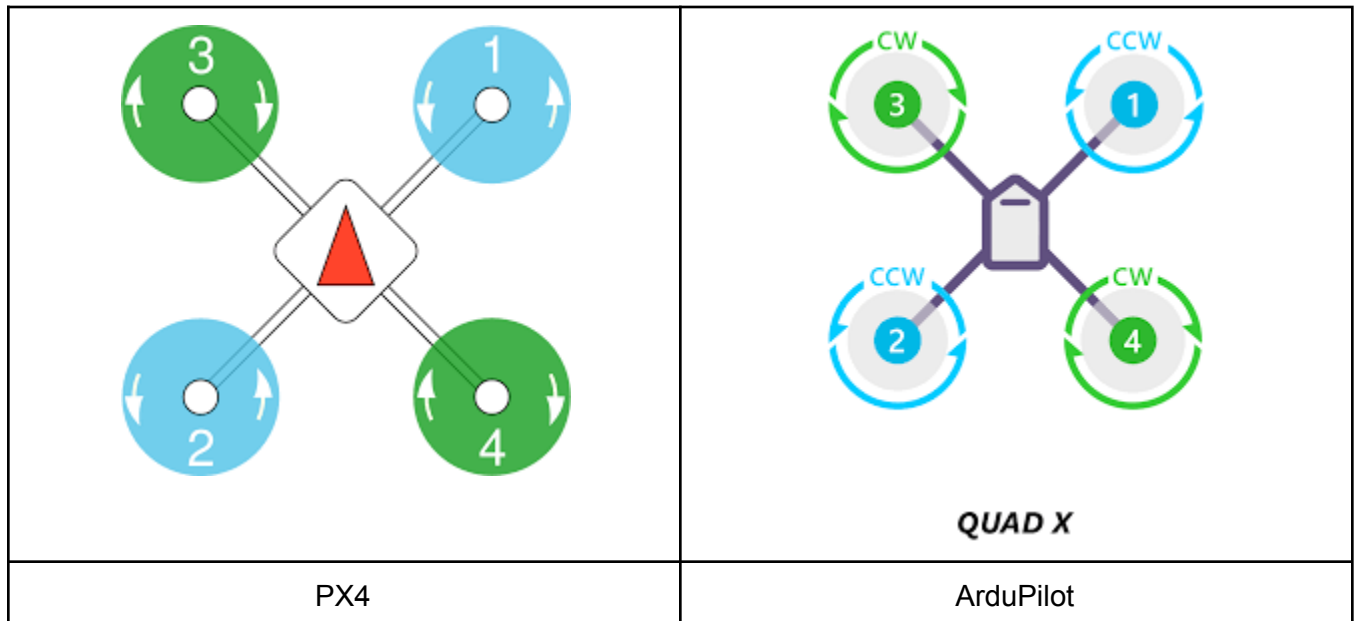


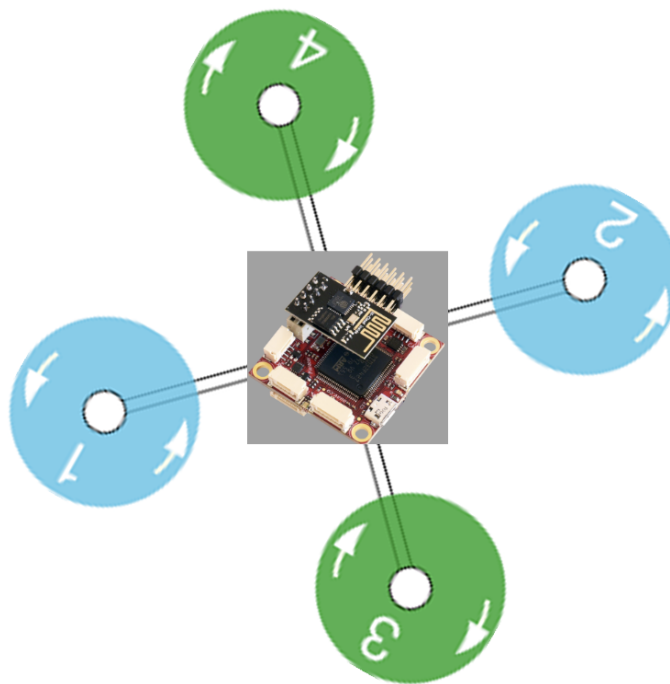
Pre-flight Test/Check

1. Check the directions of the flight controller, motors and propellers

Define the heading of the quadrotor --> Know the correct direction of each motor (CW or CCW)



Make sure the heading of the quadrotor matches the direction of the flight controller. For instance, if you use Pixracer, the servo pin should be pointing to the opposite of the heading.

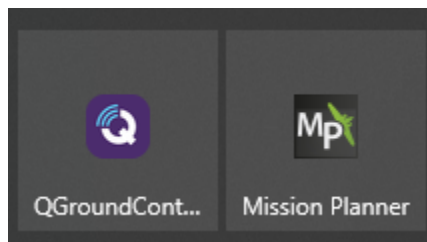


2. Test motor directions (REMOVE all propellers!)

Use the power supply and external PWM input (e.g. servo tester) to test the direction of the brushless motors. Change the order of the wires of the motor on ESC if the direction should be changed. Remember that you must REMOVE all propellers when you are testing the motors. **It is so dangerous if you install any propellers on your drone before/during the motor testing.**

3. Set up in ground control station

Open a ground control station (GCS) software in the computer, e.g. QGroundControl or MissionPlanner



