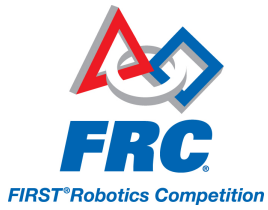
Vision Processing - More information Coming Soon



FIRST® Robotics Competition

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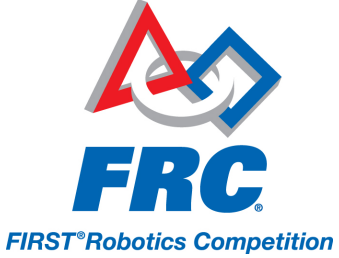


Setup

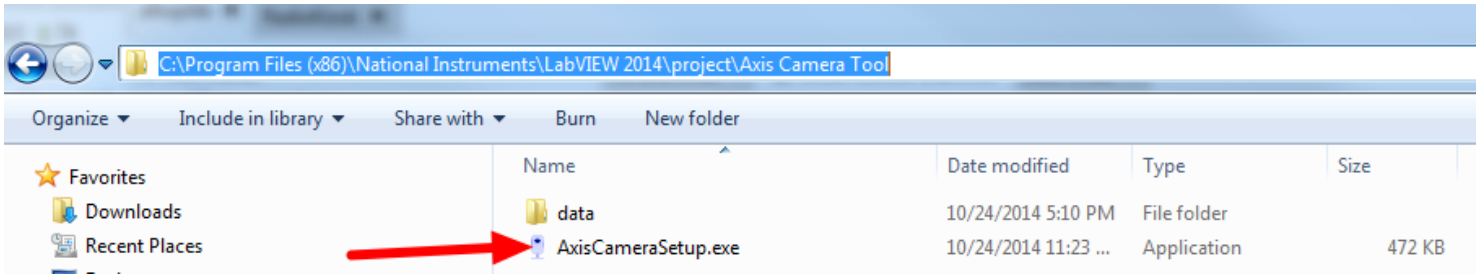
Configuring an Axis Camera

Three different Axis camera models are supported by the FRC software, the Axis 206, Axis M1011 and Axis M1013. This document provides instructions on how to configure one of these cameras for FRC use. To follow the instructions in this document, you must have installed the NI 2015 FRC Update Suite and Configured your radio

Connect the camera

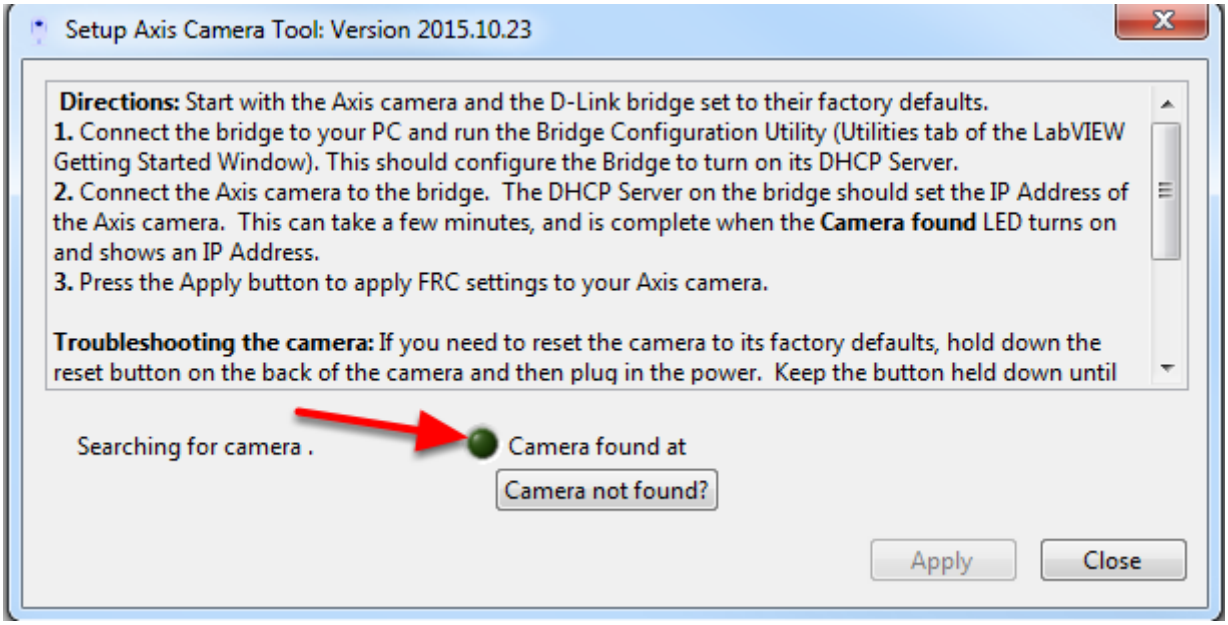
Connect the Axis camera to the DAP-1522 radio using an Ethernet cable. Connect your computer to the radio using an ethernet cable or via a wireless connection.

Axis Camera Setup Tool



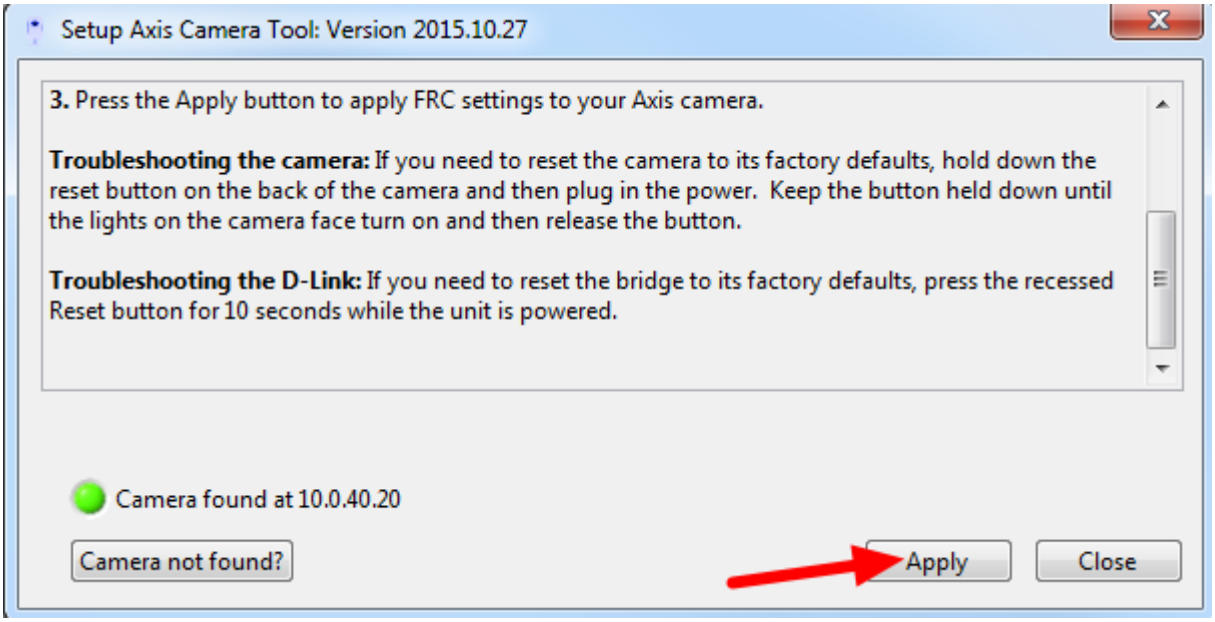
Browse to **C:\Program Files (x86)\National Instruments\LabVIEW 2014\project\Axis Camera Tool** and **double-click** on **AxisCameraSetup.exe** to start the Axis Camera Setup Tool.

