

F-POD: Rechargeable Lithium Battery Holder

Safety:

Lithium-ion batteries are well known to carry a fire risk. The configuration and management of the F-POD lithium batteries avoids these risks and this guide sets out the principles for managing the F-POD rechargeable Lithium Battery Holder. When we refer to lithium packs we mean holders that have lithium cells installed. More technical details below.

Management:

A single person = the Battery Manager - should be given specific responsibility for managing the packs, the batteries and the battery recharging and monitoring.

Packs should, in general, not be exchanged at sea, as having lithium batteries outside the POD housing may violate ship safety constraints – insurance etc. and cells could be dropped etc. So F-PODs should be swapped at sea so that data downloading and battery recharging undertaken ashore. A careful decision might be made about carrying a spare pack in the water tight battery pack carrier and exchanging complete packs in a safe cabin.

The Batteries

The lithium cell market is constantly evolving with new models appearing frequently. We have used and tested the following cells which we can recommend and it's likely that other cells from the same manufacturers are reliable:

Samsung: 50E (now replaced by 58E model)

Samsung: 58E

LG: M58T

BAK: 65E

In the UK we have used www.cellsupply.co.uk

For example the Samsung 58E cells have enough power to run a F-POD R25 for over 9months. They deliver 5.9Ah but are rated fractionally lower than that, they deliver more when discharged slowly as in an F-POD, so we expect/hope the actual continuous running time to exceed 12 months. The Lithium Holder only takes 21700 cells 21mm (21.5mm maximum) diameter and 70mm long. Do not use 18650 cells, do not mix cells of different brands or with different histories of use. The Samsung 50E has a slightly lower capacity than the 58E but will run an F-POD R25 for 8months.

Chelonia cannot ship these batteries, so they must be procured by users. Each F-POD holder takes 25 cells and the LF-POD holder takes 10 cells.

These cells are flat top cells so it is essential to mark the positive end of each cell with permanent marker also a colour to identify the sets of cells used together – sets should be kept together.

This marking reduces the chance of putting in a cell the wrong way round and allows you to check the orientation of each cell in the pack – the lower two layers can be checked through the back of the pack. A wrongly inserted cell would significantly reduce the running time.

The Chargers

For chargers we've used these models which have worked well for us:

PowXS CDH0113 model R4



XTAR X4



LiitoKala Lii-S8



There are many chargers available. All cells in a pack must be fully charged before they are put back into the pack.

The PowXS R4 takes longer as it goes through more cycles to obtain a capacity reading for each cell.

The LiitoKala Lii-S8 is an efficient way to charge 8 cells at once.

The XTAR X4 charges at 1amp (about 6 hours for a full charge from flat) and shows the voltage and current delivered during charging of each cell - at the end of charging you can view the mAh value for each cell. This is the charge that has been put in during this charging session, and may be much less than the battery's capacity.

The lowest value for the 8 cells should be more than 75% of the highest. This shows that no individual cell has significantly deteriorated and they are being used evenly.

Cell Storage



Batteries can be stored in the F-POD provided that no SD card is present in the slot. Ideally, they should be above 1/3 charged. If stored outside the F-POD or Lithium carrier then a waterproof box is recommended as shown here.

The Lithium Battery Holder

- Has built in diode protection to prevent reverse current flow through a stack in which a cell is the wrong way round.
- Has built in fuses on each stack to avoid the risk of cells overheating if the stacks were shorted.
- Recessed contact points at the outer end so that the voltage can be measured.
- Two black thumbscrews at the outer end that are unscrewed to allow cells to be taken out or put in. The thumbscrews are then screwed up fully.
- All cells face the same way, which is marked on the ends of the pack.
- The power cable is fitted when the pack is nearly fully inserted into the F-POD housing, and the connector can then be fully inserted into the socket in the battery pack.

