



# MiniFFB v1.0

## **Included Kit Hardware**

✓	Item Name	Qty
	150mm 2020 Extrusion	1
	M3 3mm Button Head	4
	M2.5 10mm Button Head	2
	M3 5mm Male-Female Standoff	4
	M3 Tapered Heat-Set Inserts for Plastic	4
	M4 20mm Button Head	6
	M4 8mm Button Head	26
	M4 Washer	4
	M5 5mm Button Head	4
	M5 Hammernut	4
	M6 12mm Socket Head (12.9)	2
	M6 12mm Socket Head	2
	M6 18mm Button Head	2
	M6 22mm Button head	1
	M6 20mm Round Coupling Nut	1
	M6 35mm Button Head	1
	M6 Nylon Locknut	3
	M8 15mm Button Head	4
	M8 30mm 12mm OD Round Coupling Nut	8
	M8 50mm Button Head	4
	SI6TK Rod End	4
	Small Washer DIN 433 - 6.4	20
	25mm M6 Threaded Rod	1

## Included Kit Parts

# Printable Parts

## **Electronic Items Sold Separately**

✓	Item Name	Link	Qty
	Brushless Motor Controller	See Next Page	2
	Robot Actuator	See Next Page	2
	OpenFFBoard	<a href="https://www.tindie.com/products/gigawipf/open-ffboard-stm32f407-usb-interface-only/">https://www.tindie.com/products/gigawipf/open-ffboard-stm32f407-usb-interface-only/</a>	1
	XT60 Panel connector(Female socket)		1
	19.5-24v Power Supply (330W+)	19.5v Dell Y90RR 330W laptop supply(Passive), or 24v 360W electronics power supply	1
			1

# ATTENTION

When purchasing a motor and driver combination, purchase a No Driver actuator unless you plan on adding support for your driver in OpenFFBoard. Currently only ODrive and VESC protocols are supported

## Compatible Motors

✓	Item Name	Tested	Driver Option	Onboard Driver Currently Supported	Link
	MyActuator RMD X8 1:9 (No Driver Version Available)	N	Y	N	
	MyActuator RMD X8 Pro 1:9 (No Driver Version Available)	Y	Y	N	<a href="https://www.aliexpress.us/item/3256801956301171.html?gatewayAdapt=glo2usa4itemAdapt">https://www.aliexpress.us/item/3256801956301171.html?gatewayAdapt=glo2usa4itemAdapt</a>
	MyActuator RMD X8H Pro 1:6 (No Driver Version Available)	N	Y	N	
	TMotor CubeMars Ak80-6	N	Y	N	
	TMotor CubeMars Ak80-9	Y	Y	N	<a href="https://ozrobotics.com/shop/cubemars-ak80-9-kv100-blcd-motor-with-driver/">https://ozrobotics.com/shop/cubemars-ak80-9-kv100-blcd-motor-with-driver/</a>
	By Request Only MyActuator RMD X10	N	Y	N	
	By Request Only TMotor CubeMars AK10-9	N	Y	N	
	MJBots qdd100 Beta 3	Y	N	N	<a href="https://mjbots.com/collections/servos-and-controllers/products/qdd100-beta-3">https://mjbots.com/collections/servos-and-controllers/products/qdd100-beta-3</a>

## Motor Controllers

✓	Item Name	Requires Case and Harness	OnBoard Encoder Included	Mounted On Motor	Torque Control Working?	Needs Resistor Board	Working With FFBoard Now	Link/Details	# of Axis Controlled
	ODrive Pro	Y	Y	Y	Y	N	Y	<a href="https://odriverobotics.com/shop/odrive-pro">https://odriverobotics.com/shop/odrive-pro</a> <a href="https://odriverobotics.com/shop/enclosure-for-odrive-pro">https://odriverobotics.com/shop/enclosure-for-odrive-pro</a> <a href="https://odriverobotics.com/shop/connector-pack-for-odrive-pro">https://odriverobotics.com/shop/connector-pack-for-odrive-pro</a>	1
	ODrive S1	Y	Y	Y	N	N	Y	<a href="https://odriverobotics.com/shop/odrive-s1">https://odriverobotics.com/shop/odrive-s1</a> <a href="https://odriverobotics.com/shop/io-harness-for-odrive-s1">https://odriverobotics.com/shop/io-harness-for-odrive-s1</a> <a href="https://odriverobotics.com/shop/heat-spreader-plate-for-odrive-s1">https://odriverobotics.com/shop/heat-spreader-plate-for-odrive-s1</a>	1
	ODrive 3.6	Y	N	N	Y	N	Y	<a href="https://odriverobotics.com/shop/odrive-v36">https://odriverobotics.com/shop/odrive-v36</a> (Clones Fine, see Discord) <a href="https://odriverobotics.com/shop/20480-cpr-encoder-with-odrive-cable-x2">https://odriverobotics.com/shop/20480-cpr-encoder-with-odrive-cable x2</a>	2
	VESC	Y	N	N	Y	Y	Y	* Flipsky, Trampa, or other VESC6 * 2 Compatible Encoders * Wiring * Brake Resistor Board	2
	MJBots Moteus	Y	Y	Y	Y	N	N(not Yet)	<a href="https://mjbots.com/products/moteus-r4-11">https://mjbots.com/products/moteus-r4-11</a>	1
	MyActuator OnBoard MCX	N	Y	Y	Y	N	N(not yet)	Comes with robot actuator when selecting With Driver	1
	TMotor OnBoard	N	Y	Y	Y	N	N(not yet)	Comes with robot actuator when selecting With Driver	1



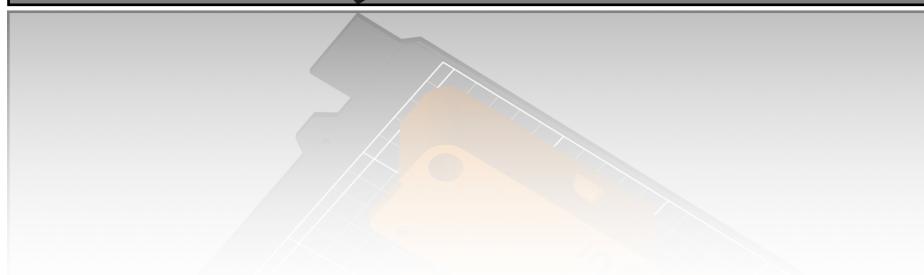
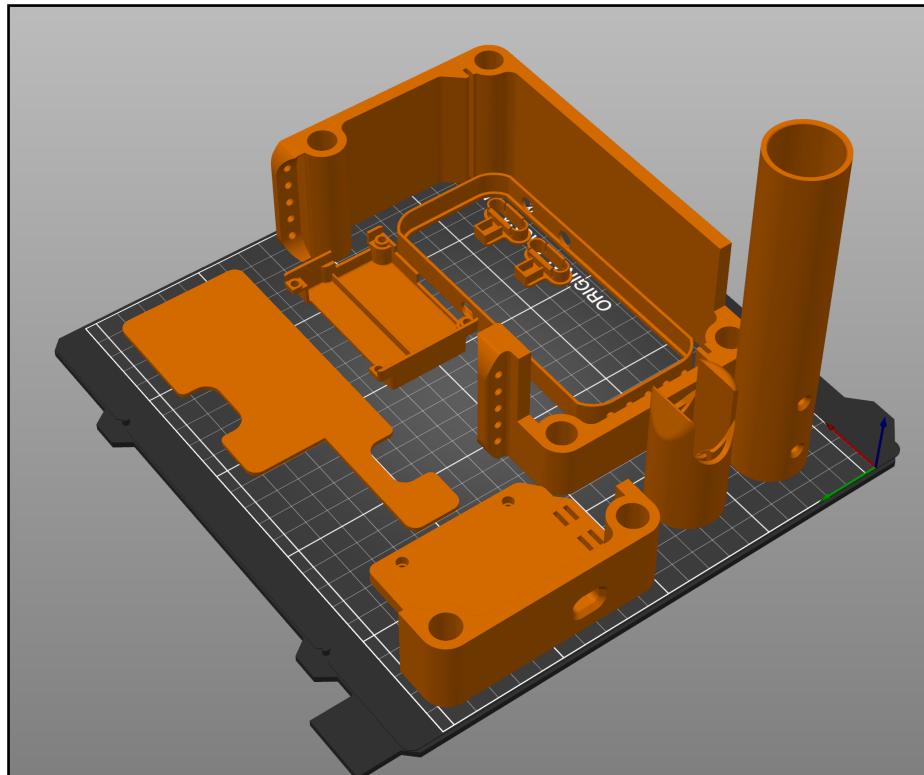
## Files

