



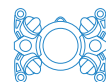
Power Pack (1600Wh).

For Boxfish vehicles



BOXFISH[®]
RESEARCH

Boxfish 1600Wh Power Pack



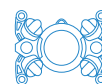


Table of Contents

1	Introduction	4
2	Power Pack battery safety information.....	5
2.1	Safety instructions for your Power Pack.....	5
2.2	Safety instructions for charging the ROV.....	5
3	1600Wh Power Pack components.....	6
3.1	800Wh Power Pack case.....	6
3.2	1600Wh Power Pack case	6
3.3	Charging devices.....	7
3.4	Spares.....	7
3.5	Next steps	7
4	How to transfer battery module from 800Wh Power Pack case to the 1600Wh Power Pack case.....	8
5	Overview of Power Pack components.....	10
6	How to charge Power Pack battery modules	11
6.1	Items required.....	11
6.2	Connection diagram.....	11
6.3	Connect cables to battery module and power up charger	11
6.4	Start charging the battery module.....	12
7	How to power the ROV Control Station with the Power Pack.....	13
7.1	Items required	13
7.2	Connection diagram.....	13
7.3	Connect cables and power up battery module.....	13
7.4	Using the Power Pack in wet conditions.....	14
7.5	Turn off the Power Pack.....	14
7.6	Charge Power Pack battery module to storage voltage.....	14
8	Charging the ROV with the Power Pack.....	15
8.1	Safety when charging the ROV battery pack	15
8.2	Charging the ROV with a Power Pack battery module.....	16
8.3	Rapid-charging the ROV using the 1200W Power Supply and 30A charger.....	19
9	Preparing Power Pack for long-term storage or shipping.....	21
9.1	Best voltage for storage and shipping.....	21
9.2	Prepare battery modules for storage.....	21



9.3	Prepare battery modules for shipping	22
10	General warnings and cautions	24
10.1	Battery module current ratings	24
10.2	Fuses	24
10.3	Do not connect battery modules together.....	24
10.4	Do not charge using external power output connector	24
11	Troubleshooting	25
12	Document history.....	26



1 Introduction

This manual covers all topics related to the use, care and safety of your Boxfish Power Pack, including:

1. **Preparing the Power Pack for use:**

- How to assemble the 1600Wh Power Pack upon receipt
- How to charge Power Pack so its battery modules are fully charged.

2. **Using the Power Pack as a power source in the field:**

- How to use the Power Pack as a power source for the ROV Control Station
- How to use the Power Pack to charge the ROV battery.

3. **Using the Power Pack as a high-speed charger for the ROV battery** (when AC power is available).

4. **Storing and shipping/travelling with your Power Pack:**

- How to prepare the battery modules for storage
- How to prepare the battery modules for surface travel.



2 Power Pack battery safety information



WARNING!

The Boxfish Power Pack uses Lithium Polymer (LiPo) batteries. Failure to follow the usage, charging and storage instructions in this manual could result in a fire or explosion which could cause injury, death or property loss.

If you have any questions or concerns about your Power Pack, contact us immediately: support@boxfish.nz or +64 9 600 1910.

2.1 Safety instructions for your Power Pack

A large amount of potential energy is stored in the Power Pack. Obey the following safe operating conditions for LiPo batteries at all times.

- Monitor the Power Pack during all charging procedures.
- Only use cables and charging equipment supplied by Boxfish.
- Do not drop, pierce, strike, stand on or subject the Power Pack to strong impacts or shocks.
- Protect the Power Pack from excessive heating or cooling.
- Do not allow water, moisture, metal wires or other conductive material to enter the Power Pack.
- Do not modify the Power Pack.
- Dispose of batteries in accordance with local regulations. We encourage customers to recycle batteries with an approved provider.
- Do not put LiPo batteries directly into household or business waste, as fires or explosions can be caused when charged batteries are crushed by the compacting equipment.

2.2 Safety instructions for charging the ROV

When using the Power Pack to charge the ROV, you must also comply with the safety instructions in [Section 8: Charging the ROV with the Power Pack](#).



3 1600Wh Power Pack components



The 1600Wh Power Pack consists of two separate cases:

- A smaller case containing one 800Wh battery module.
- A larger case containing one 800Wh battery module and space for another 800Wh battery module, a 1200W Power Supply and a 30A charging device.

3.1 800Wh Power Pack case

The smaller case with an 800Wh battery module inside can be used as a Power Pack its own (see separate manual). For maximum versatility in the field, we recommend transferring its battery module to the larger case so that both battery modules are in the same pack.

