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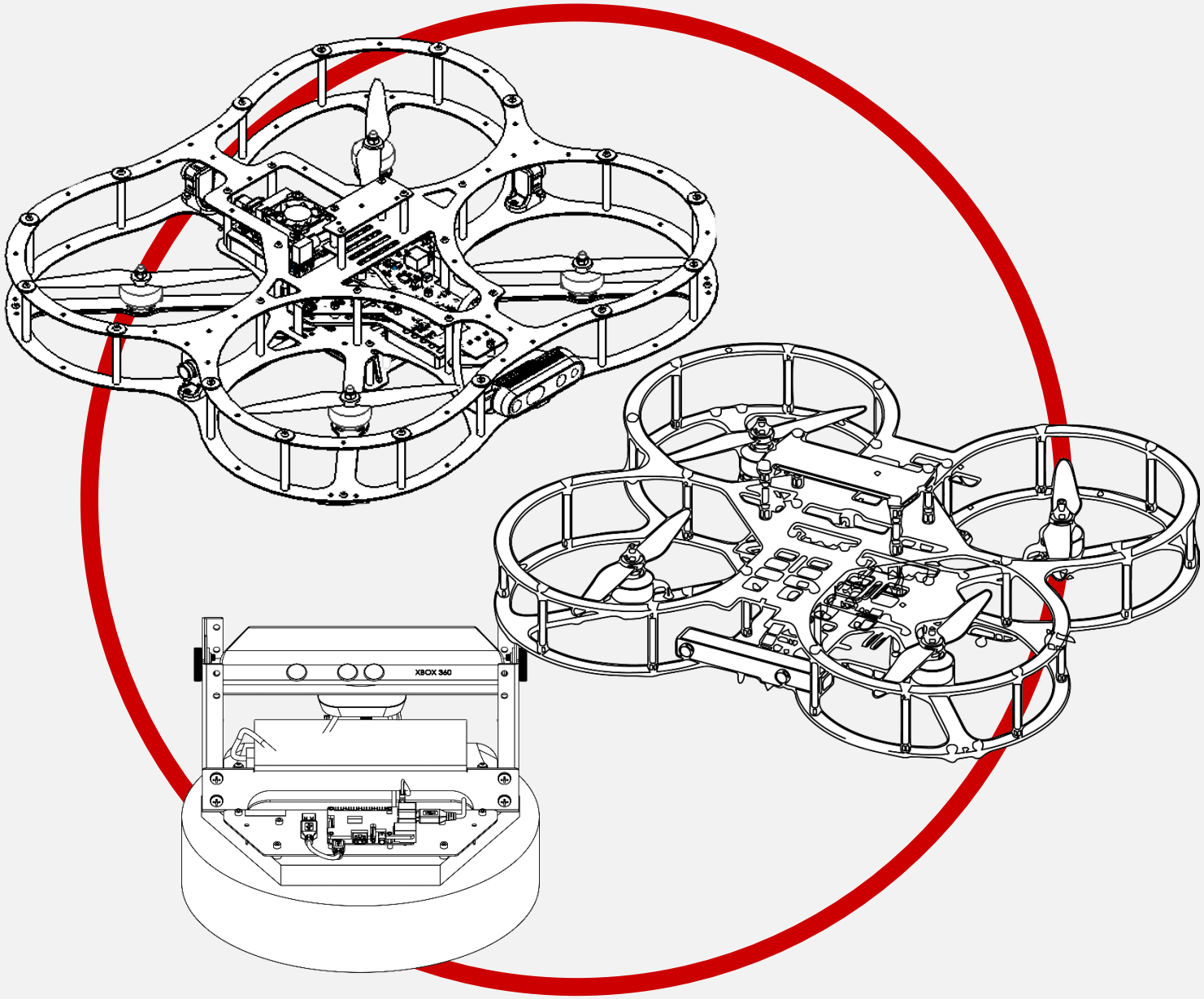

Autonomous Vehicles Research Studio

Setup Guide – SPEKTRUM® Joystick Setup

v 2.0 – 18*th April* 2023

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Note: If you have a different joystick (FrSKY) make sure to instead read the FrSKY_joystick_setup file located in the same folder as this file.

