Sun Fun Kits V4 Standard + Heating Manual

Revision 1.0

Before you Begin:

Thank you for purchasing your Sun Fun Kits V4 standard edition + heating battery kit, diy battery kits make assembling your battery quick and easy and only require basic tools and hardware to assemble. We recommend having a basic understanding of DC wiring in order to assemble your battery pack and you will also need the following tools:

- Hex driver set: 3mm, 4mm, 5mm, and 8mm
- Insulated drives for securing bolts
- Kapton or PET tape 1” to 2” in width
- Hydraulic Crimper
- Wire Strippers
- Standard Lug Crimper
- Velcro style loop
- DC Voltmeter
- Standard scissors
- 90% isopropyl alcohol.
- Adjustable DC Power Supply that is able to charge up battery cells (3.65 volts, 20 Amps) if manually balancing or standard 13.6v to charge the battery.
- 300-400 grit sandpaper

Optional:

- Electrical Safe Silicone sealant (for those looking to make a water resistant battery)
- Hot glue gun (if you wish to secure wires using this method)

Watch a brief overview to use a guide when building your kit:

https://youtu.be/Pzo33dQmofM

& Heating Supplement:
https://www.youtube.com/watch?v=Mx81NXe1zPc


DEWALT


91%
isopropyl
alcohol


Wirefy


KLEIN TOOLS

Preparing your battery cells:

Sun Fun Kits DIY battery kits support various prismatic cells, in this manual we will be using the EVE 304 battery cells, however the process is the same for other manufacturers such as CATL, EVE, Ganfeng and more, the V4 Kit includes spacers and other items to ensure maximum compatibility for cells in this class (270-320 AH)

Certified Automotive Grade Cells generally do not require balancing; however, you may choose to balance your cells, we have a video explaining this process.

This process is explained in this tutorial video:
https://www.youtube.com/watch?v=JGbZozzCYvM

NOTE: With the v4 standard kit, simply assemble your pack, charge the battery at 5-20 amps and within a few hours your cells should be evenly balanced. Again, certified cells that are available with the v4 standard kit will balance very quickly with the active balancer.

Assembling your battery cells:

Starting with version 4 we are now including different cell shims or spacers, this allows users to have a nice tight fit while also adding a third layer of insulation between cells. Version 4 includes 1 set of 1.5mm and 1.0mm shims (3 pieces each). The shims should be placed between the inner cells and most installs will use about 1-3 shims (depending on the install method). For Sun Fun Kits certified cells (LF280K, REPT 280, and LF304) you should be able to use either a

single 1.0mm or 1.5mm shim along with dual in-between cell heating pads, or 3x 1.5mm or 1.00 mm shims to complete the install and have a nice tight fit when using the sidewall heating pads.

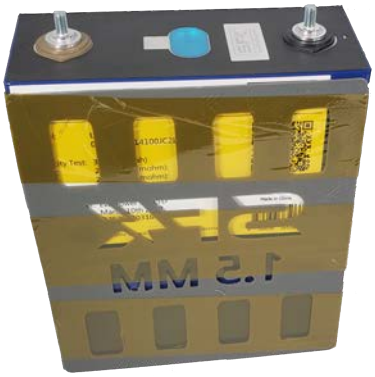
If you find difficulty installing the 1.5mm shims you may go down to 1.0 MM shims, you can mix and match the 1.0 and 1.5mm shims as needed to suit your install preference.

You can watch the cell setup overview video here:
https://www.youtube.com/watch?v=Mx81NXe1zPc&t=375s

For this install, we will be using the in-between cell heating pads; to begin the cell install ensure that the included foam is inserted on either side of the ledges and begin by installing your cells in the orientation shown below, **BE SURE TO MATCH THE ORIENTATION** exactly:

Test fit the cells to get an idea of the installation; you will now need to prepare the cells with shims. For this you have 2 options:

1) Place the cells and then insert the shims as you install the cells
2) **Recommended:** Tape the shims with Kapton tape to the cells and insert them together into the case.



Note: You will want to have the textured side of the shim facing the cell you installed, with the smooth side facing outward. This will ensure the shim stays in place while you install cells.

