

3D Printed F-18 UFC

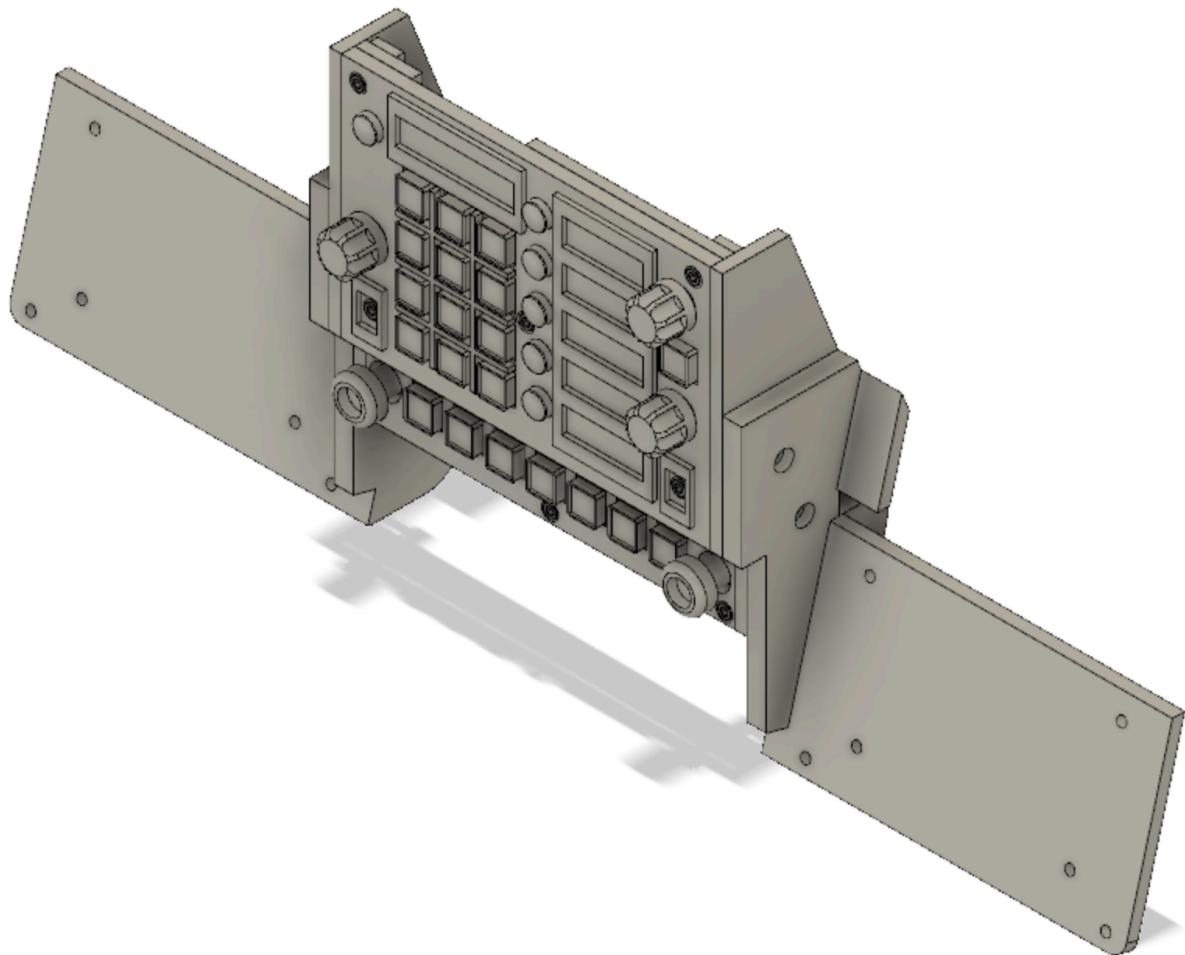
Assembly Instructions

9mm Max Thickness Edge Clamp Mount (PCB Board Electronics)

Version 1

Last Update : 2019-07-27

Author : Elliot Francis (shadowmouse)



Introduction

Thanks for using these plans for the F-18 UFC.

This project is a kit of parts that will require a little bit of drilling and a LOT of 3D printing and soldering. It took me about a week to put mine together but most of that was printing time or waiting for parts to ship. The electronics for the project are based around a Teensy 3.6.

Note: The MFD mounts are designed for the Thrustmaster Cougar MFD set. The mounts take 15 hrs to print and can be safely omitted if you don't want to use them.

Some users will note that there is no ADF selector switch hole, it has been omitted from this version for 2 reason:

1. The Teensy 3.6 Joystick Library only allows 32 buttons and I had to drop something.
2. I rarely use the ADF functionality on the F-18 so I dropped it to fit in all the other buttons.

Before we begin please make sure you have the following files :

Reference Files

- PCB Parts List.pdf
- Assembly Instructions.pdf (This document)

STL Files

- All Files Listed in the **Printed Items** section of the parts list

If you are missing ANY of these files they are available in the github repository.

Purchasing Parts

Open up the Parts List PDF and take a look at the “Purchased Items” Section. This is the stuff you are going to need to build the project to completion. I’ve included links to the parts I used but feel free to substitute if you want from other suppliers.

— Notes about the Buttons —

The clearance between the bottom of the buttons (round and square) and the top of the tactile switch for that button is about 1mm. This allows enough play for the buttons to function properly regardless of how tight you crank down the mounting screws but this leaves the buttons a little loose in the holes. Not enough to affect function but may make the discerning user a little twitchy as they slide around a bit. If this is a problem for you I recommend purchasing the optional Button compression springs to firm things up a but. I use mine without them and find the experience isn’t diminished much.

— Notes about assembly —

- I like cutting threads directly into my 3d printed parts rather than using nuts during assembly. It's a little less robust but makes my life easier. The holes are sized for 6-32 machine screws since I also am a fan of Actobotics Aluminum Extrusion (from servocity.com) for mounting things and I've got a whole bunch of 6-32 Socket Cap Machine Screws laying around. I recommend in the parts list the Actobotics Hardware Pack A but you can also get compatible 6-32 machine screws at your local hardware store.

