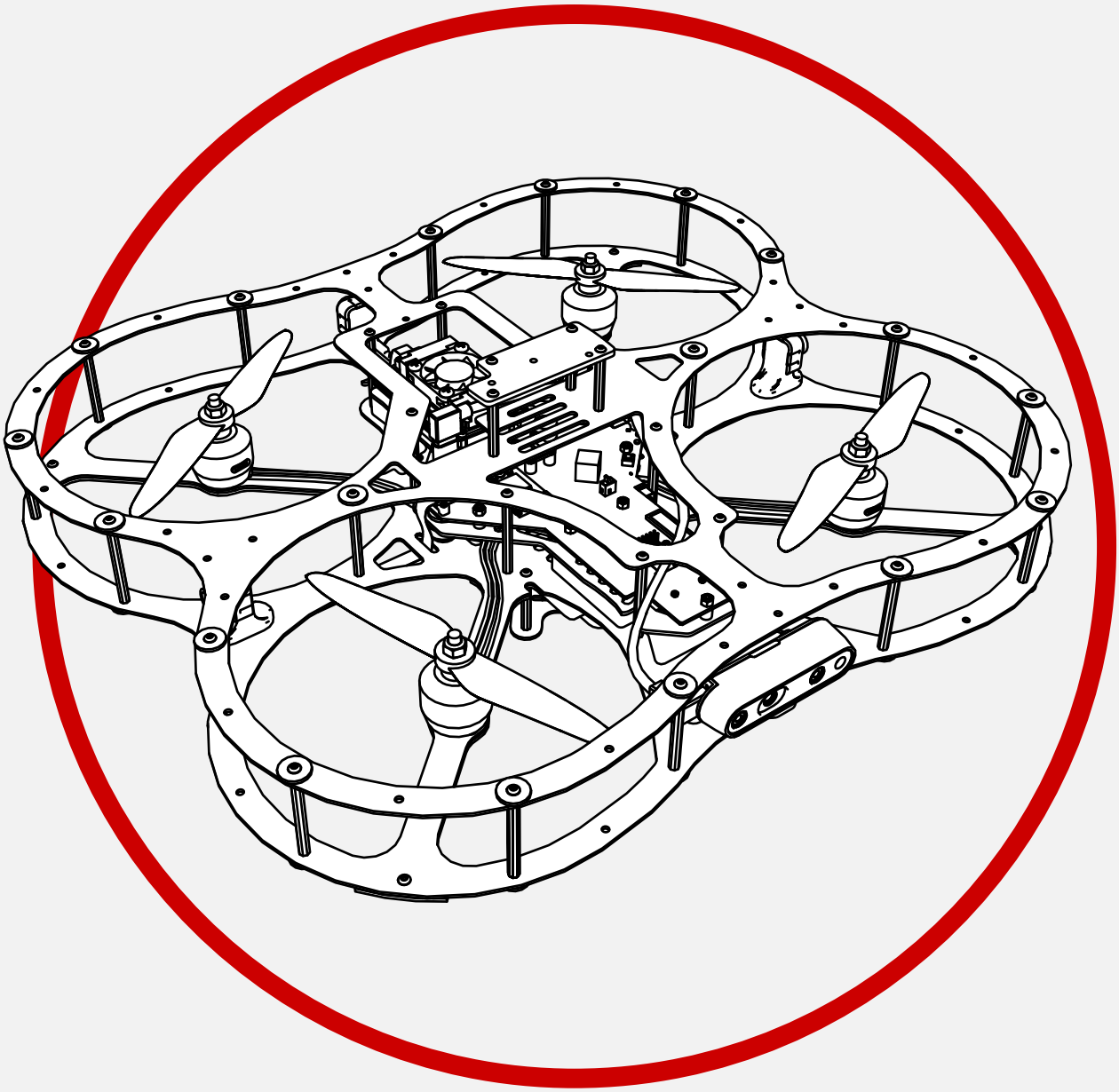
QUANSER
INNOVATE·EDUCATE



Autonomous Vehicles Research Studio

Setup Guide–QDrone 2 I/O Test

v 2.0 – 18*th April* 2023

For more information on the solutions Quanser offers,
please visit the web site at: http://www.quanser.com

Quanser Consulting Inc.
119 Spy Court
Markham, Ontario
L3R 5H6, Canada

info@quanser.com
Phone : 19059403575
Fax : 19059403576
printed in Markham, Ontario.

Caution

This equipment is designed to be used for educational and research purposes and is not intended for use by the public. The user is responsible for ensuring that the equipment will be used by technically qualified personnel only. **NOTE:** While the GPIO, and USB ports provides connections for external user devices, users are responsible for certifying any modifications or additions they make to the default configuration.