Tool Overview



The camera should be automatically detected and the green indicator light should be lit. If it is not, make sure the camera is powered on (the ring on the camera face should be green) and connected to your computer. If the indicator remains off follow the instructions in the tool textbox next to **Troubleshooting the camera** to reset the camera. You can also use the **Camera not found?** button to check the IP address of your computer, one of the addresses listed should be of the form 10.TE.AM.XX where TEAM is your 4 digit team number.

Setup the Camera

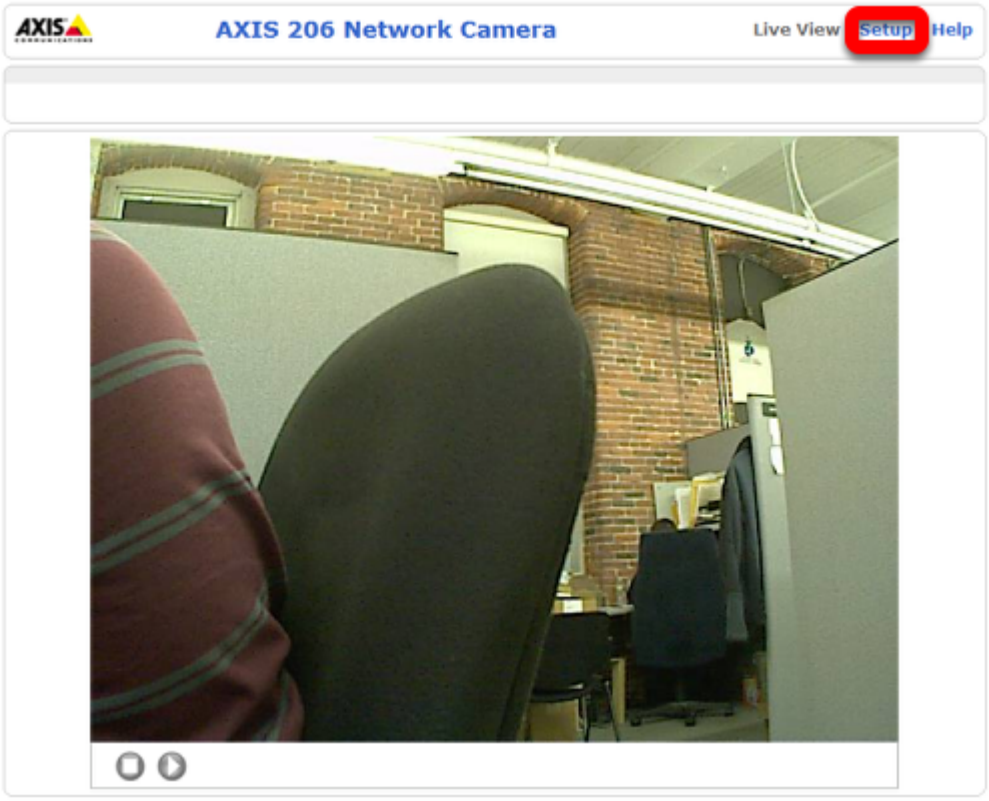


To configure the camera, press Apply. This will configure many of the necessary/recommended settings for using the camera for FRC. Currently the tool does not properly configure the DNS name of the camera in many cases.

Camera Webpage

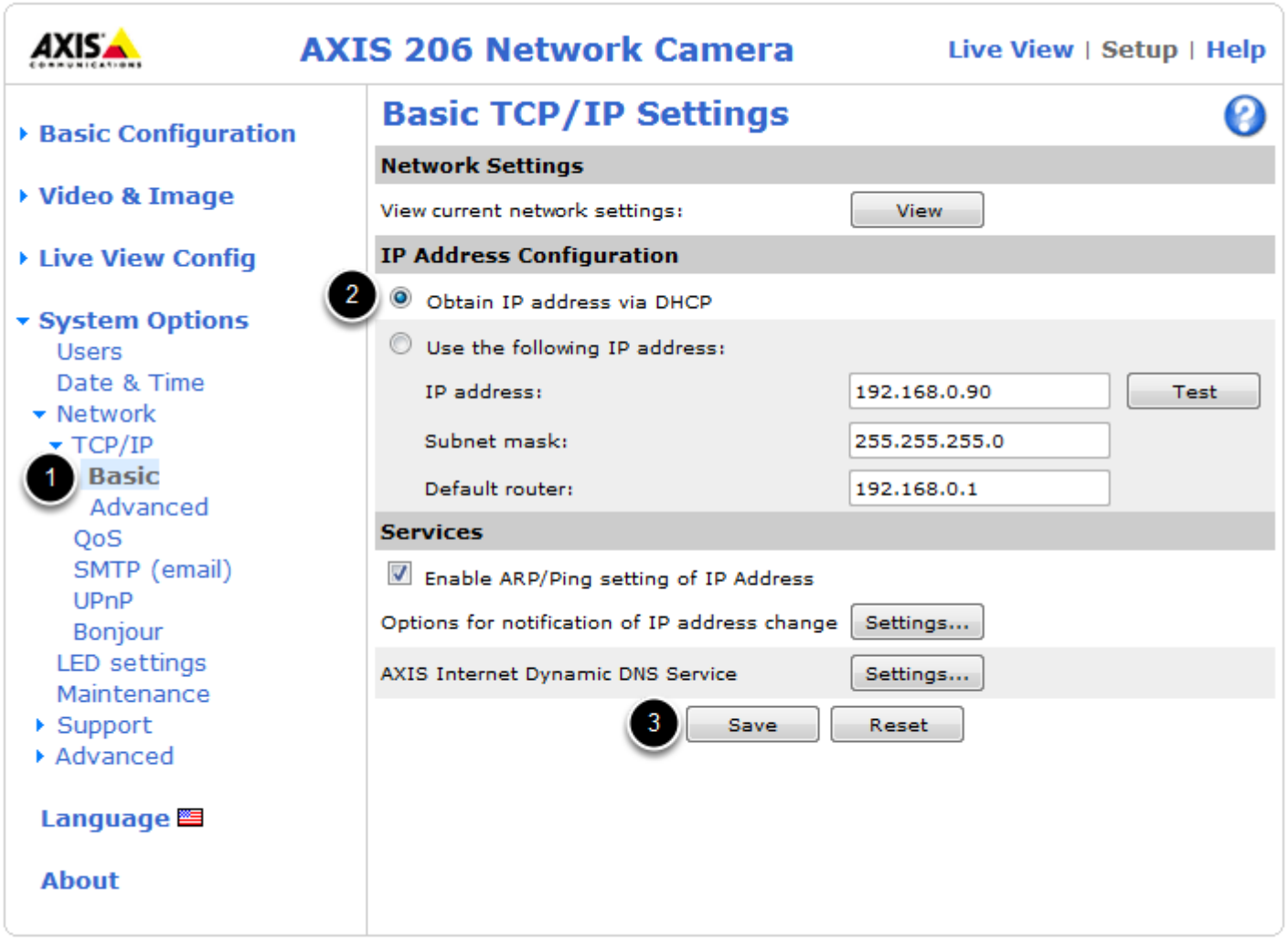
To set the network settings, open a web browser and enter the address shown next to **Camera found at** in the tool (in the example above this is 10.0.40.20) in the address bar and press enter. You should see a Configure Root Password page, set this password to whatever you would like, but **admin** is recommended.

Setup Page



Click **Setup** to go to the setup page.

