



# LITHIUM-POLYMER BATTERY INSTRUCTIONS



**IMPORTANT!! Failure to read and obey all instructions contained herein can result in battery failure and possibly a FIRE which could result in quick, severe, permanent damage to the battery and its surroundings!!**

Great care must be observed when handling lithium-polymer (LiPo) batteries. Misuse, overcharging, and other conditions could cause a LiPo battery to swell, overheat, emit smoke, or rupture violently and catch fire. This product is intended for use with radio controlled models only. As the full scope of possible R/C hobby applications is too large to cover every possible use in these instructions, the user assumes the responsibility to make smart and safe decisions about the use of this product.



- **NEVER LEAVE LITHIUM BATTERIES UNATTENDED WHILE BEING CHARGED OR DISCHARGED!**
- **NEVER** use an incompatible charger to charge a LiPo battery.
- **NEVER** charge a LiPo cell to over 4.20V.
- **NEVER** charge a LiPo at a rate exceeding its maximum charge current rating.
- **NEVER** discharge a LiPo cell below 3.0V.
- **NEVER** discharge a LiPo at a rate exceeding its maximum discharge current rating.
- **NEVER** allow the battery's temperature to exceed 140°F (60°C).
- **NEVER** store batteries near an open flame or heater.
- **NEVER** disassemble or modify a LiPo battery.
- **NEVER** put a LiPo battery in the pocket of any clothing.
- **NEVER** allow LiPo cells to become damaged physically.
- **NEVER** short circuit individual LiPo cells or assembled packs.
- **NEVER** allow LiPos to come in contact with moisture or water.
- **ALWAYS** charge the battery in a fireproof setting with good ventilation.
- **ALWAYS** keep out of reach of children.
- **ALWAYS** check batteries for signs of physical damage before use.
- **ALWAYS** follow recommended battery disposal instructions.

## GLOSSARY OF TERMS

**CELL:** a single battery unit within an assembled pack.

**PACK:** multiple cells connected together electronically form a "pack".

**VOLTAGE:** a battery's maximum electric potential, with individual LiPo cells nominally rated at 3.7V and 4.20V at full charge.

**CAPACITY:** amount of energy a battery can store. Typically listed as "mAh" (milliamp-hours), the higher the rated capacity the longer the run time.

**C VALUE:** "C" equals the cell's capacity in Amps. For example, if you have a 2200mAh (2.2Amp hour) pack, C would equal 2.2amps. When a number is put in front, it means to multiply. Therefore, 2C would equal 4.4A, 4C would be 8.8amps, 1C would be 2.2A, etc.

**PACK C-RATING:** A factory spec used to indicate "theoretical" max burst current of the cell. **NOTE:** C-Rate values do not take into consideration any limitations associated with wires, connectors, or other components used in the assembly.

## GENERAL CARE AND HANDLING OF LIPO BATTERIES



- **NEVER** allow a LiPo battery's temperature to exceed 140°F (60°C) while being charged or discharged, or in the ambient environment such as in hot vehicles, rooms, etc. Keep LiPo batteries away from open flames and heaters. Wear protective gloves when moving a heated battery.
- **NEVER** use a LiPo battery which has previously overheated, suffered physical damage such as a puncture, severe dent, or tear in a cell's outer foil. See the Disposal of LiPo Batteries section for proper disposal instructions.
- **ALWAYS** keep combustible/flammable items away from LiPo batteries while being charged or discharged, such as paper products, flammable liquids and gases, cluttered workbenches. Remove the LiPo battery from the R/C model for charging. Do not charge on counter-tops, tables, carpets, furniture, inside cabinets, over or under flammable items.
- **ALWAYS** provide adequate ventilation around LiPo batteries while being charged or discharged.
- **ALWAYS** remove metallic objects such as wristwatches, bracelets, or rings from the hands and wrists when handling LiPo battery packs. Accidentally touching battery terminals to any such objects could create a short-circuit condition and possibly cause severe personal injury.
- For proper long-term storage of a LiPo battery, charge or discharge it as needed so that each cell measures between 3.6–3.8V. Store in a cool (40-80°F), dry place away from sunlight and inside a fireproof container.
- Do not expose battery packs to direct sunlight for extended periods of time, or place in direct contact with any liquids. If batteries come in contact with water, immediately dry the battery with a clean towel.
- Transport LiPo batteries in a fireproof container. **NEVER** leave batteries lying loosely anywhere inside a vehicle, or in a vehicle indefinitely as temperatures inside the vehicle can easily rise far in excess of 120°F which could damage the battery.
- **ALWAYS** make sure all LiPo connectors are covered to prevent an accidental short. Small sections of fuel tubing make good insulators.

