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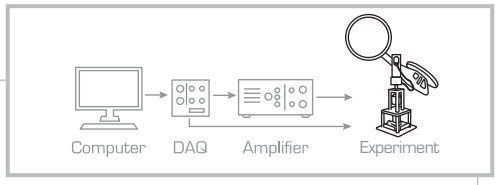
Quick Start Guide: 2 DOF Helicopter

MATLAB SIMULINK

STEP 1 Check Components and Details

Make sure your 2 DOF Helicopter experiment includes the following components:



1. 2 DOF Helicopter body
2. 2 DOF Helicopter pedestal
3. Set of two 5-pin DIN to 5-pin DIN encoder cables
4. Logitech USB joystick
5. Set of four 8-32 brass thumb screws
6. Quanser Workstations Resources DVD* (includes controllers; digital versions of User Manual, Quick Start Guide and courseware; and other files)

*DVD supplied with the QUARC Real-Time Rapid Control Prototyping software, see Step 2

STEP 2 Additional Components Required for Set Up

To complete the 2 DOF Helicopter set up, you will also need the following:

1. QUARC Real-Time Rapid Control Prototyping software Installation DVD
2. Power Amplifier (VoltPAQ-X2 pictured)
3. One of the following data acquisition devices:
   a. Quanser Q2-USB, or
   b. Quanser Q8-USB, or
   c. NI PCI/PCIe with NI M and X Series Terminal Board
4. Set of two RCA to RCA cables
5. Set of two 4-pin DIN to 6-pin DIN motor cables
6. E-Stop switch (optional)

Note: These components must be purchased separately.

To set up your 2 DOF Helicopter experiment, please read the following instructions carefully.

STEP 3 Install and Test QUARC

A. Make sure you have all required software, as listed in the QUARC Compatibility Table document located in the QUARC DVD folder.

B. See the QUARC Installation Manual for details on how to install the software.

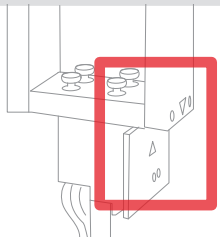
C. Make sure you test the system using the Sine and Scope demo. You can access this by typing qc_show_demos in the Matlab prompt.

STEP 4 Set Up the Hardware

A

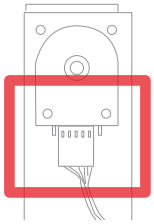
Secure the pedestal to a solid surface. Failing to do this step, the 2 DOF Helicopter might tip over when running.

B



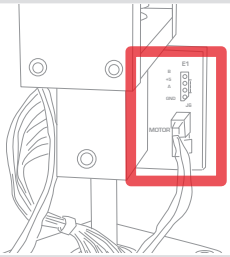
Using the supplied 8-32 brass thumb screws, attach the 2 DOF Helicopter body to the pedestal. Make sure the two alignment arrows are facing the same side.

C



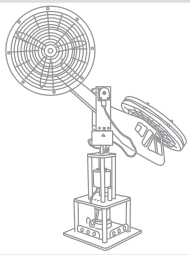
Using the four colour cables in the pedestal, connect the pitch encoder on the 2 DOF Helicopter body to the pedestal. Make sure that the ground pin on the encoder matches the ground terminal of the connector (the black wire).

D



Connect the motor cable from the 2 DOF Helicopter to the 6-pin rectangular connector labeled **MOTORS** on the pedestal circuit board.

E



Your 2 DOF Helicopter should now be assembled and ready to connect.

STEP 5 Wiring

To set up your 2 DOF Helicopter experiment, please read the following instructions carefully. The connections shown below are illustrated using a generic data acquisition (DAQ) device and a VoltPAQ-x2 amplifier (e.g., you may have a different DAQ or amplifier). For detailed instructions, see the 2 DOF Helicopter User Manual (enclosed with shipment).

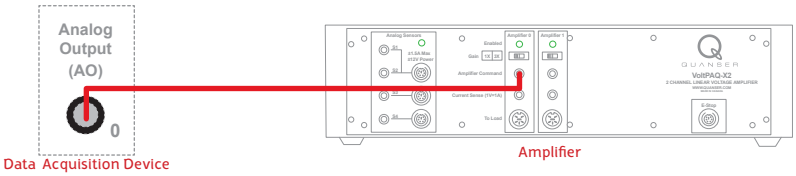
A

Before proceeding, set up and test your DAQ device (e.g.,Q2-USB) as described in its corresponding Quick Start Guide.