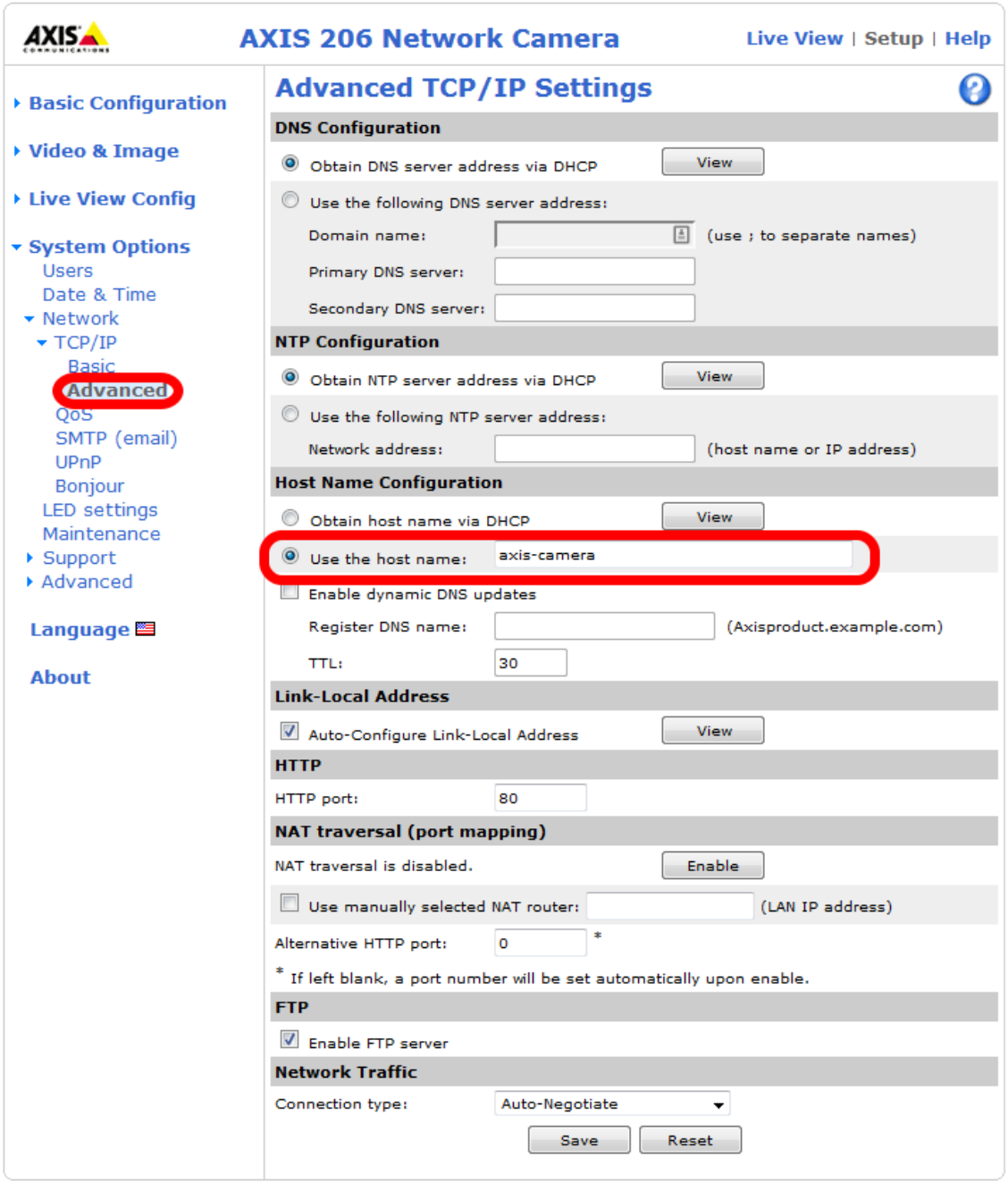
Configure Basic Network Settings



To configure the network settings of the camera, click the arrow to expand the **System Options** pane, then click the arrow to expand **Network**, then expand **TCP/IP** and select **Basic.** Set the camera to obtain an IP address via DHCP by selecting the bubble. Alternately, you may choose to set a static IP in the range 10.TE.AM.3 to 10.TE.AM.19. This is outside the range handed out by the DAP-1522 radio (home use) or FMS system (event use) so you will avoid any IP conflicts.

Click **Save**.

Configure Advanced Network Settings



Next click **Advanced** under **TCP/IP**. Set the **Host Name Configuration** to **"Use the host name:"** and set the value to **"axis-camera"** as shown. If you plan to use multiple cameras on your robot, select a

unique host name for each. You will need to modify the dashboard and/or robot code to work with the additional cameras and unique host names.

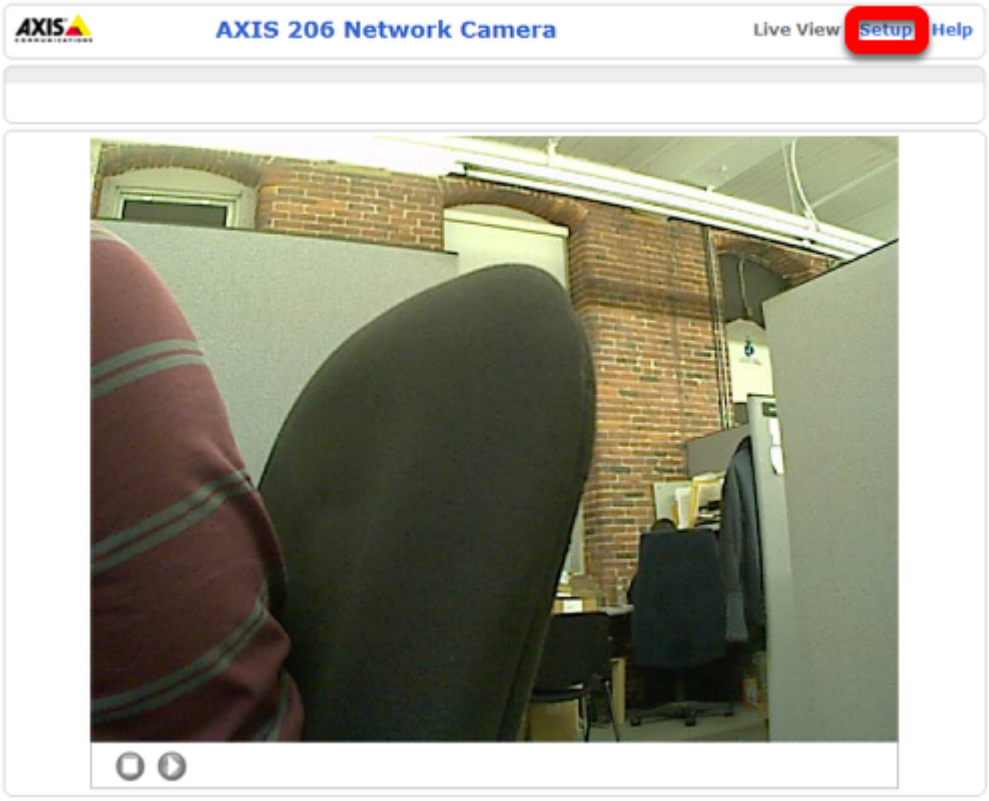
Click **Save.**

Manual Camera Configuration

It is recommended to use the Setup Axis Camera Tool to configure the Axis Camera. If you need to configure the camera manually, connect the camera directly to the computer, configure your computer to have a static IP of 192.168.0.5, then open a web browser and enter **192.168.0.90** in the address bar and press enter. You should see a Configure Root Password page, set this password to whatever you would like, but **admin** is recommended.

