



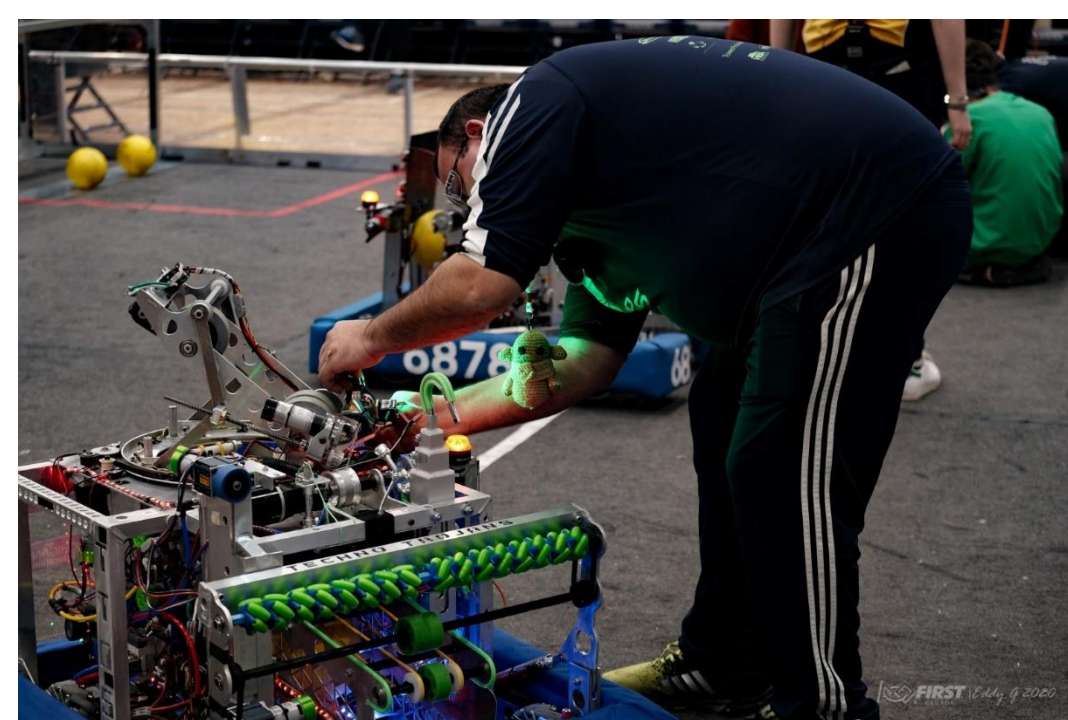
# TECHNO TROJANS

CONTROLS WORKSHOP



# WHO AM I?

- FIRST Alumni 2003-2004 season on team 1254
- ~16 Years of mentoring with FRC teams 1254 and 2405
- 4th year mentoring with FTC teams at Fruitport and Montague
- Working at Bennett Pump as Technical Customer Service
- Electrical Certification from Van Buran Technology Center
- Studied Electrical Engineering at Lake Michigan College and Western Michigan University
- Controls Engineer by trade
- FRC Volunteer positions held
  - FRC Judge
  - CSA in training
  - Pit admin
  - Inspector
  - Field reset
  - Spare parts
- Avid golfer: ex competitor on the Michigan Amateur Golf Tour
- Played Baseball at Lake Michigan College
- Other interest...
  - Ultimate Frisbee
  - Hockey
  - Baseball
  - Fishing
  - Barbecuing
  - Texas hold'em
- Email: [Jeremy\\_M1580@yahoo.com](mailto:Jeremy_M1580@yahoo.com)



# WORKSHOP BREAKDOWN

- Setup of Rev Control Hub
- Setup Driver Station
- Basic Wiring of Robot
- Programming options for FTC
- Motors and servos
- Basic Sensors
- Programming Teli-op mode
- Programming Auton op mode
- Robot rules to keep in mind
- Questions??



```
to runOpMode
  Put initialization blocks here.
  call MyFIRSTOpMode . waitForStart
  if call MyFIRSTOpMode . opModelsActive
  do Put run blocks here.
  repeat while call MyFIRSTOpMode . opModelsActive
  do Put loop blocks here.
  set tgtPower to - gamepad1 . LeftStickY
  set motorTest . Power to tgtPower
  call Telemetry . update
```

