Using the Gyro & Accel Board On Your Robot with LabVIEW

Guide for FIRST Robotics Competition Teams

ADXRS450 & ADXL362 Gyro & Accel Board

FEATURES

- Easy plug-and-play installation on the RoboRIO
- Integrates a single-axis, digital gyroscope and tri-axis, digital accelerometer
- No wiring harness required
- Digital SPI output – no additional wiring or data conversion required
- Software support for LabVIEW, Java, and C++ is included in the official FIRST libraries

NAVIGATE THE FIELD WITH ANALOG DEVICES

Analog Devices has designed a sensor board to help make navigating competition fields much easier. In the past, the analog sensors made available to teams relied on analog-to-digital converters that were not optimized for precise sensor measurement. Instead of teams assembling their own wiring harness, the new sensor board simply connects to the SPI port on the RoboRIO. The board (shown below in Figure 1) features an ADXRS450 gyroscope and an ADXL362 accelerometer.

Figure 1 - Board Image

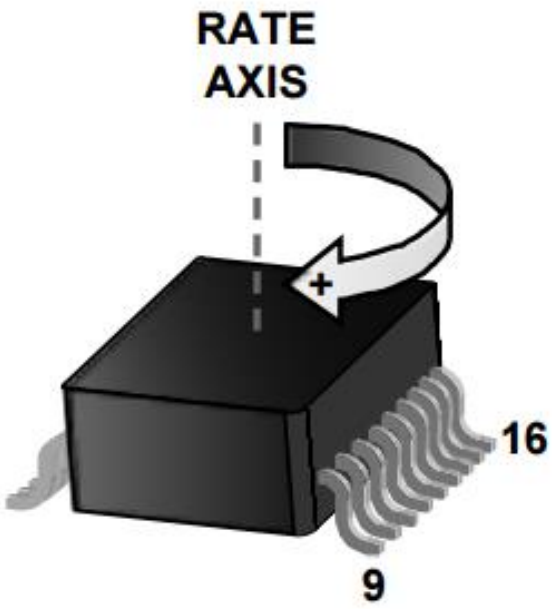

Figure 2 - Gyro Rotation Orientation

The ADXRS450 gyroscope is a "yaw-rate sensor" meaning that only the yaw, or Z, axis is measured (see Figure 2 above).

For most applications, this single axis gyroscope should be enough to track and maintain robot orientation during autonomous and teleoperated game modes.

This guide will walk you through how to run the example code on your RoboRIO and how to integrate a gyro into a mecanum robot example.

One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781.329.4700 www.analog.com
Fax: 781.461.3113

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CONNECTING THE BOARD

To get started, plug the sensor board into the SPI port on the RoboRIO as shown below in Figure 3.

Figure 1 - FRC Gyro & Accel Board installed on a RoboRIO

TESTING THE CODE

Once the sensor is connected to the RoboRIO, open LabVIEW, select the "Support" tab, and click on "Find FRC Examples". A window should appear with a list of all available examples for the RoboRIO (see Figure 4). Navigate to "Sensors > XRS450 SPI Gyro".

