

QDrone 2 – Hardware Test

IMU

What to expect in the IMU Tests?

An IMU or an inertial measurement unit has both an accelerometer and a gyroscope to measure the objects rotational speed and acceleration. QDrone 2 has a two IMUs to be able to measure how it is moving in space. This document will guide you through running IMU tests and confirming the results of both the accelerometer and the gyroscope.

IMU Test – MATLAB/Simulink

Open the QD2_IMU_2021a.slx file from the same folder containing this file.

Quanser Autonomous Vehicles Research Studio
QDrone 2 IMU Measurement Q

- INSTRUCTIONS**
1. Turn the QDrone 2 ON by pressing the red button on the PCB once. The LCD screen should turn on.
 2. Ensure that a connection to the drone is established by pinging it. See the [Research Studio Setup](#) documentation (step 8 - [Vehicle Comms](#)).
 3. Open the [Hardware Settings](#) under the [HARDWARE](#) menu.
 4. Under the [Code Generation > Interface](#) tab, on the External mode configuration, enter the following MEX-file arguments
`'-w -d /tmp -uri %u','tcpip://192.168.2.%d:17001'`
where **192.168.2.%d** is the IP address of the QDrone2 found on the LCD screen.
 5. Ensure that the **ESC disable** switch on the drone's PCB has a red LED, that is, the ESCs are disabled.
 6. Under the [HARDWARE](#) menu, click on [Monitor & Tune](#).
 7. You will hear a series of beeps (which indicates that the model has started running on the QDrone).
 8. Hold the drone by the handle and move it around. Observe the **IMU scopes** and make sure they are reasonable according to the Drone's frame as per the image to the right. Make sure the two IMUs on the drone give similar results and that the average is reasonable.
 9. Ensure that the **Low Battery?** display shows 0 (as in your new Battery is not low. The low battery threshold is set to 14V)
 10. When you're done with the tests, Click the **'Stop'** button under the [HARDWARE](#) tab to stop the model.

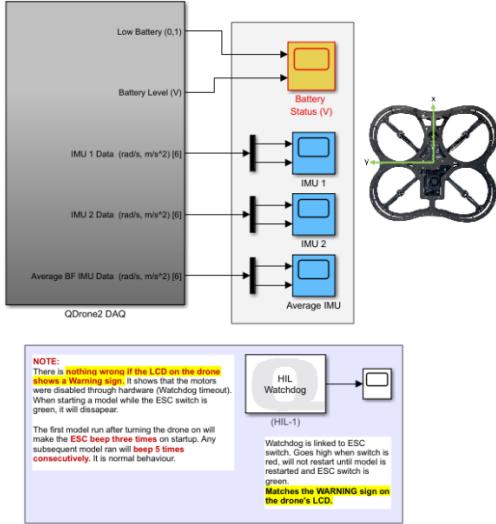


Figure 1. IMU Measurement model

Follow the instructions on the left of the the Simulink model (figure 1) to make sure the motors are disabled and that the model has started successfully. Look at the output of the Average IMU scope. This takes the data from IMU 1 and IMU 2 and averages it out.

Hold the drone by the top handle and rotate it along all three axis using the figure to the right of the model to understand its reference frame, where the Z axis is going up on the drone. Figure 2 shows the expected output when rotating the drone along the positive and negative X, Y and Z axis in order. Notice the accelerometer output in Z is right under 10 since gravity acting on a still drone should be 9.8 m/s^2 .

