APEROLiker
HUGOliker

APEROLIKER BUILD GUIDE

Version 11.01.2024

PROLOG

Before you begin on your journey, a word of caution.

In the comfort of your own home, you are about to assemble a robot. This machine can burn or electrocute you if you are not careful. Please do not become the first APEROLIKER fatality. There is no special Reddit flair for that.

Please, read the entire manual before you start assembly.

Most of all, good luck!
THE APEROLIKER TEAM

Finally, thank you to Christoph, Kai and Jakob who always support my work.

TABLE OF CONTENTS

INTRODUCTION

PART PRINTING GUIDELINES
We recommend you follow these Guidelines.

3D PRINTING PROCESS:
Fused Deposition Modeling (FDM)

MATERIAL:
PLA / ABS

LAYER HEIGHT:
Recommended: 0.2mm

EXTRUSION WIDTH:
Recommended: Forced 0.4mm

INFILL TYPE:
Gyroid

INFILL PERCENTAGE:
Recommended: 40%

WALL COUNT:
Recommended: 4

SOLID TOP/BOTTOM LAYERS:
Recommended: 5

FILE NAMING
By this time you should have already downloaded our STL/3MF files. You might have noticed that we have used a unique naming convention for the files. This is how to use them.

PRIMARY COLOR:
Example: ControlPanelRing.3mf
These files will have nothing at the start of the filename.

ACCENT COLOR:
Example: [a]_Controlpanel_Aperoliker.3mf
We have added “[a]” to the front of any STL file that is intended to be printed with accent color.

QUANTITY REQUIRED:
Example: [a]_Foot_x4.3mf
If any file ends with “_x#”, that is telling you the quantity of that part required to build the machine.

SUPPORT AND MULTIMATERIAL:
Example: [MM]_HousingAperoliker.3mf
All files will print **without support**, if your 3D printer is well calibrated!

Except for the file of the housing. The "support structure above print bed" must be activated there!

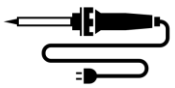
In addition, you will notice the [MM]. The housing can be printed as a multi-material. No colour changer is necessary for this. See the chapter "Print housing multimaterial" for more information.

OVERVIEW OF TOOLS

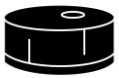
TOOLS YOU WILL NEED

You will need the following tools. You should also be familiar with them and know how to use them.

SOLDERING IRON



SOLDERING TIN



STRING CUTTER

SCISSORS

WIRE STRIPPER (OPTIONAL)

SCREWDRIVER

HOT GLUE GUN

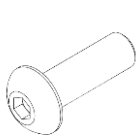
BENCH VISE (OPTIONAL)

SCALPEL

SUPER-GLUE

PARTS LIST

You can source your parts from amazon, aliexpress, ebay or from your local parts store.


BHCS


FHCS


Hex nut


Heat set insert

Part	Quantity	Description	Part	Quantity	Description
M3x25 BHCS	1	Mounting the lever	DC-DC Converter 12->5V (Model MP1584)	1	Power source of the microprocessor
M3x6 BHCS	4	Mounting the control panel to the housing	DC-DC Converter 12->20V (Model MT3608)	1	Power source of the pumps
M3x10 BHCS	6	Mounting the pumps to the housing lid	Solder wires 0.14-0.25qmm	5m	Use different colors for recognizability
M3x8 FHCS	8	Mounting the housing lid to the housing	GROTHEN 12V pumps (OD ⌀5mm, ID ⌀3mm tube)	3	Peristaltic pumps
M3x8 FHCS	8	Mounting the feet to the housing	Tube OD ⌀5.5mm, ID ⌀3.5mm	3m	Tubing betweet bottles and aperoliker
M3x5.7mm heat set insert	31	For all screw holes (See Ruthex)	Rotary encoder aluminium knob	1	Control panel
6x6x150mm Aluminium profile	4	Extended Feet (optional)	Rotary encoder KY-040	1	Control panel
Stainless steel straws, OD ⌀5mm, ~240mm	3	Extension of the tubing	470µF, 35V capacitor	1	Voltage stabilization 20V
Rubber band 500mm	1	Used for holding the bottles (optional)	17x7mm breadboard (4x2 holes)	2	Base board for power LEDs
M8 hex nut	4	Weight of the drip tray (optional)	32x47mm breadboard (12x18 holes)	1	Custom output stage PCB
100k Ohm resistor	4	Output stage parts	Shrink tubing	30cm	Electrical insulation
100 Ohm resistor	4	Output stage parts			
470 Ohm resistor	1	LEDs resistor			
1N4007 diode (or any >1A diode)	4	Output stage parts			
22µF, 35V capacitor	3	Output stage parts			
IRLU024N mosfet	4	Output stage parts			
Tactile switch 6x6mm	1	Lever switch for dispensing			
DC jack, OD ⌀7mm	1	Connector for power supply			
12V Power supply	1	Power supply for APEROLiker/HUGOliker			
Piezo buzzer, OD ⌀11.5mm	1	Sound output when operating			
Wemos S2 mini	1	Microprocessor			
GMT130-V1.0 display IPS 240x240	1	Display			
Power LED	2	For illuminating the bottles			

PARTS LIST

WHAT PUMP TO BUY:

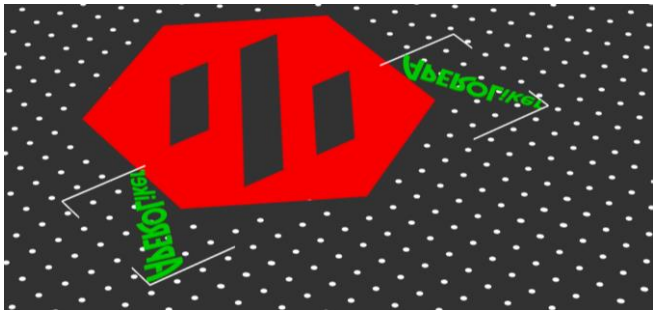
With 3mm ID and 5mm OD tube

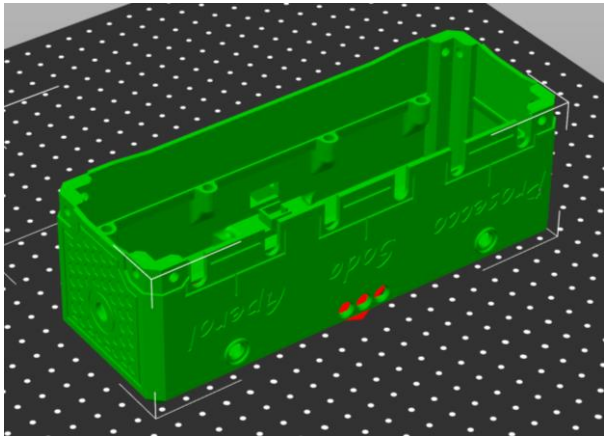
Volt: DC 12V
Tube size: 3*5mm
Flow rate: 150 ml/min (max)
Turning speed: 0.1-60 rpm
Driver size (Φx H): Dia. 32mm x Height 23mm
Install hole: 48.5mm

PRINT HOUSING MULTIMATERIAL

PRINT HOUSING

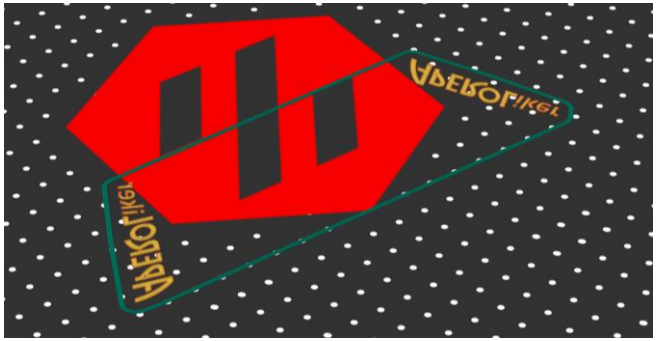
It is possible to print the housing with two colors **without a multi material unit** or color changer like the Prusa MMU or Bambu Lab AMS. The .3mf files are designed to print them as is, in two separate consecutive printing operations.
Step 1: Slice two different files. The first one only containing the characters ***APEROLiker*** or ***HUGOliker*** and the second with the remaining enclosure.
Step 2: Print the first file with the accent color you are using.
Step 3: Directly after the end of printing, go to the printer settings and set the bed temperature back to 55°C (PLA). This will prevent the printed characters from cooling down and from detaching from the print bed.
Step 4: Remove the skirt from the printer bed and change filament manually to your primary color.
Step 5: Print second file. The printer will wrap the letters and fuse them into a single first layer.

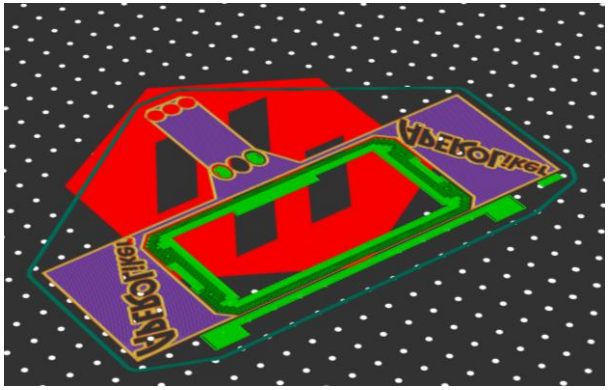


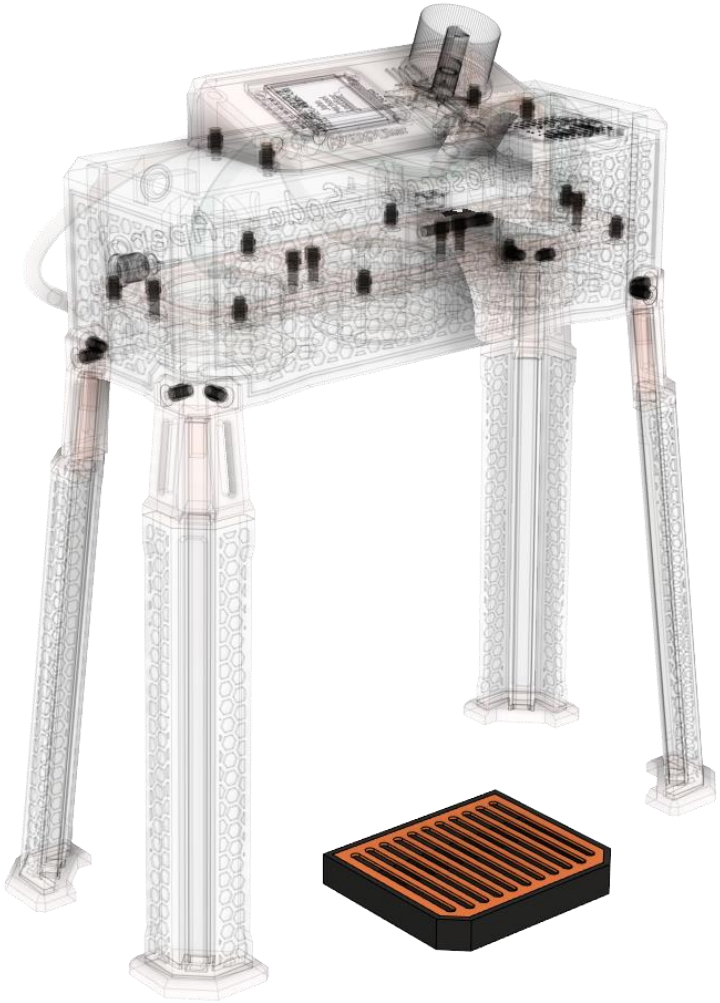


PRACTICE MAKES PERFECT

It's a bit challenging and you have to exercise patience and also start one or two more attempts. But it works and the result is stunning!