3.2 1600Wh Power Pack case

The larger case is shown below as it might appear after arrival.



1. 2x battery module compartments. Each compartment can contain an 800Wh battery module.
2. 1200W Power Supply
3. 30A battery charger.



3.3 Charging devices

The Power Supply and battery charger are attached to a removable tray that sits on top of the battery modules.



3.3.1 Cables

The following cables are included with the Power Pack:



1. AC power cable for Power Supply
2. XT90 to XT60 cable
3. 2x XT60 extension cables (one long and one short)
4. Control Station power cable (for powering Control Station from Power Pack external output)
5. Extension for balance cable USB connection. The balance cable in your ROV Accessory Box does not have a long enough connection to reach the USB port on the 30A charger, so this extension cable is required.

3.4 Spares

2x spare 30A fuses and 1x spare 10A fuse.

3.5 Next steps

1. **Transfer battery module from 800Wh Power Pack case:** See Section 4.
2. **Charge your battery modules to safe storage voltage:** The Power Pack will arrive after shipping with a relatively low voltage (around 15.0V) to satisfy safe shipping requirements. Please charge both battery modules to the storage voltage of 15.6V as soon as you receive your Power Pack. Instructions are in [Section 6: How to charge Power Pack battery modules](#).



4 How to transfer battery module from 800Wh Power Pack case to the 1600Wh Power Pack case

To transfer the battery module from the smaller case into the empty compartment in the bigger case:

1. Lift the charging tray out. Apply inward pressure to the metal handles on the sides of the tray and lift it up.



2. (If present) Take out the fasteners beside the aluminium clip (beside the empty compartment only) and store them in a safe place.



3. Press the aluminium clips towards the outside of the case and lift up the plate.



Press the clips outwards to remove the cover plate

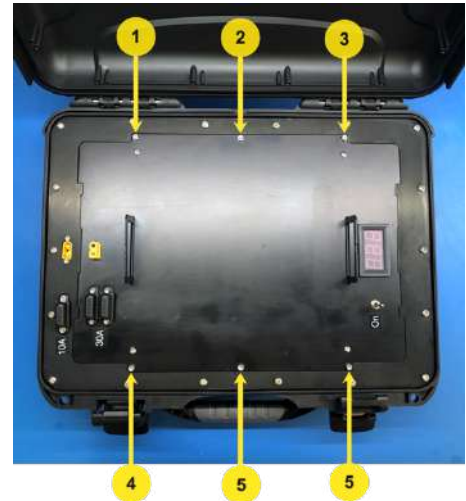


Remove the cover plate and keep it in a safe place

4. Store the metal tray in a safe place in case you need to ship the Power Pack in future.



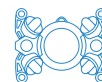
5. Open the 800Wh Power Pack case. Remove the six fasteners shown.



