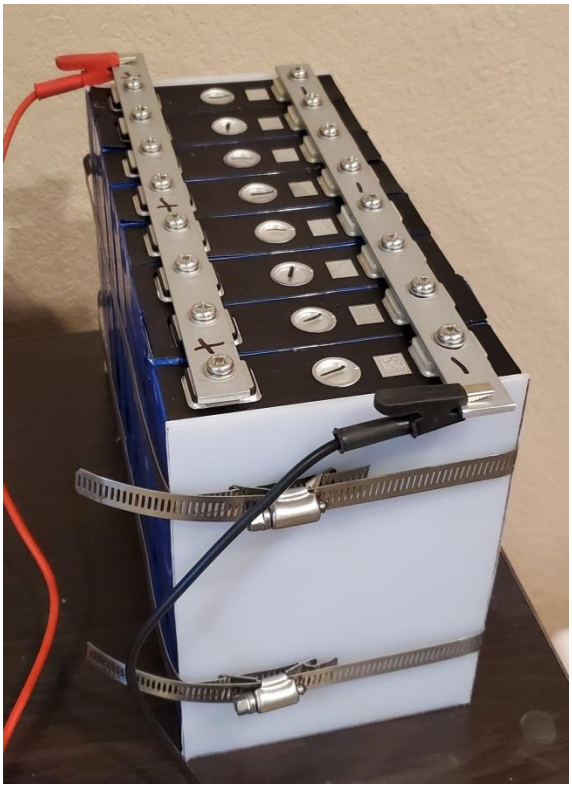
Here are some basic tips that I used to assemble my own large capacity LiFePO4 batteries using prismatic-type cells. I highly encourage you to do your own research as well. Remember, there is ***A LOT*** *of energy stored in these cells! Making a wrong connection can have catastrophic results!! I assume no responsibility for your actions, and I am simply detailing how I built my own batteries.*

Initial balancing. When I build the battery, I want all of the cells to be within .100 volts of each other. Easiest way is to "top balance" them: connect all of the - together, and connect all of the + together, and let it sit like this for a couple weeks. (With 200Ah cells, I now have a 3.2V 800Ah battery) After a couple weeks, I test each cell with a voltmeter, they should all be the same. If they are close, but still not within .100 volts, I let them set another week. Once they are all within .100 volts, they are ready to be assembled. But they will most likely all read exactly the same by this point.

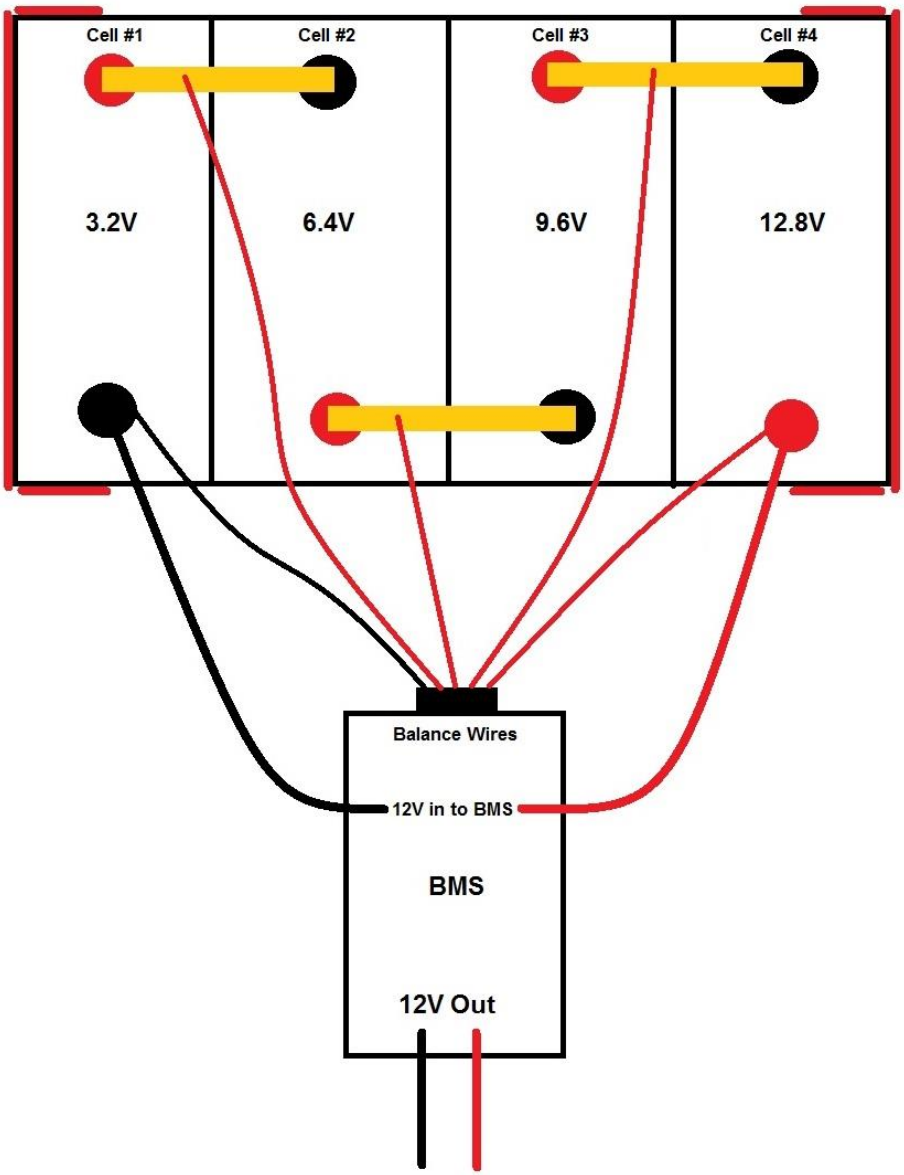
Assembly and compression. These cells will naturally want to swell a bit while charging, so it is recommended to compress them together. That doesn't necessarily mean TIGHT, but rather just holding them all together snugly so there is some resistance to the expansion. I used some cheap plastic cutting boards from Walmart (the red lines around the outside of the drawing below), and cut two to the same size as the cells, but slightly wider by about 1/8" on each side, and used those on the ends. Then I cut 4 narrow pieces the same height and used those on the corners. To compress, I found some really long pipe clamps online (hose clamps on steroids) and used one towards the top and one towards the bottom.