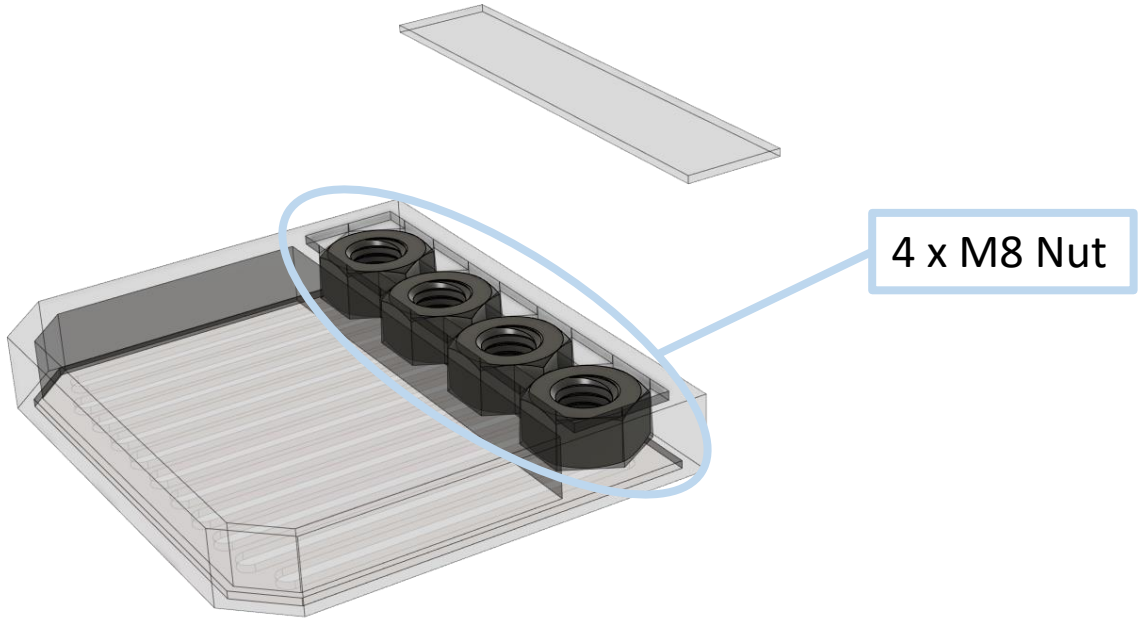
DRIP TRAY ASSEMBLY

DRIP TRAY

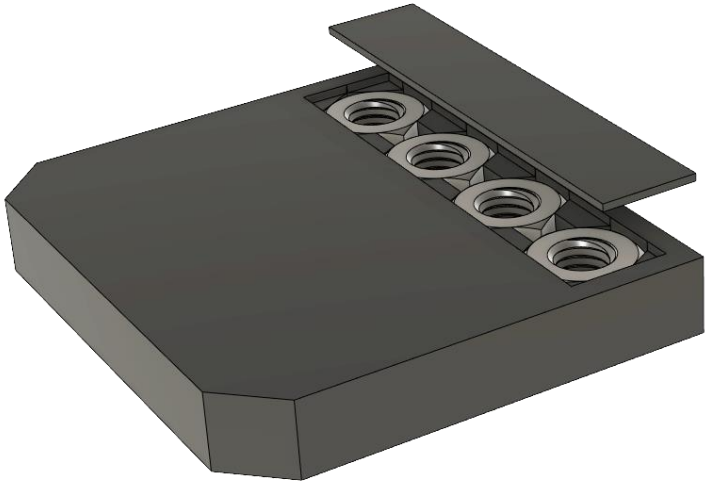
GLUE INTO PLACE

Use a fast-acting glue, like super-glue.

DRIP TRAY



DRIP TRAY



GLUE INTO PLACE

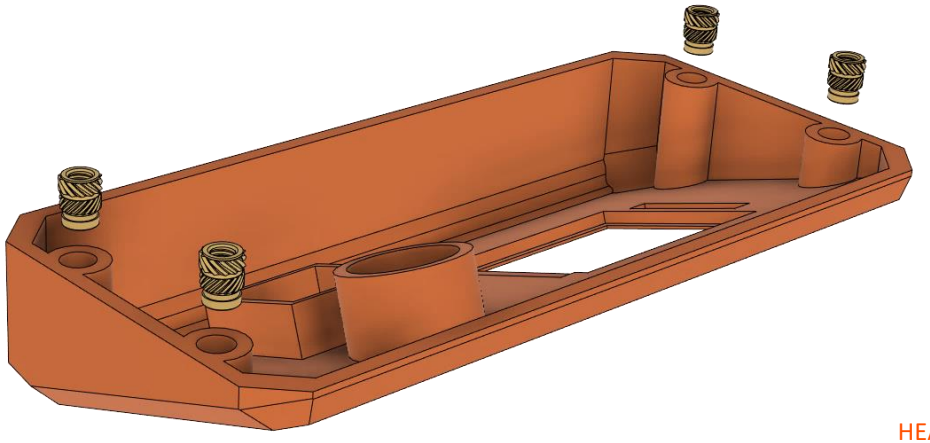
Use a fast-acting glue, like super-glue.

TIP:

Use a bench vise to press the two pieces together directly after applying the glue.

CONTROL PANEL ASSEMBLY

CONTROL PANEL



Heat Set Inserts

HEAT SET INSERTS

This design relies heavily on heat set inserts. Make sure you have the proper inserts (check the hardware reference for a close-up picture and the BOM for dimensions).

If you've never worked with heat set inserts before we recommend you watch a video guide before.

CONTROL PANEL

Control Panel Ring

GLUE INTO PLACE

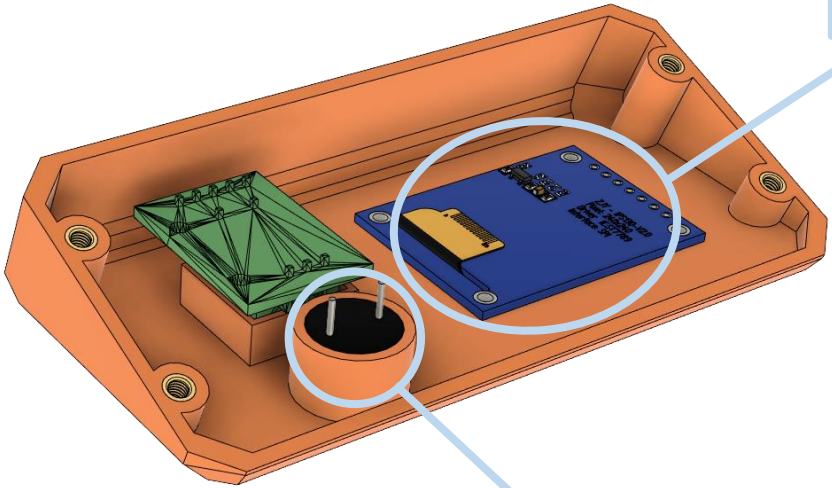
Use a fast-acting glue, like super-glue.

KY-040 Rotary Encoder

TIP:

Make sure you have soldered the cables before installing the encoder. See chapter 'Electrical wiring'.

CONTROL PANEL



Display 1.3“ IPS 240x240

GLUE INTO PLACE
Use a hot glue gun to glue in place.

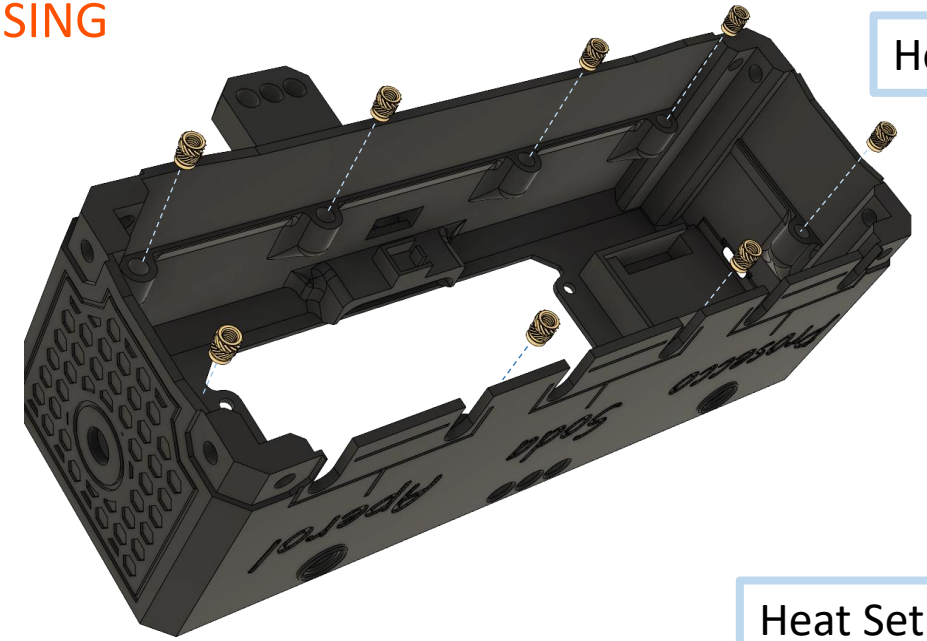
TIP:
Make sure you have soldered the cables before installing the display and the buzzer. See chapter 'Electrical wiring’.

Piezo Buzzer

GLUE INTO PLACE
Use a fast-acting glue, like super-glue.

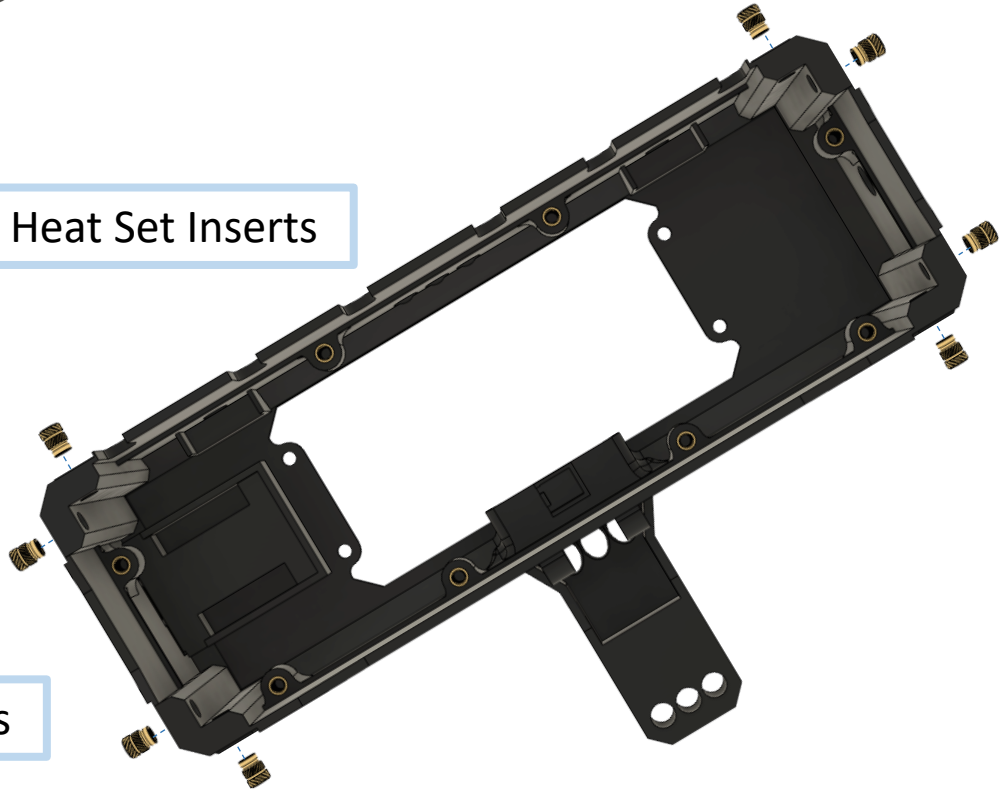
HOUSING ASSEMBLY

HOUSING

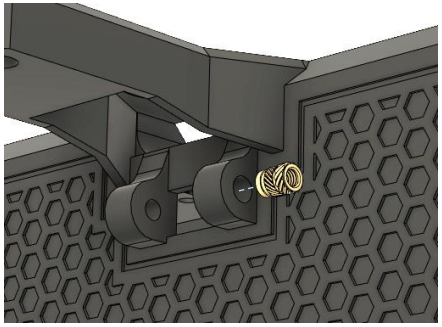


Heat Set Inserts

TIP:
If you printed with PLA, do not apply to much heat.