For the heating pads you will need to use kapton tape to secure the heating pad to each cell (note newer versions of the heating pads may come with adhesive backing making this step a bit easier):

Note: you may find some resistance installing your cells, this is because the EPE foam exerts pressure on the cells to keep them in place; this is why we recommend adding the left most and right most cells first and then adding the remaining 2 inner cells in the end as shown in the picture below:

PLEASE MAKE SURE TO PLACE CELLS CORRECTLY IN THE ORIENTATION ABOVE.

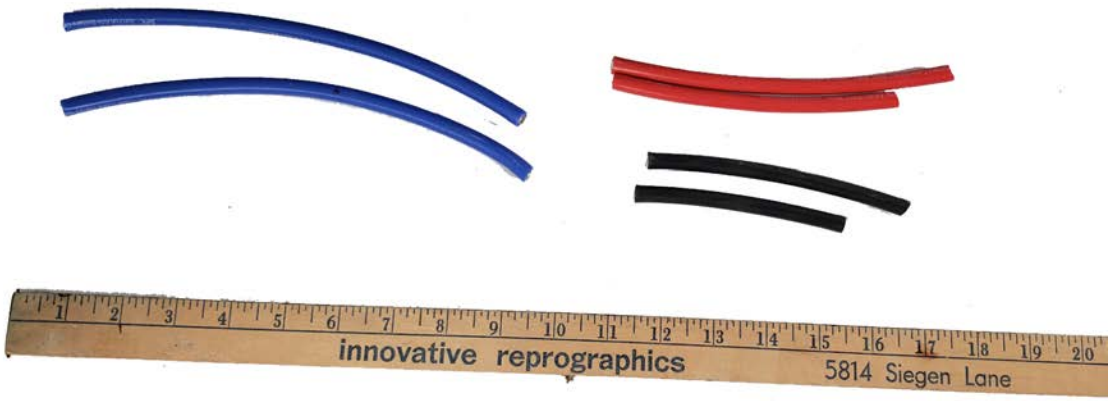
V4 kits support various cells and depending on your cell height you may or may not need cell spacers. For the LF280K, REPT 280 and LF304 cells sold by Sun Fun Kits, you will use the 1.0mm cell shim on top of the case molded in ledges to raise the height of the support so that it matches the cell. If you are using EVE LF280N or other cells that are 200mm tall you will need the 2.5mm cell booster to raise the height of your cells.

Once your cells are in the correct position; it is now time to install your cell plate. With our v4 kits we have made our cell bracket universal and it should fit virtually all cells in the 270-320 AH class.

Version 4 changes the 4x m5 screws mounting method in favor of 7x m4. This method provides us with superior holding power and also ensures that the plate can not be mounted incorrectly as 1 side has 4 mounting points while the other has 3. **NOTE:** Ensure the negative and positive signs on the plate match your cells.

Setting Up Electronics & Cell wiring:

This step involves preparing wires, setting up the bus bars, and connecting the cells to the V4 standard edition SFK 150A bms. For this step we will be discussing wiring and crimping needed to complete your instal:



The v4 Standard kit includes 3 sets of wires, 24” of blue, 18” of red and 18” of black wire. These are ultra flexible silicone 6 awg wire.

You can also watch a our overview video of the cable building process:
https://www.youtube.com/watch?v=Pzo33dQmofM&t=773s

Cut the blue wire into two 9-¼” inches segments. The blue wire will use 1x 6mm lug and 2x 5mm lugs.

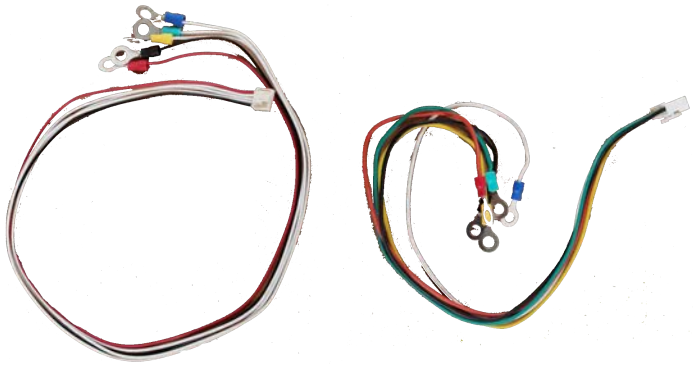
Cut the red wire into one 6-¾” inch and another segment at 5-¾” inches. The red wire will use 1x 6mm lug and 1x 8mm lug

Cut the black wire into a 5-¼” segment and another piece that is 4-¼” The black wire will use 1x 8mm lug and 2x 5 mm lugs.

