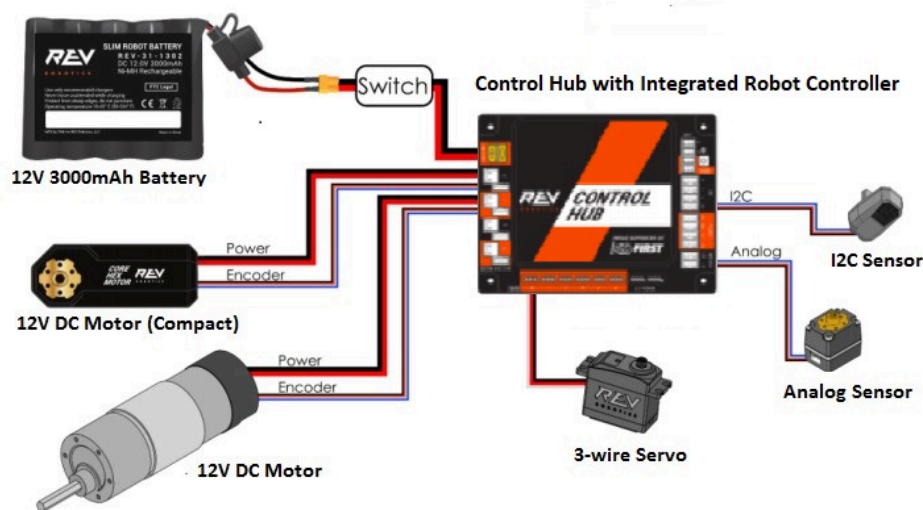


Control System Overview

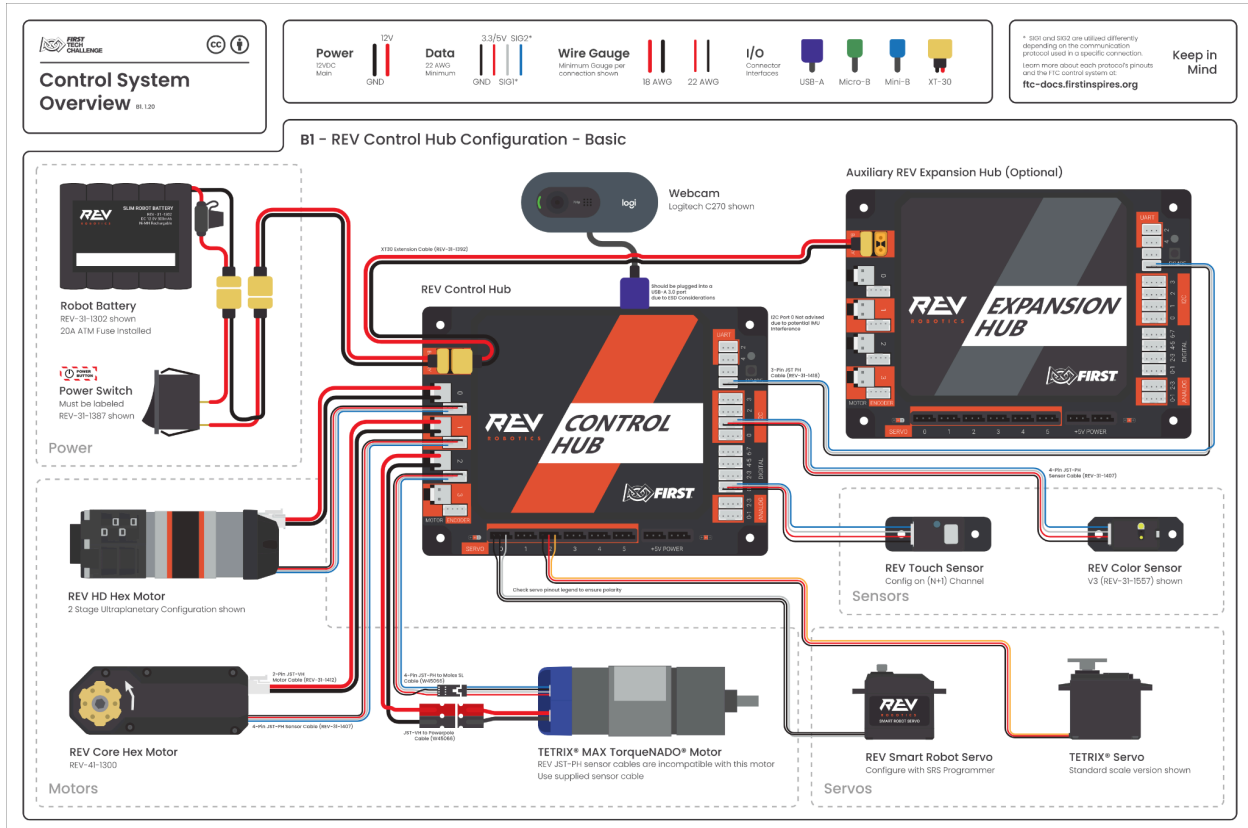
- Each robot has a **Driver Station** that can connect to 1-2 **gamepads**. This is sometimes also called a Driver Hub.
- The Driver Station will be connected to the Control Hub on the robot by a wifi signal.
 - The Control Hub has an Android device built into it.
 - The Control Hub is the brains of your robot.
 - All of your code is stored on your robot's Control hub.



