

Tiny Whoop LiPo 101

Disclaimer: LiPo batteries should be handled properly and with care. They can be dangerous. This article should be one small stop during your learning process for understanding the care, safety, and science of these batteries. They are critical to this hobby and should be a topic of study for all FPV pilots.

History and Terminology:

The original Horizon Hobby Blade Inductrix was the base of the original Tiny Whoop build and has the micro jst 1.25 connector. However, it also has the Blade black and white wiring that is known for wearing out quickly and being a bottleneck that does not allow the batteries full potential to be transferred to the quad. The first and arguably the most useful mod to the original inductrix was changing out the battery lead. When the Inductrix was first transformed into the Tiny Whoop a camera that used a battery cable with the 1.25 connector was used. The wires and plug from the camera were significantly more efficient. Trimming the wire to length and soldering the camera straight to the board and using the remaining portion of the pigtail to replace the stock black and white wires was and is still the preferred method for those using the batteries with the micro jst 1.25 connector. However, there is still a lifespan limitation to this plug. Even though we are now getting better power transfer and more reliable performance there is still a very short lifespan for the plug itself. It is only rated for 20-30 cycles before performance begins to decline. People began experimenting with different connectors and plugs.

Some tried the walkera losi connectors since they were readily available and more reliable, but they too were not without their own setbacks. The Losi connector was a simple addition to the stock inductrix flight controller but the batteries were a different issue. The batteries that came with the losi connectors were too large and heavy to be effective for the Tiny Whoop. People began swapping the connectors on the batteries themselves from 1.25 to the losi but that required a procedure that was not recommended for beginners and could result in catastrophic failures. Boris Mueller-Kaatsch of mylipo.de designed a battery with the Power whoop (PH 2.0) connector to match the Tiny Whoop form factor.

The Power whoop connector is the Jst PH 2.0 or MCPX connector. These connectors have been available in other aspects of the hobby, but it was now added to batteries that match the size limitations and requirements for the Tiny Whoop. This connector alone allowed more power transfer from the battery to the Tiny Whoop resulting in an immediate boost in performance. It is also rated for more plug and unplug cycles. Up until this point all of the 1s batteries used for the Tiny Whoop have been standard voltage batteries. That means they are fully charged at 4.2 volts no matter what their mah or milliamp hour capacity. So you will see 150mah - 255mah batteries. All of these standard voltage batteries will be fully charged at 4.2v even though you will see the 3.7v rating on their label. With any LiPo battery you do not want to completely discharge it and should always stay between 3.6-3.8v after your flights. Anything lower will rapidly degrade their lifespan. Now we have the pleasure of the high voltage (LiHV) batteries, thanks to Boris Mueller-Kaatsch and Jesse Perkins. Mylipo created the world's first LiHV battery in this small form factor, and the first battery this size greater than 250mah in 2016.

The HV batteries are chemically designed to be lighter and hold a higher charge voltage. The LiHV batteries can be charged to either the standard 4.2v or the LiHV 4.35v, but the same cannot be said with the standard 4.2v batteries. DO NOT charge a 4.2v battery to LiHV 4.35v's.

but the LiHV's will still say 3.7v on the label. So now we have a pile of several different types of batteries but how do we charge them.

Charging:

There are a few different methods that are commonly used for charging Tiny Whoop batteries. There is the usb charger (not recommended) that is included with the inductrix, but they can only charge 1 battery to 4.2v at a time and since that can take a long time to charge a pile of batteries most people will resort to using a parallel board. The parallel board lets you charge multiple batteries at a time greatly reducing down time. Instead of one battery taking 30-40 mins, now up to 12 batteries can be charged at once. Charging is the most critical and most dangerous part of the hobby. Charging and understanding LiPos needs to be a solid topic of study for anyone looking into FPV as a hobby.

The usb charger is pretty self explanatory even though it is not recommended since you are not able to monitor how many milliamps are charged into the battery and they do not have a storage voltage option. However, if you choose to use the usb charger, always plug usb charger into the power source prior to plugging in the LiPo and NEVER leave a charging LiPo unattended. I repeat: because it is that important. NEVER leave a charging LiPo unattended. When things go wrong they go wrong in a hurry. Now the most preferred method is the parallel board.