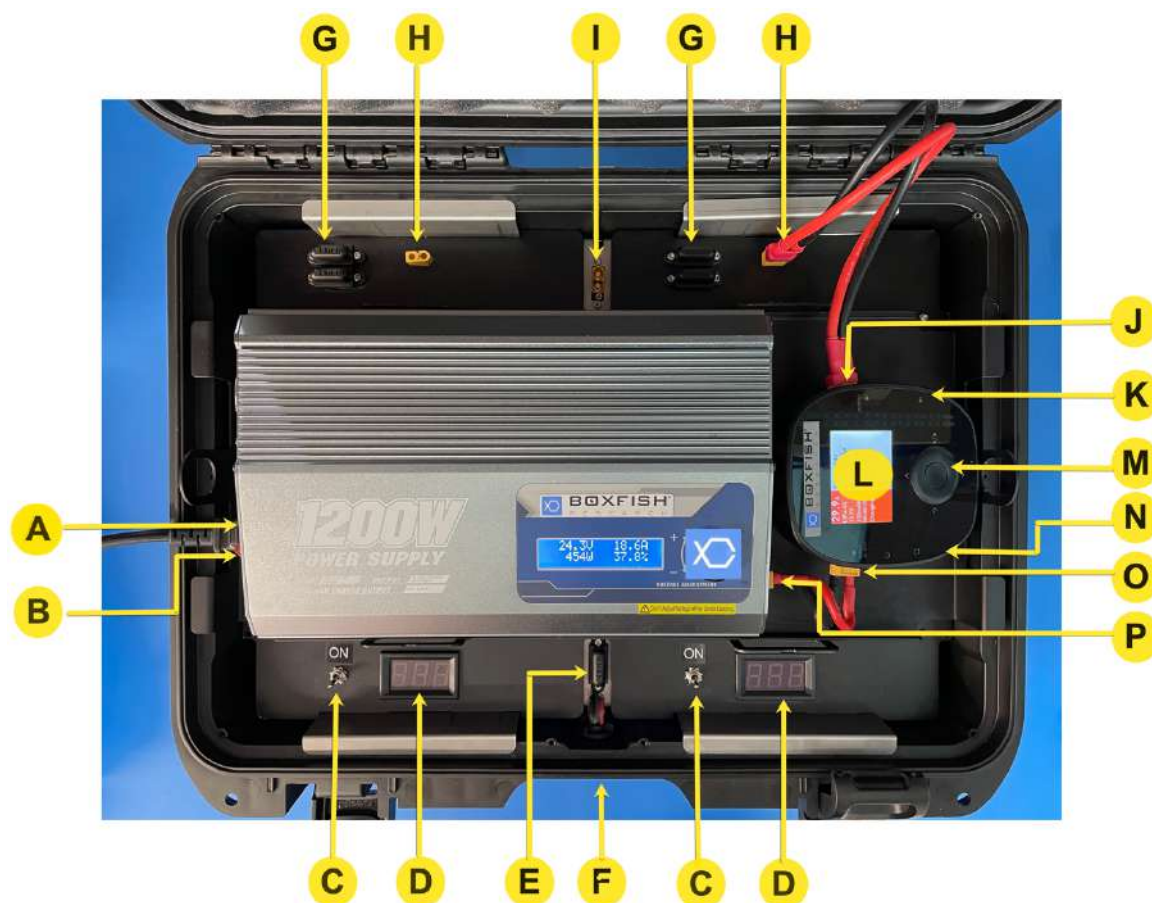
6. Lift the battery module out of the case: grip the two metal handles and lift upwards.



7. Insert the battery module from the 800Wh case into the empty compartment in the 1600Wh case. Note: you do not need to fasten it in place using the same six hex head screws used in the 800Wh case.
8. Replace the tray with the 1200W power supply and 30A charger into the Power Pack, and reattach any Velcro used to hold this in place over the battery modules.
9. Screw in the four fasteners beside the aluminium clips.



5 Overview of Power Pack components



- A. 1200W power supply AC input (100-240V AC, 60/60Hz)
- B. 1200W power supply on/off switch (red)
- C. Battery module on/off switch (one for each module)
- D. Battery module voltage display (one for each module)
- E. External power output fuse (10A)
- F. External power output connector (for powering Control Station)
- G. Battery module input/output fuses (2x 30A for each module)
- H. Battery module main power input/output (one for each module)
- I. External output jumper
- J. 30A charger output
- K. 30A charger cell balancing cable JST connector input
- L. 30A charger screen
- M. 30A charger selection button and dial
- N. 30A charger cell balancing cable USB connector input
- O. 30A charger input
- P. 1200W power supply output



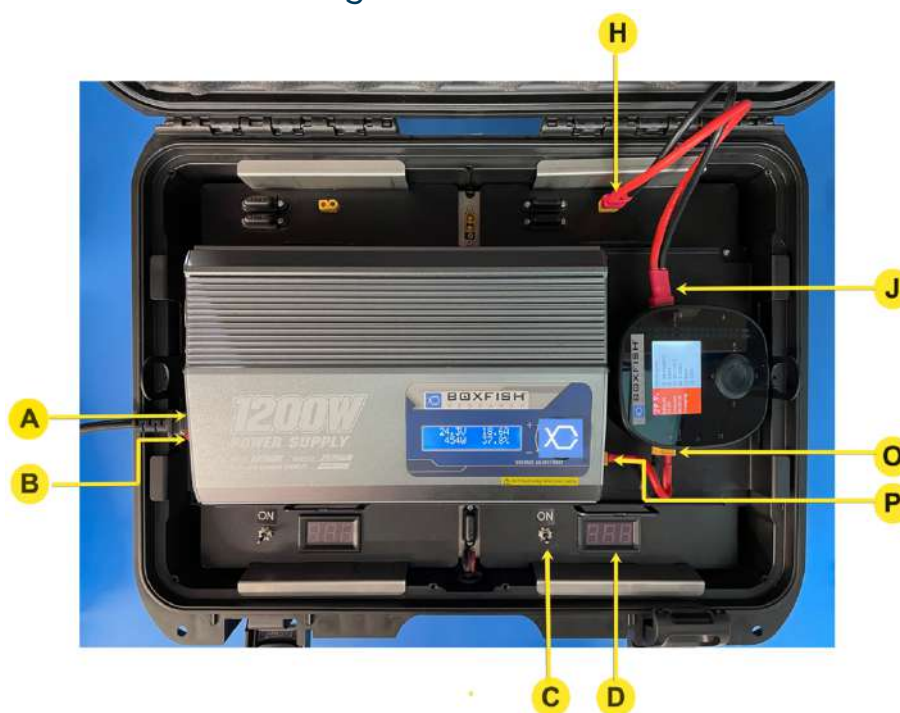
6 How to charge Power Pack battery modules

Before you can use the Power Pack, you will need to charge one or both of its 800Wh battery modules. One battery module can be charged at a time.