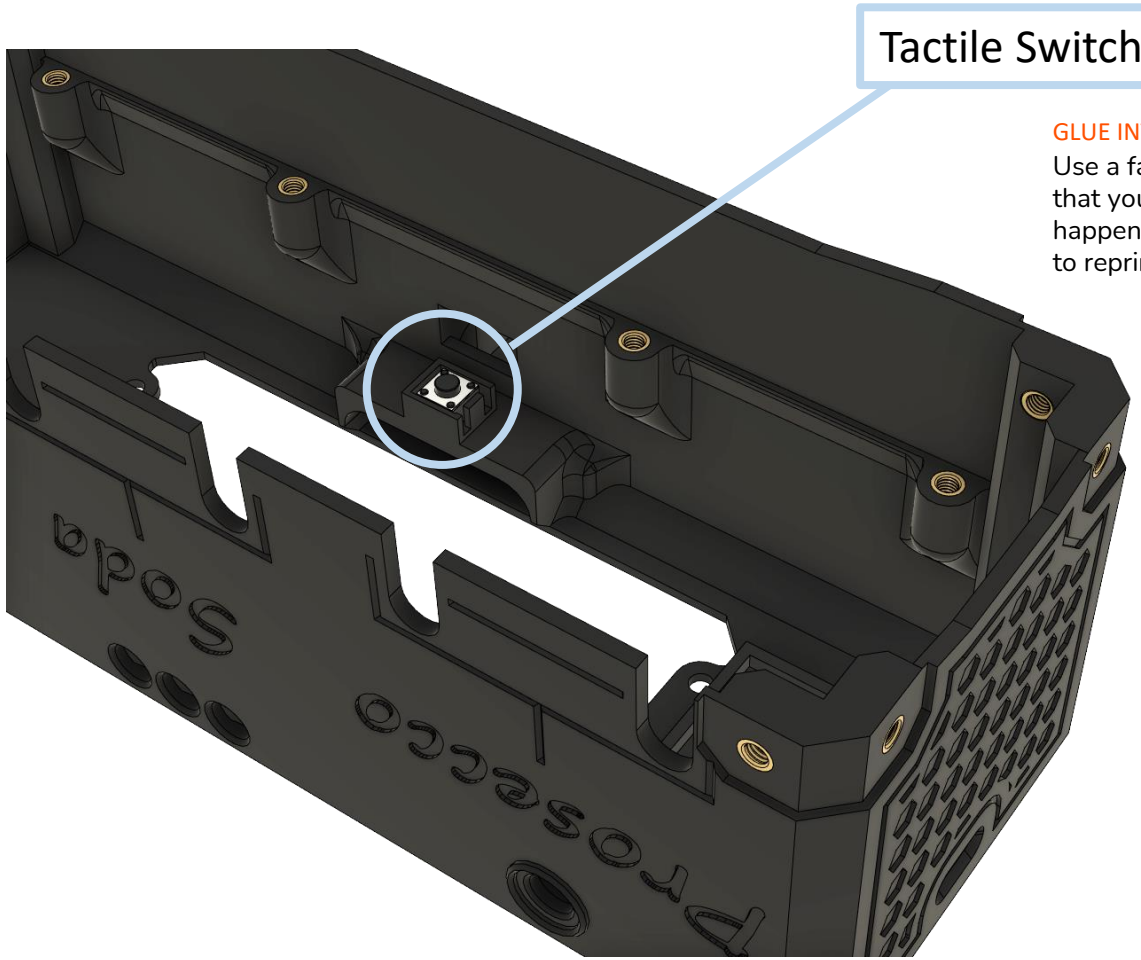


Heat Set Inserts



Heat Set Inserts

HOUSING



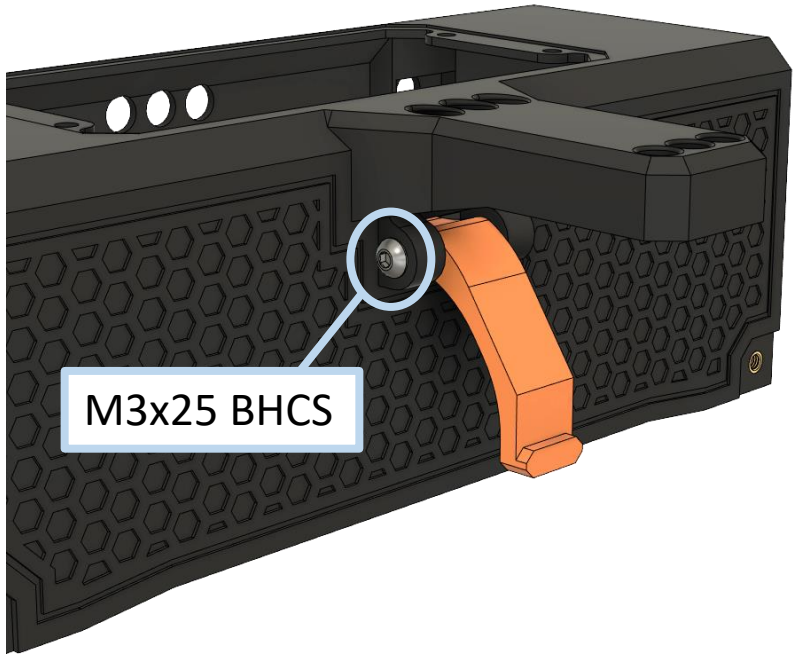
GLUE INTO PLACE

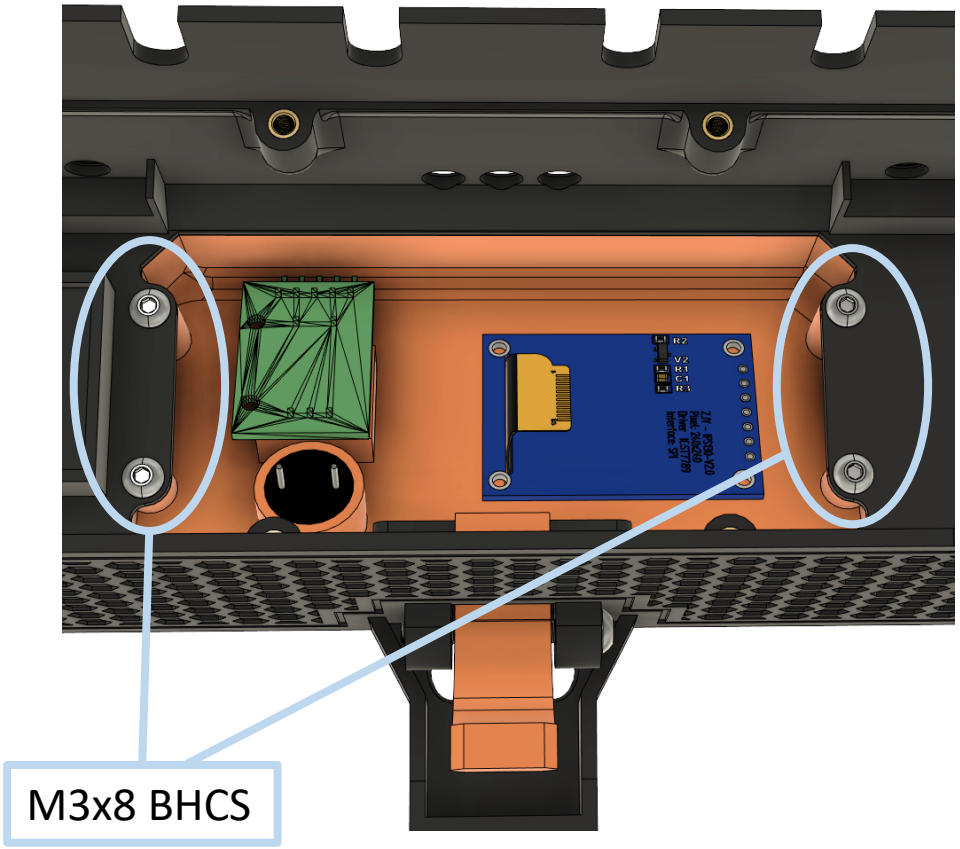
Use a fast-acting glue, like super-glue. Be careful so that you don't stick the switch as well. If this happens, the button is unusable, and you may have to reprint the entire housing.

TIP:

Make sure you have soldered the cables before installing the tactile switch. See chapter 'Electrical wiring'.

HOUSING





HOUSING

DC Connector Jack

GLUE INTO PLACE

Use a fast-acting glue, like super-glue.

TIP:

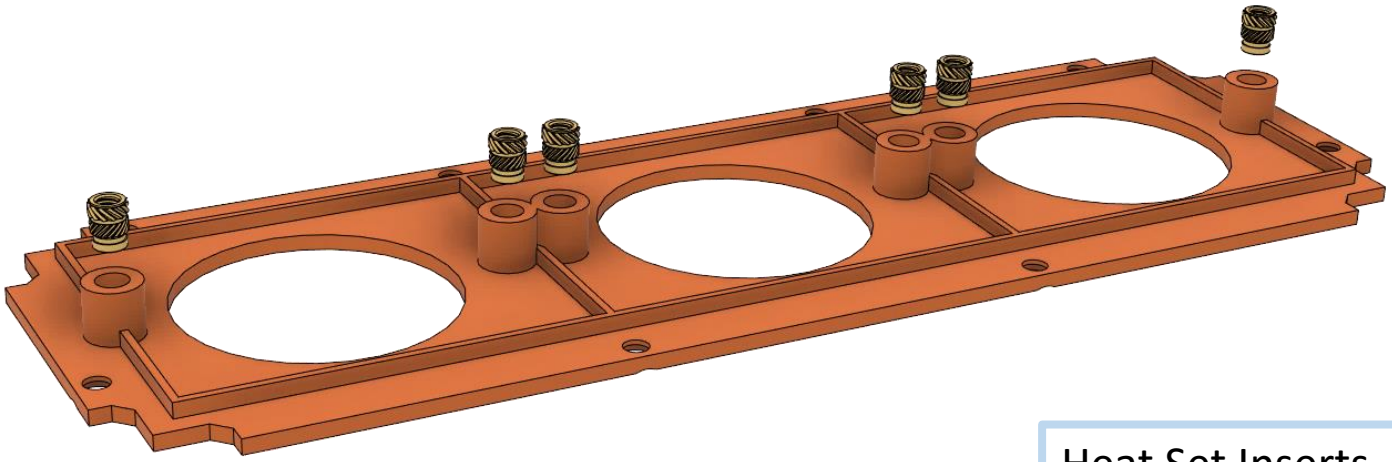
Make sure you have soldered the cables before installing the DC jack and the power LEDs. See chapter 'Electrical wiring'.