# REV CONTROL HUB

- Physical Dimensions

- 143mm X 103mm X 29.5 mm
- Mounting holes on a 16mm spacing

- Input Voltage

- 12V nominal (8-15V DC)
- ESD and reverse polarity protection

- Processors

- RK3328 Quad-core ARM® Cortex-A53
- Texas Instruments ARM® Cortex-M4

- 3.3V Ports

- 8x digital I/O: 1A source max
- 4x I2C 100kHz/400kHz busses: 500mA source max
- 4x 12-bit analog inputs: 500mA source max
- 4x quadrature encoder inputs: 500mA source max

- 5V Ports

- +5V Power: 2A source max
- Servos: 2A source maximum per pair (0-1, 2-3, 4-5)
- USB 2.0: 1.5A source max
- USB 3.0: 1.5A source max



The Rev control hub for 2022-2023 season is required on the robot!



# REV CONTROL HUB

## GETTING STARTED

- Getting started with the Control Hub you will need
  - Control Hub
  - 12V Battery (preferably FTC legal battery)
  - FTC switch
  - Tamiya to XT30 adapter (if needed)



FTC Legal



FTC Legal



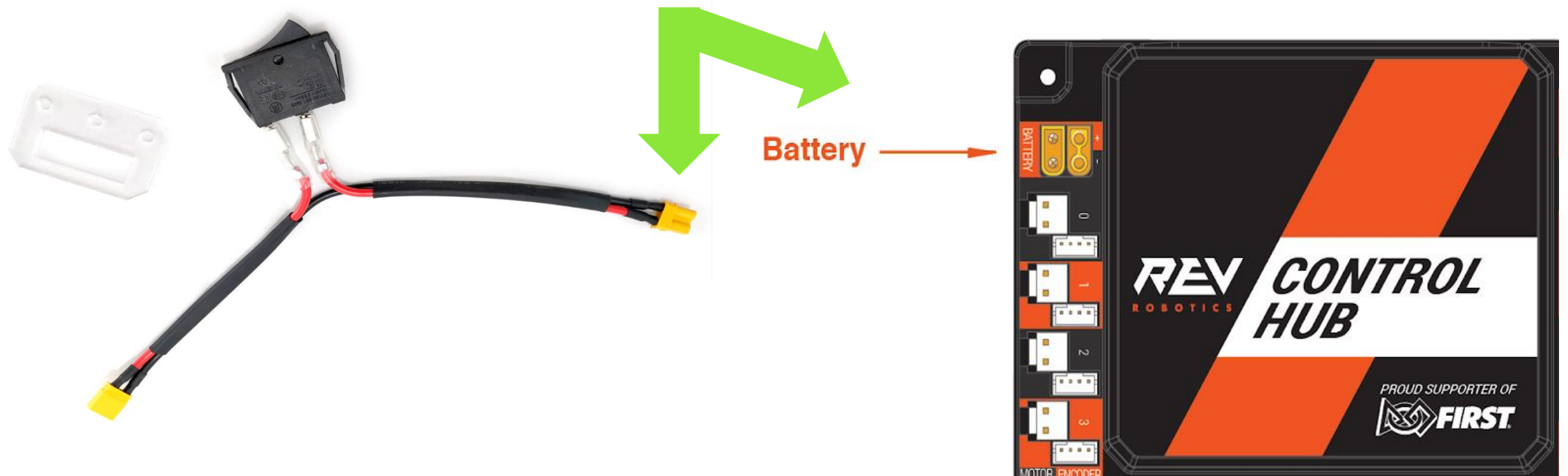
FTC Legal



# REV CONTROL HUB

## BOOTING UP FIRST TIME

Start by attaching switch and adapter to the control hub with the female end of the switch going to the slot labeled “battery” on the hub and the other either going to the adapter or the battery.



# REV CONTROL HUB

## BOOTING UP FIRST TIME CONTINUED...

Once battery is connected, flip the switch to “I” position and the hub should start the booting process. Once hub is done loading you should see the led light turn green. It is now putting out a Wi-Fi signal that you can connect to with any device that has Wi-Fi capability and a web browser.