6.1 Items required

- AC power supply cable and external power source
- Charging tray with 1200W power supply and 30A DC charger
- One battery module
- XT60 to XT90 cable
- XT60 extension cable, long or short depending on which battery module you are charging.

6.2 Connection diagram



6.3 Connect cables to battery module and power up charger

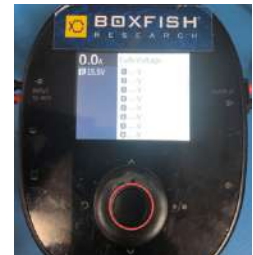
1. Connect the AC power cable to the input of the 1200W power supply (A) and your wall socket.
2. Connect the XT90 to XT60 cable to the 1200W power supply output (P) and the 30A charger input (O).
3. Connect the XT60 extension cable to the 30A charger output (J) and the battery module main input/output (H). Use the short cable for the battery module in the right compartment, and the longer cable for the left battery module.



- Switch on the 1200W power supply with the red button on the side (B). A menu of items will appear on the 30A charger screen (L).
- (Optional): Switch the battery module on/off switch (C) to ON, you will see the battery module voltage display (D) show the existing voltage of the battery module. It is not necessary to switch this on when charging.

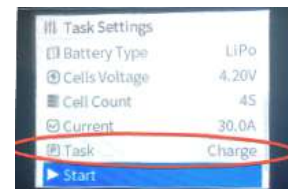
6.4 Start charging the battery module

- From the default screen, press the centre button to access the menu.



- Check settings on the charger:

- Battery Type:** LiPo
- Task:** Charge
- Cells Voltage:** 4.20V
- Cell Count:** 4S
- Current:** 30A



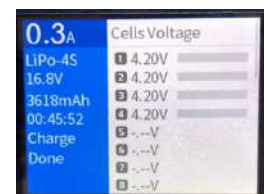
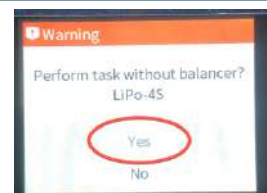
- Once you are happy with the settings, select 'Start'.



WARNING!

Battery Type and Cell Count must be set to EXACTLY the settings above, otherwise battery fire and/or explosion could occur.

- Confirm Yes (it is ok to charge the Power Pack without a balance cable because its battery modules contain an internal cell balancing mechanism).
- Wait until charging is complete. The screen will turn blue when each cell reaches 4.20V.



WARNING!

While charging battery modules, leave the lid of the Power Pack completely open to allow heat to dissipate.



7 How to power the ROV Control Station with the Power Pack

IMPORTANT! Use a fully-charged battery module to power the Control Station. Monitor the voltage of the battery module and return the ROV to the surface before it reaches 14.8V to avoid loss of power while the ROV is at depth.

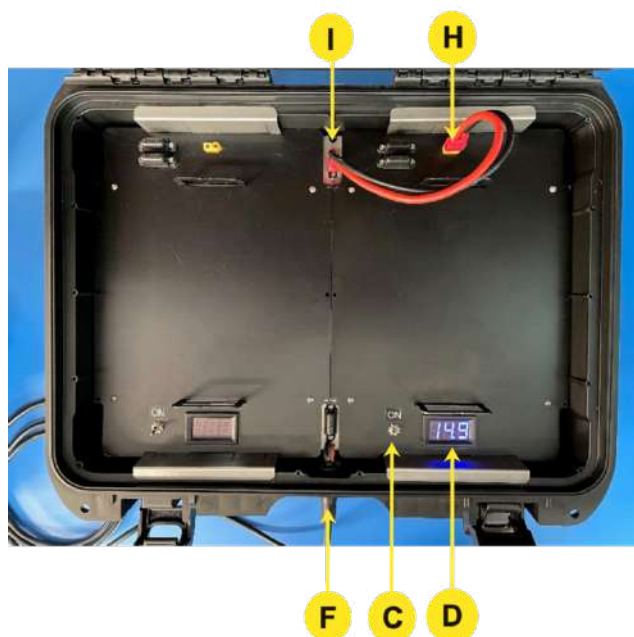
7.1 Items required

- One fully-charged battery module
- XT60 extension cable
- Control Station power cable.