SOLDER POWER LED

Use 17x7mm breadboard to solder the power LED on

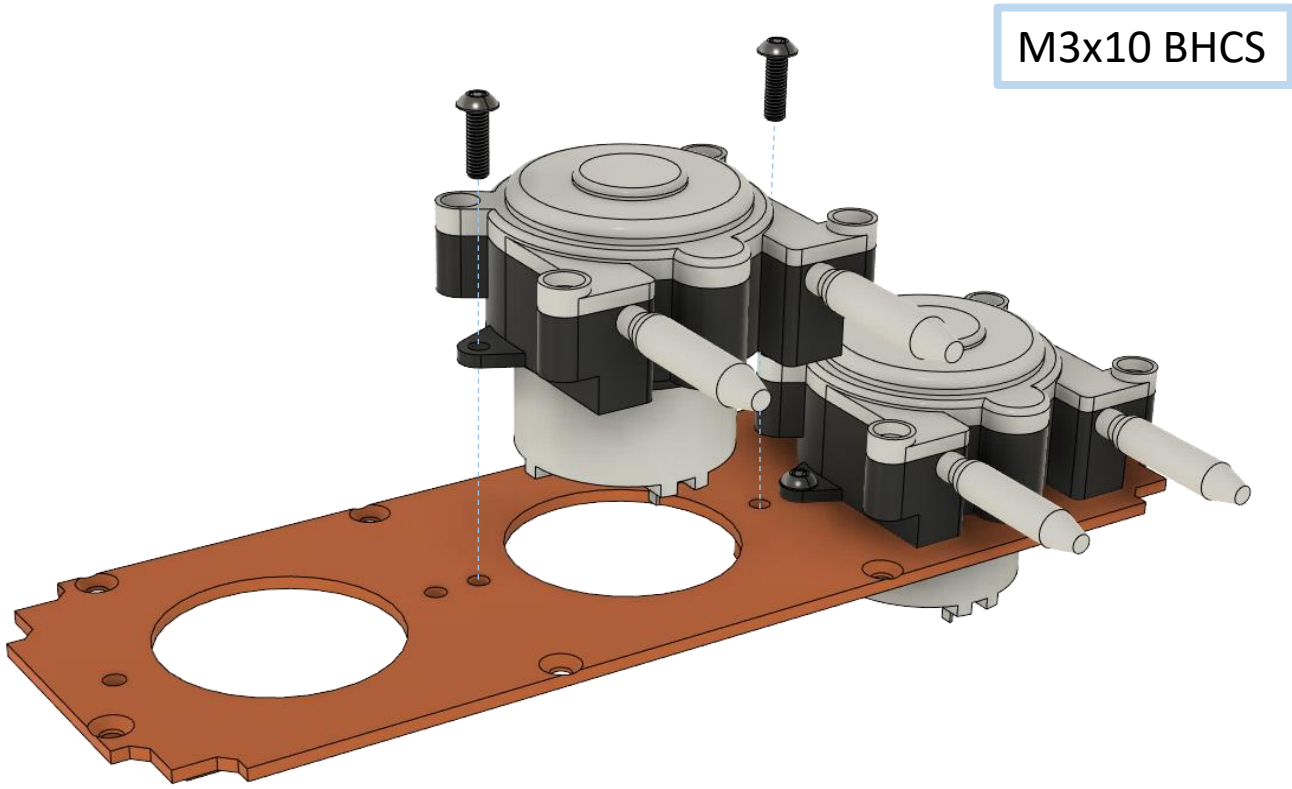
HOUSING LID ASSEMBLY

HOUSING LID



Heat Set Inserts

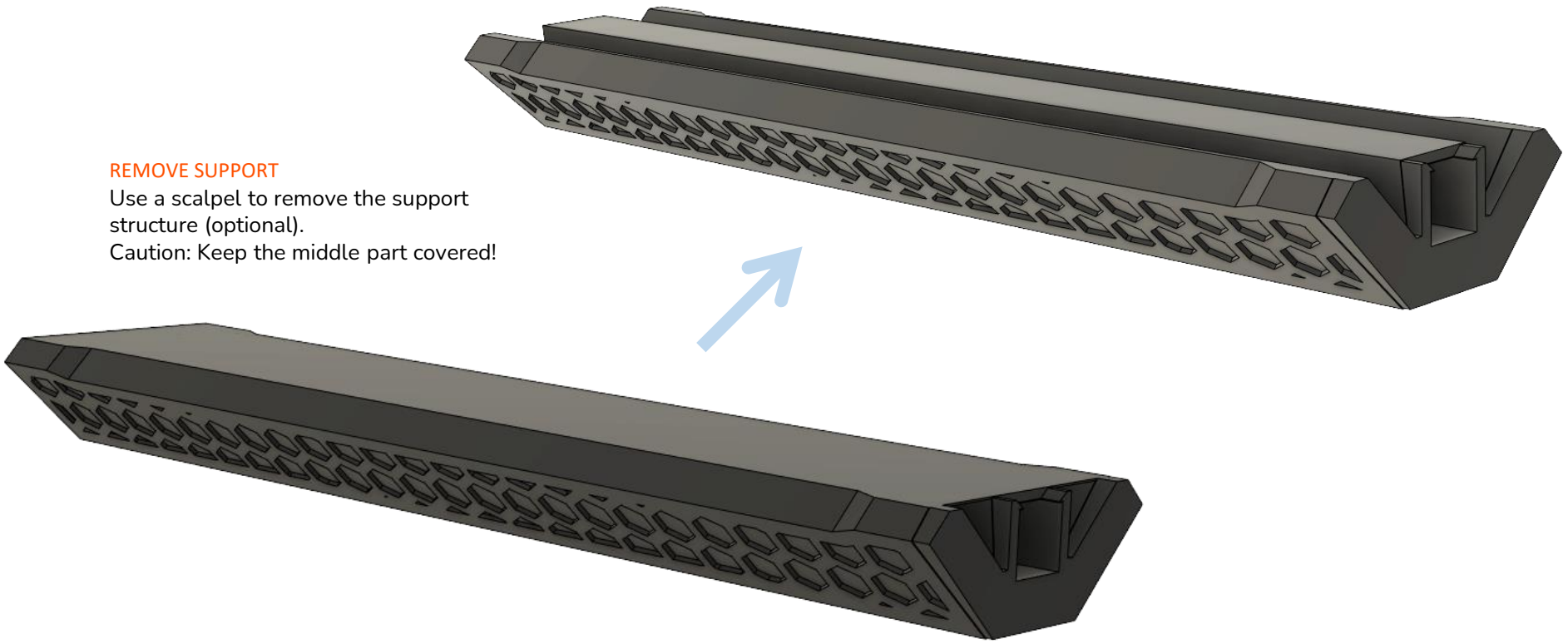
HOUSING LID



EXTENDED FEET

FEET ASSEMBLY

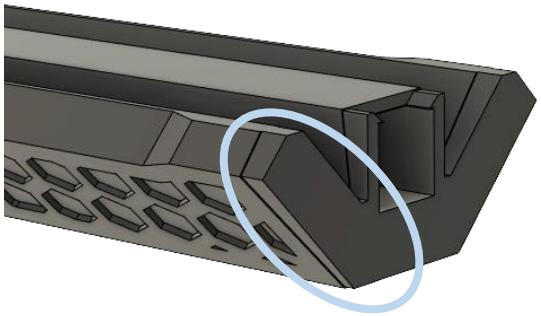
EXTENDED FEET



REMOVE SUPPORT

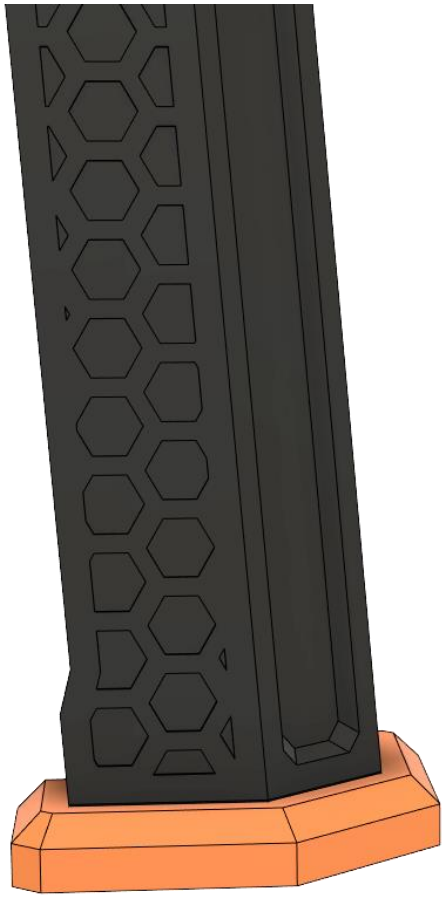
Use a scalpel to remove the support structure (optional).
Caution: Keep the middle part covered!

EXTENDED FEET



FIND CORRECT SIDE

Have a close look to find the correct side to glue on!
The right side has a notch.

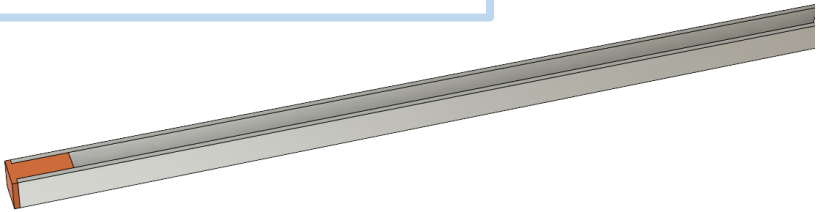


GLUE INTO PLACE

Use a fast-acting glue, like super-glue.

EXTENDED FEET

Aluminium rod 6x6x150mm

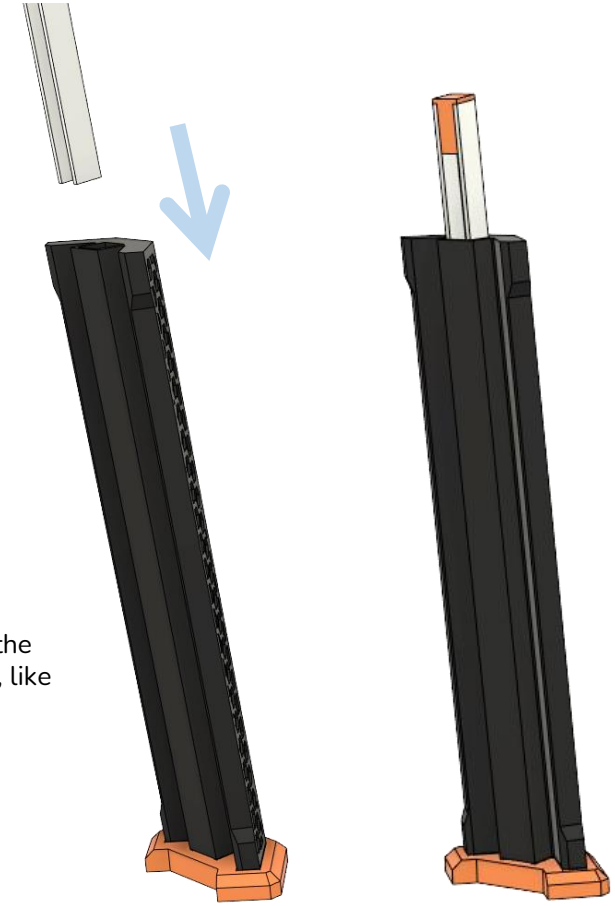


GLUE INTO PLACE

Use a fast-acting glue, like super-glue.

GLUE INTO PLACE

Fully insert into the inner part of the foot cover. Use a fast-acting glue, like super-glue.