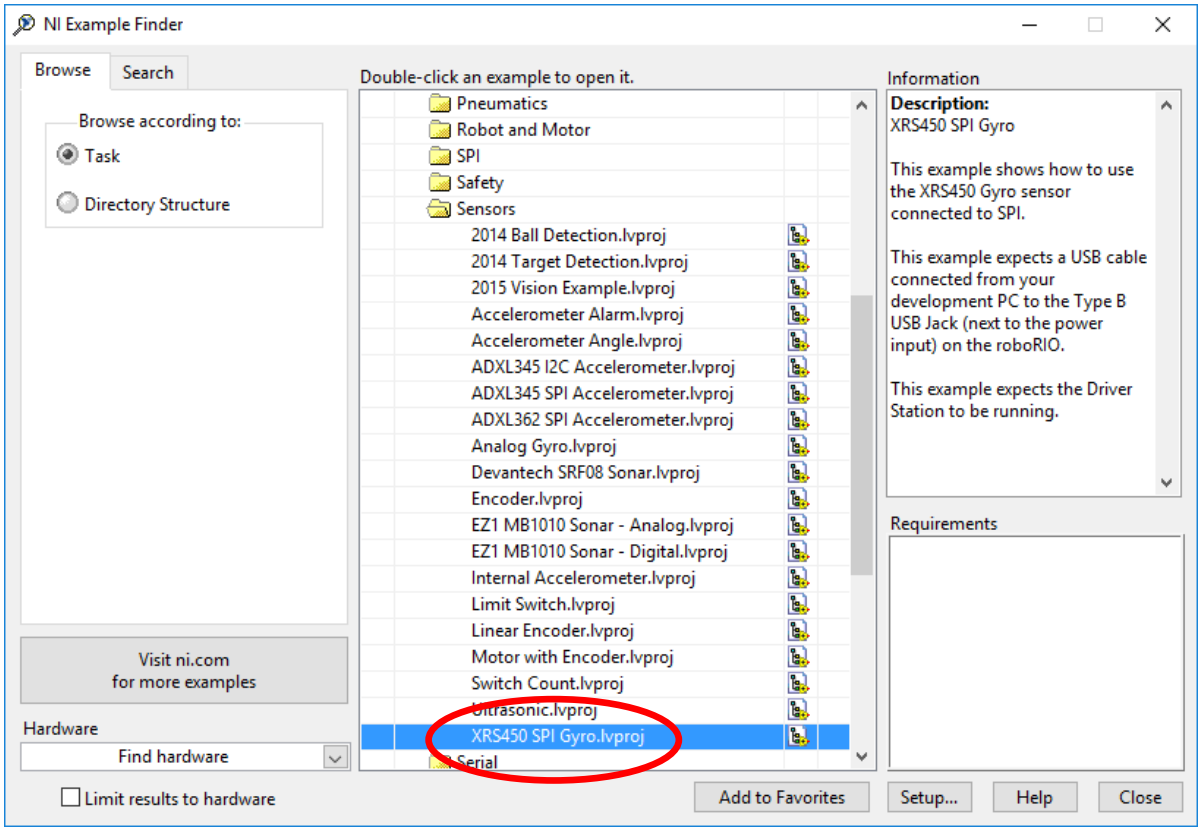

Figure 2 - NI FRC Examples

A project window similar to the one shown below in Figure 5 should appear once everything loads. Double-click on "XRS450 SPI Gyro.vi" to open the program.

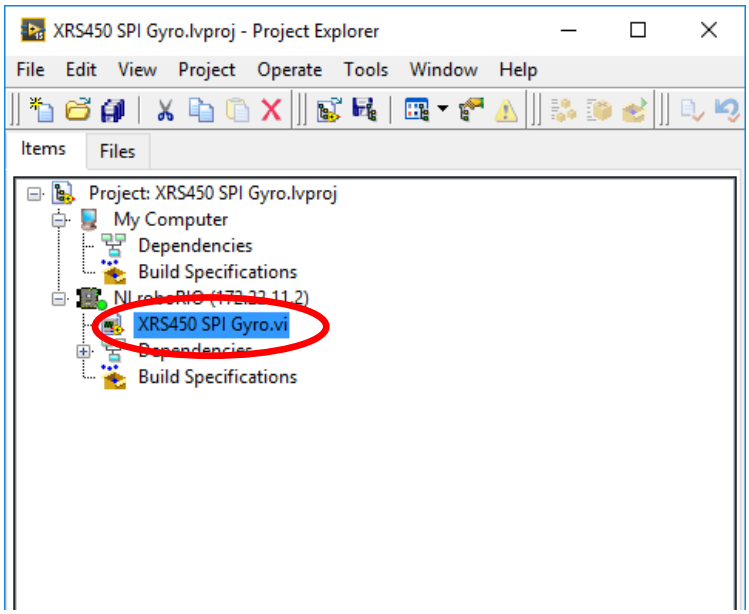

Figure 3 - XRS450 Example Project Explorer

A front panel similar to the one shown below should appear. Place the RoboRIO on a flat surface and click on the "play" symbol to run the code. **DO NOT touch or move the RoboRIO or the sensor until both LEDs on the front panel turn green.** The sensor must run a calibration routine upon start-up and should not be moved durng this time. **Remember that this calibration routine must take place every time your code executes, so don't move the robot when first turning it on!** Once the LEDs on the front panel are green, the sensor is calibrated and ready for use. Spin the RoboRIO and give it a try!