7.2 Connection diagram

The picture below shows the Power Pack configured so that the right-hand battery module will power the Control Station.

Note: the top tray with the charging devices has been removed in this picture, but removing it is not necessary.



7.3 Connect cables and power up battery module

1. Use the XT60 extension cable to connect your one of the battery module input/outputs (H) to the external power output jumper (I).
2. Unscrew the blue cap of the external power output connector (F). This is located on the outside of the Power Pack, as shown below.



External power output connector

3. Connect the external output cable to the Power Pack. **Note:** you will need to line up the ridge on the cable with the notch on the connector. Screw in the collar to hold the connector in place.
4. Connect the other end of the cable to the 'POWER' input on the Control Station. Screw in the collar.
5. To power on the Control Station, turn the on/off switch on the Power Pack battery module (C) to ON. Check that the voltage display (D) displays the battery module's voltage.
6. Monitor remaining voltage of the battery module to ensure that the Control Station does not run out of power.

7.4 Using the Power Pack in wet conditions

IMPORTANT!

The Power Pack is not weather-proof when the lid is open, and it will be easily damaged by water ingress.

If conditions are wet, close the lid of the Power Pack to protect the battery modules from damage, or keep the Power Pack under a covered area.

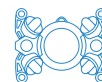
7.5 Turn off the Power Pack

After your dive, ensure the Power Pack is switched off.

1. Set all switches to Off.
2. Ensure both battery module voltage displays (C) have turned off.
3. Reattach the protective cap to the external output connector.
4. Close the lid.

7.6 Charge Power Pack battery module to storage voltage

As soon as possible after returning from your mission, charge the battery module to storage voltage again (See [Section 9: Preparing Power Pack for storage](#)).



8 Charging the ROV with the Power Pack

There are two ways to charge the ROV with the Power Pack:

1. With a full battery module (16.8V), or
2. With the 1200W Power Supply connected to an AC power source, to accomplish fast charging.

8.1 Safety when charging the ROV battery pack



WARNING!

The Boxfish battery pack contains Lithium Polymer (LiPo) batteries.

Failure to follow our charging instructions could result in fire or explosion which could cause injury, death or property loss.

8.1.1 Safe charging environment

Prepare the ROV and charging environment to ensure the safest possible conditions to charge your ROV.

- **Charge the ROV battery in an open and well-ventilated space.** This allows heat generated by the charging equipment to dissipate.
- **Remove all clutter from charging area, especially flammable or explosive substances:** Do not charge the ROV near material that may cause any fire or explosion to become worse.
- **Charge battery on a non-flammable surface:** Suitable surfaces are concrete, steel, ceramic or stone. Do not charge or discharge on flammable surfaces such as carpet, wooden tables, paper, plastic, vinyl, leather or wood.
- **Do not leave charging equipment unattended:** Stay with the Power Pack and ROV during charging so that you can react quickly and evacuate if necessary.

8.1.2 Safe condition of ROV battery pack

Ensure your ROV battery pack is safe to charge by following our safety and maintenance procedures:

- **Yearly check/maintenance:** Take out your battery pack and inspect for:
 - Silicone sealant – this should be in place on XT60 connectors to ensure they remain connected at all times.

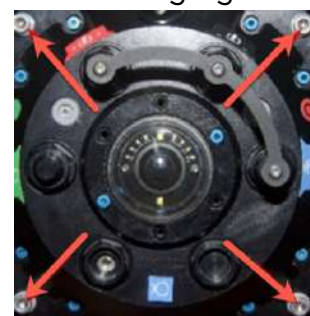


- Swollen/puffy battery cells: Do not use batteries if any sign of puffiness is present.
- Heat labels activated: If the labels have turned black, do not use your batteries.
- **Look out for any unusual behaviour of your ROV battery:** for example, significantly reduced dive times, as this indicates a problem. Contact us for advice.