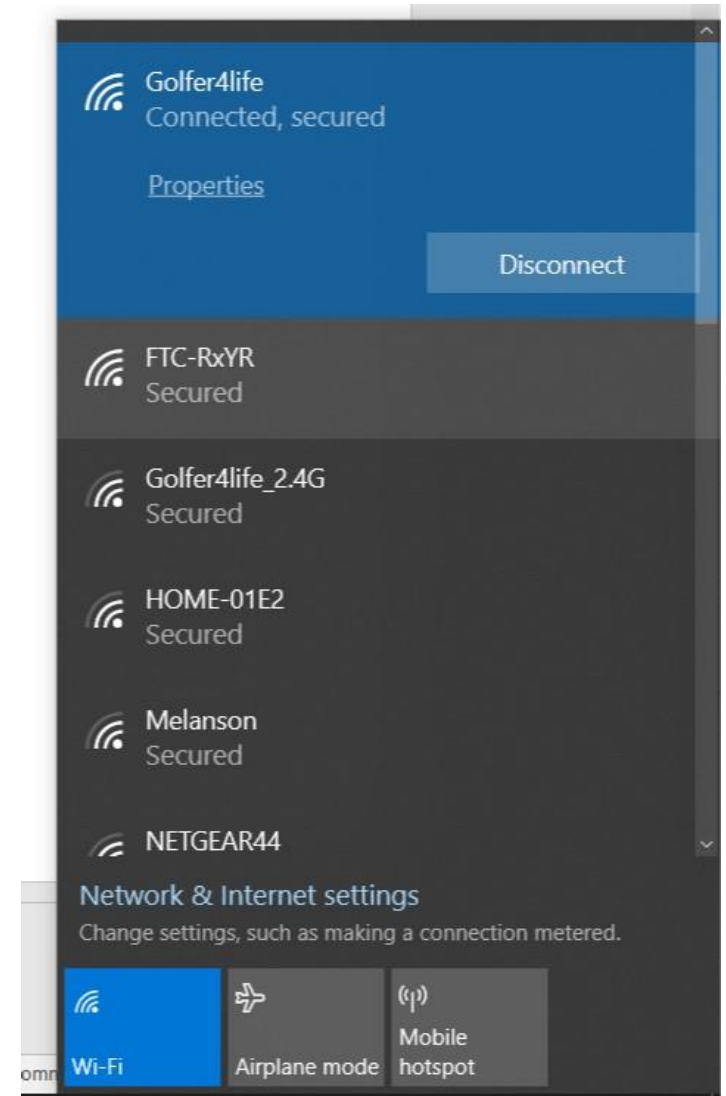


# REV CONTROL HUB

## CONNECTING TO NETWORK

Now that the hub is putting out a signal to connect to open up the Wi-Fi list on the device that you are going to connect to it and you should see the hub listed as “FTC-?????”. Click connect and enter in the default password which is “password”. Once the device is connected you can now enter into the web browser in order to access the dashboard where we can change the settings.

**\*\*Note it is recommended that you change your password of your hub\*\***





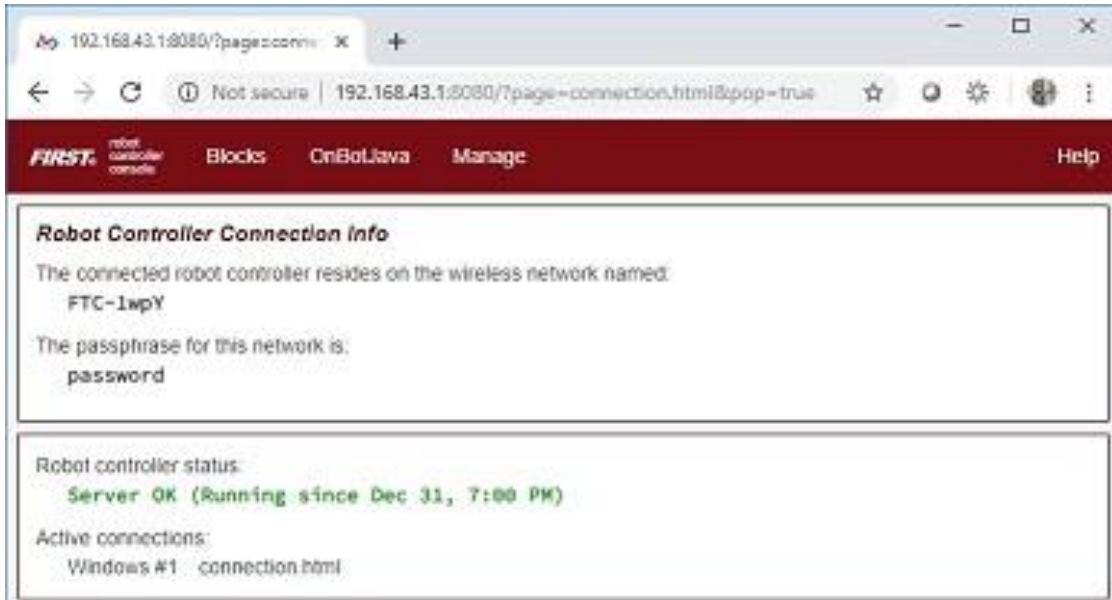
# REV CONTROL HUB

## CHANGING NETWORK NAME

- To enter the dashboard, open up your web browser and enter the dashboard address:

"192.168.43.1:8080"

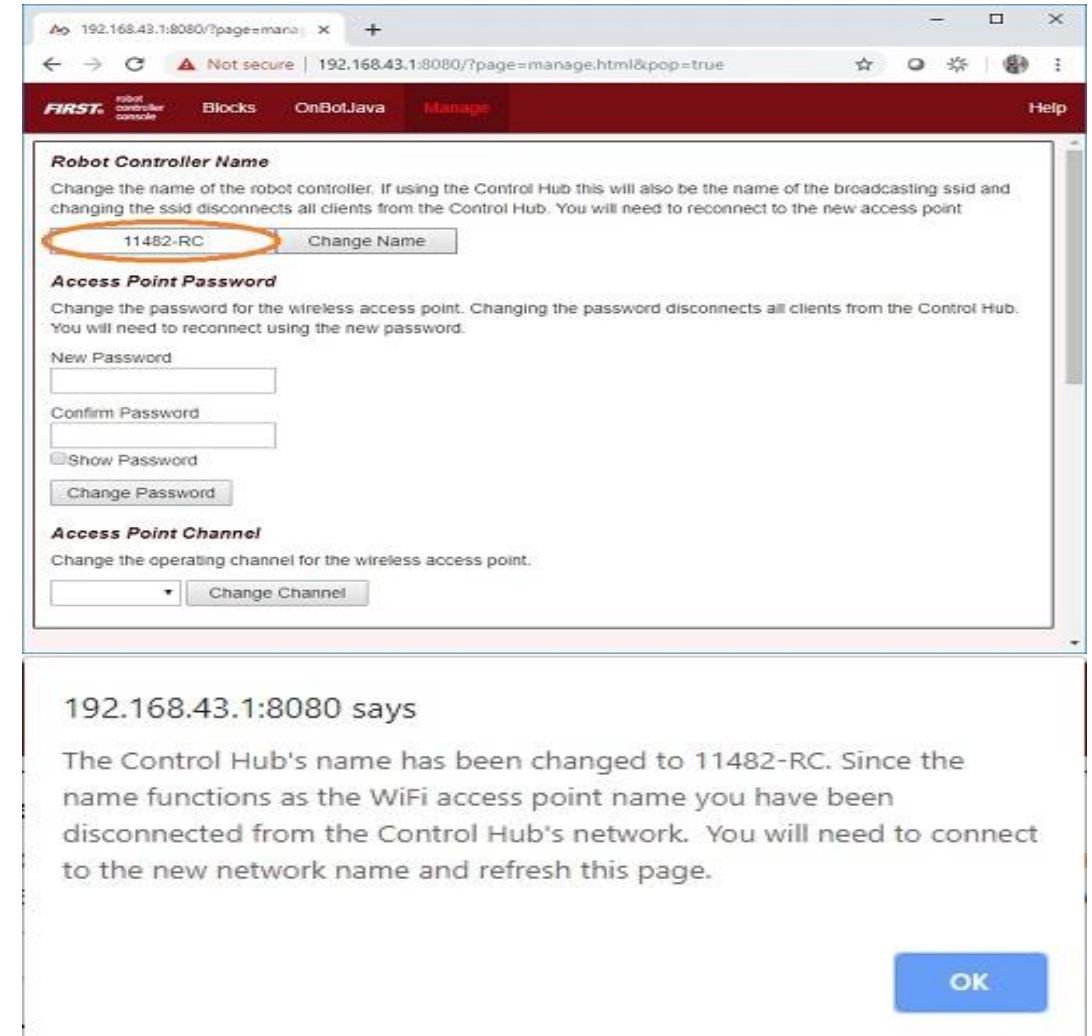
- Click on the Manage link towards the top of the Robot Controller Connection Info page to navigate to the Manage page.