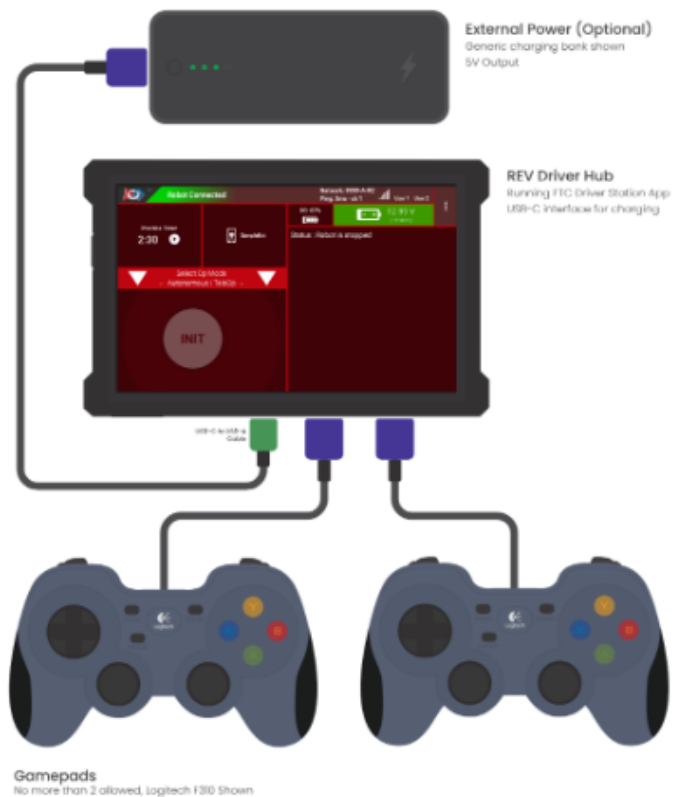
- The components of your robot (motors, servos, sensors, camera) plug into your robot's Control Hub in the appropriate ports.



- An **Expansion Hub** can be added to allow you to install more components. The Expansion Hub gives you more ports to plug motors, servos, and sensors into your robot.



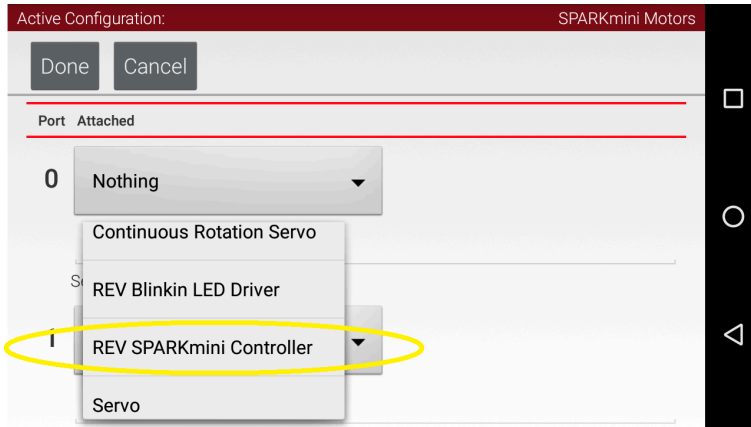
- The Driver Station has a battery power source. It can be plugged in and charged. However, these devices have notoriously unreliable batteries. So, it is advisable to plug in an external power source and use that to charge your Driver Station instead. You will need to remove the Driver Station's battery pack in order for it to run off the external power source.
- Some games will allow you to play with 2 gamepads, and some will allow only 1. The maximum number of gamepads your Driver Station can support is 2.
- The first time your Driver Station and Control Hub are used, they will have to be paired. They will also need to get updates occasionally. This is accomplished by downloading the Rev Hardware Client onto a computer and managing these devices by plugging them into that computer while the Rev Hardware Client is running.
 - The Driver Stations and Control Hubs assigned to your team have already been paired- you just have to grab the correct ones. They should be labeled. Alert a mentor if you get a message on your Driver Station telling you that your devices need updates installed.