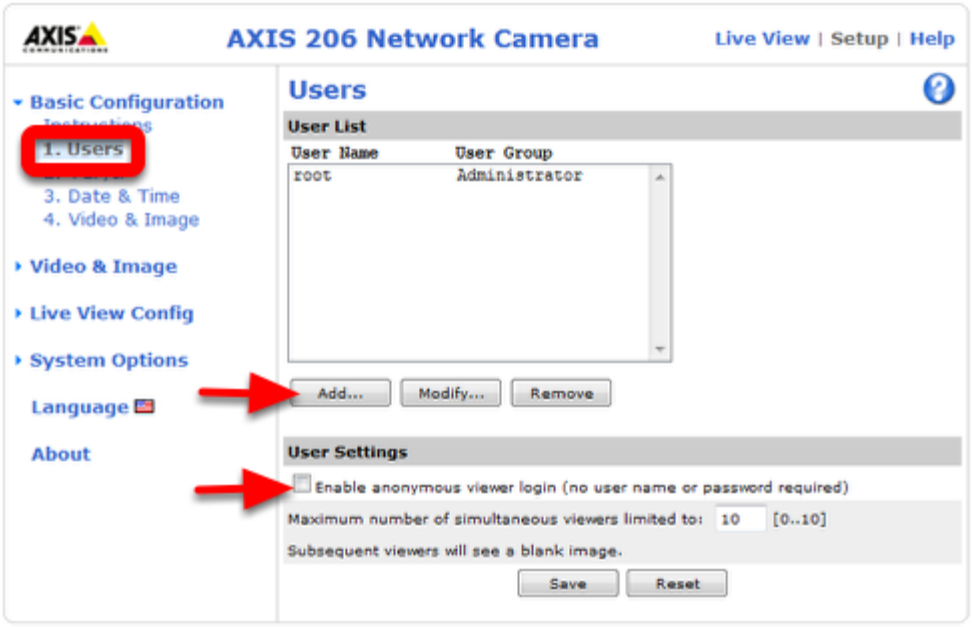
If you do not see the camera webpage come up, you may need to reset the camera to factory defaults. To do this, remove power from the camera, hold the reset button while applying power to the camera and continue holding it until the lights on the camera face turn on, then release the reset button and wait for the lights to turn green. The camera is now reset to factory settings and should be accessible via the 192.168.0.5 address.

Setup Page



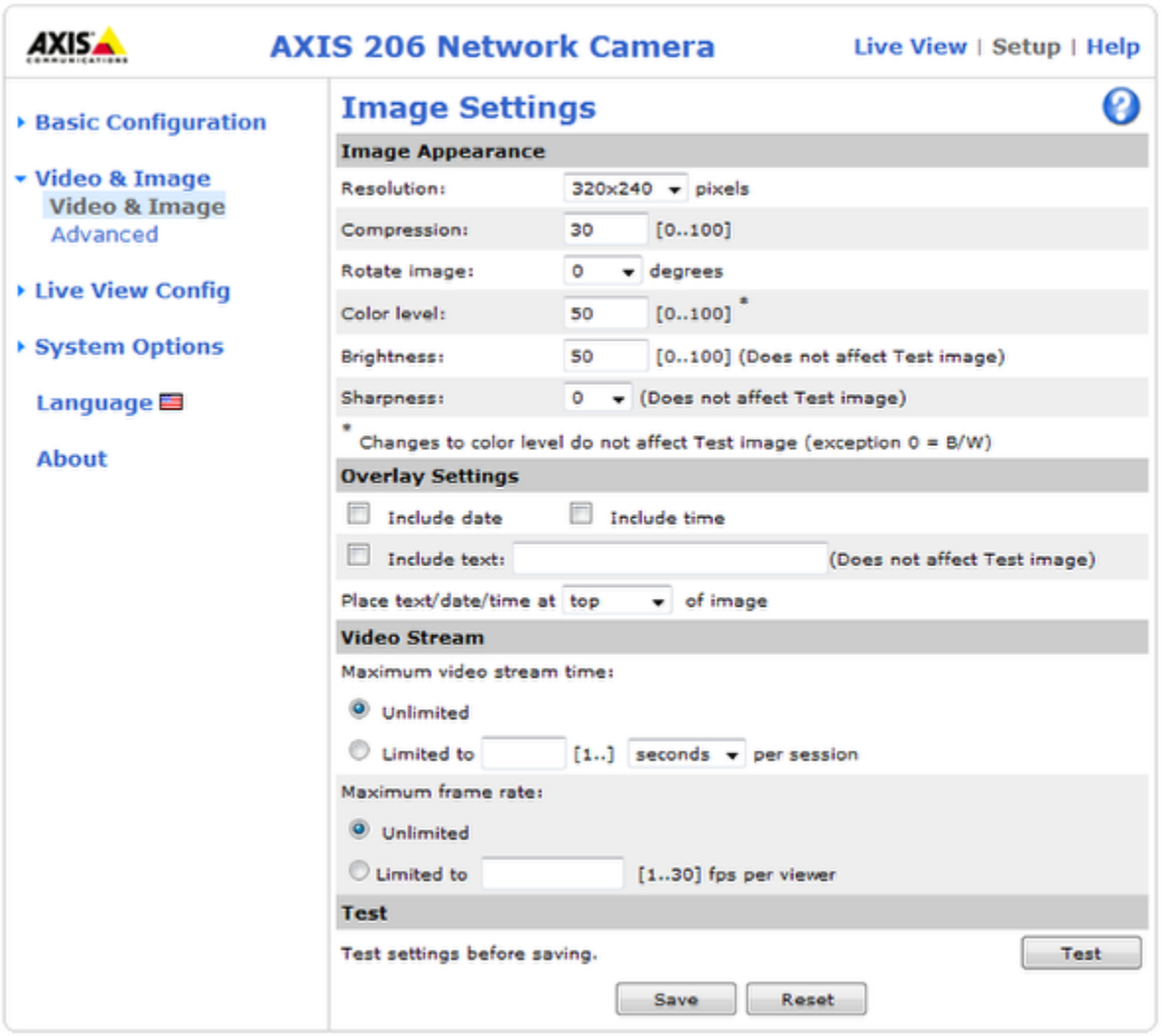
Click **Setup** to go to the setup page.