Once cut; you will assemble the wiring harness as shown:

Please take note of the lug orientation. It is very important you set up the wires correctly, also take note some lugs are rightside up while others are upside down. Install the heat shrink to complete the cell / bms wiring harness.

Next we will assemble the BMS and active balancer harness. These can be setup as 2 independent harnesses or as a single combination harness. The kit includes options to setup both:

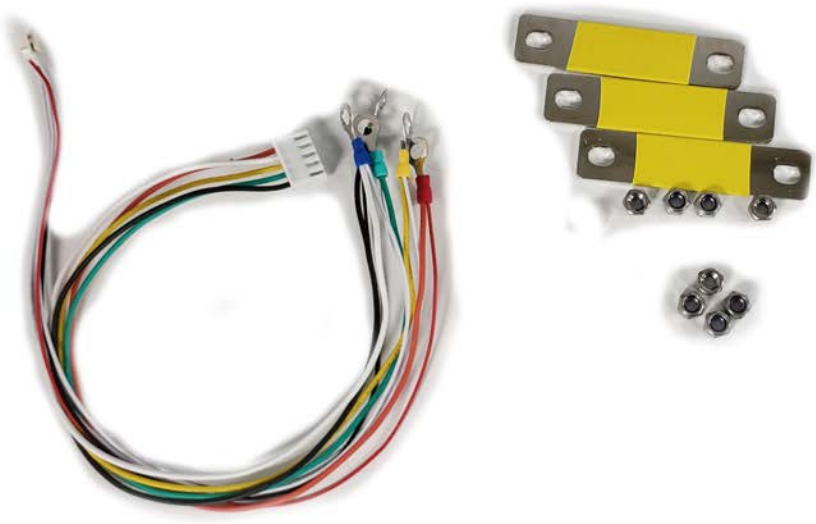


Here is how the lugs should be mounted:

Final Positive = Red Lug
White wire closes to Final Positive = Blue Lug
Center white wire = Yellow Lug
White wire closest to Final Negative = Green Lug
Final Negative = Black Lug

Overview Video: https://www.youtube.com/watch?v=Pzo33dQmofM&t=1205s

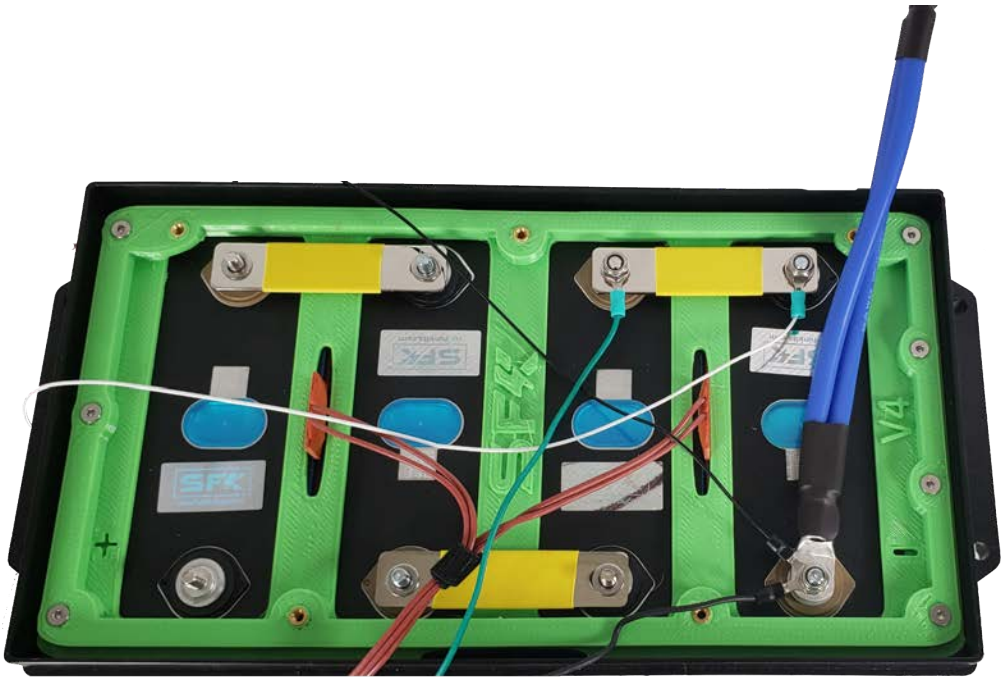
The combination harness uses a single set of lugs for both wires and makes the install cleaner and easier; it is the recommended harness option:



The combination harness requires you to strip, twist and ensure both wires are making good contact with each other before applying a crimp. Done properly it will provide the best overall setup and cell readings.