- The holes can be tapped with a normal 6-32 hold tap by hand with little effort but if you don't have a 6-32 tap and don't want to get one they can also be drilled out with a 5/32" drill bit and assembled with nuts on the far side. The hole positions allow this assembly method with no issue. If you REALLY want you can try and self tap the hole without a hole tap by just forcing a screw in but I don't recommend it.
- Holes that need to be threaded or drilled are 3mm in diameter and you can't fit a 6-32 screw through them. Holes that don't are 4mm in diameter will allow a 6-32 machine screw to fit through them easily.

3D Printing the Parts

When developing this for my own use I printed all my parts on a Prusa3D i3 MK3S using MatterHackers or Prusament Filament. **I make NO guarantees about the effectiveness or accuracy of your printer and there for no promises about how well the files will work.** While the tolerances on most of this project are reasonably forgiving the tactile switch button wells are calibrated for 0.1mm (eg. the switch squares are 6.1mm in size) so that you can easily press fit the switches. That being said I've been designing 3d printed parts for nearly 5 years so there shouldn't be too much of an issue.

Shapeways is another alternative if you don't have access to a FDM printer on your own but trust me.... you don't want to go that way, the buttons are \$5.00 a pop and the Clamp mounts are \$80. Find someone with a FDM printer and do that instead.

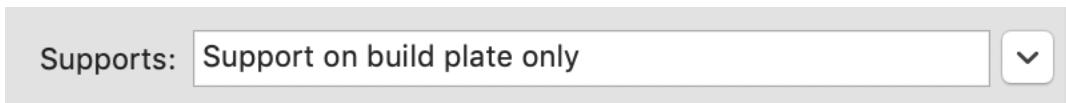
I've laid out the most efficient set of prints for my Prusa i3 as a recommendation but feel free to lay your own depending on your printer. There are 3 Print Jobs ranging from 9 to 15 hours each. Your mileage may vary. The total print time is about 38 hours. 20 if you are doing just to UFC and not the MFD mounts.

— Note on the Buttons —

The button files provided are divided into 2 types - Round and Square. The holes are designed to fit any of the correct type. You will need 6 Round and 20 Square buttons. Please select the button tops according to how you would like your MFD buttons laid out. Also, Feel free to make your own based on the files provided.

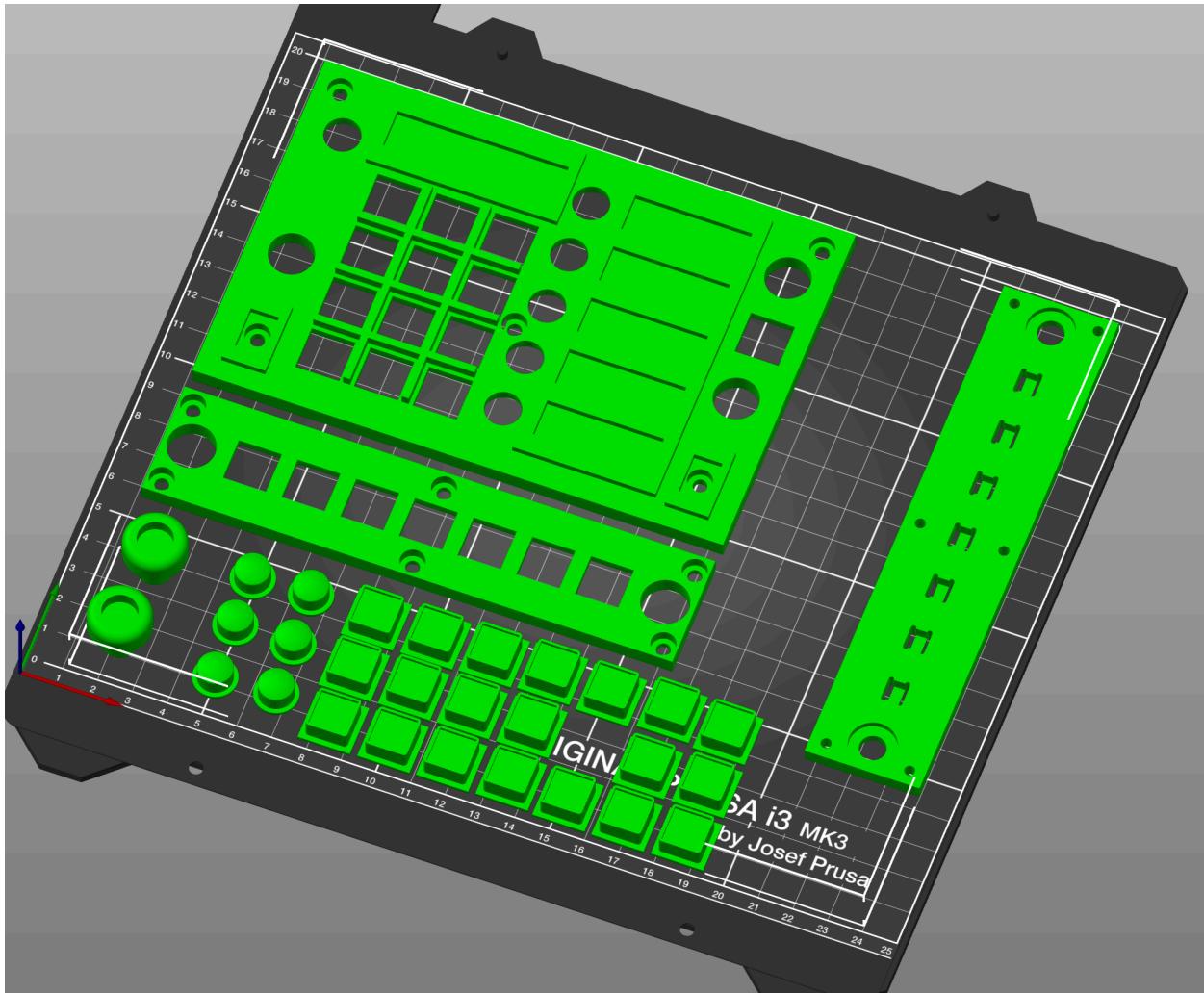
— Note on Supports —

Job 1 when printed in the orientations recommended requires supports. The supports are minimal and easily removed by hand or with the tip of a hobby knife. PrusaSlicer will handle this using the following setting. Jobs 2 and 3 require no supports for proper printing.