FCC Notice This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.
Contains FCC ID: SQG-60SIPT

Industry Canada Notice This Class A digital apparatus complies with CAN ICES-3 (A). Cet appareil numérique de la classe A est conforme à la norme NMB-3 (A) du Canada.
Contains IC: ST60-2230C-PU

Waste Electrical and Electronic Equipment (WEEE)

This symbol indicates that waste products must be disposed of separately from municipal household waste, according to Directive 012/19/EU of the European Parliament and the Council on waste electrical and electronic equipment (WEEE). All products at the end of their life cycle must be sent to a WEEE collection and recycling center. Proper WEEE disposal reduces the environmental impact and the risk to human health due to potentially hazardous substances used in such equipment. Your cooperation in proper WEEE disposal will contribute to the effective usage of natural resources.

CE Compliance CE

This product meets the essential requirements of applicable European Directives as follows:

- 2014/35/EU; Low-Voltage Directive (safety)
- 2014/30/EU; Electromagnetic Compatibility Directive (EMC)
- 2014/53/EU; Radio Equipment Directive (RED)

Warning: This is a Class A product. In a domestic environment this product may cause radio interference, in which case the user may be required to take adequate measures.

Caution

During flight QDrone 2 sound pressure level has been measured at 92 dBA at 1m away from the QDrone 2 and it is considered hazardous. Users shall ensure that they are not exposed to a sound level greater than the hazardous level as defined by the local authority. Use protective earpieces during operation.

Caution

The Intel RealSense D435 RGB-D camera is classified as a Class 1 Laser Product under the IEC 60825-1, Edition 3 (2014) internationally and EN 60825-1:2014+A11:2021 in Europe. The camera complies with FDA performance standards for laser products except for conformance with IEC 60825-1 Ed. 3 as described in Laser Notice No. 56, dated May 8, 2019.
Do not power on the product if any external damage is observed. Do not open or modify any portion of any laser product as it may cause the emissions to exceed Class 1. Invisible laser radiation when opened. Do not look directly at the transmitting laser through optical instruments such as a magnifying glass or microscope. Do not update laser product firmware unless instructed by Quanser.

Regular maintenance of QDrone 2:

- Inspect the propellers before flight to confirm they are not damaged or loose (able to move while the motor is not moving).
- Prior to using the QDrone 2, visually inspect the LiPo battery for damage (e.g., bloating). **DO NOT USE** the battery if damaged.
- Ensure that the battery and its cables are secured using the provided straps to avoid movement or damage during flight.
- Inspect the QDrone 2 frame before and after each flight to confirm that no major structural damage exists. Repair if needed.

Table of Contents

A. QDrone 2 I/O Check

1. From the same folder containing this file, open the folder QDrone2 IO Check, and open QD2_IOCheck_2021b.slx.
2. In the model that loads, from the **HARDWARE** tab on top of your Simulink model, click on **Hardware Settings** (Gear Icon). (If using an older version, click on **Model Configuration Properties** under the **Simulation** drop menu.)
3. Expand **Code Generation** on the left side of the window, click on **interface** and set the **MEX-file arguments** (Figure 1) as follows

   ```
   '-w -d %d -uri %u','tcpip://192.168.2.x:17001'
   ```

   where 192.168.2.d refers to the IP address of the QDrone 2 you are using (found on the LCD screen). Press OK.

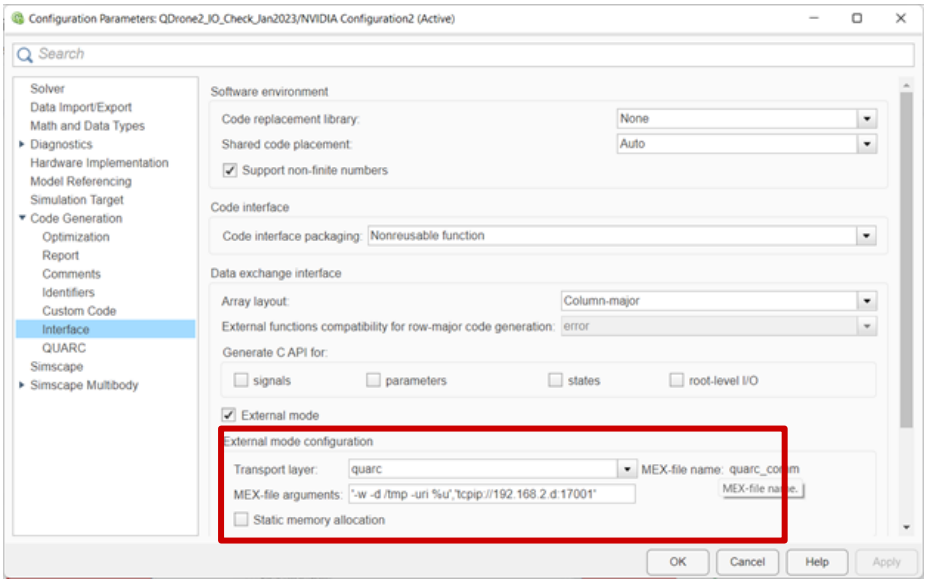


Figure 1. Setting up the MEX-file arguments

4. Plug in a battery and turn ON the QDrone 2 using the red on button. Place the drone at the center of the workspace ensuring the ESC disable switch has a green light (which means the ESC is enabled), as shown in figure 2.

