# AP handcontroller assembly instructions

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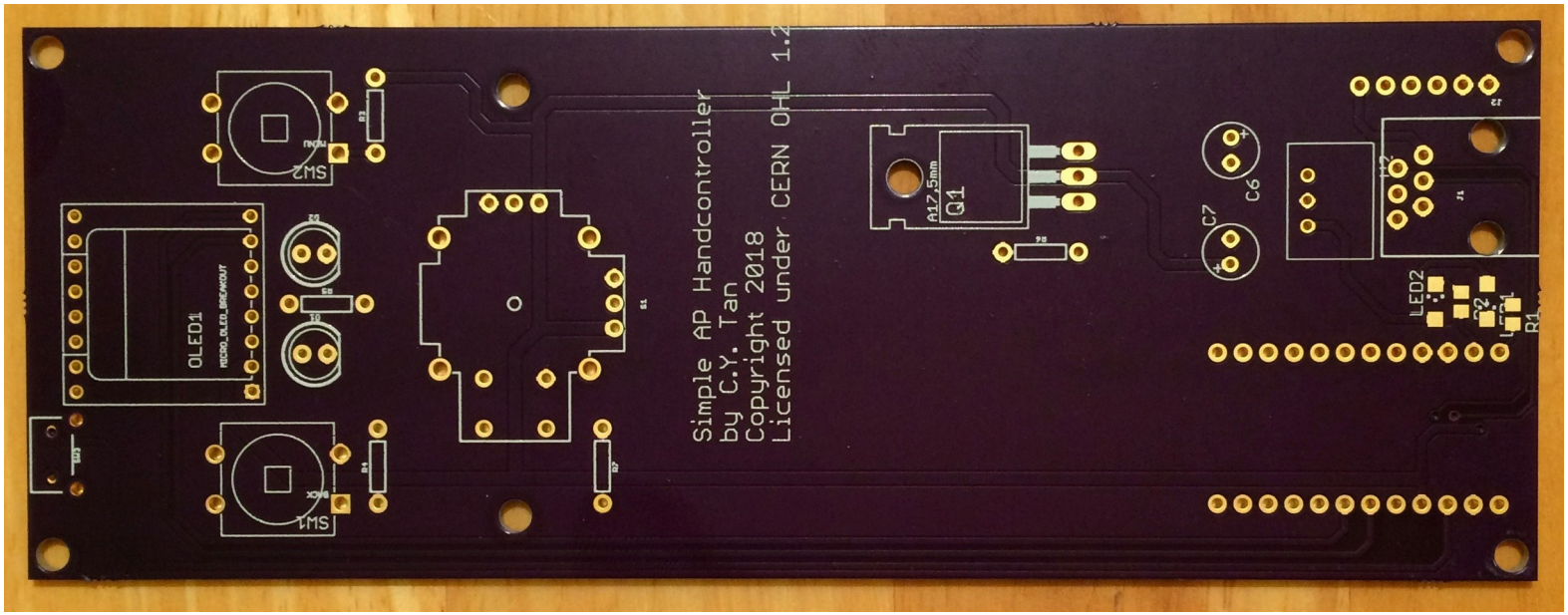
7/29/18

# License

# Assembly instructions

- **These instructions will only highlight the important parts of the assembly.**
  - The assembly is quite straightforward, but as usual, there are some parts of the assembly that need a little bit of care and feeding.
  - All the required parts are listed in the bill of materials.