Configure Users



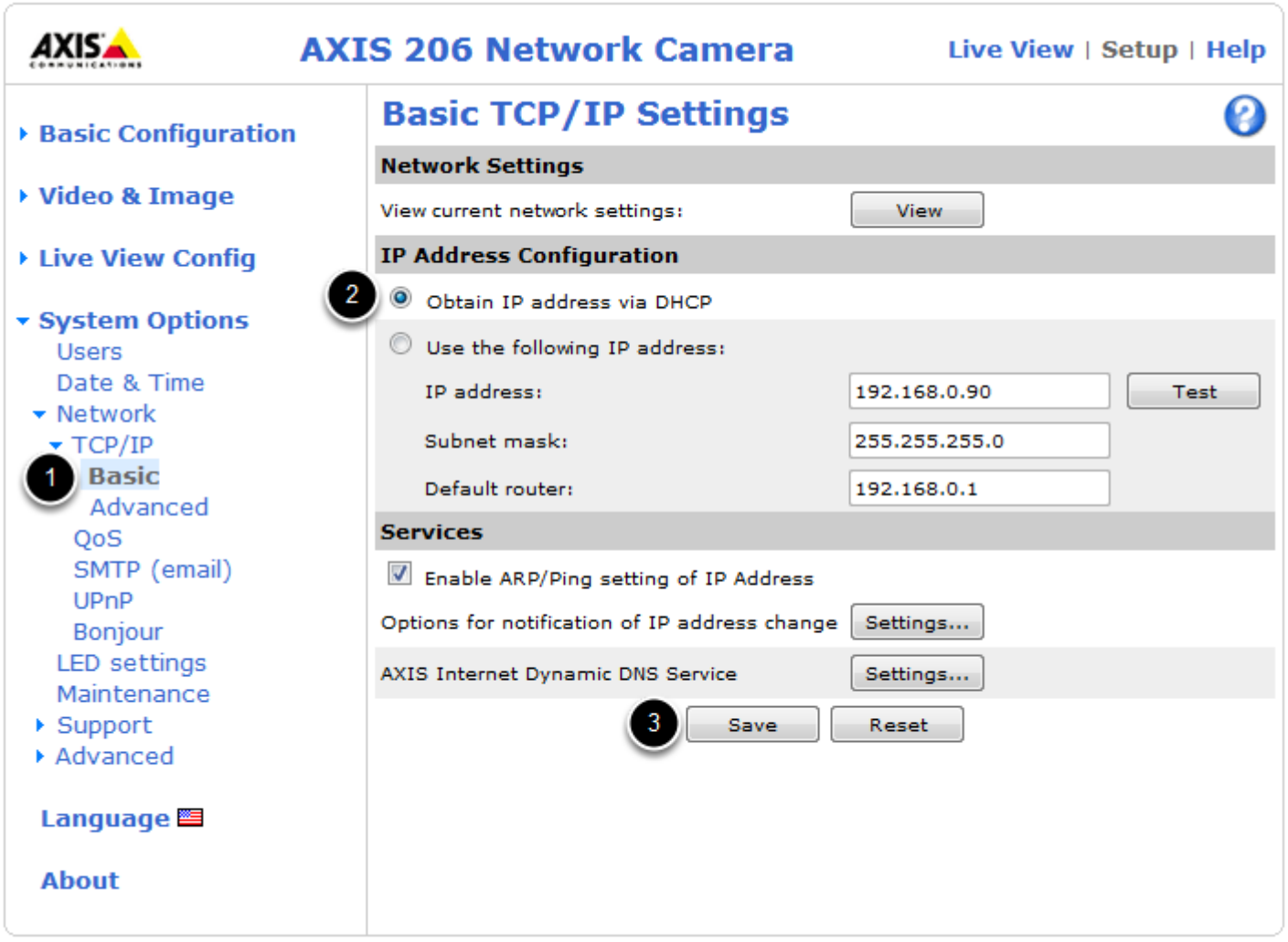
On the left side click **Users** to open the users page. Click **Add** then enter the Username **FRC** Password **FRC** and click the **Administrator** bubble, then click **OK.** If using the SmartDashboard, check the **Enable anonymous viewer login** box. Then click **Save**.

Configure Image Settings



Click **Video & Image** on the left side to open the image settings page. Set the **Resolution** and **Compression** to the desired values (recommended **320x240, 30**). To limit the framerate to under 30 FPS, select the **Limited to** bubble under **Maximum frame rate** and enter the desired rate in the box. Color, Brightness and Sharpness may also be set on this screen if desired. Click **Save** when finished.

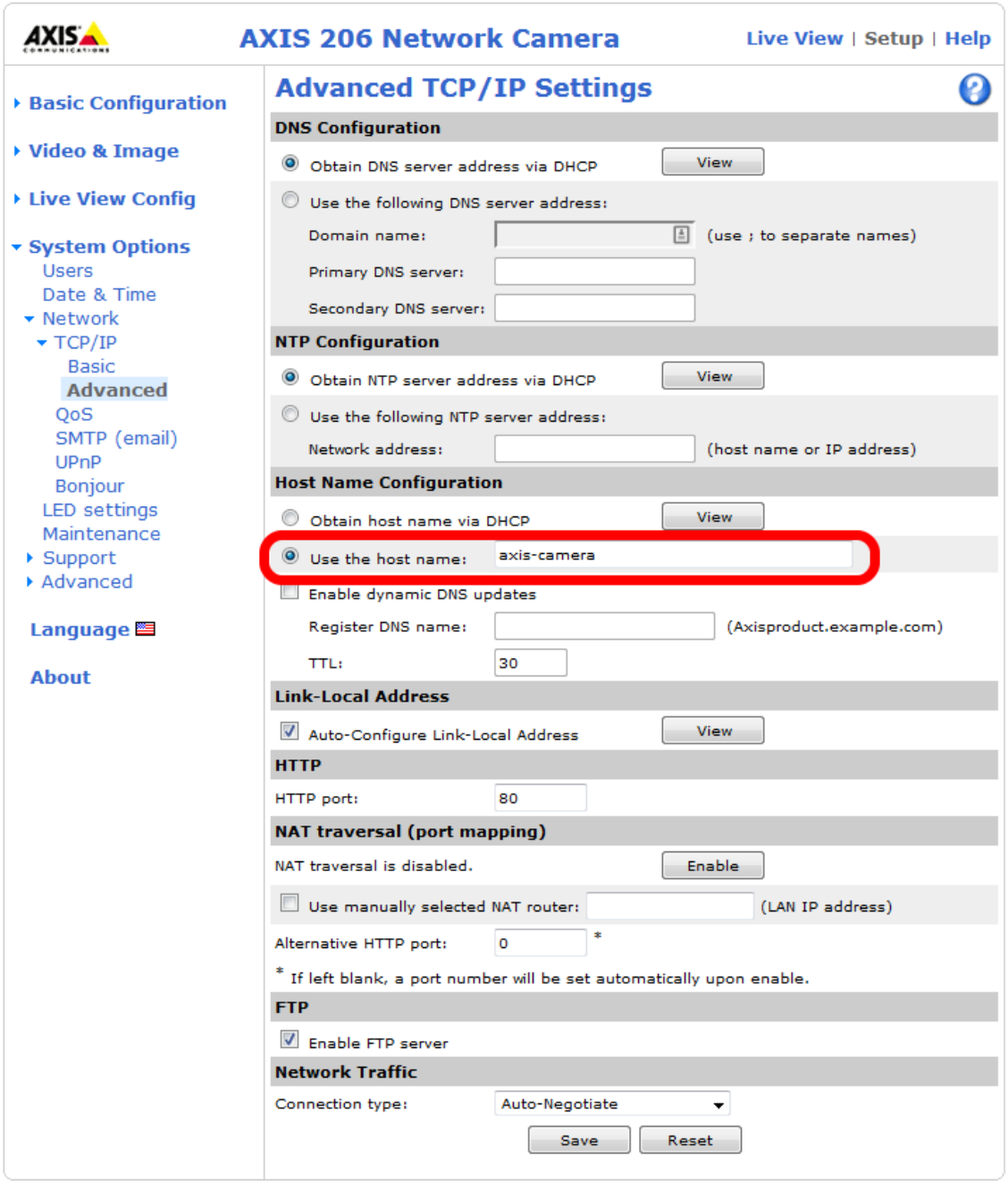
Configure Basic Network Settings



To configure the network settings of the camera, click the arrow to expand the **System Options** pane, then click the arrow to expand **Network**, then expand **TCP/IP** and select **Basic.** Set the camera to obtain an IP address via DHCP by selecting the bubble. Alternately, you may choose to set a static IP in the range 10.TE.AM.3 to 10.TE.AM.19. This is outside the range handed out by the DAP-1522 radio (home use) or FMS system (event use) so you will avoid any IP conflicts.

Click **Save**.

Configure Advanced Network Settings



Next click **Advanced** under **TCP/IP**. Set the **Host Name Configuration** to **"Use the host name:"** and set the value to **"axis-camera"** as shown. If you plan to use multiple cameras on your robot, select a

unique host name for each. You will need to modify the dashboard and/or robot code to work with the additional cameras and unique host names.

Click **Save.**

Using the Microsoft Lifecam HD-3000

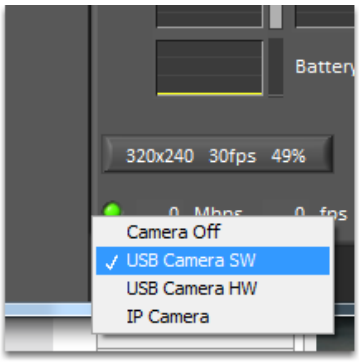
The Microsoft Lifecam HD-3000 is a USB webcam that was tested with the roboRIO as part of the Beta testing and software development effort. While other USB webcams may work with the roboRIO, this camera has been tested to be compatible with the provided software.

