit ni.com for more examples

Hardware
Find hardware
□ Limit results to hardware

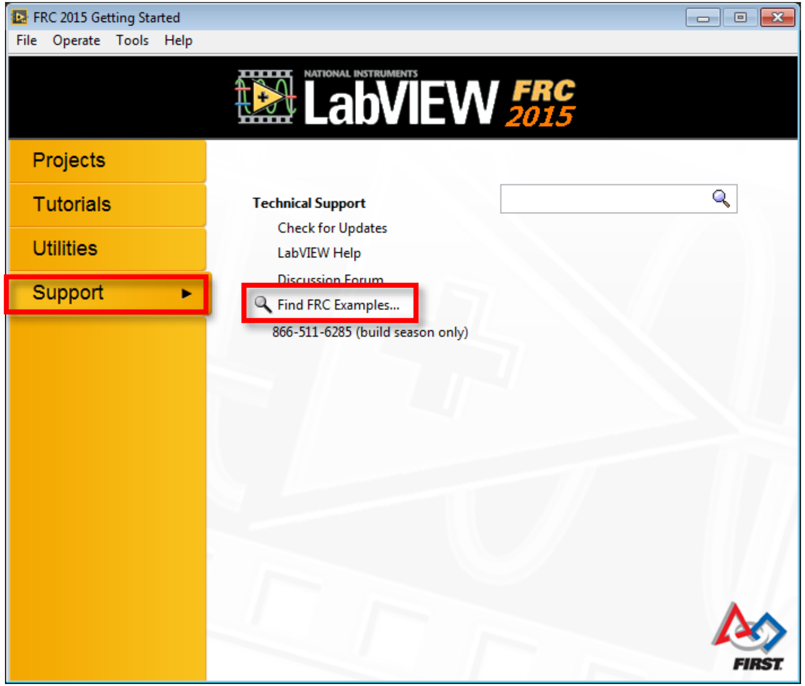
Double-click an example to open it.

- Analysis, Signal Processing and Mathematics
- Building User Interfaces
- Communicating with External Applications
- Control and Simulation
- Distributing and Documenting Applications
- FRC Robotics
  - Actuators
  - Analog
  - CAN
  - Complete List
  - DMA
  - Digital
  - Driver Station Inputs
  - File Input and Output
  - I2C
  - Joystick
  - Pneumatics
  - Robot and Motor
  - SPI
  - Safety
  - Sensors
  - Vision
- Favorites
- Fundamentals
- Hardware Input and Output
- Industry Applications

Information

Requirements

Add to Favorites | Setup... | Help | Close



FRC 2015 Getting Started

File Operate Tools Help

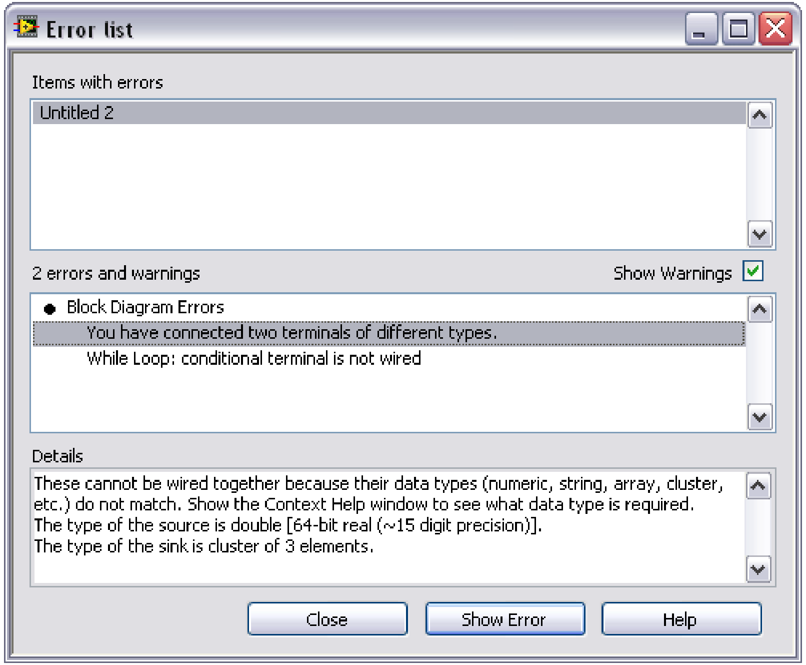
Projects
Tutorials
Utilities
Support ▸

Technical Support
Check for Updates
LabVIEW Help
Discussion Forum
Find FRC Examples...
866-511-6285 (build season only)