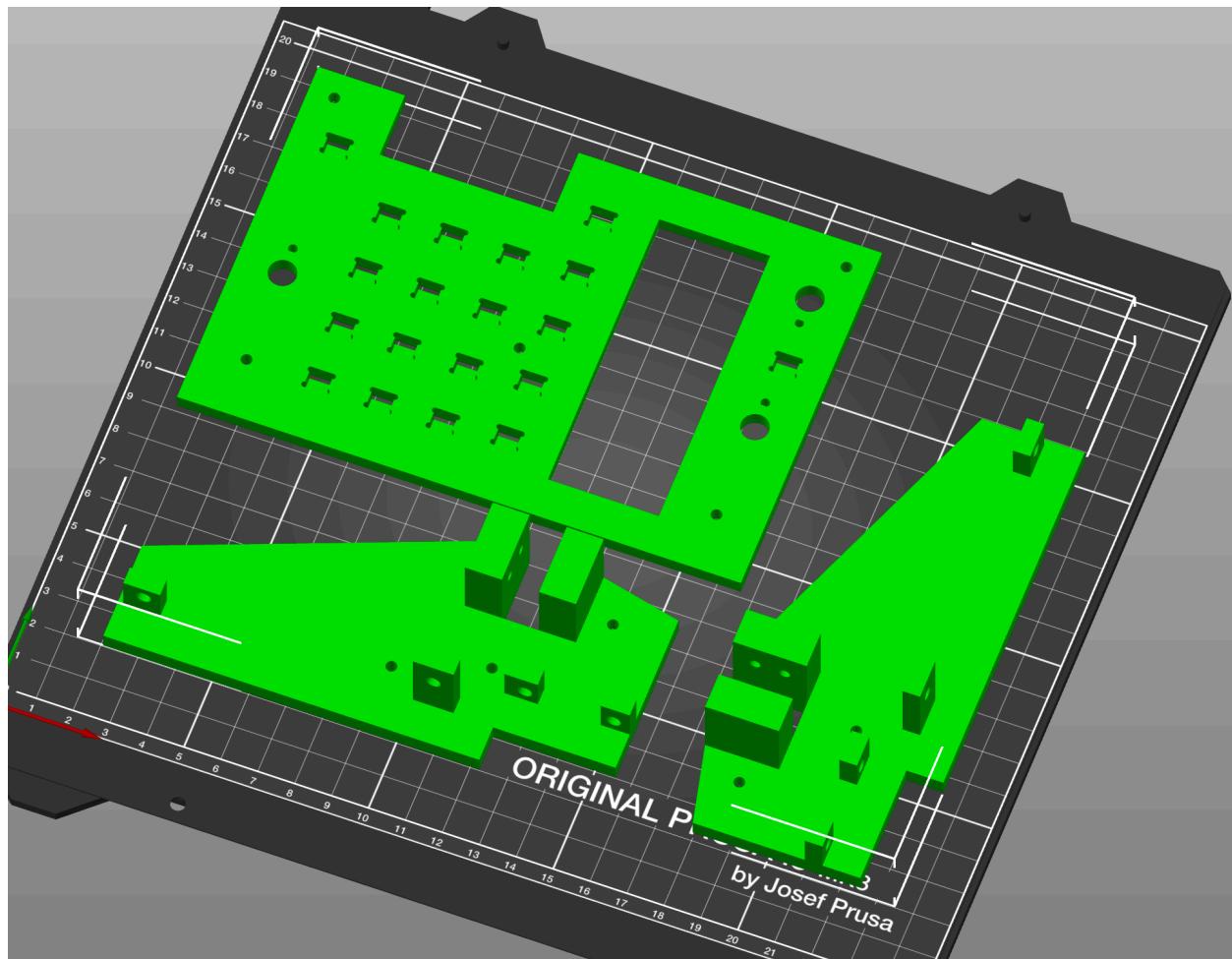
(See Parts List.pdf for which items belong to which job)