## IN CASE OF FIRE



LiPo batteries contain flammable electrolyte that may vent, ignite and produce sparks when subjected to high temperature (>150°C, 302°F). Only “Class D” fire extinguishers are designed to effectively put out a combustible metal fire as can occur with a LiPo battery. Look for extinguishers with the yellow D-star logo as shown here. Other common extinguisher types such as Halon or ABC could *worsen* the fire by spreading it or not extinguishing it, and should not be used. Dry sand or soil can also be used to smother a LiPo fire.

## CHARGING LIPO BATTERIES



**WARNING!!** Failure to follow any of these warnings could result in internal damage and/or catastrophic failure of the battery and its surroundings in the form of FIRE.

- **NEVER** use an incompatible charger to charge LiPo batteries. Only use a LiPo cell balancing charger or cell balancer to charge a LiPo. Make sure the charger can balance every cell in the battery. Read the charger’s specifications and features list to ensure its compatibility. If unsure, contact the charger’s manufacturer for confirmation. NEVER use a charger designed for NiCd, NiMH, or any other battery type to charge a LiPo battery!
- **NEVER** charge a LiPo cell to more than 4.20V. Maximum total pack voltage should never exceed 4.20V x the total number of cells in the pack. Always set the charger’s output voltage to match the nominal rated voltage of the battery. Manually stop the charge process immediately if the charger fails to recognize full charge.
- **NEVER** charge a LiPo cell at a current which exceeds the maximum charge rating shown on the battery’s label.
- **NEVER** apply a trickle charge to a LiPo battery.
- **NEVER** allow a LiPo to continue charging if the battery begins to swell or emit smoke. This is an indication of an internal failure inside the pack and FIRE could soon result. Stop the charge process immediately and leave the battery sit idle in its fireproof location for at least 1 hour. Batteries exhibiting these behaviors are permanently damaged and should never be used again. See the Disposal of LiPo Batteries section for details.
- **NEVER** charge a LiPo battery that was previously discharged below 2.50V. See the Disposal of LiPo Batteries section for details.
- **ALWAYS** charge a LiPo in a fireproof location such as inside a steel can, ceramic pot, LiPo safe fire bag such as the Electrify SafeCharge LiPo Charge Bag (mfg #GPMP0751, compatible with LiPo batteries rated at 11.1V 3200mAh or smaller), or outdoors on a concrete walkway or driveway.

**1. RE-READ ALL WARNING NOTICES ABOVE BEFORE PROCEEDING.**

2. Place the battery in the fireproof location, and select the appropriate LiPo compatible charger with settings that match that of the battery to be charged.

3. Set the charger’s output voltage to EXACTLY MATCH the voltage rating shown on the battery’s label.

4. Set the charger’s current level (amps or milli-amps) to not exceed the maximum rated charge current level shown on the battery’s label. Charging the battery at 1C is recommended. Determine a

battery’s 1C current level by dividing the rated capacity (mAh) shown on the label by 1000. The table below lists 1C charge current levels for many common battery sizes.

Battery	Nominal Voltage	* Maximum Charge Voltage
1S	3.7V	4.2V
2S	7.4V	8.4V
3S	11.1V	12.6V
4S	14.8V	16.8V
5S	18.5V	21.0V
6S	22.2V	25.2V
7S	25.9V	29.4V

\* Based on 4.20V per cell

Rated Capacity	1C Charge Current	Rated Capacity	1C Charge Current	Rated Capacity	1C Charge Current
125 mAh	0.1 amps	1300 mAh	1.3 amps	3200 mAh	3.2 amps
250 mAh	0.25 amps	1600 mAh	1.6 amps	3600 mAh	3.6 amps
350 mAh	0.35 amps	1800 mAh	1.8 amps	3800 mAh	3.8 amps
450 mAh	0.45 amps	2200 mAh	2.2 amps	4000 mAh	4.0 amps
600 mAh	0.6 amps	2500 mAh	2.5 amps	4200 mAh	4.2 amps
800 mAh	0.8 amps	2700 mAh	2.7 amps	5000 mAh	5.0 amps
1000 mAh	1.0 amps	3000 mAh	3.0 amps	5500 mAh	5.5 amps

5. Some chargers might require the battery’s rated capacity be set instead of or in addition to, setting the charge current level. Set the charger’s capacity level to match that shown on the battery’s label. Make sure the charger doesn’t automatically set a current level which exceeds the maximum charge rating shown on the battery’s label. See the charger’s instructions for details.