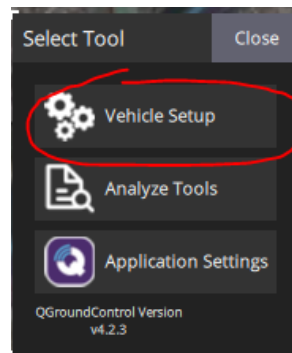
a. Load the firmware (PX4 or Ardupilot)

If you use QGroundControl,

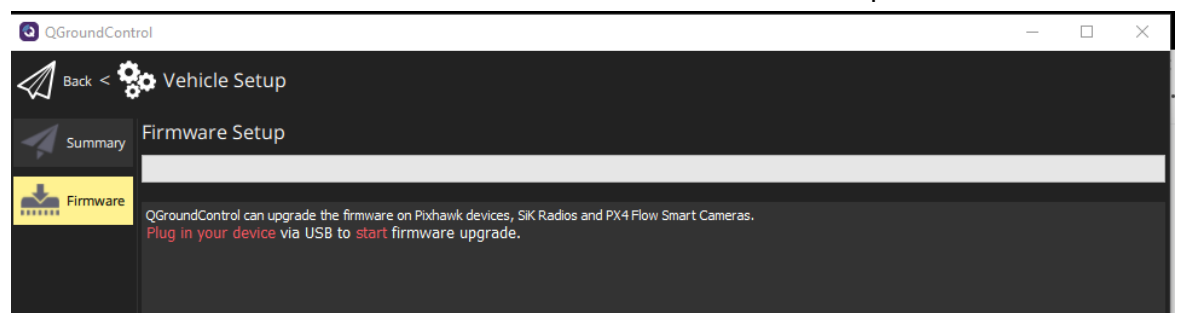


1. Click the QGC icon at the top left corner

2. Select Vehicle Setup



3. Select Firmware and follow the instructions to do the firmware setup.

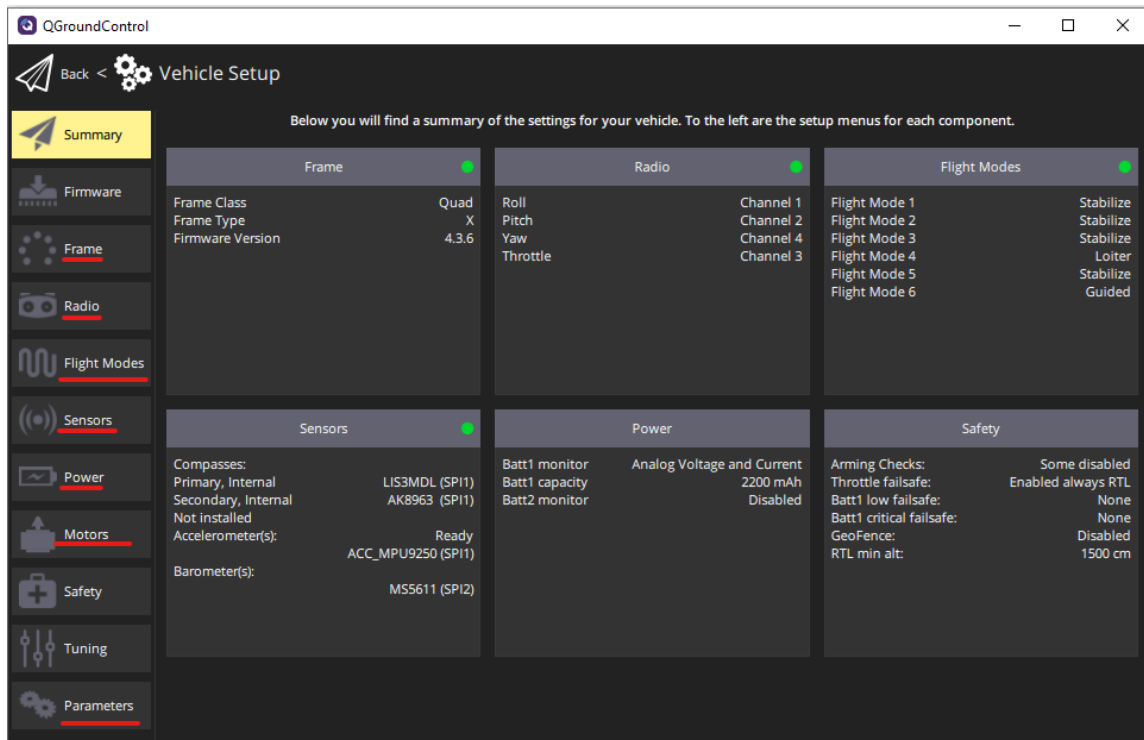


- b. Do the pre-flight test/check by following the instructions of the GCS

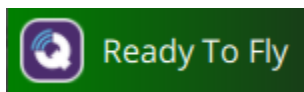
Your drone should be stated as “Not Ready” if you have not finished the setup completely.



You should finish the setup in “Frame”, “Radio”, “Flight Modes”, “Sensors”, “Power” and “Motors”. And do the configuration of ArduPilot/PX4 in “Parameters”.



After finishing all the set-up, your drone should be stated as “Ready to Fly”.