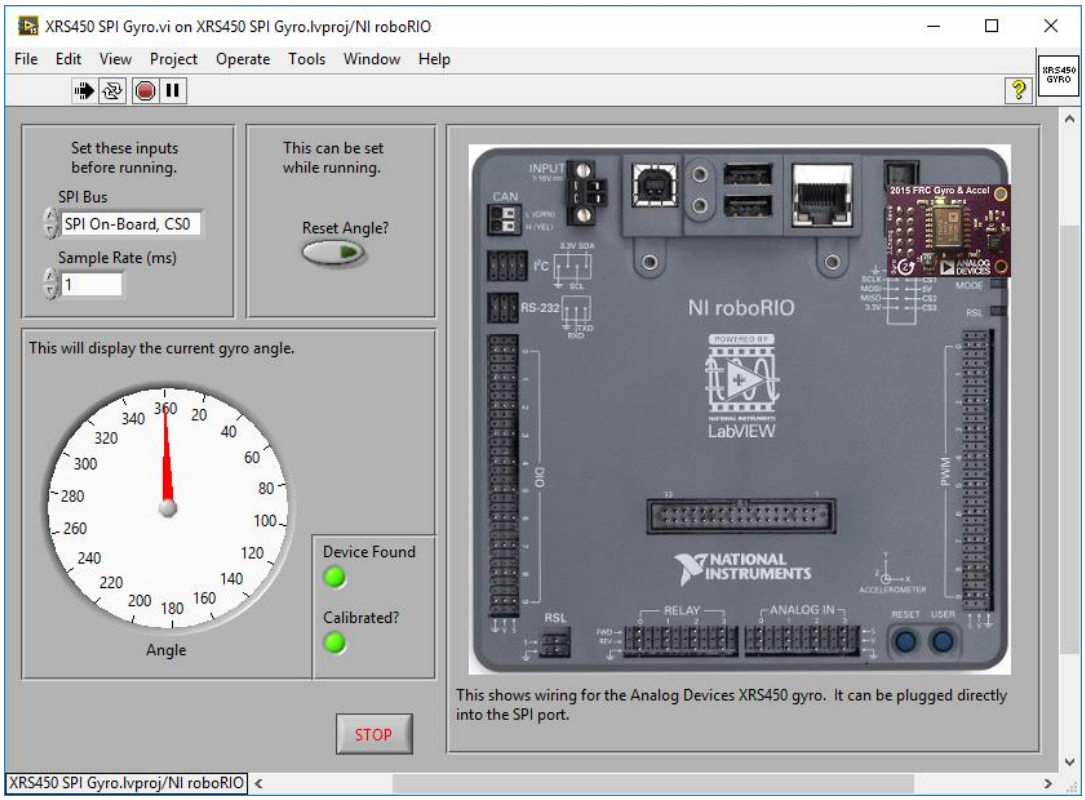

Figure 4 - XRS450 Example Front Panel

If everything is working correctly, the dial should show the angle currently being measured by the sensor board. If you click the "Reset Angle?" button, the gyro orientation will "zeroed" to whatever orientation the RoboRIO is facing. This is extremely handy if your driver needs correct the sensor or change orientation during a match.

Take a look at the block diagram by pressing CTRL + E. This diagram shows the basics required to read data from the sensor. We will go over using the sensor in a robot project in the next section.

