

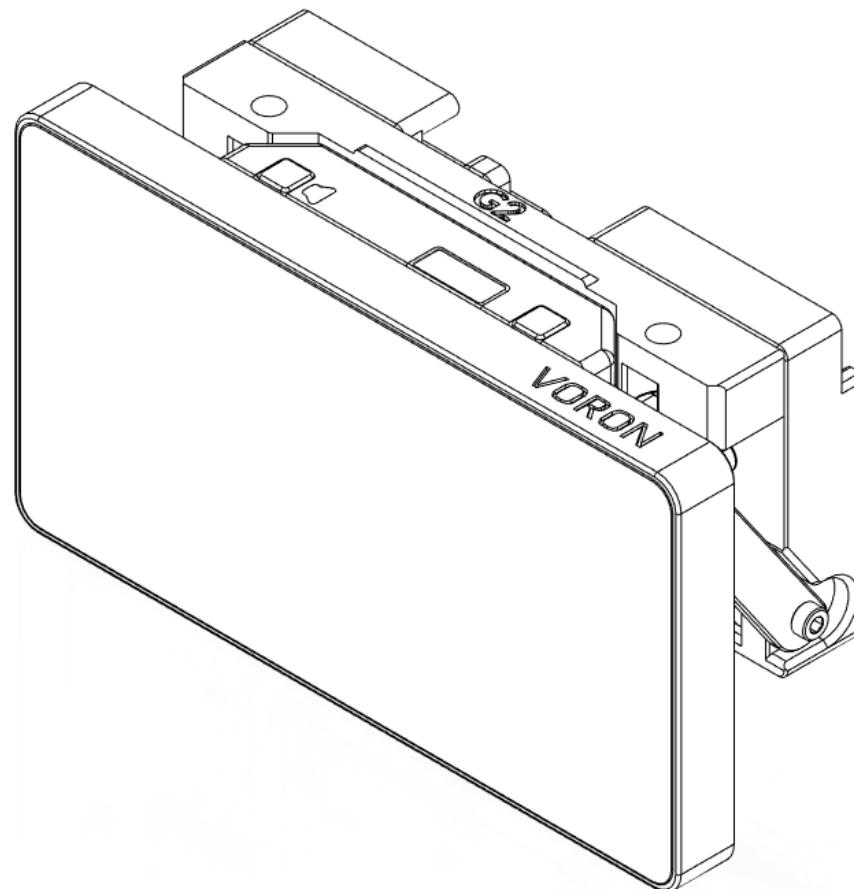
# RealEstate

Generation 2.1

Assembly manual

REV 2023-10-01

Now with  
volume buttons



OITSWILLIAM PANG

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# Before getting started

You are about to read the mod project assembly manual.

This manual shows the assembly, wiring and configuration guide of RealEstate display for Voron Trident and Voron 2 printers.

You need to make your own micro-USB cable with four 24AWG wires in between 30cm and 65cm ends, prepare either an end-stop switch or a silent mouse switch with two 26, 28 or 30AWG wires in between 40 and 70cm ends.

# About RealEstate

RealEstate is a display unit made for Voron Trident and Voron 2. It is a freely adjustable tilting display that defines portability.

It is made using 3 parts, back panel, mid-joint and the screen. The joints between the back and the screen are inserted with PTFE tubes so that there will be no stress between joints and there is no lubrication required. The mid-joint and the back panel secures the wires so they will not be pulled / pushed on its own. The back of the screen has a glowing chin that is ARGB. Users can use KlipperScreen on Raspberry Pi / NUC PCs that run in Debian without any desktop environment or use Windows 11 if for experimental.

The current design only uses 3 types of screws that are found in Voron Design printers' BOMs, while one of it (M2x8mm BHCS or self-tapping screw) is unique to this mod.

# Warnings



Danger: risk of electric shock

- Even though you can build with this mod from start, if you want to extract the power supply that you previously have, you need to check that the mains is unplugged.
- Failure doing so which is unplugging the mains power may cause electrocution or even death, especially on regions that use 240V.
- When in doubt, please don't touch the wires connected to the power supply or SSR.

When you accept all the warnings for this project,  
you can start building one.

# Contribution

Starting in November 2021, every Oitswilliam Pang projects including this will have a dedicated sources and source files for free, which makes them open-source.

If you want to contribute this project, you can visit in [GitHub.com/Bunny350](https://GitHub.com/Bunny350).

In other words, each OIWP's projects have their own licensing policies. So if you want to distribute the projects, you need to refer to their licensing policies first.

# Support

Having problems building our projects? You can contact us in Facebook or Twitter.  
<https://www.facebook.com/officialbunny350>

However, for the better experience, you can visit and then join Oitswilliam Pang Discord server and receive the community support. Please follow its rules. <https://discord.gg/Cu6e9ra>

If you have problems because of the project's errors or simply issues, you can submit them in GitHub.  
<https://GitHub.com/Bunny350/OITSWILLIAMV2/issues>

The manual might be updated overtime, so when you start building, or are trying to build the projects, you might need to get the latest manual if it was left for at least every three months.