# REV CONTROL HUB

## CHANGING NETWORK NAME CONTINUED

- Change the name in the "Robot Controller Name" field and click on the Change Name button to change the Control Hub's name.
- Device Names - Each Team MUST "name" their Robot Controller with their official FIRST Tech Challenge Team number and -RC (for example, "12345-RC"). Each Team MUST "name" their Driver Station with their official Team number and -DS (for example, 12345-DS). Teams with more than one Driver Station or Robot Controller Android Device must name these devices with the Team number followed by a hyphen then a letter designation beginning with "A" (for example, "12345-A-RC", "12345-B-RC").
- After pressing the Change Name button, a dialog box will appear indicating that the name has been changed. You will need to reconnect to the wireless network and refresh the current page.



The screenshot shows a web browser window with the URL `192.168.43.1:8080/?page=manage.html&pop=true`. The page title is "FIRST robot controller console". The main content area is titled "Robot Controller Name" and contains the following text: "Change the name of the robot controller. If using the Control Hub this will also be the name of the broadcasting ssid and changing the ssid disconnects all clients from the Control Hub. You will need to reconnect to the new access point". Below this text is a text input field containing "11482-RC" and a "Change Name" button. The next section is "Access Point Password" with the text: "Change the password for the wireless access point. Changing the password disconnects all clients from the Control Hub. You will need to reconnect using the new password." It includes fields for "New Password" and "Confirm Password", a "Show Password" checkbox, and a "Change Password" button. The final section is "Access Point Channel" with the text: "Change the operating channel for the wireless access point." and a "Change Channel" button.

192.168.43.1:8080 says

The Control Hub's name has been changed to 11482-RC. Since the name functions as the WiFi access point name you have been disconnected from the Control Hub's network. You will need to connect to the new network name and refresh this page.

OK

# REV CONTROL HUB

## UPDATING OPERATING SYSTEM

Get the latest software versions from our website under the [FTC Resources](#) tab or the [Revs Robotics](#) page.

- **PC and Browser Method:**

1. Power on the Control Hub, by plugging the 12V Slim Battery into the orange XT30 connector labeled “BATTERY” on the Control Hub.
2. The Control Hub is ready to connect with a PC when the LED turns green. Note: the light blinks blue every ~5 seconds to indicate that the control hub is healthy.
3. Connect to the Control Hub’s WiFi Network. If not renamed this starts with either “FIRST-“ or “FTC-“.
4. Open a browser and navigate to the FIRST Robot Controller Console (type 192.168.43.1:8080 in the navigation bar)
5. Scroll down to Update Control Hub Operating System and press the Select Update File button.
6. Choose the latest version downloaded earlier and press the Update & Reboot button.
7. Wait while the Upload is in process. Keep the Control Hub powered during this process.
8. Allow update to install. Keep the Control Hub powered during the installation.
9. When the OS update has completed, the Control Hub LED will switch from blue, back to its normal blink pattern.
10. Reconnect your computer to the Control Hub network and verify that the update was a success.

# REV EXPANSION HUB

- Physical Dimensions
  - 143mm X 103mm X 29.5 mm
  - Mounting holes on a 16mm spacing
- Input Voltage
  - 12V nominal (8-15V DC)
- Processors
  - Texas Instruments ARM® Cortex-M4
- 3.3V Ports
  - 8x Digital I/O: 1A source max
  - 4x I2C 100kHz/400kHz Busses: 500mA source max
  - 4x 12-bit Analog Inputs: 500mA source max
  - 4x Quadrature Encoder Inputs: 500mA source max
- 5V Ports
  - +5V Power: 2A source max
  - Servos: 2A source maximum per pair (0-1, 2-3, 4-5)