Then you can arm your drone with a remote control (pull the throttle to its right bottom corner for a few seconds). If you can arm the drone, that means the set-up is done. Then, propellers can be installed (be aware of the direction: CW/CCW)

Link Wi-Fi in the VICON room (ArduCopter)

Reference:

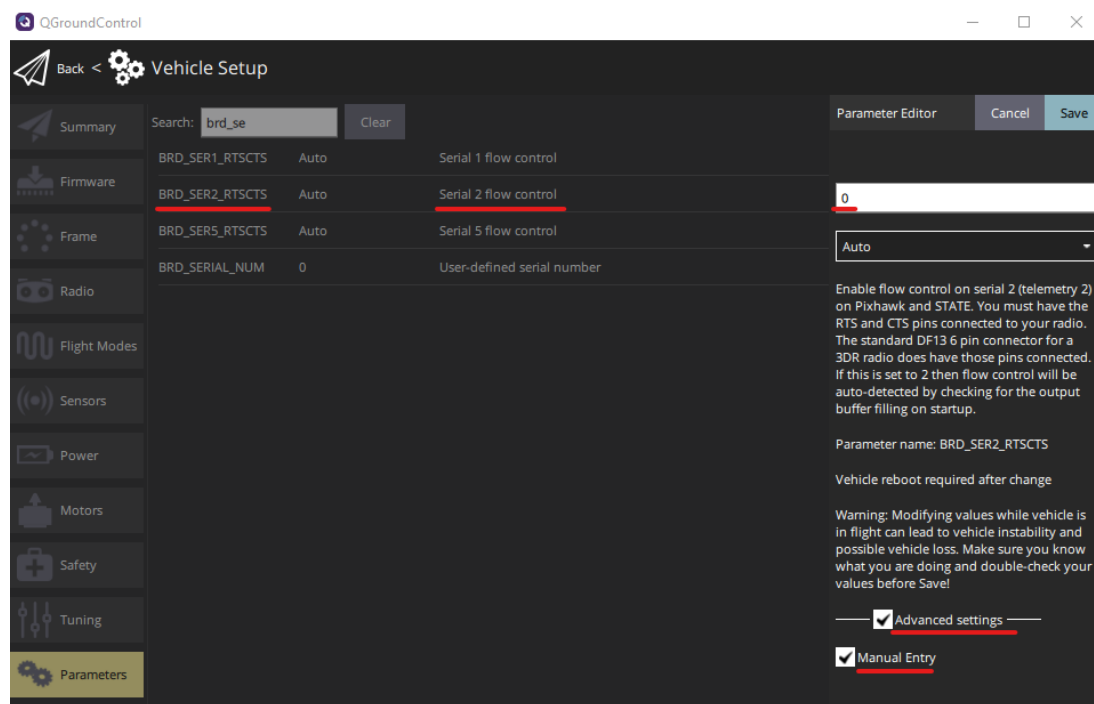
<https://ardupilot.org/copter/docs/common-esp32-telemetry.html#:~:text=The%20ESP32%20are%20readily%20available.with%20any%20ArduPilot%20autopilot%20controller>

1. Configure ArduPilot (using GCS)

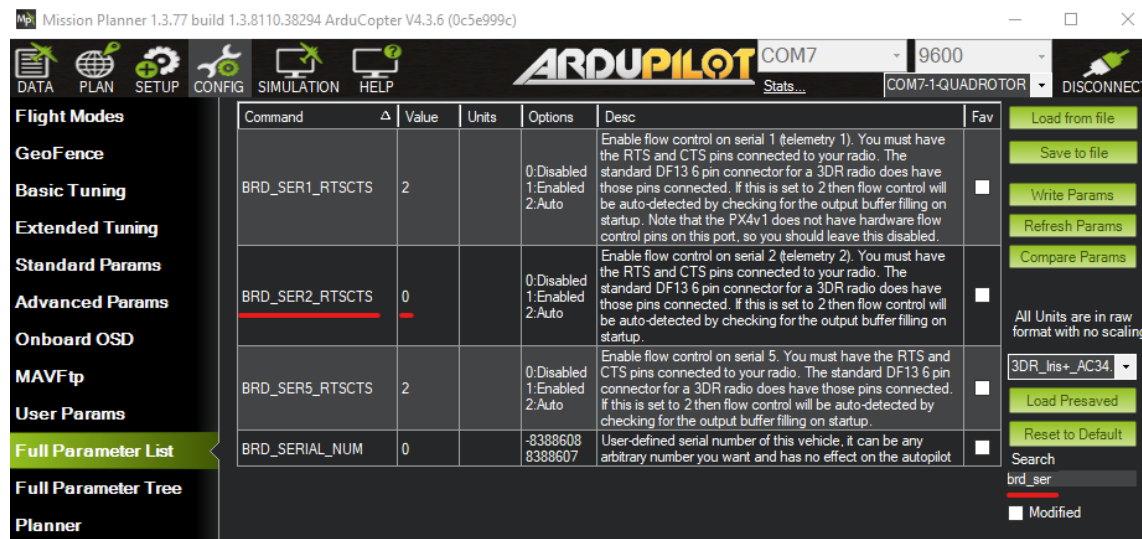
Disable CTS & RTS on your Telemetry port:

Check which telemetry port you use for the WiFi module. E.g., if you use telemetry 2, set “BRD_SER2_RTSCS” = 0 (disable) to disable the CTS & RTS on Telemetry 2 of the flight controller.

If you use QGC, you have to select “Advanced settings” → “Manual Entry”, and input “0”



If you use Mission Planner, you can directly input “0”.



2. Check the IP address of your Wi-Fi module

Make sure your computer is connected to the Wi-Fi “GH034” in VICON room.

