



Guide to LiFePO4 Battery

LiFePO4 batteries (Lithium Iron Phosphate) have several advantages over LiPo (Lithium Polymer) batteries. Most importantly, LiFePO4 batteries are much safer. LiFePO4 batteries also have a much longer cycle and calendar life, and consist of iron and phosphate which have a much lower environmental impact than the cobalt used in LiPo batteries. It is **important** to have a good understanding of the operating characteristics of LiFePO4 batteries – most importantly, how to charge and care for them safely. Always read the specifications printed on the battery’s label and in this instruction sheet in their entirety prior to use. Failure to follow these instructions can quickly result in severe, permanent damage to the battery and its surroundings!

Warning

LiFePO₄ batteries are **ENTIRELY DIFFERENT** from NiCd, NiMH, and LiPo batteries and must be handled differently!! Hyperion will not be held responsible for any and all incidental damages and bodily harm that may result from improper use of Hyperion brand LiFePO₄ batteries. In purchasing these products, the buyer/user agrees to bear all responsibilities of these risks and not hold Hyperion and/or its distributors (owners and employees) responsible for any accidents, injury to persons, or property damage. If you do not agree with these conditions, please return the battery to the place of purchase.

Before and after every use of your LiFePO₄ battery, inspect the pack carefully to ensure no physical damage is evident, such as swelling, splitting or torn outer heat shrink wrapper, or loose plugs and wires. Such signs can often indicate a problem exists with the battery that could lead to failure.

Life Battery Ratings

LiFePO₄ battery packs are identified by the pack voltage and capacity. A 6.6V 1100mAh LiFePO₄ battery has a *NOMINAL* voltage of 6.6 volts and a storage capacity of 1100 milliamp hours, or 1.1 amp-hours.

LiFePO₄ packs are made up of individual cells that are connected together in *SERIES*. Connecting cells in series adds the voltage of all cells to result in a total pack voltage. A 6.6V 1100mAh pack is made up of two 3.3V 1100mAh LiFePO₄ cells ($2 \times 3.3V = 6.6V$). This is referred to as a "2S" pack, meaning two cells in series. Each LiFePO₄ cell has a *NOMINAL* voltage of 3.3V. A fully charged LiFePO₄ cell is 3.6V, and a fully depleted LiFePO₄ cell is 2.5V. Most LiFePO₄ chargers and balancing equipment are based using a battery's nominal voltage rating as a parameter.

Battery capacity is measured in mAh (milliamp-hours), being the amount of current that the battery can deliver over a certain time period. The larger the capacity, the longer the run or operating time (assuming the load current doesn't change).

A battery's "C" rating indicates the maximum current the battery can deliver at any given moment, as well as the maximum charge rate for the battery. The "C" value is simply a multiplier of the amp-hour capacity rating of the battery. An 1100mAh LiFePO₄ battery has a 1C value of 1.1. An 1800mAh LiFePO₄ battery has a 1C value of 1.8, and so on. LiFePO₄ batteries are also rated by their maximum discharge capability using the C value. A battery rated as 10C can deliver a maximum current of 10 times the C value of the battery. As an example, an 1100mAh battery with a 10C discharge rating can deliver a maximum current of 11A ($10 \times C = 10 \times 1.1 = 11A$).

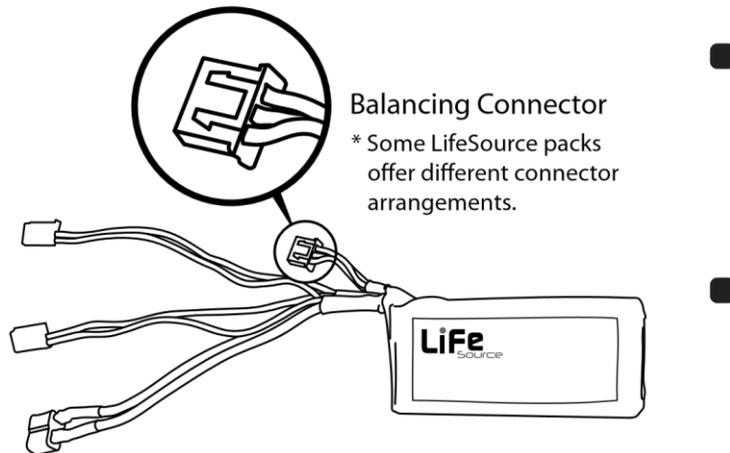
Choosing the Right LiFePO4 battery for your application.