Loading the holder:

The thumbscrews should be out like this:



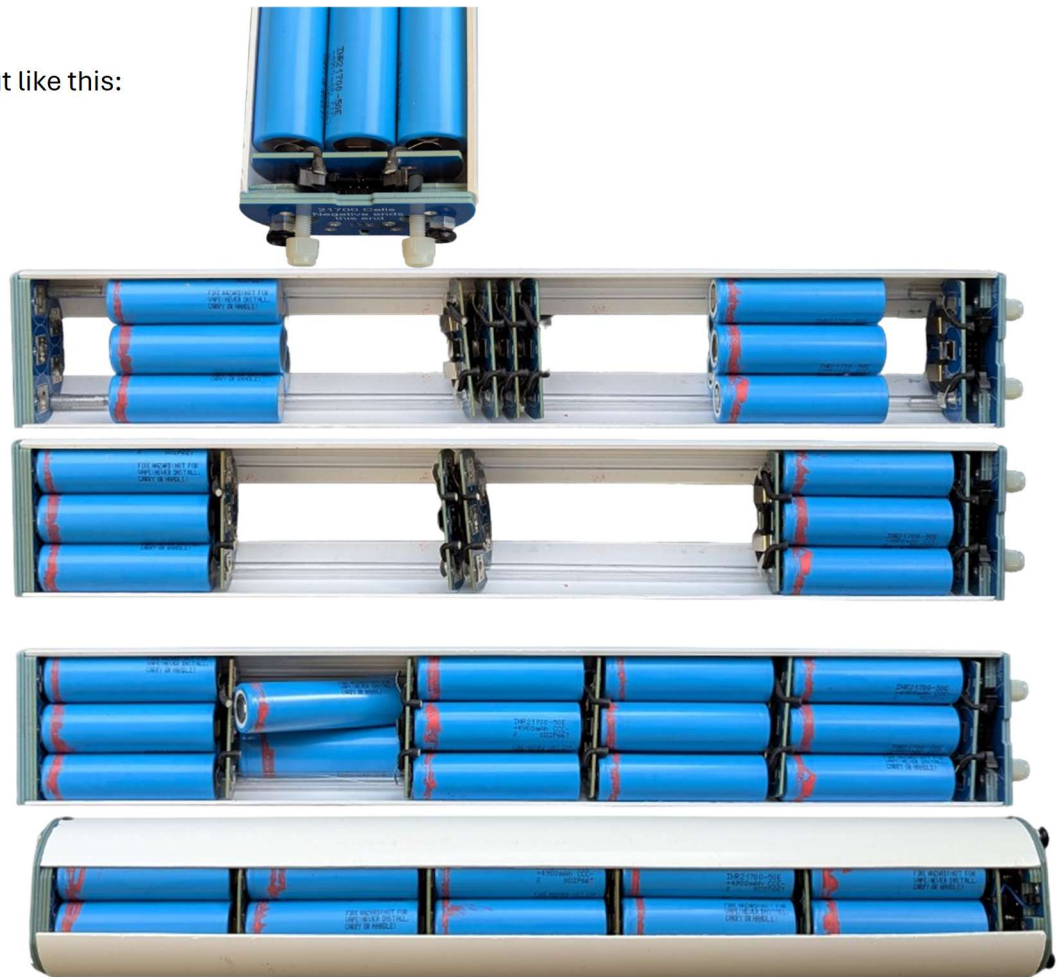
+ve
positive

-ve
negative

Put the 5 batteries in each end – slide them out towards the end.

Add this set last, putting the negative end in first

Check the back to ensure all cells are the right way round!!



Screw the thumbscrews in fully – a flat blade screwdriver is useful.



Unloading the pack:

Unscrew the thumbscrews.

Push from behind the middle set of cells to get them out and the rest will fall out.

Keep the cells from one POD together.

Installing and removing the pack:

<https://www.chelonia.co.uk/wp-content/uploads/2025/01/Lithium-FPOD-installing-the-battery-pack.mp4>

<https://www.chelonia.co.uk/wp-content/uploads/2025/01/Lithium-FPOD-removing-the-battery-pack.mp4>

Running time:

The Lithium Pack will give 16 months when logging alternate minutes (adequate for most projects) and half that when running continuously, so servicing trips can be fewer. This depends on having 5Ah cells, as below.

Pelican case as a carrier

These robust waterproof cases are very suitable for taking loaded battery packs to sea to replace the drained pack e.g.



