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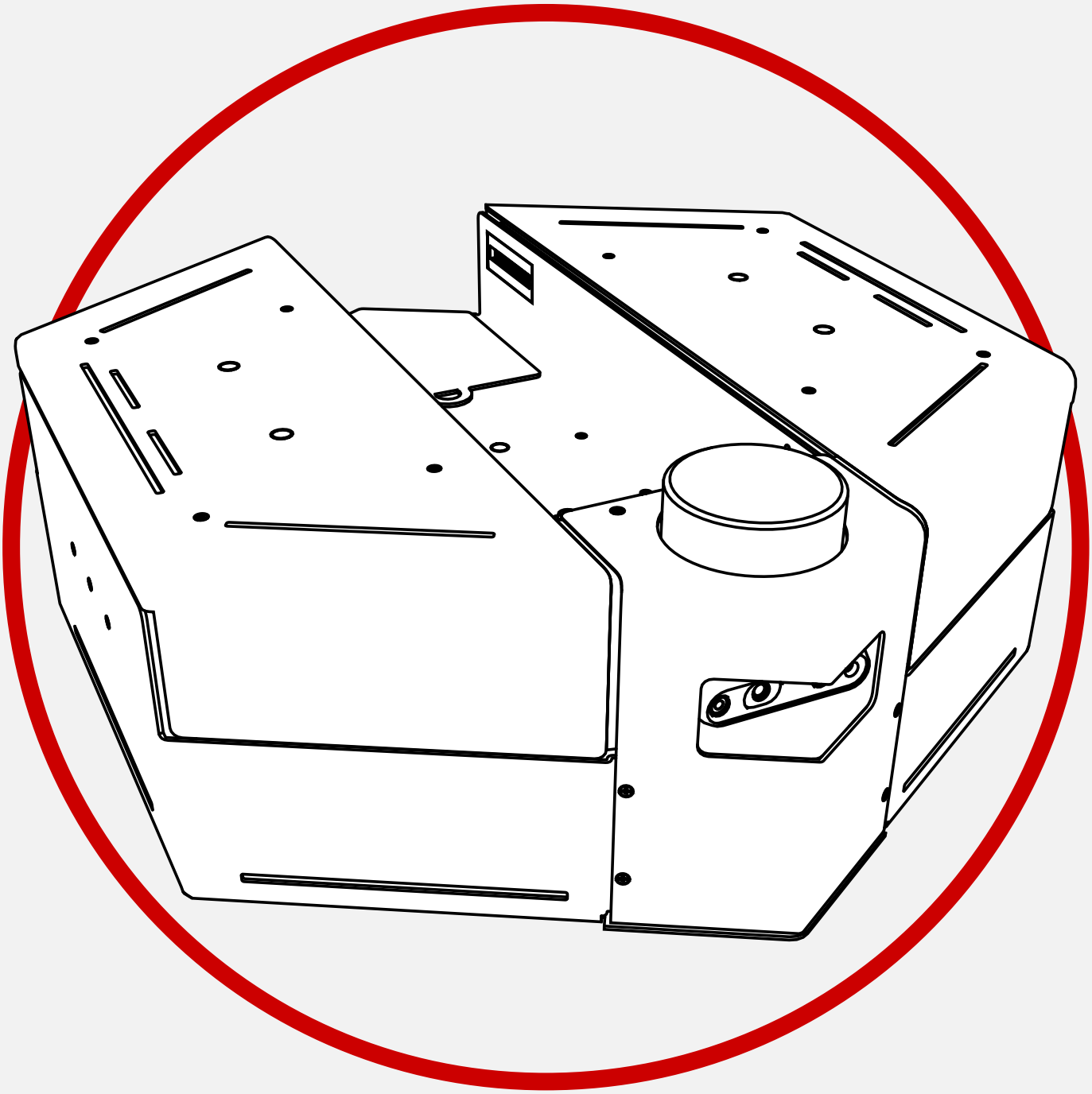

QBot Platform

User Manual – Connectivity

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

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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, Ethernet and USB ports provide 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: 3147A-602230C

Waste Electrical and Electronic Equipment (WEEE)

This symbol indicates that waste products must be disposed of separately from municipal household waste, according to Directive 2012/19/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

The Leishen LiDAR M10P and the Intel RealSense D435 RGB-D camera are both classified as Class 1 Laser Products. The laser safety of both products meets the following standards:

- IEC 60825-1:2014
- 21 CFR 1040.10 and 1040.11 standards, 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.