Top balancing and compression:



Busbars. The busbars they send with these should be OK for radio use. The problem with them is the holes are drilled too far apart. So when they are connected, there is a gap between the cells, and that is not good (can't compress the cells with the gaps there!). I made my own buy hammering a piece of 1/2" copper pipe flat, cutting to length, and drilling holes. Can't beat copper for these connections anyhow! Aluminum flat bar could also be used, such as 1/8" x 1", or ¼" x 1", provided the current draw doesn't become excessive.

Battery assembly and BMS. I assemble the batteries in series; + to -, + to -, and + to -, then compress. The BMS I use from Amazon is rated at 30 amps and is more than sufficient for radio and backup use. They are pretty straight forward to wire. On the balance leads, the black wire will go to the – of the #1 cell. The red wire NEXT TO IT will go to the + of the same cell. (Keep in mind, since the busbar ties cell #1 and #2 together, connecting this wire to the + of the #1 cell or the – of the #2 cell is essentially the same). The NEXT red wire goes to the + of the #2 cell. The NEXT red wire to the + of cell #3. And the LAST red wire to the + of cell #4.

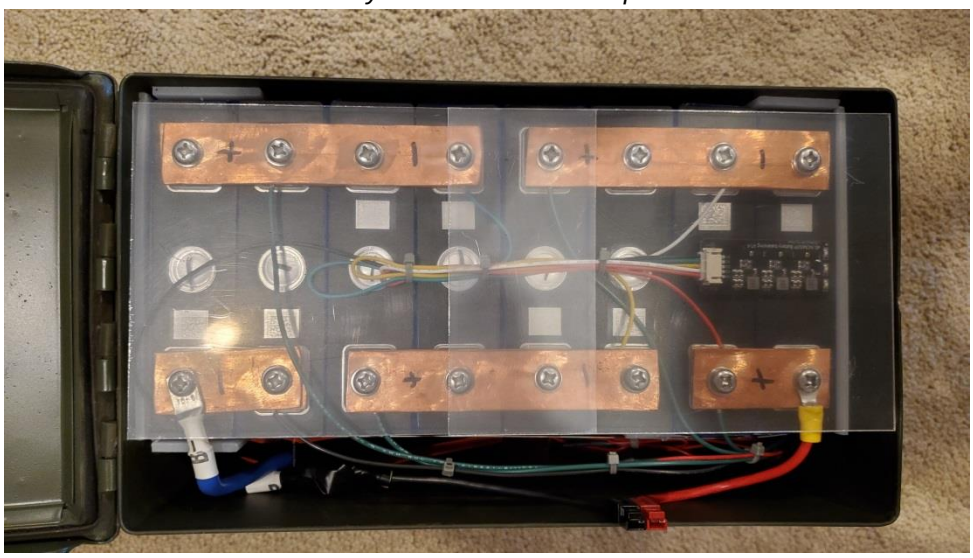


Before plugging in the balance wire connector to the BMS, I test each one with a voltmeter. Starting with the - lead of the meter on the black wire, test the first red wire next to it. It should be around 3.2 volts +/-. The next red wire over should be around 6.4V +/-. The next one over at 9.6V +/-, and the last one at 12.8V +/-. If they don't read in that order, make sure they are corrected before plugging into the BMS. My method is to first connect the main 12V OUT wires to the BMS with the fuse holder and Power Pole connectors (or whatever you use) already installed. Then connect the balance wires to the cells. Then connect the main + and – wires from the battery to the BMS. Test the balance wires, and if correct, plug them into the BMS. Once that's done, I now have a live battery.

Protect the balance wires. I use either heat shrink or small wire loom to protect the balance wires from rubbing against the busbars. I have even used a dab of hot glue to keep them in place.