Evaluate your application to determine the "average" discharge amperage rate needed for operation. Choose a LiFePO4 battery which can easily handle the current needs of the application. The current draw of the application can be measured using a multi-meter or meters made specifically for the radio-controlled hobby. When measuring the current, servos should be in operation when a reading is made. Actual current draw will be greater in flight due to increased load on the servos (an on-board data logger can provide accurate servo current draw). Desired flight time and battery weight should also be considering when selecting a battery.

Charging a LifePo4 battery

A LiFePO4 compatible charger which can apply the "constant current/constant voltage" charge technique (cc/cv), such as the LiFePO4Source AC/DC Charger (HCAM6375), ElectriFly™ Triton™ EQ (GPMM3155), and ElectriFly Triton2™ EQ (GPMM3156), is required for charging LiFePO4 batteries. All of these chargers have built in cell balancers.

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1. Always observe the correct polarity when connecting the battery to the to the charger and refer to the instructions that came with the charger. For LiFePO4Source batteries having a balancing connector, attach this lead to the balancing port on the charger.
2. Set the charger's output voltage to match the nominal rated voltage of the entire LiFePO4 battery pack. **NEVER** set the charger to a voltage which is greater than the nominal voltage rating of the LiFePO4 pack or allow LiFePO4 cells to charge to greater than 3.6V per cell at any time!! Overcharging

usually will result in a permanent, catastrophic failure in the LiFePO₄ cells. This can result in permanent damage to the battery and its surroundings, and cause personal injury!

3. Set the charger's output current to NO GREATER than a "3C" rating of the battery. Using a "1C" rate will help to maximize the LiFePO₄ span of the LiFePO₄ battery. See the section on ratings on page 1 for details.
4. Start the charge process

Important Warnings

Be sure to READ and FOLLOW these important warning statements regarding the charging of LiFePO₄ batteries:

- **NEVER** charge LiFePO₄ batteries with a charger not specifically compatible with LiFePO₄ batteries! ONLY use a charger which can apply the "constant current / constant voltage" (cc/cv) charge technique with LiFePO₄ voltage settings. Although a LiPo charger also applies this charge technique, the charger **MUST** be LiFePO₄ compatible. **DO NOT** attempt to charge your LiFePO₄ battery on a LiPo-only charger.
- Always charge Life batteries in an area with adequate ventilation.
- Never charge Life batteries at currents greater than the "3C" rating of the battery ("C" equals the rated capacity of the battery).
- **NEVER** allow the temperature of LiFePO₄ batteries to exceed 140°F [60°C] at any time. Overheating will cause permanent damage. Do not reuse your LiFePO₄ battery if you suspect it has been damaged in any way.
- **ALWAYS** discontinue charging a LiFePO₄ immediately if at any time you witness smoke or see the battery starting to swell. This may cause the battery to rupture and/or leak, and the reaction with air may cause the chemicals to ignite, resulting in fire. Disconnect the battery and leave it in a safe, fireproof location (ideally outside).
- **NEVER** continue to charge LiFePO₄ batteries if the charger fails to recognize full charge. Overheating or swelling of the LiFePO₄ cells is an indication that a problem exists. The batteries should be disconnected from the charger immediately and placed in a fireproof location!!

Connecting and Using LifePo4 batteries

- A voltage regulator might be required to step the Life battery voltage down to an acceptable level when used with some receivers. Check with your radio manufacturer for details. Some servos have a maximum input voltage of 4.8V or 6.0V.