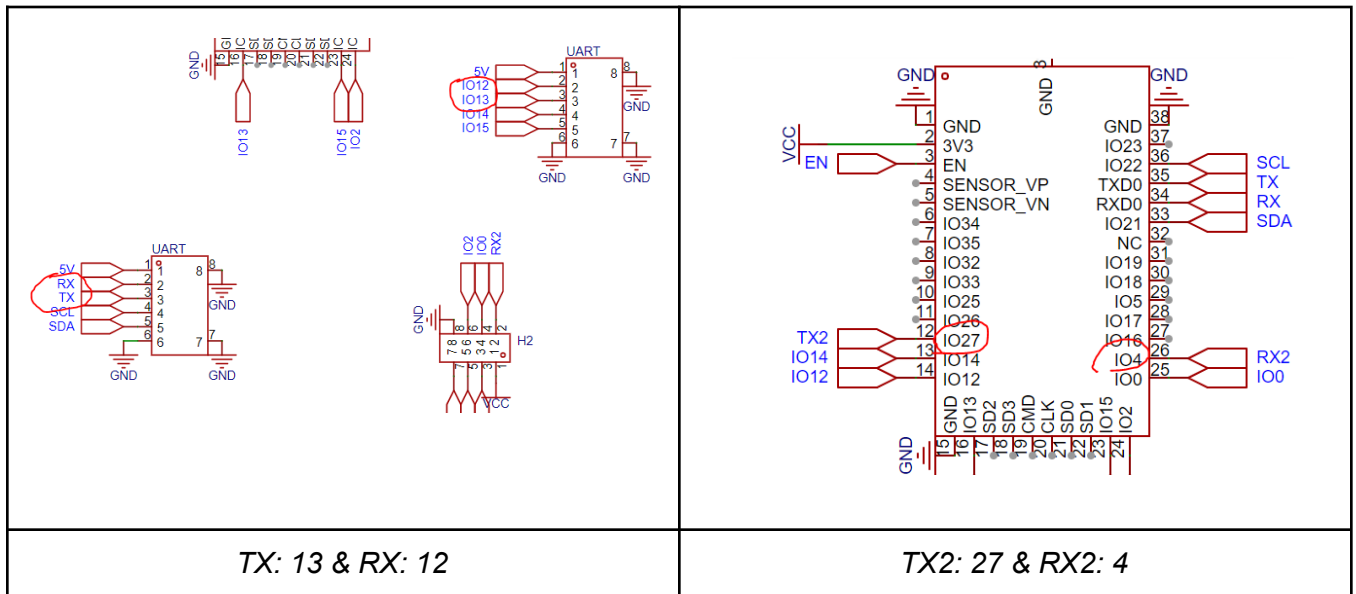
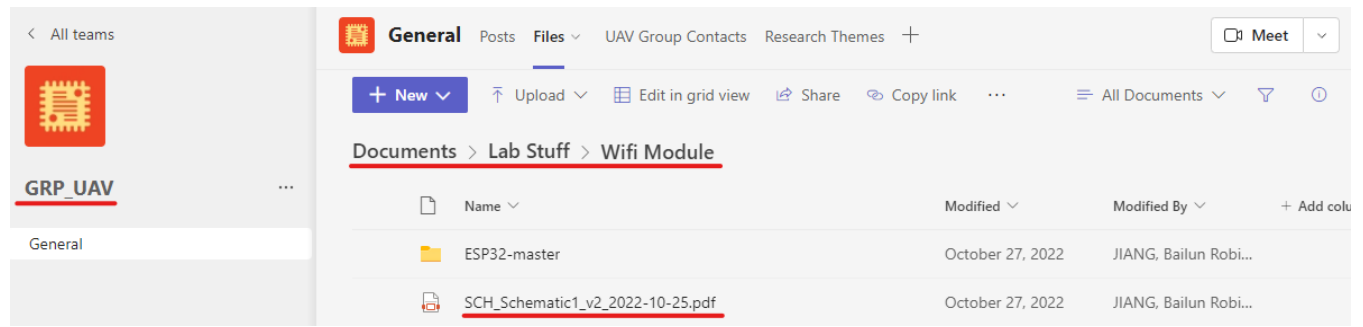
“198.168.10.2” is the IP address of the WiFi in the VICON room. So, input “198.168.10.2” in a new browser. Then, log in to this website:

Admin name: **admin**, password: **Polyuaae2520**

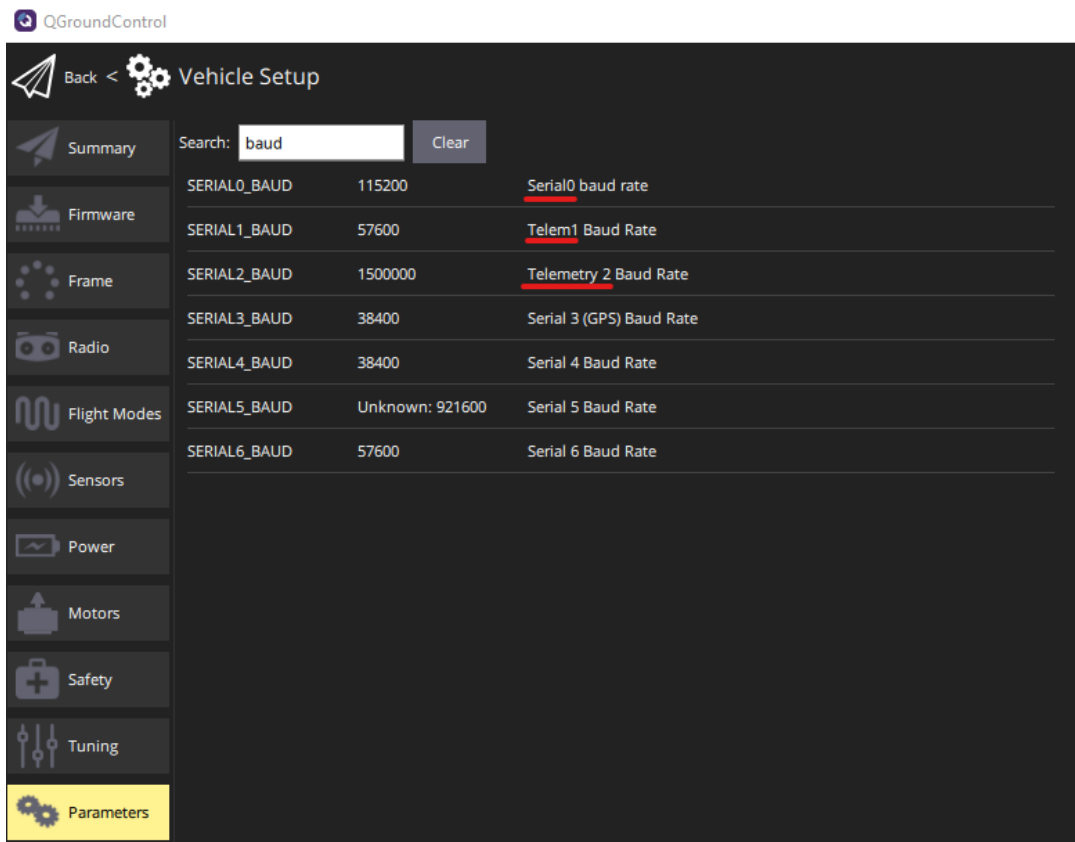
Check the IP address of the quadrotor's WiFi modules. Click “View List” under “Clients: (no. of clients)”