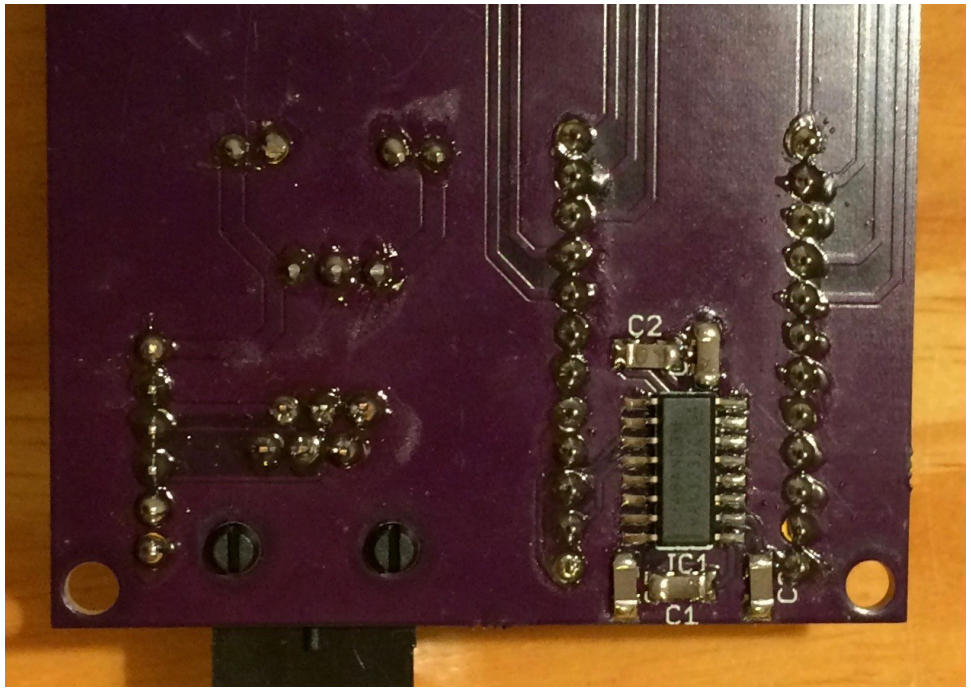
# Electronics




This is the prototype printed circuit board that I'll be using to demonstrate how to assemble the hand controller.

The version 2 hand controller that is on the github site is nearly the same as the prototype. The obvious part that is missing in version 2 of the hand controller is the MOSFET.

# Surface mount parts

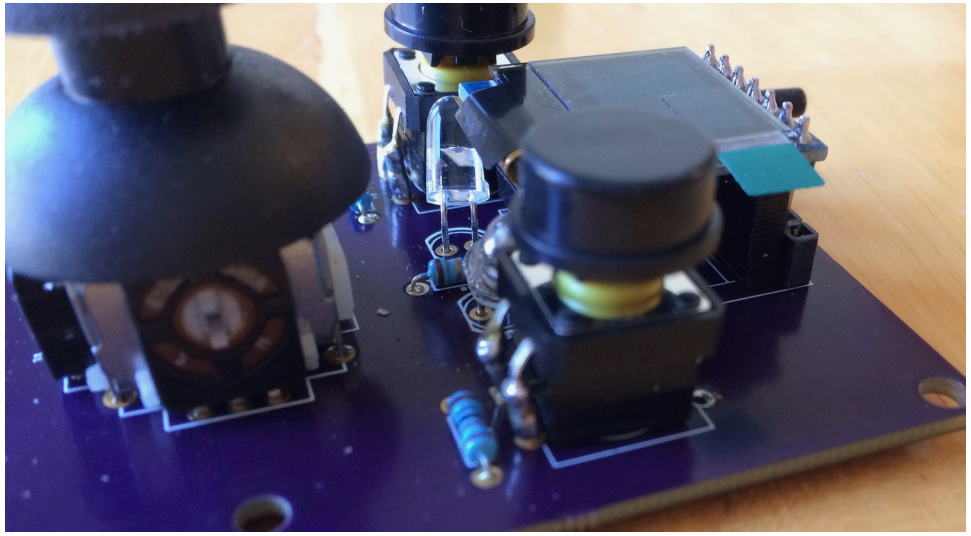


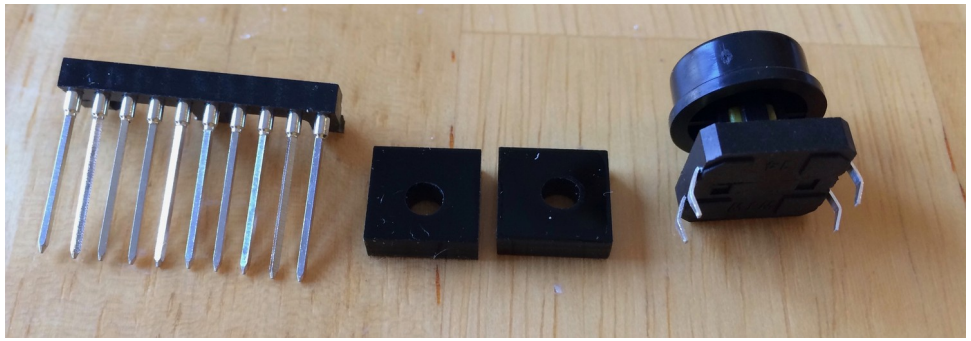

There are surface mount parts that need to be soldered at the back of the printed circuit board.