Thanks for viewing the manual. Now go on the next page to build the first part.

# Part printing

## Print guidelines

Each part of the model requires the following set settings, failure to match most of them may result in unexpected damages.

**Bold text** indicates the recommended value and *italic text* indicates what setting it is being changed.

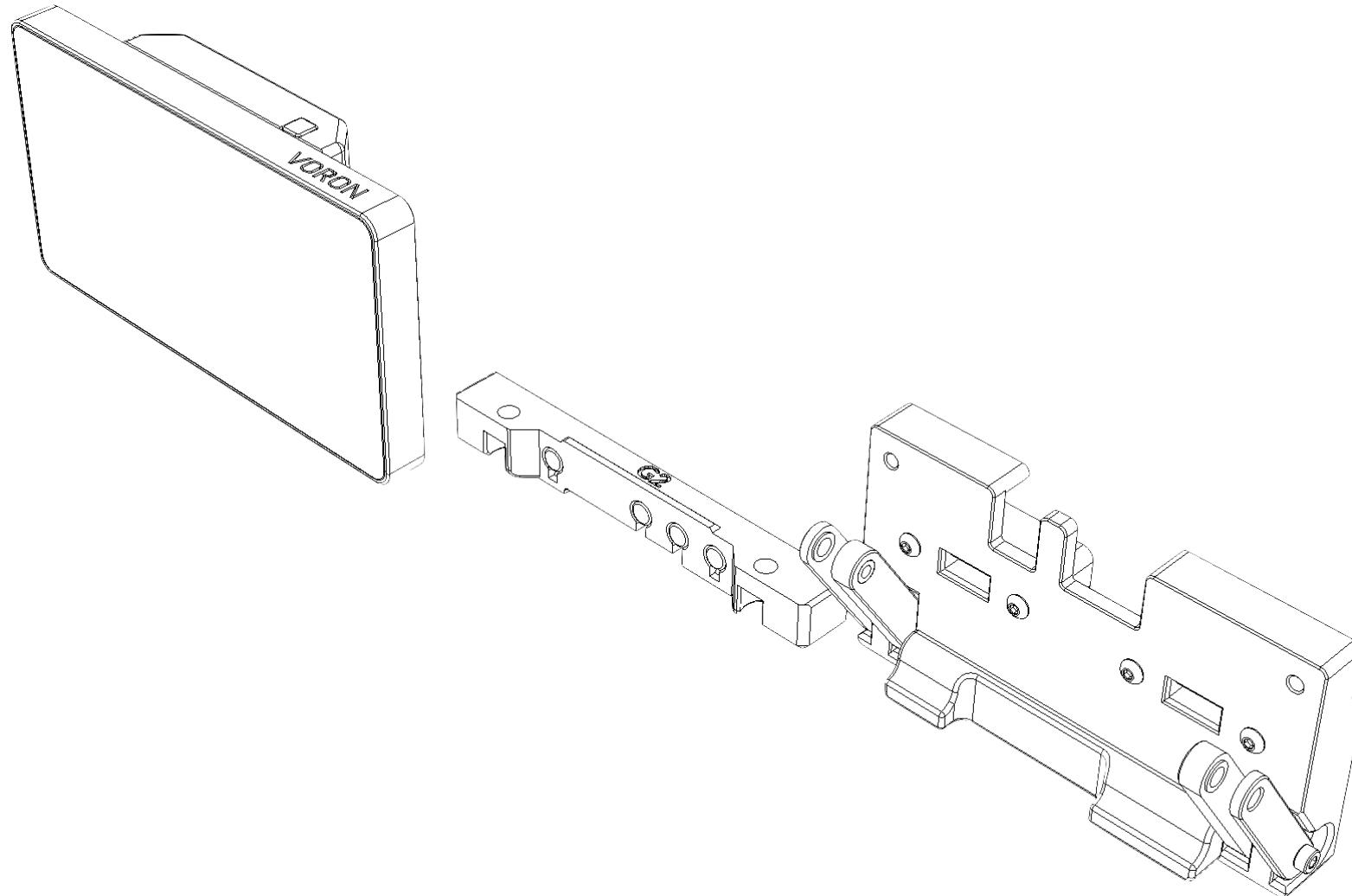
Printer types <b>FDM / FFF, SLA (non-motion parts only) or SLS</b>	Print material: ABS, ASA or PA12 <b>Prohibits PLA.</b> Do not use PETG in motion or enclosing parts.
<b>Layer height of 0.2mm</b> Initial layer height <b>can be 0.2mm or higher</b>	<i>Nozzle and extrusion width</i> must be <b>forced 0.4mm</b>
<b>1.6mm wall width</b> Or <b>4 wall counts</b> , excluding tools and jigs	<i>Infill</i> must be <b>at least 40%</b> , excluding tools and jigs
<i>At least 4 solid bottom and top layers.</i>	The best <i>print speed</i> is up to <b>120mm/s</b> . The speed might be reduced by the hot end flow rate.
Supports are <b>not required</b> . Uncheck generate support if available.	<i>Other settings might be depended on your printer.</i> <i>Follow it's warnings for proper handling.</i>