ELECTRONICS

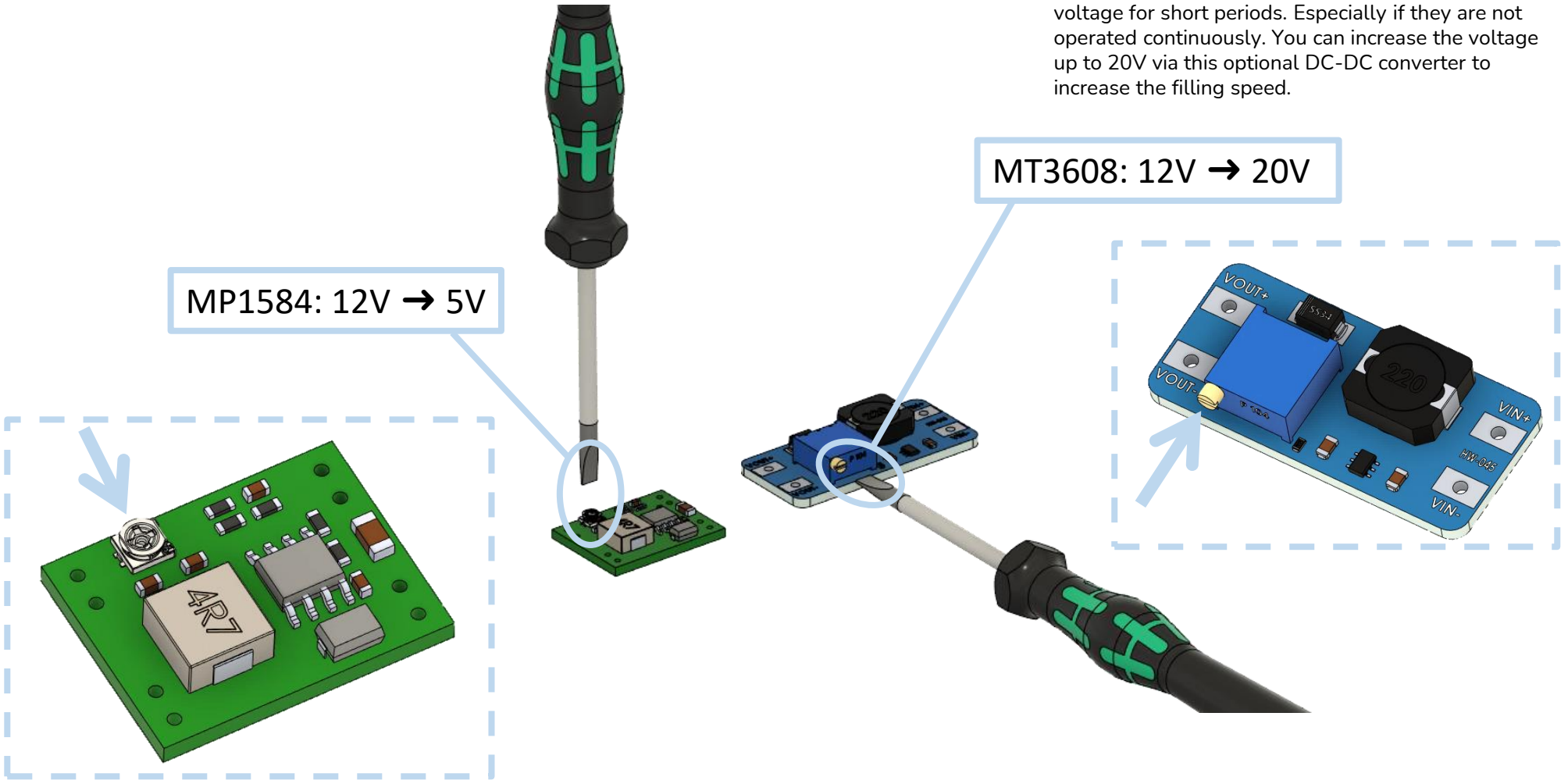
ELECTRONICS

CALIBRATING THE DC-DC CONVERTERS:

Use a screwdriver and a 12V power source to calibrate the DC-DC converters BEFORE installing them.

OPTIONAL: STEP-UP CONVERTER TO 20V

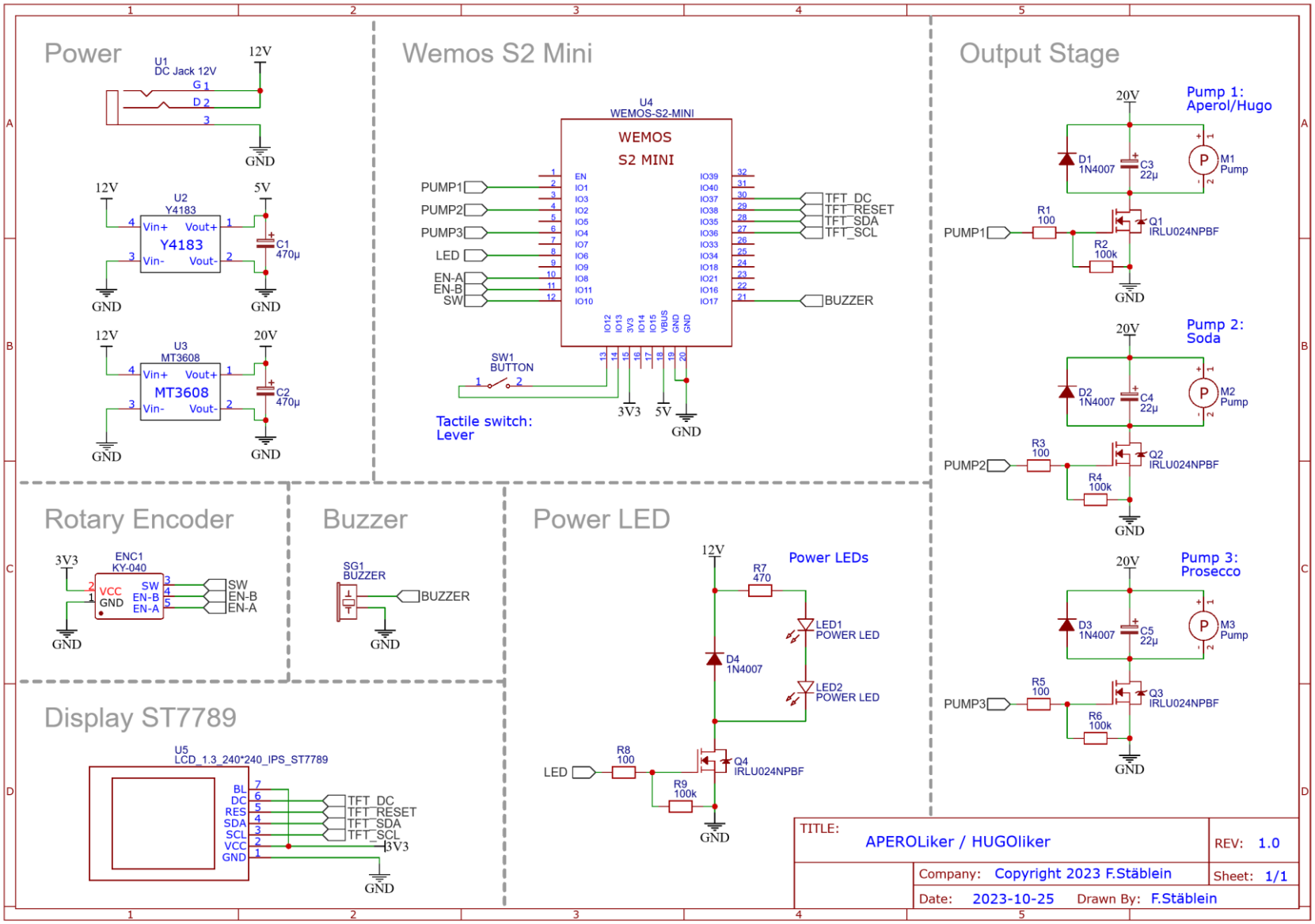
The pumps are typically 12V but can tolerate more voltage for short periods. Especially if they are not operated continuously. You can increase the voltage up to 20V via this optional DC-DC converter to increase the filling speed.



ELECTRONICS

SCHEMATICS:

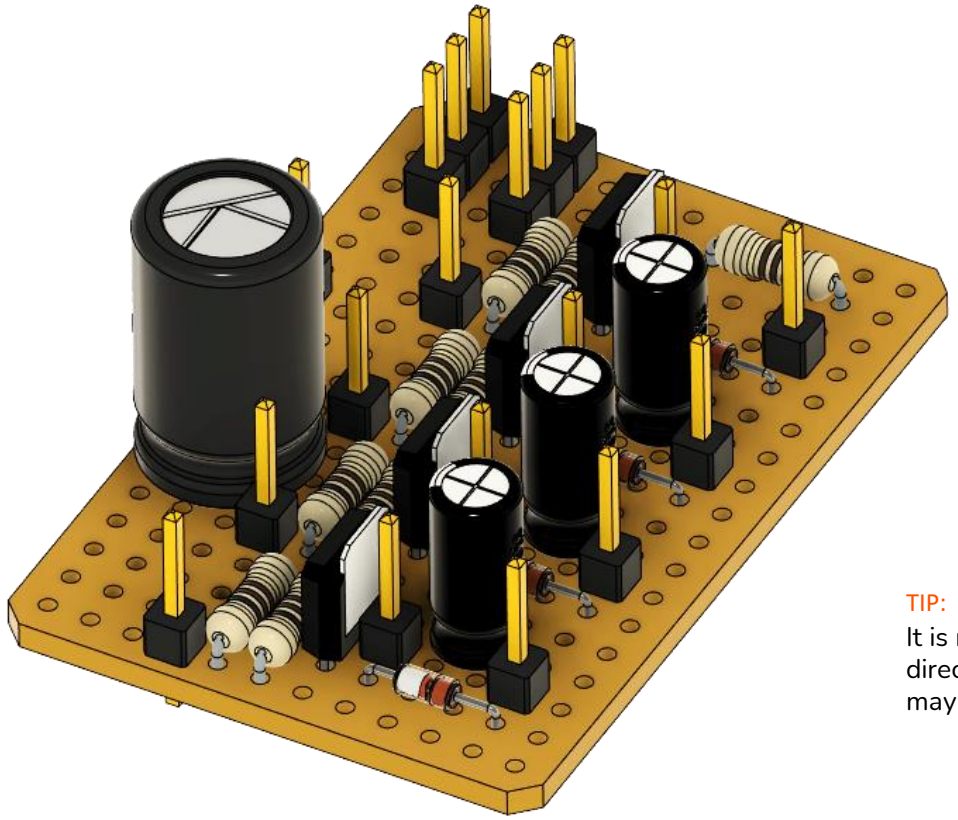
The schematics are for overview purposes only.
Use the electrical wiring diagram for wiring.



ELECTRONICS

CUSTOM OUTPUT STAGE PCB:

Solder custom PCB like shown:



TIP:

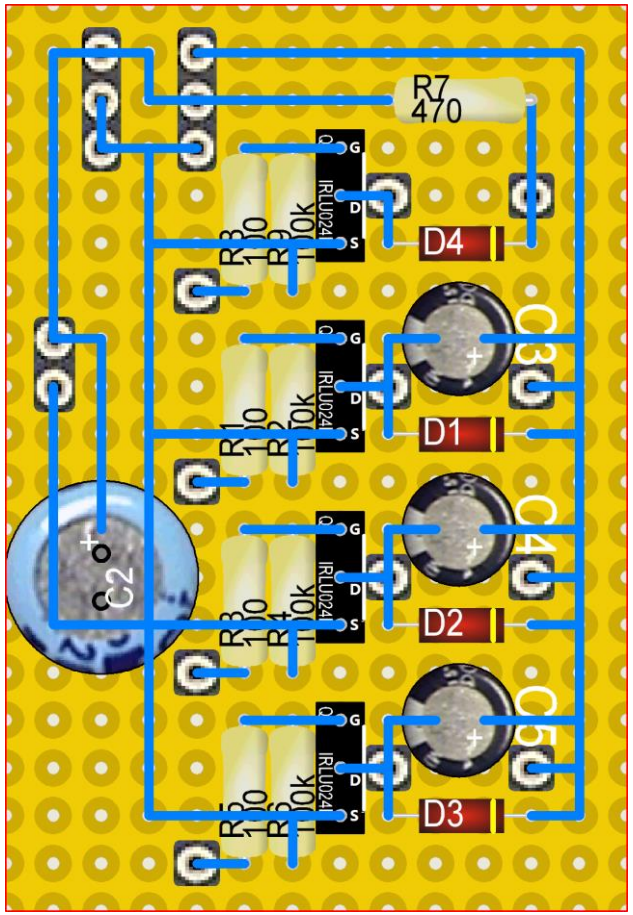
It is recommended to solder the cables directly into the PCB as the pin headers may come loose.

