Getting Started with the 2013 FRC Control System

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Welcome to the 2013 FRC season! This document is to be used after the electrical assembly of the Robot Control System is completed, either via the instructions in the Electrical Assembly portion of the Robot Quick Build Instructions or on a previously built robot.

If you have feedback on the system or this document please post your comments on the FIRST Control System Forum at http://forums.usfirst.org/forumdisplay.php?f=23

Acquire Needed Documentation

You will need the following documents as you assemble your control system. Before you even open the Kit of Parts, we suggest you save all of these documents so they are ready for immediate reference by your team. These documents can all be found on the FRC Kit of Parts Website (http://www.usfirst.org/frc/kitofparts).

- Getting Started with the 2013 FRC Control System (this document)
- 2013 Kickoff Kit Checklist
- 2013 Robot Power Distribution Diagram
- 2013 Robot Data Connectivity Diagram

Identify and Inventory Control System Components

Identify each of the components in your Kit using the descriptions and photos provided in the Kickoff Kit Checklist. Record the quantities you received on your printed checklist. Report any inconsistencies within 3 days of receiving your Kit to TIMS as directed in the 2013 Competition Manual.

Veteran teams will need to gather the following items from Kit of Parts from 2009 or later:

- cRIO
- Joysticks
- Computer to run Driver Station software (Like the Classmate)

Install Software on the Computer You Choose to Use for Development

Note: If you are using the Classmate as your development machine, you should skip these steps and go to "How to Set Up Your 2013 Classmate" before completing these steps.

The 2013 FRC Control System can be programmed in LabVIEW, Java or C/C++. Teams should choose their programming language at this point. The Classmate is a likely candidate for your Driver Station hardware, but you are also invited to use it for development, if that's appropriate for your team. Teams may choose National Instruments LabVIEW, which supports a graphical programming language; Wind River Workbench, which supports C and C++ languages; or Net-Beans which supports Java. After compiling, executables are transferred to the cRIO.

Regardless of the programming language you plan to use, you must install the FRC Tools from the National Instruments DVD included in the 2013 Kit of Parts.

If you would like to use LabVIEW, you can install it from the same National Instruments DVD.

If you would like to use C/C++, you can install Wind River Workbench 3.0/3.3 from the Wind River discs included in the Kit of Parts.

If you would like to use Java, you can download Netbeans 7.2 IDE from http://java.sun.com.

After you've installed your programming language base software, all teams must install the language specific updates.

- LabVIEW (http://joule.ni.com/nidu/cds/view/p/id/2261)
- Java (http://firstforge.wpi.edu/sf/frs/do/viewSummary/projects.wpilib/frs)
- C/C++ (http://firstforge.wpi.edu/sf/frs/do/viewSummary/projects.wpilib/frs)

Next, all languages are required to install the Utilities update (http://joule.ni.com/nidu/cds/view/p/id/2262).

If you plan to use the Driver Station application on your development machine, you must also install the Driver Station Update (http://joule.ni.com/nidu/cds/view/p/id/2263).

To program the DAP-155 RevB radio, you will need to install the FRC Bridge Configuration Utility (http://www.usfirst.org/roboticsprograms/frc/2013-Technical-Resources)

Licensing

The National Instruments LabVIEW license and WindRiver license are active through January 2014. Java has no expiration date.

The National Instruments serial number is S14X86763.

The Wind River Workbench License Authorization Code (LAC) is pre-populated in the installer.

Teams are permitted to install the software on as many team computers as needed, subject to the restrictions and license terms that accompany the applicable software, and provided that only team members or mentors use the software, and solely for the FRC. Rights to use LabVIEW and Workbench are governed solely by the terms of the license agreements that are shown during the installation of the applicable software.

Installation Requirements

The installation has been tested on Windows 7 operating system.

To install, you must be logged on as an administrator or as a user with administrator privileges. You will need Internet access to activate the Wind River and NI Licenses.

Requirements for the LabVIEW Programming Environment

Installation of the "LabVIEW Package" from the FRC DVD requires 3.91 GB total disk space. This package takes an average of 1.5 hours to install. Installation on a Vista operating system sometimes takes longer. If you currently have National Instruments software on your PC, it will not interfere with that installation. However it will install over another version of LabVIEW 2012.

Requirements for the C/C++ Programming Environment

Installation of the "Wind River Package" from the FRC DVD requires 2.4 GB total disk space. Note that even the C/C++ programming environment will require installation of many portions of the NI software to support the cRIO. On a Windows XP platform the Wind River software takes an average of ½ hour to install. The FRC installation must be installed in the directory "c:\WindRiver". A different version of Workbench on your PC can remain installed, but it must be in a different directory.

Note: If you are installing WindRiver on a 64-bit machine, please read through the complete set of installation instructions located here before beginning installation: http://wpilib.screenstepslive.com/s/3120/m/7913/l/79732-installing-the-c-development-tools

Users of the software must read the license agreements that are shown during installation of the software carefully and completely.

Requirements for the Java Programming Environment

Installation of the "Java package" requires a minimum of 350 MB disk space and 512 RAM. Note that even the Java programming environment will require installation of many portions of the NI software to support the cRIO. On a Windows XP platform the Java software takes an average ½ hour to install. Users of the software must read the license agreements that are shown during installation of the software carefully and completely.

Before Installing

Deactivate / Uninstall software

1. Disable any automatic virus detection programs before you install. Some virus detection programs interfere with installation. (NOTE: Some of the beta test teams that did not disable virus detection before installation needed to re-install their programming environments again to remedy problems encountered in installation.)
2. If you have another version of the Wind River Workbench installed, make sure it is not in the C:\WindRiver directory because that is the preferred location for the FRC installation (some of the tools expect that location).

FOR ALL LANGUAGES Install LabVIEW 2012 and Associated Components

1. Insert the NI LabVIEW 2012 for FRC 2013 DVD. If the Autorun program doesn't open, navigate to the DVD drive through "My Computer" and click **Autorun**.
2. If you're programming in LabVIEW, click the **Install Everything** link and follow the instructions that appear on the screen. If you're programming in C/C++ or Java, click the **Install only the FRC Tools** link and follow the instructions that appear on the screen.
3. When prompted, enter the serial number, S14X86763, in the **Serial Number** text box.
4. On the **Installation Summary** page, choose to **Run License Manager to activate the product(s)** and click the **Next** button to display the NI Activation Wizard.
5. Select the **Automatically activate through a secure Internet connection** option and click the **Next** button.
6. Enter the serial number, S14X86763, in the **LabVIEW 2013 FIRST Robotics Competition** text box.
7. Follow the instructions that appear on the screen to complete activation.
8. Install updates, see above.

Install Wind River Workbench

Installation Procedure

NOTE: If you have just installed the NI DVD the National Instruments Activation Wizard may start while Workbench is being installed. Internet access is needed to complete the install for Workbench.

Insert the DVD. After a few minutes the Installer-Welcome screen will appear. Follow instructions on your screen.

At the Installer-Choose Activation Type screen, select Permanent activation and click Browse.
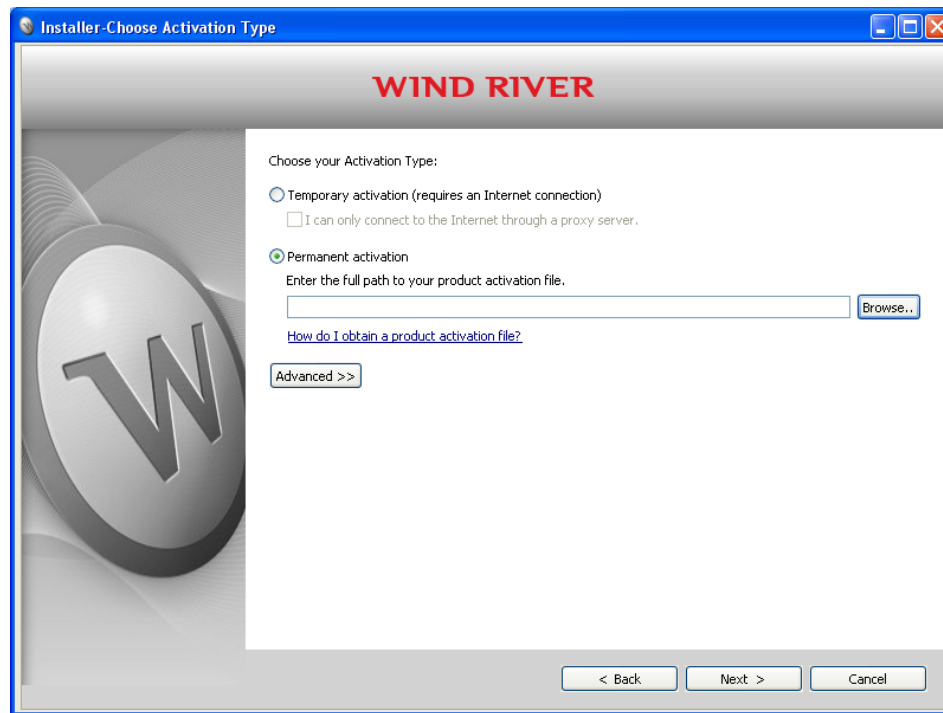
Browse to the DVD-R138732.1-1 directory and select FirstRobotics_2013_install.txt file. Click Open. No internet connectivity is required to obtain your product activation file (FirstRobotics_2012_install.txt).

The FirstRobotics_2013_install.txt file contains the installation keys and licensing needed to install and activate Wind River products. Once the path to the FirstRobotics_2013_install.txt (product activation file) is displayed under Permanent activation, click Next.