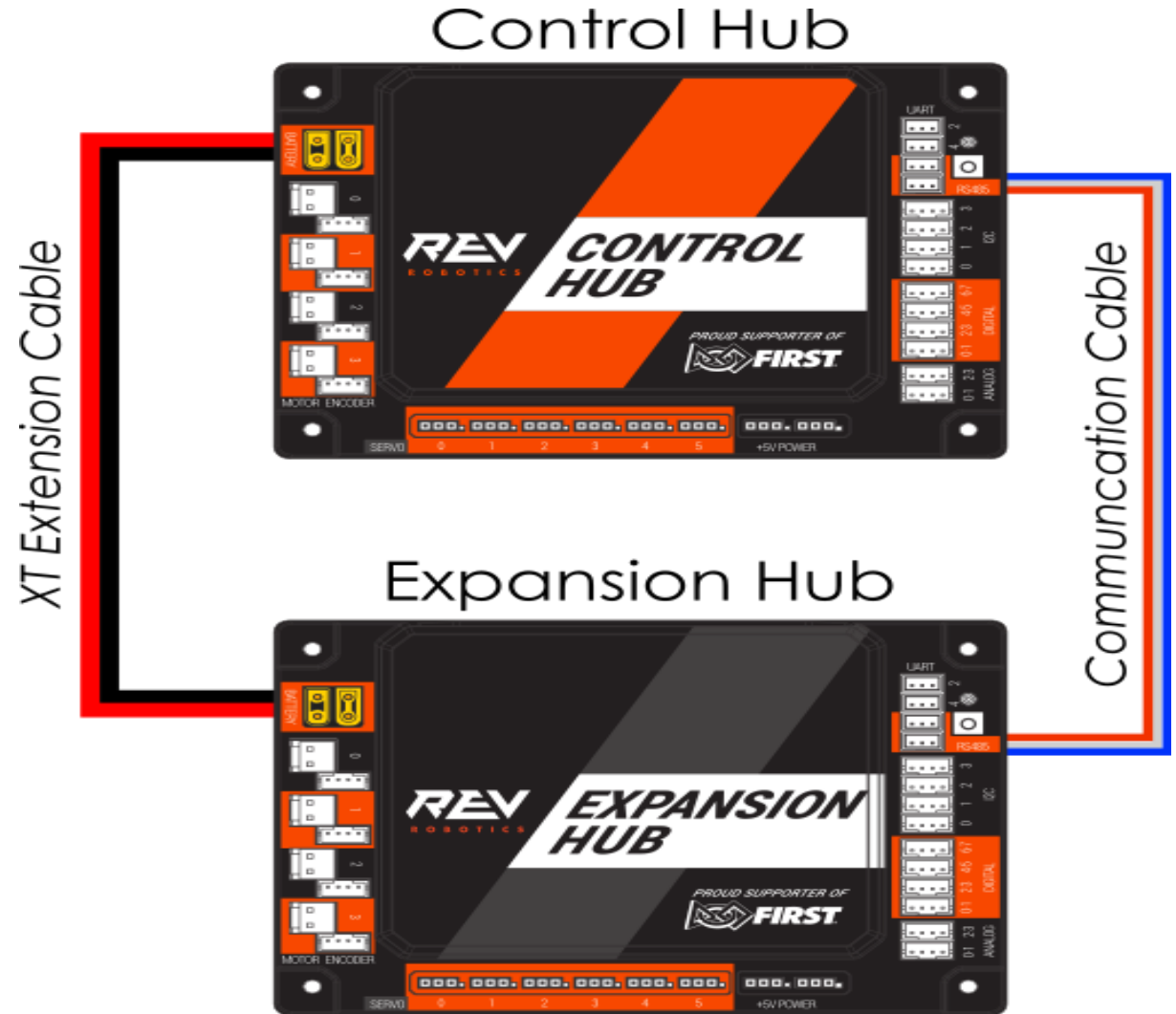
- FIRST Tech Challenge teams may use one (1) Control Hub and may add one (1) Expansion Hub starting in the 2022-2023 season. Read the official FTC Game Manuals for complete game rules.



# REV EXPANSION HUB

## ADDING A EXPANSION HUB TO ROBOT

- Use the XT Extension Cable to connect power between the Control Hub and the Expansion Hub.
- Use a 3-pin JST PH cable to connect the RS485 port on the Control Hub to the Expansion Hub.



# REV EXPANSION HUB

## FIRMWARE UPDATE INSTRUCTIONS

There are two methods to update the Expansion Hub firmware: through the Robot Controller phone or using the REV Hub Interface Software.

**Please Note:** You may need to readdress and reconfigure your hub after updating the firmware.

### Robot Controller Phone Method:

1. Download the latest firmware binary file (.bin) using the link above.
2. Connect the phone to the computer. It should show up as an attached drive.
3. Navigate to the **FIRST/updates/Expansion Hub Firmware** directory on the phone.
4. Copy the *REVHubFirmware\_X\_YY\_ZZ.bin* file into that directory.
5. Once copied, disconnect the phone from the computer and plug it back into the hub.
6. Open the Robot Controller app and navigate to ... > **Settings** > **Advanced Settings** > **Expansion Hub Firmware Update**.
7. You can now initiate the update. Do not unplug the phone until it is complete.