▼ SUGGESTED LAYOUT ON THE NEXT PAGE ▼

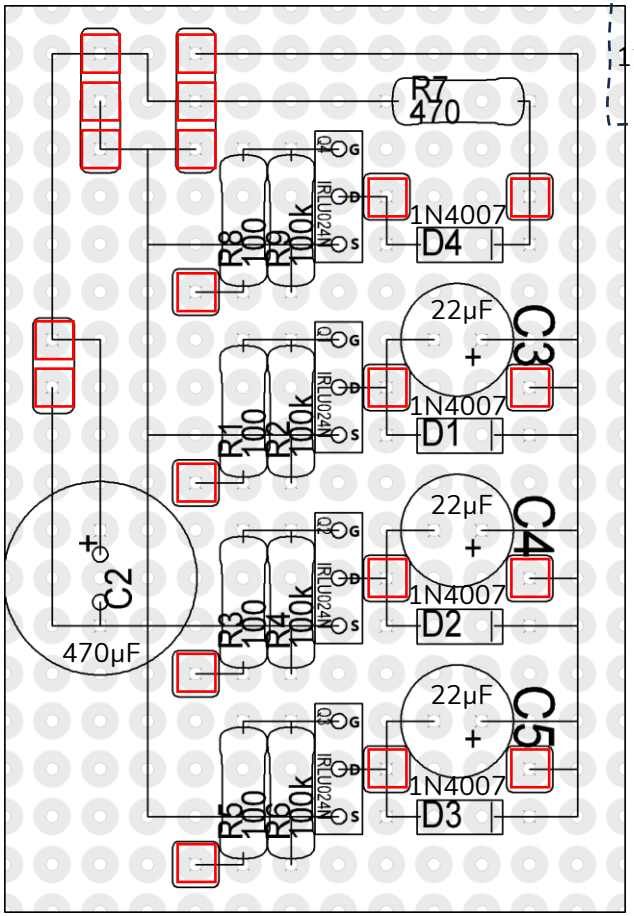
ELECTRONICS

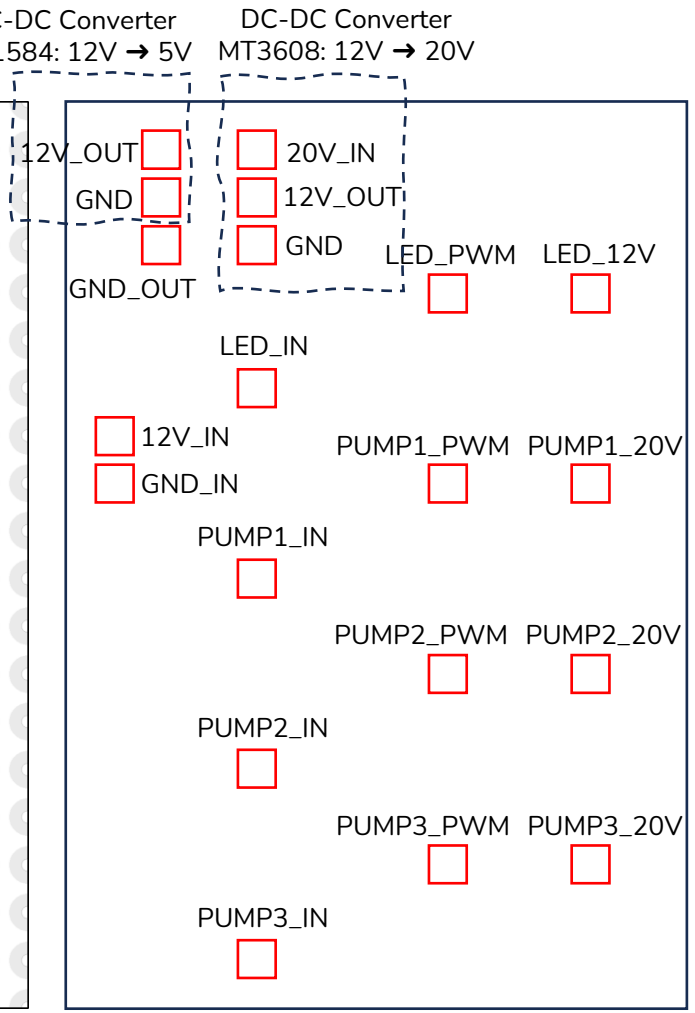
CUSTOM OUTPUT STAGE PCB:

Solder custom PCB like shown:



Breadboard: 32mm x
47,5mm (12x18 Holes)

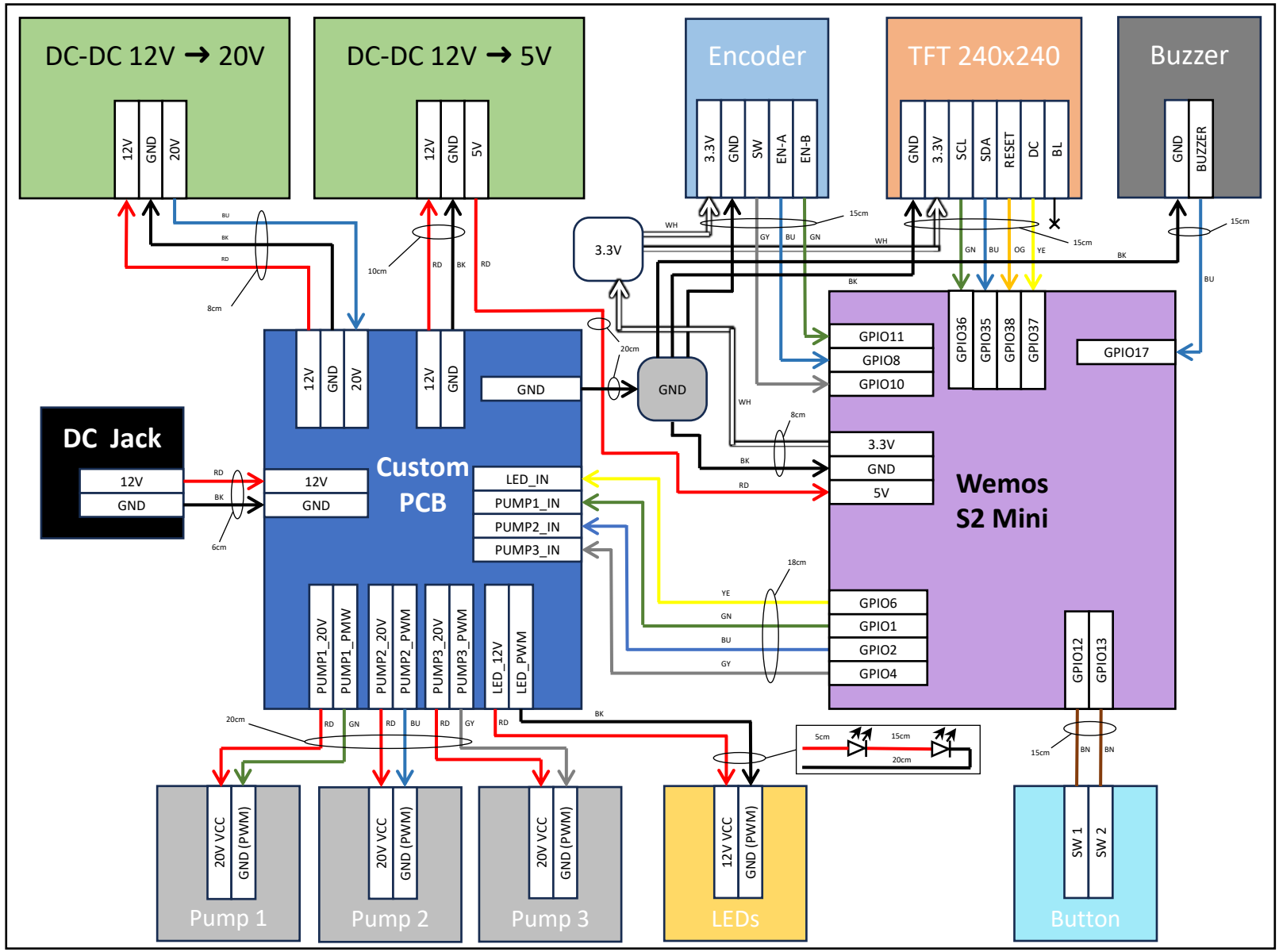




ELECTRONICS

WIRING:

Use this electrical wiring diagram to solder all your parts together.



TIP:

Make sure your wires are long enough to fit for the correct length.

FINAL ASSEMBLY

FINAL ASSEMBLY

SOLDER WIRES AND GLUE INTO PLACE

Solder all wires to the output stage PCB before gluing and use a fast-acting glue, like super-glue.

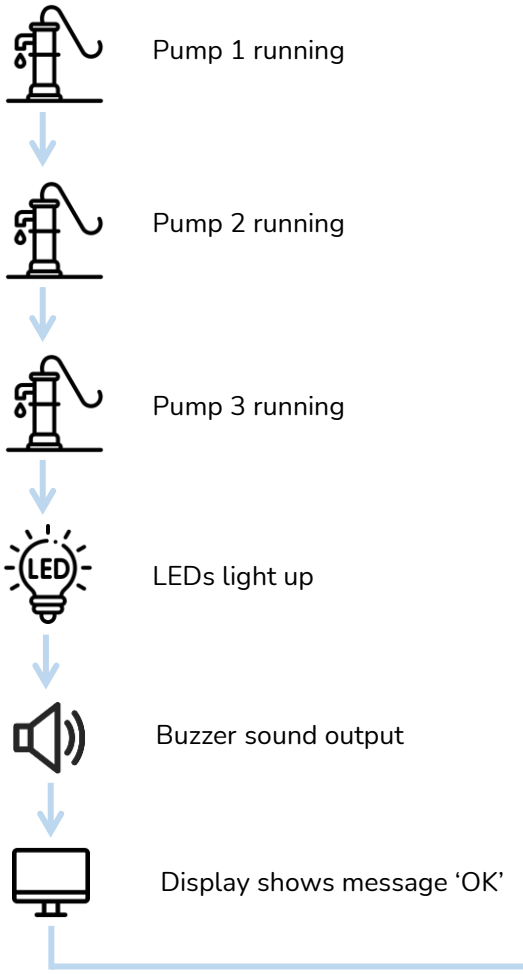
CHECK PUMP POLARITY

Be sure to check the polarity of the pump. It can happen that the pump is incorrectly labelled and then turns the wrong way round later.