At the Installer-Choose Installation Filters screen, make no changes. Click Next. Follow the instructions until the process is complete.

Installing Java and Tools

Installation Procedure

This is an overview on to install the Java SDK for FRC. For complete details please read the "Getting Started with Java" found at http://wpilib.screenstepslive.com/s/3120/m/7885.

Required Software

In order to setup your machine to program in Java, the following software components are required:

- Java SE Development Kit (JDK) version 6.
- NetBeans IDE version 6.7 or later.
- SunSPOT Java SDK for FRC which includes WPILib.

All these components can be installed on Windows, Mac OSX, or Linux. Each platform requires slightly different installation procedures.

Install the Java tools in three steps, downloading the components from the Internet for each step:

1. Install the Java SE Development Kit (JDK) version 7 available from http://java.sun.com.
   Note: Your development system may already have the JDK installed, for example on Mac OS X.
   Note: On 64-bit Windows the SunSPOT tools still need a 32-bit JDK so download a JDK for platform "Windows" not "Windows x64." You can install the JDK in C:\Java\32-bit\ even if you also have a 64-bit JDK in, say, C:\Java\. Give this SDK location to the NetBeans installer wizard.
2. Install NetBeans version 7.2. This is available from http://netbeans.org/downloads.
3. Add the FRC plugins to NetBeans. These plugins can be downloaded from the WPILib project on http://firstforge.wpi.edu/sf/projects/wpilib or installed via the NetBeans built in downloader as described in the following sections of this document.

Note: The details of each step vary by operating system and browser.

Besides the tools for Java programming you'll also need:

- The FRC cRIO Imaging Tool to format/initialize your cRIO for Java programming. This tool is currently only released and supported for Windows.
- Optionally the FRC Driver Station software to control your robot, also only supported on Windows.

These tools are available online as an update to the installed LabVIEW platform installer DVD that is included with the kit of parts:

Utilities update (http://joule.ni.com/nidu/cds/view/p/id/2262).
Driver Station Update (http://joule.ni.com/nidu/cds/view/p/id/2263).

Installing the NetBeans Plugins: Sun SPOT Java SDK for FRC and WPILib

The FRC Plugins add the FRC specific components to your standard NetBeans installation. The NetBeans plugins contain everything needed to extend your Java development environment to program your cRIO. The FRC plugins enable NetBeans to directly download and debug code on the NI cRIO controller. The plugins include project templates and sample programs to help you get started developing robot programs. For details on how to install the plugins offline, please read the "Getting Started with Java" guide.

Setting the internet plugin location in NetBeans
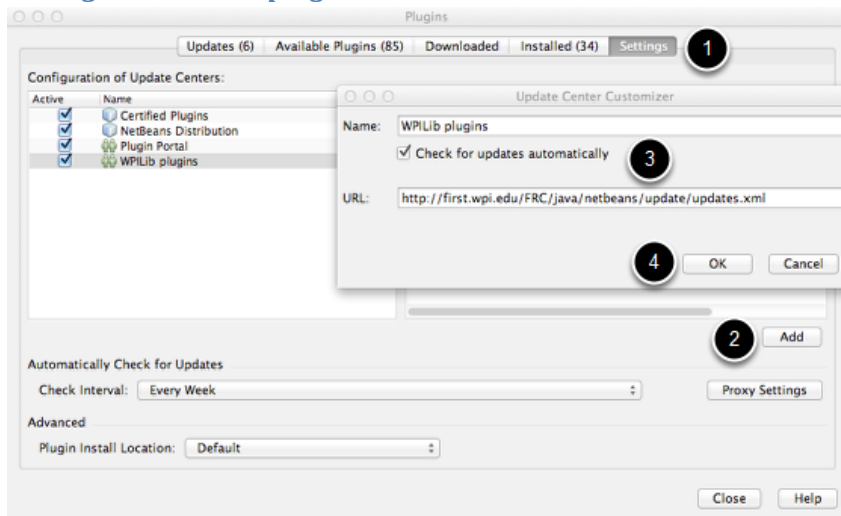
Intalling the plugins from the internet is best since NetBeans will look for updates when they are available and automically offer to install them. If you don't have access to the Internet for your development computer go onto the step "Downloading the plugins" to get the plugins and to set a local filesystem installation path.

To install from the Internet start NetBeans and choose Tools/Plugins from the menu. Click the "Settings" tab on the Plugins window (1) and select "Add" (2). Enter a name for the plugins, like "WPILib plugins" and enter the URL "http://first.wpi.edu/FRC/java/netbeans/update/updates.xml" (3). Then click "OK" (4) to add WPLILib to the list of available plugins.

Installing the downloaded plugins
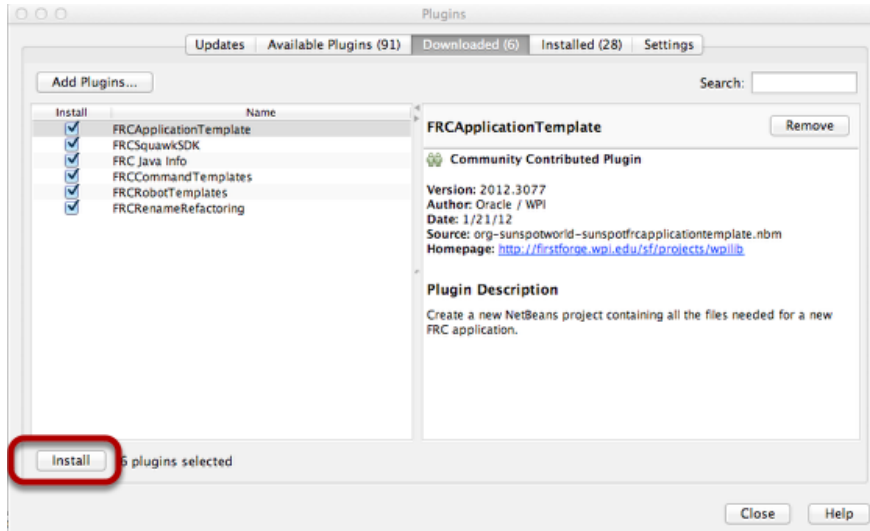
You should see the 6 downloaded plugins highlighted with the Install box checked on each of them. Click "Install" to add them to NetBeans. Accept all the default options and allow NetBeans to restart when you are given the option. Look out for notices of updates to the plugins and repeat these steps if an update is published.

How to Set Up Your 2013 Driver Station

Reimage the Classmate

It is not required for Veteran teams to reimage their Classmates. Rookie teams must install the 2013 image onto their E12 Classmates. To do this, please follow the steps below:

1) Make sure the Classmate is turned off, but plugged in.
2) Insert the "2013 Image" USB Thumb Drive into a USB port on the Classmate. (Remember use the appropriate image for your Classmate).
3) Power on the Classmate and tap the F11 key on the USB keyboard. Tapping the F11 key during boot will bring up the boot menu.
4) Use the arrow keys on the keyboard to select the USB device (it will be called "Generic Flash Disk").
5) Press the ENTER key when the USB device is highlighted.
6) To confirm that you want to reimage the Classmate, type "1" and click ENTER. Then, type "Y" and click ENTER. The Classmate will load the CTL AutoInstaller. The installation will take 15-30 minutes.
7) When the installation is complete, remove the USB drive.
8) Restart the Classmate. The Classmate will boot into Windows.

Initial Driver Station Boot

The first time the Classmate is turned on, there are some unique steps, listed below, that you'll need to take. The initial boot may take several minutes; make sure you do not cycle power during the process.

Please note that these steps are only required during original startup.

Initial Driver Station Set Up
1. Log into the Developer account.
2. Click "Ask me later".
3. Click "OK". The computer now enters a Set Up that may take a few minutes.
4. Establish an Internet connection.
5. Once you have an Internet connection, click the Start menu, right click "Computer" and click "Properties".
6. Scroll to the bottom section, "Windows activation", and Click "Activate Windows now"
7. Click "Activate Windows online now". The activation may take a few minutes.
8. When the activation is complete, close all of the windows.
9. Navigate through the Microsoft Security Essentials Setup Wizard. Once it is complete, close all of the windows.
10. Set a theme for your computer by right clicking anywhere on the Desktop and clicking "Personalize".
11. Scroll within the themes and select a theme. We recommend "Windows 7 Basic". Note that using any of the "Aero" themes has been shown to slow down processing when using the Microsoft Kinect.

Update Classmate Software
In order for the Classmates to arrive at Kickoff locations in time, they were shipped before the final version of the software was ready. It is essential that you update your classmate software before proceeding so that you are using the most updated software throughout this set up and during competition.

a) Retrieve the driver station update http://joule.ni.com/nidu/cds/view/p/id/2263.

b) Open file
c) Click setup.exe

d) Choose next
e) Choose next
f) Product notifications are optional. Answer as you see fit.
g) Read, and if appropriate, accept the user license agreement. (If you do not accept the user license agreement, I'm afraid we're in trouble…)
h) Ditto for the supplemental license agreement
i) After the software loads, choose finish and restart the computer when prompted

Set your team number

When the classmate reboots it will automatically open the Driver account.

Click on the Set up Tab and enter your team number in the field provided and Tab out of the field. As noted above, we've used team number 9999 for these examples.