## Before assembly

To get started building the project, you must use the following tools:

- Soldering iron

# Assembly



# Cable preparation

You need to make a micro-USB cable that has it's profile lower than the factory specified, by not installing the hard case, but with heat-shrink tube. Most factory cables do not fit into RealEstate display unit and may cause damage to the display or mount if forced. This only requires at least four 30cm 24 to 26AWG wires to power.

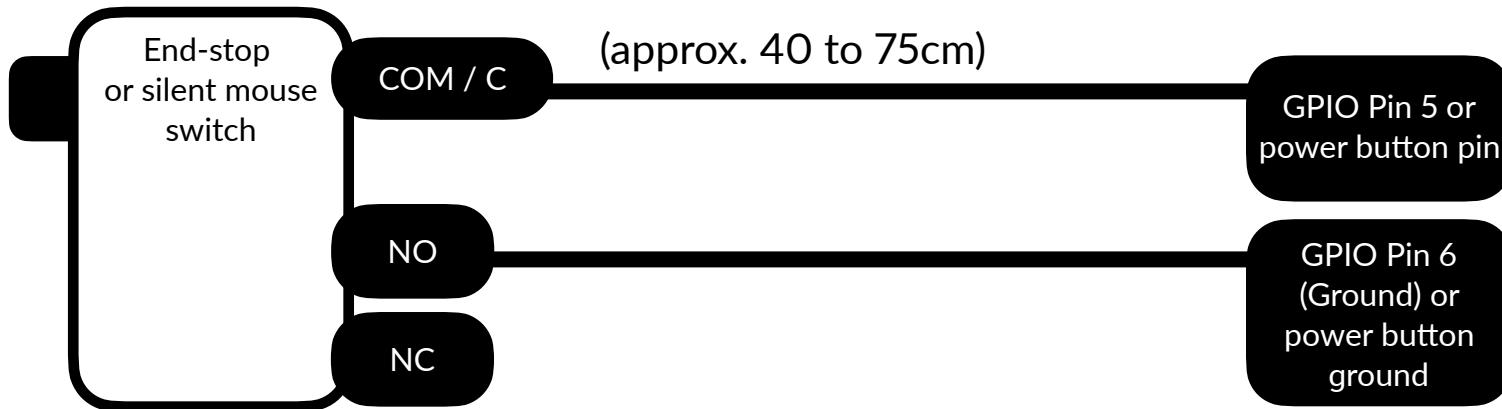
The cable might be extended to 50cm for 250mm spec, 55cm for 300mm spec and 60cm for 350mm spec builds. The power button needs to be approximately 40 to 75cm. This is used to turn the PC or SBC on using such button in this unit. **These are for reference only. Please report these to GitHub issue if you have found the wire looking too short or long.**

If you want to utilize the glowing chin, you need to wire an ARGB strip with three 50cm 24AWG wires. It might be extended to 60cm for 250mm spec, 65cm for 300mm spec and 70cm for 350mm spec builds.

This display unit also requires two HDMI to flex cable with 90 degree up on both heads. **Cable included from the display never fit with this mod!** 250mm spec only require 50cm flex cable while 300mm and 350mm requires 1 meter one.

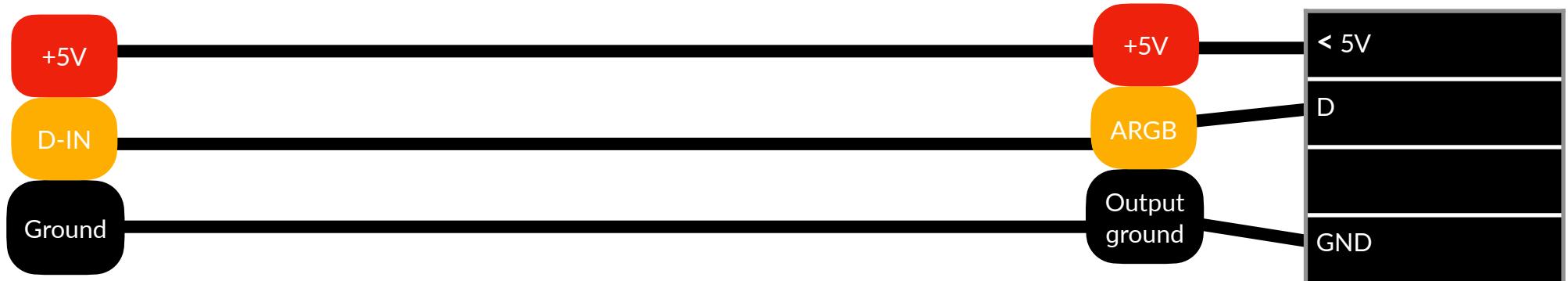
If you are wiring the volume buttons, the easiest way to do is to wire 5V inputs by taking from the display's cable and then putting the Raspberry Pi Pico in the hatch. That way, only two wires (data wires) are exposed.