Caution

ESD Warning. The QBot Platform internal components are sensitive to electrostatic discharge. Before handling the QBot Platform, ensure that you have been properly grounded.

Table of Contents

A. Network Setup

i. Router Setup

Each QBot Platform Bundle comes provided with a router, router power supply and ethernet cable. The key ports and parts have been outlined in Figure 1 for easy setup.

a. provided router

b. router power supply

c. ethernet cable

d. wiring the router

Figure 1. Router parts and key ports

Set up sequence:

1. Connect the power supply (Figure 1b) provided with the router to the power port on the back of the router (Figure 7d).
2. *Optional Step*: Connect the PC to the router by using the provided ethernet cable (Figure 1c) and one of the four black ports on the back of the router labelled 1 to 4 (Figure 1d).
    a. Connect the other end of the ethernet cable directly into the PC using an Ethernet port.

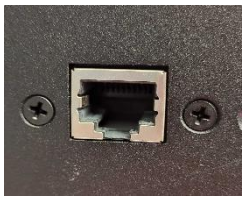
Note: DO NOT use the yellow port labelled WAN to connect to a PC. This port is used to provide an internet connection to the router, which is not recommended, as the router is configured to optimize local traffic only.

Note: DO NOT use an ethernet switch or any other device between the router and the PC

Turn on the router. After a few minutes, the lights on the front of the router (Figure 7a) should start flashing with a white light to indicate to the user that the ports are active.

ii. LAN

The QBot Platform may be connected to the supplied router or network of your choice using an ethernet cable connected to the 10/100/1000 Base-T Ethernet jack on the side of the QBot highlighted in Figure 2a. In this mode, the LCD will show an ethernet symbol as shown in Figure 2b.



a. Ethernet jack on QBot Platform

b. LCD showing wired connectivity

Figure 2. Ethernet setup with the QBot Platform

The LCD will also show the IPv4 address of the QBot Platform assigned dynamically by the DHCP server on the provided router (if using LAN) or the network of your choice.

iii. Wireless

The QBot Platform is configured to automatically connect to the router provided with the full QBot Platform Bundle. The wireless access point (AP) settings for the network with the provided router are,

SSID	-	**Quanser_UVS** (2.4GHz) or **Quanser_UVS-5G** (5 GHz)
Password	-	**UVS_wifi**

If the QBot Platform was not purchased as part of the Bundle package or if you choose to set up your own network, you will need to manually configure the Wi-Fi. Please keep the following considerations in mind:

1. The QBot Platform can use either the 2.4GHz (full spectrum) or 5GHz bands. The 5GHz band at higher frequencies is disabled on the router provided with the QBot Platform for easy integration with all Quanser products. Ensure that your 5GHz network is broadcast over the channels in the range 36 to 60 and not higher. If you are using your own router, this warning can be ignored.
   Note: The 2.4GHz band offers coverage over farther distances but performs at slower speeds. The 5GHz network offers higher bandwidth and data rates over shorter distances.
2. Ensure that your router has the Dynamic Host Configuration Protocol (DHCP) server enabled. This will ensure that the router automatically assigns an IP address to the robot when it connects.
3. To have the QBot Platform connect to a wireless network of your choice, you need to access the Wi-Fi configuration menu in Linux. To access this GUI desktop, you can connect to the QBot Platform using a monitor/keyboard/mouse as described in section B.i - Direct.