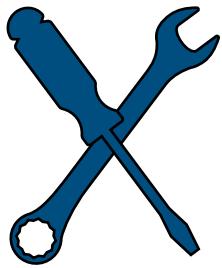
Please visit our GitHub to download the latest “printable” files.

<https://github.com/LaserWing/LaserWing-MiniFFB>

## Printing Tips, and Methods

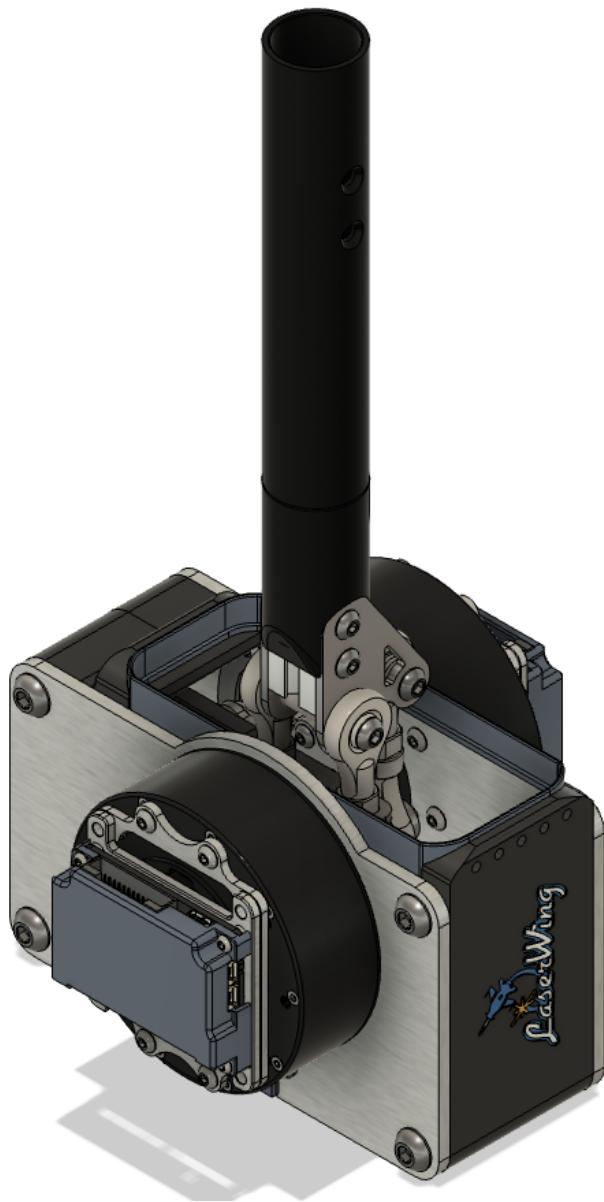
- Please Print with these general orientations
- Use ASA filament or ABS filament because of their heat and chemical resistance
- Each item has the quantities needed listed in the filename if the quantity required is more than one.
- Use 100 or 99% infill. While some of these items are not high stress components , they do protect critical internal parts.
- Print your extrusion covers with 100.5 to 101% scale if you have trouble fitting. These are very sensitive to printer tuning, and often need a little enlargement to account for shrinking/warping

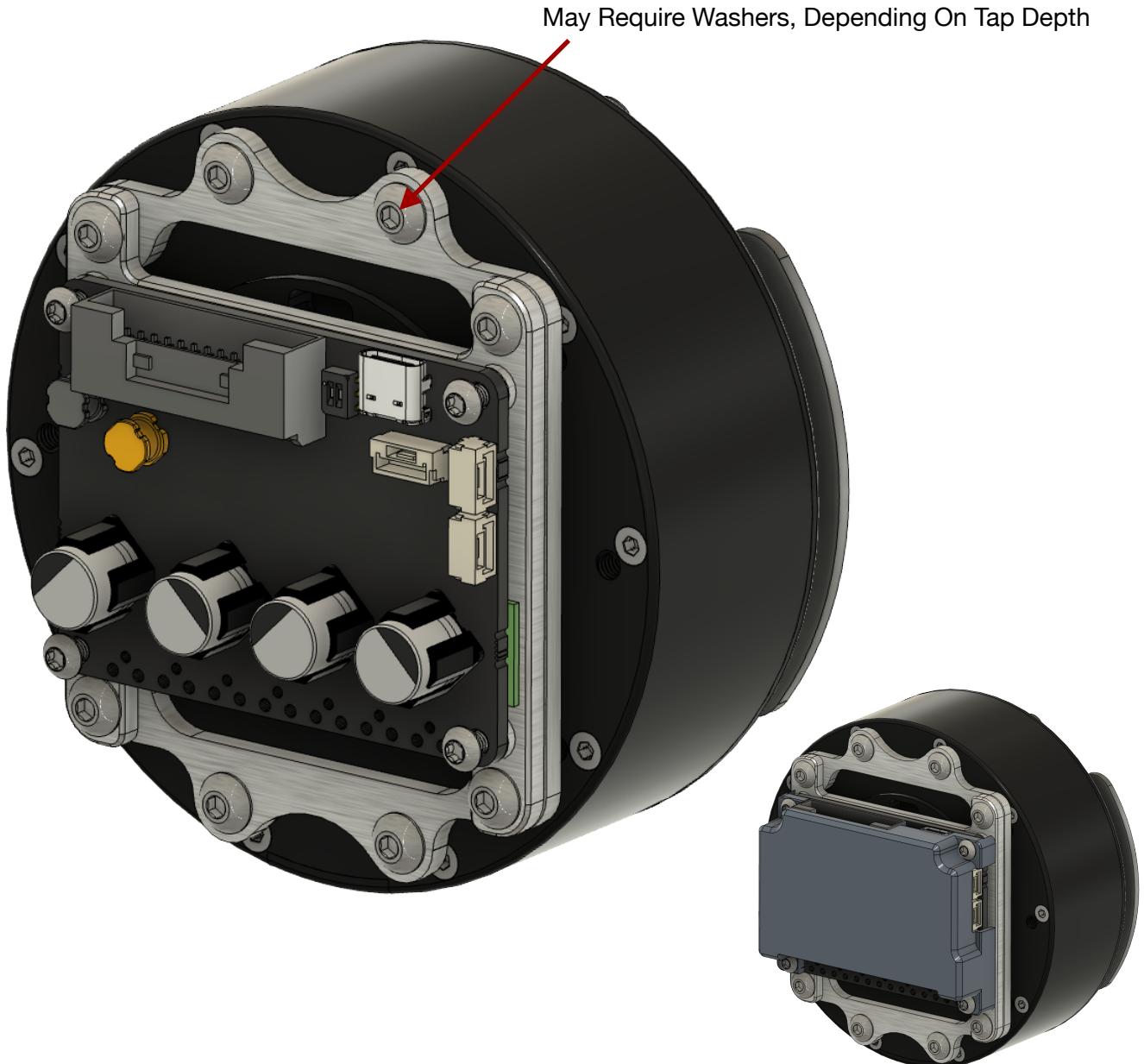




## Assembly Guide

When building your Forced Feedback flight stick you must take great care tightening all the hardware sufficiently. This build requires a full set of metric hex wrenches, a soldering iron, and various other electrical tools depending on your kit level.