Layout Recommendations

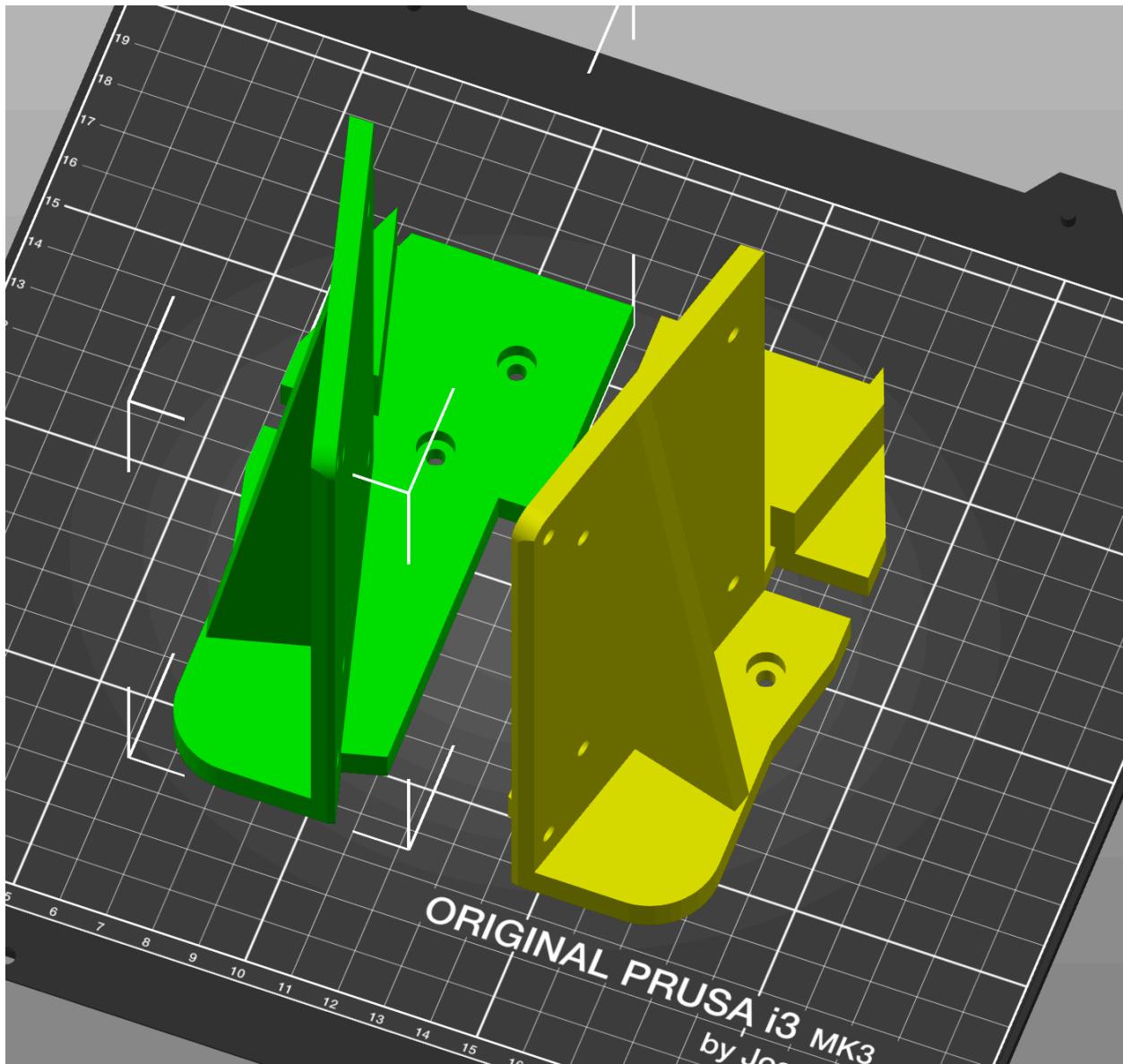


Job 1

Job 2



Job 3

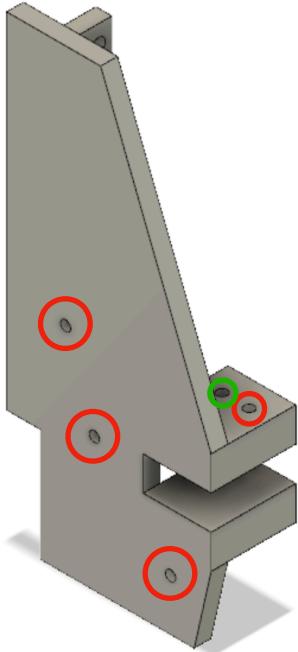


Assembly Process

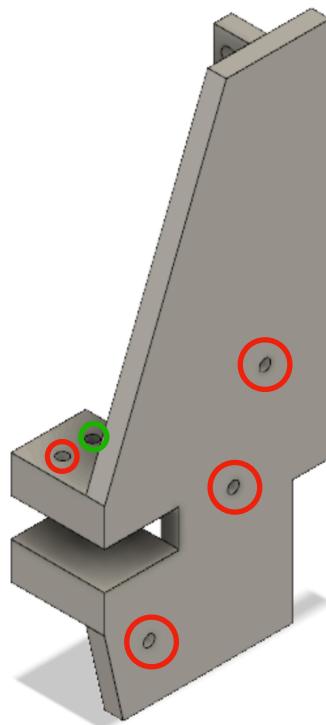
Tapping/Drilling Holes

Grab your drill or 6-32 tap and either drill out or tap through the following holes on the following parts:

Clamp Mount (Right)



Clamp Mount (Left)

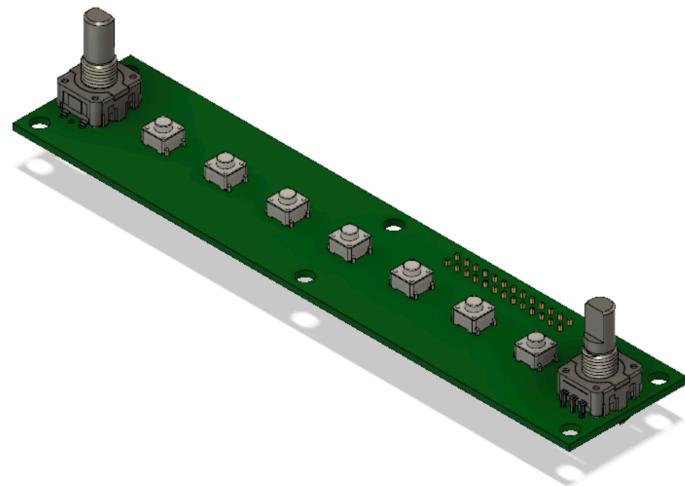
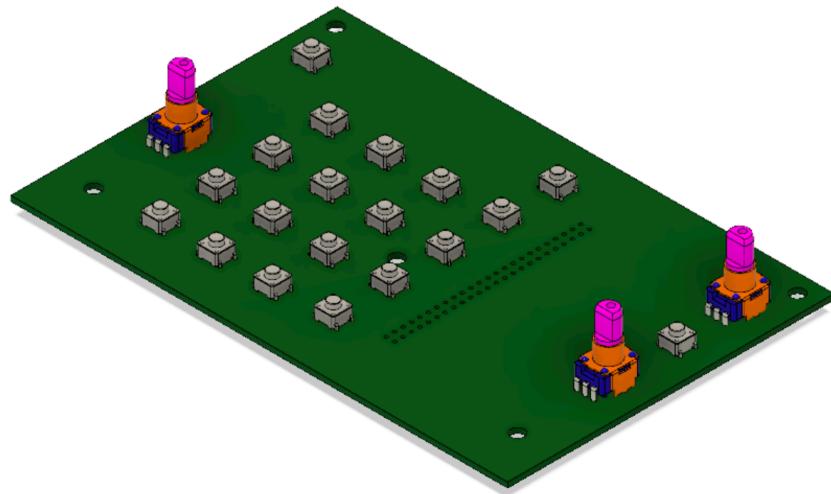


