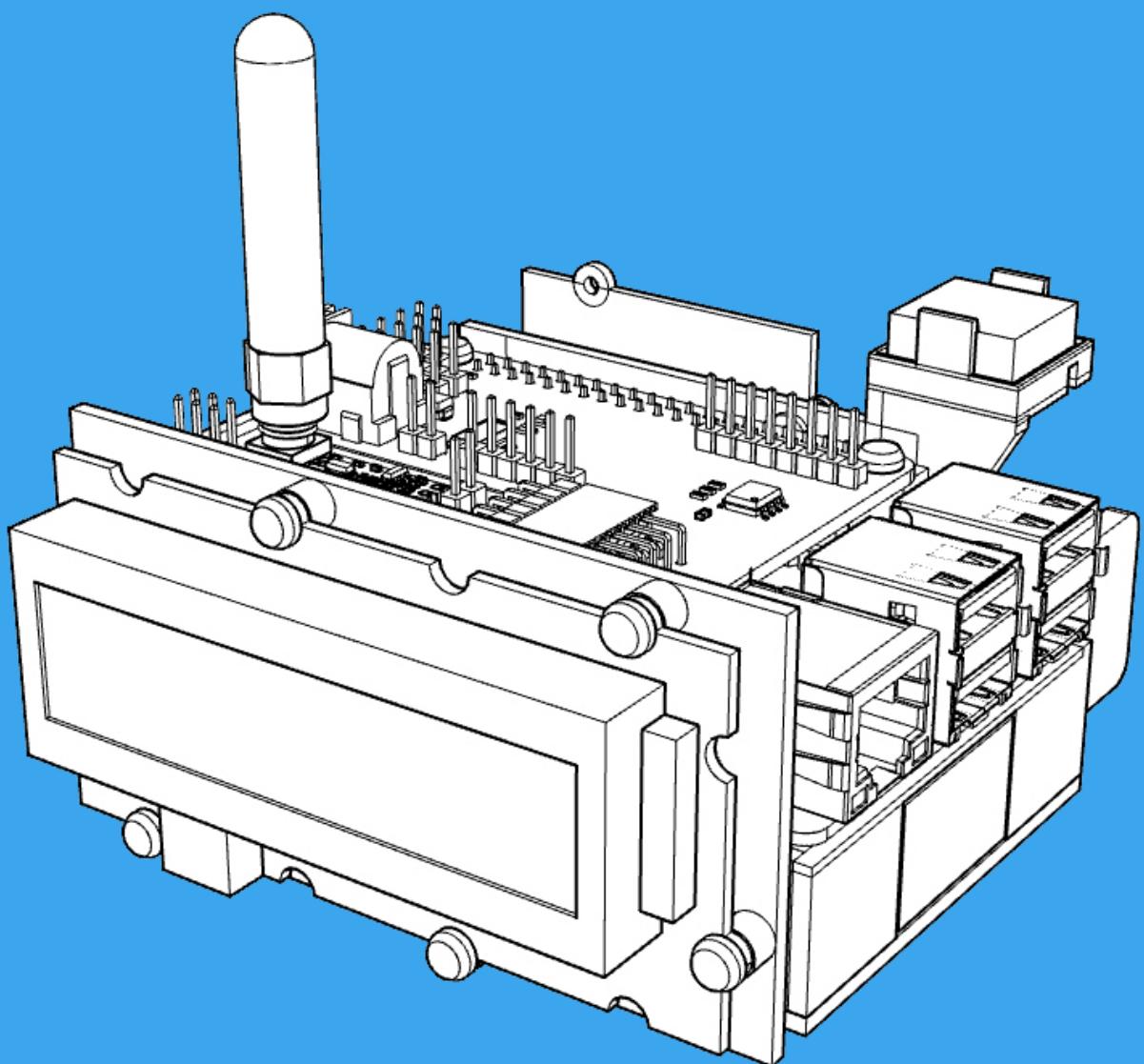


# Making the experimental linux node prototype

REV: 1.1EN



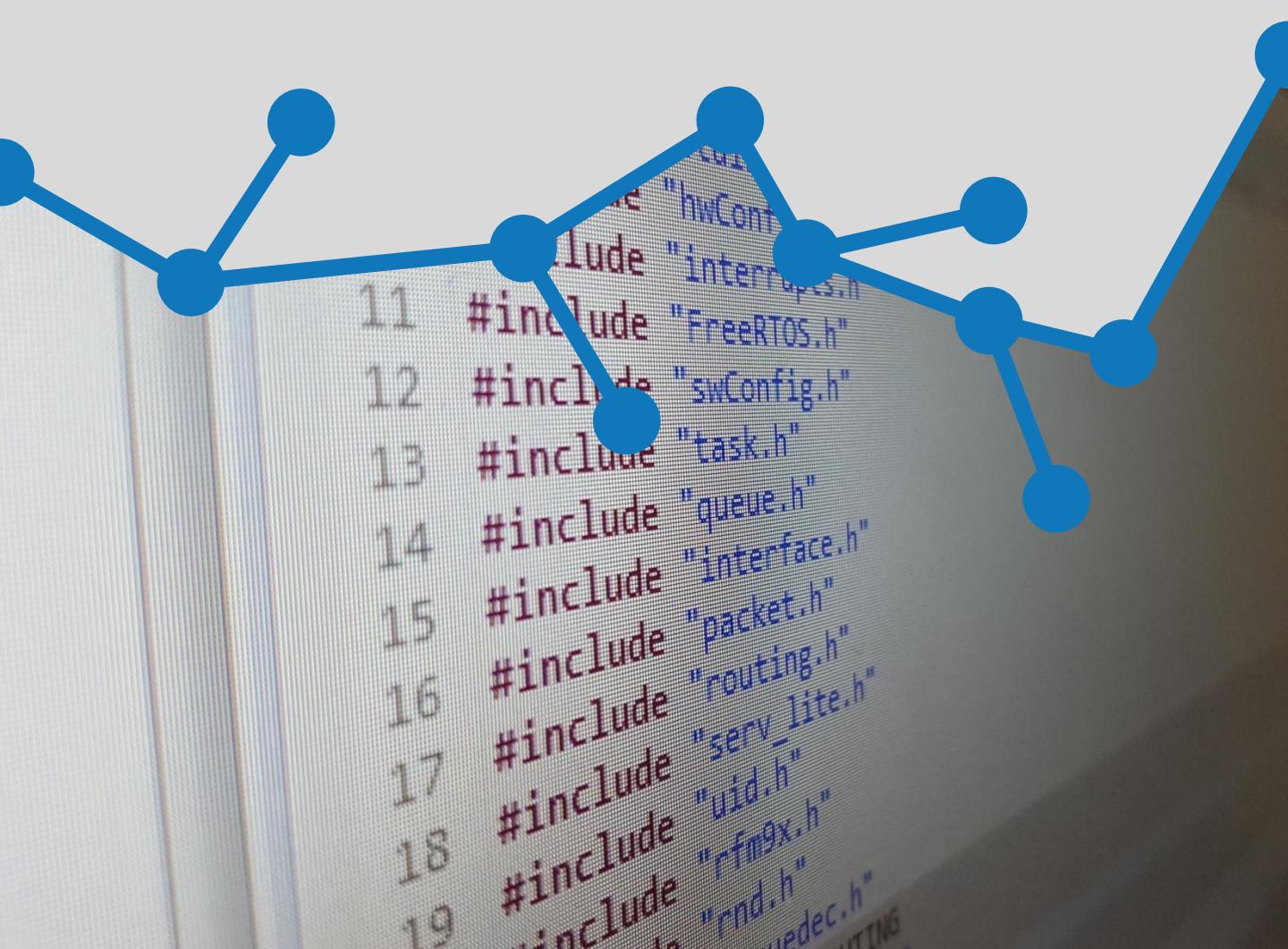
moarstack

## 0 | Overview

We built several Raspberry-Pi based devices for GNU/Linux in order to test MOAR in 'live' environment.

