

'Snow Problem Programmer Thoughts for FIRST Steamworks

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Abstract—This white paper provides the thoughts of our programmers on the importance of various items during build season. It also includes the troubleshooting steps and advice we followed to get our radio working, as it was not properly configured for use with the FRC Radio Configuration Utility out of the box.

1 OVERVIEW

This document discusses several ideas that the 'Snow Problem programmers came up with while working on our 2017 Ri3D robot, Lelantos. We have tried to avoid rehashing ideas that are already widely discussed or suggested in the FIRST community, but have listed them below to highlight their importance:

- Programming language choice is arbitrary and should align with your team's knowledge and resources
- Version control is a must-have – any platform will work. Git and Mercurial are popular choices for FIRST teams
- Iterative testing saves time and heartache – finding issues is easier when there is less to sift through
- Insist on time before the end of build season to test all features of the robot and driver control setup
- Have a tested autonomous – even if it's just moving toward a desired position. This year there are 5 match points for any robot that can simply drive forward

There are abundant resources throughout the FIRST community and internet as a whole on the above topics. If you are looking for help or additional advice, feel free to contact us as described in Section 5. The remainder of this document discusses topics not frequently mentioned during build season and that we were reminded of during our shortened build period.

2 THINGS TO DO IN WEEK ONE

There are two important but often neglected things that we find vital for teams to accomplish in Week One – or as early as possible – that do not require intimate knowledge of the final robot design or even strategy. These things are as follows:

- Configure your RoboRIO for your team and confirm it works properly
- Set up your team radio; troubleshooting advice is provided

2.1 Set up your RoboRIO

The highest priority item for a programmer in Week One should be configuring and testing the RoboRIO. If there are

any issues with it, you'll want to find them now so that you can RMA it early in the season. Waiting to confirm the RoboRIO is working could cost you vital testing and programming time in the later weeks. Fortunately, there is very little hardware setup necessary to confirm your RoboRIO works. You'll need one of each of the following items:

- RoboRIO
- Charged FRC Battery
- Power Distribution Panel
- Laptop running Windows
- USB A to B (printer) cable

Instructions for powering the RoboRIO from the Power Distribution Panel are provided on the WPI Control System Wiring website. For this initial configuration, you do not explicitly need any of the other components such as the VRM or PCM, although you'll need to have them on the final robot. Detailed instructions for configuration and imaging of a RoboRIO are also available from WPI.

You can confirm the RoboRIO is working properly by opening the FRC Driver Station while connected to the RoboRIO via USB and checking if the communications indicator is green. You may need to set your team number in the settings tab of the driver station for it to recognize the attached device properly.

2.2 Set up (and troubleshoot) your radio

Similar to the RoboRIO, the radio is a necessary item for both testing during build season and competing. While it is possible to drive tethered (and may be desirable if you work in an area with a lot of interference), any high speed maneuvering and driver practice is going to require wireless operation. For most teams, following the guide provided by WPI will be sufficient.

While we don't anticipate the setup process for the radios to take long for most teams following the guide linked above, the OM5P-AC radio we received was not configured to correctly work with the FRC Radio Configuration Utility (RCU) out of the box. In order to work with the RCU, the radio must be pre-flashed with an initial firmware (even to use the load firmware option!). Some teams have reportedly had similar issues in past years with their OM5P-AN

routers; the solution to our problem this year and common solutions for previous issues are listed below.

If configuring the radio does not work with the 2017 utility, try updating the firmware using the RCU. You may want to try running the utility as an administrator and explicitly disabling all non-ethernet network adapters prior to launching. This reportedly fixed issues for many teams in the 2016 season.

If the utility is still unable to flash the correct firmware¹ (as it was for us), the following approach may work:

- 1) Download the official flashing utility from Cloud-Trax. At the time of writing, the latest stable version was 6.1.2.
- 2) Remove power from the radio, but leave it connected via ethernet to the computer, using the ethernet port on the radio furthest from the power jack.
- 3) Run the flashing utility without arguments from the command line. Identify the id number of the desired ethernet port. If all other adapters are disabled, this will be 1.
- 4) Run the flashing utility with the id number as the only argument, e.g. `open-mesh-flash-ng.exe 1`. After launching the utility, power the radio. Wait until a message appears indicating flashing is complete before removing power from the radio, and exiting the flashing application (Ctrl-C should do).²
- 5) Run the flashing utility again, with the id number as the first argument and the path to the `firmwareOM5PAC.bin` file included with the RCU as the second, e.g. `open-mesh-flash-ng.exe 1 C:\firmwareOM5PAC.bin`. Follow the instructions outlined in step 4 after running the utility.
- 6) Launch the RCU and configure the radio accordingly.

3 IMPORTANCE OF A TEST BOARD

Odds are, your team might not decide on a robot design for a week or two, and it wont be fully put together for you to program until long after that. If you dont have any prior experience programming FRC robots (or even if you do), it can be difficult to get started programming the basics without any confirmation that what youre doing will work!

Creating a test board can be extremely helpful for confirming that your code is behaving the way you expect. Wed recommend laying out as much of the control system as you can on a separate board (plywood works!) before it ever touches the robot. Ideally youd have several motor controllers and motors hooked up, along with any sensors you might use. You should be able to test your code on this base, and confirm that user input produces the expected output on the robot. While it might not help you get your autonomous perfect down to the millimeter, its a great way to ensure youll have a driving robot as soon as possible.

1. At the time of writing, Team Update 01 and version 17.2 of the RCU had not been released. It is unknown if the update would have solved our issues.

2. This step may not be necessary, but was performed as a part of our configuration process.

4 NI LABVIEW MAKES DASHBOARDS EASY

Regardless of the programming language used by your team to control the robot, you should consider using NI LabVIEW to create your driver station dashboard. Since the robot and dashboard communicate over Network Tables, they can be written in any combination of languages.

The biggest advantages we see in using NI LabVIEW to program the dashboard are its 'what you see is what you get' (WYSIWYG) approach to interface building and the ability to easily create more complex designs such as multi-tabbed windows without needing to learn JavaFX's fxml. These make it possible for a non-programmer to easily create or mock-up a design, which can be extremely helpful if members of the drive team cannot program.

5 CONTACTING THE AUTHORS

Team 'Snow Problem may be reached in order to ask questions on our Chief Delphi thread, on Twitter (@SnowProblemz). or via email (at gofirst@umn.edu). We are doing this for you, the FRC community, and are happy to answer questions and discuss our ideas with you.