B

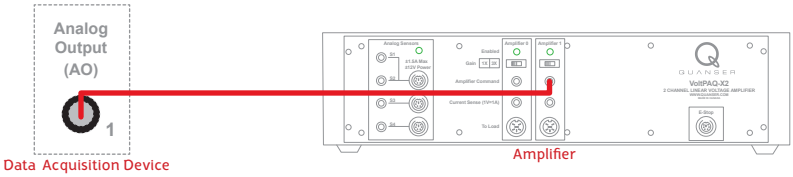
Make sure everything is powered OFF before making any connections. This includes turning off your PC and the amplifier.

C



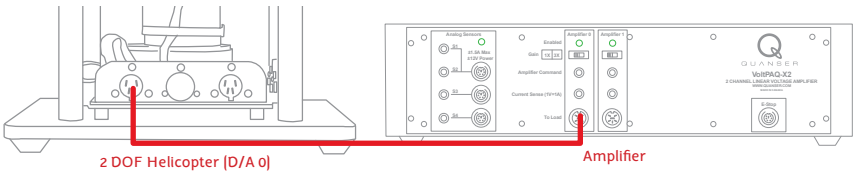
Using one of the connectors on the RCA to RCA cable, connect **Analog Output Channel #0** (AI #0) on the data acquisition (DAQ) device to the **Amplifier Command** 0 socket on the amplifier.

D



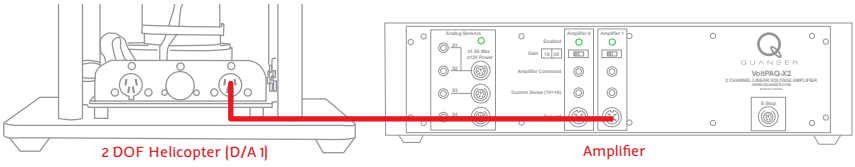
Using the other line of the RCA to RCA cable, connect **Analog Output Channel #1** (AI #1) on the data-acquisition (DAQ) device to the **Amplifier Command** 1 socket on the amplifier.

E



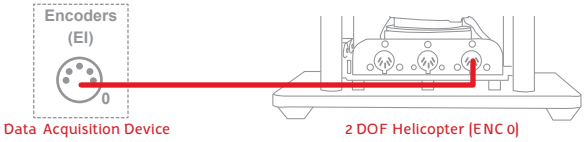
Using the 4-pin DIN to 6-pin DIN motor cable, connect the **To Load** from **Amplifier 0** to the **Pitch Motor (D/A 0)** connector on the 2 DOF Helicopter.

F

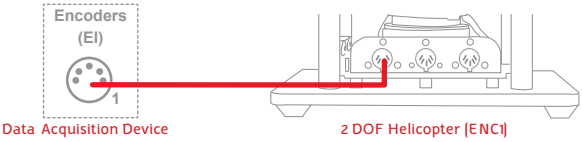


Using another 4-pin DIN to 6-pin DIN motor cable, connect the **To Load** from **Amplifier 1** to the **Yaw Motor (D/A 1)** connector on the 2 DOF Helicopter.

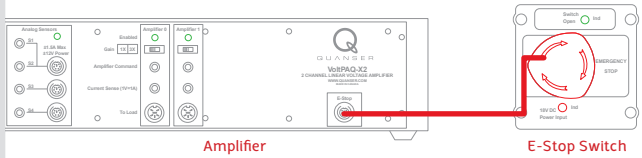
G Using the 5-pin DIN to 5-pin DIN cable, connect the **Pitch Encoder** (ENC 0) socket on the 2 DOF Helicopter to the **Encoder Input** #0 socket on the data acquisition device.



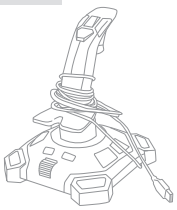
H Using another 5-pin DIN to 5-pin DIN cable, connect the **Yaw Encoder (ENC 1)** socket on the 2 DOF Helicopter plant to the **Encoder Input** #1 socket on the data acquisition device.



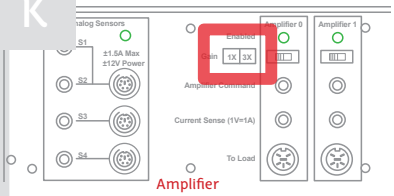
I Connect the **Emergency Stop** switch to the **E-Stop** socket on the amplifier (Optional Step).



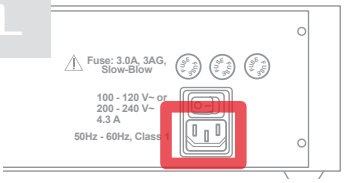
J Connect the USB cable from the joystick to a USB port on the PC. The system should detect the joystick and automatically install the driver (you will be prompted). See the Logitech Installation Manual for more information on the set up procedure. See the 2 DOF Helicopter User Manual for more information on system requirements of the Logitech joystick and how to use the Rate Command knob.