## Power button wiring diagram



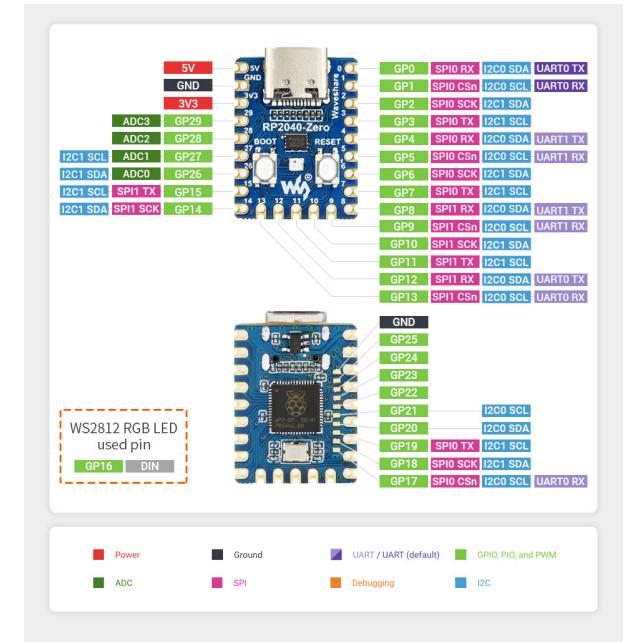
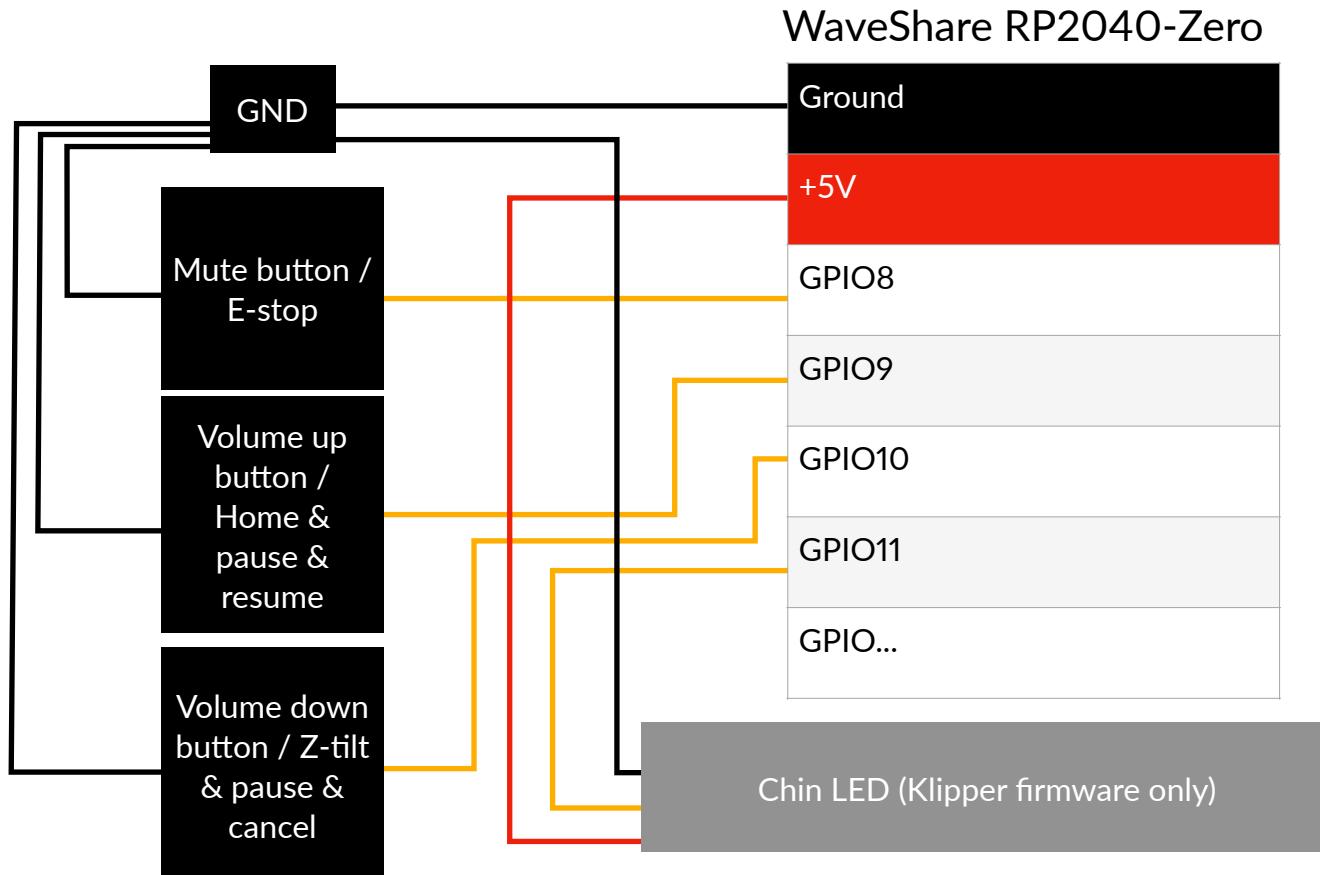
Legend: COM / C: Common, NO: Normally open, NC: Normally closed