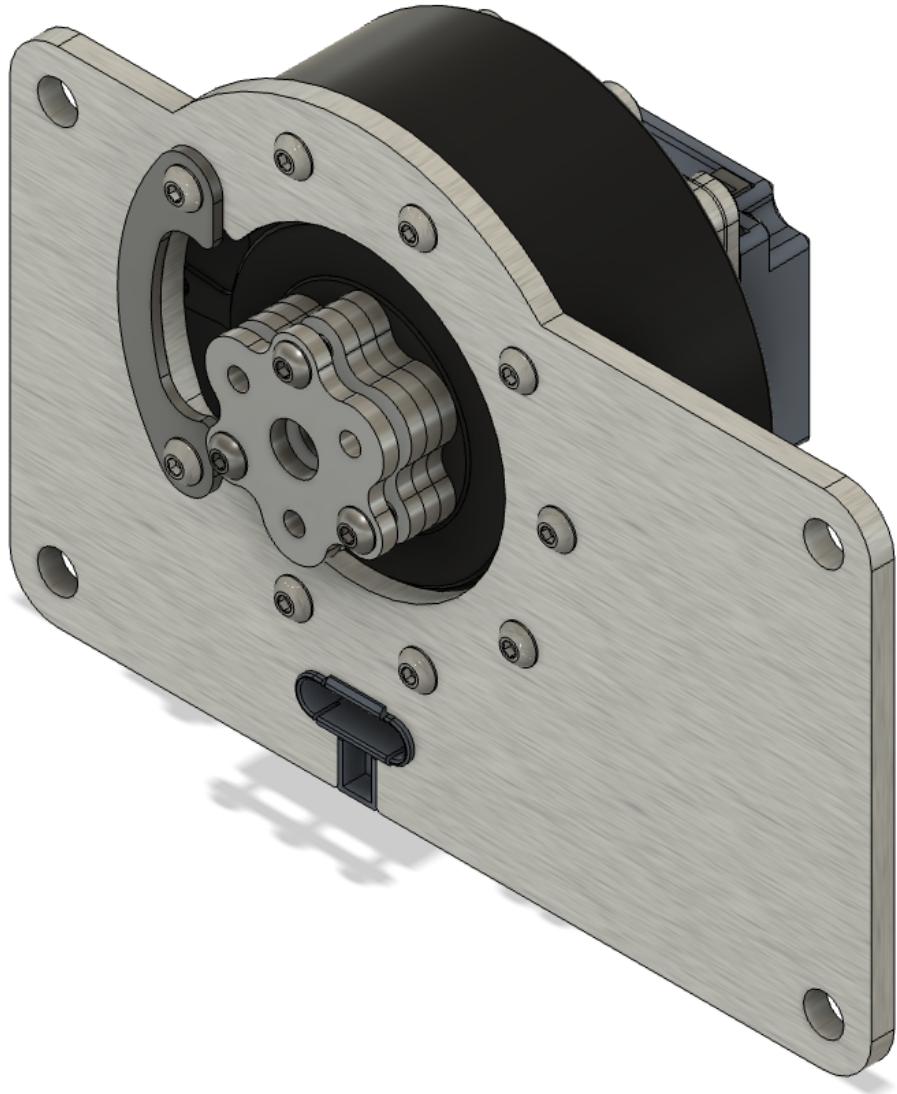


## ODrive S1 Assembly

- Attach ODrive to Heat Spreader Plate
- Using (4) M4 8mm attach ODrive Mount to actuator
- Mount ODrive Heat Spreader Plate to ODrive Mount using (4) M4 6mm Bolts
- Route motor wires to ABC phase pads and solder
- Solder DC + and - power wires to ODrive
- Check clearance on magnetic encoder
- Actively tune motor using ODrive web interface using guide at  
<https://docs.odriverobotics.com/v/latest/getting-started.html>