How to Configure Your CompactRIO

All FRC teams, both Rookie and Veteran teams, must configure/reconfigure the cRIO in preparation for the 2013 season. The cRIO Imaging Tool is included as part of the Utilities Update, and requires the LabVIEW or FRC Tools install from the NI DVD located in the KOP.

Set the Static IP Address of the Computer you are using for development

Note: This is for Windows 7. The steps for Windows XP will look slightly different.

1. Select Start»Control Panel» View Network Status and Tasks»Change Adapter Settings»Local Area Connection to display the Local Area Connection Properties dialog box.
2. On the General page, select Internet Protocol (TCP/IPv4)
3. Click the Properties button to display the Internet Protocol (TCP/IP) Properties dialog box.
4. Select the Use the following IP address option.
5. In the IP address text box, if this computer is the Classmate and you have run the Driver Station software and successfully set your team number, you should see 10.xx.yy.5, where xx corresponds to the first one or two digits of your team number and yy corresponds to the last two digits of your team number. If this is not the classmate PC you should set the address to 10.xx.yy.6 as the Driver Station defaults to 10.xx.yy.5 for its IP address. In this text box, change the final digit .5 to .6.

Team Number	Static IP Address
45	10.0.45.6
234	10.2.34.6
1024	10.10.24.6

6. The Subnet mask text box defaults to 255.0.0.0. Change this value to 255.255.255.0
7. Click the OK button twice to close the Internet Protocol (TCP/IP) Properties and Local Area Connection Properties dialog boxes.
8. Click the Close button to close the Network Connections dialog box.

Considerations Before Running the cRIO Imaging Tool

Before configuring the cRIO with the cRIO Imaging Tool, you must ensure that the hardware and software are configured properly. You should also ensure you have all of the latest updates, including the latest Utilities update and Language Update (C++, Java or LabVIEW).

Do not use the cRIO Imaging Tool on the cRIO over a wireless connection. If the connection is lost, the data that the cRIO Imaging Tool writes to the cRIO will be corrupted.

Do not use Measurement and Automation Explorer (MAX) to install additional software on the cRIO. MAX overwrites the FRC VIs on the cRIO, which makes the cRIO unusable for the FRC competition. If you use MAX to install additional software on the cRIO, you must use the cRIO Imaging Tool to restore the device to a usable state.

Before running the cRIO Imaging Tool, ensure the SAFE MODE switch on the cRIO is turned off (this only applies to the cRIO-FRC, on the cRIO-FRC II, the dipswitches are only available on the cRIO Imaging Tool). For routine use, do not use the cRIO Imaging Tool when the cRIO is in SAFE MODE.

Severe corruptions of the software or settings on the cRIO result in the device no longer functioning. If the cRIO is corrupted or if the IP Address is set incorrectly, the device boots only in SAFE MODE. When this occurs, switch the device into SAFE MODE. The cRIO Imaging Tool offers to reformat the disk. After the disk has been reformatted, switch the cRIO out of SAFE MODE, reboot, and run the cRIO Imaging Tool normally.

Running the cRIO Imaging Tool
Complete the following steps to configure the cRIO with the cRIO Imaging Tool.

Note: Make sure the wireless is turned off on your computer before doing these tasks.

1) Plug the cRIO into the Classmate using the yellow Ethernet crossover cable provided in the Kit of Parts.
2) Select Start»All Programs»National Instruments(folder)»LabVIEW 2012(folder)»FRC 2013 cRIO Imaging Tool to launch the cRIO Imaging Tool dialog box. You also can display this dialog box by selecting Utilities»cRIO Imaging Tool in the LabVIEW Getting Started window.
3) Select the cRIO you want to configure from the Select cRIO Device table. This table lists all cRIO devices visible on the network to the host computer.
4) In the Development Environment section, specify whether you want to run and debug LabVIEW, C/C++, or Java .
   a. When developing robot code using LabVIEW it is recommended that the "Always run deployed code at startup" option be selected, but means that using the Undeploy option in LabVIEW will do nothing.
5) Place a checkmark in the Format Controller checkbox. Use the Format Controller section to restore an image on the cRIO or update the cRIO with a new name or team ID.
6) From the Select Image list, select the most recent FRC_2013_xx.zip file to download the FRC_2013_xx image to the cRIO. The FRC_2013_xx image consists of support for LabVIEW, C/C++, and Java programming and supports both the cRIO-FRC and the cRIO-FRC II.
7) Enter the name you want to use to identify the cRIO in the Device name text box.

8) Enter your team number in the Team ID field. The cRIO Imaging Tool sets the IP address of the cRIO to 10.xx.yy.2, where xx corresponds to the first or first two digits of the team number and yy corresponds to the last two digits of the team number.

9) Click the Apply button to apply the changes you made and download the FRC_2013_xx image to the cRIO. Do not turn off power to the cRIO or interfere with the network connection while the cRIO Imaging Tool downloads the image to the cRIO.

10) When the reconfiguring device window states the CompactRIO image was successfully updated, click close on the small dialog box.

11) Allow the tool to rescan and detect your cRIO. The cRIO graphic should now show green for all modules which are installed in the correct locations. Any red modules are either missing or not installed in the correct slot, hover your mouse over the red module graphic for more information. Click "Rescan" if you would like to update the graphic.

12) After verifying that all modules are installed in the proper locations, close the cRIO Imaging Tool.

If you receive a timeout error when attempting to image your cRIO, first ensure that your network settings are configured properly as detailed above. If all settings are correct, you may need to disable all Network Adapters other than the one connected to the cRIO. To do this (in Windows 7, XP will differ slightly):

1. Select Start»Control Panel» View Network Status and Tasks»Change Adapter Settings
2. For each adapter not connected to the cRIO, Right Click on the adapter and select Disable
3. To use any of these adapters after you have finished imaging the cRIO, simply right click on the adapter and select Enable

If you want to switch to another development environment, select the new development environment from the Choose Development Environment section and click the Apply button. Switching development environments does not reformat or download a new image to the cRIO.

Refer to the LabVIEW Robotics Programming Guide for the FIRST Robotics Competition for more information about the cRIO and other programming procedures. You can access this guide by selecting the Tutorials tab on the LabVIEW Getting Started window, by navigating to the Progam Files\National Instruments\LabVIEW 2011\manuals\FRC Programming Guide directory and opening index.html or by browsing to http://www.ni.com/info and entering "FRCTutorials" for the Info Code.

Using the Classmate with your cRIO

1) Log into the Driver Account
2) Plug the following devices into your Classmate
   - Joysticks
   - cRIO using the yellow crossover Ethernet cable (via the only Ethernet port on the Classmate and port 1 on the cRIO)

The basic Driver Station setup with simulated robot (cRIO, motors, etc)

3) Turn on your cRIO using the 120A main circuit breaker (make sure that the Analog Breakout Board is attached to the 9201 module in slot 1 of your cRIO and that it has the jumper installed for battery voltage tracking).
4) On the left side of the Driver Station window, check the status indicators to confirm that the Classmate has communication with the cRIO (meaning that IP addresses are set and the cRIO has been imaged). This will be indicated with a green light next to Communications.
5) In the Setup Tab, confirm that the Driver Station recognizes your joysticks. Joysticks should be listed in green.

How to Build and Load Programming in LabVIEW, C/C++, and Java

Teams should only read the section for the programming language they have chosen.

How to Build and Load a LabVIEW Program

Configuring an FRC Robot Project

1) Launch LabVIEW.
2) Click the FRC cRIO Robot Project link in the Projects window to display the Create New FRC Robot Project dialog box.
3) In the Project name text box, enter the name you want to use to identify the new FRC robot project.
4) In the Project folder text box, enter the location on the host machine to which you want to save the project files and VIs.
5) In the cRIO IP address text box, enter the IP address of the cRIO to which you want to deploy the project. The IP address of the cRIO must be in the form 10.xx.yy.2, where yy corresponds to the last two digits of the team number and xx corresponds to the remaining first or first two digits of the team number. Note that the team number entered here should not contain any leading zeroes.

Team Number	cRIO IP Address
45	10.0.45.2
234	10.2.34.2
1107	10.11.7.2

6) Select the desired robot type from the options in the bottom left, if unsure, leave the selection as the default "Arcade Robot – hardware and simulation"
7) Click the Finish button to close the Create New FRC Robot Project dialog box and create the new FRC robot project. LabVIEW displays the new FRC robot project in the Project Explorer window.

Running the FRC Robot Project

You can deploy the FRC robot project to the cRIO before making any modifications. In the Project Explorer window, right-click the Robot Main.vi item and select Run from the shortcut menu. LabVIEW deploys the Robot Main VI and any support files for the VI to the cRIO. The Robot Main VI then runs on the cRIO. If the robot has a joystick connected to port 1 of the Driver Station and Jaguar motor controllers controlling the two wheels, you can move the joysticks and observe how the robot responds.

You also can run the FRC robot project on the cRIO and maintain a connection with the host computer to perform live front panel programming and debugging. By maintaining a connection with the host computer, you can monitor indicators and observe how changes to the front panel of VIs affect the behavior of the robot.

Complete the following steps to run the FRC robot project and perform live front panel debugging.

1) In the Project Explorer window, double-click the Robot Main.vi item to open the Robot Main VI.
2) Click the Run button of the Robot Main VI to deploy the VI to the cRIO. LabVIEW deploys the VI, all items required by the VI, and the target settings to memory on the cRIO.
3) Using the driver Station application put the robot in **Teleoperated** mode, then **Enable** the robot.
4) Move the joysticks and observe how the robot responds.