## ARGB cable to ARGB controller wiring diagram



## Volume buttons wiring diagram

Requires Gen 2.1 hatch. Requires additional 3 buttons.



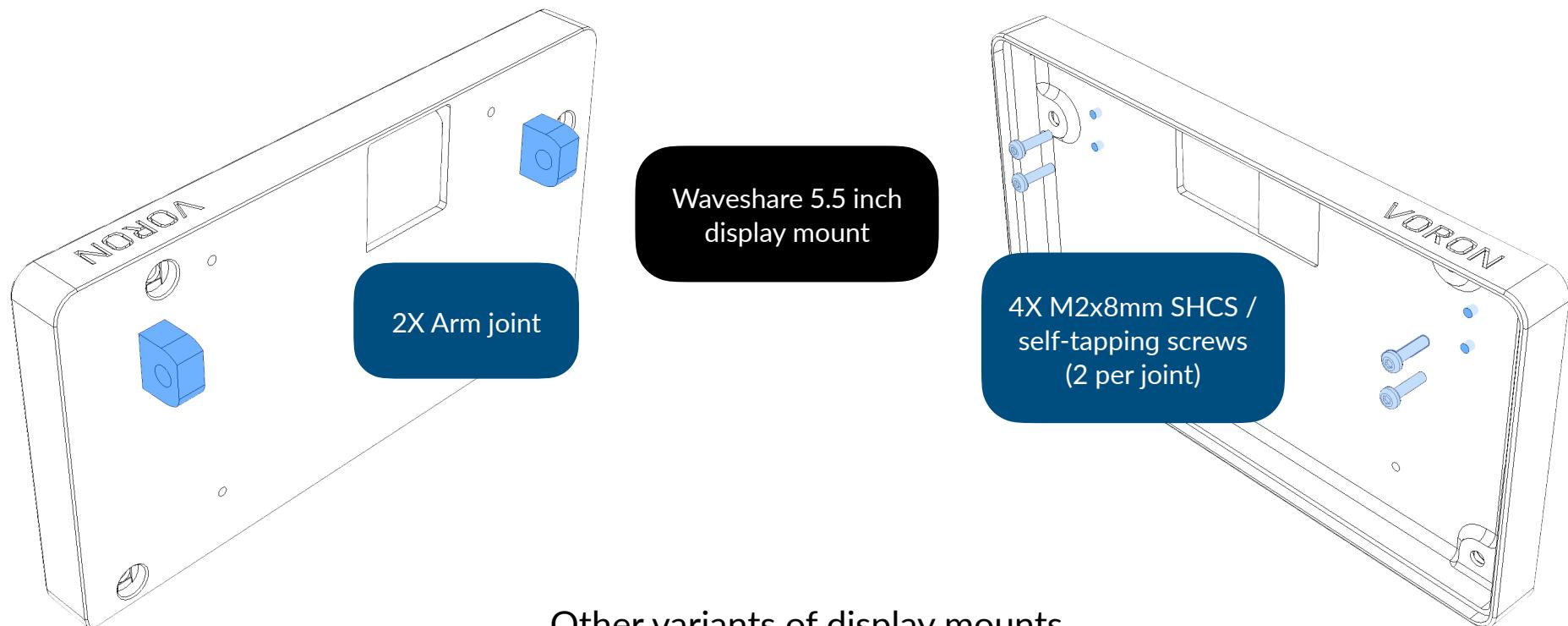
[https://www.waveshare.com/  
wiki/RP2040-Zero](https://www.waveshare.com/wiki/RP2040-Zero)

After wiring the volume buttons, you may mark the volume up button with + and volume down button with - to ease assembly. You may then flash RP2040 firmware from your device. See [page 44](#) for more details. You can see the [page 17](#) on how to place them and tidy up wires.

Please do this before assembling or upgrading, otherwise it's too late and you may need to use the software to access its upload mode. If you have got the controller with pins, you may want to cut off 3.3V pin to prevent short-circuit. If 5V pin will not be used forever, then it's recommended to also be cut off too.