### REV Hub Interface Method:

1. Download and install the REV Hub Interface software.
2. Connect your REV Expansion Hub to your computer with a USB A to mini B cable.
3. Drivers should install automatically, but please wait for them to finish.
4. Run the REV Hub Interface software.
5. Click on the Firmware tab.
6. Click "Choose .bin file" and open the "REVHubFirmware\_1\_08\_02.bin" located in the same directory as the Hub Interface software or in the location that you saved the downloaded file.
7. Click "Flash" and wait for the update to complete.
8. Use the XT Extension Cable to connect power between the Control Hub and the Expansion Hub.
9. Use a 3-pin JST PH cable to connect the RS485 port on the Control Hub to the Expansion Hub.

# DRIVER STATION PHONE

## Legal Phones for 2022-2023 FTC Season

- Motorola Moto G 2nd Generation
- Motorola Moto G 3rd Generation
- Motorola Moto G4 Play
- Motorola Moto G5
- Motorola G5 Plus
- Motorola Moto E4
- Motorola Moto E5 Play



# DRIVER STATION PHONE

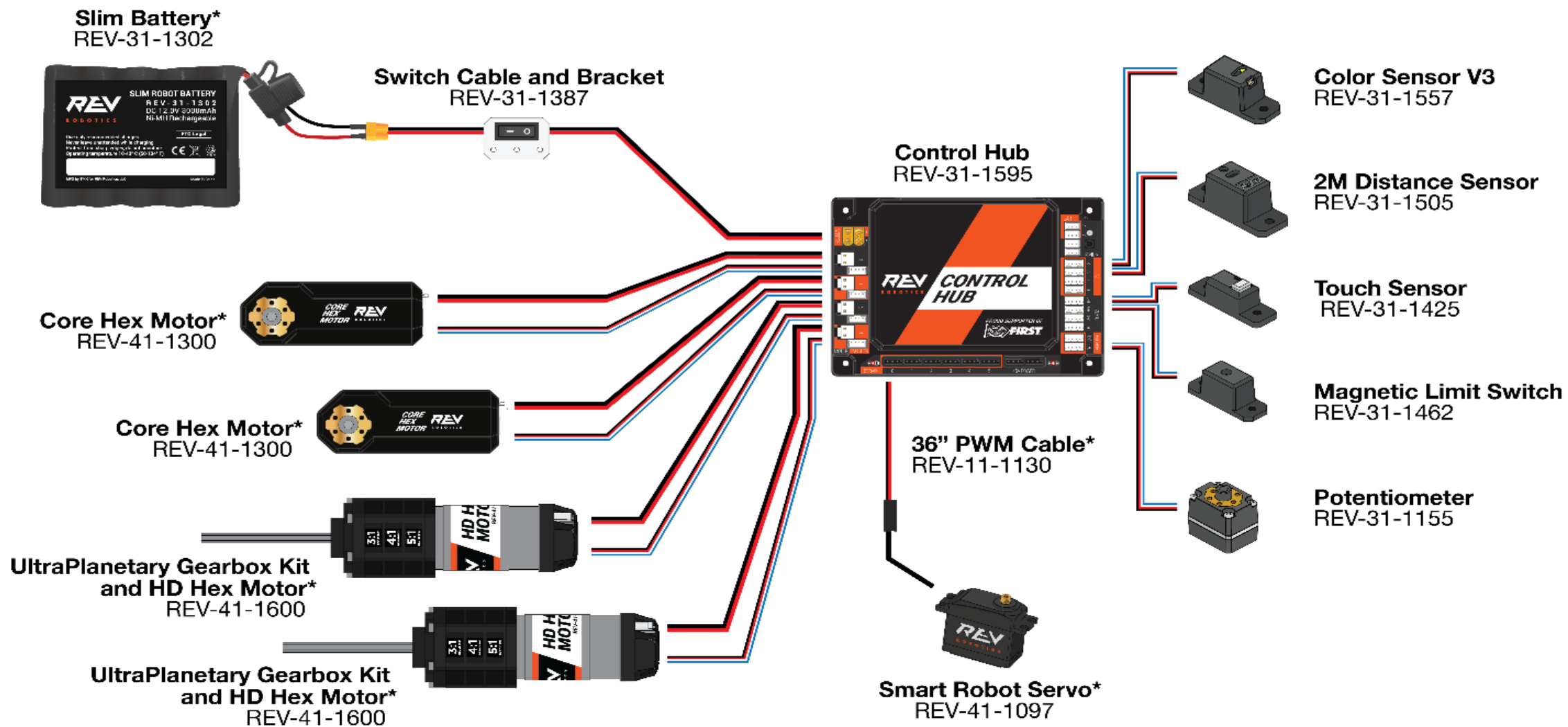
## CONTINUED...