Debugging: Correcting Broken VIs

Broken Run arrow»VI cannot be compiled»VI cannot be executed

Click to open Error List



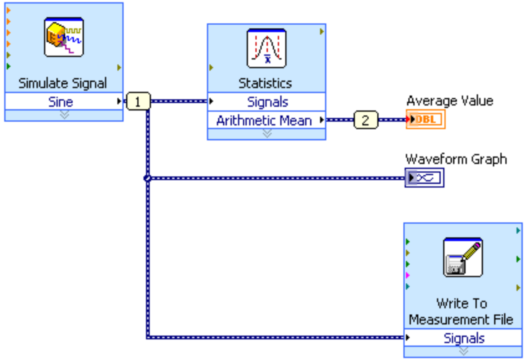
- Block Diagram Errors
  - You have connected two terminals of different types.
  - While Loop: conditional terminal is not wired

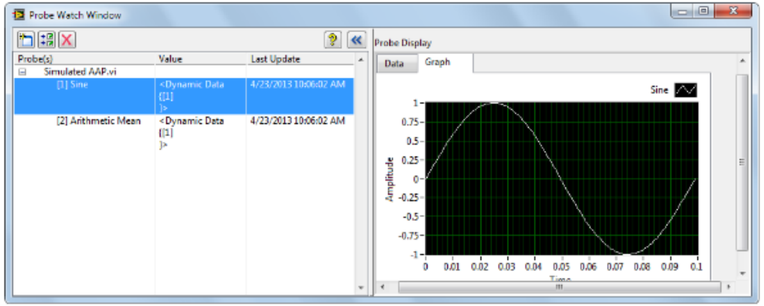
Details

These cannot be wired together because their data types (numeric, string, array, cluster, etc.) do not match. Show the Context Help window to see what data type is required.
The type of the source is double [64-bit real (~15 digit precision)].
The type of the sink is cluster of 3 elements.

Debugging: Probes

- Use the Probe tool to observe intermediate data values and check the error output of VIs and functions, especially those performing I/O.
- Specify to retain the values in the wires so that you can probe wires for data after execution.