Once the wireless connection is established, the LCD will show a wireless symbol as highlighted in Figure 3, as well as the IPv4 address of the platform dynamically assigned by the provided router or the router for the network of your choice. If you are using the provided router, the IP will look like the IP in Figure 4. (192.168.2.X).

Figure 3. Wi-Fi setup with the QBot Platform

iv. Setting Up a Windows Laptop as a Hotspot

If you do not have a router available, you could use your windows laptop to create a hotspot.

1. Select **Start,** then select **Settings** > **Network & internet** > **Mobile hotspot**.
2. For **Share my internet connection from**, choose the internet connection you want to share.
3. For **Share over**, choose **Wi-Fi** which is the default.
4. Expand the **Properties** section, then select **Edit** and enter a new network name (**Quanser_UVS-5G**), password (**UVS_wifi**), and network band (**5G**). Select **Save**.
5. Turn on the **Mobile hotspot** toggle at the top of the Mobile hotspot settings page.
6. Since the name and password of the network are the same as the ones the router would have provided, the robot should connect to it automatically without having to go to the Wi-Fi settings. Make sure to restart your QBot if it was already turned on.

B. User Interface

i. Direct

The QBot Platform can be used directly as a computer. You will need a USB keyboard and mouse, an HDMI cable, and a monitor.

1. Connect a keyboard/mouse to the robot using the USB ports.
2. Using the HDMI port on the side of the robot, connect the robot to the monitor's HDMI port.
3. The network can be set up using LAN, Wi-Fi or a Hotspot as described in section A.
4. The credentials to login are as follow: **username** is "**nvidia"** and the **password** is "**nvidia**".

ii. Remote

For applications that require the QBot Platform to be moving or require remote access, a direct setup is not feasible. In such cases, a wireless connection using the router is preferred. For this setup, you could use a PC or the provided Ground Control Station (GCS) (if the QBot Platform was purchased with a bundle). Connect the computer to the same network or connect it directly to the router as in section A.i.

To ensure both devices are in the same network, use the command **`ipconfig`** (in a Windows command prompt) or **`ifconfig`** (in an Ubuntu terminal) to check your current computer's IPv4 address. You can also use the **`ping`** command in both Windows and Ubuntu to check your connection to the QBot Platform, eg.

```
>> ping 192.168.2.X -t
```

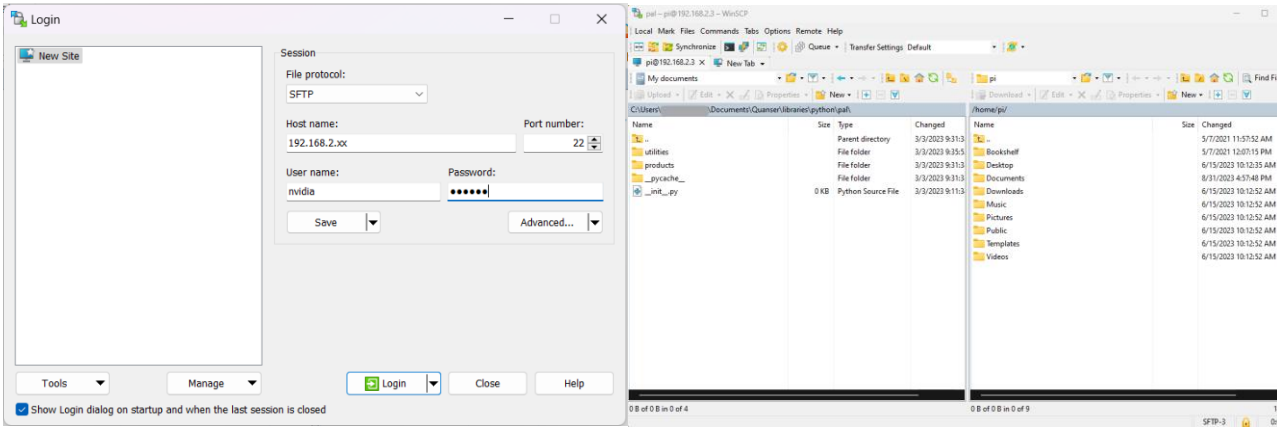
where **`192.168.2.X`** represents the IPv4 address of the QBot Platform (in using the provided network).