A. Spektrum® Joystick Setup and Binding/Pairing

The provided Spektrum® DXE joystick (Figure 1a) communicates wirelessly to the Spektrum® USB dongle (Figure 1b), which is plugged into a USB port on the ground control station PC. The dongle and joystick have been pre-configured to bind/pair with each other prior to shipping. When the joystick is turned on while the USB dongle is plugged into a live PC, a steady orange LED should be lit on the dongle and the joystick to indicate binding/pairing is successful.

a. Spektrum DXE joystick b. Spektrum USB dongle

Figure 1: FrSKY transmitter and USB dongle bound

Note: If the USB dongle is connected for long periods of time, then the joystick may stop receiving data. If so, try to disconnect and then reconnect the USB dongle to renew the connection.

i. Pair Joystick to USB Dongle

This section is only important if your joystick and dongle are no longer paired. If you do not have this problem, you can continue to the next section.

If the binding/pairing is lost (orange LEDs on joystick and dongle keep flashing), see Spektrum USB Dongle Manual (located in supplementary_material/Spektrum Dongle Manual.pdf).

To bind/pair the Spektrum joystick transmitter to the Spektrum USB dongle, follow these steps:

1. Ensure that the joystick transmitter is OFF. Disconnect the USB dongle from the PC if it was previously plugged in.
2. While pressing the pair button (Figure 2a), connect the USB dongle to the PC. An orange LED on the dongle will start flashing indicating the dongle is ready for binding.
3. Hold the joystick close to the USB dongle. While holding down the BIND/PANIC/TRAINER button on the top left corner of the joystick (Figure 2b), turn ON the joystick transmitter. The power LED on the joystick will start flashing indicating it is ready for binding.
4. Keep holding down the BIND/PANIC/TRAINER button until a sequence of three beeps is emitted from the joystick transmitter. That indicates the binding/pairing process is successful.

NOTE: Do NOT use the Wireless Trainer Bind button on the top right of the joystick.

NOTE: If you reach step 4 and the two devices have not been bound together repeat the process.

a. Bind button on the USB dongle b. Bind button on the joystick

Figure 2: Binding the joystick to the USB dongle

B. Spektrum Joystick Channels

The Spektrum DXE joystick has numerous buttons, toggles and sticks. However, only a subset of these relay information to the USB dongle receiver. These are highlighted in Figure 3 along with the reference terminology. The Simulink/Quarc subsystem that outputs data from these channels will be covered under Guides and Resources. The PUSH button reads TRUE when pressed and held, and FALSE otherwise. The Toggles read TRUE when at position labelled 1 or 2, and FALSE at position 0. The Throttle stick reads 0 to 1 as it is moved from the bottom to the top. The Yaw, Pitch and Roll sticks read -1 to 1 as they move over their range and 0 if left untouched (spring loaded to maintain center position).