Protect the busbars from being shorted. I had some thin acrylic pieces from another project that just happen to fit the width of the battery just right, so I used several pieces of double sided adhesive to stick them to the top of the battery. It's just there to keep something from falling on top of the battery and shorting it out. I might even take the plastic off and put down a layer of black Gorilla tape, then put the plastic back on top. Can't be too careful here!

Acrylic sheets over the top:



Fuse. On the Beast, I have a 25A fuse on the wire coming out of the BMS, between the BMS and the meter. From the meter, the wires run to a Power Pole connector installed into the box.

Charger. The LiFePO4s need a specific charger, as the charging profile is different that say a lead acid battery. I use a 20A charger for my 100Ah and 200Ah batteries. Different cells have different charge and discharge specs, but if the charger is about 25% of the rated max charge current spec, there really is no way to harm the battery from "too fast" of a charge. Also, for mine, 20A is at the top end of 25% of the max charging spec for the 100Ah battery, and a little lower than the max spec for the 200AH battery.

At a 90% depth of discharge, my batteries would recharge in:

	w/20A charger	w/30A charger
30 Ah battery -	1.4 hours	(mine is only rated at 25A max charge current)
34 Ah battery -	1.6 hours	1.0 hours
100 Ah battery -	4.8 hours	2.9 hours
200 Ah battery -	9.6 hours	5.8 hours

The 20A charger is roughly the equivalent of 240 watts of 12V solar in 6 hours of good sunlight, and a 30A charger is roughly the equivalent of 400 watts of 12V solar in 6 hours of good sunlight. I will go out on a limb here and say if I am NOT contesting, and I run my shack off of a single 200Ah battery with 240 watts of solar and 5-6 hours of good sunlight a day, I will never run out of battery power.

Keep in mind, if you build a larger battery, your charging needs will be larger too. My 200Ah battery at a 90% DoD will take ~9.6 hours to fully charge with a 20A charger. A 320Ah battery will take ~12.3 hours!

1. Arrange the cells in parallel; all – on one side, all + on the other.
2. Connect all the - together, and all the + together. Let sit for 2-4 week until all the cells read the same voltage, or at least within .100 volts of each other or less.
3. Cut the cutting board or other material to size. Arrange the cells in series and install the cutting board pieces and the bands, then snug the bands.
4. Connect cell in series with the busbars, but do not torque the screws yet.
5. Solder the main power out leads with fuse holder to the BMS, and Power Poles or whatever connector you use.
6. Determine where you will mount the BMS. Be sure the BMS is protected from being shorted out, or the wires being pinched. Mount the BMS and connect the power in wires from the battery to the BMS.
7. Starting with the balance wire connector being DISCONNECTED from the BMS, connect the balance wires to the battery. Test at the connector to be sure they are in the correct order. If they are, connect to the BMS. It is now a live battery.
8. Add protection to the balance wires to ensure they do not rub the bus bars or anything else and short out. Heat shrink, split loom, hot glue to the battery, etc.
9. Cover the top of the battery to prevent shorting. Cover everything with thick Gorilla tape, and/or another piece of plastic cutting board.
10. If the battery will be housed in something metal like an ammo can, use another piece of plastic cutting board on the bottom of the can. This keeps the cells from rubbing on the metal.

200Ah Cells https://www.aliexpress.com/item/1005001683469872.html
$312, ships from China. 4 cells @ 200Ah. If I were to do it all over again, I would order these. A little less money, and takes up a lot less space. Good price, and many good reviews. Expect 1 to 1.5 months to receive when ordering from China on AliExpress.

200Ah Cells https://www.aliexpress.com/item/1005002903808853.html
$377, ships from the US, so I would have them in about a week. 4 cells @ 200Ah. If I were to use these, I would get the ones they call "perforated". It just means threaded holes. The other choice is studs, and that just adds to the overall height.

BMS https://www.amazon.com/gp/product/B07CB14RT1/
$9.50. This is the BMS I use on all my other battery builds, and I will replace the one I used in the Beast with one of these. It is rated at 30 amps, so unless I plan to run an amplifier on it (I don't), it will be more than sufficient for radio and backup use.

If I wanted a larger 100A BMS, this is a good one. Only downside to this one is it uses separate power out and charging input leads. That just means another connection.
https://www.amazon.com/Protection-Phosphate-Charging-Controller-Balancing/dp/B07DMTKBG1/

20A Charger https://www.amazon.com/gp/product/B074X1QK2R/
$69. This is the 20A charger I use for my 30Ah and up batteries, including the Beast.

Watt Meter https://www.amazon.com/gp/product/B013PKYAV6/
$15. I use this meter installed in to my battery box to monitor voltage, current draw, watt hours and amp hours used. It is re-settable.

Portable Watt Meter https://www.amazon.com/HTRC-Precision-Analyzer-Battery-Voltage/dp/B06XPVKY13/
$16. Another meter I use with my smaller batteries. I have Power Poles on each end so I can just plug it in between the battery and the radio. All parameters reset when it is unplugged from the battery.