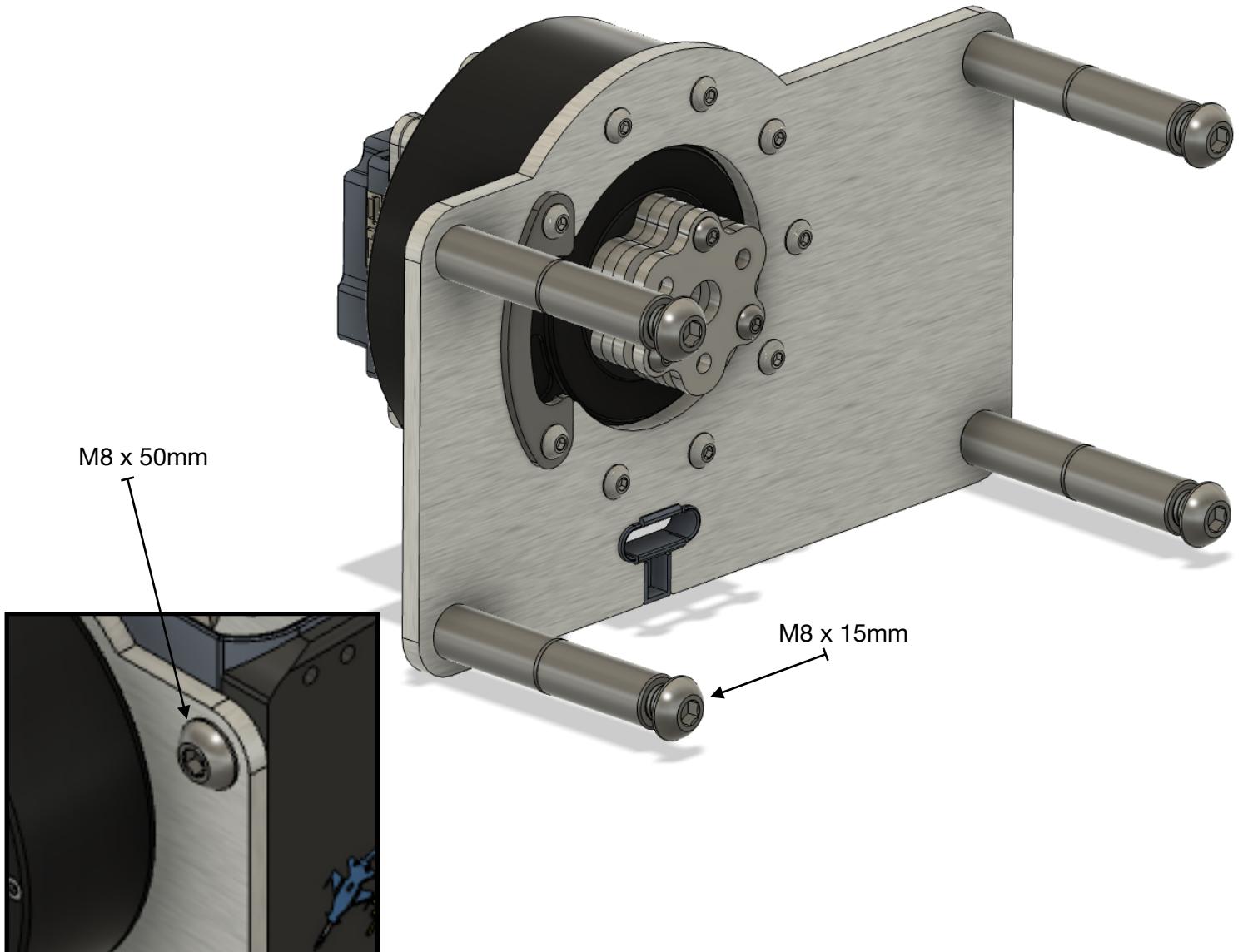
# ATTENTION

Use ODrive Getting Started Guide for ODrive hardware setup. This is required for correct soldering, tuning, and settings.



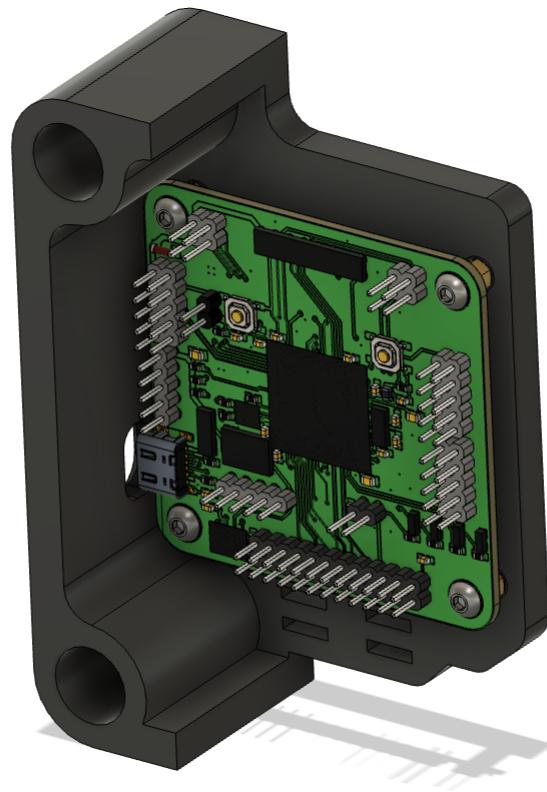
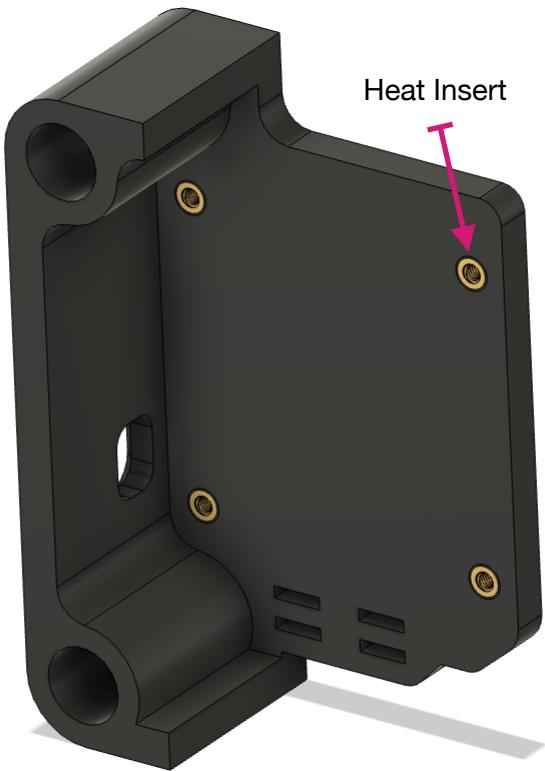
## Inner Motor Module Assembly

- Using (8) M4 8mm attach the actuator to the stainless motor plate as shown. Optionally you may use (2) M4 11mm screws to attach a 35 degree limiting plate on the left side in the limiting slot. The default range of motion is 50 degrees per axis.
- Attach wire guard to motor plate as shown by pushing into place from the outside direction.
- Using (4) star shaped spacer brackets and (3) M4 25mm temporarily screw into the motor center loosely.
- Duplicate on opposite side motor housing identically. These are not mirrored components.



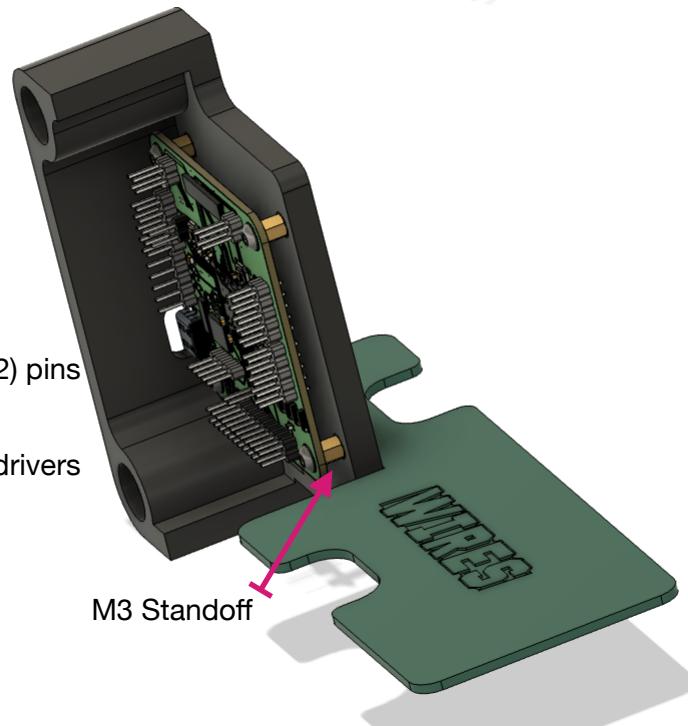
## Frame Spacer Assembly

- Find (4) M8 x 50mm bolts, (4) M8 x 15mm bolts, and (8) Round M8 spacers head spacers
- Assemble each corner as shown with the M8 x 50mm bolt from the back side, followed by a the motor plate then a single 30mm spacer. Tighten up firmly. You might want to use a vice grip on the round spacer to get it to begin to catch if needed.
- Proceed to add another spacer to each corner. Tighten by hand to the spacer we added in the last step
- Loosely add the (4) M8 15mm bolts to the end of the last spacer, they all be readied later once we mate the entire assembly



