11/30/22
Disclaimer: This guide is pretty old by vesc standards and used the now unavailable Little Focer 3.0. Basic wiring should be the same. Will update when I have the time. I removed obsolete Ap XML and motor settings.

 This guide hopes to answer some basic newbie questions that are sometimes taken for granted by our more technical VESC users. I am no means a VESC power user or understand the complicated tuning and or software programming. I am just a joe that dove into the process and later found out that it's not that difficult to get up and running. The VESC pioneers have done all the hard work already.

These things when broken down are really simple, it's basically a hub motor attached to rails, footpads, battery and controller. The VESC merely replaces the controller. You have the option of swapping the Future motion controller (leaving your battery box untouched) so you can swap back later or you can replace the controller and remove the future motion BMS to remove the BMS amp limitation (30amps is the consensus).

Materials:
1. Onewheel XR-minus the controller.
2. VESC controller/Kit for XR conversion (Flowglider DIY bundle)
   https://www.makerspev.com/products/flowglider-diy-bundle
   This made me realize how easy it was to build a controller
   https://customwheel.shop/blog/manual-how-to-install-your-controller

3. 3d printed controller box (print your own) or buy one from here Lit Timber
   http://www.littimber.com/

4. Controller Lid and Gaskets
   https://plasticspider.com/controller-lid-and-gaskets-wtfoc-mk2-for-little-focer-v3/

Extra Parts:
1. Momentary switch and resistor
   https://www.amazon.com/dp/B01LZ4OU04?psc=1&ref=ppx_yo2ov_dt_b_product_details
   https://www.amazon.com/dp/B07QG1VL1Q?psc=1&ref=ppx_yo2ov_dt_b_product_details

   2.0mm JST Connector Socket Kit with 22AWG Pre-Crimped

   https://www.amazon.com/dp/B0B1XCP271?psc=1&ref=ppx_yo2ov_dt_b_product_details

   You will only need this if you do not want to open your battery box and want to use the FM BMS to balance your battery and be able to turn off your board when unused after a

few minutes. I went this way as I wanted cell balancing. You will not be using the provided power switch from the kit. You will need to solder a few wires to this new switch to a premade JST plug and wire. Advantage of not touching your battery box is you can swap your FM controller back anytime you want.

2. Schottky Diode: not needed but it removes the power to the charge port when not charging. It's like a one way valve that allows voltage to go in when charging but prevents power from the battery to go to the charging pins. I used 2 of the 5amp 100 amp diodes in parallel %ahttps://www.amazon.com/gp/product/B09SD46FN5/ref=ppx_yo_dt_b_search_asin_image?ie=UTF8&psc=1
3. Glue gun/basic solder iron/solder flux/

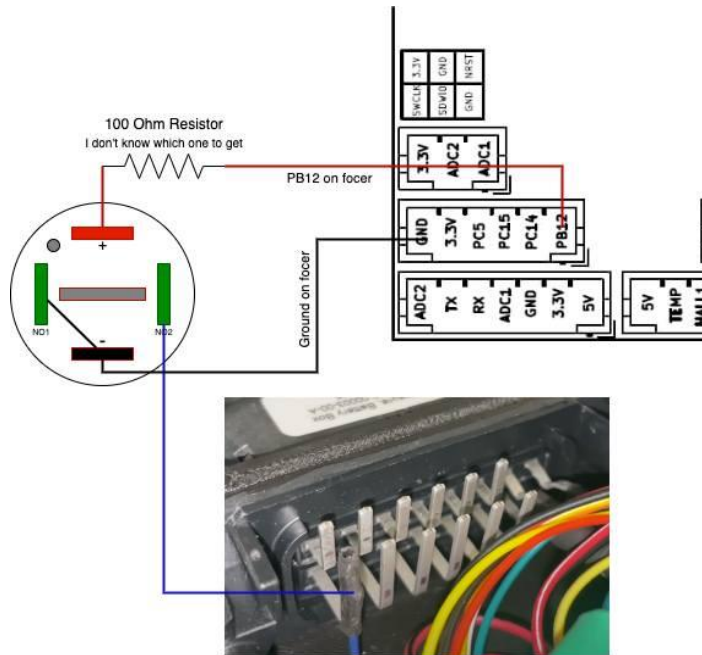—--
For the software /firmware you will need:
1. VESC tool both PC and Android or apple version, support Vedder by dropping a few dollars. https://vesc-project.com/vesc_tool
2. Optional Float Control app (Apple only) can also monitor your board with apple watch support.
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The actual build process is pretty simple if you are removing the BMS but it entails you opening the battery box. NOTE there is a certain order when unplugging the BMS to avoid damage. I do not think there is any soldering involved if you go this route.
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If you want a direct/ swap with the FM controller you will need to do a few things.

1. Use a Momentary switch instead of the provided switch, 100 ohm resistor is to make the LED brighter. I used the 6 pin connector and connected ground to ground, LED + to PB12. This is where the premade JST plugs are great, I could not for the life of me make a proper JST plug, even bought a crimper and watched several videos. Save yourself the hassle and just buy the pre-crimped wires. Reason explained by surfdado 4 min mark https://www.youtube.com/watch?v=7SXRMY4M6HM

100 Ohm Resistor
I don't know which one to get

PB12 on focer

Ground on focer

resistor 100 ohm

2. Send a signal to BMS (purple wire) from the charge port to inform the BMS that it is time to charge and balance. Without this the board will charge but the BMS will not be able to balance the battery. Surfdado link for more detailed explanation. The diode is also explained. Explained 1:45min mark https://www.youtube.com/watch?v=ZeN0Z60g2Gg