Note: You can also tap the green holes if desired but I've found that the single red hole provides sufficient strength for mounting on my setup

Placing Switches

Assembly starts with the PCB panels to hold the switches and knobs. The **6mm tactile switches** should press into the holes with little effort. The side tabs on the encoders and potentiometers will need to be bent in a little and some force expended to get them into the holes properly. Be careful. The assembled panels should look like the images below.

Make sure the headers are on the OPPOSITE side from the buttons otherwise stuff won't go together when placing the plates on top.



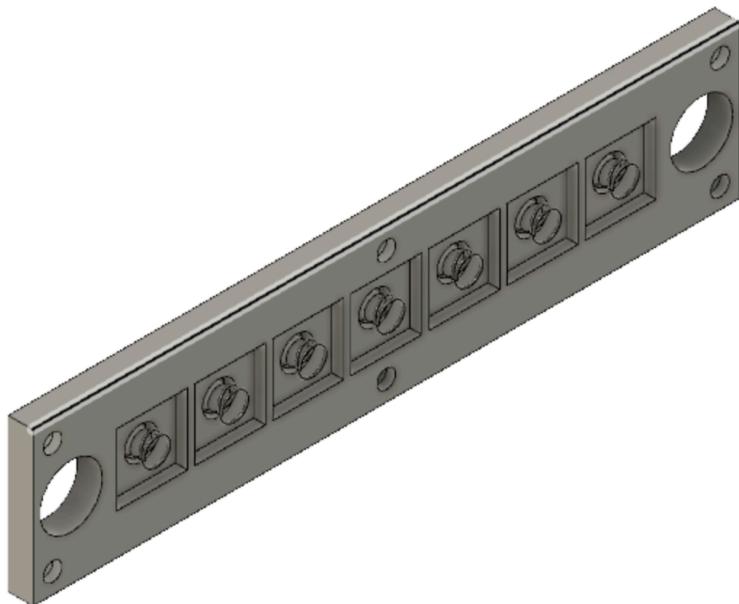
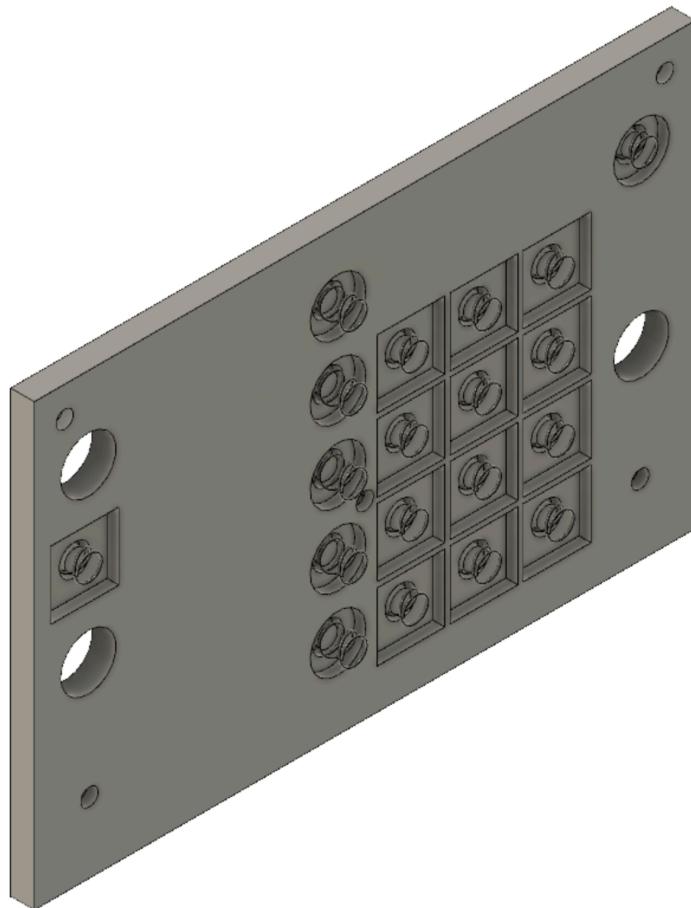
Soldering

This is the point where you flip on your soldering iron and go to town on all the little contacts on the back of the PCB. All the switches should hold their position relatively well.

Make SURE all the switches are flat against the board. Any lift will interfere with the buttons working correctly.

Place Springs and Button Caps

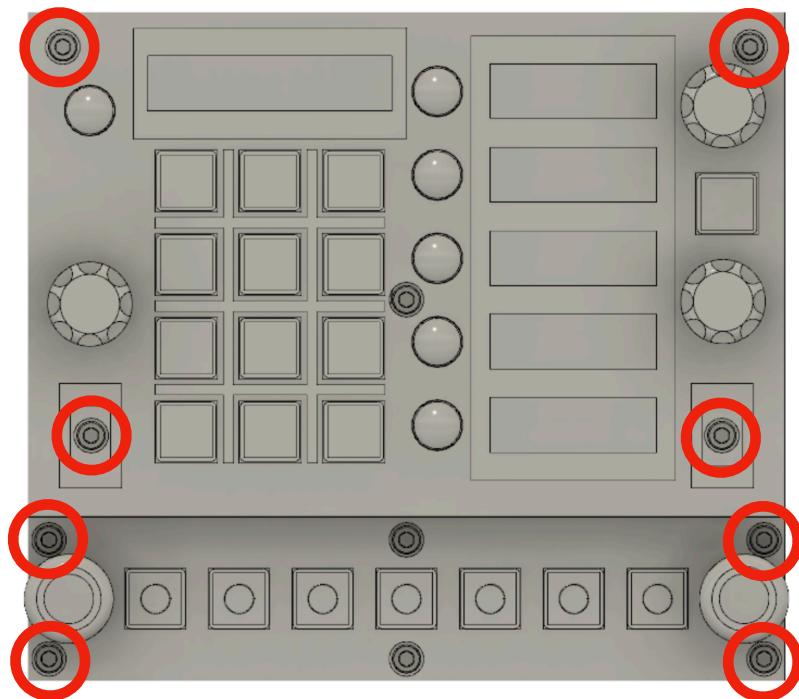
If you are using springs then place them inside the slots in the button caps. Otherwise just place the button caps in the holes. You may need to sand the bottom outer edges of the button caps to ensure a smooth fit. Sandpaper or a simple scrape along the edge with a hobby knife worked for me on any “sticky” buttons.