We added several features useful for field testing including accumulators for autonomous work, led screen with layers work indication and GPS location.

As part of the project we designed and built our own extension board (HAT) for Raspberry Pi. Extension board is the typical "HAT" for Raspberry Pi that support replacement SPI radio modules and provide stable 3.3V/150mA power supply for them. We use the Rx/Tx LPWAN module with RFM96 chip with LoRa support.



A blue line graph with circular markers overlays a portion of the slide, showing a path through several lines of C code. The code includes #include directives for various header files such as FreeRTOS.h, swConfig.h, task.h, queue.h, interface.h, packet.h, routing.h, serv\_lite.h, uid.h, rfm9x.h, rnd.h, and quedec.h.

```
11 #include "FreeRTOS.h"
12 #include "swConfig.h"
13 #include "task.h"
14 #include "queue.h"
15 #include "interface.h"
16 #include "packet.h"
17 #include "routing.h"
18 #include "serv_lite.h"
19 #include "uid.h"
20 #include "rfm9x.h"
21 #include "rnd.h"
22 #include "quedec.h"
```

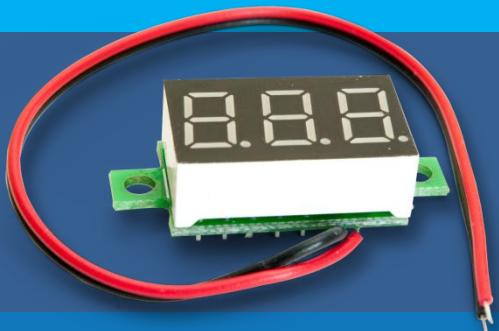
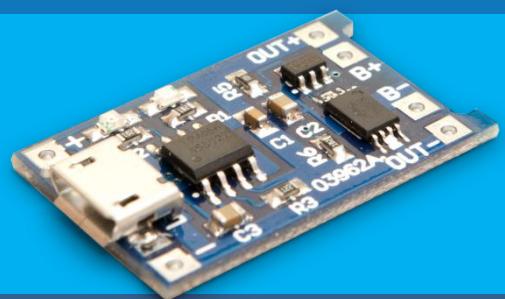


# 1 | List of components



Power DC-DC step-up converter module,  
max current 3A, XL6009 chip

Li-Ion 1S accumulator charge  
controller



Voltage meter

Battery slot for 18650-type  
accumulator



Soviet switch. Hard as frozen vodka

Samsung made Samsung ICR18650-26F rechargeable battery (or any other 1S Lithium accu battery greater than 1500 mAh in case you have samsung-phobia)



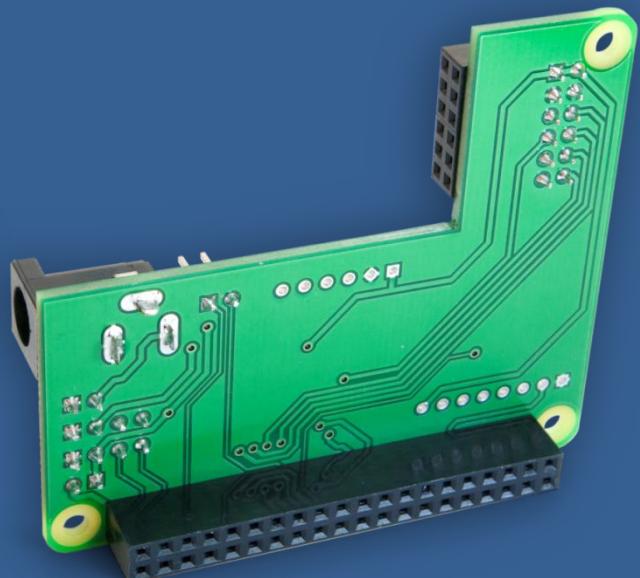
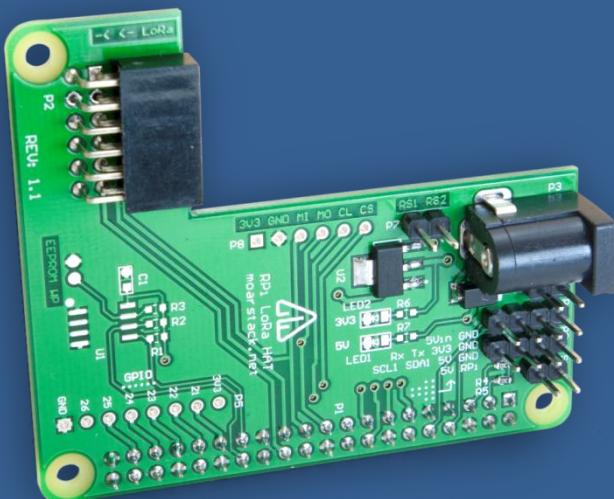
LED RGB backlit display with I2C

GPS Simcom SIM28 module with UART interface



Extension board of our design, download it right now!

 download



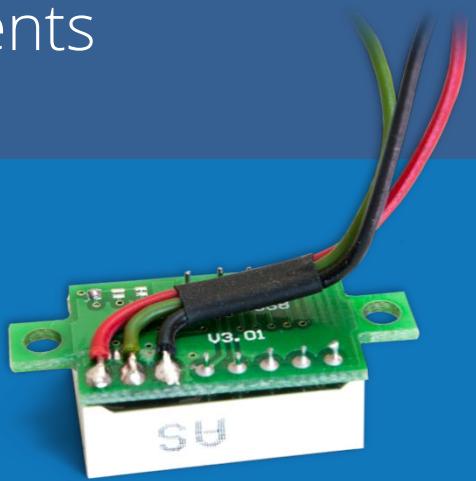
## 2 | Preparing of components

Voltmeter is used for battery voltage monitoring.

### **Warning!**

Almost all voltmeters use current being measured as source for their own power. However, some models like DSN-DVM-368 V3.01 stop working if power drops less than 4.2V.

To overcome this issue we solder third (powered) wire to pin V<sub>p</sub> and remove short-circuit between V<sub>p</sub> and V<sub>m</sub> pins.