3. Configure Wi-Fi module

Check the Pin no. of TX and RX (Read "Documents/Lab Stuff/Wifi Module/SCH_Schematic1_v2_2022-10-25.pdf in MS Teams)



Check the baud no. by using QGC according to your connecting method, e.g. by USB(Serial), Telemetry 1, Telemetry 2.



Input the pin no. of TX & RX & baud no. in the IP address of the quadrotor's WiFi modules
 You MUST close the website of the IP address of the quadrotor's wifi modules! It is because this website will block the connection.

Open a Terminator.

```
roscd {your_pkg/launch}
roslaunch {your_uav_wifi_file}.launch
```

If you cannot connect with the WiFi successfully, you may:

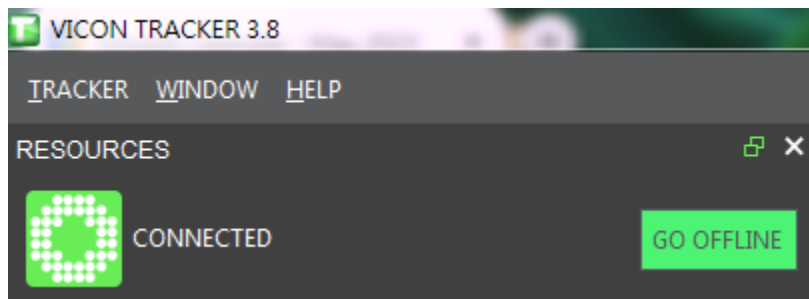
- Check the parameters of the {your_uav_wifi_file}.launch
- Reboot ESP32 by clicking "Reboot" on the website
- If you still fail after trying steps a and b, then you can change the IP address of your WiFi module

Setup in VICON room

- Turn on VICON router and open the software

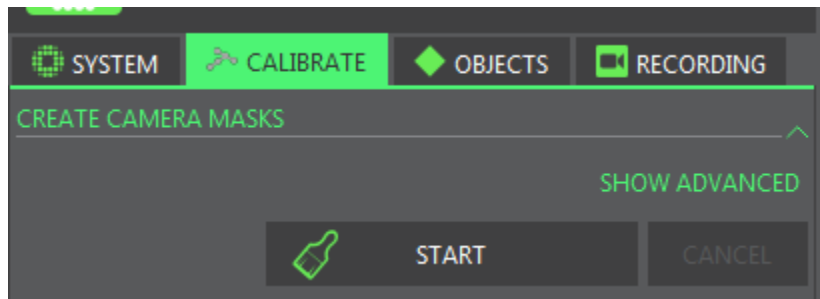
Open "Vicon Tracker 3.8" and turn on the VICON router.

If you successfully turn on the VICON router, you should see a green logo at the top left corner.