5) Click the Abort button of the Robot Main VI. Notice that the VI stops. When you deploy a program with the Run button, the program runs on the cRIO, but you can manipulate the front panel objects of the program from the host computer.

If you redeploy the Robot Main VI with the Run button, the cRIO stops and restarts the Robot Main VI. LabVIEW redeploys any VIs that changed or are no longer in memory on the cRIO.

Refer to the LabVIEW Robotics Programming Guide for the FIRST Robotics Competition for more information about creating and running a LabVIEW program. You can access this guide by selecting the Tutorials tab on the LabVIEW Getting Started window, by navigating to the Program Files\National Instruments\LabVIEW 2011\manuals\FRC Programming Guide directory and opening index.html or by browsing to http://www.ni.com/info and entering "FRCTutorials" for the Info Code.

# How to build and load a C/C++ program

Creating the sample program

1) Launch WindRiver Workbench using the desktop shortcut.
2) Select "New" then "Example…" from the File menu.
3) Choose "VxWorks Downloadable Kernel Module Sample Project" and click "Next>".
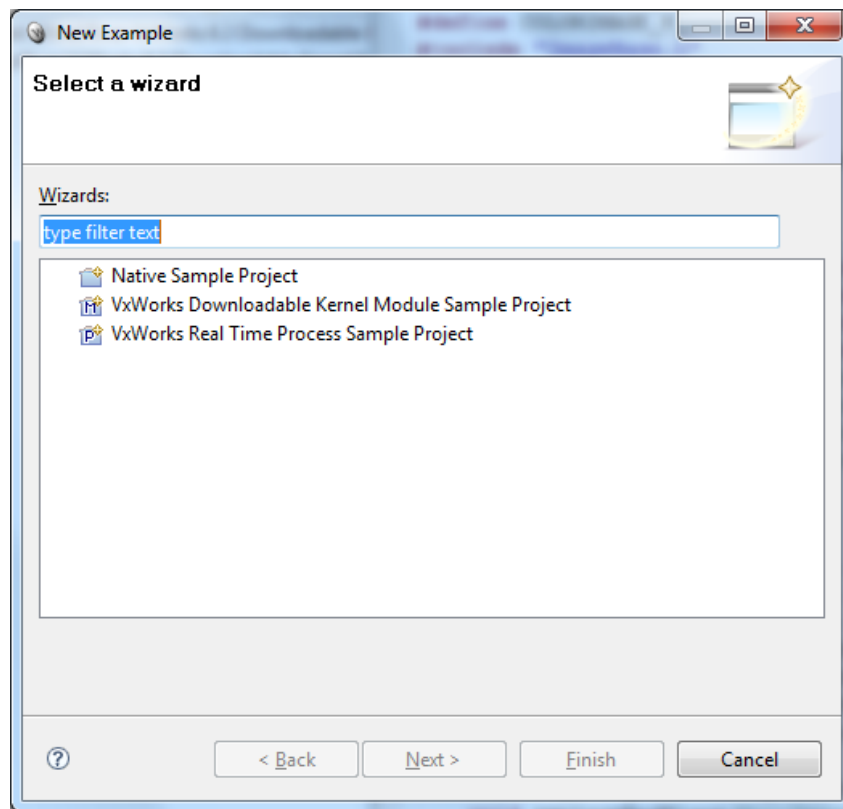
4) Choose "Default Robot Main Program" from the list of choices presented and then click "Finish".
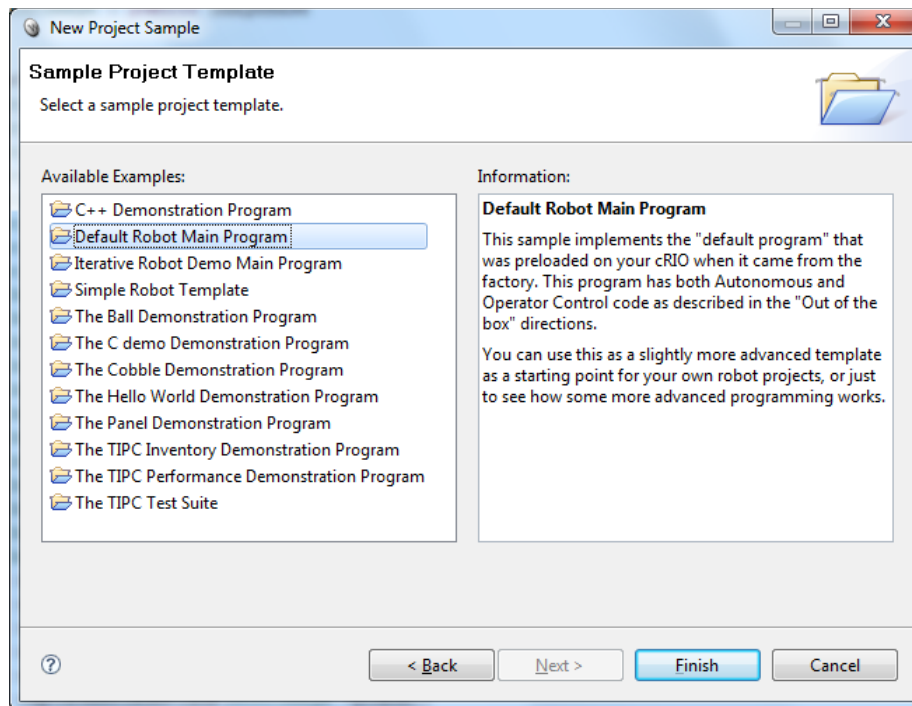
5) Notice that the project is now loaded into the Project Explorer tab on the left panel of Workbench.
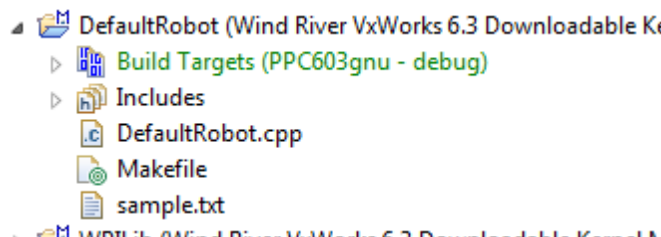
6) If you double-click on the "DefaultRobot.cpp" file name in the Project Explorer, you'll see the C++ source code in a tab in the main window in Workbench.
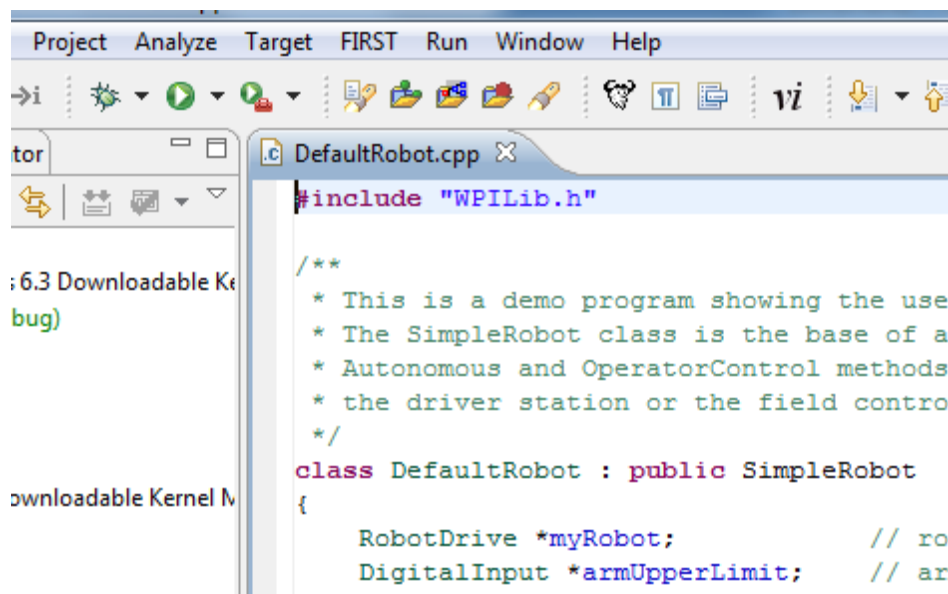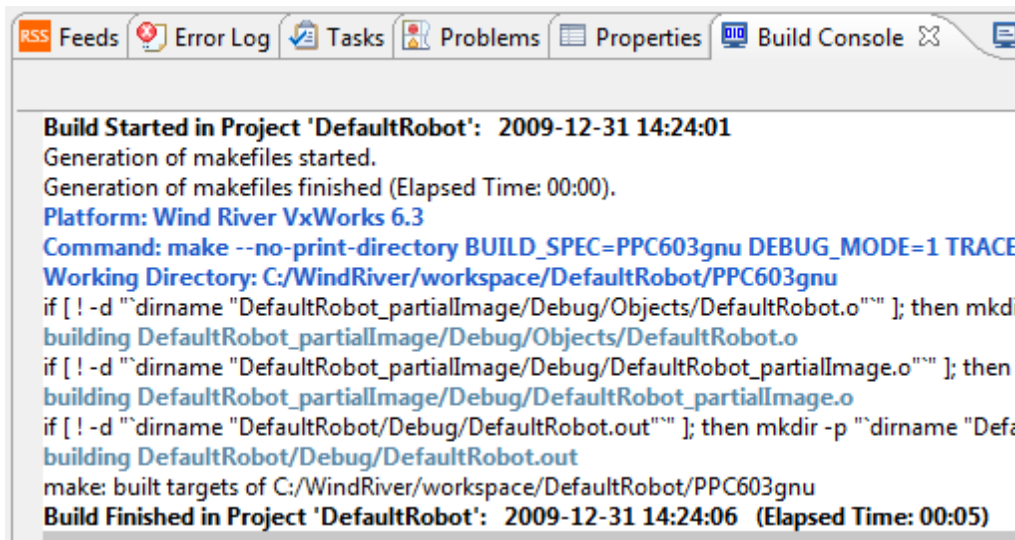
7) To build the program, right-click on the project name in the project explorer and select "Build Project" from the pop-up context menu.
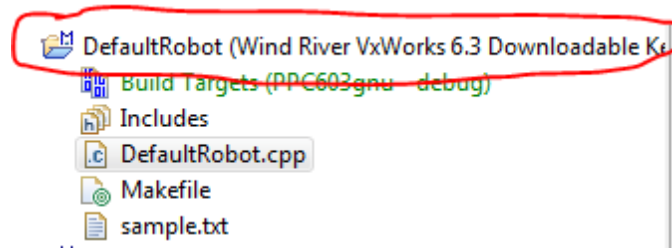
8) You should see the results of the build in the "Build Console" tab at the bottom of the Workbench window. If you don't see these results, exit from Workbench and restart it, then rebuild the project.