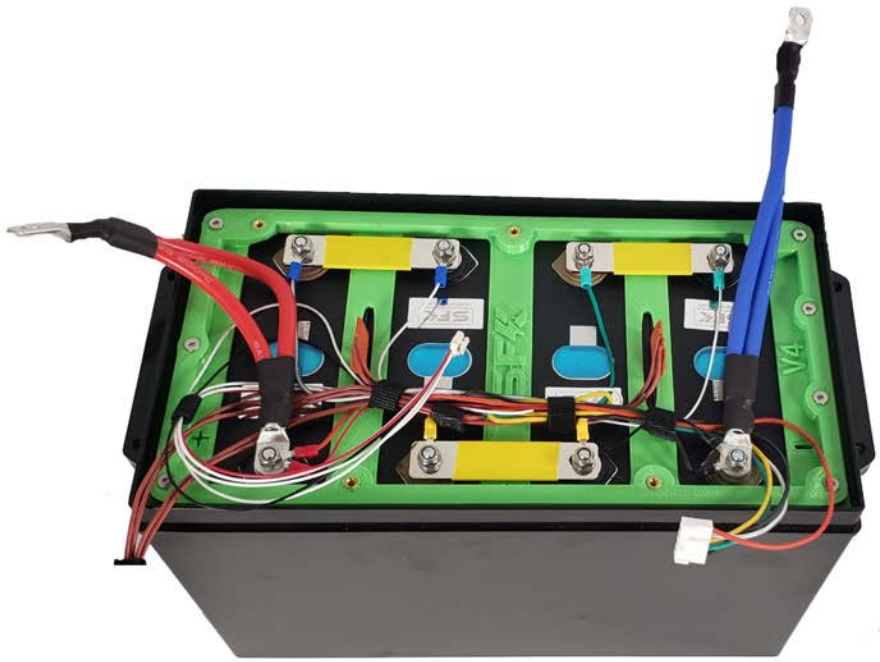
Note: Before beginning this step it is EXTREMELY IMPORTANT that you clean and wipe down all of your bus bars, washers, terminals and battery post with 90% isopropyl alcohol. Dirty terminals and connections will result in improper readings and poor results.

Begin by placing your bus bars in the orientation shown below and then, you will have the terminal lugs placed directly on top of the bus bar for the best cell voltage readings. Also take note of how the bus bars are placed on the cells.



Now you will add your series terminals and BMS balancing/monitoring wires as well as the active balancer wires (NOTE the initial negative post; and the final positive post are shared between both the active balancer & BMS, all other posts may be separate for each cell). Place the BMS ring terminal directly over the main lug and then the active balancer ring on top of it.

NOTE: be sure to use the included washers for the BMS and Active balancer terminals. For version 4 we are now including M8 nylon lock nuts as they provide excellent anti-vibration capabilities without needing thread locking compound.



Your cells should come with the bus bars and terminal studs or welded terminals. Tidy up your install using electrical tape, zip ties, or velcro strips. Setup the wiring schematic as follows:

black wire = cell 1**(black lug)** negative **(0.00 Volts)**
1st white wire **(green lug)** = cell 1 positive / **(3.3 Volts)**
2nd white wire **(yellow lug)**= cell 2 positive / **(6.6 Volts)**
3rd white wire **(blue lug)** = cell 3 positive /**(9.9 Volts)**
red wire = cell 4 **(red lug)** positive **(13.2 Volts)**

*The 1st white wire is the wire that is right next to the black wire, the subsequent wires will be white wire 2, and white wire 3.