**V<sub>p</sub>** - module power source voltage

**V<sub>m</sub>** - measured voltage

**GND** - ground

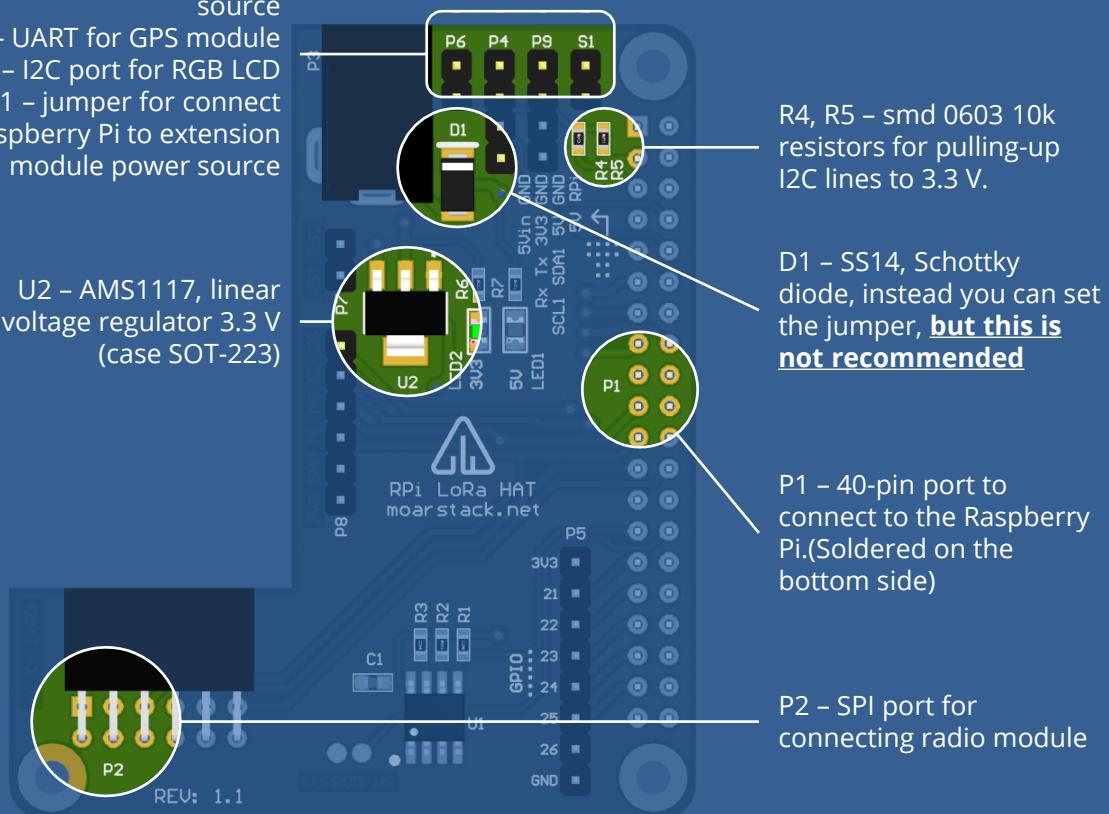
P6 – port for connect power source

P4 – UART for GPS module  
P9 – I2C port for RGB LCD

S1 – jumper for connect Raspberry Pi to extension module power source

U2 – AMS1117, linear voltage regulator 3.3 V (case SOT-223)

The minimum set of details that need to be soldered for the normal operation





## 3 | Casing parts

We used zortrax n200 printer with black ABS plastic. It took 6 hours and 61 grams of source material with «medium» fill setting in printer software.

You can download the models by clicking on this link:

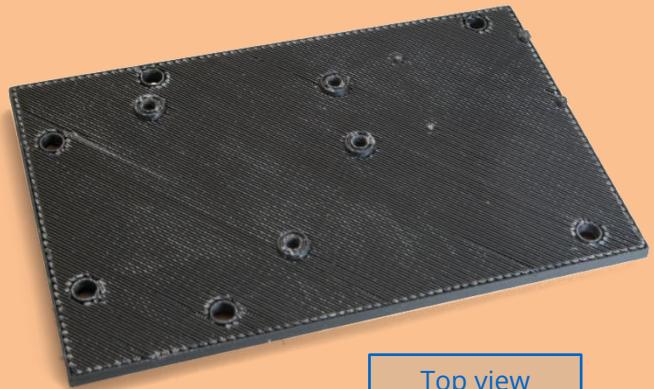
download

Bedding part

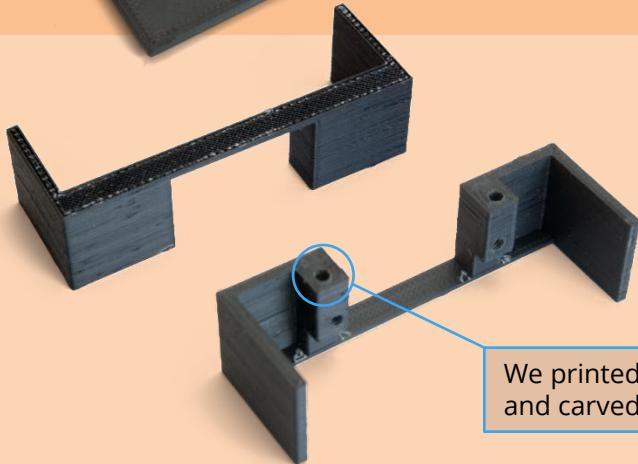
Bottom view



Top view

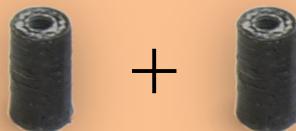


Voltage meter holder



We printed it with 2mm diameter bolt holes  
and carved 2.5M thread

Spacers for extension module (RPi LoRa HAT) and SPI radio module

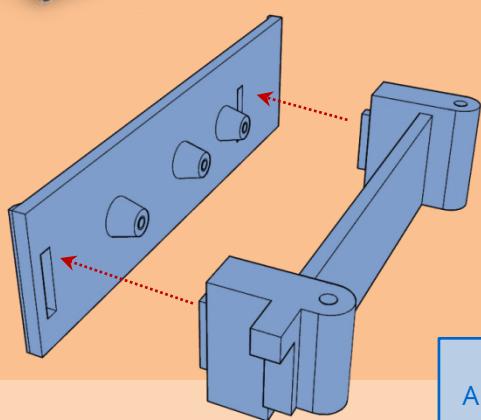




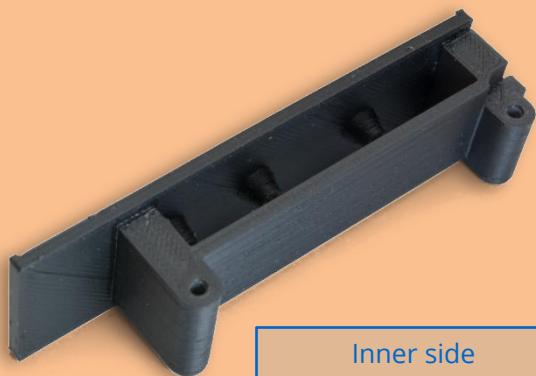
Outer side



Accumulator holder mount



Inner side

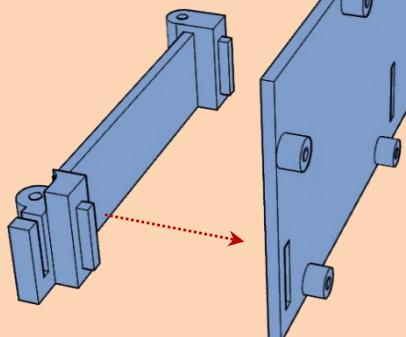


Part assembly as shown on diagram.  
Apply super glue on contacting surfaces

Display mount



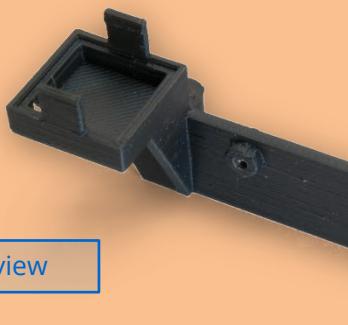
Inner side



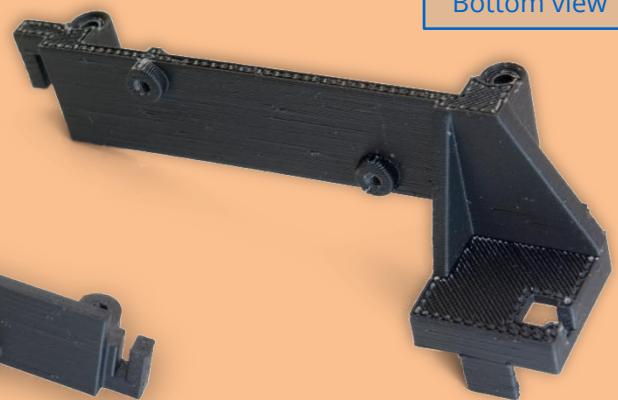
Outer side



Mount for GPS module and its antenna

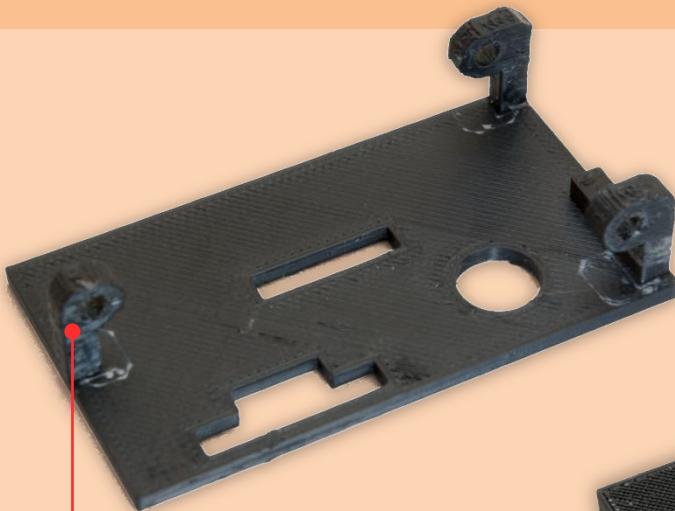


Top view

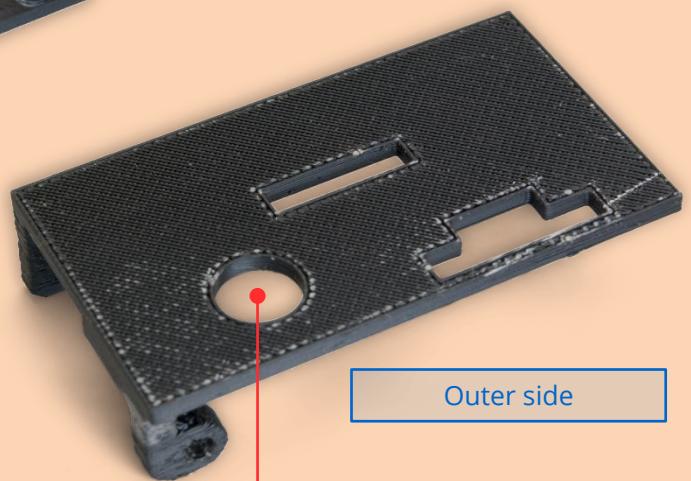


Bottom view

Casing part with space for on/off switch



Inner side



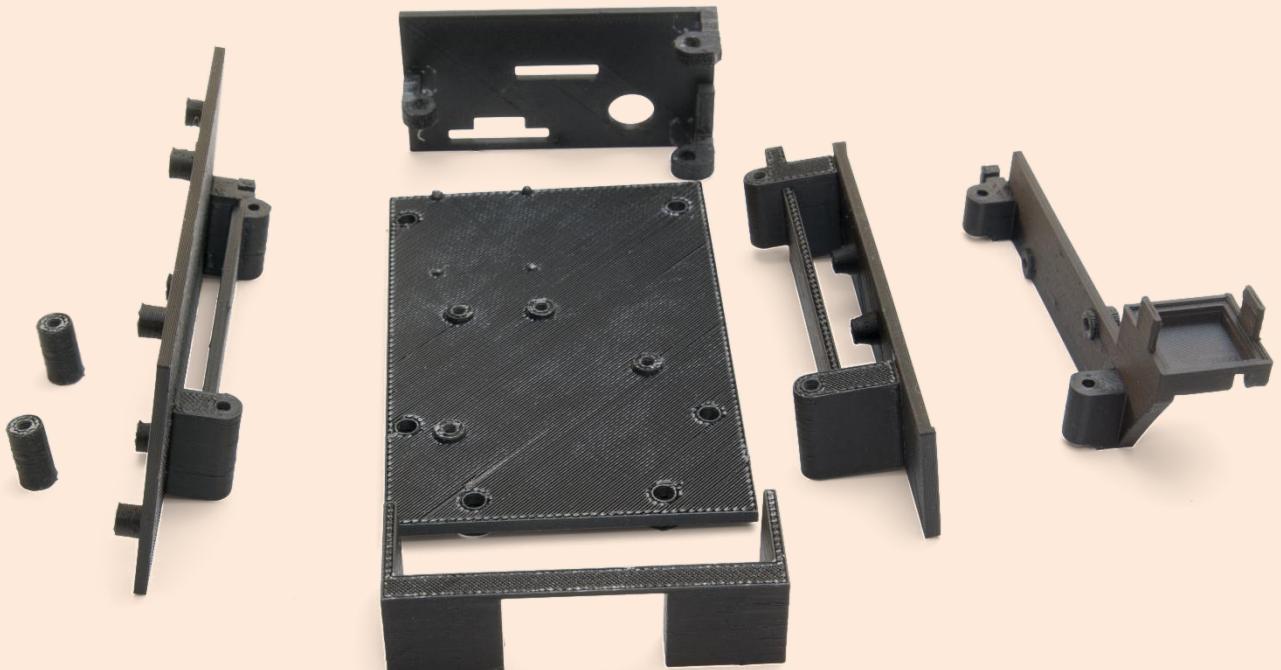
Outer side

Be careful when cleaning parts from plastic residues. Some parts are very fragile

Choose the diameter and shape of the holes for those switches that you have



General view of all parts disposed around the places where they will be installed



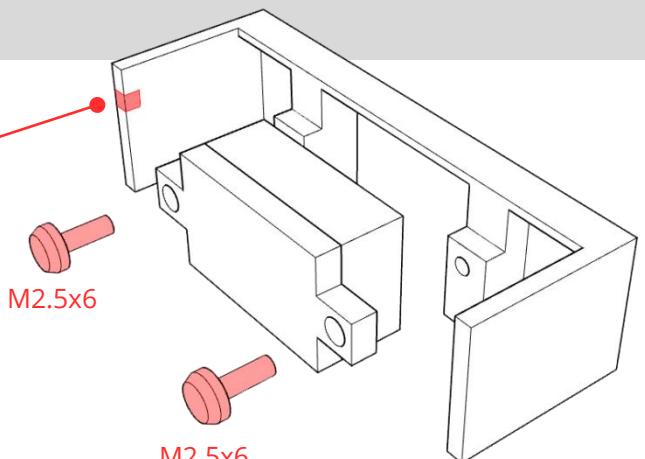
If you planning to assemble parts with screws M2.5, you need to carve M2.5 thread in all holes at this stage



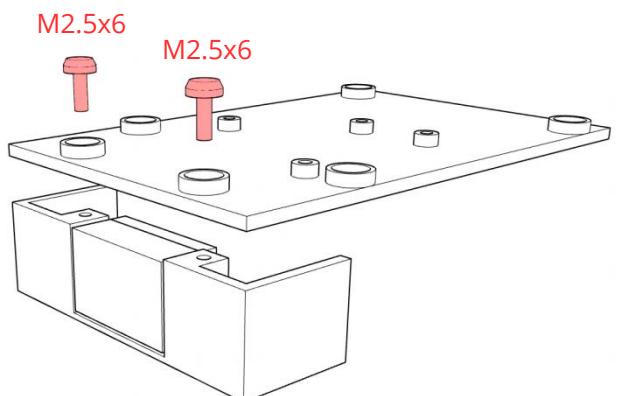
## 4 | Assembling

You will need PH1 screwdriver, double-sided scotch tape(both thin and thick), pair of needle-files, thermal glue, stationery knife and anything else you like.