Connecting the camera to the roboRIO

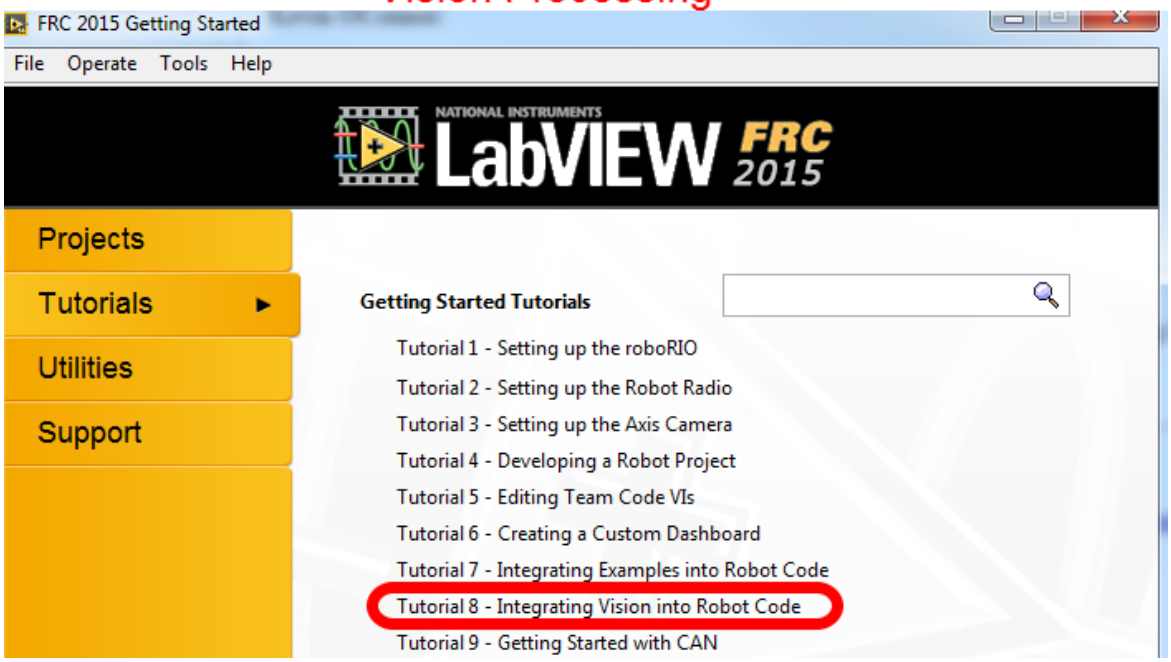
The camera can be connected to either of the roboRIO USB ports.

Using the camera - LabVIEW

Dashboard Stream



Vision Processing



To stream the camera back to the Dashboard using LabVIEW, no additional code is necessary. Simply select USB HW (image compression done by the camera, fewer options but lower roboRIO CPU usage) or USB SW (image compressed by roboRIO, more options, but higher roboRIO CPU usage) and the image should begin streaming back.

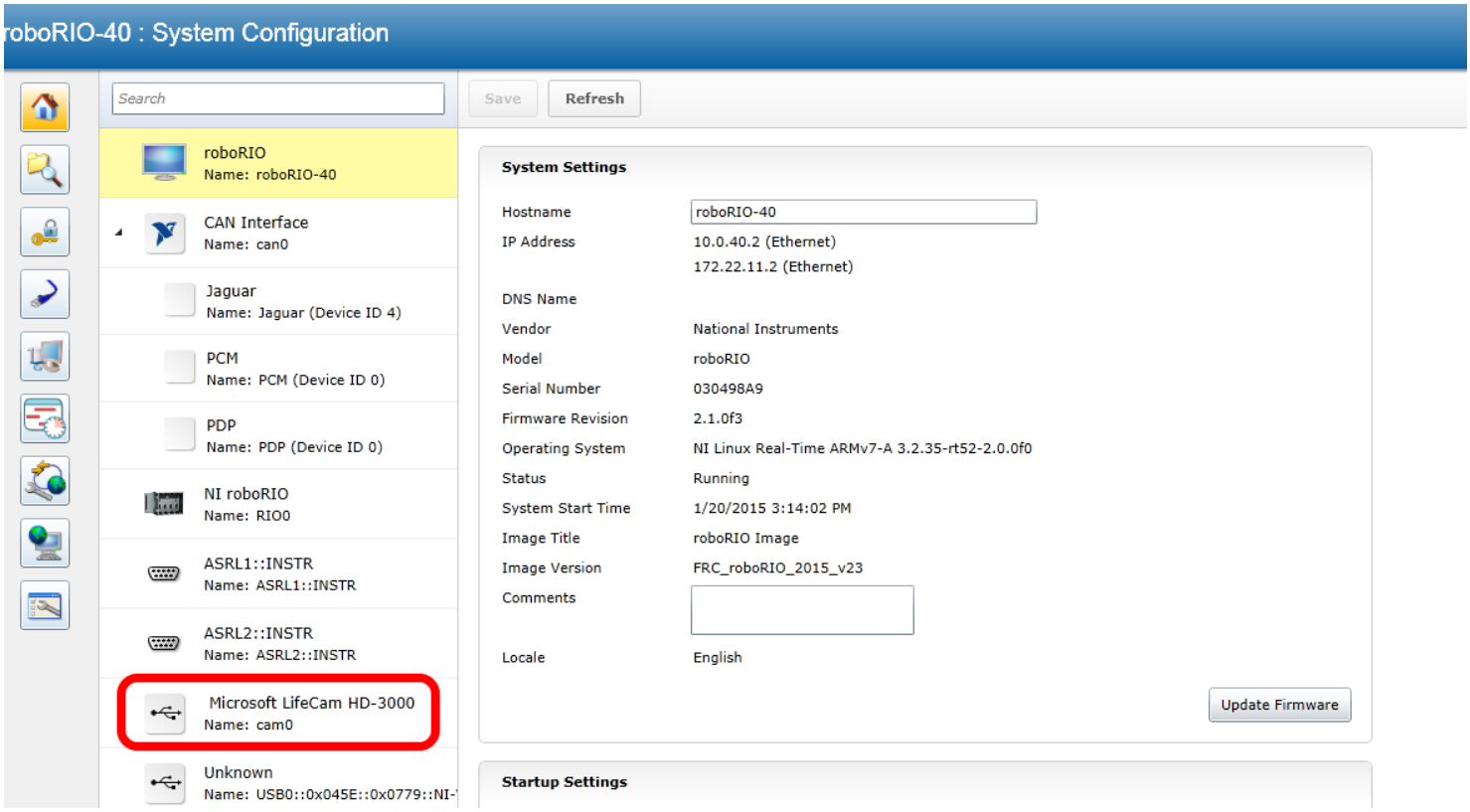
Note: The camera should be plugged in before your LabVIEW code starts running to work properly. If you just plugged in the camera rebooting the roboRIO is a quick way to make sure it is recognized properly.

The default LabVIEW templates and the image processing examples are already set up for the USB camera if you want to do image processing. On the LabVIEW splash screen, click Tutorials, then click Tutorial 8 for more information about integrating Vision processing in your LabVIEW code.

Using the Camera - C++\Java

To stream the camera back to the Dashboard using C++ or Java robot code, you will need to add some code to your robot project. Example have been provided in Eclipse to illustrate the use of the CameraServer class to automatically stream images back to the Dashboard (SimpleVision) and send back modified images (IntermediateVision and the 2015 Vision examples). This class will allow images to be streamed back to either the SmartDashboard "USB Webcam Viewer" or the LabVIEW Dashboard (set to USB HW).