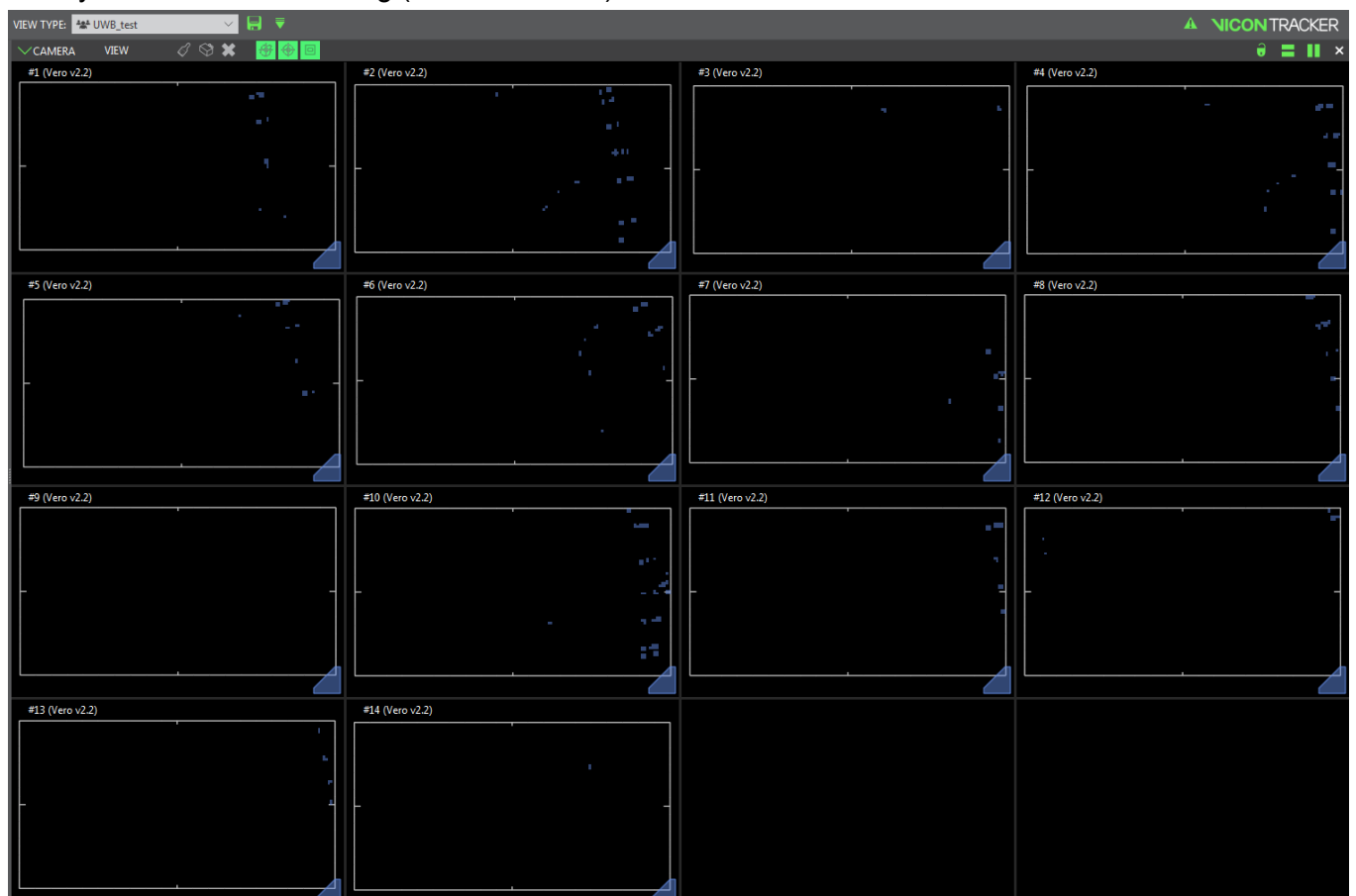


2. Create Camera Mask

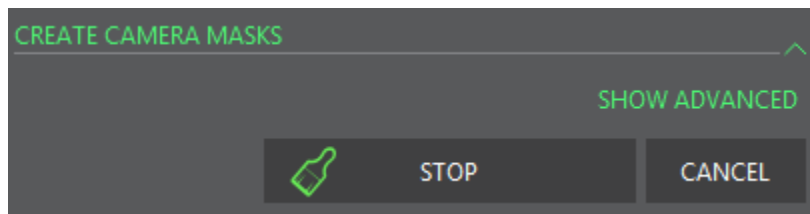
Go to "CALIBRATE". Click "START" under the "CREATE CAMERA MASKS".



Then you will see the masking (blue/white dots) of all cameras.

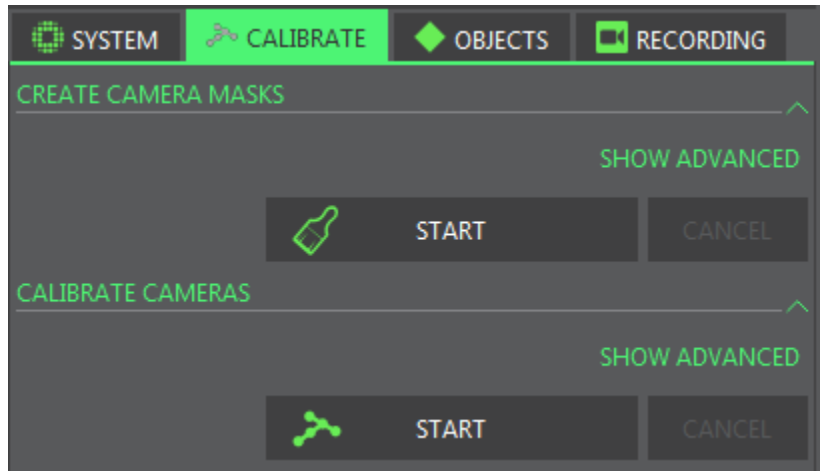


After waiting for a few seconds, click "STOP".



3. Calibrate cameras

Press "start" at "CALIBRATE CAMERAS"