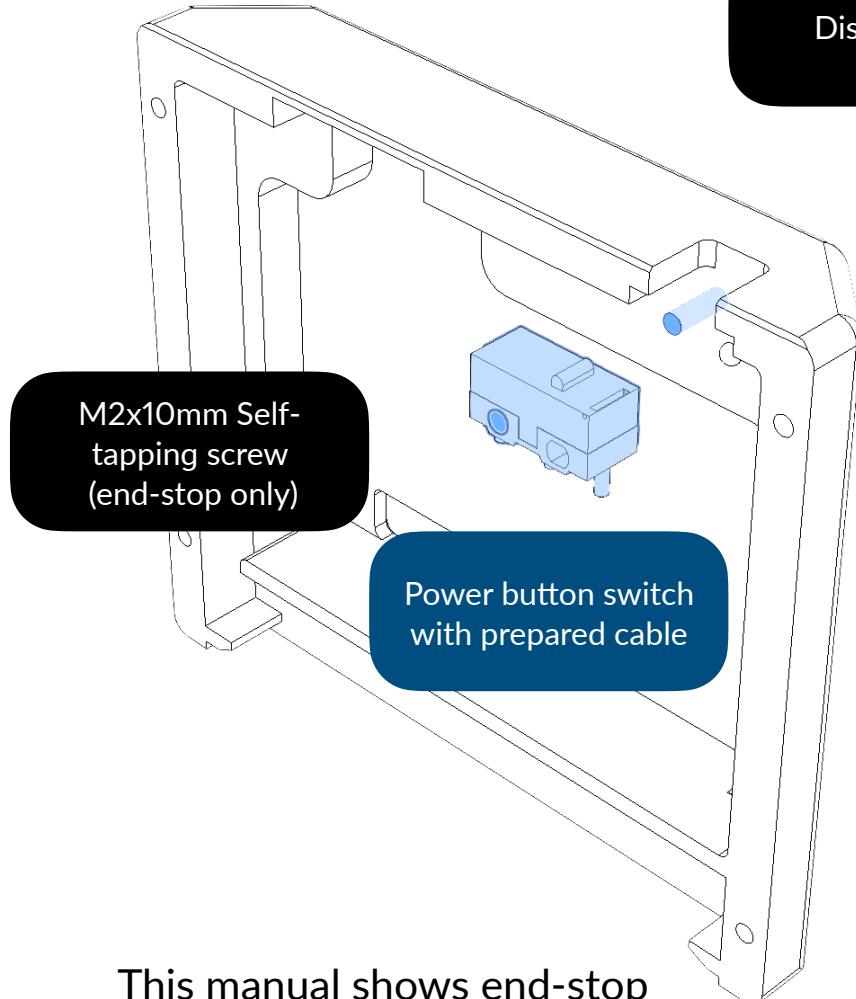
# Display unit

## Display body



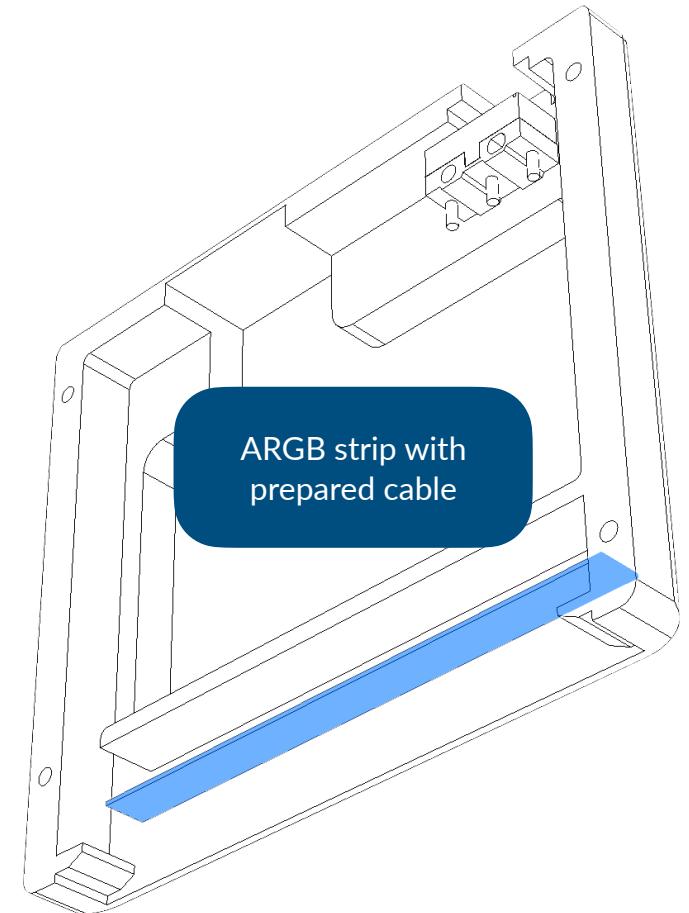
Other variants of display mounts  
can be available via user request.