## Small Case + OpenFFBoard Assembly

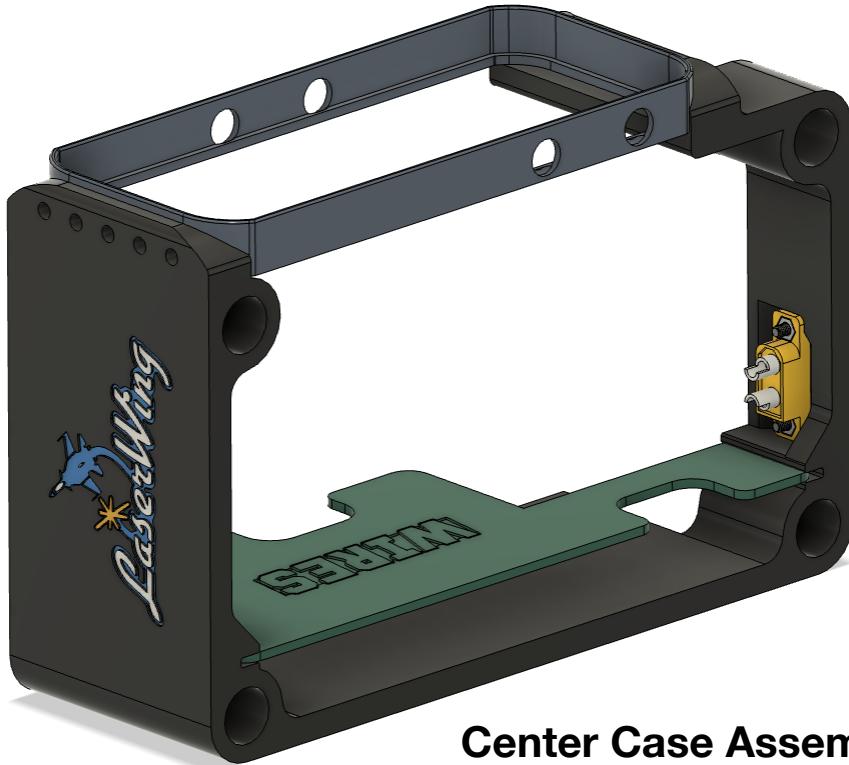
- Using a soldering iron place 3mm heat inserts firmly into each hole shown
- Allow plastic case to cool for a half hour to allow inset to cool and attach to the housing
- Thread (4) M3 5mm standoffs into the heat inserts
- At Minimum solder the GND, CAN H, CAN L, and CAN R(2) pins
- Place Jumper between CAN R and CAN R
- Attach Open FFBoard as Shown using 3mm M3 screws
- Wire the CAN H L and GND connections from ODrive S1 drivers to the OpenFFBoard using best CANBUS practices



# ATTENTION

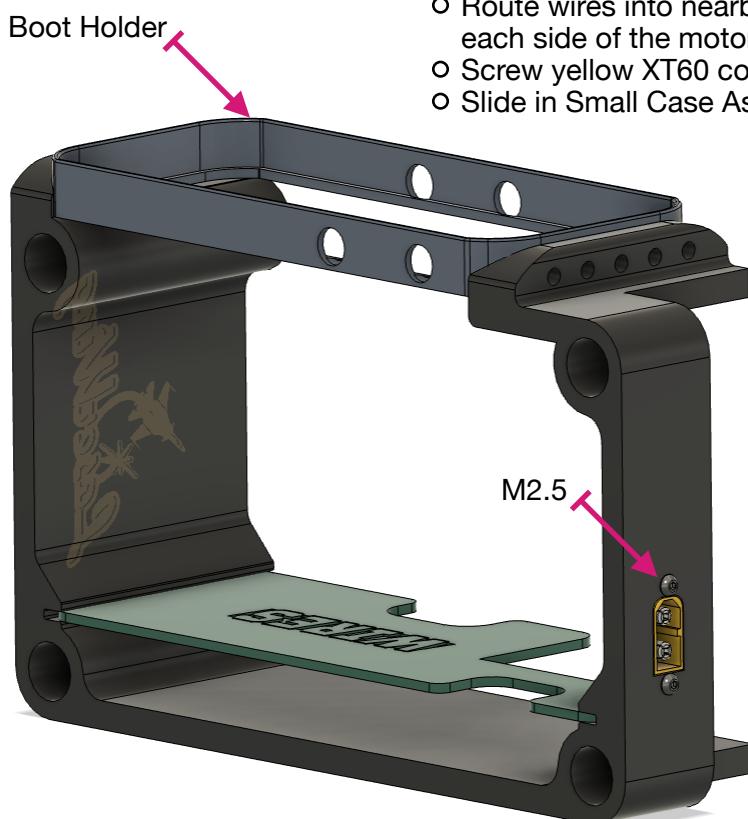
Use ODrive Guide for ODrive hardware setup. This is required for correct soldering, tuning, and settings  
<https://docs.odriverobotics.com/v/latest/getting-started.html>

Follow OpenFFBoard guide and visit Discord for setup questions  
<https://github.com/Ultrawipf/OpenFFBoard>



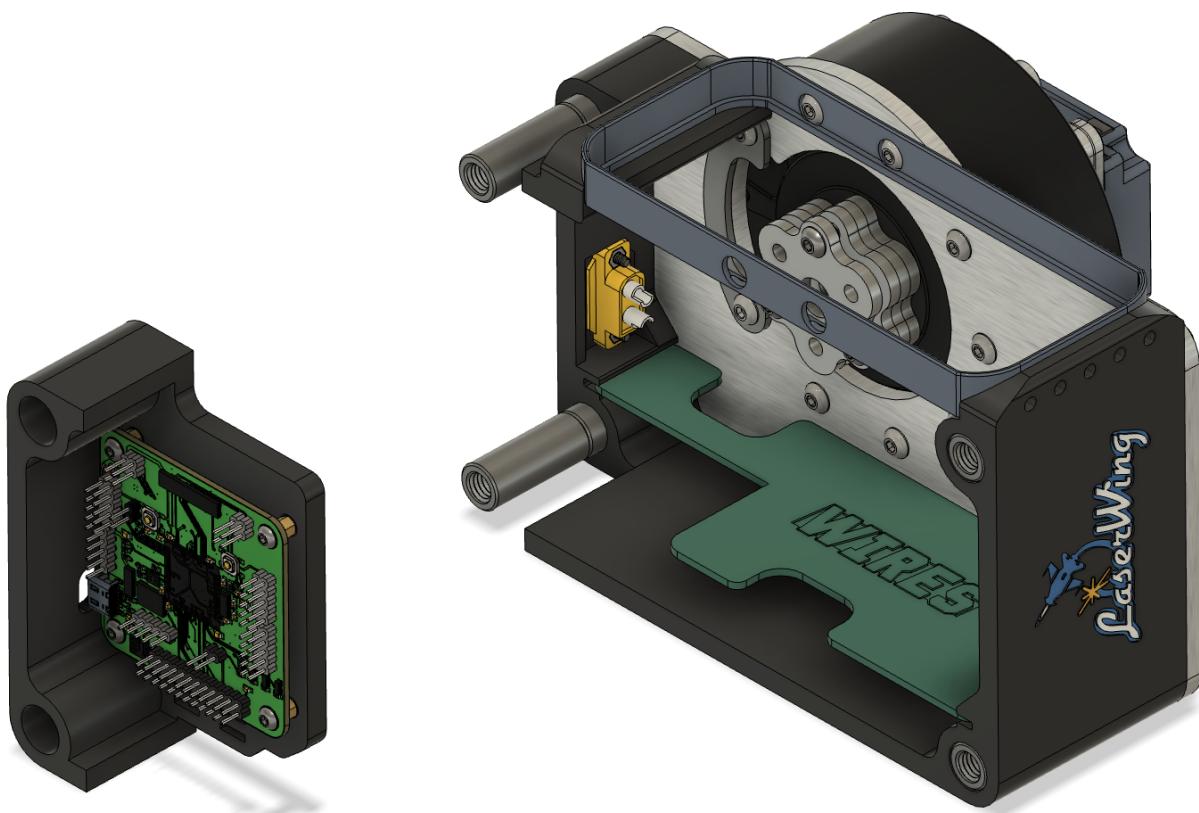
## Center Case Assembly

- If using leather boot insert leather boot holder as shown
- Slide in Wire Shield as shown. This will protect wires from the moving parts above. Proper routing is key. Don't feel shy to add holes as you see fit.
- Attach appropriately sized driver wires to XT60 panel connector with soldering iron. Be aware of Positive and Negative placement.
- Route wires into nearby slot and prepare to route out each side of the motor plates
- Screw yellow XT60 connector into Center Case with M2.5 screws
- Slide in Small Case Assembly for a test fit.