Configuring your robot:

- In the top right corner of your Driver Station display when the FTC Driver’s Station app is open, you will see 3 dots. Once you click on them, you will see a section labeled “Configure Robot.” Once you click on this, you will be presented with a list of your robot’s configurations (there may be only one or there may be more than one). This is where you can choose which configuration to activate.
- Click on the one you intend to use. Then, click through all the sections of the configuration and make sure that every slot is correct. Each slot corresponds to a physical slot on the robot’s Control Hub and Expansion Hub (if you are using one). For every item you have plugged into the robot (motors, servos, sensors, etc), you should have a corresponding entry listed in your configuration.

- Make sure to select the right item from the drop-down menu in the right slot for everything you have plugged in. Give each item a name. Pick out a name that is logical and will help you and your teammates understand the function of the item. *Example: left front wheel, claw servo, linear slide, etc.*



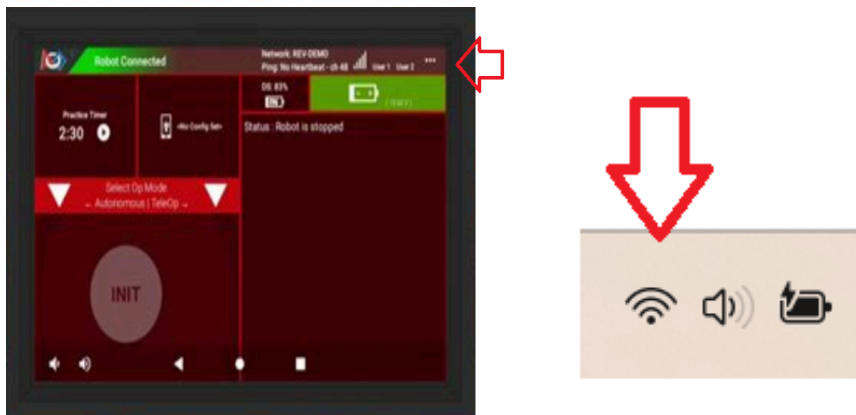
*Note. If possible, avoid using the “0” slot of the I2C inputs. This slot is automatically assigned to your Control Hub’s IMU. You may want to use it later.

Connecting to your robot from the Driver Station:

- 1) Plug your 12v battery into your Control Hub on your robot.
- 2) Grab the Driver Station that is paired with your robot’s Control Hub.
 - a) Make sure it is charged (either because it was recently plugged in or because it has a charged external power source attached and has its battery removed).
- 3) Turn on your robot. The light on your Control Hub (and Expansion Hub if you have one) will turn blue initially, then turn green once they are ready to use).
- 4) Turn on your Driver Station. Simply tap the power button on the bottom once.
- 5) Open the FTC Driver Station app (it might open automatically).
 - a) You can get out of the app by swiping up on the screen and touching the circle icon at the bottom of your screen.
- 6) You are now ready to use your robot. Select the OpMode you wish to use from either the Autonomous or TeleOp (Driver Controlled) menus available on the left hand side.
 - a) Only the OpModes that are “enabled” will appear on these drop-down menus.
- 7) Once you have selected your desired OpMode, hit the large **INIT button** to initialize your program. When you do this, the INIT button will transform into a large **“play” button**.
- 8) To start your program, press the “play” button. Once you hit the “play button, the main button will transform into a large **“stop” button**. Hit the “stop” button to stop your program.

Connecting to your robot's programming (OpModes):

- Click on the 3 dots in the upper righthand corner of your Driver Station
- Select "Program & Manage" from the drop-down menu
- You will now see the name of your Control Hub's private wifi network, the password for the private wifi network and the web address you will input to access your code.
- Connect to your robot's wifi with a computer. Some school computers may not be able to access "outside networks" (including your robot's wifi network).
 - A student or mentor's personal computer should be able to connect.
 - Certain Robotics Club Computers should be able to connect (ask your teacher)
- Once you have connected to your robot's wifi network, open a web browser and type in your robot's web address. Click on the "Blocks" tab on the top to view your OpModes.
 - *The website is the same for everyone. Your robot's programming will only pop up if you are connected to YOUR robot's wifi. If you accidentally connect to someone else's robot, you will see THEIR code. Double check that you are on the correct wifi if the code and OpModes don't look familiar.
- Now you will see all the OpModes saved on your robot's Control Hub.
 - From this screen you can create new OpModes and if you select an OpMode (using the box on the left hand side) you can copy, rename or delete OpModes.
 - You can check or uncheck the "enable" box on the right. Only the OpModes that are enabled will show up on the Driver Station drop-down menu.
- Clicking on the name of your saved OpModes will allow you to view or edit them.
- Changes you make in your OpModes will not be saved unless you hit the SAVE button.



Resources:

First Official Team Resources: Control System Introduction:

https://ftc-docs.firstinspires.org/en/latest/programming_resources/shared/control_system_intro/Team-FTC-Control-System.html

First Official Team Resources: Hardware Component Overview

https://ftc-docs.firstinspires.org/en/latest/control_hard_compon/index.html