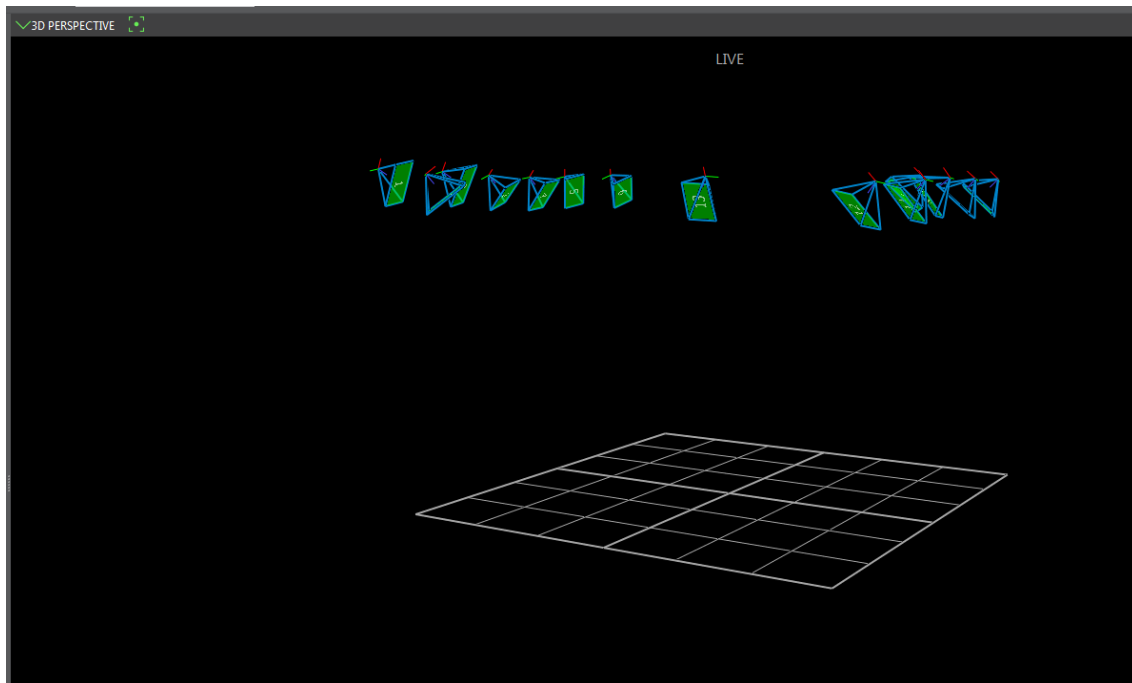
Let all cameras detect the "T" until all cameras' lights turn green and finally turn purple.

Put the "T" on the floor: the x direction is pointing forward (pointing to the wall next to the emergency exit), while the y direction is pointing left (pointing to FJ005a)

4. Set volume origin

Press "START" at "SET VOLUME ORIGIN" after you put the "T" on the floor in the correct direction.

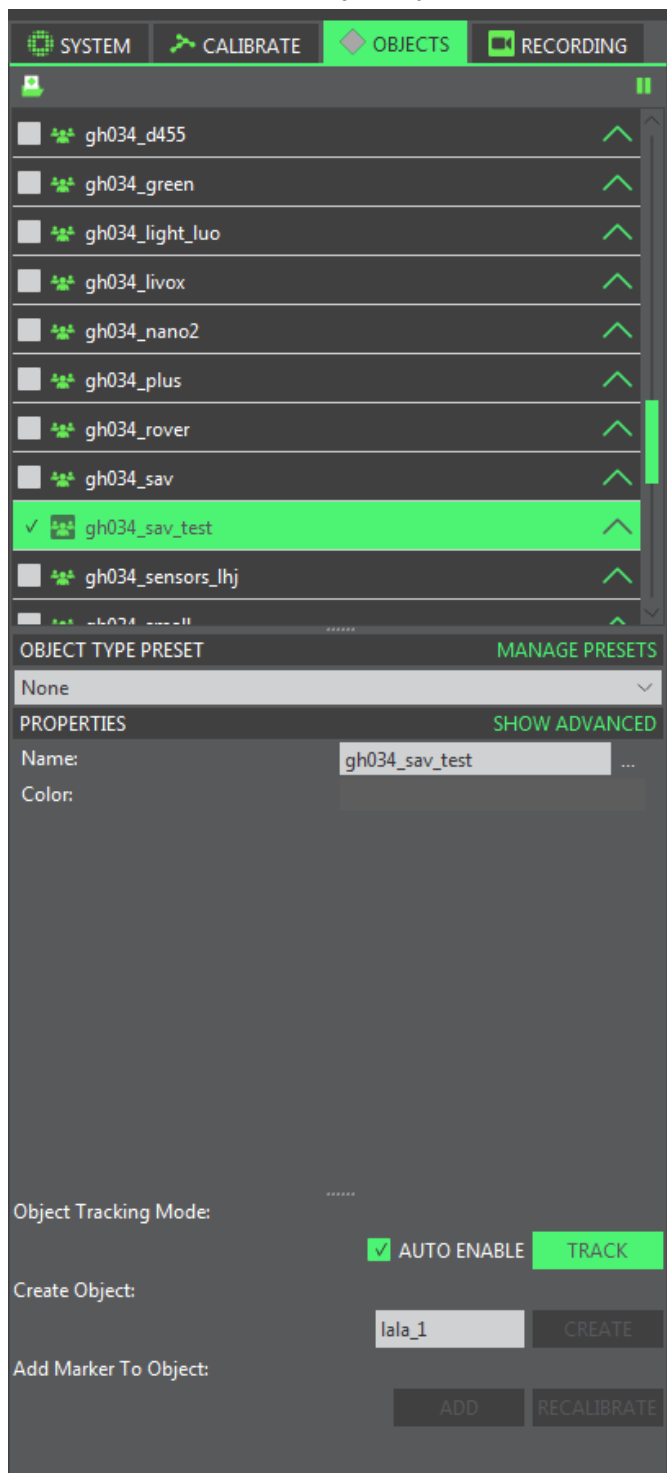
Take away the "cross" and turn it off. Select "3D PERSPECTIVE" and then you should see all cameras should be located on the top.