For those who use silent mouse switch, a M2x10mm self-tapping screw is not needed.



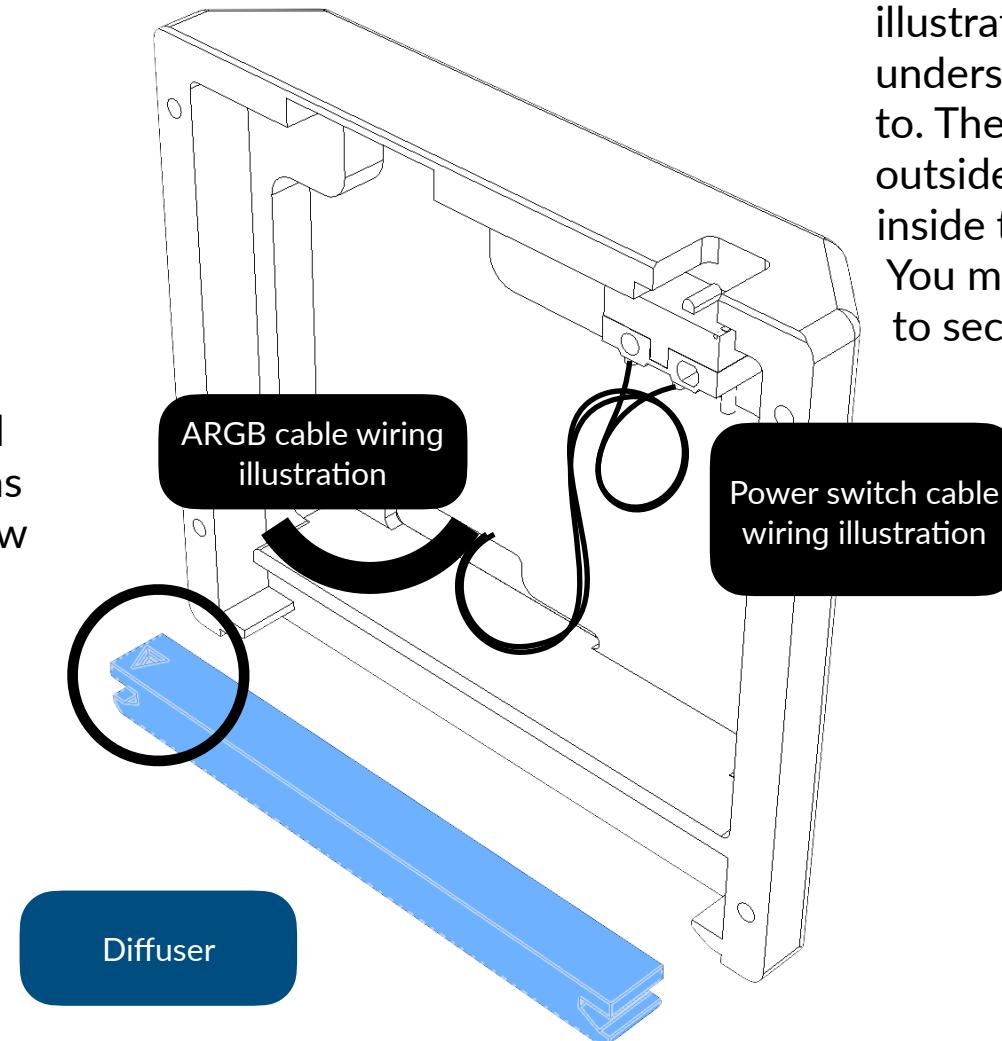
This manual shows end-stop switch as a power button.

If the switch has a lever, you may remove the lever before inserting.