- Three discharge leads are provided on some LiFePO₄ Source packs. Two are equipped with Universal Rx connectors and the other is a Deans® Ultra Plug®. Dual Universal Rx plugs are provided for models having redundant radio systems. The Deans Ultra Plug is provided for applications drawing more than 10A. No more than 5A should be carried through either Universal Rx plug.
- The voltage of each LiFePO₄ cell in the battery pack should not be drawn below 2.5V. Drawing the voltage below this can cause permanent damage to the pack or make the battery non-recognizable by the charger. A 2-cell LiFePO₄ battery with a nominal voltage of 6.6V should not be discharged below 5.0V.
- NEVER discharge LiFePO₄ batteries at currents which exceed the discharge current rating of the battery, as this can often cause a cell to overheat. Do not allow a LiFePO₄ cell to exceed 140°F [60°C] during discharge.

DEALING WITH BATTERIES INVOLVED IN A CRASH

After a crash, remove the LiFePO₄ battery from the model but **DO NOT** immediately place it in a model, pocket, or full size automobile. Instead, inspect it thoroughly by checking for cracks in the casing, loose plugs and wires, or any other physical damage. If any physical damage is noticeable, place the battery in a fireproof location and observe it for safety concerns. If no physical damage is apparent, it should not be assumed that no internal damage has occurred as LiFePO₄ batteries can have a delayed chemical reaction. While they may appear to be safe immediately after removing them from the crash, they can suddenly begin to smolder, emit smoke, and generate heat even an hour or more after a crash. For this reason, all LiFePO₄ batteries involved in a crash should be placed in a fireproof location and observed for at least 24 hours before they are reused or disposed.

OVERHEATED PACKS

When handling LiFePO₄ Batteries, it is recommended to have a class "D" type fire extinguisher available. At a minimum, a medium size (2 gallon) metal bucket filled with sand will work. A scoop for the sand and fireproof gloves are also recommended. In the event that a LiFePO₄ battery begins to smoke, immediately bury the battery in your bucket of sand or use the fire extinguisher. If **SAFELY** possible, move the battery outdoors. If the battery cannot be taken outside, evacuate the building and open all doors to clear the fumes. If needed, call the fire department. Avoid breathing the fumes. **TIP:** Keep a large zip lock bag filled sand in your pit box. This is handy for when you travel to events. If a battery fails, simply throw the bag onto the battery. As the plastic melts, it will cover the pack with sand.

Handling storage & Transportation

- **ALWAYS** store LiFePO₄ cells/packs in a fireproof container and place in a secure location away from children.
- **NEVER** leave a LiFePO₄ battery unattended at ANY TIME while being charged or discharged!!!
- **NEVER** put a LiFePO₄ pack in the pocket of any clothing!
- **ALWAYS** have a lithium-approved "Class D type" fire extinguisher or a bucket of sand available at all times.
- **NEVER** allow LiFePO₄ batteries to come in contact with water or moisture at any time. If batteries do come in contact with water or moisture, immediately dry them with a clean towel. **NEVER** store batteries near an open flame or heater.

In Short follow these simple steps when handling lithium batteries

Before you use or charge any lithium battery you must read the [Lithium Battery Safety Instructions and Warnings document](#).

- 1. Do not charge or use batteries if the battery ...**
 - A. is punctured or damaged**
 - B. is bloated, expanded, swelling or otherwise deformed**
 - C. Has any cell with a voltage of 3.3v. This means less than 9.9v for a 3-cell/11.1v battery.**
- 2. Do not charge batteries unattended. Monitor batteries during charging for popping, hissing, smoke, sparks or fire. Also monitor the battery for any swelling or other deformities. Disconnect the battery from your charger immediately.**
- 3. Do not charge batteries near flammable material. Charge batteries in a fireproof container. Do not charge batteries while they are in your robot.**