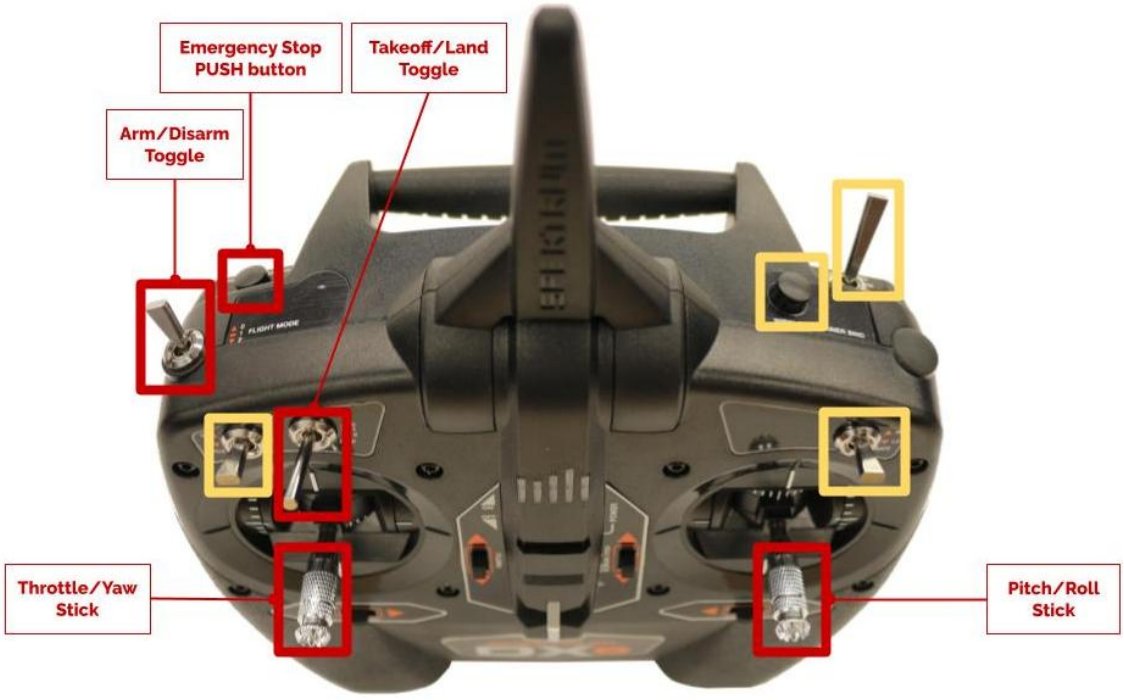


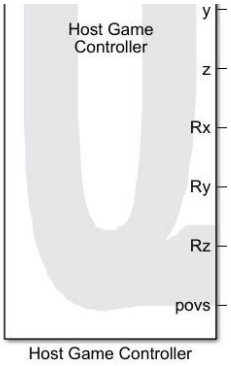
Figure 3: Spektrum DXE joystick buttons, toggles, and sticks

Note: Some of the buttons/toggles are for internal use and do not relay information to the USB dongle receiver or are ignored. These are highlighted in Figure 3 in yellow. For proper operation of the Autonomous Vehicles Research Studio, ensure that these toggles are set to a position tilted away from the user holding the joystick as illustrated in Figure 3.

C. Checkpoint – Joystick Visualization Demo

1. From the same folder as this file, under Joystick Visualization Demo, open the Joystick_Visualization.slx model.
2. Change the joystick to the correct one. Comment out the Joystick_Frsky subsystem, uncomment the Joystick Spektrum subsystem and flip the manual switch.
3. In the model that loads, double-click the **JOYSTICK_SPEKTRUM** subsystem (Figure 4a), and double-click on the **Host Game Controller** block (Figure 4b). In the pop-up dialog window, ensure that the **Controller number** (Figure 4c) drop down menu has selected the item labelled **SPEKTRUM RECIEVER**.

a. Joystick subsystem



b. Host Game Controller

c. Controller number set to Spektrum

Figure 4: Selecting the SPEKTRUM RECEIVER in Simulink/QUARC

4. Ensure that the joystick is powered **ON** and that it is bound to the USB dongle plugged into the ground station PC.
5. Go back to the root level in the model, click on the **HARDWARE** tab on the top menu and click the green play button **(Monitor & Tune**)
6. Follow the instructions at the model's root level to move the drone around.
7. The drone should fly around in directions aligned with the user joystick commands.
   a. Pushing the throttle stick up/down should increase/decrease the drone's height.
   b. Pushing the yaw stick left/right should increase/decrease the drone's heading.
   c. Pushing the pitch stick up/down should move the drone forward/backward.
   d. Pushing the roll stick left/right should move the drone left/right.

This completes the checkpoint task and confirms that your Joystick has been configured successfully. If you encounter 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).

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