



# QBot Platform

## User Manual – Power

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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.

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)

**CE Compliance** 

**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.

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.



Caution

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.

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## A. Charging the battery

-  **Caution:** If a battery has been left uncharged for a long time, pay close attention when attempting to charge it again.
-  **Caution:** Before using any batteries, chargers/balancers, or power supplies, users must first read the manuals packaged with their equipment. Quanser supplies these guidelines for charging batteries, but it is the users' responsibility to ensure they are operating their equipment safely and correctly. Quanser is not responsible for any damages resulting from use of batteries, power supplies, chargers, or balancers.
-  **Caution:** Prior to using the QBot Platform, visually check the battery for bloating or damage. If the battery exhibits bloating **DO NOT USE** it. Visual bloating of the battery is dangerous - discard it in accordance with your country's relevant recycling and disposal laws
-  **Caution:** Do not charge the battery under direct sunlight.
-  **Caution:** Keep LFP batteries away from children and animals.
-  **Caution:** Never charge a LFP battery or battery charger that has been punctured or damaged in a crash. After a crash, inspect the battery or charger for signs of damage. Protect your LFP batteries from accidental damage during storage and transportation. Do not put batteries in pockets or bags can encounter sharp or metallic objects.
-  **Caution:** Do not use batteries unless supplied by Quanser. If you require additional batteries, please contact Quanser.
-  **Caution:** A LFP battery left deep-discharged for an extended period may develop permanent damage in one or more cells. Such batteries may heat up excessively while charging. Always monitor battery temperature during the first hour, then hourly there-after. If at any time the battery is uncomfortably hot to touch or you notice any unusual signs, disconnect the charger immediately.
-  **Caution:** Do NOT attempt to disassemble, modify, or repair the LFP battery.
- Note:** When discarding a LFP battery, discard it in accordance with your country's relevant recycling and disposal laws.

For more information about the battery charger and battery safety please consult the Optimate lithium battery charger manual included with your charger or see the manual [here](#). More information on the Dakota Lithium Iron Phosphate (LFP or LiFePO<sub>4</sub>) batteries can be found [here](#). Some battery parameters have been summarized in Table 1.

1. Power the Optimate battery charger (Figure 1a), that has an SAE charging cable attached.
2. **Skip this step unless your battery becomes disconnected from the battery connectors.** Connect the SAE battery connector cable (highlighted in the red rectangle) to the battery by connecting the red spade connector to the red terminal on the battery and the black spade connector to the black terminal on the battery (Figure 1b).  
**NOTE:** You should only do this step if the connectors become disconnected to the battery. There are other methods of attaching to your battery and charging it that come with this battery charger (Figure 1b). Any of the connector cables can be used, but for day-to-day ease of use we suggest using the SAE cable already connected to the batteries provided.
3. Plug the SAE connector on the cable attached to the battery into the SAE connector on the cable attached to the battery charger.  
**NOTE:** If the battery is connected incorrectly the reverse polarity symbol on the battery charger will light up to let you know (Figure 1c).
4. Charging should start automatically.  
**NOTE:** If the battery is completely drained the internal protection will trigger (Figure 1d). In this case you will have to press the black **Tune** button (Figure 1e) until the red charging button stops flashing and is solid red, this will start the battery charging as the charger will not automatically sense that there is a battery connected.
5. Charging is complete when the LED has moved up to the green check marked section (See Figure 1f). Battery will charge much faster to a 75% charge (< 1 hour). A full charge should take no more than 6 hours.
6. After charging is complete, unplug the SAE connector and re-plug that connector back into the corresponding SAE connector on the QBot Platform. Then disconnect the battery charger from the outlet.