The active balancer should be wired as follows we will be using the negative terminal post for most of the cells for this harness:

black wire = cell 1 negative **(0.00 Volts)**
green wire = cell cell 2 negative **(3.3 Volts)**
yellow wire = cell 3 negative bus bar) **(6.6 Volts)**
white wire **(with blue lug)** = cell 4 negative bus bar) **(9.9 Volts)**
red wire = cell 4 positive **(13.2 Volts)**

You will need to ensure a tight fit, take care not to strip your battery terminals, if you are using a torque wrench you will want to tighten down to 4-6 NM. **WARNING!** Loose terminals will cause the cells & batteries to fail.

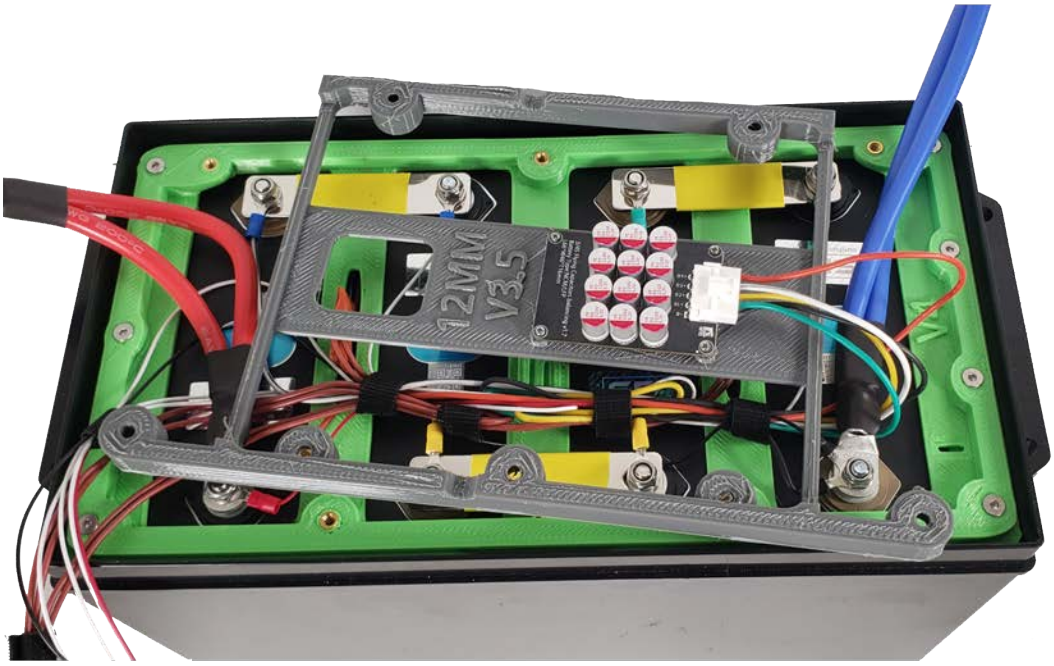
USE EXTREME CAUTION! THE BLUE WIRE SHOULD NOT TOUCH THE POSITIVE TERMINAL OF THE FIRST CELL OR IT WILL ARC AND DESTROY THE CELL. You should consider covering this terminal with kapton tape or other insulating material to ensure that it can not short circuit the first cell.

Verify your voltages using a volt/multi-meter

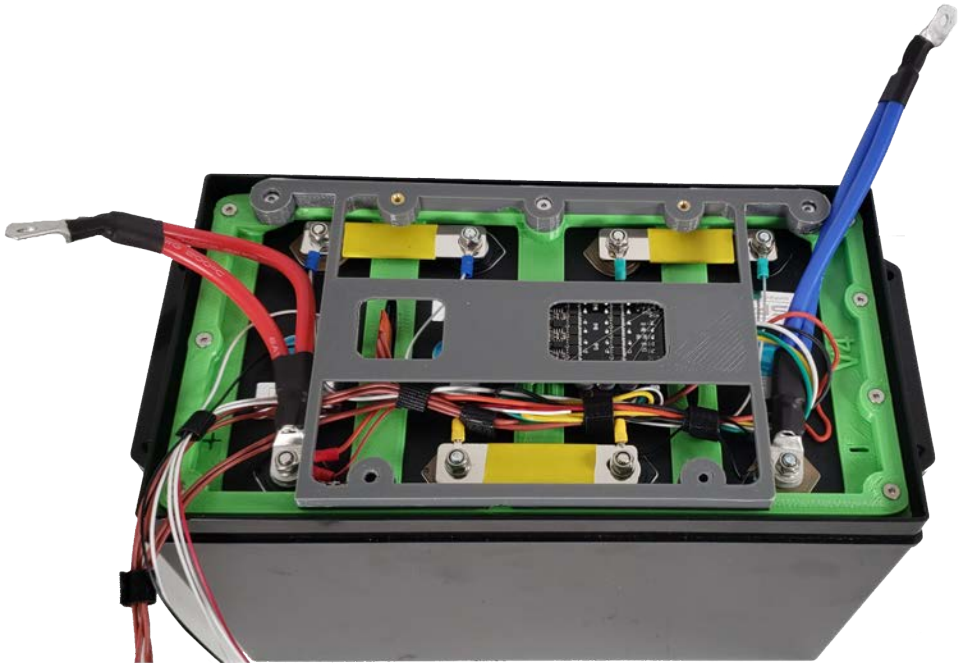
Once you have verified the wiring has been installed correctly, you can now begin by attaching the top plate & your BMS.