6. Some chargers include a battery temperature monitoring function which can automatically stop the charge process if a battery exceeds a specified temperature. It’s recommended to use a temperature monitoring system and set the charger’s maximum temperature to 115°F (46°C). See the charger’s instructions for details.

7. ALWAYS make sure the charge adapter cable is connected to the charger BEFORE connecting the battery to the cable. Only after this is confirmed, connect the battery’s main connector to the charge adapter. Failure to do so could result in the adapter’s leads shorting and causing a fire.

8. For batteries having a balancing plug, ALWAYS attach the balancing plug to the charger’s balancing connection as described in the charger’s instructions.

9. Start the charge process. **NEVER LEAVE THE ROOM WHERE THE BATTERY AND CHARGER ARE LOCATED UNTIL THE CHARGE PROCESS HAS COMPLETED!**

## DISCHARGING LIPO BATTERIES



**WARNING!!** Failure to follow any of these warnings could result in internal damage and/or catastrophic failure of the battery and its surroundings in the form of FIRE.

- **NEVER** discharge at currents which exceed the maximum discharge current rating as shown on the battery’s label.
- **NEVER** discharge a LiPo cell to less than 3.00V per cell. However, for optimum performance it’s recommended to not discharge a LiPo cell below 3.2V per cell. Minimum total

pack voltage should never be less than the total number of cells in the pack multiplied by 3.00V. Check the instructions included with battery dischargers and electronic speed controls to make sure they stop the discharge process *at a voltage no lower than* described here. See the Disposal of LiPo Batteries section for details about how to dispose of a battery which has been discharged too low.

- **NEVER** allow a LiPo to continue discharging if it becomes hot, swells, or emits smoke. Stop the discharge process immediately and leave the battery idle in its fireproof location for at least 1 hour. Batteries which swell or emit smoke are no longer safe for use and should be disposed of immediately.
- **ALWAYS** discharge a LiPo in a fireproof location such as inside a steel can, ceramic pot, LiPo safe fire bag such as the ElectriFly SafeCharge LiPo Charge Bag (m/n GPMP0751, compatible with LiPo batteries rated at 11.1V 3200mAh or smaller), or outdoors on a concrete walkway or driveway.

### 1. When powering an ESC:

- a. Do NOT use an ESC unless it's compatible for use with LiPo batteries.
- b. Carefully follow the ESC's instructions to set the proper low voltage cutoff point for the battery. It's recommended to not allow the battery to discharge below 3.20V per cell. For ESCs which do not have an adjustable low voltage cutoff level, make sure the low voltage cutoff value is not below 3.00V.
- c. When finished operating the model always disconnect the battery BEFORE turning off power to the radio controlled transmitter. Failure to do so could cause the power system inside the model to run out of control, possibly resulting in damage to the surroundings or personal injury.
- d. Always disconnect LiPo batteries from ESCs when not in use to prevent accidental over-discharge.

### 2. When using a battery discharger:

- a. Choose an isolated, fireproof area to discharge the battery as explained above.
- b. Choose a LiPo compatible discharger having a balancing function, or a combination LiPo compatible discharger with separate LiPo balancer. NEVER use a NiCd or NiMH discharger on LiPo batteries!
- c. For optimum lifespan of the battery, set the discharge cutoff voltage to 3.20V per cell. NEVER discharge a LiPo below 3.00V as permanent failure can result.
- d. Set the discharger's output current to an appropriate value for the battery, not exceeding the maximum rated discharge current listed on the battery's label.

Battery	Nominal Voltage	* Minimum Discharge Voltage
1S	3.7V	3.2V
2S	7.4V	6.4V
3S	11.1V	9.6V
4S	14.8V	12.8V
5S	18.5V	16.0V
6S	22.2V	19.2V
7S	25.9V	22.4V

\* Based on 3.20V per cell

**3. ALWAYS** make sure the discharger adapter cable is connected to the discharger BEFORE connecting the battery to the cable. Only after this is confirmed, connect the battery's main connector to the adapter. Failure to do so could result in the adapter's leads shorting and causing a fire.

**4.** For batteries having a balancing plug, ALWAYS attach the balancing plug to the discharger's balancing connection as described in the discharger's instructions.

**5.** Start the discharge process. **NEVER LEAVE THE ROOM WHERE THE BATTERY AND DISCHARGER ARE LOCATED UNTIL THE DISCHARGE PROCESS HAS COMPLETED!**

## BATTERIES INVOLVED IN A CRASH



Closely inspect a LiPo battery which has been involved in a crash to ensure no physical damage has occurred. Make sure the pack is free from cracks, splits, punctures, swelling, deformation, discoloration, or damage to the wiring and connectors. Otherwise, a damaged battery can later fail, resulting in a total loss of power in the battery or even a FIRE. Damaged batteries may not show signs of failure even after an extended time. Remove the LiPo battery from the crashed model and place it in a fireproof location for up to 24 hours for observation.