My charge port
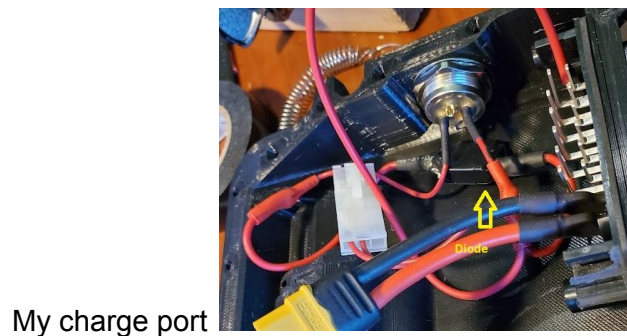
I did try to do the extra bluetooth but have been unsuccessful (probably poor soldering). So far internal included bluetooth has been solid, but may retry at a later time

I also did the buzzer but removed it since I don't have any use for it as alerts/warnings are done thru the phone and headphones.

Miscellaneous Stuff:

You will need to use a soldering iron to heat insert 4 brass inserts that came with the lid kit to your 3d print enclosure. Was wondering what they were for 2 short and 2 long ones 1:42 min mak https://www.youtube.com/watch?v=KqSmCHr4fdA

You may want to buy an extra thermal pad, especially if you are like me and keep on re-opening your controller. They kind of stay in place though.
https://www.amazon.com/gp/product/B09GBMHVLC/ref=ppx_yo_dt_b_search_asin_title?ie=UTF8&psc=1

If you are getting a 3d print PLA + box like I did, there is some question with regards to it becoming brittle over time after exposure to moisture. I used plasti-dip spray 4-5 coats to add waterproofing to my enclosure, did not affect fitment.

Motor wires do not need to be plugged in a specific way, just check tire rotation after you do to see if you need to reverse motor direction.

You can check your switch and connections before closing the lid, you will not burn the VESC by just turning it on.

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Configuration: make sure you are using the latest VESC tool app

Should be done using VESC tool **PC app**. However do not be an idiot like me and try to connect to the VESC via bluetooth directly from the PC. I could not do this so I connected directly using the USB C you can do it this way also but you want to make sure bluetooth is working before you close the box.

CONNECTION: turn on the VESC—>connect thru the **Phone VESC tool App** (android or apple)—>scroll to the bottom check activate bridge and make note of the ip Address—> on the PC tool VESC app go to connections TCP type in the address then connect. You will only need to do this once as it remembers the last connection. You can now do the configuration using the PC VESC tool app.

1. Update the VESC bootloader (from VESC tool)
2. Load a good App XML (load to VESC ap then Write to board)
3. Load a good Motor XML (load to VESC ap then Write to board)
4. Load and write Firmware (different flavors) I use Surfdado
   https://github.com/surfdado/bldc/releases
5. For good measure I load and write App and Motor XML again.
6. Run Motor wizard 15:23min mark
   https://www.youtube.com/watch?v=JdDeJJBhq1w&list=PLfuHGDuxwO2Aepq6JgcwOzm
   HrMxraOZFH&index=4
a. Switch to UART app (General-app to use)
b. Set up motor wizard, do not load default parameters–EUC–Large **Outrunner**
   2000grams–override-(change to sensorless 2000, motor poles 30)
c. Battery 15 cells, 5.5ah (stock battery 10.5ah fo JWXR), advanced (regen -30A, battery
   current max 30A)
d. Direct drive, wheel diameter 280, motor poles 30–run detection-uncheck CAN bus.
e. Finish
f. Motor-General (Motor Current Max 120 A, Max brake 120 A, Absolute 180 A, slow ABS
   current:**FALSE**)
g. Voltage (Battery voltage cutoff start 40.00 V, Cutoff end 37.50 V
h. Temperature (Mosfet temp cutoff start 80 C, end 90C,
i. FOC (Change observer gain to 0.75) (hall sensor interpolation 200)
j. Write

7. RUN IMU calibration: detect→apply—> write (make sure the board is level and wheels
   are not touching anything) That's all I needed to do but if you have issues you can do an
   extra step https://www.youtube.com/watch?v=XacXjwFKKF8

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Field weakening (if you want same top speed as a regular XR)
In FOC-Field Weakening:
Set FW Max current 30 amps
Set FW Duty Start to 65%

Motor– General– Advanced:
MAX duty Cycle 95% or 96%

Tiltback:
 set duty tiltback to 85%
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That should be it, test the motor direction while on the bench, I use 2 stools. If you have a horrible motor sound you may have missed a step and need to run the motor setup again. You will need to run the motor setup every time you change or load Firmware (not app or motor XML).

Save App XML and Motor XML often on your PC

You can also back up settings on your phone. So on the field you can try different settings and always load back your back up thru you phone.

Do not panic if things get messed up just start over Firmware→Motor wizard→IMU calibration→load saved App and Motor XML backup.

Sometimes my power button LED does not light up after a firmware change or when I unplug the VESC but it comes back after a day or so the board runs well despite no power LED.

If you want to learn what some of the common settings do and how it affects the ride watch Vescmann.

Vescmann (Hannes)Tunning

https://www.youtube.com/watch?v=QpF3yGf7R1Y&t=133s

https://www.youtube.com/watch?v=tqRQ7WzbBo4 tune modifiers

Link to Surfdado VESC XR conversion, pretty much watched all his videos over and over with screen grabs, until I had a general idea on what was happening. Keep in mind some of these are 5 months old and in the VESC tuning time this is a longtime and much has improved.

https://www.youtube.com/watch?v=uAjfT5VlYDM&t=385s

Enjoy the torque, sorry If I confused you more but the links should help clarify