5. Check/create the tracking object

Put your UAV with Vicon markers (DUN stick them on the UAV symmetrically!) in the previous position of the "T". If this is the first time that the UAV is placed inside VICON space, you have to create a new "object" to recognise your UAV:

After putting your UAV in the VICON space, you should see your UAV's markers shown in "3D PERSPECTIVE". Press "Alt" on the keyboard and select all "points" (hold your left click) at "OBJECTS". Name the object (type its name) at "Create object" --> Press "CREATE"



If you have created the tracking object, you can select your object and see the object's markers appear in the "3D PERSPECTIVE".

6. Get VICON's position via ROS

Open a Terminator.

```
roscd {your_pkg/launch}  
roslaunch {your_vicon_file}.launch
```

You should see that your UAV is recognised by checking if the correct object name is created or not (should be shown on Terminator).

FAQ of Setup in Vicon room

1. How to know whether the UAV can receive the VICON's position?

You should also finish "Link Wi-Fi in the VICON room" as well. After opening 2 terminators for Wi-Fi connection between UAV and VICON room (next section), and the setup in VICON room (this section), you can open a new terminator:

```
rostopic echo /mavros/local_position/pose
```

Then you should see the position and orientation of the UAV are printed on the terminator.

2. How to change the update rate of all the rostopics?

Open a new terminator and input your target rate:

```
roslaunch mavros mavsys rate --all {target rate}
```

E.g.: "roslaunch mavros mavsys rate --all 50" means change the update rate of all the rostopics to 50 hz.

3. What should I do if I cannot see the correct "object name" is printed in the terminator?

In {your_vicon_file}.launch file,

1. make sure that you have named your UAV in VICON software and use the same name in the two lines after "vrpn_client_node/". For instant, if the name is "gh034_sav", the two lines are:

```
<remap from="/vrpn_client_node/gh034_sav/pose" to="/mavros/vision_pose/pose" />  
<remap from="/vrpn_client_node/gh034_sav/twist" to="/mavros/vision_speed/speed_vector" />
```

2. make sure that you input the correct IP address of VICON HOST, "192.168.10.1" after "default="

```
<arg name="vicon_server" default="192.168.10.1"/>
```

(Optional) Use "RC Override" with Ardupilot

2 main points:

1. Use ROS to publish the topic "RC Override". Then the PWM inputs of the RC (remote controller) should be overridden by ROS. This means you do not need to use the RC manually for changing the PWM input of the RC channels.

To-do (This example uses QGC as a ground control station):

- a. Open QGC. Click "Analyze Tools" → MAVLink Inspector → RC Channels
- b. Select which channel(s) you want to override by mavros

- c. Click “Vehicle Setup” → Parameters. Search “SYSID_MYGCS” and set it to be “1”. Then reboot the flight controller.
- d. Modify the *rcoverride.cpp* and “*catkin_make*” in the terminator.
- e. Open terminator. Follow the command below.

```
cd ros_utils_ws
roslaunch ros_utils rcoverride
```

Then overriding the channel(s) through mavros should be done.

- f. Check whether the channel(s) are overridden by mavros via step a.
2. Transfer the PWM signal from ROS to the pins of the flight controller. This causes the actuators which connect to the flight controller can be controlled by ROS.

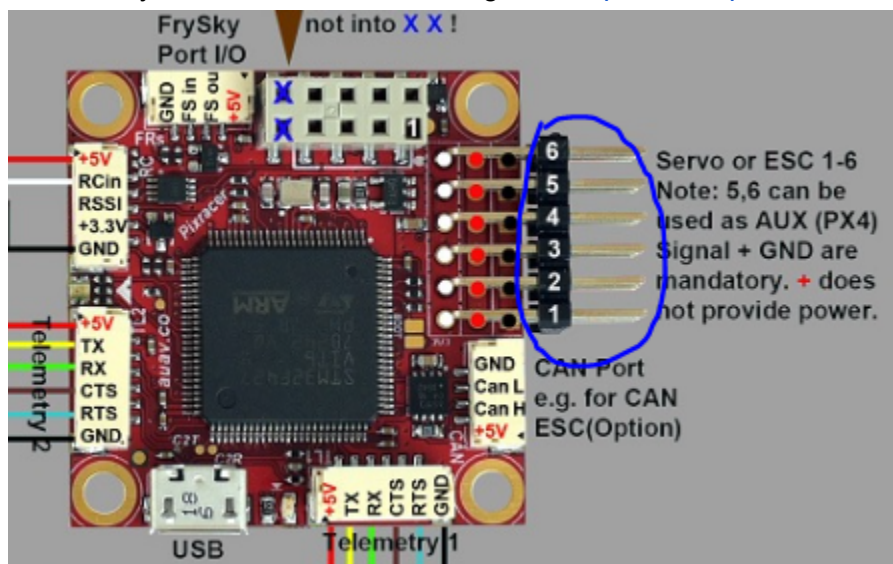
FAQ of “RC Override”

1. What are the channels?

The channels can be controlled by the position switch on the RC directly. Normally, you should set channel 8 as the safety switch and the corresponding position switch (wrapped in red). You can check the channels and their corresponding position switches on the ground control station, e.g. QGC or Mission Planner.

2. What are the pins of the flight controller?

The pins mean the PWM pins on the flight controller. For instance, if you use “Pixracer” as your flight controller, you should check the wiring of it: https://docs.px4.io/main/en/flight_controller/pixracer.html



Referring to the above wiring diagram, there are 6 pins on the Pixracer, which mean you can have 2 pins for external actuators (4 pins are used for the 4 brushless motors of the quadrotor).

Version	Date	Name
01	2023/05/15	CHEUNG Hiu Ching, Athena