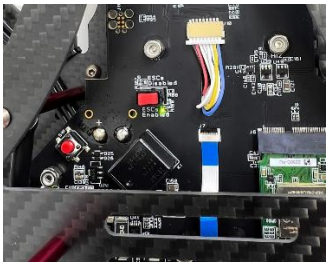


Figure 2. ESCs enabled (motors can spin)

5. Ensure that a connection to the drone is established by pinging to it. See the vehicle communication document for more information.
6. Ensure that the **Arm/Disarm Switch** in the model (Figure 3) is set to 0.

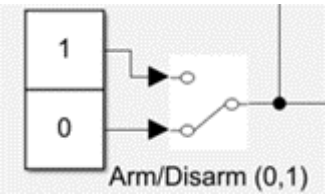


Figure 3. Motor Switch set to off in the QDrone 2 IO check model.

7. Ensure both the SAFETY GOGGLES and PROTECTIVE GLOVES are worn.
8. Click on the **HARDWARE** tab on the top menu, and then click the green play button (**Monitor & Tune**), It should build and start the model. If you have an older version of Simulink that does not have a Hardware tab, under the **QUARC** drop down menu, click **Build** and once it finishes click **Start**.
9. After you hear 3 or 5 beeps (which indicates that the ESCs are enabled and that the model is running on the drone), set the **Arm/Disarm switch** to 1. The four motors should start spinning at the same time. Use this to make sure all motors are spinning in the correct direction. **Switch the Cycle Motors switch** to 1, the motors will move sequentially (one at a time in clockwise order) which you should see in the **Motors (%) Scope**. Ensure that the motors are turning on and off in a clockwise cyclical order and each motor is spinning in expected directions: bottom right (motor 0, clockwise), bottom left (motor 2, counter-clockwise), top left (motor 3, clockwise) and then top right (motor 1, counter-clockwise). Shown in figure 4 where the front of the drone is where the real sense camera is mounted.

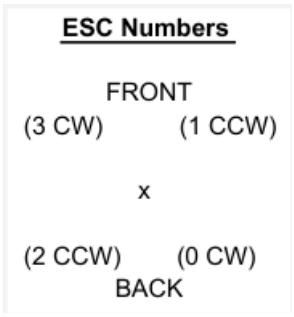


Figure 4. Motor numbers and spinning directions.

10. Set the **Arm/Disarm Switch** to 0.
11. Step into the workspace and set the **ESC Disable** switch on the QDrone to **ON** (that is, the ESCs are DISABLED, which is indicated by a **red LED lit next to the switch**). **This will trigger a warning sign on the LCD, it is okay and is there to show that the motors have been disabled through hardware. If you flip the switch again, you would not be able to Arm the motors. The icon will not disappear until the model is restarted with the Switch OFF (has a green LED).** The Scope at the bottom of the model connected to the HIL watchdog should change from 0 to 1 when the switch is flipped.

12. Move the drone around manually by holding it using the handle on the top frame of the QDrone. Check the attitude of the drone in the **Attitude Estimates (rad)** scope to ensure that the readings are reasonable. Use the picture of the drone axis in the model to make sure the movements in X, Y and Z are correct.
    CAUTION: DO NOT handle the drone with spinning motors.
    CAUTION: DO NOT handle the QDrone 2 with spinning motors (Make sure Arm/Disarm Switch is set to 0).
13. Hold the QDrone 2 and check the Height using the **BF_Height (m)** scope. The sensor is in the front bottom of the QDrone 2 next to the bottom facing camera. You can place the drone on the edge of a table and make sure it is working properly.
14. While holding the QDrone 2 by the handle, move it around and confirm that the **Optical Flow scope** measurements are changing when moving the QDrone 2 in X and Y directions. Use the drone image on the model as a reference for positive X and Y.
15. Ensure that the **Low Battery** display is 0 (i.e., battery is charged, low battery threshold is 14V).
16. Ensure that the **Sensor Failure** display is 0 (i.e., no sensor issue).

This completes the **QDrone 2 IO check** task and confirms that your QDrone is functioning correctly. The **QDrone 2 IO Check** model can be used to confirm basic functionalities whenever you run into unexpected behavior, to isolate software from hardware issues. If you have any errors, make sure that all the steps prior to this checkpoint have been followed. If further issues persist, please contact Quanser technical support (tech@quanser.com).

Solutions for teaching and research. Made in Canada.