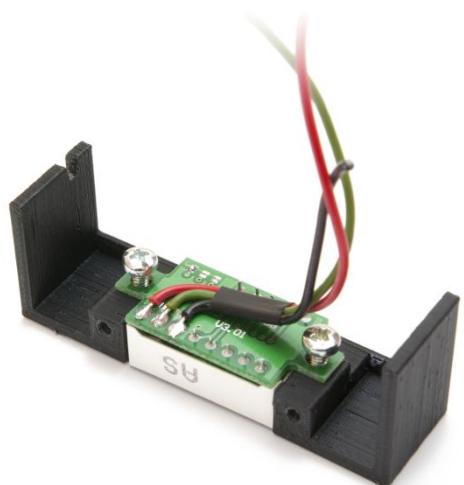
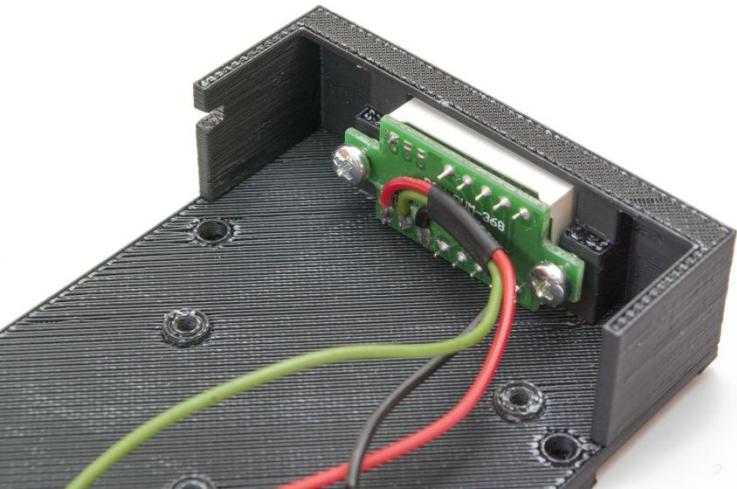
You've got to make a recess for the power cable

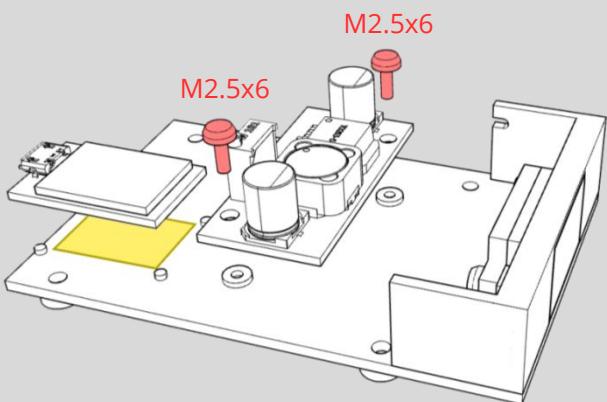


Place voltmeter into its cradle and half-tie bolts

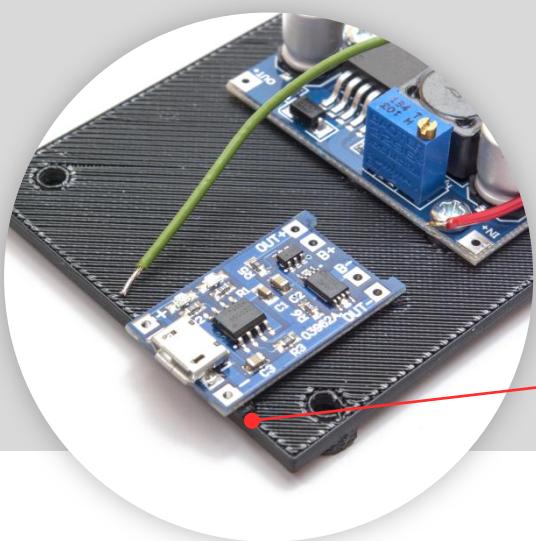
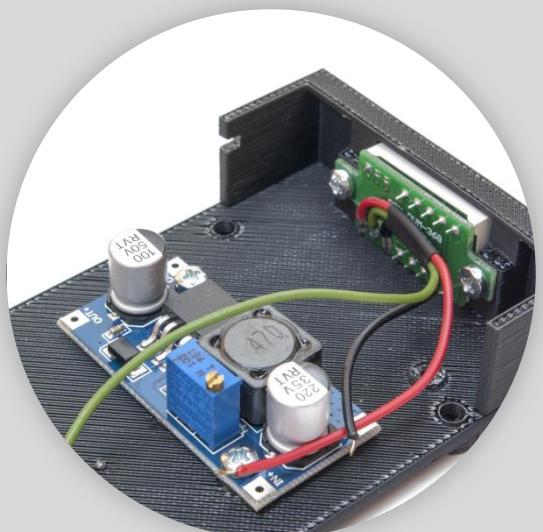


Screw voltmeter mount to bedding part, align everything properly, fully fasten bolts.



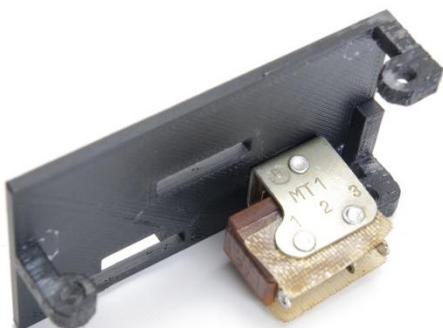


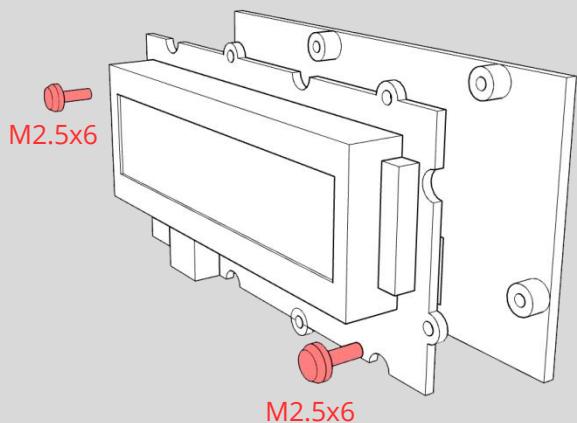
Place Power DC-DC converter onto bedding and attach it with two M2.5x6 screws



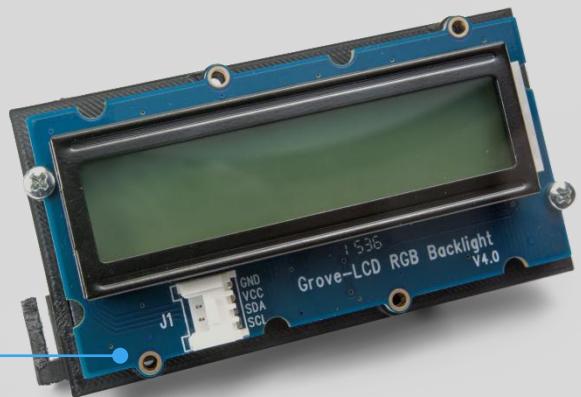
Please note that the edge of the controller board must be shifted for 1-1.5 mm from the edge of the bedding

Place on/off switch and fasten it



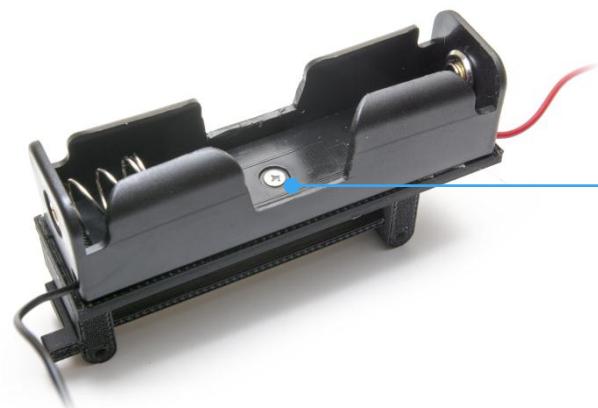
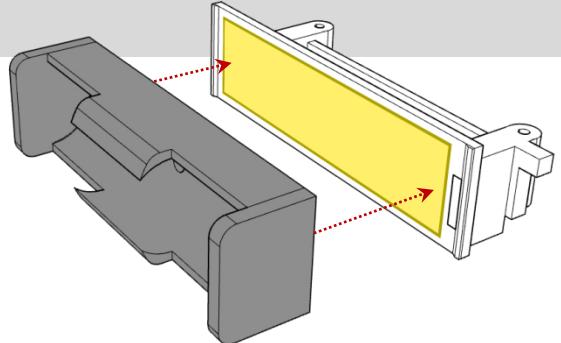


Fasten display to display mount with at least two M2.5x6 screws



... why only two? Because we're not going to run this thing into space!