FINAL ASSEMBLY

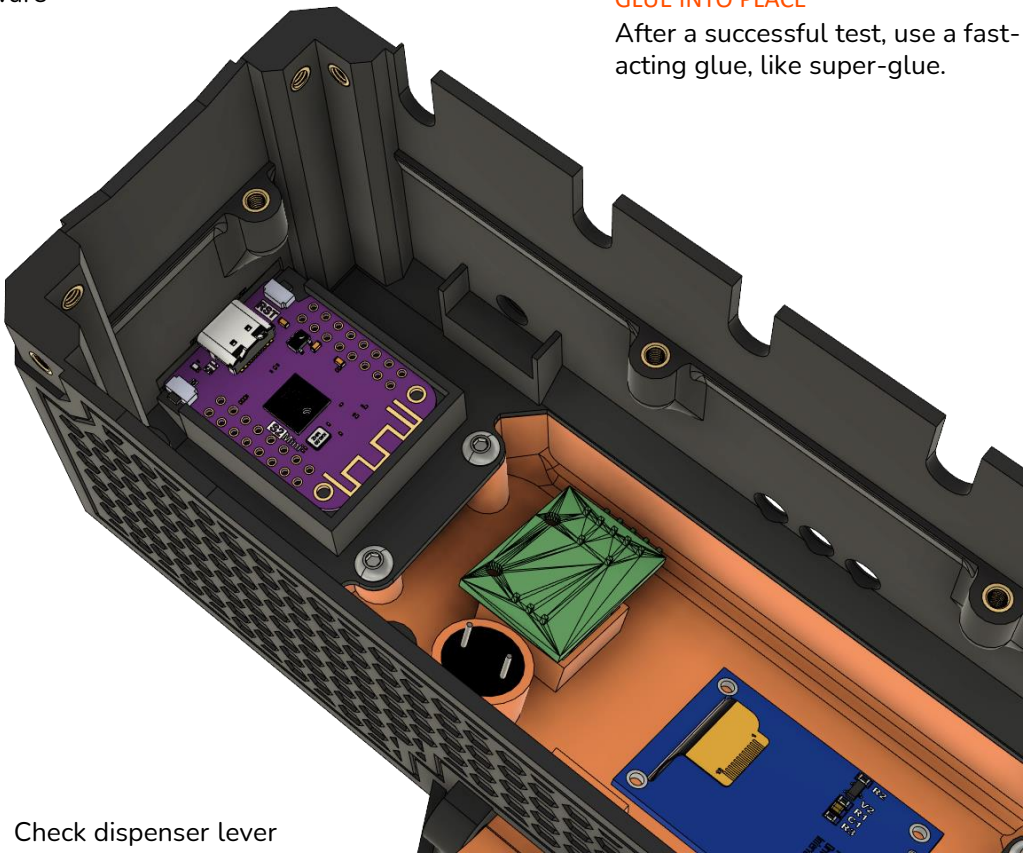
SOLDER WIRES

Solder all wires to the Wemos S2 mini and load Check-Firmware “ESP32S2_Check” (Link to source code see last Page).

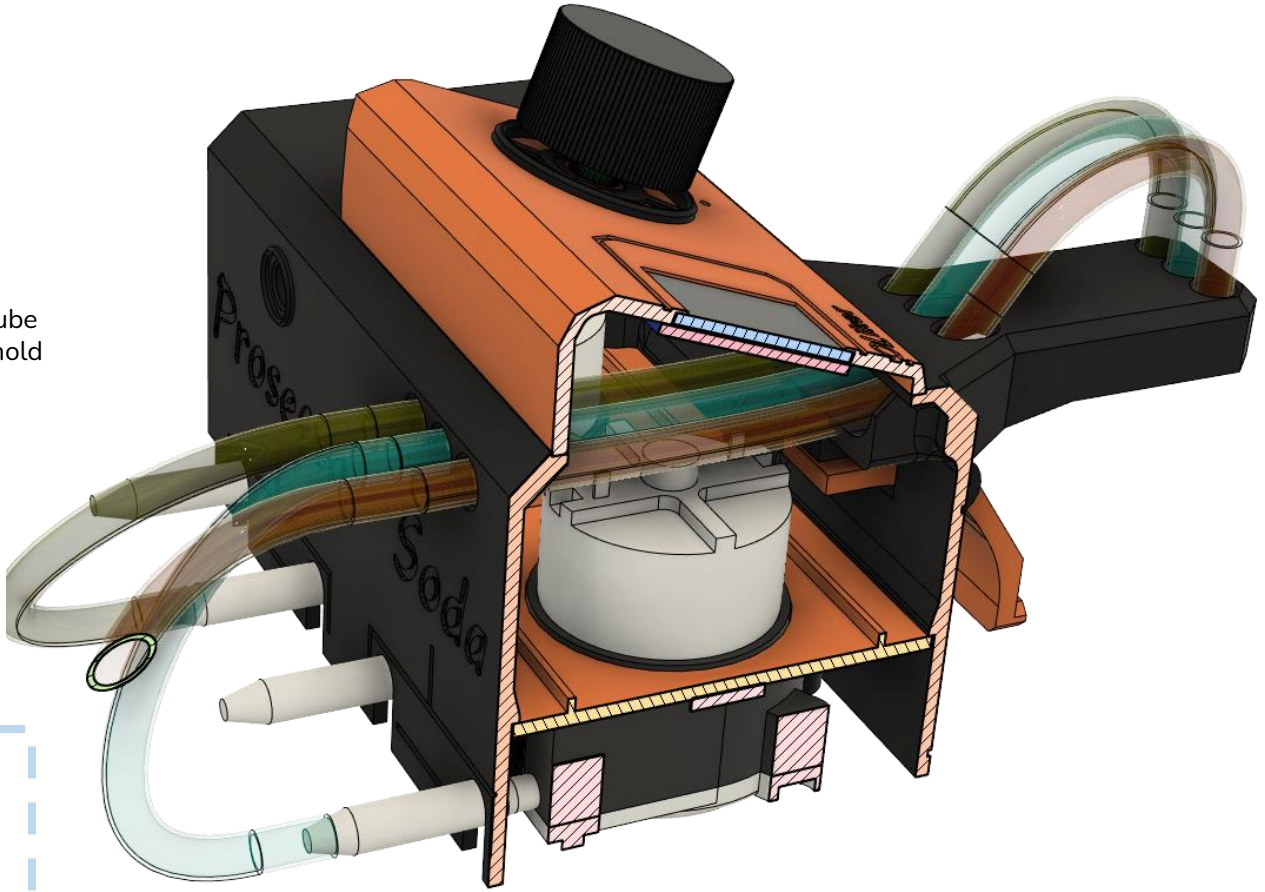


GLUE INTO PLACE

After a successful test, use a fast-acting glue, like super-glue.

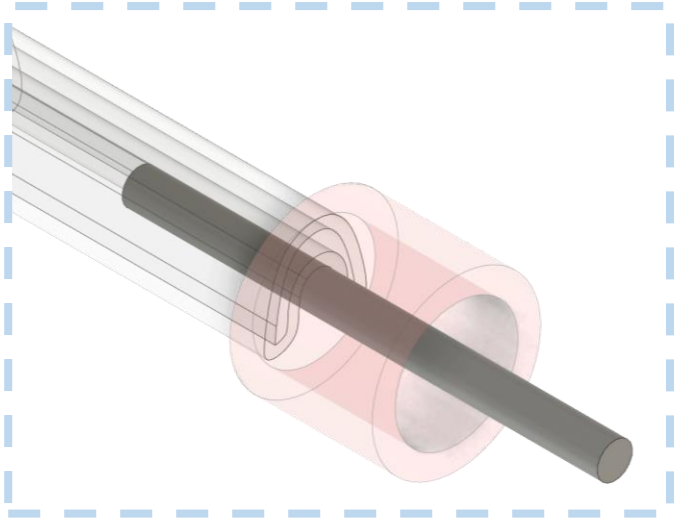


FINAL ASSEMBLY



MOUNT TUBING

Insert the cut to length tubing into the APEROLiker/HUGOliker like shown. If it is a tube with the appropriate outside diameter it will hold inside the holes without any glue.

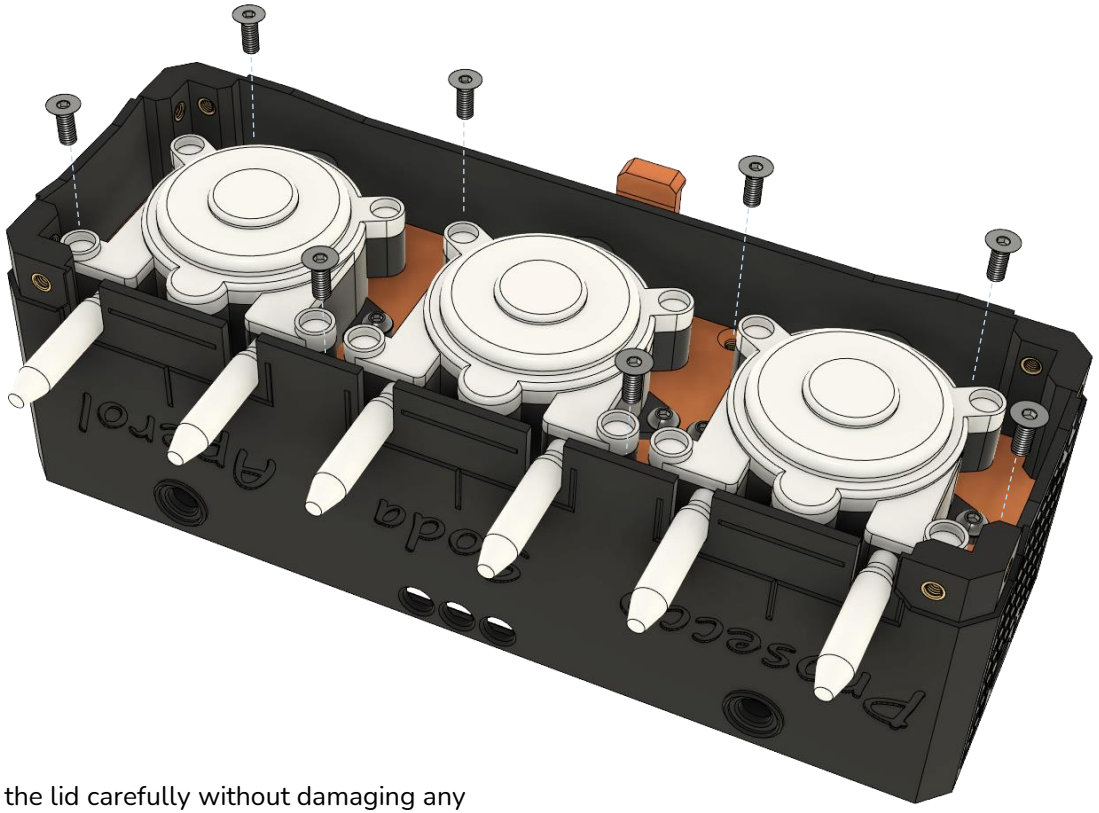


TIP:

Use the back of a 1.5mm drill to fold in the tube as shown. This makes it very easy to push it into the hole. Let it unfold in the correct position.

FINAL ASSEMBLY

M3x8 FHCS



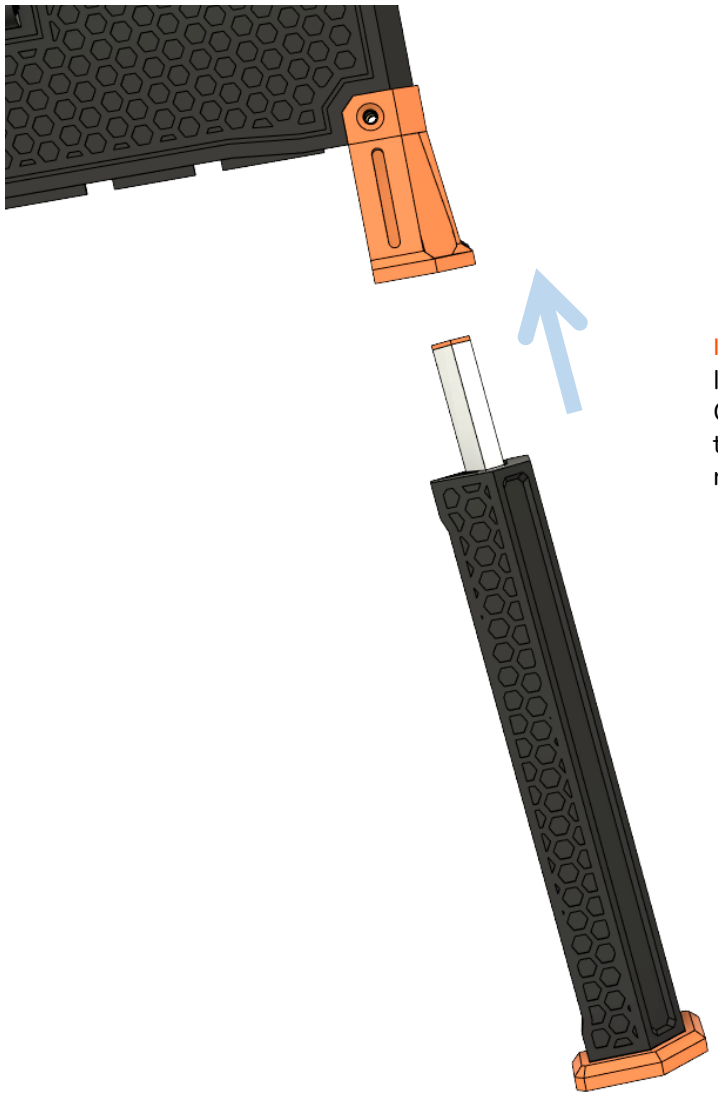
TIP:

Close the lid carefully without damaging any wires. Always double check – the screw is always stronger than any wire.