File Transfer

To transfer files between the windows device and the robot manually, An **`scp`** application can be used. A graphical **`scp`** software such as **`WinSCP`** can also be used. Find more information on WinSCP here. This can be used for one-time file transfers, or you can navigate to a file onboard the QBot Platform.

To use WinSCP, enter the QBot Platform's IP address as the host name, **`nvidia`** as the username, and **`nvidia`** as the password, as shown in Figure 4a. You can now use the WinSCP browsers to transfer files from the computer to the QBot Platform (right browser), shown in Figure 4b. Double clicking a file on the right will automatically transfer a copy of the file to your PC and open it in your default editor. Clicking save in your editor will automatically transfer the saved version back to the QBot Platform.

To transfer files, you could also drag and drop files from one side to the other one.



a. WinSCP login b. WinSCP browser to transfer files

Figure 4. WinSCP usage for file transfer

If looking to use direct **scp** commands to transfer files from your windows command prompt or powershell directly to the QBot, you can use a command such as,

```
>> scp fileLocationOnHostComputer nvidia@192.168.2.X:/home/nvidia/...
```

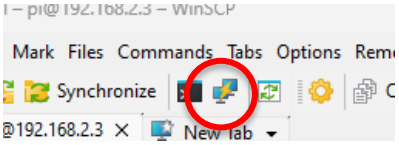
Terminal access

You can use the terminal to connect to the robot. These are just some of the ways to do it.

PuTTY

Install the PuTTY tool in your machine. Find more information on PuTTY here. If you are familiar with Linux command-line text editors, you can also edit code on the QBot Platform via PuTTY. This software by itself is sufficient to access the file system and execute code that does not require any graphical feedback display.

If you moved files to the robot through WinSCP, you could open a PuTTY terminal directly from the menu there.



To use the PuTTY app directly, open the application and enter the hostname or IP address of the QBot Platform in the hostname field as shown in Figure 5 then click Open. You will be prompted to login (username **nvidia**, and password **nvidia**). Note that you can open more than one PuTTY terminal to the QBot Platform if you need to.

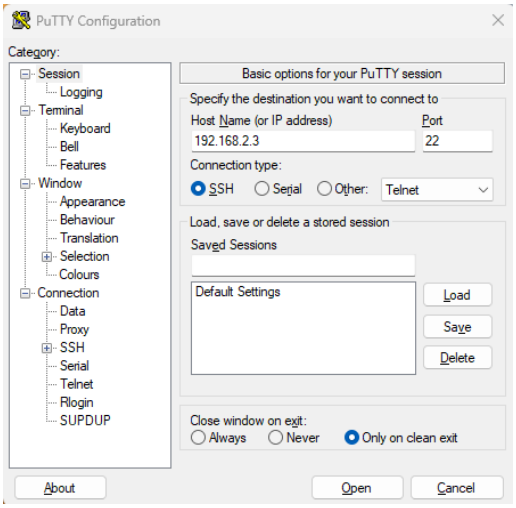


Figure 5. Connecting to the QBot Platform with PuTTY

SSH

To remotely connect to the robot through the terminal without downloading any software you could use SSH. To use the OpenSSH client on Windows, simply open a PowerShell

window or a command prompt window and run the ssh command. For example, if you want to connect to the QBot Platform via terminal, run the following command in a command prompt or powershell,

```
>> ssh nvidia@192.168.2.x
```

The terminal will prompt you for the password (**nvidia**).

Note: **SCP** and **SSH** are both terminal utilities installed in Windows 11, and **WinSCP** and **PuTTy** have graphical interfaces to launch this.

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