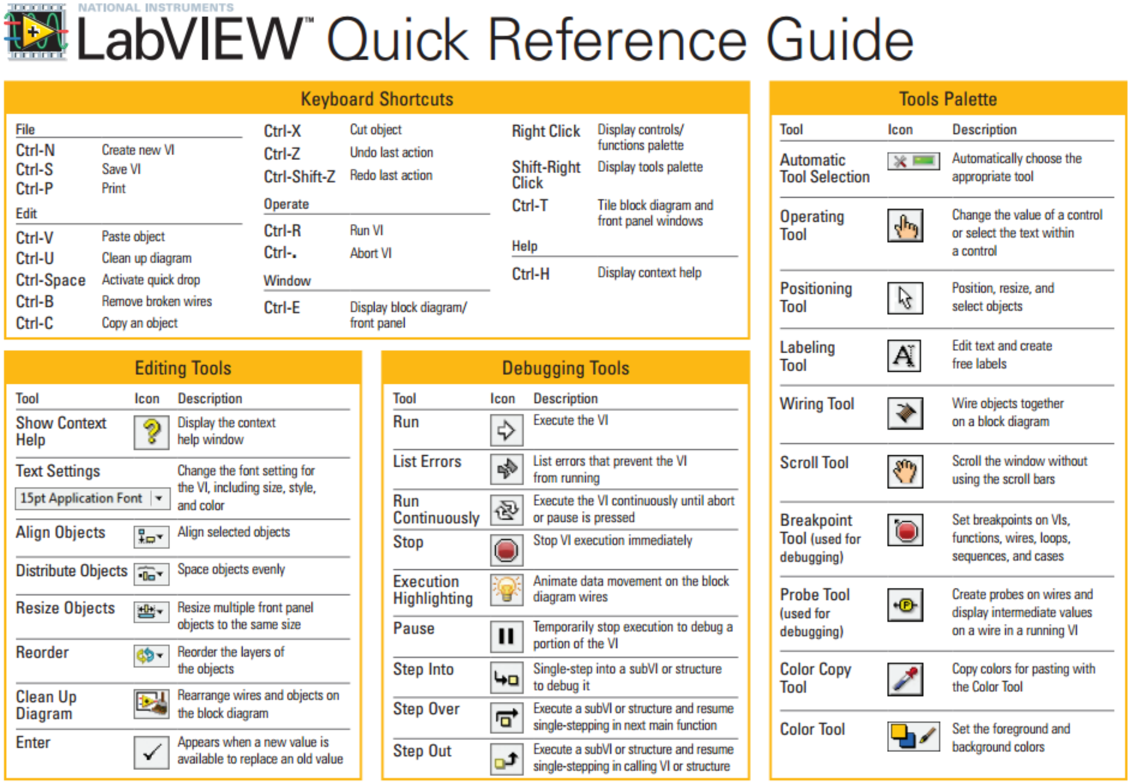




Probe(s)	Value	Last Update
Simulated AAP.vi		
[1] Sine	<Dynamic Data {[1]]>	4/23/2013 10:06:02 AM
[2] Arithmetic Mean	<Dynamic Data {[1]]>	4/23/2013 10:06:02 AM

LabVIEW Basics

Learn Your Hotkeys



NATIONAL INSTRUMENTS

LabVIEW™ Quick Reference Guide

Keyboard Shortcuts

File	
Ctrl-N	Create new VI
Ctrl-S	Save VI
Ctrl-P	Print

Edit	
Ctrl-V	Paste object
Ctrl-U	Clean up diagram
Ctrl-Space	Activate quick drop
Ctrl-B	Remove broken wires
Ctrl-C	Copy an object
Ctrl-X	Cut object
Ctrl-Z	Undo last action
Ctrl-Shift-Z	Redo last action

Operate	
Ctrl-R	Run VI
Ctrl-.	Abort VI

Window	
Ctrl-E	Display block diagram/ front panel

Right Click	Display controls/ functions palette
Shift-Right Click	Display tools palette
Ctrl-T	Tile block diagram and front panel windows

Help	
Ctrl-H	Display context help

Editing Tools

Tool	Icon	Description
Show Context Help	?	Display the context help window
Text Settings 15pt Application Font ▾		Change the font setting for the VI, including size, style, and color
Align Objects		Align selected objects
Distribute Objects		Space objects evenly
Resize Objects		Resize multiple front panel objects to the same size
Reorder		Reorder the layers of the objects
Clean Up Diagram		Rearrange wires and objects on the block diagram
Enter	✓	Appears when a new value is available to replace an old value

Debugging Tools

Tool	Icon	Description
Run	⇨	Execute the VI
List Errors		List errors that prevent the VI from running
Run Continuously		Execute the VI continuously until abort or pause is pressed
Stop	●	Stop VI execution immediately
Execution Highlighting		Animate data movement on the block diagram wires
Pause	⏸	Temporarily stop execution to debug a portion of the VI
Step Into		Single-step into a subVI or structure to debug it
Step Over		Execute a subVI or structure and resume single-stepping in next main function
Step Out		Execute a subVI or structure and resume single-stepping in calling VI or structure

Tools Palette

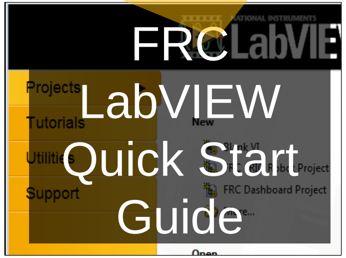
Tool	Icon	Description
Automatic Tool Selection		Automatically choose the appropriate tool
Operating Tool		Change the value of a control or select the text within a control
Positioning Tool		Position, resize, and select objects
Labeling Tool	A	Edit text and create free labels
Wiring Tool		Wire objects together on a block diagram
Scroll Tool		Scroll the window without using the scroll bars
Breakpoint Tool (used for debugging)	●	Set breakpoints on VIs, functions, wires, loops, sequences, and cases
Probe Tool (used for debugging)	P	Create probes on wires and display intermediate values on a wire in a running VI
Color Copy Tool		Copy colors for pasting with the Color Tool
Color Tool		Set the foreground and background colors

Setup Resources

- Learn LabVIEW—Video Training
- LabVIEW Environment Overview
- Creating Custom Controls
- LabVIEW Dataflow
- LabVIEW Tools
- LabVIEW Data Structures
- LabVIEW Debugging
- WPI Library Overview

- Forum Support (year round)
  - ni.com/frc
- Phone Support (during build season only)
  - (866) 511-6285 from 1:00 to 7:00 pm (Central Time)

All links available at ni.com/frc or click this button


FRC LabVIEW Quick Start Guide