FINAL ASSEMBLY

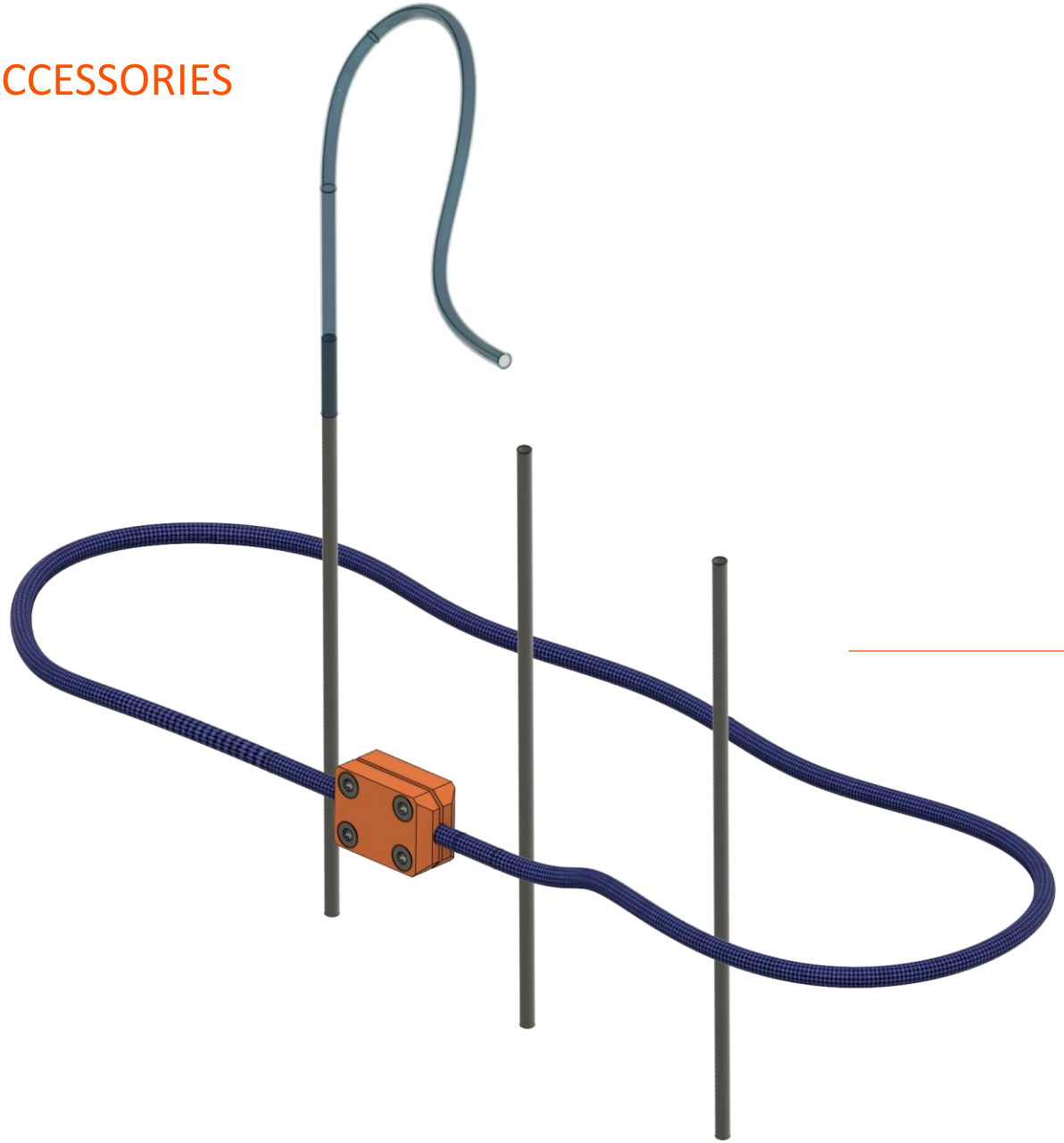
M3x8 FHCS

FINAL ASSEMBLY



INSERT FOOT

Insert the foot extension into the foot. Caution: Do not glue the extension foot to the standard foot, so you can remove it for transport.

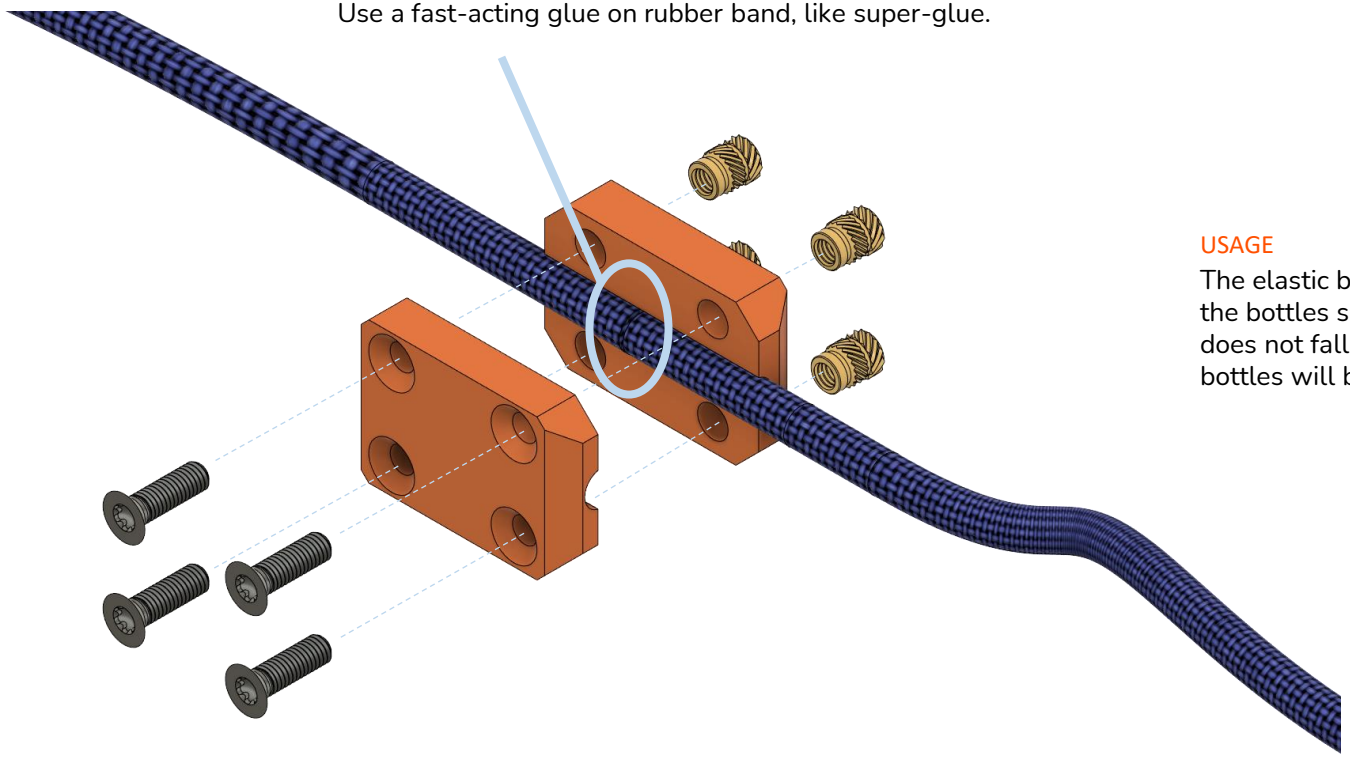


ACCESSORIES

ACCESSORIES

GLUE INTO PLACE

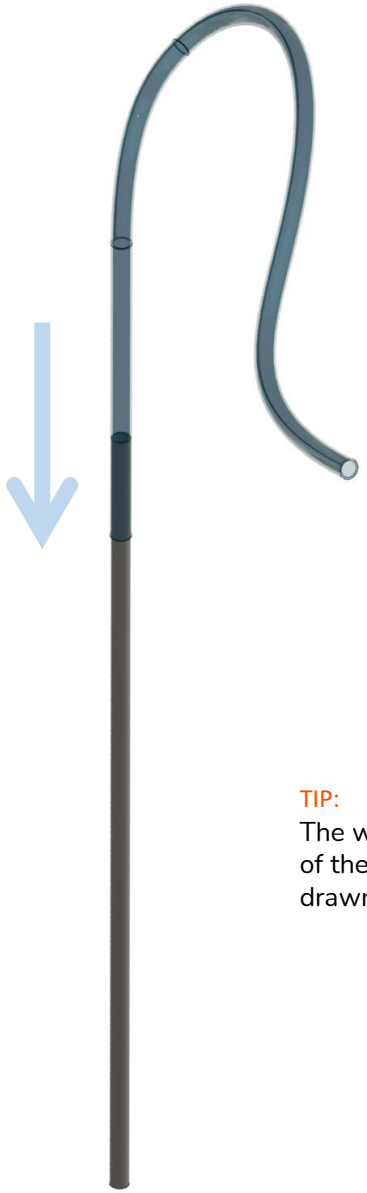
Use a fast-acting glue on rubber band, like super-glue.



USAGE

The elastic band is simply placed around the necks of the bottles so that when a bottle becomes empty, it does not fall over. The probability that all three bottles will be empty at the same time is zero.

ACCESSORIES



PUSH TUBE OVER STRAW

Use some force to push the tube about 2-3cm over the straw.

TIP:

The weight of the straw ensures that the tube reaches the bottom of the bottle and does not curl up so that no more liquid can be drawn in when the fill level is low.

SERVICE

SERVICE

TIP:
Press down rotary encoder button until the start screen is displayed for CLEANING MODE.

Clean the APEROLiker immediately after each use to prevent mildew.

NORMAL MODE

The firmware is largely self-explanatory. But there is a hidden mode to perform cleaning after successful use → see CLEANING MODE.

Without special inputs the APEROLiker starts with a start screen and then automatically switches to an instruction page. You can exit this screen by simply pressing the rotary encoder. The APEROLiker then switches to normal mode and dispensing is enabled.

CLEANING MODE

If the rotary encoder button is pressed down until the start screen is displayed when the supply voltage is connected, the APEROLiker starts in CLEANING MODE.

CLEANING MODE means that all three pumps run at full power when dispensing. This makes it possible to pump a cleaning fluid by placing a bucket underneath until the APEROLiker and its pumps are completely cleaned.

NEXT STEPS

ASSEMBLY COMPLETED! ... NEXT STEP: SETUP & TEST

This manual is designed to be a reference manual for the build process. Next step is to upload the firmware to the Wemos S2 mini and start testing each pump for its function.

You can find the firmware here:

GitHub https://github.com/flo199213/APEROLiker

Enjoy your APEROLiker / HUGOliker.

And please send the pictures of your build to: aperoliker.hugoliker@gmail.com ☺