- Download the latest version of the FTC Driver Station app. The driver station and the robot controller must have the same versions.
- [Drivers Station Pairing to Control Hub](#)
- [Changing Wi-Fi channel](#)
- [Configuring your robot](#)



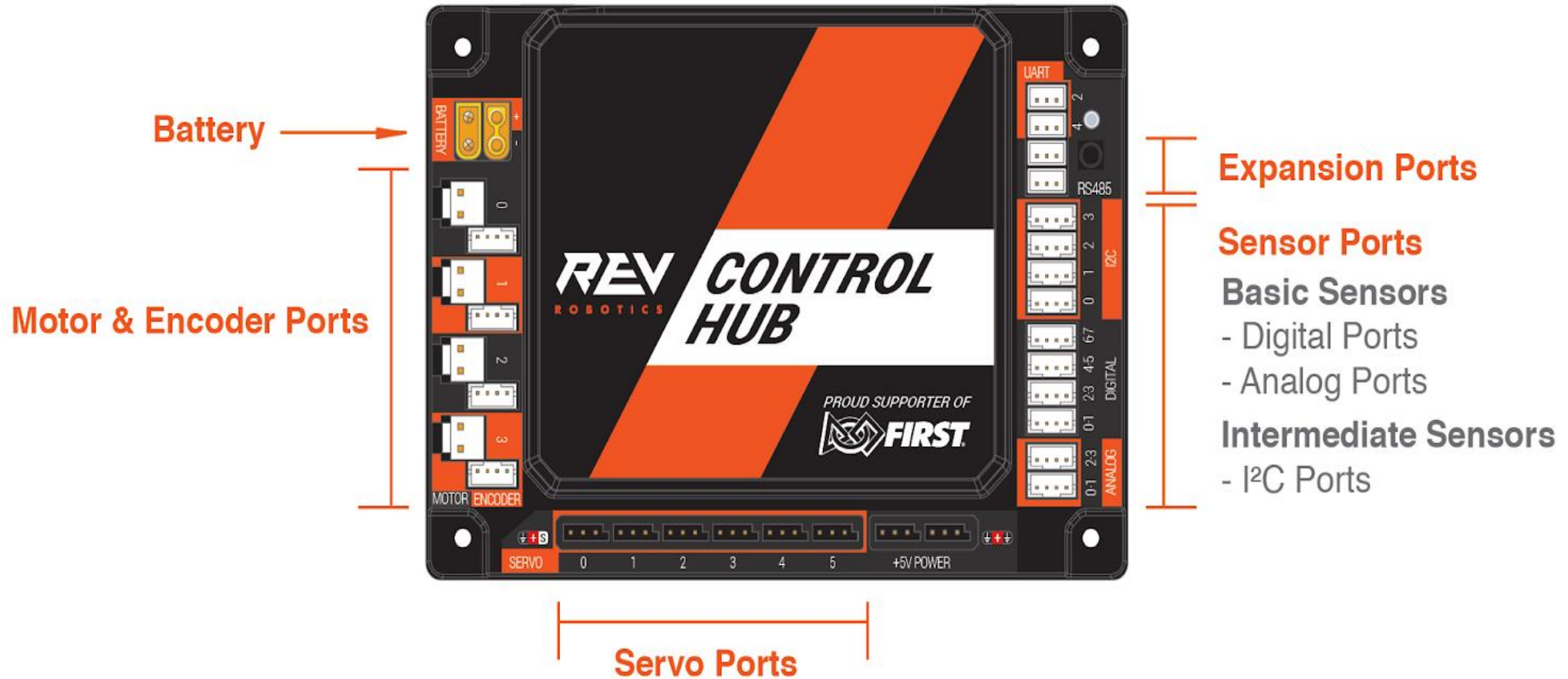
# BASIC WIRING

Be sure to reference the Wiring Guide for FTC on our website on the [FTC Resources](#) tab or the [FIRST](#) website.



# BASIC WIRING

## CONTINUED...



# RULES TO KEEP IN MIND

- Make sure you keep your Control Hub, expansion hub and Driver Station phone up to date with latest Firmware and software versions.
- Use LEGAL motors and servos (use this [list](#))
- Keep it in the cube 18 x 18 x 18