Downloading the program

1) Set up your team number in Workbench so it can find your robot. To do this, select "Window" and then "Preferences" from the main menu.

2) On the preferences window select "FIRST downloader preferences". Then fill in your team number and the file to download to the robot. It will likely be:
   C:\WindRiver\workspace\DefaultRobot\PPC603gnu\DefaultRobot\Debug\DefaultRobot.out You can use the "Browse…" button to find it.
   Once done these settings don't need to be changed until you decide to work on a different project.

3) To download the program click on "FIRST" and then "Deploy" from the Main menu in Workbench. If the cRIO is properly set up, the file will be downloaded.

Running the program

Reboot the cRIO to run the program and then proceed to "Basic Operator Control to verify basic teleoperated and autonomous control of the robot. The steps here are described in more detail in the C/C++ Getting Started Guide available in: C:\WindRiver\docs\extensions\FRC\GettingStartedWithC or at http://wpilib.screenstepslive.com/s/3120/m/7913.

How to build and load a Java program

Creating the BuiltInDefaultCode Project

1) Launch NetBeans.
2) Select "File > New Project…".
3) In the New Project Dialog, browse to "Samples > FRC Java".
4) Select "DefaultCodeProject"
5) Click "Next >"
6) Click "Finish"

NetBeans displays the new BuiltInDefaultCode project in the Projects window.

Building and Running the BuiltInDefaultCode Project

You can build and deploy the BuiltInDefaultCode project to the cRIO before making any modifications. Before starting insure that the computer you're using for software development is connected and configured with the correct IP address as instructed in Section 2.6. If you are using the Classmate Driver Station for software development, the IP address should already be correctly set. If you are use another computer for software development, its IP address should be set to an address that doesn't conflict with the Classmate, robot or wireless bridge, such as 10.xx.yy.6 or 10.xx.yy.10 (where xxyy is your team number). Complete the following steps to build and run the default code:

1) Right-Click on the BuiltInDefaultCode project name.
2) Select "Set as Main Project" from the pop-up menu.
3) Click the green "Run Main Project" arrow in the NetBeans toolbar.

The BuiltInDefaultCode will build, load and run on the cRIO. You can proceed to "Basic Operator Control" to verify basic teleoperated and autonomous control of the robot. Note that you may want to uncomment the autonomous code in BuiltInDefaultCode before building and testing.

Basic Operator Control

Confirmation of "Tank Drive" Control System Component Operation

Before powering on the "benchtop" system, ensure that the motors are located in such a way that if they were to become immediately operational, they would not pose a safety hazard. Also ensure the joysticks plugged into the Driver Station are 'centered'.

1. Move the joystick #1 Z-Wheel to the down position [-].
2. Power up the Classmate Driver Station and the benchtop system.
3. Set the Classmate Driver Station to "Operation > Enable". When enabled, the Jaguar LEDs should be solid yellow (assuming that the joystick inputs are centered.)
4. The "benchtop" system is now configured so that the two joysticks should give "tank drive" behavior. For an "out of the box" cRIO, you should observe the following behavior:
   a. Move joystick #2 all the way forward. The Jaguar connected to PWM #1 should have its LED change color to green and the motor connected to that Jaguar should turn forward.
   b. Move joystick #2 all the way backward. The Jaguar connected to PWM #1 should have its LED change color to red and the motor connected to that Jaguar should turn in reverse.
   c. Joystick #1 full forward should result in Jaguar on PWM #2 having a red LED and the motor turning in reverse.
   d. Joystick #1 full backward should result in Jaguar on PWM #2 having a green LED and the motor turning forward.

Confirmation of "Arcade Drive" Control System Component Operation

1. Move the joystick #1 Z-Wheel to the up position [+].
2. The "benchtop" system is now configured so that joystick #1 should give "arcade drive" behavior. For an "out of the box" cRIO, you should observe the following behavior:
   a. Move joystick #1 all the way forward while keeping the joystick centered from right to left. The Jaguar connected to PWM #1 should have its LED switch to green and the motor connected to that Jaguar should turn forward; meanwhile, the Jaguar connected to PWM #2 should have its LED switch to red and the motor connected to that Jaguar should turn in reverse.
   b. Move joystick #1 all the way backward while keeping the joystick centered from right to left. The Jaguar connected to PWM #1 should have its LED switch to red and the motor connected to that Jaguar should turn backward; meanwhile, the Jaguar connected to PWM #2 should have its LED switch to green and the motor connected to that Jaguar should turn forward.
   c. Move the joystick to each of the four "corners" – when completely in each "corner" only one motor should turn. (This would implement "pivot" turns on a typical FRC robot.)
   d. While holding down button 2 of the joystick, move the joystick from side to side. Both motors should turn with rates proportional to the distance the joystick is moved away from center. This would implement "spin" turns on a typical FRC robot.
   e. Experiment with moving the joystick to different positions, noting that different output behaviors take effect depending upon the position of the joystick.
3. Set the Classmate Driver Station to "Operation > Disable."
4. Turn off the "benchtop" system by firmly pressing the red button on the Hi-Amp 120A circuit breaker.
5. Turn off the Driver Station by powering down the Classmate.

Confirmation of "Autonomous" Control System Component Operation

Before powering on the "benchtop" system, ensure that the motors are located in such a way that if they were to become immediately operational, they would not pose a safety hazard. Also ensure the joysticks plugged into the Driver Station are 'centered'.

1. Turn on the Driver Station by powering up the Classmate. Wait approximately 35 seconds for the Driver Station to boot to the status screen.
2. Set the Driver Station to "Mode: Autonomous" using the buttons on the Operation tab of the DS.
3. Confirm that the screen reads "System: Disabled" and "Mode: Autonomous."
4. Turn on the power to the "benchtop" system and wait for the cRIO to boot. Set the Driver Station to "System: Enabled" using the enable toggle on the Operation tab of the DS.
5. Set the Driver Station to "System: Disabled" in the Operations tab to disable the benchtop system.
6. Set the Driver Station to "Mode: Teleoperated" in the Operations tab.
7. Set the Driver Station to "System: Enabled" to re-enable the benchtop system with teleoperated control. Check that the motors move in accordance with the program coded for the joystick(s).
8. Set the Driver Station to "System: Disabled."
9. Turn off the "benchtop" system by firmly pressing the red button on the Hi-Amp 120A breaker.
10. Turn off the Driver Station by switching to the setup tab and hitting the exit button, then logoff and power down the Classmate.

How to Configure Your Camera

The camera comes with a network address of 192.168.0.90 and a root password of "pass". The IP address and user accounts must be updated to work for the recommended FRC configuration (camera is plugged into robot radio).

Using the Camera Configuration Tool

A tool to automatically configure the camera for FRC use is installed with the FRC Utilities Update.

1. Connect your computer to the camera using a crossover Ethernet cable.
2. Set your PC's IP address to 192.168.0.XX where XX is something not in use (1-255), for example 192.168.0.6. See "How to Set Up Your 2012 Driver Station" for instructions on how to set a static IP address.
3. Close the window and wait while it configures the network card.
4. Select Start»All Programs»National Instruments(folder)»LabVIEW 2012»Setup Axis Camera to launch the Setup Axis Camera Tool dialog box. You also can display this dialog box by selecting Tools»Setup Axis Camera in LabVIEW.
5. The green Indicator light next to the text "Camera found at 192.168.0.90" should be lit. If it is not, verify that your camera is powered on (the ring on camera face should be green) and properly connected and that your computer IP address was set properly in steps 2 and 3. If the indicator is still unlit, reset your camera using the instructions contained inside the tool as Step 3.
6. Ensure the Robot Radio option is selected and enter your team number in the Team ID box.
7. Click Apply.

Manual Configuration of the Camera

The username/password combinations that work with the default code are shown in the table below. As long as at least one of these users is configured, the camera initialization software will work.

User name	FRC
Password	FRC
root	pass (Axis default, must be changed)
root	admin
FRC	FRC

To change passwords:

1. Connect your computer to the camera using a crossover Ethernet cable.
2. Set your PC's IP address to 192.168.0.XX where XX is something not in use (1-255), for example 192.168.0.6. See section 5.2.1 for instructions on how to set a static IP address.
3. Close the window and wait while it configures the network card.
4. Navigate your web browser to http://192.168.0.90/.
5. If a "Configure Root Password" dialog box pops up, enter the username "root" and the password "pass".
6. If a login dialog pops up, enter the username "root" and the password "pass" (this is the default password).
7. In the top right, click "Setup"
8. On the left, click "Users"
9. Click "root" and click "Modify"
10. Enter the password "admin" into the two password boxes.
11. Click "OK", then "Save".