Peli iM2306 Storm Case suitable for transporting 6x R25 fully loaded battery holders



Peli 1150 Case suitable for transporting 4x R10 fully loaded battery holders



The Vault 550C Equipment Case plus suitable foam sheets to cushion the battery packs is also a good option and will take 16x R25 fully loaded battery holders.

F-POD settings

F-POD housings that take the Lithium Pack cannot take any other battery pack.

These F-PODs are given the appropriate settings for these cells. These force the POD to stop logging when the battery voltage falls to some way above their acceptable minimum.

The Battery Manager does these things:

- Procures appropriate 21700 cells.
- Note their initial voltage when placed in the charger and the mAh recorded when fully charged – these should all be above 75% of the highest, confirming that these are original cells in good condition.
- Mark all cells in a 25-cell set with coloured tape at the positive end to reduce the chance of putting one in the wrong way round and make it easy to check on this.
- Load the battery pack
- Check all cells in both layers are the right way round
- Check the voltage on the contact points
- Put the pack in the F-POD

Recharging: Note the mAh taken by each cell to confirm uniformity across the set. The lowest value should be >75% of the highest value. This confirms all cells are good.

- Store any cells in a suitable storage box or spare Lithium Pack

Technical information

The larger pack with 5x5 Samsung 50E cells nominally delivers 375Wh, and the 2x5 delivers 150Wh. The discharge rate is very low, below the level used for those power ratings, and the internal resistance of these cells rises with the current delivered, so the actual power delivered to these instruments will be higher than these nominal figures. Actual running times achieved will be added to this document when available.

The risks arise when batteries are being charged in series or at excessive currents or voltages, or discharged too fast, or are punctured or crushed.

These risks are avoided in the F-POD by in the very robust waterproof housing of the F-POD (or the structurally similar battery pack carrier) and by these features:

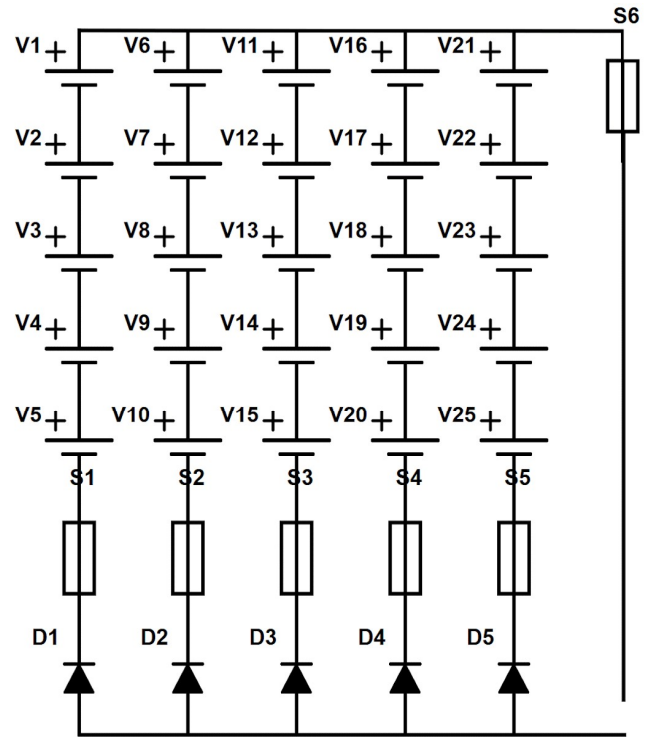
Samsung 50E cells are not protected by an internal circuit. So in this pack each stack is protected against insertion of cells the wrong way round by diodes.

Resettable fuses protect each stack and a non-resettable fuse protects the whole pack.

Individual cell charging means that any damaged or deteriorating cell can be identified as soon as it deviates from the rest.

Over-discharge is prevented by the F-POD which monitors the voltage every minute and shuts down the F-POD when the voltage is still within the manufacturer's specified range.

The voltage record stored in each POD file allows the performance of the pack to be seen for each deployment.



Batteries V1..V25 Lithium 21700
Fuses S1..S5 200mA resettable
Fuse S6 5A