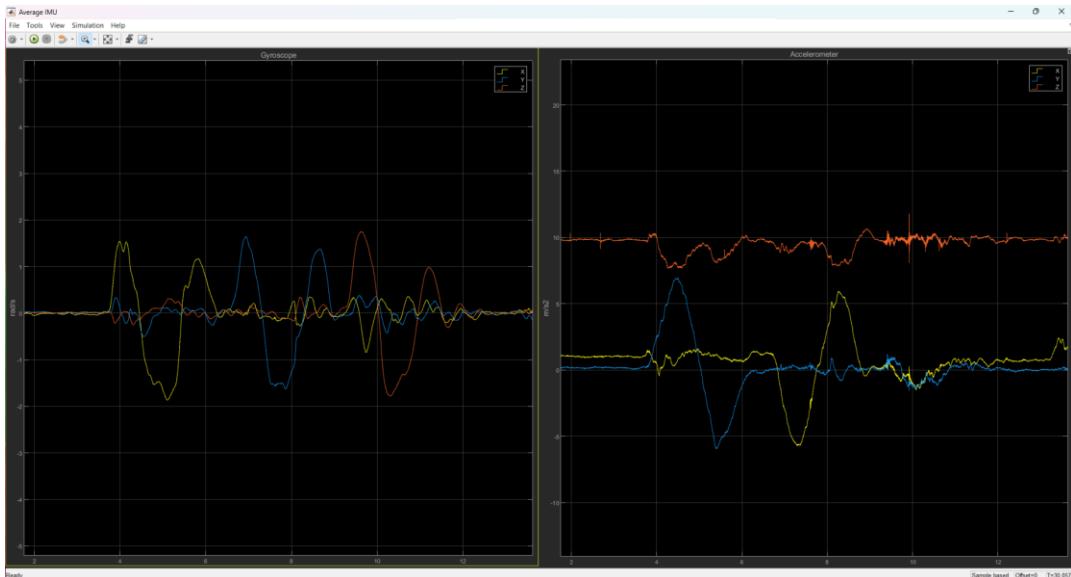


Figure 2. Average IMU gyroscope and accelerometer readings

Confirm both IMUs individually are working properly by opening the IMU1 and IMU2 scopes and confirming that the results are very similar (as shown in figure 3). Small variations may occur due to noise and/or their different locations on the drone. However, big changes in movement should be reflected similarly in both IMU plots.

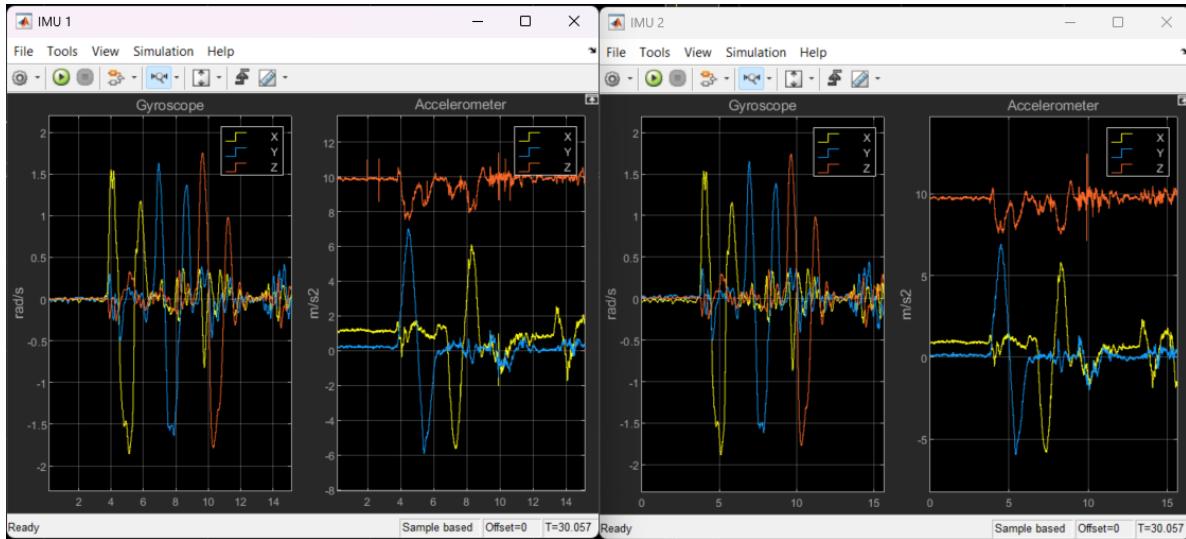


Figure 3. Plots of IMU 1 and 2 measurements