## PERSONAL SAFETY & FIRST AID



**PHYSICAL CONTACT:** If you come in physical contact with any parts of a burning LiPo battery, remove the contaminated clothing and shoes. Immediately wash the affected area of skin with soap and water and rinse for 15 minutes. Wash clothing and shoes before reuse. If irritation occurs, seek professional medical attention. Wait for burned components to cool. Use gloves to safely remove the burned components and refer to the Disposal of LiPo Batteries section for further details.

**SMOKE OR GAS VAPORS IN THE EYES:** Flush the eyes immediately with plenty of water for 15 minutes while holding the eyelids open. Get professional medical attention if irritation persists.

**INHALATION:** If smoke or gas vapors are inhaled, move to an area clear of smoke and seek professional medical attention if breathing becomes labored / difficult. If burning battery components are inhaled do not induce vomiting, and seek professional medical attention immediately. Within the U.S. call the national toll-free **Poison Help hotline at 1-800-222-1222** or see [www.illinoispoisoncenter.org](http://www.illinoispoisoncenter.org).

## DISPOSAL OF LIPO BATTERIES

1. If any cell in the pack has been damaged, resulting in a swollen cell or tear in the cell's foil covering, do NOT discharge the battery. Jump to step 5.
2. Place the LiPo battery in a fireproof container or bucket of sand.
3. Connect the battery to a LiPo discharger. Set the discharge cutoff voltage to the lowest possible value. Set the discharge current to a C/10 value. For example, a battery rated at 2500mAh has a "C/10" rating of 0.25 amps, or 250mAh [(2500 / 1000) / 10] = 0.25A. A battery can also be discharged by connecting it to an ESC/motor system and allowing the motor to run indefinitely until no power remains to further cause the system to function.
4. Discharge the battery until its voltage reaches 1.0V per cell or lower.

5. Submerge the battery in a bucket or tub of salt water. This container should have a lid, but it does not need to be airtight. Prepare a bucket or tub containing 3 to 5 gallons of cold water, and mix in 1/2 cup of salt per gallon of water. Drop the battery into the salt water. Allow the battery to remain in the tub of salt water for at least 2 weeks.

6. Remove the LiPo battery from the salt water and place it in the normal trash.

## CONSUMER NOTICE

By purchasing this product the user agrees to have read and understood all information included, and to bear full responsibility for inspecting and determining any signs of damage or abnormalities to this product at all times, to discontinue use immediately if an abnormality exists in the product's form or function, so to avoid causing any injury, loss, or damage directly or indirectly resulting from the use of this product. If these terms are unacceptable, the user should return the item in its original unused condition to the place of purchase. By accepting these terms the user agrees not to hold Onyx, its distributors (owners and employees) and/or retailers responsible for failures and damages resulting from failures.

[www.onyx-rc.com/support](http://www.onyx-rc.com/support)



### ElectriFly® by Great Planes® SafeCharge™ LiPo Charge Bag (GPMP0751)

Compatible with 1S-3S LiPo batteries, the SafeCharge LiPo Charge Safety Bag effectively suppresses and contains the flames caused by a burning LiPo pack. Constructed of super-strong fiberglass and coated with heat-resistant silicone, it has three melt-proof steel snaps on the flap to seal flames in and restricts the airflow that fires need to burn.

- Measures 12.5" x 9" and can be safely used with 1-3 cell LiPo packs with capacities up to 3200mAh.



### Onyx™ 150 AC/DC Balancing LiPo Charger (DTP4195)

If you run 1-3S LiPo packs, there's only one charger you need: Onyx 150. Built-in balancing ensures that each cell reaches maximum voltage. Compact and AC/DC compatible, the Onyx 150 can be used almost anywhere. Just plug it in, set the charge rate and hook up a pack. It starts charging automatically and stops the moment your pack has a full charge.

- Includes compact switching power supply, 90-minute safety timer and a built-in cooling fan, plus reverse polarity and current overload protection.



### Onyx™ 225 AC/DC Advanced Balancing Charger (DTP4225)

You can't find a better value in peak and balanced charging. Operating from a powerful 60W AC/DC power supply, the Onyx 225 arrives with 10 customizable charging routines already in memory. The backlit 2x16 LCD display is easy to read in any lighting condition. And the unit includes a JST EH balancing connector and the high-efficiency Star Plug.

- Charges up to 6 LiPo, Lilon or LiFe cells or up to 15 NiCd/NiMH cells, and is fully programmable with 10-model memory.