These parts are for the RS232 level shifters. They are actually very easy to solder to the pads with thin solder (0.8 mm diameter, 60/40 solder) and a soldering iron with a fine tip.

However, if you've never soldered before, it's best to ask a friend who is an experienced at soldering electronics to do it.

# Making the pushbuttons

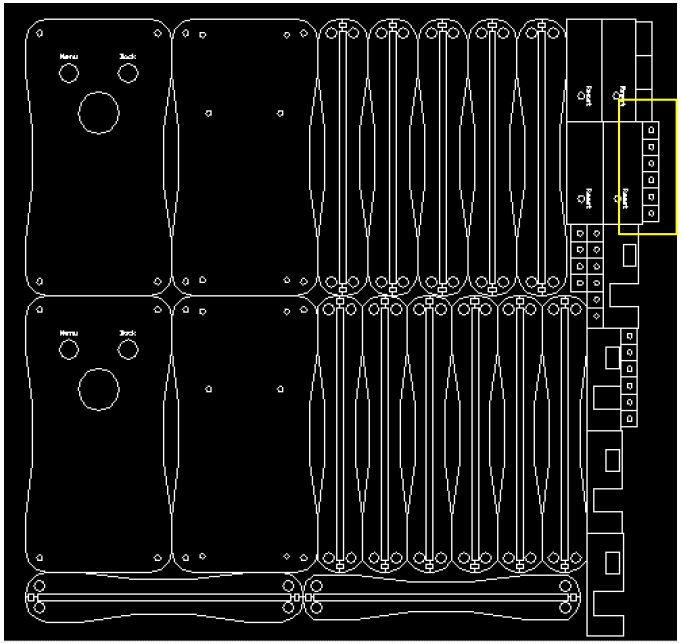




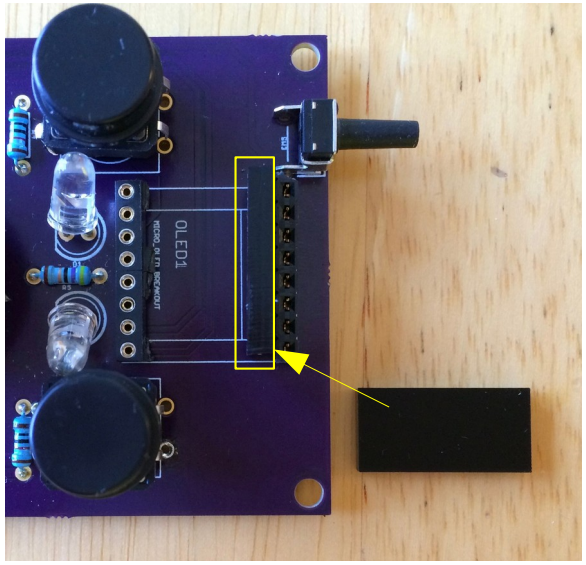
The pushbutton is mounted on 2 blocks (marked with the yellow rectangle below) glued together to form a column. The column is glued below the pushbutton switch.

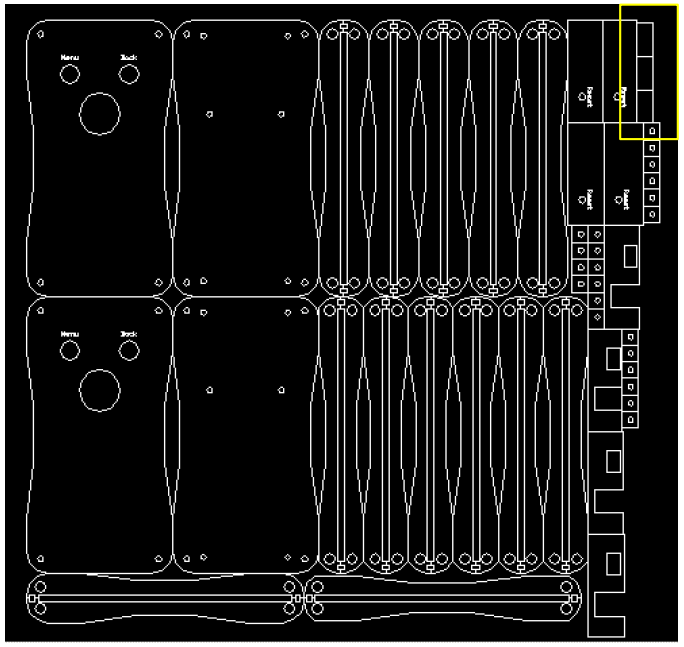
The tabs on the switch are soldered to pins that come from a wire-wrap socket.