8.1.3 Pre-charging checks

Complete the following checks and procedures before charging the ROV:

1. **Internal ROV temperature between 0-40C:** Briefly power the ROV on and connect it to the Control Station to check the Temperature value on the telemetry screen. Then power the ROV off in preparation for charging.
2. **Loosen rear bolts holding tray to ROV:** Loosen all four bolts shown, leaving the threads engaged by a few turns so the tray will be held in place. If any explosion occurs during battery charging, pressure should be released through the tray and not cause the dome to shatter.
3. **Check internal resistance:** Before every dive, ensure the internal resistance each of the battery pack cells are within our acceptable limit. See the **Boxfish Battery Charging Manual** for instructions:



<https://www.boxfish.nz/downloads/>

8.2 Charging the ROV with a Power Pack battery module

Note: Ensure the battery module is fully-charged (16.8V) before using it to charge the ROV battery.

1. Gather items required:
 - ROV
 - Charging tray with 1200W power supply and 30A charger
 - Power Pack with one fully-charged battery module
 - XT60 extension cable (long)
 - Charging cables, including the cell balancing cable, from your ROV accessories case (shown below). Attach the USB extension cable to the balancing cable so that the USB connection can reach the USB port on the 30A charger.

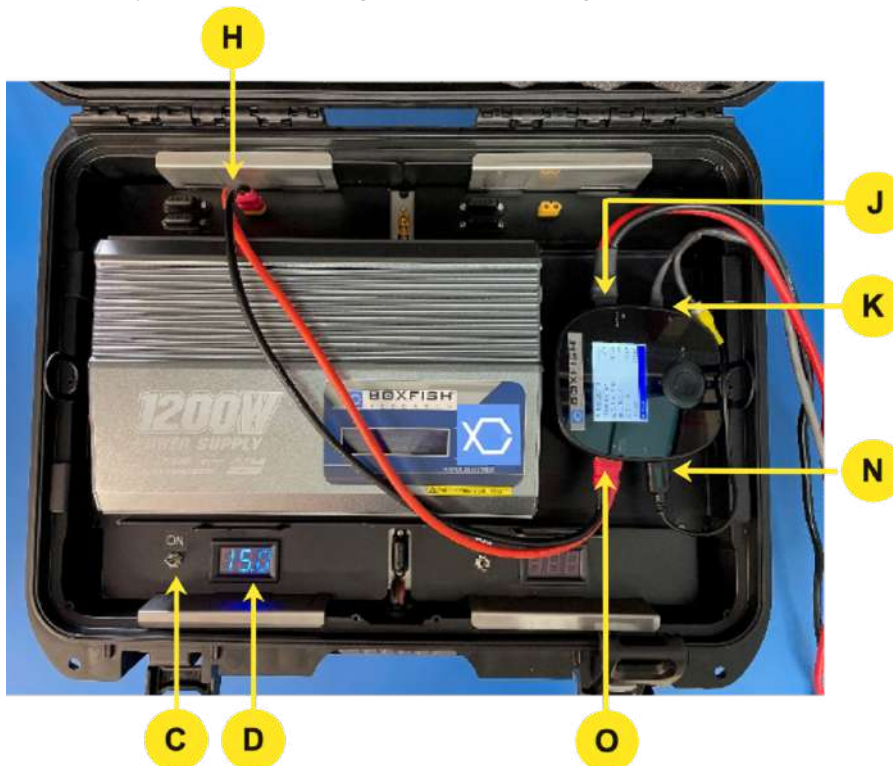


Boxfish ROV charging and cell balancing cables



USB connection extender for the cell balancing cable

2. Connect cables to Power Pack. The picture below shows the left-hand battery module being used to charge the ROV.

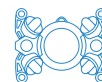


3. Using the longer XT60 extension cable, connect the battery module input/output connector (H) to the charger input (O).
4. Connect the cell balancing cable to the charger - both the white JST connector (K) and the USB connector (N).
5. Connect the ROV positive and negative charging cables to the charger output (J). **Note:** be sure to connect terminals with correct polarity.
6. Switch on the battery module (C) to supply power to the charger.

8.2.1 Connect battery charging cables to ROV

Next, connect the charge cables to the ROV.

1. Power off ROV and loosen four rear bolts in preparation for charging.
2. Remove the interconnected plugs from the three battery charging ports on the rear of the ROV. Keep the plugs in a safe place.



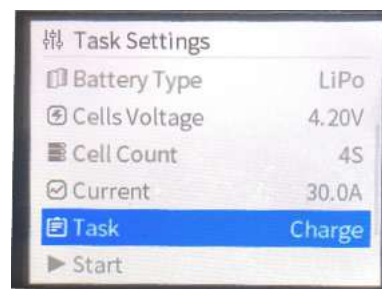
3. Connect the POSITIVE/RED/+ cable to the port labelled POSITIVE/RED/+ on the ROV.
4. Connect the NEGATIVE/BLACK/- cable to the port labelled NEGATIVE/BLACK/- on the ROV.
5. Connect the BLUE/BALANCING cable to the BLUE port. There are pins in this connector. To help you connect the cable, line up the notch on the balance port with the groove on the cable.