To change the IP:

1. On the left, click "TCP/IP"
2. Click on the radio button next to "Use the following IP address" to select it
3. In the "IP address" box enter 10.xx.yy.11. The xx.yy is the same as is used for the robot.
4. Click "Save"

The camera can also be connected to the second Ethernet port on the 8-slot cRIO FRC. In this configuration the IP is left at the default 192.168.0.90. The User name and Password are setup identically to if the camera is connected to the radio

Camera tools and documentation

A link for vendor information about the Axis M1011 camera can be found from the Kit of Parts website.
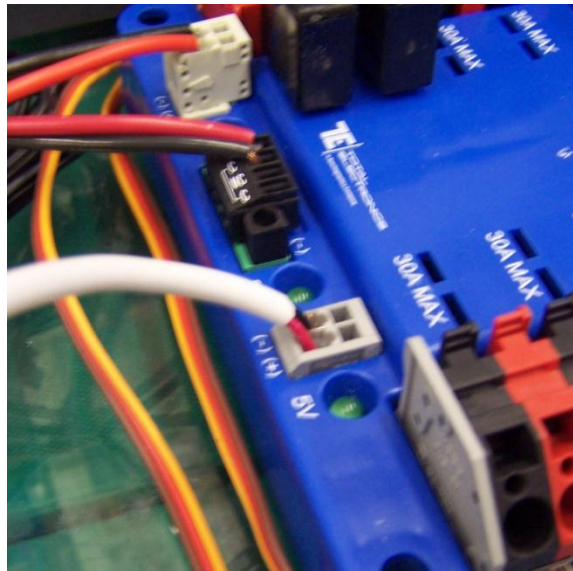
Camera Power Feed on the Power Distribution Board

How to Configure Your Wireless Bridge

This section describes the features and functionality of the new D-Link DAP-1522 robot wireless bridge, and the steps used to configure it for use on an FRC robot.

> NOTE: The screenshot examples in this document reflect an example wireless bridge configured for team 1995

Overview of the DAP-1522
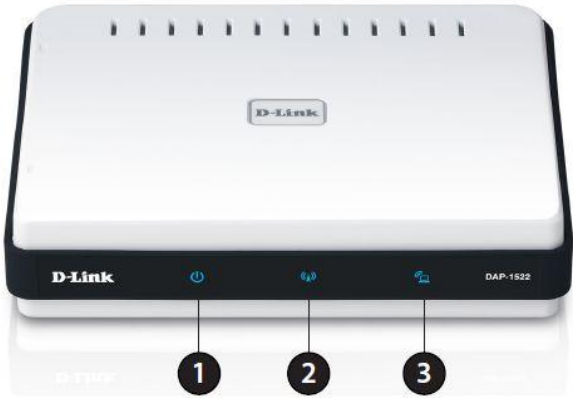
Features

The D-Link DAP 1522 RevB is the robot wireless bridge for the 2013 season. Some new features of this unit as compared to the 2009 and 2010 seasons include

- **Access Point mode:** computers with wireless networking capabilities can connect to the DAP-1522 directly (without additional wireless routers or bridges). This is the recommended operating mode when teams are developing their robots at home
- **Bridge mode:** allows the DAP-1522 to connect to an access point. This mode is used at FRC events to allow the robots on the field to connect to the field access point.
- **Four Ethernet ports:** teams can now tether to the cRIO through the DAP-1522 using a standard Ethernet cable. Using this feature, teams will no longer have to unplug the wireless bridge in order to tether to the cRIO. Other devices, such as the camera, can also be connected to the Ethernet ports.

Hardware Overview

Front:

1	Power LED	A solid blue light indicates a proper connection to the power supply.
2	AP LED	A solid light indicates that the DAP-1522 is in AP mode.
3	Bridge LED	A solid light indicates that the DAP-1522 is in bridge mode.
4	WPS LED	A solid light indicates a successful WPS connection. A blinking light indicates the device is trying to establish a connection.

Back:

Mode selection switch

Ethernet Ports (4)

Reset button

Connecting to the DAP-1522 via Wi-Fi

When connecting a computer to the DAP-1522 via Wi-Fi, ensure the computer's network settings match the following:

- IP address = 10.xx.yy.zz
    - xxyy is the team number (do not enter leading zeros).
    - zz is any number greater than 10 and less than 255.
    - Examples (team number follow by IP address)
        - 19 = 10.0.19.51
        - 109 = 10.1.9.51
        - 190 = 10.1.90.51
        - 1109 = 10.11.9.51
        - 1190 = 10.11.90.51
        - 1900 = 10.19.0.51
- Subnet Mask = 255.0.0.0

Also, make sure that Internet Version Protocol Version 6 (TCP/IPv6) is unchecked.

Resetting a wireless bridge to default settings

1. Plug in the power and Ethernet connections
2. Wait for the either the orange Bridge light or blue Access Point light to begin flashing
3. Hold the reset button (on the back of the unit) for 10 seconds then release
4. Wait for the light to stop flashing (this signals the wireless bridge is starting to reset)
5. Wait for the light to resume flashing, your wireless bridge is now reset

Configuring a Wireless bridge for Team Use

1. Disable WiFi connections on your computer, as it may prevent the configuration utility from properly communicating with the bridge
2. Make sure no devices are connected to your computer via ethernet, other than the wireless bridge.
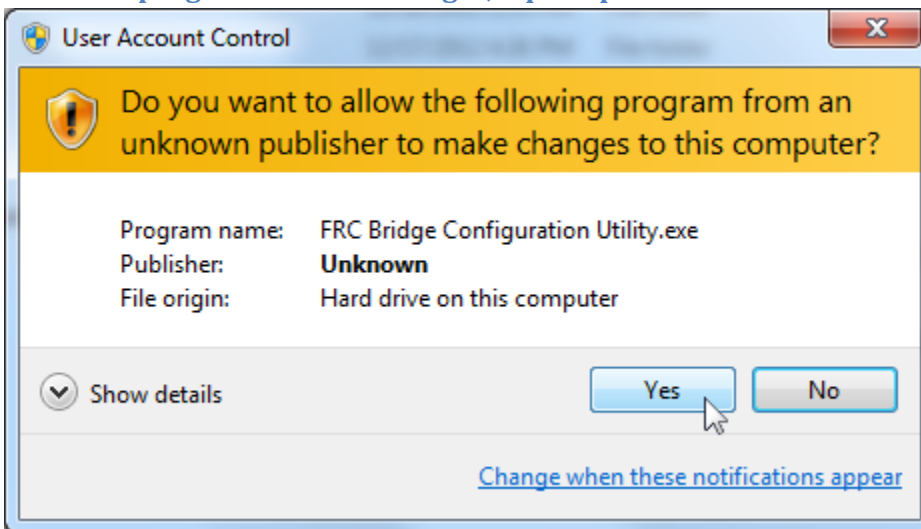
Install the Software
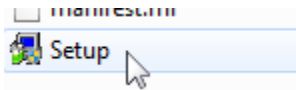
Run the "Setup.exe" program, and follow the instructions in the installation wizard.
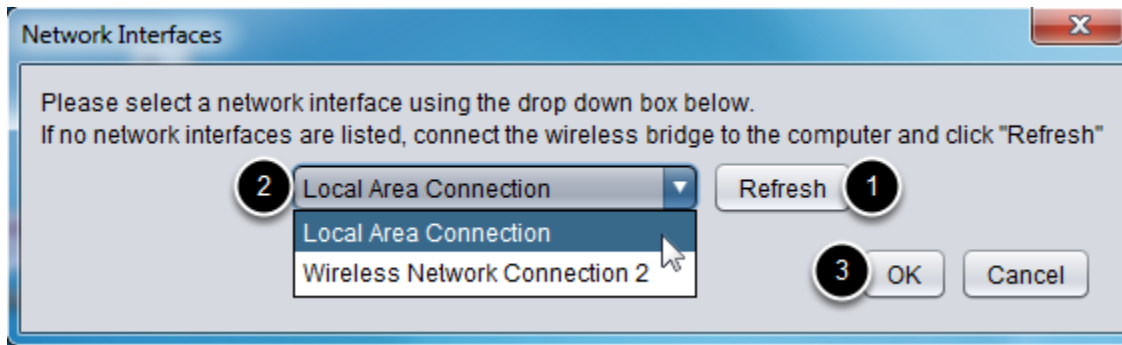
Launch the software

Double-click the shortcut on the desktop to launch the program

Allow the program to make changes, if prompted

If the your computer is running Windows Vista or Windows 7, a prompt may appear about allowing the configuration utility to make changes to the computer. Click "Yes" if the prompt appears.

Select the network interface

Use the pop-up window to select the which ethernet interface the configuration utility will use to communicate with the wireless bridge. On Windows machines, ethernet interfaces are typically named "Local Area Connection". The configuration utility cannot program a bridge over a wireless connection.