Charging with the parallel board requires a more sophisticated LiPo battery charger. For recommendations and preferred chargers please refer to www.tinywhoop.com or the Tiny Whoop Facebook group. Parallel boards are sold separately. You need a 1s capable charger and preferably one with LiPo and LiHV settings. Even if you don't have LiHV batteries at the moment, you will probably gravitate towards those as you progress and its nice to have that option on your first purchase. You will also need a way to measure the voltage of your LiPos. Again you can find recommended products at www.tinywhoop.com but you need a LiPo checker that measures 1s LiPos. Easy adapters can be made to fit both battery styles or can be soldered directly to the checker itself.

The LiPo checker is an extremely important tool. It is imperative that each battery's voltage is as close to each other as possible. The nature of parallel boards and LiPos cause them to try and self balance each other. So when you plug 2 batteries into the same board they want to equalize each other. This is not a problem for the battery with the higher voltage because LiPos are designed to discharge rapidly but it is a problem for the lower voltage battery since they are not designed to charge quickly. More on that in a minute. Therefore when plugging in batteries with drastically different voltages one battery will essentially slam the volts into the other battery and bad things can and will occur. It is best to have the batteries as close to each other as possible. I prefer to have my batteries within .05v of each other. If you have some batteries at 3.79v and some at 3.92v then charge them in 2 separate groups of matching voltages.

So now we have our piles of batteries with matching or similar voltages and we can continue. DO NOT plug batteries into the board with the banana plugs exposed. Contact between the negative and positive plugs with batteries plugged in, can result in bad things happening. Plug board into charger first then plug batteries into the board. Now we need to do some math.

I am not going to cover the entire topic of the C rating. I encourage you to continue your studies and research the many facets of LiPo batteries and safety. In short the C rating

describes how fast energy can transfer to and from the battery. For example, when a battery says 25C/50C it means the battery is rated to discharge continuously for 25C but can handle burst of up to 50C. Any current draw higher and for extended periods of time can lead to overloading and puffing. More on that later. For now we are gonna concentrate on charging at 1C. The most recommended rate since LiPos are designed to discharge rapidly but charge slowly.

Calculating Charger Settings:

Choose your setting depending on battery type. Select LiPo when charging standard LiPo (4.2v) batteries or when charging LiHV's to 4.2v. (remember: never charge 4.2v batteries to 4.35v. Always triple check settings before starting a charge cycle)

The mah x 1000 will give you the 1C rating so for the 2 most popular mah you are looking at .2a per batter for 205mah and .25a for 255mah. So plugging in 5 205mah batteries the charger will be set to 1s, 1000mah and 1.0a. for 5 255mah batteries the charger will be set to 1200mah and 1.3a. These settings need to be adjusted every time you charge a different number of batteries together. Round mah down to the nearest 100 to accommodate your charger's settings. These calculations remain the same whether you are charging LiPo or LiHV. The charger itself needs to be on the LiPo or LiHV setting depending on the type of battery being charged. Micro Jst 1.25 and Jst PH 2.0 batteries can be charged simultaneously if all other conditions are met. A video tutorial can be found at <https://youtu.be/pNcnF9oE0R8>

Parallel Charging Reference Chart

205mah			255mah		
#	mah	amps	#	mah	amps
1	205	0.2	1	255	0.25
2	410	0.4	2	510	0.5
3	615	0.6	3	765	0.75
4	820	0.8	4	1020	1.0
5	1025	1.0	5	1275	1.25
6	1230	1.2	6	1530	1.5

Puffing:

LiPo batteries have a distinct sign that they are not happy. LiPos will puff or swell when something starts to go wrong. They can puff if they are discharged too much (flown too long) and overloaded. Cold batteries will not be able to deliver full power and can result in them being overloaded and puff. Puffing can occur in the rare occurrence that there is an error in the manufacturing process. Storing LiPos fully charged can also cause puffing. Never leave LiPos fully charged. If puffing occurs discontinue use immediately and dispose of correctly. Store puffy LiPos in a fire safe container until proper disposal can be done. Always recycle LiPo batteries.

They are considered hazardous material and need to be recycled properly. Most battery stores can do this for you.

Recommended Batteries:

I recommend mylipo.de (which includes the tiny whoop labeled batteries) and Nitro Nectar batteries from NewBeeDrone.

Care and Maintenance:

- 3.8v is recommended storage charge voltage.
- Do not store fully charged batteries.
- Do not discharge below 3.6v resting
- Always store them in fire proof containers.
- Do not leave unattended while charging.
- Do not expose to extreme heat or cold.
- Do not puncture.
- Discontinue use and take immediate precautions if suddenly puffed
- Always recycle and dispose of properly
- Continue researching and learning about lipo care and safety
- Always ask questions and seek further help from experienced pilots

Written by Scott Keatts

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