Autonomous Vehicles Research Studio

Setup Guide – QDrone 2 Communication

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For more information on the solutions Quanser Inc. offers,
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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.

Industry Canada Notice This Class A digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Waste Electrical and Electronic Equipment (WEEE)

This symbol indicates that waste products must be disposed of separately from municipal household waste, according to Directive 2002/96/EC 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.

This product meets the essential requirements of applicable European Directives as follows:
- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

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.

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 to ensure that the equipment will be used by technically qualified personnel only. While the end-effector board provides connections for external user devices, users are responsible for certifying any modifications or additions they make to the default configuration.

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A. Communicating with QDrone 2

The QDrone 2 is shipped pre-configured to connect to the wireless network created by the provided router: Quanser_UVS-5G. This happens automatically following a boot sequence when they are powered on. To ensure that the drone is connected, observe if there is an IP in the LCD screen on top of the drone and try to ping it from the command prompt in the ground control station, similar to ensuring that the ground control station PC - router connection has been established in the router to PC documentation step 7 – router pc connection.

To connect additional vehicles to the UVS network, the 5GHz and 2.4GHz bands on the router have been configured as follows:

5GHz:

SSID: Quanser_UVS-5G   Password: UVS_wifi

2.4GHz:

SSID: Quanser_UVS   Password: UVS_wifi

Router login credentials are as follows:

Username: admin   Password: Quanser_123

The QDrone 2 does not have a preset IPV4. **If you would rather set a fixed IP, refer to the Setting Fixed IP Addresses document (supplementary_material > setting_fixed_ip).** For a successful connection, the DHCP server option on the router must be enabled. For the Netgear Nighthawk router provided with the AVRS system, the DHCP server can be found by going to Advanced/Setup/LAN Setup.

To ensure compatibility with the Self-Driving Car Research studio, the **5GHz band** for the Netgear Nighthawk router has been configured to **channel 44.** If you do notice intermittent issues with communication to any of the vehicles, it is recommended that you use a WiFi spectrum analyzer and check if there are networks which are broadcasting on the same channel but at a higher signal strength. Microsoft has a free WiFi analyzer: (https://www.microsoft.com/en-us/p/wifi-analyzer/9nblggh33n0n?activetab=pivot:overviewtab#)

You can change the Netgear Nighthawk's channel number by logging into the router and checking the channel number under the 5GHz wireless band.

B. Boot-Up for QDrone 2

i. Connecting the Battery

Insert a fully charged battery into the battery compartment on the QDrone 2 (Figure 1) all the way to the hard stop marked with a red circle at the bottom of the image. Make sure that the long cables that have the XT-60 connector go to the top left so that you can connect it plug it in, **Tighten the battery with the velcro**. It is generally good practice to hide the 5-pin connector under the battery, so it is not dangling while in flight.

> **Note:** Ensure that the velcro strap is tight and that the battery is secured in place.

Connect the XT-60 connector on the battery to the XT-60 connector on the tail at the bottom of the drone (Figure 1).

> ⚠ **Caution:** Leaving the QDrone 2 powered on with the battery connected will continue to drain power below the minimum voltage threshold of 13.3V **and may permanently damage the battery**.
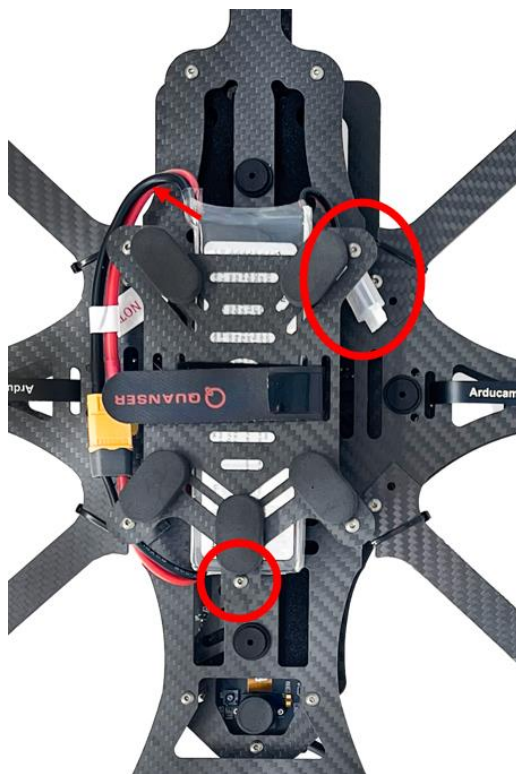

Figure 1. Battery setup

ii. Turning the QDrone 2 ON and OFF

Press and quickly release the red power button on the drone PCB to turn it on. It should be acknowledged by 3 beeps from the QDrone 2 as the drone's computer boots. The LCD on the QDrone 2 should turn on and it should show Figure 2a. Figure 2 shows the LCD display as the QDrone 2 is being turned on (2a), as it starts (2b) and gets an IP address (2c) and what happens after the button is pressed for power off (2d).
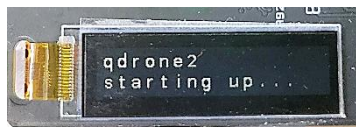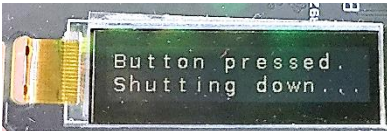