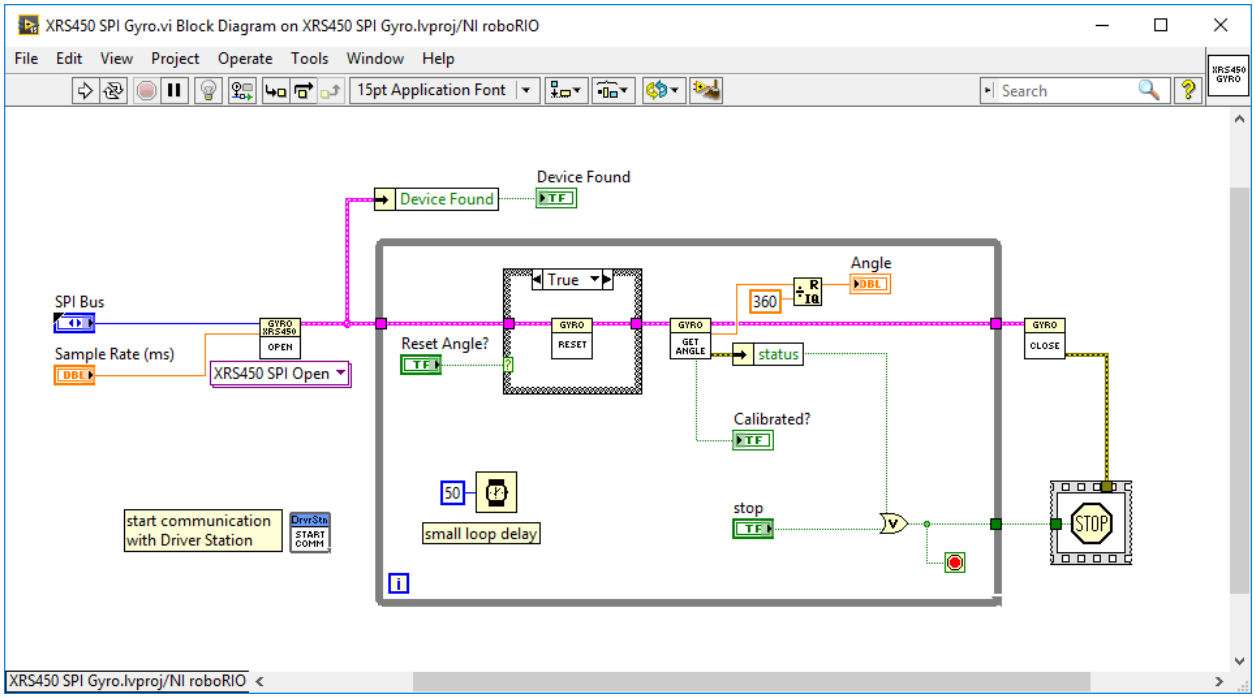

Figure 5 - XRS450 Example Block Diagram

USING THE GYRO & ACCEL BOARD IN A ROBOT PROJECT

The sensor board is easy to use in any robot project. All of the code required has been integrated into the official FIRST libraries and requires no additional software. The sensor board is compatible with any drive system and can be used for both autonomous or teleoperated feedback. This section will show you how to enable field-oriented driving by integrating gyro feedback into a mecanum robot project.

OPENING A NEW PROJECT

Open LabVIEW and click on "FRC RoboRIO Project". Change your settings as needed, being sure to select "Mecanum Drive with Arm – RoboRIO" option. Click "Finish" to create the project.

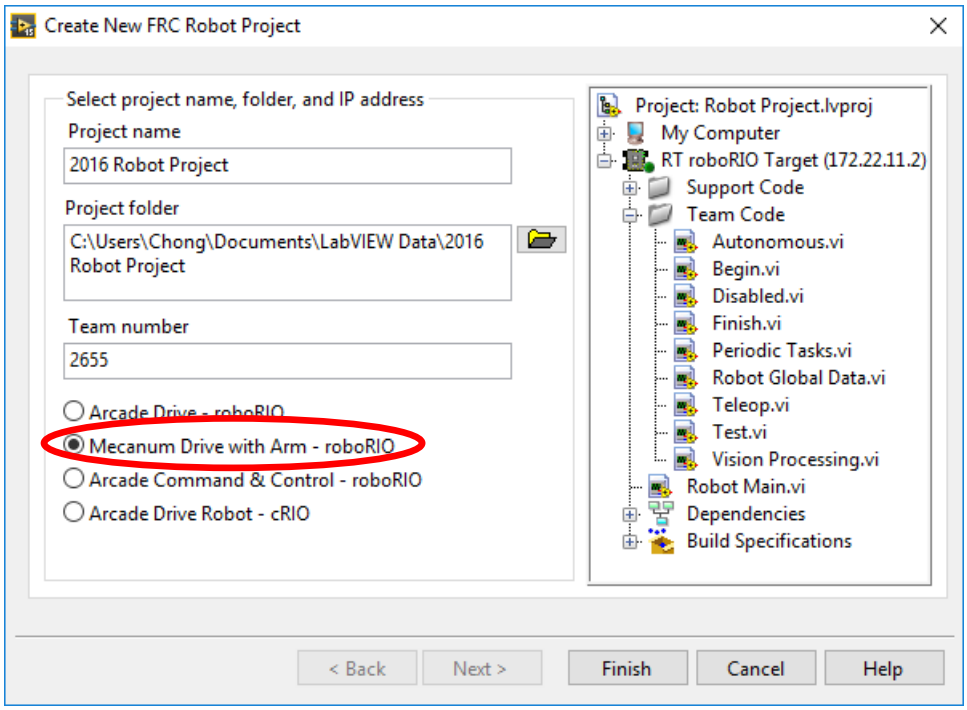

Figure 6 - New Robot Project

Gyro Vis must be added in several sections of the code, shown below.