Panel Assembly and Knob Attachment

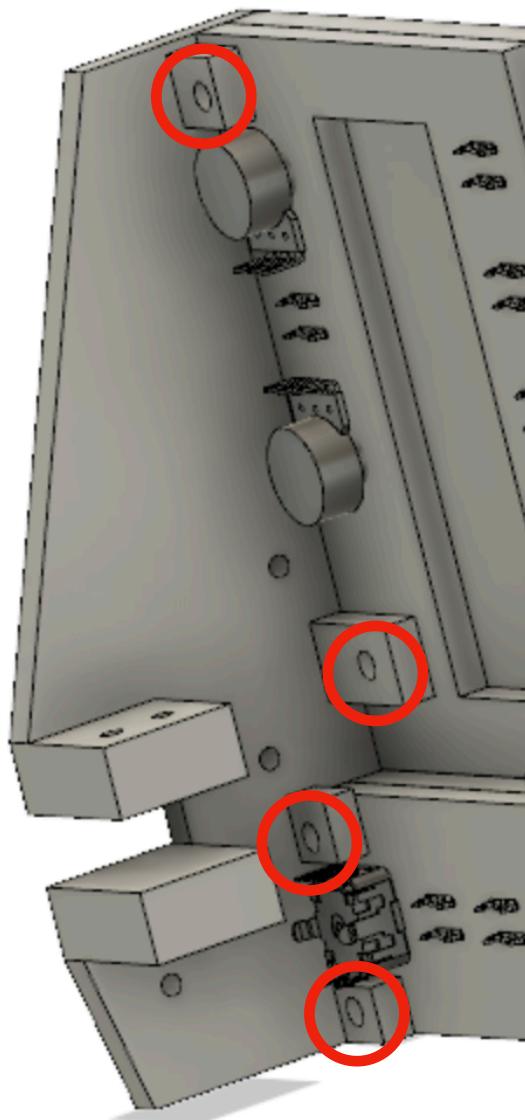
Now sandwich and secure the top, bottom and PCB panels together using the 6-32 Machine Screws and test all buttons for “clickyness”. Then place all knobs on the encoders and potentiometers. The Potentiometer knobs may take a little force to put on. The knobs should slide on and hold pretty easily. If any of the knobs are loose you can use a little bit of hot glue on the end of the potentiometer or encoder to help with hold.

Note: When assembling the panel with the screws be sure to use longer screws on the following holes, you will need them to mount the clamps:



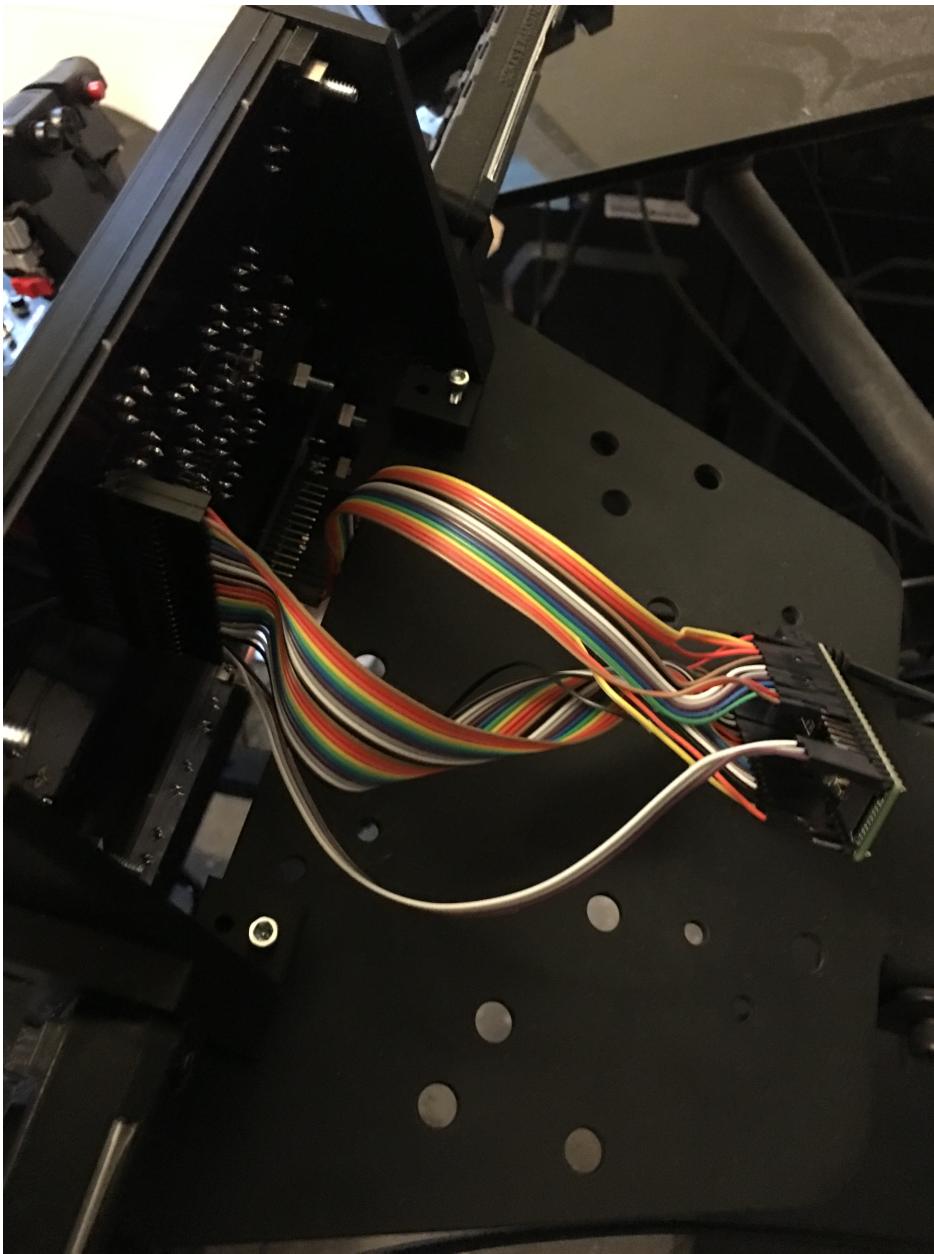
Attaching the Mount Clamps

The next step is slotting and securing the mount clamps. Starting with either the left or right mount clamp slide the panels into the holes on the clamp and secure them with the nuts. This is where you should take care to have used long screws on the indicated holes from the panel assembly step. The clamp mount holes are 4mm and so should slide pretty easy.



Wiring things up

Grab the Jumper Wire Ribbon Cables and start connecting the headers to the Teensy 3.6 (or other control board) Eventually you'll end up with something that looks vaguely like this :

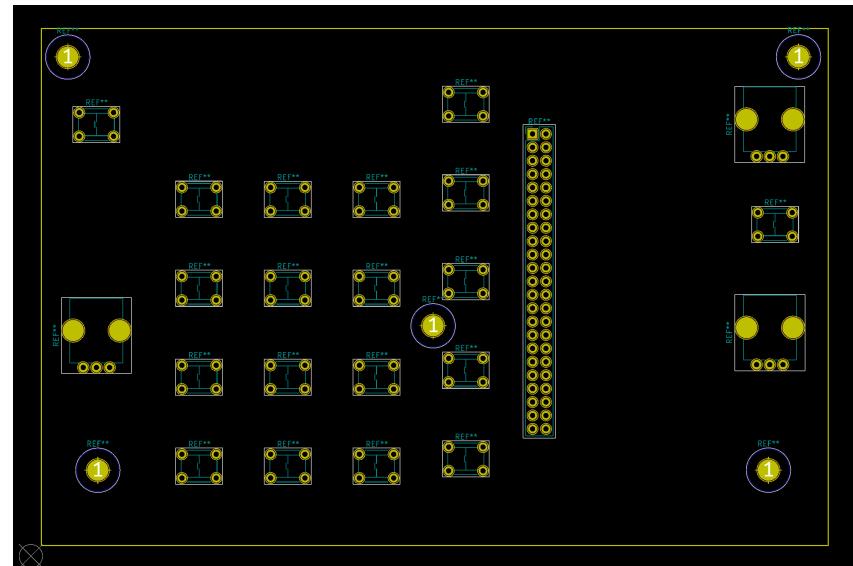


Once that's finished you can plug in the board and start testing your buttons. If they all work as expected then you can continue with the assembly process.

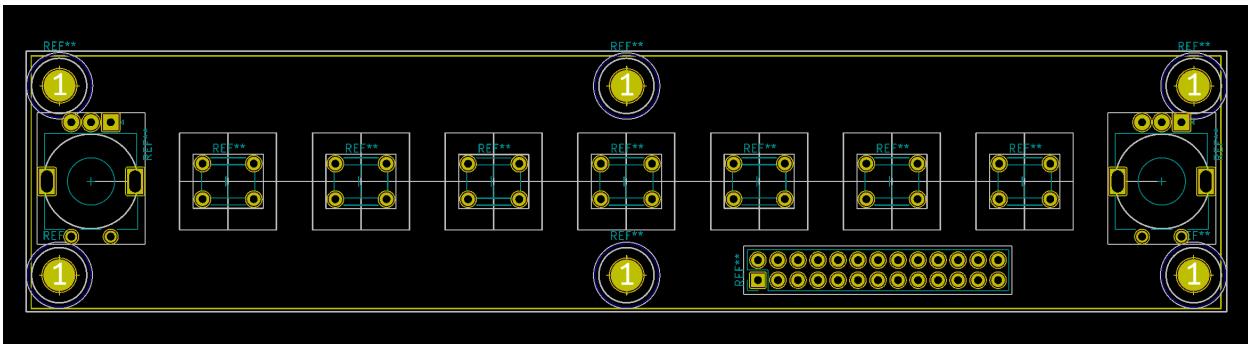
Pinouts

(Viewed From Top)

	3.3v	REF**	GND
0	3.3v		-
B1		REF**	-
B2			-
B3			-
B4			-
B5			-
B6			-
B7			-
B8			-
B9			-
B10			-
B11			-
B12			-
B13			-
B14			-
B15			-
B16			-
B17			-
B18			-
B19			-
K1			-
K2			-
K3			-