(a) Booting up
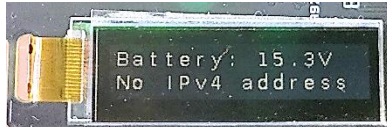
(b) Started

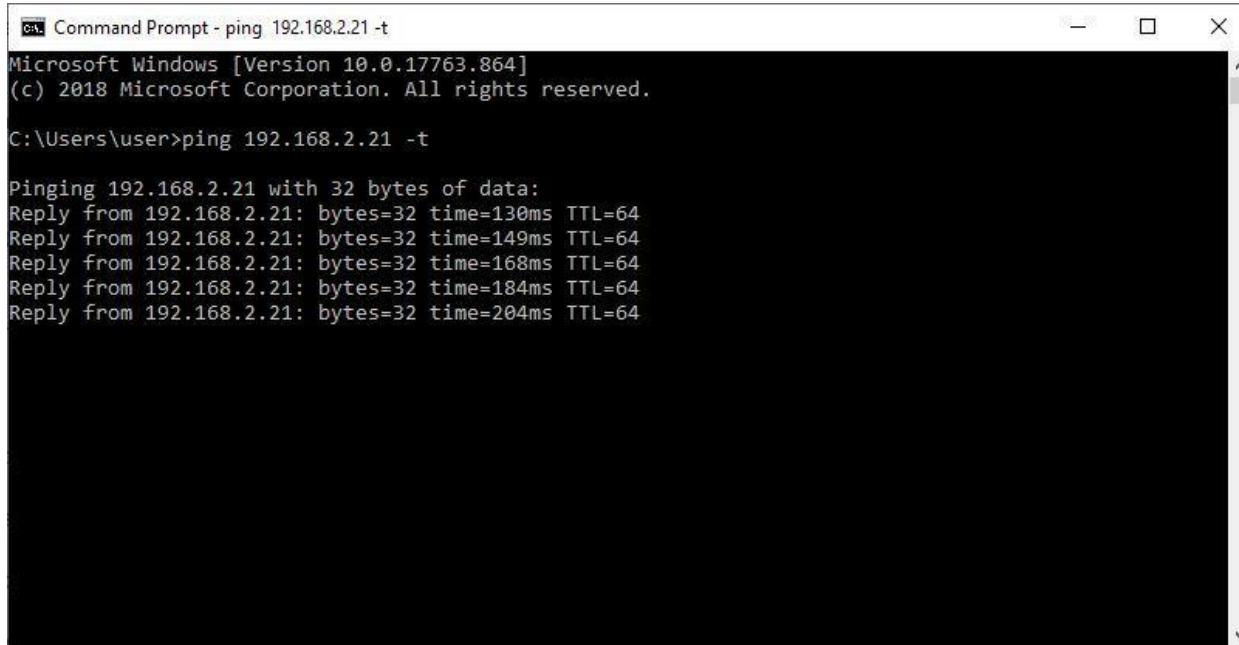

(c) Connected

(d) Powering off

Figure 2: QDrone 2 boot and power off

Note: Turn off the QDrone 2 by using the red power button. Only press once quickly and release, LCD should show Figure 2d. Do not keep the red button pressed to turn it off as it could cause issues. Disconnect the XT-60 battery cable whenever the QDrone 2 is not in use.

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iii. Testing the Connection

Open a command prompt on the ground control station PC (type `cmd` in the start menu). Type the following command: `ping 192.168.2.d -t` where 192.168.2.d represents the IP on the drone. It should be displayed in the LCD when the drone is powered on. It could take a couple of minutes to appear. A reply should be registered as in Figure 3, which indicates that a connection has been established. You can press CTRL+C to terminate the ping.


```
Command Prompt - ping 192.168.2.21 -t                                    —   □   ×
Microsoft Windows [Version 10.0.17763.864]
(c) 2018 Microsoft Corporation. All rights reserved.

C:\Users\user>ping 192.168.2.21 -t

Pinging 192.168.2.21 with 32 bytes of data:
Reply from 192.168.2.21: bytes=32 time=130ms TTL=64
Reply from 192.168.2.21: bytes=32 time=149ms TTL=64
Reply from 192.168.2.21: bytes=32 time=168ms TTL=64
Reply from 192.168.2.21: bytes=32 time=184ms TTL=64
Reply from 192.168.2.21: bytes=32 time=204ms TTL=64
```

Figure 3: Checking the connection between the QDrone 2 and
the ground control station PC

An alternative way of checking connectivity between the QDrone 2 and the router is to note if the router is seeing the QDrone 2 by connecting to the router. Router login credentials are in section A.

The QDrone 2 network information can be found by checking under the Connected/Attached Devices option.

If the QDrone does not have an IP address on its LCD after a few minutes and the router is turned on configured properly, contact Quanser's technical support.

> **Note:** If the ping test fails, double-check the network connection and try again. Also try power cycling the drone. If issues persist, contact Quanser technical support (tech@quanser.com).

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