Boxfish ROV charge cables

8.2.2 Use charger to begin charging

1. Set the Task to **Charge**, and the Cell Voltage to **4.20V**.
2. Other settings should NOT be changed:
Battery type: LiPo
Cell count: 4S
Current setting: 30A.



WARNING!

Battery Type and Cell Count must be set to EXACTLY the settings above, otherwise battery fire and/or explosion could occur.

3. Select **Start** to begin charging.
4. If the charger displays a warning message saying “Charge without balancing” DO NOT proceed. Check that the balance cable is connected and contact us if the charger continues to display this message.
5. If you see any other warning messages on the charger, DO NOT CHARGE your battery pack. Contact us for assistance.



WARNING!

Leave the lid of the Power Pack completely open when charging the ROV battery to allow heat to dissipate.

6. While charging, the screen will display in orange colour.



7. When charging is complete, the screen will turn GREEN. However it is best to wait until the screen turns BLUE to ensure the cells are evenly balanced (4.20V each).

8.2.3 Disconnect cables and switch off battery module

1. Disconnect the charging cables from the ROV, and replace the cover for the three battery ports. Screw in the collars on each port to secure the cover in place.
2. Turn off the switch (C) on the battery module you used.
3. Disconnect charging cables from the charger.
4. Disconnect cables from the Power Pack.
5. Close the Power Pack lid.

8.2.4 Charge Power Pack battery module to storage voltage

As soon as possible after returning from your mission, charge the battery module to storage voltage again (See [Section 9: Preparing Power Pack for storage](#)).

8.3 Rapid-charging the ROV using the 1200W Power Supply and 30A charger

You can use the 1200W power supply and 30A charger in the Power Pack to rapidly charge to the ROV battery. **Note:** The power supply must be connected to AC power to use this feature.

This method of charging is about three times faster than using the 12A DC charger that is originally supplied with the ROV.

1. Gather items required:
 - AC cable and an external power supply
 - 1200W power supply and 30A DC charger
 - XT60 to XT90 cable
 - Boxfish ROV battery charging cables, including the cell balancing cable, from your ROV accessories case.



Boxfish ROV charging and cell balancing cables



USB connection extender for the cell balancing cable



- (Optional) remove charging tray from Power Pack. Note: if tray is not removed, leave Power Pack lid open when charging.
- Connect cables to 1200W power supply and charger.



- Connect 1200W power supply (A) to an AC power source.
 - Connect the XT90 to XT60 cable to the 1200W power supply output (P) and the charger input (O).
 - Connect the cell balancing cable to the charger - both the white JST connector (K) and the USB connector (N).
 - Connect the ROV positive and negative charging cables to the charger output (J). **Note:** be sure to connect terminals with correct polarity.
 - Switch the red 1200W power supply switch (B) ON to supply power to the charger.
- Connect battery charging cables to ROV: See [Section 8.2.1: Connect battery charging cables to ROV](#).
 - Use charger to begin charging: See [Section 8.2.2: Use charger to begin charging](#).



WARNING!

If you have not taken the charging tray out of the Power Pack, ensure the lid is left completely open when charging the ROV to allow heat to dissipate.

- When charging is complete, disconnect charge cables from ROV.
- Switch off Power Pack, disconnect cables and pack away.



9 Preparing Power Pack for long-term storage or shipping

9.1 Best voltage for storage and shipping

- **Storage:** If your Power Pack battery modules will not be used in the next 24 hours, prepare them for storage. LiPo batteries are safest and most stable at storage voltage of 3.90V per cell (15.6V per battery module).
- **Shipping:** The Power Packs are not designed to be transported by air. For surface transport each battery module should be at 15.0V during shipping. (And charged to storage voltage as soon as they reach their destination).

9.2 Prepare battery modules for storage

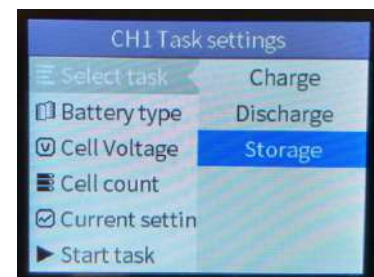
1. Prepare the items for charging and connect cables as you would when charging the battery modules (See diagram and instructions in [Section 6: How to charge Power Pack](#)).
2. Turn battery module voltage switch (C) to ON. The voltage of the battery module will appear in the display (D).
 1. Connect the charger to power.
 2. When the charger screen lights up, press the CH1 button to select Channel 1.
 3. Set the Task to **Storage**, and the Cell Voltage to **3.90V** (so that the total for four cells is 15.6V).