#	Item	Value
1	Battery capacity	7 Ah
2	Max continuous discharge	10 A
3	Instantaneous discharge	50 A @ 300ms pulse
4	Connector on battery side	SAE
5	Maximum charge voltage (recommended)	14.4 V
6	Nominal voltage	12.8 – 13.4 V
7	Minimum voltage (cutoff/recommended)	9.0 / 11.0 V
8	Battery weight	907.18 grams
9	Battery dimensions (L x W x H)	15.1 cm x 6.5 cm x 9.5 cm

Table 1. Dakota Lithium 12V 7Ah LFP battery characteristics



a. Charger/Balancer



b. Battery & Battery Connector Cables



c. Reverse Polarity Warning



d. Fully Drained Battery or Not Connected



e. Fully Drained Battery/Tune



f. Fully Charged

Figure 1. Using the batteries and battery charger

## B. Connecting the battery to the QBot Platform

Once the LFP battery is charged, place it in the QBot Platform by following these steps in Figure 2:

1. Open the wings of the QBot Platform gently tugging on the sides of the wings until the strength of the magnet is released and they pop open.
2. Place the LFP battery in any bay of choice (or both) and connect the SAE connector of the battery cable to the QBot. Guide the wire under the wing rails.
3. Close the wings and you are ready to go.



a. Empty battery bay (right bay #1)



b. battery bay with LFP battery connected to QBot Platform

Figure 2. QBot Platform battery compartment with connectors

## C. Turning ON the QBot Platform

After the batteries are connected, turn on the QBot platform by firmly but gently pressing on the silver power button shown in Figure 3.



Figure 3. Silver power button and emergency motor shutoff

The power LED strips around the QBot Platform should turn red. The LCD will display 'QUANSER INNOVATE EDUCATE' as shown in Figure 4a. After a few seconds, the LCD will



change to display the serial number and say 'qbp-XXXXX starting up...' as shown in Figure 4b. Once the QBot Platform boots up completely, it will switch to a default mode that shows which battery the robot is running on as well as the current battery level, Ethernet/Wi-Fi status as well the IP address that the robot is connected to, an example of which is shown in Figure 4c. It may take several minutes for the robot to connect and display the IP address after the battery level is shown.



a. First bootup message



b. Second bootup message



c. Default display message

Figure 4. LCD startup and default messages

## D. Turning OFF the QBot Platform

To turn OFF the QBot Platform, firmly but gently press on the silver power button once to turn off the robot. **This is the recommended process to initiate shutdown normally.** Please wait for the QBot Platform to fully shut down before disconnecting the battery or tipping the robot on its side (as it will damage the lidar).



Figure 5. Normal shutdown message

If for some reason the QBot Platform will not shut down by clicking the power button, press and hold the power button for approximately 3-4 seconds. The QBot Platform's lights will go off indicating the robot has shut down, however the LCD will hold its last display until you release holding the button. Upon releasing the power button, the power to the QBot Platform computer will be cut off immediately and the LCD will go blank, equivalent to a hard shutdown. This is **not recommended** and should not be required during normal operation, as it may corrupt the SD card on the embedded computer.

## E. Low-battery and auto-shutdown

When the LFP batteries get low, safety measures have been built into the QBot Platform to ensure proper shutdown of the robot and maintain the health of the batteries.



### Single battery configuration:

On power up, the QBot Platform will continue using the battery until its voltage goes under 12.0V. At this point, a LOW BATX message will get displayed on the LCD as shown in Figure 6a. Below 11.5V, the QBot Platform will automatically shutdown to prevent battery damage.

### Dual battery configuration:

On power up, the QBot Platform will select the battery with a lower but valid voltage. A valid voltage is any value above 12.0V. When the selected battery voltage goes under 12.0V, the QBot will automatically switch to the other battery so long as it is still valid. This switchover is automatic via an onboard relay and no reboot is required.

If both batteries reach a voltage under 12.0V, the message in Figure 6b will be displayed. At this point, both batteries are used and drained simultaneously until they reach 11.5V to prolong their life. Under 11.5V, the QBot Platform will automatically shut down, displaying the shutdown message. It will first attempt a normal shutdown, but if it is unable to do so, it will disconnect the power after a short period and the LED strips will flash red.



a. Low battery warning message



b. Recharge Message



c. Automatic Shutdown

Figure 6. Low voltage protection and automatic shutdown

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