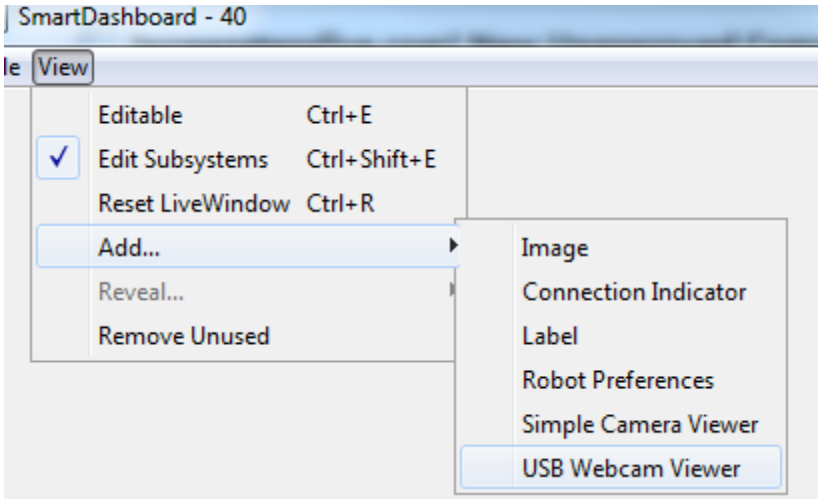
Determining the Camera name



Unlike the LabVIEW code which attempts to determine the camera name of the camera you want to use, the C++\Java code requires you to specify the camera name. To determine the name of the desired camera, you will need to use the roboRIO webdashboard. For more information about

accessing the roboRIO webdashboard see RoboRIO Webdashboard. Open the roboRIO webdashboard and locate the camera in the left pane and note the Name, this is the string you will pass into the camera server or IMAQDx open (in the image above, the camera name is cam0).

Using the SmartDashboard USB Camera Viewer



To view the camera stream from the LabVIEW dashboard, set the camera dropdown to USB HW. To view the stream from the SmartDashboard you will need to add a USB Webcam Viewer widget to your layout. For more information on the SmartDashboard and widgets see the SmartDashboard manual. To add the USB Webcam Viewer widget to the SmartDashboard, select View -> Add -> USB Webcam Viewer. To move or resize the viewer widget, make the layout Editable by selecting that option in the View menu (select again to disable).

Axis M1013 Camera Compatibility

It has come to our attention that the Axis M1011 camera has been discontinued and superseded by the Axis M1013 camera. This document details any differences or issues we are aware of between the two cameras when used with WPILib and the provided sample vision programs.

Optical Differences

The Axis M1013 camera has a few major optical differences from the M1011 camera:

1. The M1013 is an adjustable focus camera. Make sure to focus your M1013 camera by turning the grey and black lens housing to make sure you have a clear image at your desired viewing distance.
2. The M1013 has a wider view angle (67 degrees) compared to the M1011 (47 degrees). This means that for a feature of a fixed size, the image of that feature will span a smaller number of pixels

Using the M1013 With WPILib

The M1013 camera has been tested with all of the available WPILib parameters and the following performance exceptions were noted:

1. The M1013 does not support the 160x120 resolution. Requesting a stream of this resolution will result in no images being returned or displayed.
2. The M1013 does not appear to work with the Color Enable parameter exposed by WPILib. Regardless of the setting of this parameter a full color image was returned.

All other WPILib camera parameters worked as expected. If any issues not noted here are discovered, please file a bug report on the WPILib tracker (note that you will need to create an account if you do not have one, but you do not need to be a member of the project).

Using the Axis Camera at Single Network Events

The 2015 convention for using the Axis camera uses mDNS with the camera name set to axis-camera.local At home this works fine as there is only one camera on the network. At official events, this works fine as each team is on their own VLAN and therefore doesn't have visibility to another team's camera. At an offseason using a single network, this will cause an issue where all teams will connect to whichever team's camera "wins" and becomes "axis-camera", the other cameras will see that the name is taken and use an alternative name. This article describes how to modify the Dashboard and/or robot code to use a different mDNS name to separate the camera streams.

Changing the camera mDNS name

To change the mDNS name in the camera, follow the instructions in Configuring an Axis Camera but substitute the new name such as axis-cameraTEAM where TEAM is your team number.

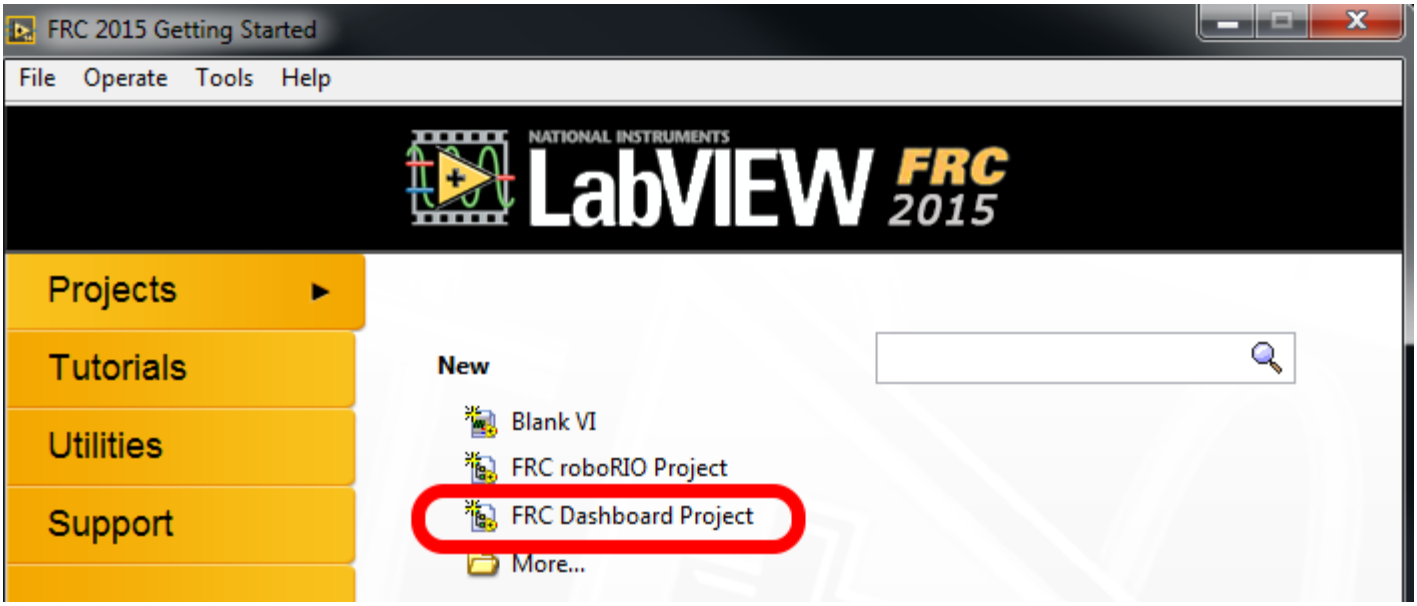
Viewing the camera on the DS PC - Browser or Java SmartDashboard

If you are using a web-browser or the updated Java SmartDashboard (which accepts mDNS names for the Simple Camera Viewer widget), updating to use the new mDNS name is simple. Simply change the URL in the browser or the address in the Simple Camera Viewer widget properties to the new mDNS name and you are all set.