- Begin.vi
- Teleop.vi
- Finish.vi

All gyro VIs can be found by right-clicking anywhere in the block diagram window and selecting "WPI Robotics Library > Sensors > Gyro" (see Figure 9).

Figure 7 - FRC Gyro Library Pallet

MODIFYING BEGIN.VI

In order to initiate communication with the gyro, an "Open" VI from the Gyro library must be added to Begin.vi (see Figure 10).

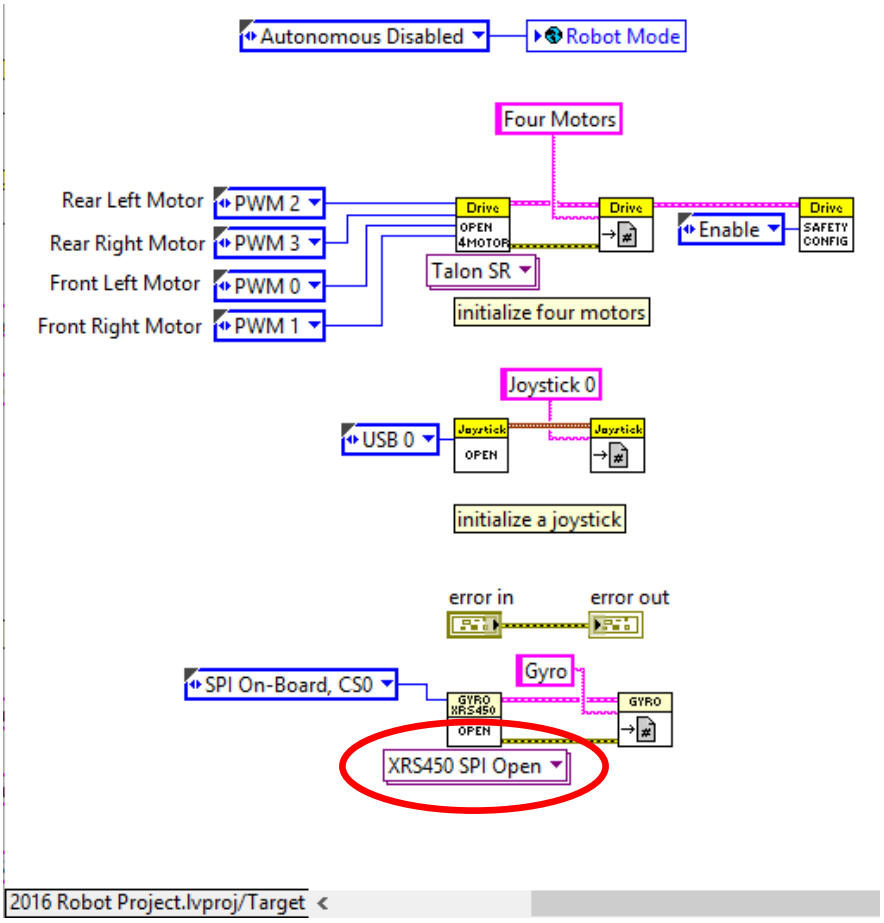

Figure 8 - Modified Open.vi Block Diagram

In the example above, a "Gyro XRS450 Open" VI and a "Gyro Ref Set" VI were added. Both can be found in the WPI Robotics Library > Sensors > Gyro pallete. Note that the "Open" VI is a "polymorphic VI", meaning you must select "XRS450 SPI Open" from the drop down menu (see Figure 10). Be sure to give the gyro a friendly name since this is how we will reference this gyro in other parts of the code.

MODIFYING TELEOP.VI

The next VI that needs to be modified is the Teleop.vi.