Do not glue the column to the PCB because it needs to be adjusted to match the hole on the front cover.



# Supporting the OLED





The OLED module only has pins on one side and so it flops after installation into its socket. There are blocks (marked in a yellow rectangle in the right figure) that can be used to prop up the OLED. The block is simply glued to the PCB.

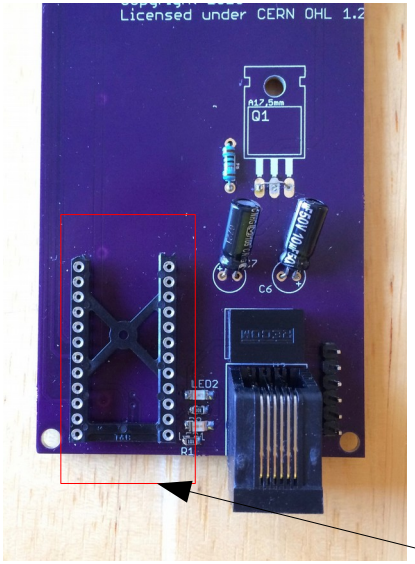
Note: The above PCB is the prototype version. Version 2 has the OLED socket nearest to the LEDs.

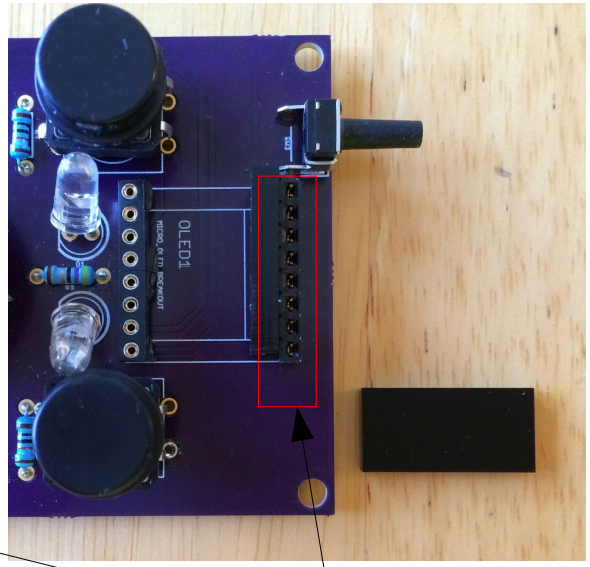
# Installation of LEDs


The LEDs are used to light up the switches so that they can be seen in the dark.

They are bent towards the switches and should be installed last.