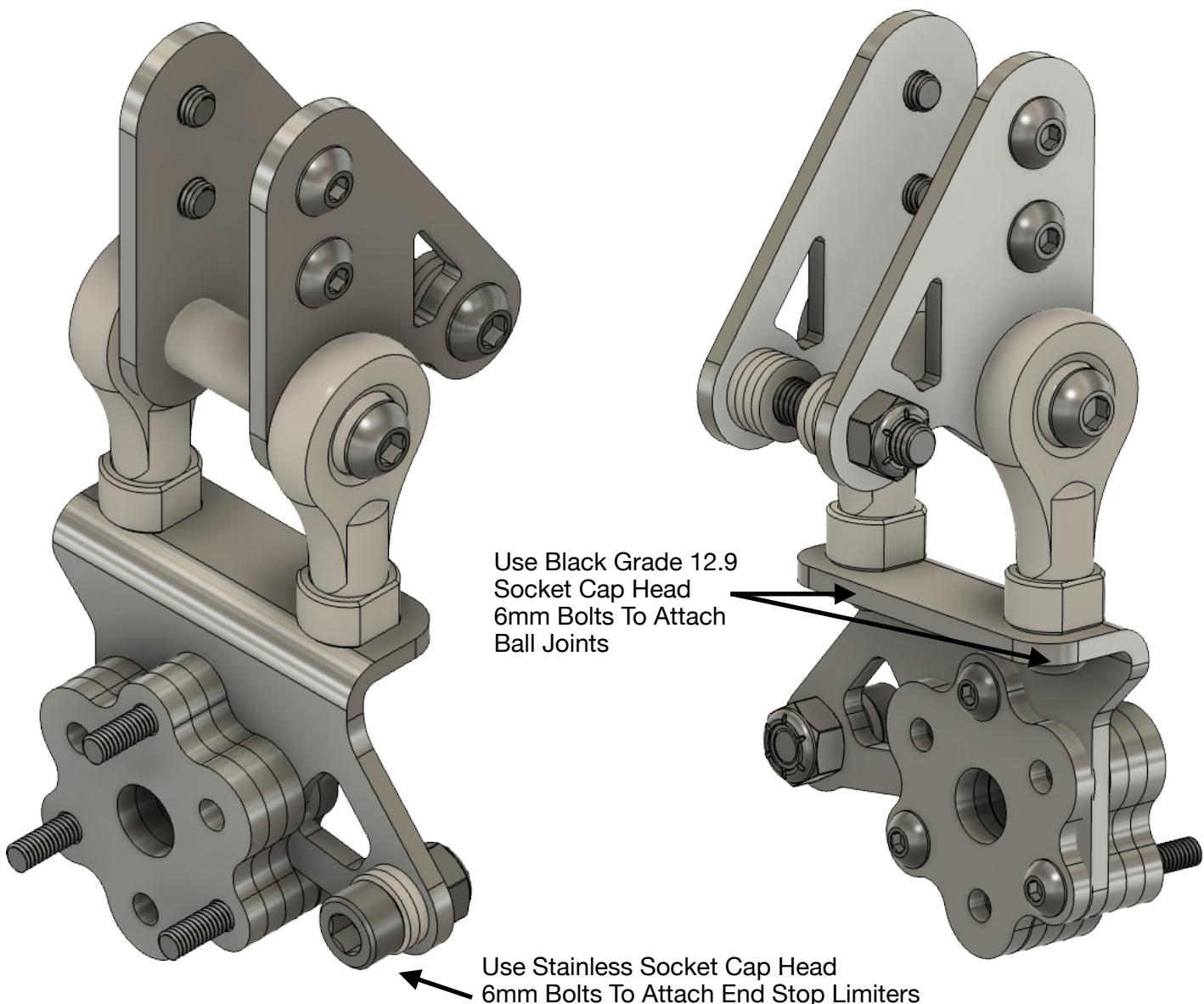
## Finishing The Lower Assembly

- Remove the loose 15mm M8 bolts
- Slide Center Case and Small Case(OpenFFBoard Case) over the spacers until it touches the Motor Plate.



