Driver Station Best Practices

FIRST Robotics Competition Control System
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Want to ensure the driver station laptop isn't a stopper for your team at the FIRST Robotics Competition (FRC) field? Building and configuring a solid driver station laptop is an easy project, and you don't need to spend a lot of money. Read on to find lessons learned by many teams over thousands of matches.

Prior to departing for the competition

1. Dedicate a laptop to be used solely as a driver station. Many teams do. A dedicated machine allows you manage the configuration for one goal – being ready to compete at the field.

    Dedicated means no other software except the FRC-provided Driver Station software and associated Dashboard installed or running.

2. Use a business-class laptop for your driver station. Why?

    They're much more durable than the $300 Black Friday special at Best Buy. They'll survive being banged around at the competition.

    Business-class laptops have higher quality device drivers, and the drivers are maintained for a longer period than consumer laptops. This makes your investment last longer.

    Lenovo ThinkPad T series and Dell Latitude are two popular business-class brands you'll commonly see at competitions. There are thousands for sale every day on eBay.

    The laptop provided in recent rookie kits is a good entry level machine. Teams often graduate from it to bigger displays as they do more with vision and dashboards.

3. Consider used laptops rather than new. The FRC Driver Station and dashboard software uses very few system resources, so you don't need to buy a new laptop -- instead, buy a cheap 4-5 year old used one. You might even get one donated by a used computer store in your area.

4. Recommended features

    a. RAM -- 2GB of RAM minimum, if you have a SSD.

    b. Display -- 13" or greater, with minimum resolution of 1440x1050.

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[1] Please send your comments or suggestions on this document to steve@stevepeterson.com.

c. Ports

  i. A built-in Ethernet port is highly preferred. Ensure that it's a full-sized port. The hinged Ethernet ports don't hold up to repeated use.

  ii. Use an Ethernet port saver to make your Ethernet connection. This extends the life of the port on the laptop. This is particularly important if you have a consumer-grade laptop with a hinged Ethernet port.

  iii. If the Ethernet port on your laptop is dodgy, either replace the laptop (recommended) or buy a USB Ethernet dongle from a reputable brand. Many teams find that USB Ethernet is less reliable than built-in Ethernet, primarily due to cheap hardware and bad drivers. The dongles given to rookies in the Kit of Parts have a reputation for working well.

  iv. At least 2 USB ports

d. A keyboard and touchpad or mouse. It's hard to quickly do troubleshooting on touch-only computers at the field. If you're using an external keyboard or mouse, according to competition rules they must be wired.

e. Solid-state disk (SSD) -- if the laptop has a rotating disk, spend $50 and replace it with an SSD. This both improves boot up time and greatly improves reliaibility.

f. Updated to the current release of Windows 10. Windows 10 is the most common OS now seen at competitions, so bugs are more likely to be found than on Windows 7.

5. Ensure Windows is up-to-date -- Install all Windows updates a week before the competition. This allows you time to ensure the updates will not interfere with driver station functions. To do so, open the *Windows Update* settings page and see that you're up-to-date. Install pending updates if not. Reboot and check again to make sure you're up to date. Updates paused? Un-pause them and run the updater.

6. Prevent updates during competition hours -- Change "Active Hours" for Windows Updates to prevent updates from installing during competition hours. From the *Windows Update* settings page, select *Change active hours*. If you're traveling to a competition, take time zone differences into account. This will help ensure your driver station does not reboot or fail due to updates.

7. Remove any 3rd party antivirus or antimalware software -- Use Windows Defender on Windows 10. Since you're only connecting to the internet for Windows and FRC software updating, the risk is low. Only install software on your driver station that's needed for driving.

Your goal here is to eliminate variables that might interfere with proper operation. Remove any unneeded preinstalled software ("crapware") that came with the machine. Don't use the laptop as your Steam machine for gaming back at the hotel the night before the event. Many teams go as far as having a separate programming laptop.

8. Avoid managed Windows 10 installations from the school's IT department. These deployments are built for the school environment and often come with unwanted software that interferes with your robot's operation.

9. Laptop battery / power

    a. Turn off *Put the computer to sleep* in your power plan for both battery and powered operation.

    b. Turn off USB Selective Suspend

        i. Right click on the battery/charging icon in the tray, then select *Power Options*.

        ii. Edit the plan settings of your power plan.

        iii. Click the *Change advanced power settings* link.

        iv. Scroll down in the advanced settings and disable the *USB selective suspend* setting for both *Battery* and *Plugged in*.

    c. Ensure the laptop battery can hold a charge for at least an hour after making the changes above. This allows plenty of time for the robot and drive team to go through the queue and reach the alliance station without mains power.

10. Bring a trusted USB and Ethernet cable for use connecting to the roboRIO. Unsure about either cable? Toss it and spend the $5 to buy a replacement.

11. Add retention/strain relief to prevent your joystick/gamepad controllers from falling on the floor and/or yanking on the USB ports, and prevent strain on any USB hubs you are using. This helps prevent issues with intermittent input device connections.

12. The Windows user account you use to drive must be a member of the Administrator group.

At the competition
1. Turn off Windows firewall using [these instructions](#).

2. Turn off the Wi-Fi adapter, either using the dedicated hardware Wi-Fi switch or by disabling it in the *Network and Sharing Center* control panel, under *Change adapter settings*.

3. Charge the driver station when it's in the pit.

4. Disable / remove login passwords or ensure everyone on the drive team knows the password. You'd be surprised at how often drivers arrive at the field without knowing the password for the laptop.

5. Ensure your LabView code is deployed permanently and set to "run as startup", using the instructions in the [LabView Tutorial](#). If you must deploy code every time you turn the robot on, you're doing it wrong.

6. Don't plan on using internet access to apply software updates. There likely won't be any in the venue, and hotel Wi-Fi varies widely in quality. If you do need updates, contact a Control System Advisor in the pit.

7. If you do need to go onto the internet from your driver station machine, limit web browsing to FRC related web sites. This minimizes the chance of getting malware during the competition.

Before each match

1. Make sure the laptop is on and logged in prior to the end of the match before yours.

2. Close programs that aren't needed during the match – e.g., VS Code or LabView – when you are competing.

3. Bring your laptop charger to the field, and plug in. Power is provided for you in each player station.

4. Fasten your laptop with hook-and-loop tape to the player station shelf. You never know when your alliance partner will have an autonomous programming issue and blast the wall.

5. Ensure joysticks and controllers are assigned to the correct USB ports. In the *USB* tab in the FRC Driver Station software, drag and drop to assign joysticks as needed. Once you've assigned joysticks to their positions, don't unplug them. Use the rescan button (F1) if joysticks / controllers do not appear green, or if during the match joystick or controllers become unplugged or unresponsive.

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