QBot Platform

Power User Manual

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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.

⚠ 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 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. Charging the battery

> ⚠️ **Caution**: If a battery has been left uncharged for a long time, pay close attention when attempting to charge it again.

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.

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 LiFePO4) batteries can be found [here]().
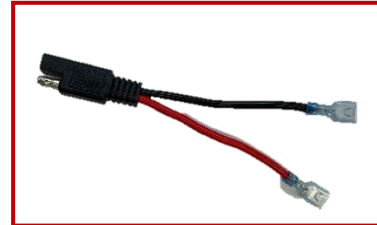
a. Charger/Balancer

b. Battery & Battery Connector Cables

c. Reverse Polarity Warning

d. Fully Drained Battery or Not Connected

Figure 1. Using the batteries and battery charger

e. Fully Drained Battery/Tune   f. Fully Charged

Figure 1 (continued). Using the batteries and battery charger

B. Connecting the battery to the QBot Platform

Once the LiFePO4 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 (1) is released and they pop open.

2. Loosen the battery straps (2) and place the Dakota Lithium 84-Wh LiFePO4 battery (3) in the battery compartment (4).

3. Connect the battery's SAE connector (5) into the QBot Platform's SAE connector (6).

4. Secure the straps back in over the battery and its cables to prevent the wings from catching on the wires (2).
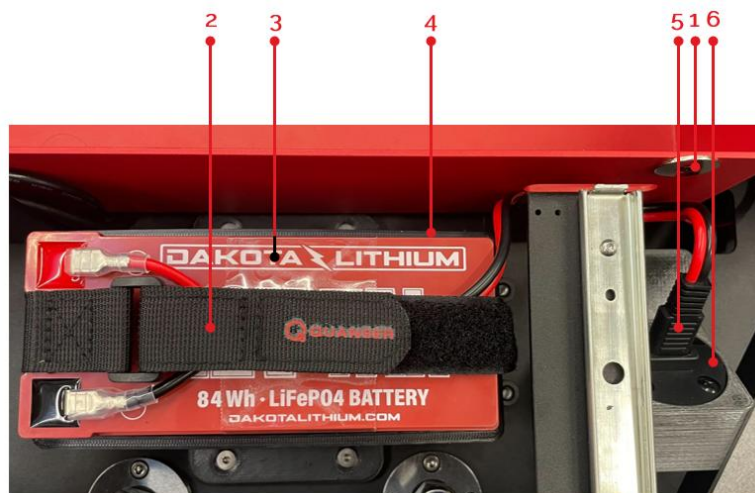

Figure 2. QBot Platform battery compartment with connectors

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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 4.

Figure 4. 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 5a. After a few seconds, the LCD will change to display the serial number and say '`qbp-XXXXX starting up...`' as shown in Figure 5b. 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/WiFi status as well the IP address that the robot is connected to, an example of which is shown in Figure 5c. 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 5. LCD startup and default messages

D. Turning OFF the QBot Platform

To turn OFF the QBot Platform, firmly but gently press on the sliver 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 6. 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 Lithium Iron Phosphate (LiFeP04) 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. Typically, the QBot Platform will select the lower of the two connected batteries provided that the battery is above **12.0 V** on startup. If the selected battery goes under **12.0 V**, it will switch to the second battery. The LCD message will update the BatteryX section correspondingly as shown in Figure 5c. However, if there is only one battery connected, the embedded computer will continue using the original battery and display a low battery warning (Figure 7a) until the battery voltage goes below **11.5 V** (see the next paragraph). However, if both battery voltages are below **12.0 V** a low battery warning message will appear (Figure 7b). You should save your work, shut down the robot, remove the batteries and begin recharging them.

LiFeP04 batteries can be damaged if discharged below a threshold voltage. To prevent damage to the battery and robot, the QBot Platform will shut down automatically if the battery voltages get below **11.5 V**, displaying the message shown in Figure 7c and flashing both the QBot Platform LEDs with red lights. It will first attempt a normal shutdown, but if it is unable to do so, it will disconnect the power after a short period.

a. Low battery warning message   b. Recharge Message   c. Automatic Shutdown

Figure 7. Low voltage protection and automatic shutdown

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