Attach battery slot to battery slot mount with thin double-sided tape or glue

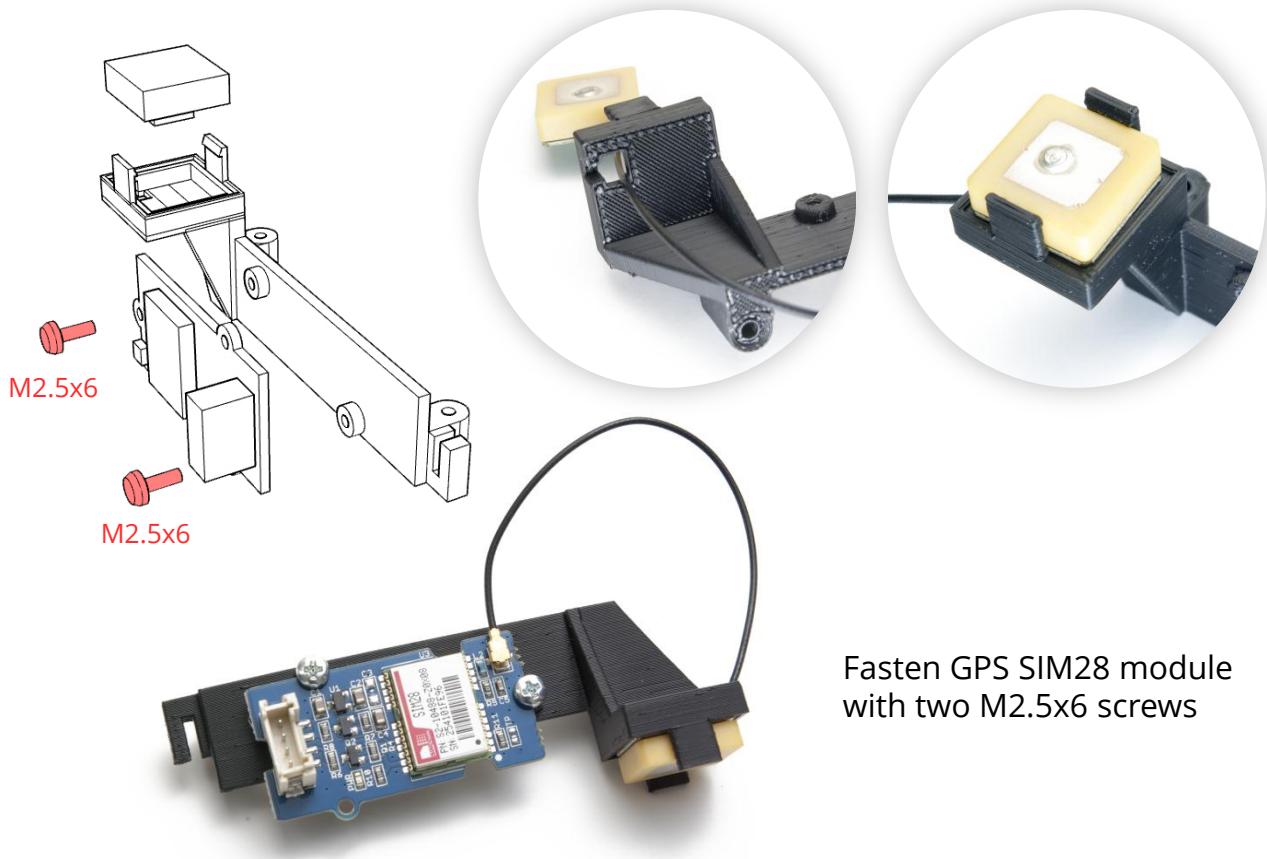


This part have holes for the screws for a more secure attachment. It is recommended to use them.

If the accumulator has poor contact with the «+» terminal, add the M2 screw to increase the height of the contact pad.