Viewing the camera on the DS PC - LabVIEW Dashboard

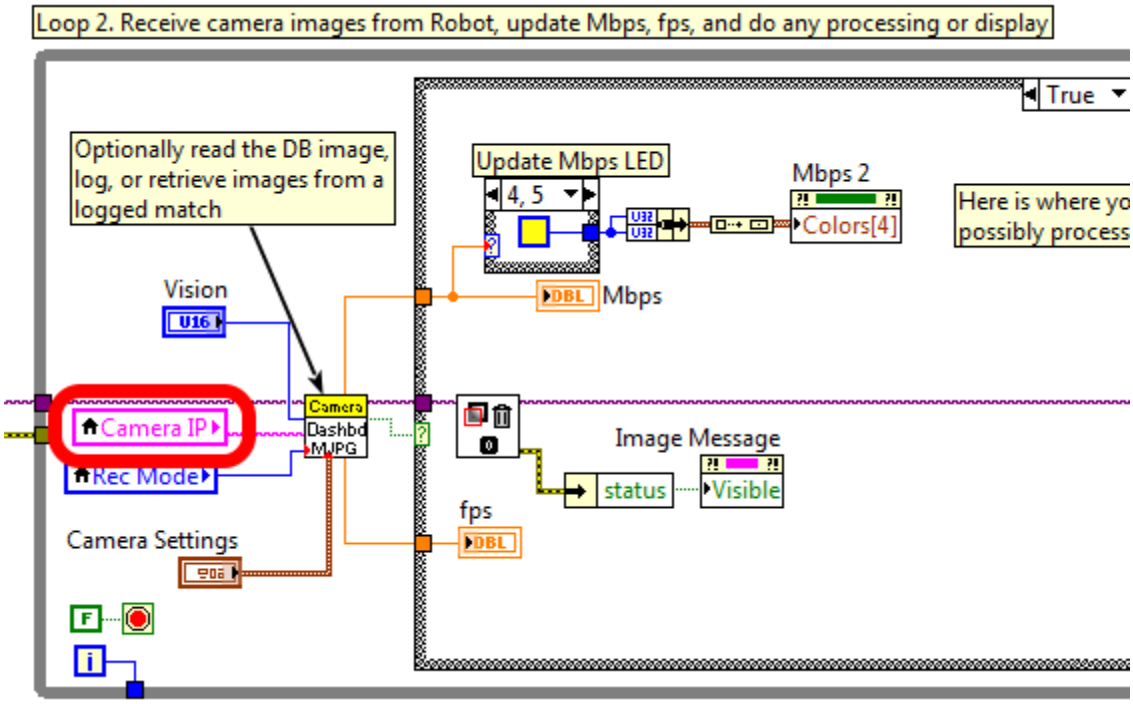
To view the camera stream in the LabVIEW Dashboard, you will need to build a customized version of the Dashboard. Note that this customized version will only work for the Axis camera and will no longer work for a USB camera, revert to the default Dashboard to use a USB camera.

Creating a Dashboard Project



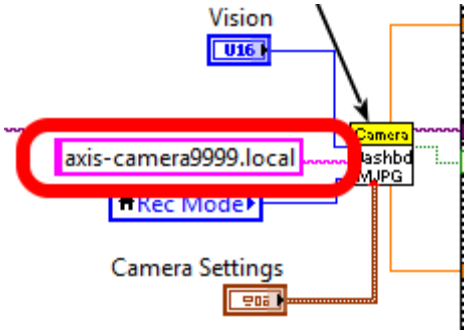
From the LabVIEW Splash screen, select "FRC Dashboard Project". Name the project as desired, then click Finish.

Locating Loop 2 - Camera IP



Double click on Dashboard Main.vi in the project explorer to open it and press Ctrl+e to see the block diagram. Scroll down to the loop with the comment that says Loop 2 and locate the "Camera IP" input.

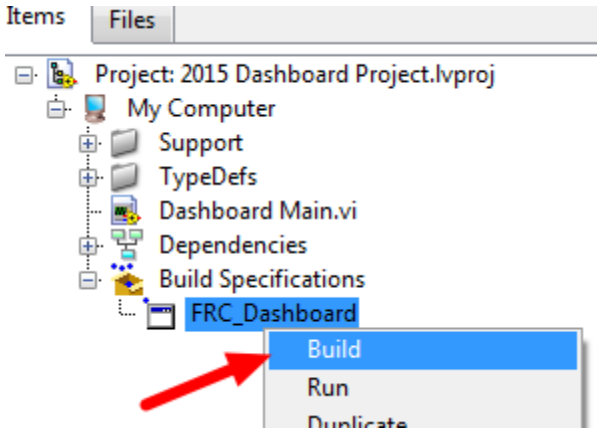
Editing the camera IP



Delete the Camera IP node, right click on the broken wire and click Create Constant (connect the constant to the wire if necessary). In the box, enter the mDNS name of your camera with a ".local" suffix (e.g. "axis-cameraTEAM.local" where TEAM is replaced with your team number). In this example I have used a sample name for team 9999. Then click File->Save or Ctrl+S to save the VI.

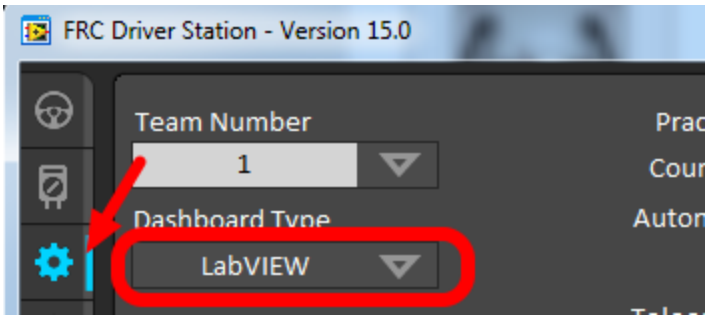
Note: You may also wish to make a minor modification to the Front Panel to verify that you are running the right dashboard later.

Building the Dashboard



To build the new dashboard, expand Build Specifications in the Project Explorer, right click on FRC_Dashboard and select Build.

Setting the Driver Station to launch the modified Dashboard

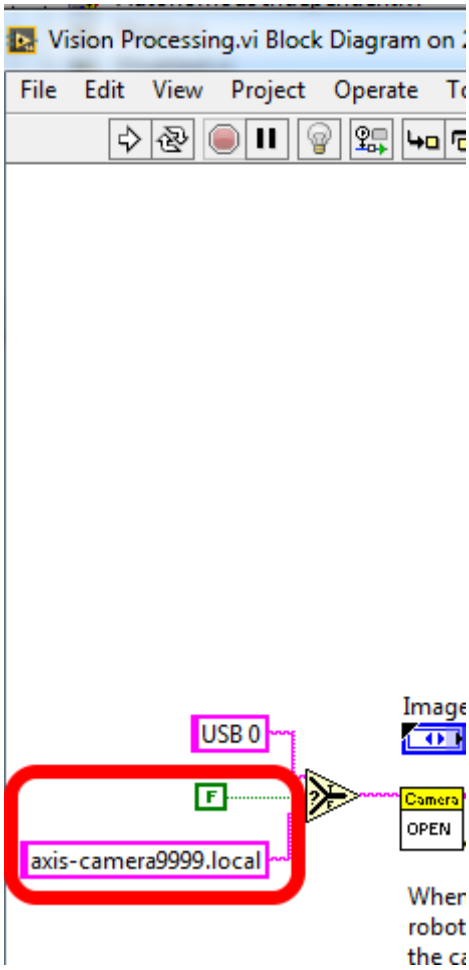


On the Setup tab of the Driver Station, change to dropdown box to LabVIEW to launch your new Dashboard.

Accessing the camera from Robot Code

If you wish to access the renamed camera from your robot code, you will have to modify it as well. In C++ and Java, just change the String used for the camera host name to match the new name. In LabVIEW follow the step below.

Modifying LabVIEW Robot Code



In the Project Explorer, locate Vision Processing.VI and double click to open it. Then press Ctrl+e to open the Block Diagram. Locate the string "axis-camera.local" near the left of the image and replace with "axis-cameraTEAM.local" Also make sure the constant is set to "False" to use the Axis camera instead of USB.