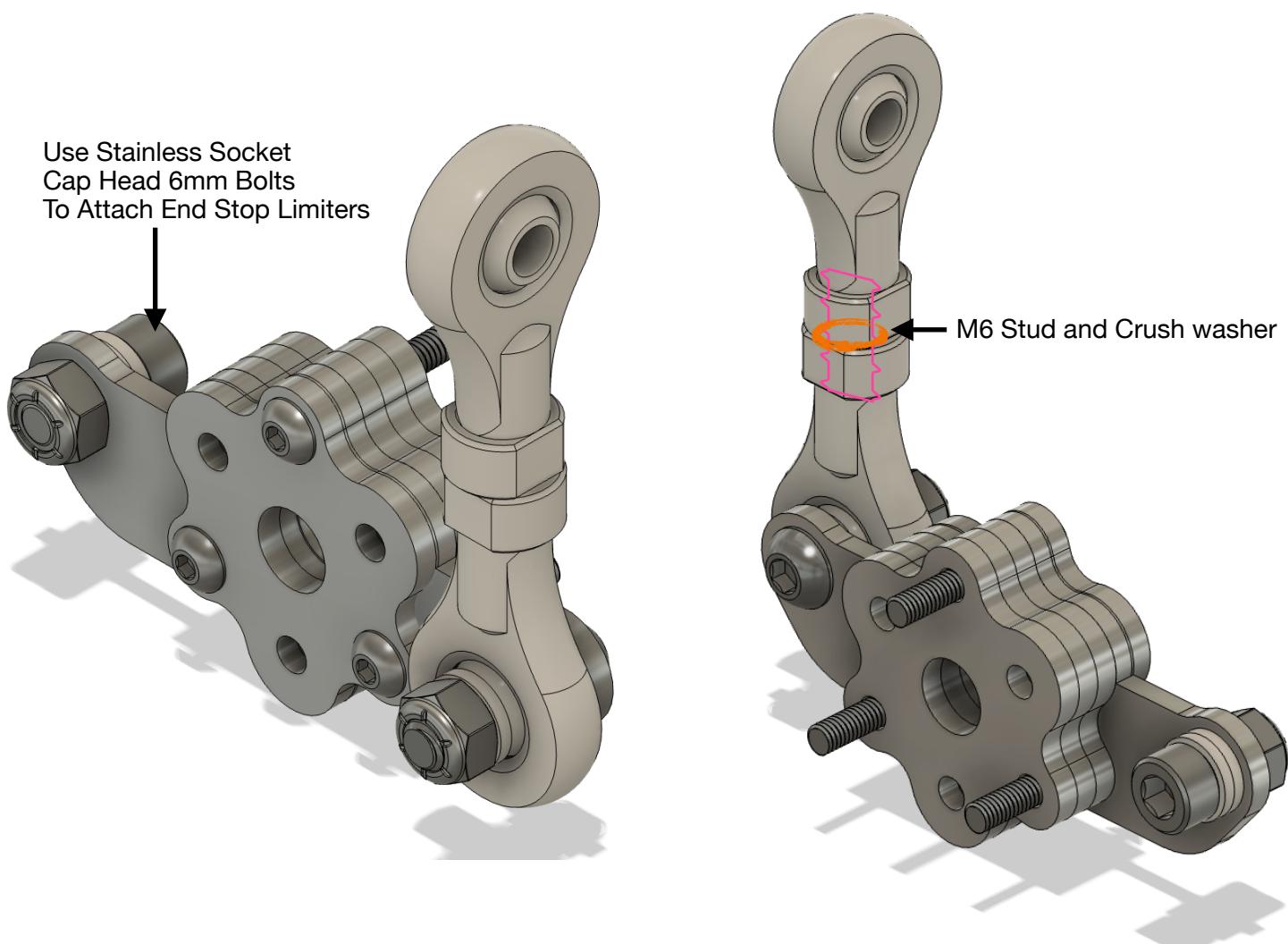
## Pitch Control Assembly

- Remove the star shaped Spacers and 20mm screws loosely added to the motor units in a earlier step
- Assemble as shown taking special care to sign up the holes and outside profiles
- Place one star shaped Spacer outside followed by the pitch control, and then three more spacers
- Check "handed-ness" orientation of the all parts
- Using (2) M6 washers, one M6 12mm Socket Head(Silver) bolt, and a M6 nut, assemble as shown. Orientation is critical, make sure you place the socket head on the side shown in the photo as it is used to limit travel.
- Attach two ball joints to the pitch pivot plate with M6 12mm Socket Head(Black) bolts, then assemble Extrusion Pivot places as shown with a M6 20mm spacer and two M6 18mm bolts.
- Find two M5 8mm bolts and two M5 hammer nuts



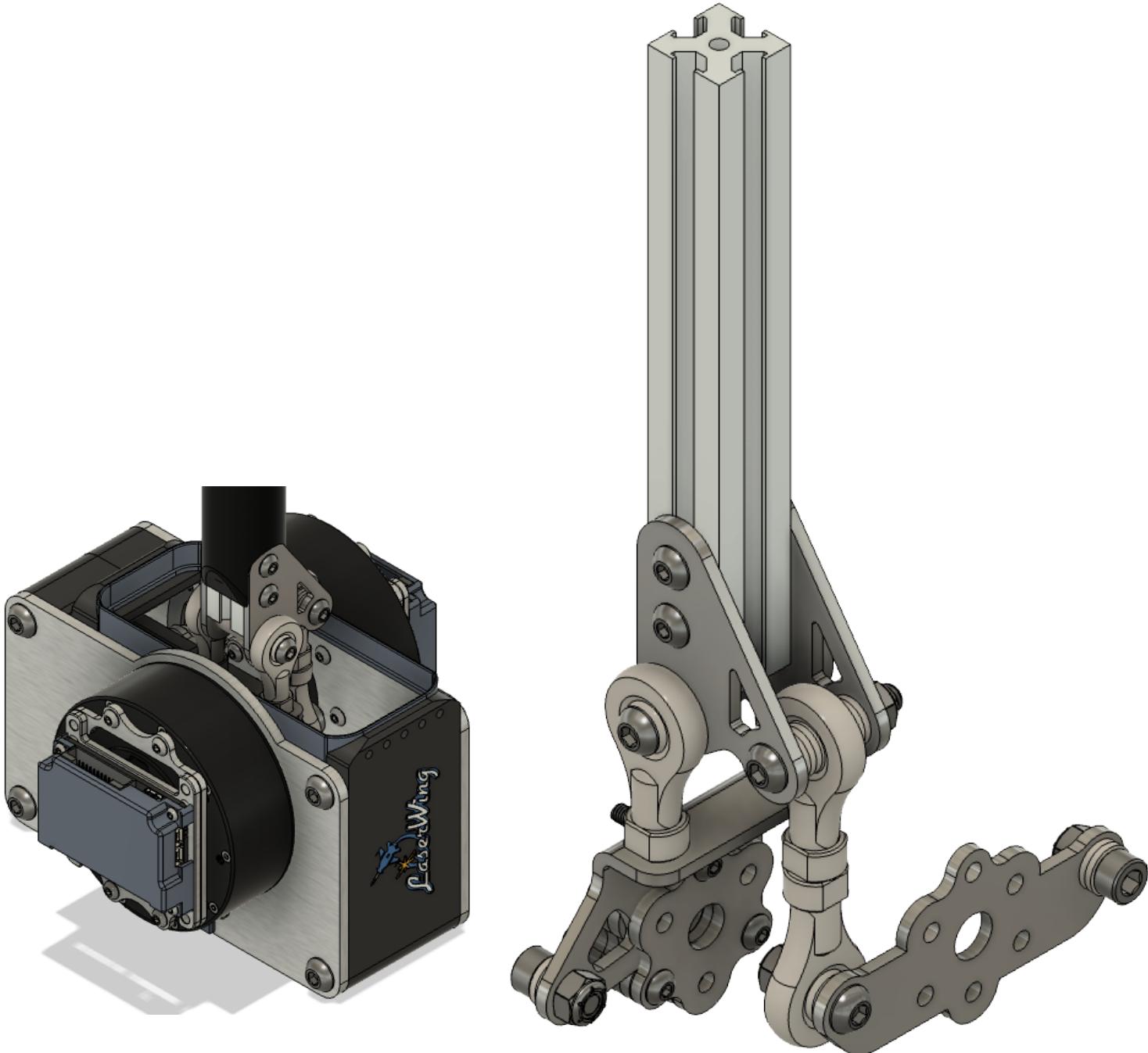
## Roll Control Assembly

- Remove the star shaped Spacers and 20mm screws loosely added to the motor units in a earlier step
- Assemble as shown taking special care to sign up the holes and outside profiles
- Place one star shaped Spacer outside followed by the roll control, and then three more spacers
- Check "handed-ness" orientation of the all parts
- Using (2) M6 washers, one M6 12mm Socket Head(Silver) bolt, and a M6 nut, assemble as shown. Orientation is critical, make sure you place the socket head on the side shown in the photo as it is used to limit travel.
- Attach lower ball joint as shown, once again being careful to place washers between the ball and the fastener and pivot plate. Please ensure bolt orientation is correct. If you place the bolt in from the wrong side you will have interference.
- Using a M6 stud and printed crush washer, add a second ball joint onto the first



## Merging the Assembly

- Attach Pitch and Roll assemblies to their correct motor units as shown below
- Using M6 35mm bolt, 8 M6 washers, and one M6 locknut attach ball joint from Roll assembly to the Pitch assembly and tighten firmly. Using a screwdriver to guide the bolt makes not losing washers easier.
- Take (4) M5 8mm bolts and four M5 extrusion hammer nuts lock in 20x20 extrusion and adjust depth
- Add printed extrusion covers onto 20x20 extrusions and tighten with hammer nuts