1. If no ethernet interfaces are listed, click "Refresh" to re-scan for available interfaces
2. Select the interface you want to use from the drop-down list
3. Click "OK"

Select a bridge model and operating mode
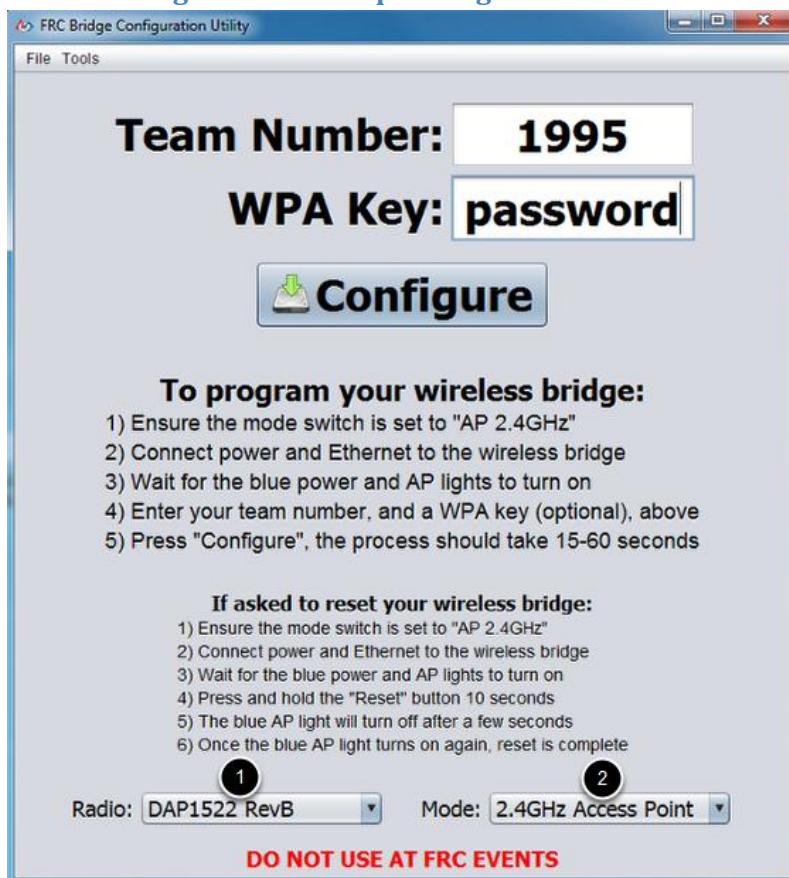
1. Select which DAP1522 revision you are configuring using the drop-down list
2. Select which operating mode you want to configure. For most cases, the default selection of 2.4GHz Access Point will be sufficient.

Prepare and start the configuration process
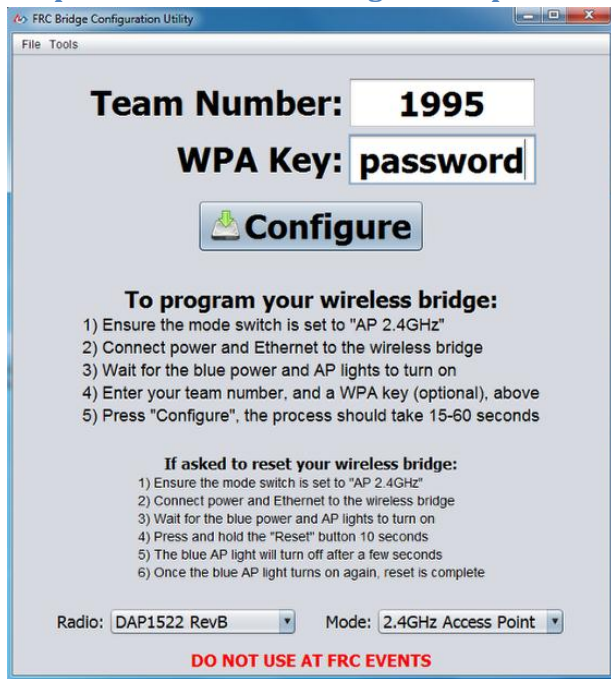
Follow the on-screen instructions for preparing your wireless bridge, entering the settings the bridge will be configured with, and starting the configuration process. These on-screen instructions update to match the bridge model and operating mode chosen at the bottom of the window.
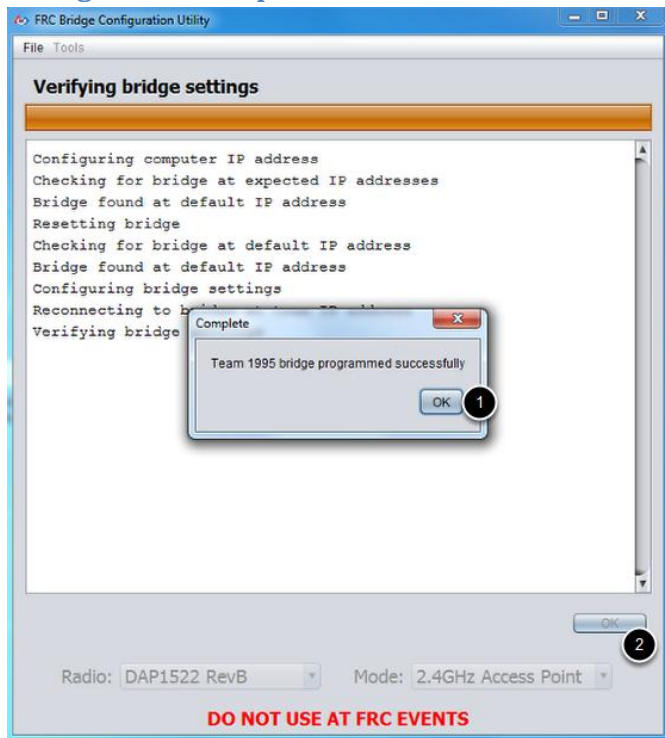
Configuration Progress
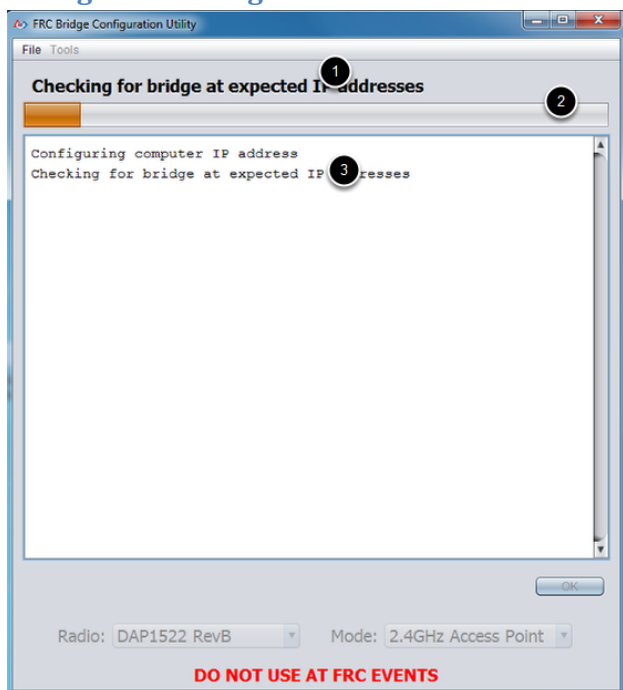
Throughout the configuration process, the window will indicate:

1. The step currently being executed
2. The overall progress of the configuration process
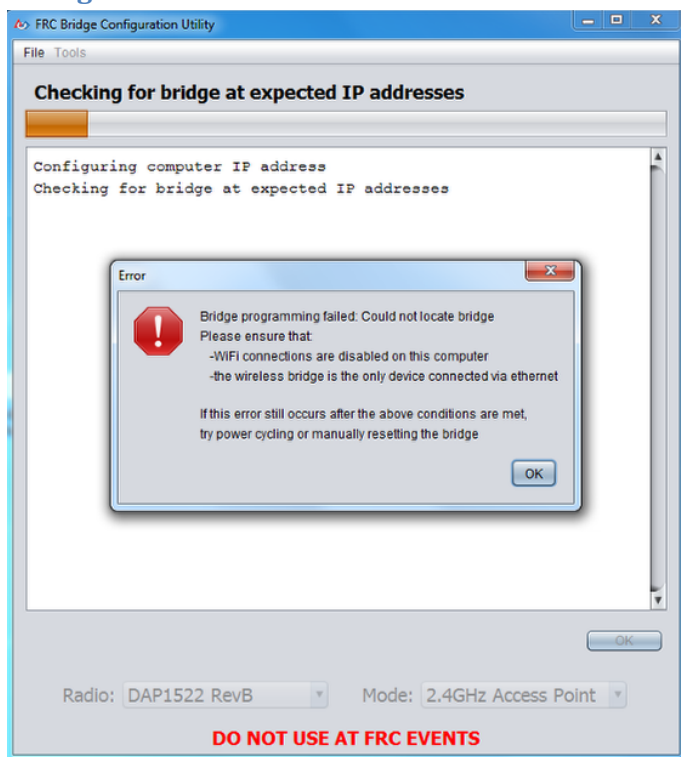3. All steps executed so far

Configuration completed

Once the configuration is complete:

1. Press "OK" on the dialog window
2. Press "OK" on the main window to return to the settings screen

Configuration errors

If an error occurs during the configuration process, follow the instructions in the error message to correct the problem.

How to Configure Your I/O Module

Now that you've confirmed that your basic Driver Station hardware and software is functional, add the I/O layer. Before using your Cypress FirstTouch I/O module, you must first program firmware into the USB chip on the board. The steps below will walk you through the process. Remember that you only need to do this step once per board. Make sure that you have the most recent version of the Driver Station software before proceeding.