Other settings should not be changed:

Battery type: LiPo,

Cell count: 4S,

Current setting: 30A.



WARNING!

Battery Type and Cell Count must be set to EXACTLY the settings above, otherwise battery fire and/or explosion could occur.

4. Select **Start task** by pressing the selection dial down.
5. If you see a warning message saying “Charge without balancing” DO NOT proceed. Check that the balance cable is connected and contact us if the charger continues to display this message.
6. If you see any other warning messages on the charger, DO NOT CHARGE your batteries. Contact us for assistance.



WARNING!

If you have not taken the charging tray out of the Power Pack, ensure the lid is left completely open when charging the ROV to allow heat to dissipate.

7. Wait until the task is complete and all cells are at 3.90V.
8. Repeat for the second battery module.
9. Power down the charger.
10. Disconnect the cables from the charger and put store all charging equipment safely in your ROV Accessory Box.

9.3 Prepare battery modules for shipping

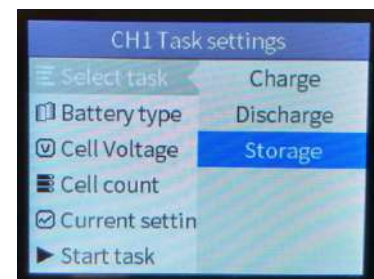
1. Prepare the items for charging and connect cables as you would when charging the battery modules (Section 6).
2. Turn battery module voltage switch (C) to ON. The voltage of the battery module will appear in the display (D).
3. Connect the charger to power.
4. When the charger screen lights up, press the CH1 button to select Channel 1.
5. Set the Task to **Storage**, and the Cell Voltage to **3.75V** (so that the total for four cells is 15.0V).

Other settings should not be changed:

Battery type: LiPo,

Cell count: 4S,

Current setting: 30A.



WARNING!

Battery Type and Cell Count must be set to **EXACTLY** the settings above, otherwise battery fire and/or explosion could occur.

6. Select **Start task** by pressing the selection dial down.
7. If you see a warning message saying “Charge without balancing” DO NOT proceed. Check that the balance cable is connected and contact us if the charger continues to display this message.
8. If you see any other warning messages on the charger, DO NOT CHARGE your batteries. Contact us for assistance.



WARNING!

If you have not taken the charging tray out of the Power Pack, ensure the lid is left completely open when charging the ROV to allow heat to dissipate.

9. Wait until the task is complete and all cells are at 3.75V.
10. Repeat for the second battery module.
11. Power down the charger.
12. Disconnect the cables from the charger and store Power Pack safely.



10 General warnings and cautions

10.1 Battery module current ratings

Each 800Wh Battery Module is rated for a sustained maximum charge or discharge current of:

- 40A through the battery module input/output connector (I)
- 6A discharge through the external power output connector (F).



WARNING!

Currents above the values stated above are outside of design parameters and may cause excessive heating and/or damage to the batteries and surrounding circuits.

10.2 Fuses

Fuse values have been chosen according to design parameters.



WARNING!

Do not use fuses larger than the prescribed values; doing so may damage the batteries and surrounding circuits in an over-current event.

10.3 Do not connect battery modules together



WARNING!

DO NOT connect battery modules together for any reason. They are separate devices and should be used separately.

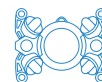
10.4 Do not charge using external power output connector

The Power Pack is not designed to be charged using the external power output connector (F).



11 Troubleshooting

Issue	Solution
No output voltage/console won't turn on	Ensure the switch is set to 'on' and the battery voltage meter is reading a reasonable voltage (15-16.8V). If they are, check the output fuses are present and intact, and connected cables are correct. If the switch is on but the meter does not show a reading, the battery module may have entered low-voltage cutoff. Charge the battery module before continued use.
Charger does not recognise there is a battery connected (when attempting to charge the battery module)	Ensure cabling is correct. Ensure fuses are present and intact.



12 Document history

Date / Release	Description of changes	Signed off by
R1 7/7/22	Latest release with updated Boxfish LiPo battery safety information, including specific instructions for charging Boxfish ROV battery packs.	Craig Anderson

Boxfish 1600Wh Power Pack





BOXFISH[®]

R E S E A R C H