## ODrive Setup

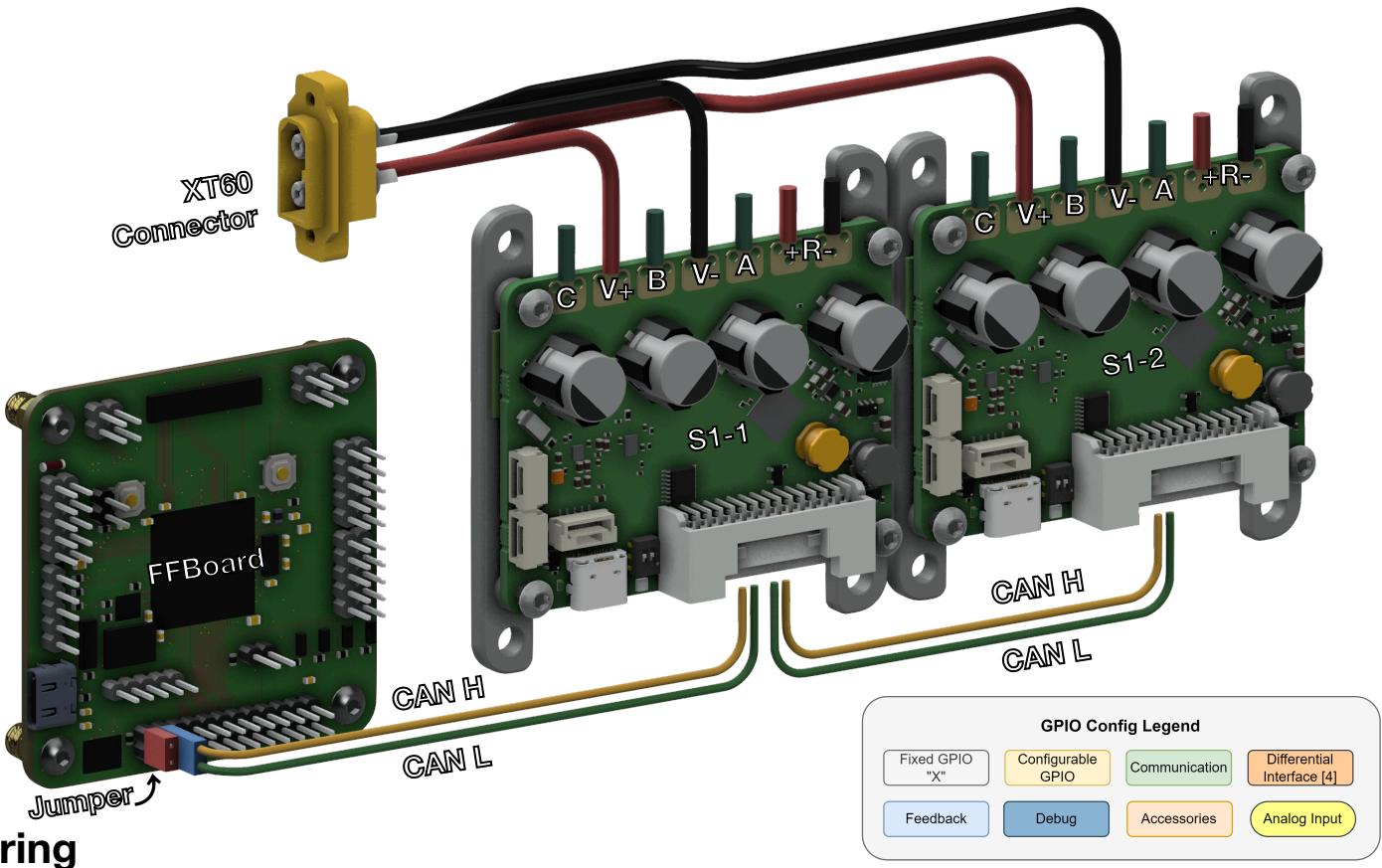
- Here are some essential settings

## OpenFFBoard Setup

- Visit the OpenFFBoard Configurator GitHub and download the latest configurator release
- Setup CANBUS Baud to 1000000 and set node to 1 on pitch and 0 for roll
- Set Strength to 5nm for each motor and submit
- Save to Configuration
- See Discord for more tips

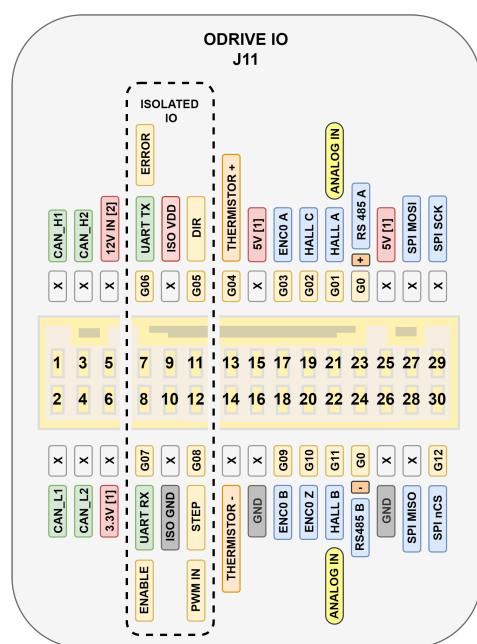
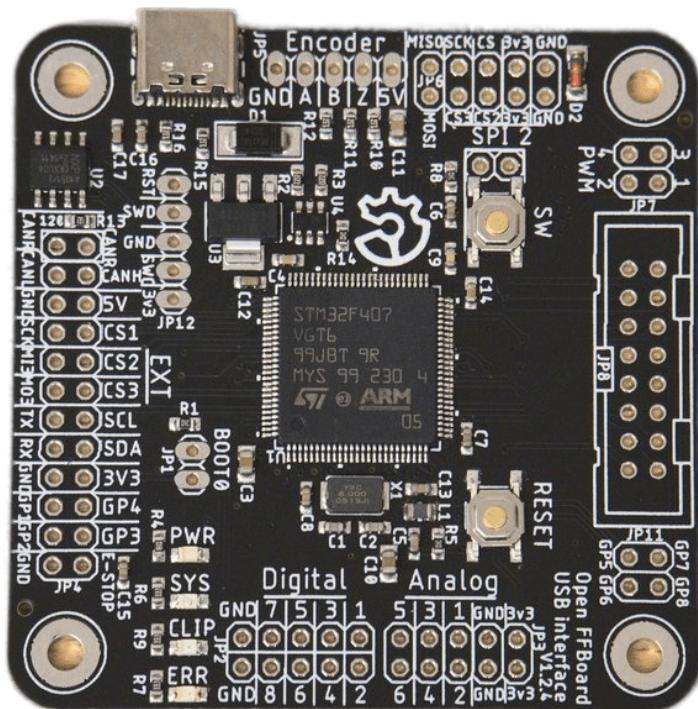
## Helpful Links

- <https://github.com/Ultrawipf/OpenFFBoard>
- <https://github.com/Ultrawipf/OpenFFBoard-configurator/>
- <https://docs.odriverobotics.com/v/latest/getting-started.html>
- <https://gui.odriverobotics.com/>
- <https://discord.com/invite/gHtnEcP>



# Wiring

- Wire Yellow to CAN H to S1 pin 1
  - Wire Green to CAN L to S1 pin 2
  - Continue wiring to next S1 controller
  - Wire Yellow2 from S1-1 Pin 3 to S1-2 Pin 1
  - Wire Green2 from S1-1 Pin 4 to S1-2 Pin 2
  - Flip CAN Resistor dip switch on furthest S1 to on
  - Solder A B and C wires from motors to S1s
  - Solder Positive and Negative terminals on S1s to XT 60 panel connector
  - Consult OpenFFBoard and ODrive documentation for chassis grounding



## What Next?

- See Discord for more tips
- Print your stick adapter or entire flight stick
- I recommend looking at authentikit for warbird grips.
- If you plan on building a yoke I will be releasing a supplemental yoke parts kit soon so reach out to me on discord
- Want to help create Printable addons? Join the team. I am happy to share a reference model to developers looking to build upon the printable parts that work with my kits