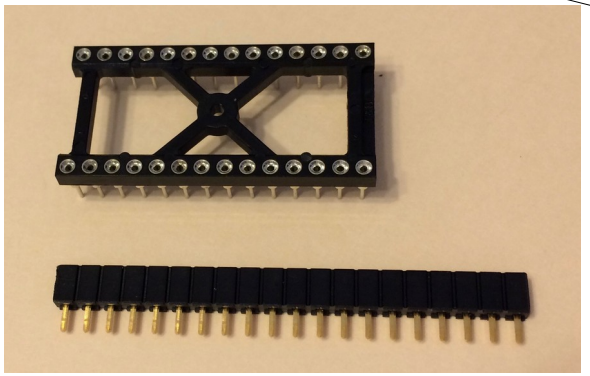
# Populating the PCB



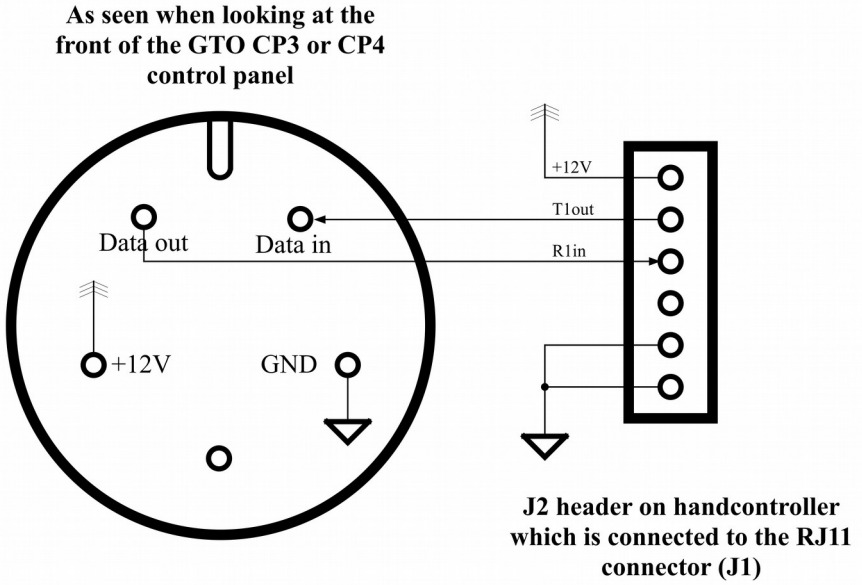

Populate the lowest height components first. Start with surface mount parts, and then resistors, IC sockets, electroytic capacitors, switches, 6P6C connector and finally the joystick.

The assembly of the pushbuttons and LEDs are discussed in later slides.



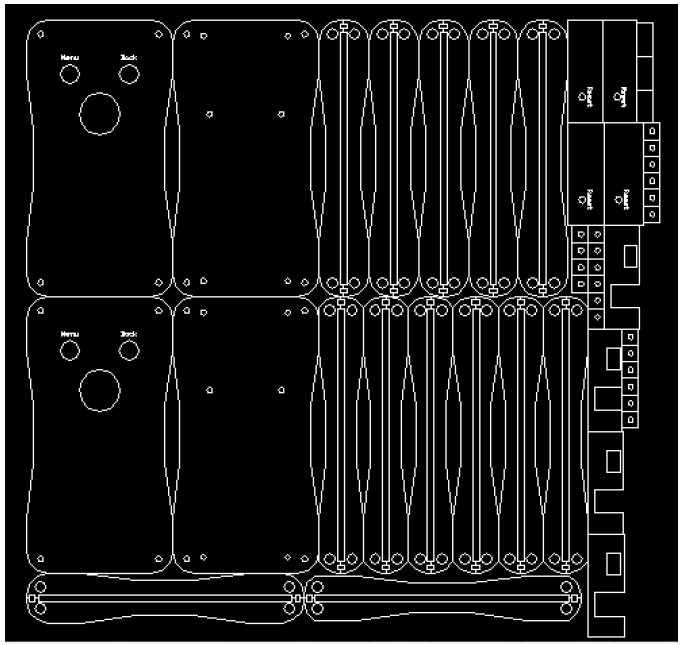
Sockets are used for the Arduino and the OLED display.