K If your amplifier has a GAIN setting switch, make sure you set the amplifier GAIN to 3x when using the 2 DOF Helicopter.



L Turn ON the power switch on the VoltPAQ-X2. It is located on the rear of the device.



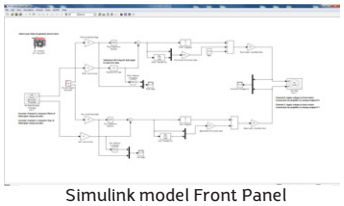
STEP 6 Testing the 2 DOF Helicopter

Follow the procedure below to test your 2 DOF Helicopter experiment.

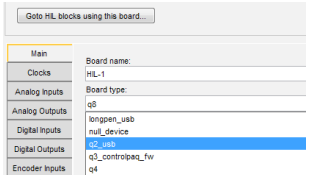
A Make sure your PC and amplifier are powered ON.

B On the Resources DVD (supplied with the QUARC and 2 DOF Helicopter package), locate the **Quick Start Folder**: Specialty\ 2 DOF Helicopter\ Quick Start. Copy the Quick Start folder to your local hard drive.

C Open the Simulink model file (.mdl) found under the Quick Start folder on your hard drive.

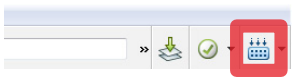

Simulink model Front Panel

D Double-click on the HIL Initialize block and choose the board that is installed on your system (e.g. Q2-USB).

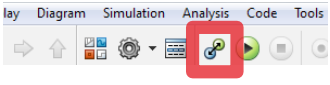


Configure HIL Initialize window

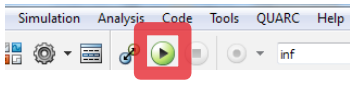
E Click on the **Build Model** button on the Simulink model toolbar.



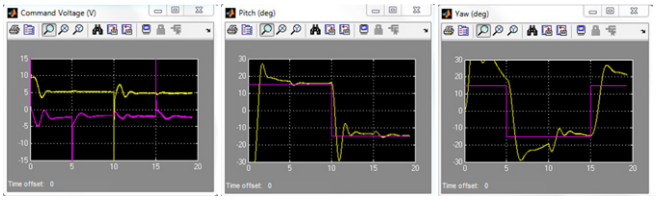
F Once the model code has been compiled, click on the **Connect To Target** button.



G Click on the **Run** button to start the QUARC real-time model.

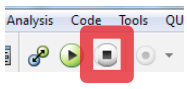


H The 2 DOF Helicopter should take off and hover. The scopes should look similar to those shown here. The measured pitch (in red) should be tracking the desired pitch angle (in blue). The pitch angle should measure 0 degrees when the helicopter is horizontal. Similarly, the measured yaw angle (in red) should be tracking the desired yaw angle (in blue). If not, go to the troubleshooting section of this guide.



Scope view of the Front Panel

I Click on the Simulink Stop button to **stop** the running model.



TROUBLESHOOTING

Please review the following recommendations before contacting Quanser's technical support engineers.

1. Make sure cables are firmly connected.
2. Check the connections outlined in Step 4 and 5 of this Guide.

Getting an error when trying to build or run the Quick Start Simulink model (.mdl)

A. Type ver in the Matlab Command Window and verify that QUARC is on the list. If not, then go through the QUARC Quick Installation Guide to install QUARC. If it is listed, run mex-setup as described in the QUARC Installation Guide.

B. If the "... specific kernel level driver for the specified card could not be found" error is prompted when you attempt to run, then you may not have selected the correct data acquisition (DAQ) device in the HIL Initialize block or the DAQ device has not been installed properly (refer to the DAQ device User Manual).

The Motor is not responding.

A. Review connections in Step 4D, Steps 5C to 5F, and Step 5I.

B. Ensure the power amplifier is powered on and operational, i.e., when using VoltPAQ-X2, verify that the green LED is lit.

C. Verify the data acquisition device is functional.

D. Ensure the voltage is actually reaching the motor terminals. See the 2 DOF Helicopter User Manual for details.

E. Ensure that the E-Stop switch is connected and that it is not engaged (i.e., the switch should be in the released position).

The Encoder is not reading.

A. Review connection in Steps 4C, 5G and 5H.

B. Verify that the data acquisition (DAQ) board is functional. Go through the DAQ User Manual for troubleshooting guidelines.

STILL NEED HELP? For further assistance from a Quanser engineer, contact us at tech@quanser.com or call +1-905-940-3575.

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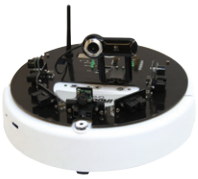
3 DOF Helicopter

3 DOF Hover

Qbot Unmanned Ground Vechicle



Qball-X4 Unmanned Aerial Vehicle

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