Teensy 3.6 Pin Map



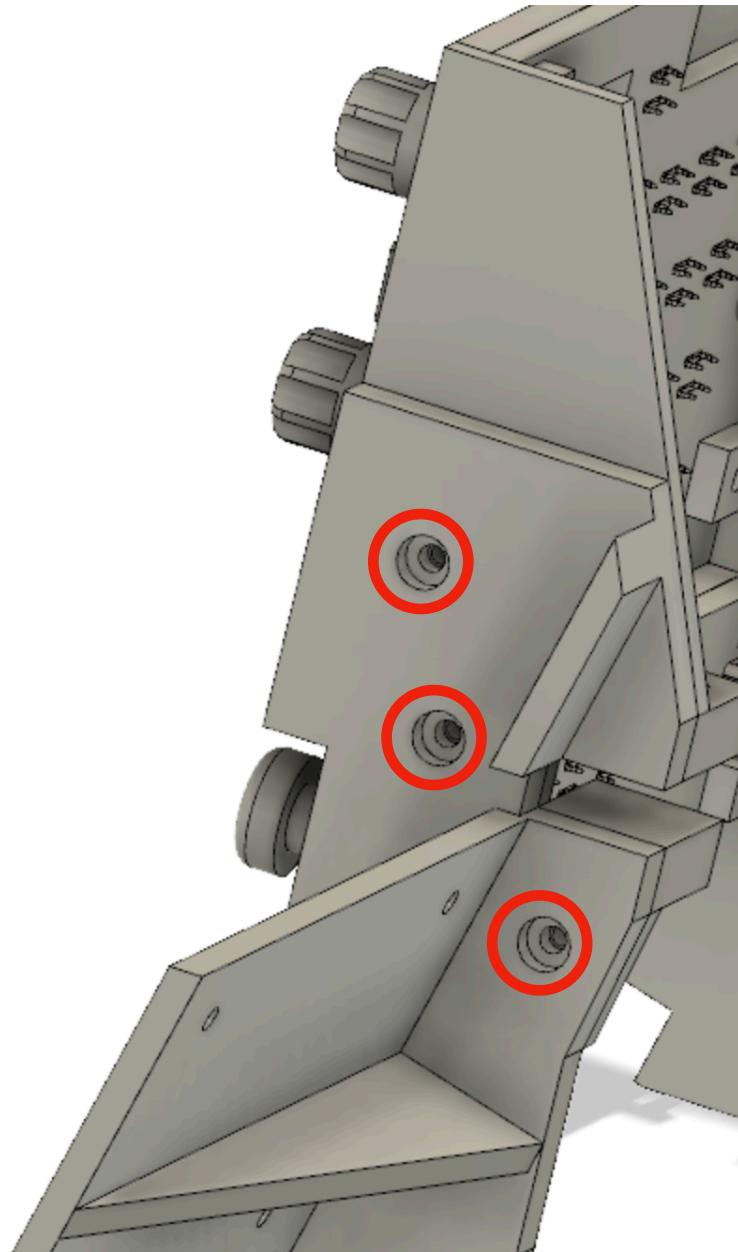
Teensy 3.6 Pin Map

	23	22	21	20	19	18						
EB1	E1	E1	B1	B2	B3	B4	B5	B6	B7	E2	E2	EB2
	REF**											

----- Ground -----

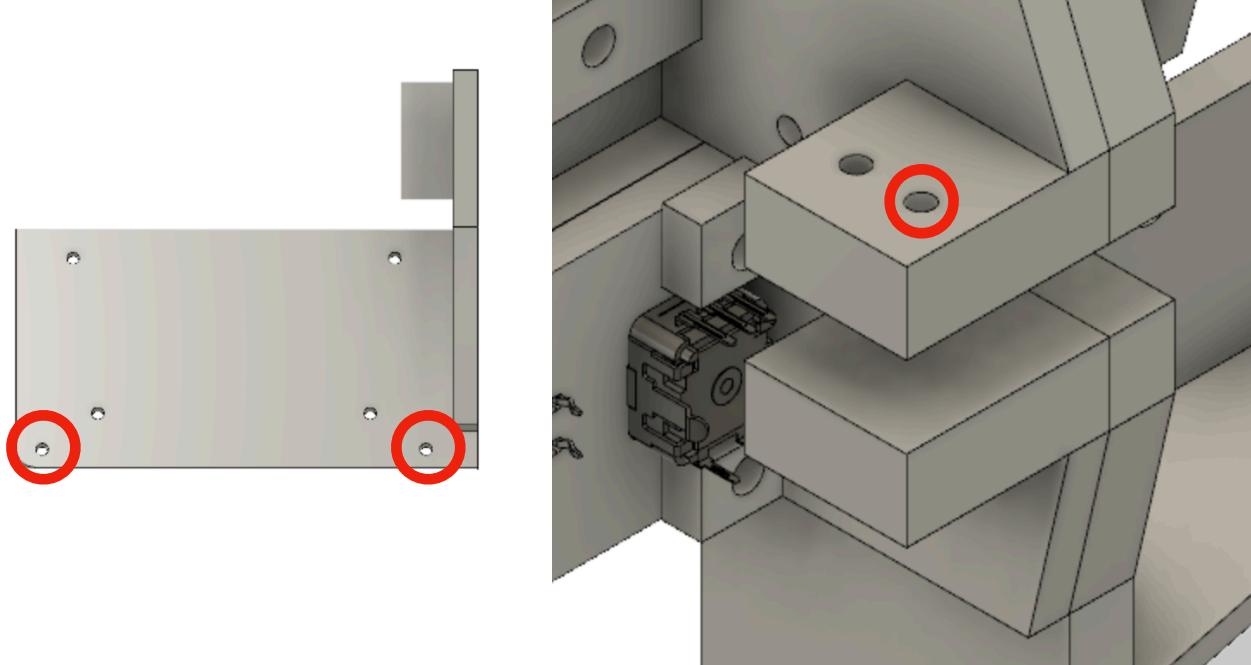
(Optional) Attaching the MFD Mounts

The next step is attaching the MFD Mounts to the Clamp Mounts. Align the screw holes and then secure the mounts using the screws and nuts (if you drilled rather than tapped these holes.



Attaching the MFDs and Clamping screws

Once the MFD Mounts are attached you can place the MFD Holding Screws and Back Clamp Screws. The MFD holding holes are 4mm so I use a screw, washer, and nut to hold the clamps. The back clamping screws are just run through.



Finished

Thats it. Assembly complete and hopefully mounted. Enjoy your new F-18 UFC. You'll have to bind some stuff in your flight sim of choice but hey, you're old hat at this and should have that done in 10 minutes or so.