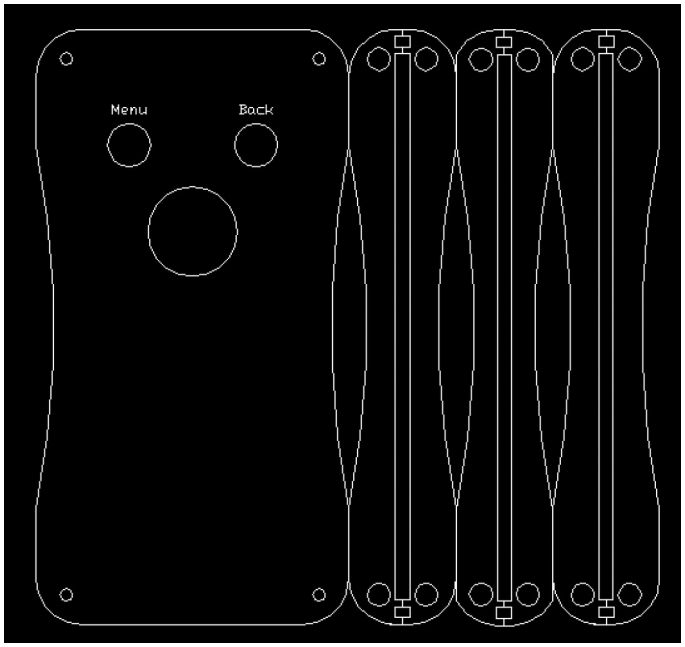
# Making the AP keypad connector




There are 6 wires but only 5 wires are soldered to the connector.
The 2 GND wires are soldered to the same pin.
One of the extra wires is just covered with insulating tape.

# Making the case



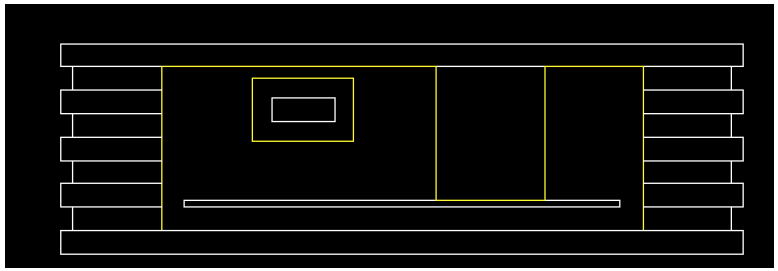


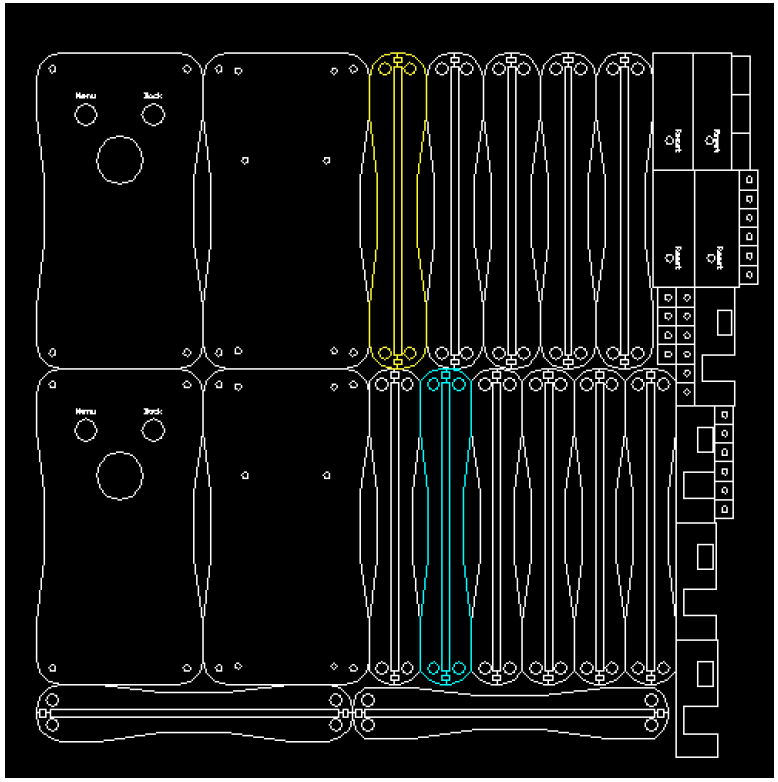

The case is made from 3 mm thick acrylic laser cut with the above patterns. The design is in the ponoko directory in the distribution.

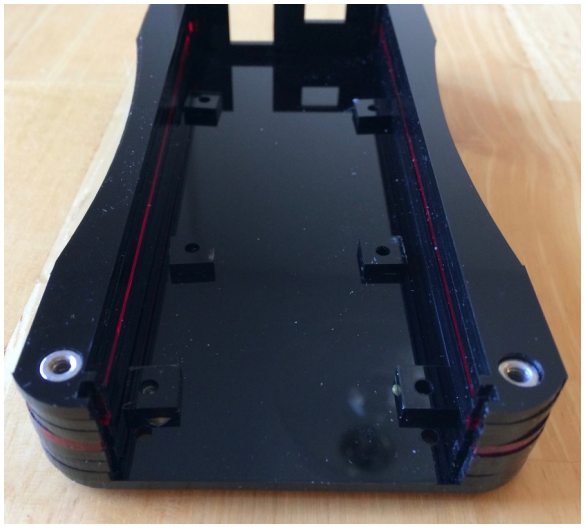
In the prototype, a black acrylic is used to make the body and the cover is made from red tint acrylic.