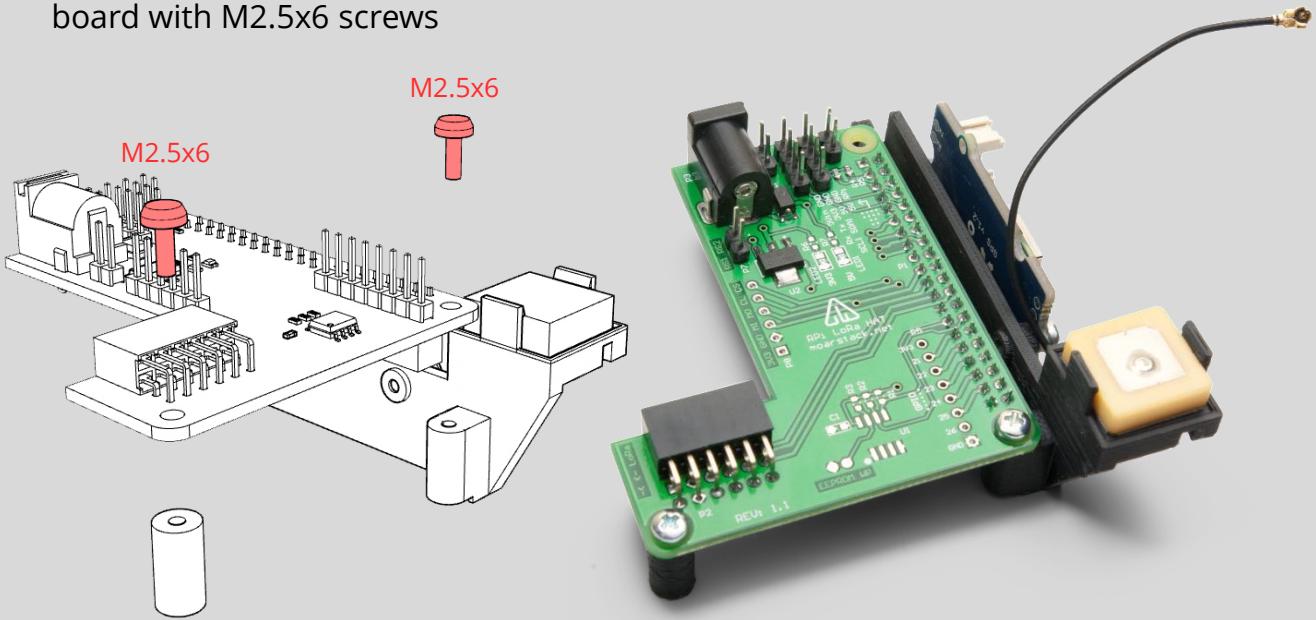


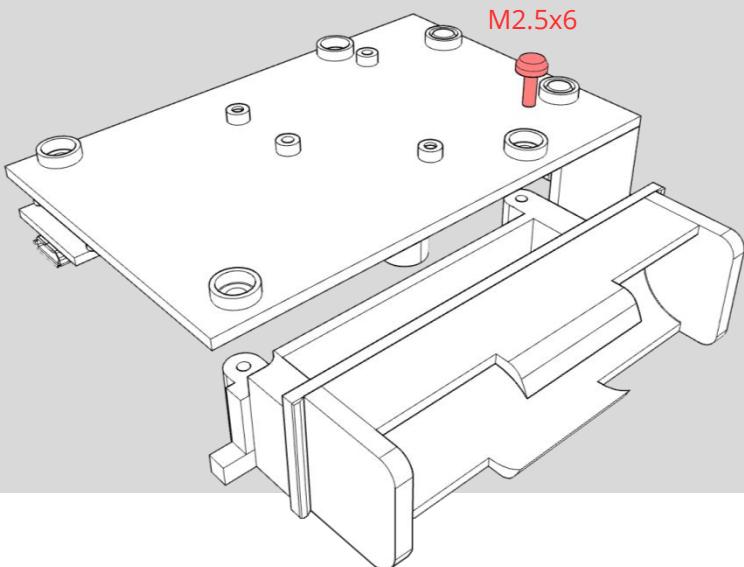
Place GPS antenna into its nest



Fasten GPS SIM28 module  
with two M2.5x6 screws

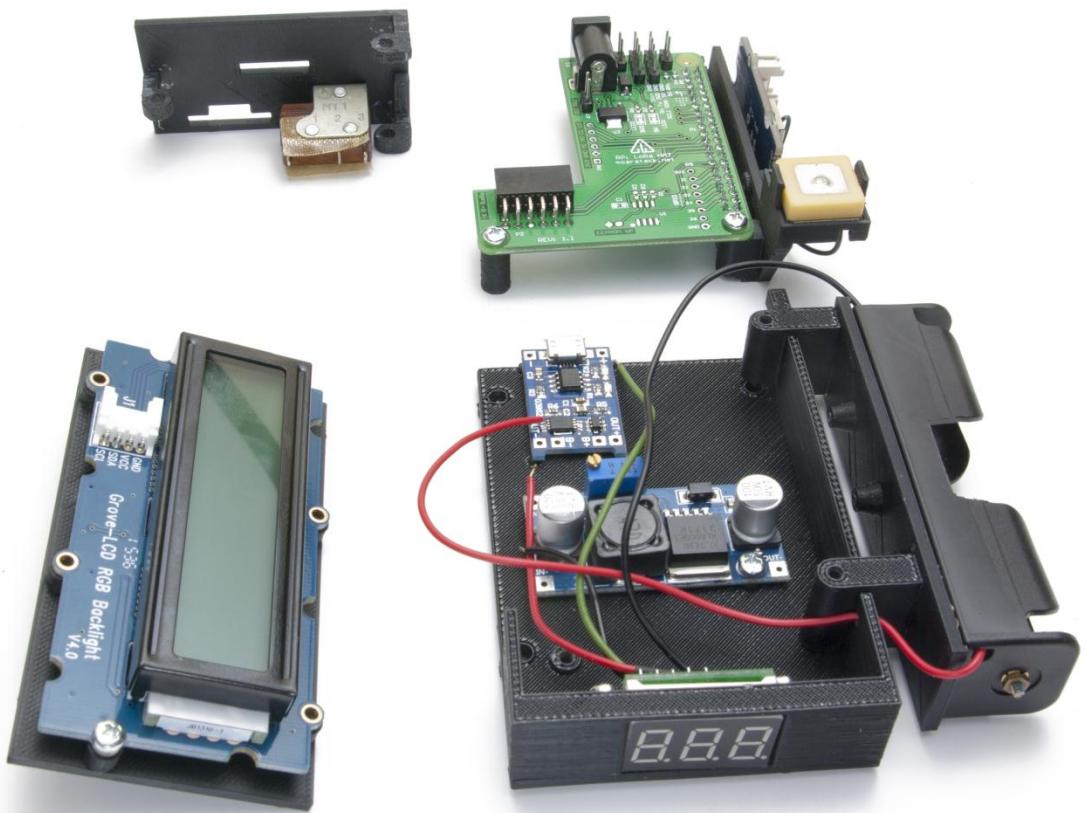
Attach GPS mount and spacer  
to RPI Lora HAT extension  
board with M2.5x6 screws





Attach battery holder mount to bedding with one M2.5x6 screw

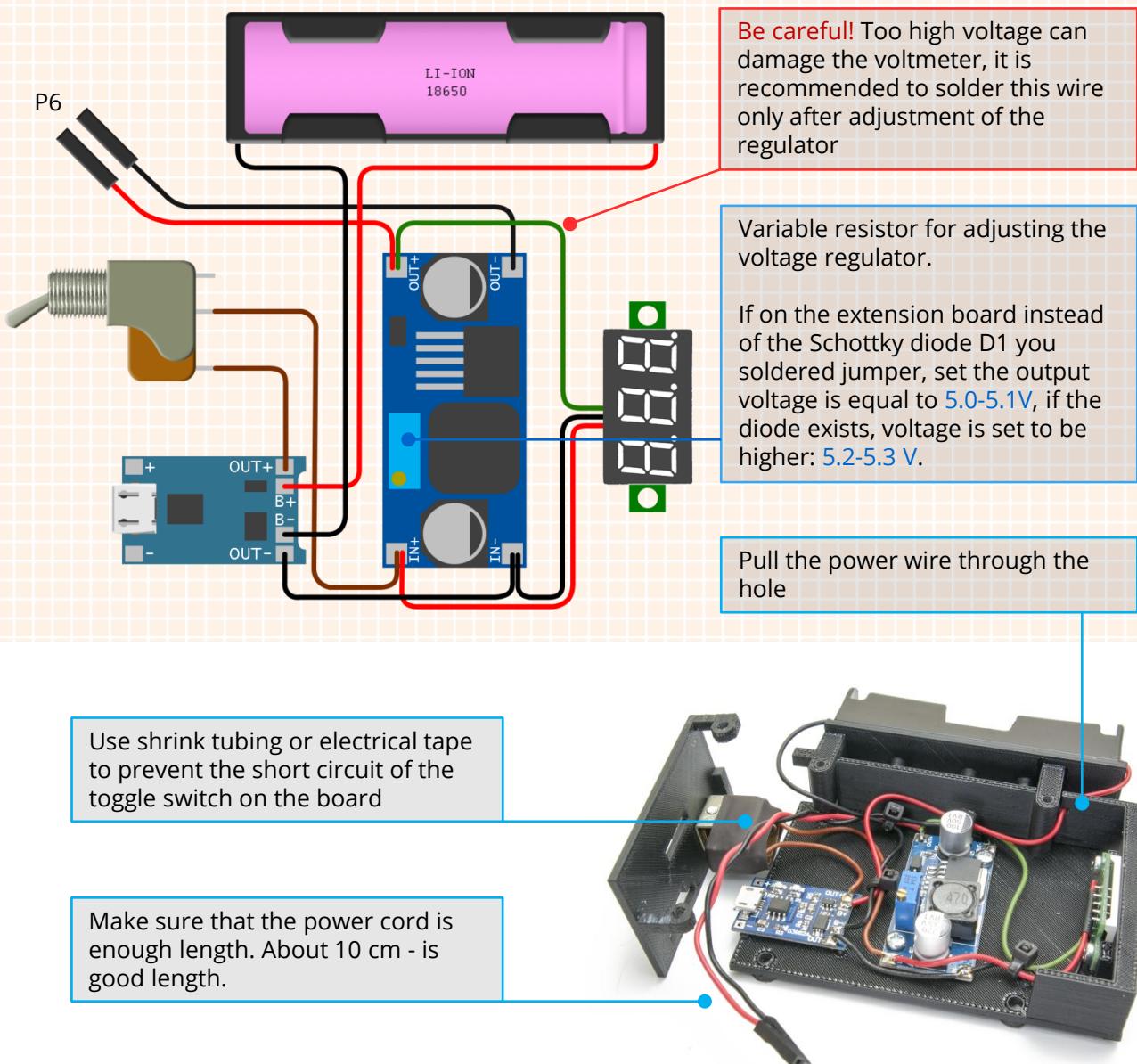
At this point we must have these:



## 5 | Soldering

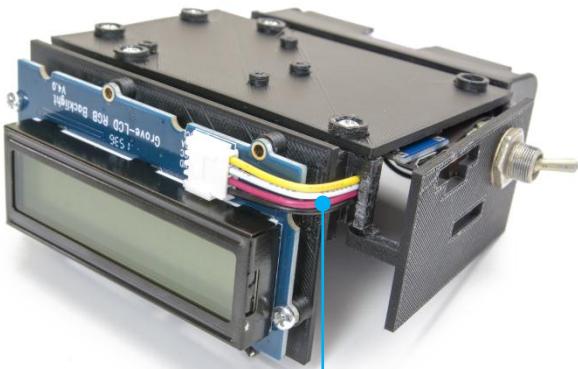
We need standard soldering tool set - 40W soldering iron, soldering alloy, soldering flux, tweezers, thermal shrinking tube, electrical tape and some wires. For power converter tuning we need multimeter and something like SL2 screwdriver

Assemble power unit according to diagram:

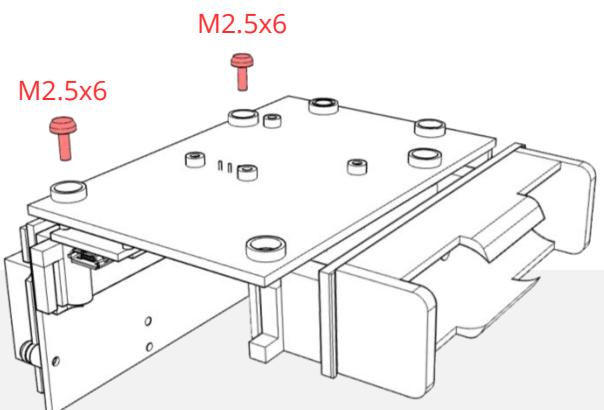


## 6 | Assembly finishing

We gonna need PH1 screwdriver, double-sided scotch tape, pair of needlefiles, glue, utility knife, etc.

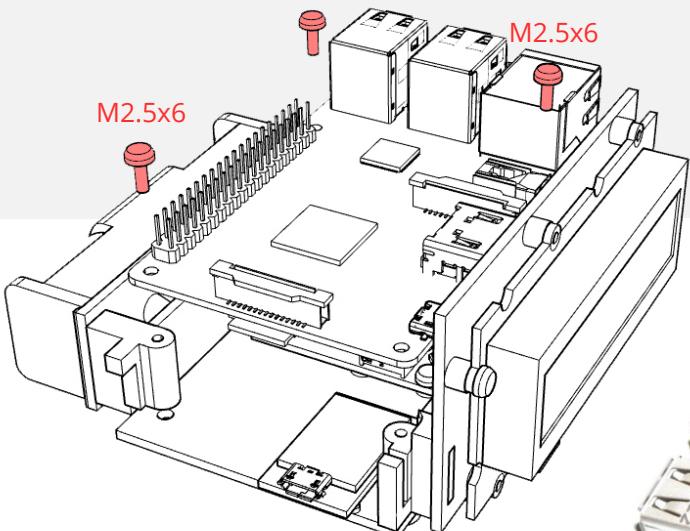


Attach display mount to bedding with two M2.5x6 screws



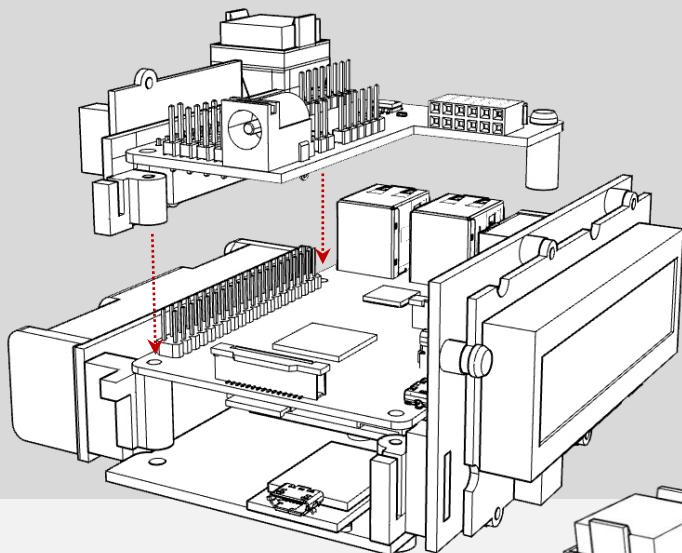
Pull the wires through the recesses in case parts

M2.5x6  
M2.5x6

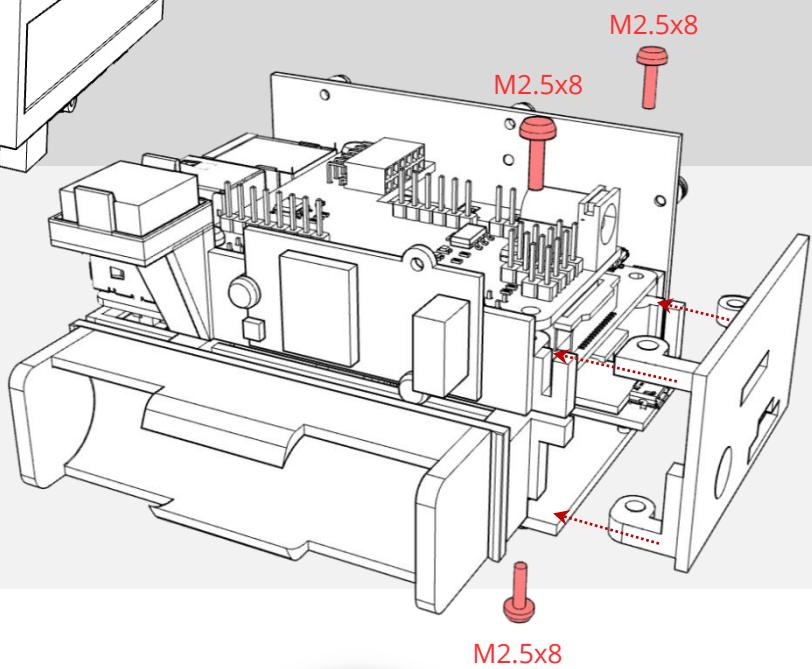


Place Raspberry PI, fasten with three M2.5x6 screws





Place RPi LoRa HAT onto 40-pin Raspberry Pi port



Place switch panel, fasten everything with **M2.5x8**

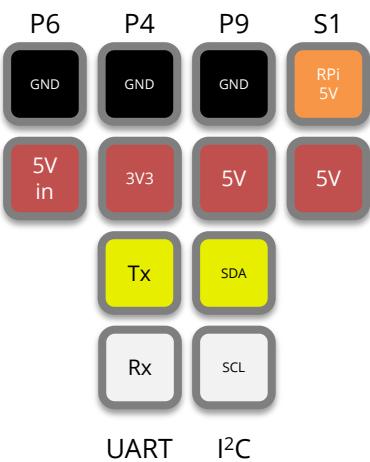
Plug in LCD, GPS, power units:

P6 - power port

P4 - GPS port

P9 - LCD port

S1 - jumper for Raspberry Pi power



## 7 | Radio unit

For live testing purposes we use LPWAN Semtech SX1272(RF96) SPI unit with LoRa support.



Plug interface is SPI. You are free to use any other radio unit after lib for this unit is added to stack.

Circuit design for radio unit are here, download them!

 download