1) Log into the Developer account.
2) Plug the USB cable provided in the FirstTouch starter kit into the I/O module and the Classmate.
3) Allow the computer time to find and connect to the new hardware.
4) Next, open the Cypress PSoC Programmer. If you are using LabVIEW on the same computer, you can find the PSoC Programmer in the Utilities tab of the Getting Started Window. Otherwise, click on Start > All Programs > Cypress > PSoC Programmer. If you get an Update Reminder, cancel it. Updating the PSoC Programmer will make the Driver Station unable to see the First Touch module

5) In the top left of the tool bar, you'll see a blue folder icon. Click the folder, browse to Shared or Public Documents/FRC, and select the FRC_IO.v3.hex or FRC_IO.v3.2010.hex (or latest version) file. You must select the correct firmware for the version of the module that you have. The location on the Classmate is Computer»Windows (C:) »Users»Public»Documents»FRC. If you are a rookie, you have a 2012 module. If you are a veteran teams and got your First Touch module in the 2010 or 2011 kit, use that firmware. Selecting the wrong firmware image will result in an error message and will not damage your First Touch module.
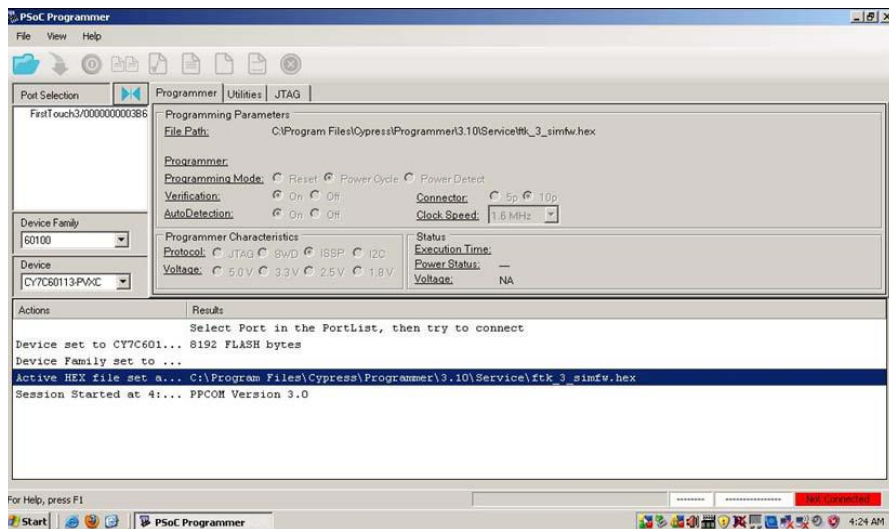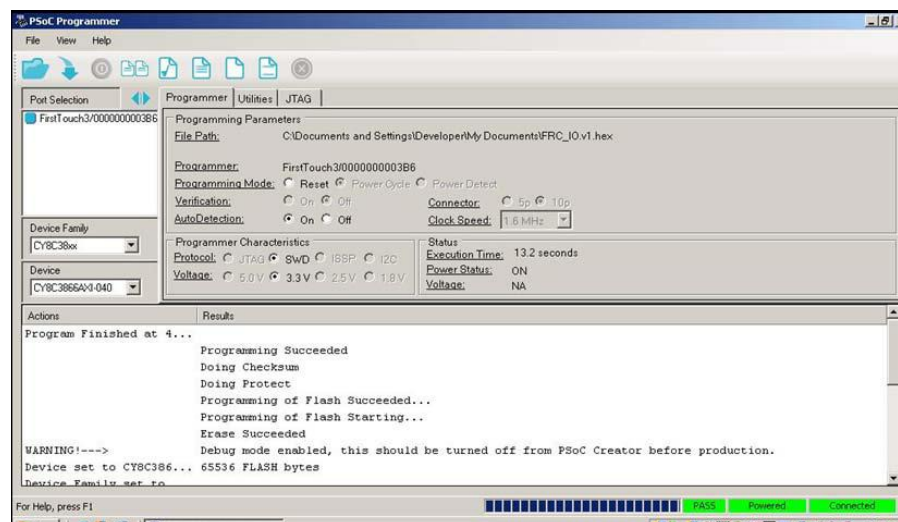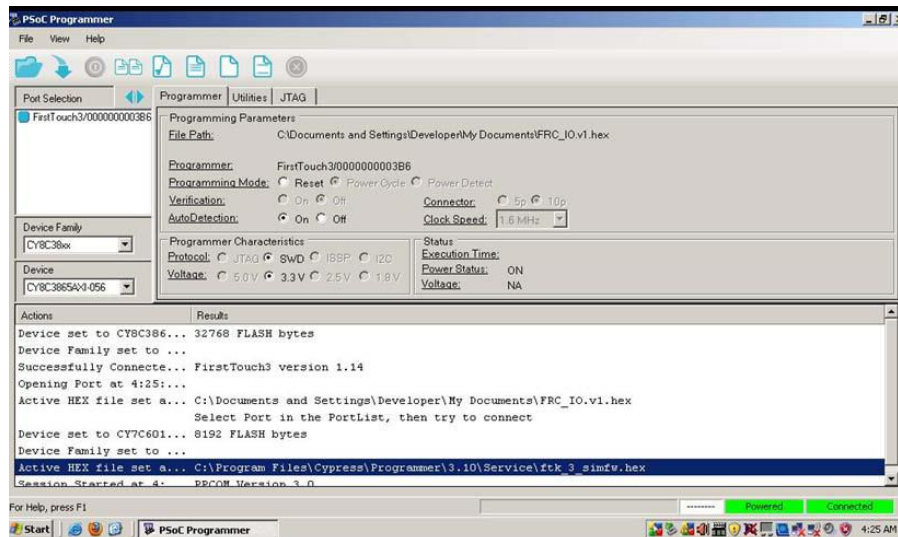
6) Directly below the tool bar, on the left, there is a Port Selection window with the device listed in it. Select the FirstTouch device.
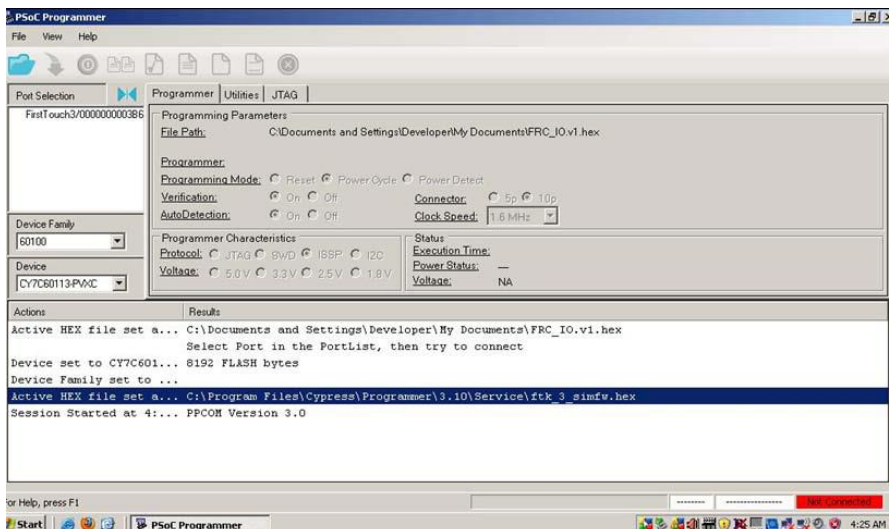
7) Click the program button on the tool bar, and wait for the programming operation to complete. You will see Programming Succeeded in the Results window.

8) Unplug and replug the USB cable and your I/O module will be ready to use. You can check to make sure the process was successful by opening the Driver Station software and confirming that the device is being recognized. With the I/O module plugged in, your I/O tab will indicate that the Hardware I/O is selected. Without the I/O module plugged in, it will default to the Virtual I/O.

Troubleshooting:

- If you are unable to find the firmware file, make sure that you have installed the Driver Station update.
- If the PSoC Programmer errors with "The hex file does not match with the acquired device, please check the device", make sure you selected the correct firmware file for the version of the First Touch module you are using.
- If the Driver Station is unable to detect the First Touch I/O module…

- Check the version of the PSoC Programmer that you have installed
  - You should have version 3.12.0.827 if you look in Help >> About in PSoC Programmer
- Check for the module in Device Manager under Universal Serial Bus controllers
- If the device is listed as "FTK3 (unconfigured)" (USB PID=F119), the CyMiniProg3Service may not be running
  - Check for the service in Control Panel >> Administrative Tools >> Services
  - Check if it is started. If not, start it and configure it to start automatically.
- If the device is listed as "FTK3 (version)" (USB PID=F11A), and version does not equal 3.4.1.20, you may have installed a newer version of the PSoC Programmer
  - Uninstall the Driver Station Update and the PSoC Programmer update in Control Panel >> Add / Remove Programs
  - Reinstall the Driver Station Update
- If the device is listed as "FTK3 (3.4.1.20)"
  - Make sure that the bootstrap firmware that is installed matches what the Driver Station needs. The file Program Files\Cypress\Programmer\3.12\Service\ftk_3_simfw.hex should be 29,663 bytes.
  - Make sure that C:\Windows\system32\nicyapi.dll is installed and is version 1.0.0.49154
- The Driver Station still won't see the First Touch I/O Module
  - Try restarting the Driver Station after you've gotten everything else correct and the device is plugged in.

For further help, look for a similar problem on the Cypress forums at http://www.cypress.com/?app=forum (be sure to select the "FIRST Robotics Competition" forum).