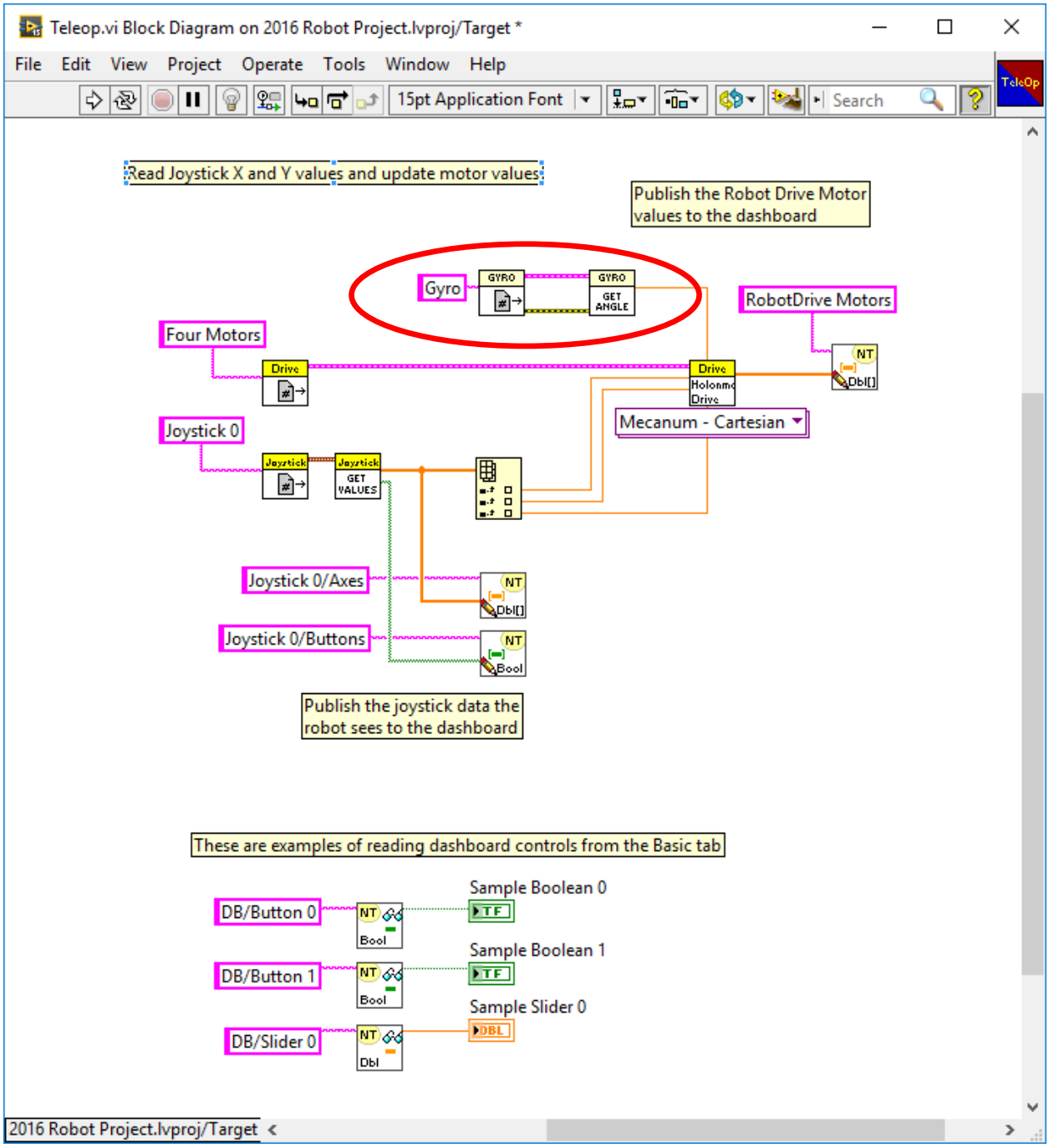

Figure 9 - Modified Teleop.vi Block Diagram

"Gyro Ref Get" and "Gyro Get Angle" Vis were added to the teleop code to provide the "Holonomic Drive" VI with gyro feedback.

MODIFYING CLOSE.VI

The last VI we need to modify is Close.vi. This modification is very important and often overlooked! If the sensor is not properly closed, it may not function correctly when code is re-deployed or restarted!