Installing riser and BMS mounting plates:

After you have verified that your cells are mounted correctly they have correct voltage readings, you can now begin mounting the BMS and other related electronics. Being by mounting the riser plate by first inserting the active balancer connector into the balancing unit and then rotate it so that it matches the mounting holes on the main kit plate:



Secure the riser plate using the 3 countersunk M4 screws. We recommend only using hand tools for this process.



Once installed the active balancer should have a small amber light appear letting you know it is working, we now move on to the BMS mounting plate.

Install the wires as shown and route the wires to best suit your needs, you can use the included wire keeps to assist in cable management. **NOTE: do not connect the BMS balancer wire until you have installed the lid & lugs.**

The BMS is mounted with 3x small M4 lugs and 2 long M4 lugs. The longer M4 lugs are installed on the corners of the side that has 3 holes. The smaller lugs are installed on the upper corners and the middle of the bottom side.

Installing Lid:

During the injection molding process some residual abs material may have gotten deposited onto the main brass conductor rings, these need to be cleaned. Using 300-400 grit sandpaper, gently scrub the conductor ring until all traces of residual abs plastic are removed.

Once cleaned, use isopropyl alcohol to wipe clean and then begin to attach the main BMS and cell wires.

Connect the heating pads to the thermal switch's XT30 plug, this is a Y-PLUG and will be able to provide power to both heating pads. Once connected you can route the harness below the BMS plate to tuck it away and provide ample room to attach the wires to the lid.

Secure the battery lid using the included m8x10mm screws, take note that the negative terminal wire sits on top of the red wire for the final install. The space is limited but does fit, however, if you do not have the orientation set correctly, you will find the final step difficult as the case lid will not close properly.

The thermal switch's wire **SIT ON TOP** of the main lugs (in other words the big lugs make direct contact with the brass terminal, and the small wires set on top of the main lugs)

ENSURE A TIGHT FIT! You must make sure the bolt is making proper and solid contact to the brass insert, a loose contact will generate heat and can lead to battery failure. Ensure at least 8-12 NM torque setting (appx 110 inch/lbs).

Once the lid wires are secured, you can now insert the balancing wires into your BMS.

Finish off by bolting down the top lid using the 4x16mm countersunk screws. **USE HAND TOOLS! No Impact Drivers for this step!**

Optionally, if you would like to have a moisture/water resistant seal, you can use electrical safe silicone (low order) sealant between the lid and the lip of the battery. A good example is this brand:

Simply apply a bead of it before closing the lid, we have a video of this process

https://www.youtube.com/watch?v=gLge2xds6gE

The last step in your kit assembly is to attach the handles & grips. This process is very simple: thread the nylon rope through the plastic barrel and through the hole on the kit handles.

Once through simply insert the nylon barrel into the built in latch using a flat head screwdriver:

Once done your kit is now complete and ready for testing.

Monitoring Apps & Tests:

You can now connect to your battery and perform tests; visit Google Play Store or Apple IOS App store and search for: Sun Fun Kits BMS

https://play.google.com/store/apps/details?id=com.companyname.sfkble&hl=en&gl=US

https://apps.apple.com/tt/app/sun-fun-kits-bms/id1600445506