Of course, it can be made completely of red tint acrylic.

# Stacking the case





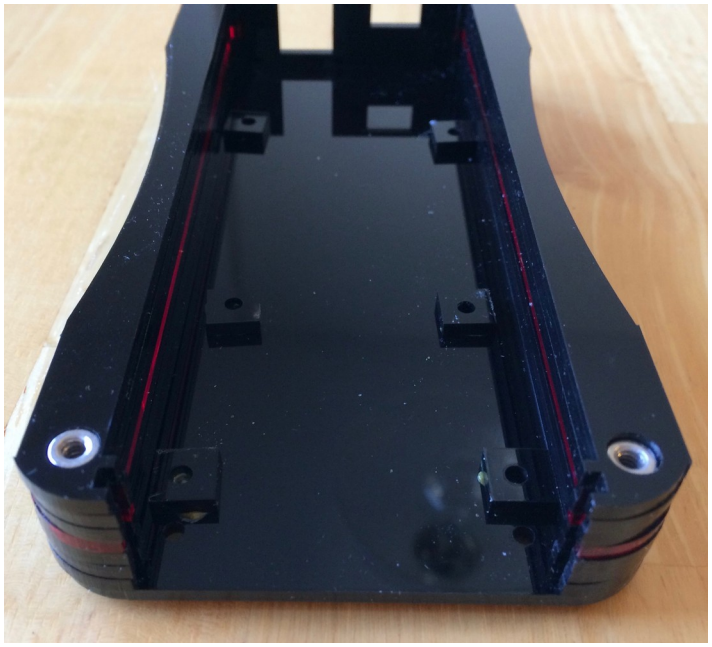


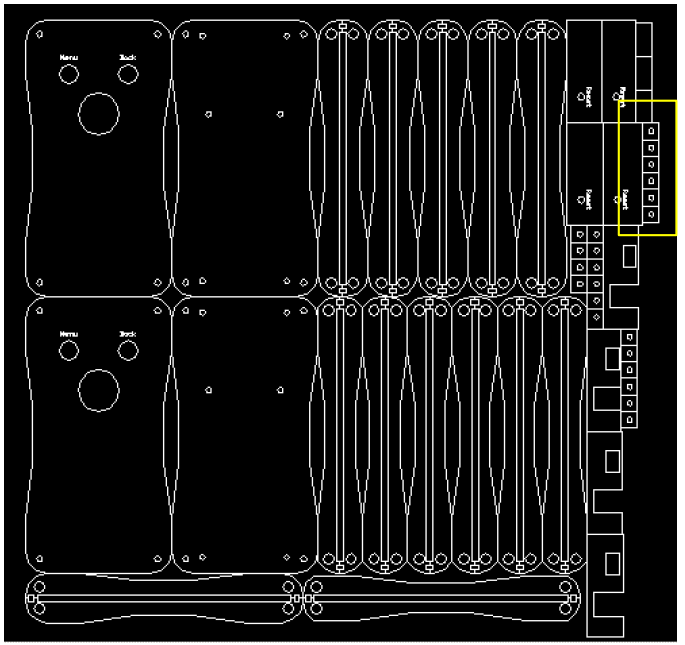
The case is made by stacking the pre-cut laser pieces together. The yellow piece that is outlined in the bottom left picture is the “fat” slice and the cyan slice is the “thin” slice.

The “fat” and “thin” slices alternate.

The posts that guide the slices are 1” long standoffs.

# Gluing in standoffs





The blocks that are used to make standoffs are in the yellow rectangle in the right figure. They are glued to the bottom of the case.

# Highlighting marks


The laser engraved characters are highlighted by rubbing in silver Rub'N'Buff compound.

The excess is wiped off using ethanol.

# Hanging loop for the controller


I made a hanging loop for the controller using cable ties looped through a cable tie mounting base.