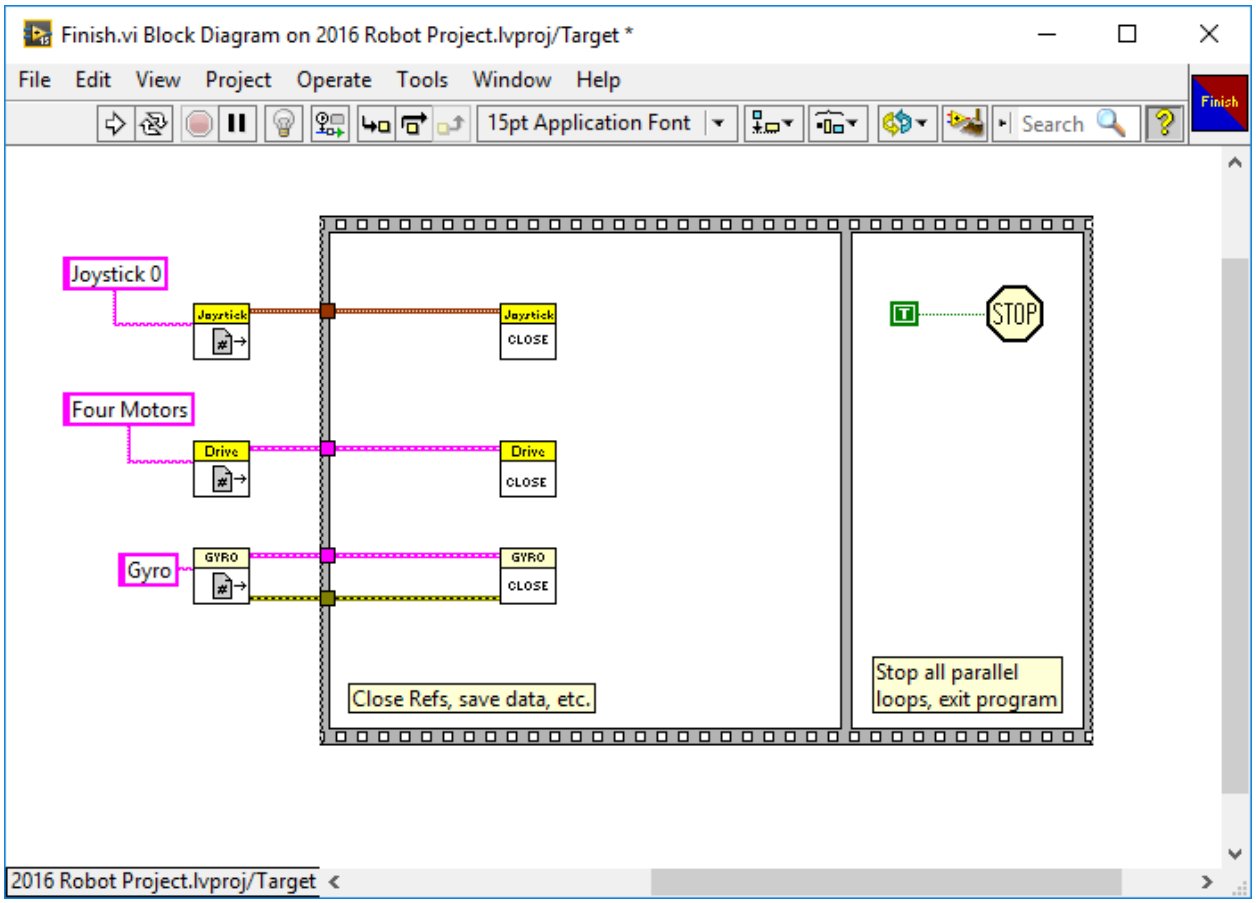

Figure 10 - Modified Close.vi Block Diagram

Place the "Gyro Ref Get" and "Gyro Close" VIs as shown in Figure 12. The RoboRIO should automaticaly close the SPI communication correctly at the end of every match or when the robot is emergency stopped.

FINAL NOTES

Adding a gyro to your robot not only allows you to implement field-oriented driving, but it can also make autonomous routines much more repeatable. The same "Get Gyro Angle" VI can be used within the autonomous loop to let your robot "rotate x degrees" or move in a very straight line.

Our Analog Devices gyro is designed for industrial applications and has been tested in many robotics applications. This sensor has been used by several teams in previous FRC seasons with great success. We hope this guide has helped you get started with the Analog Devices Gyro & Accel board!

Videos and additional resources can be found at: http://www.analog.com/first

Juan Chong – 01/08/2016