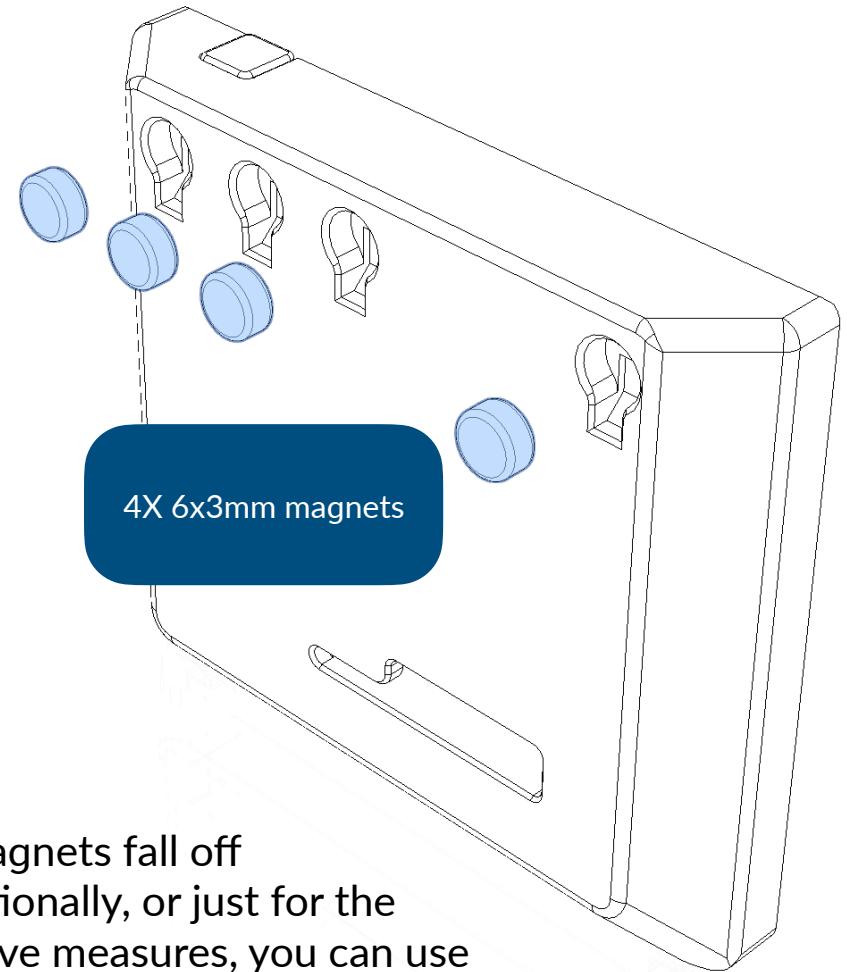
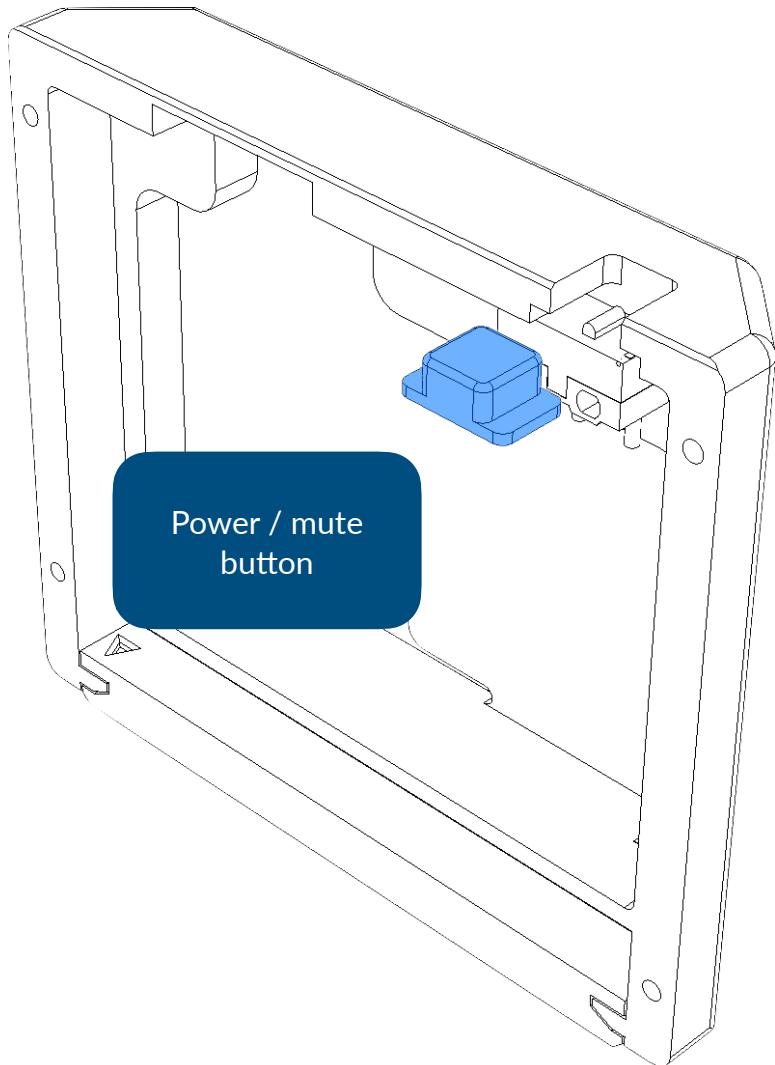
## Mind the arrow

The arrow in the diffuser circled below must point to the front, as it is directional. Letting the arrow point to back will result in placement inconsistencies. You can secure it with double-sided tape.



## Illustrated wiring

We need to provide cables' wiring illustration to make sure you can understand that are these wired to. These wirings are then go outside the hatch, which goes inside to the printer's controllers. You might need to use the tape to secure the cable wires.

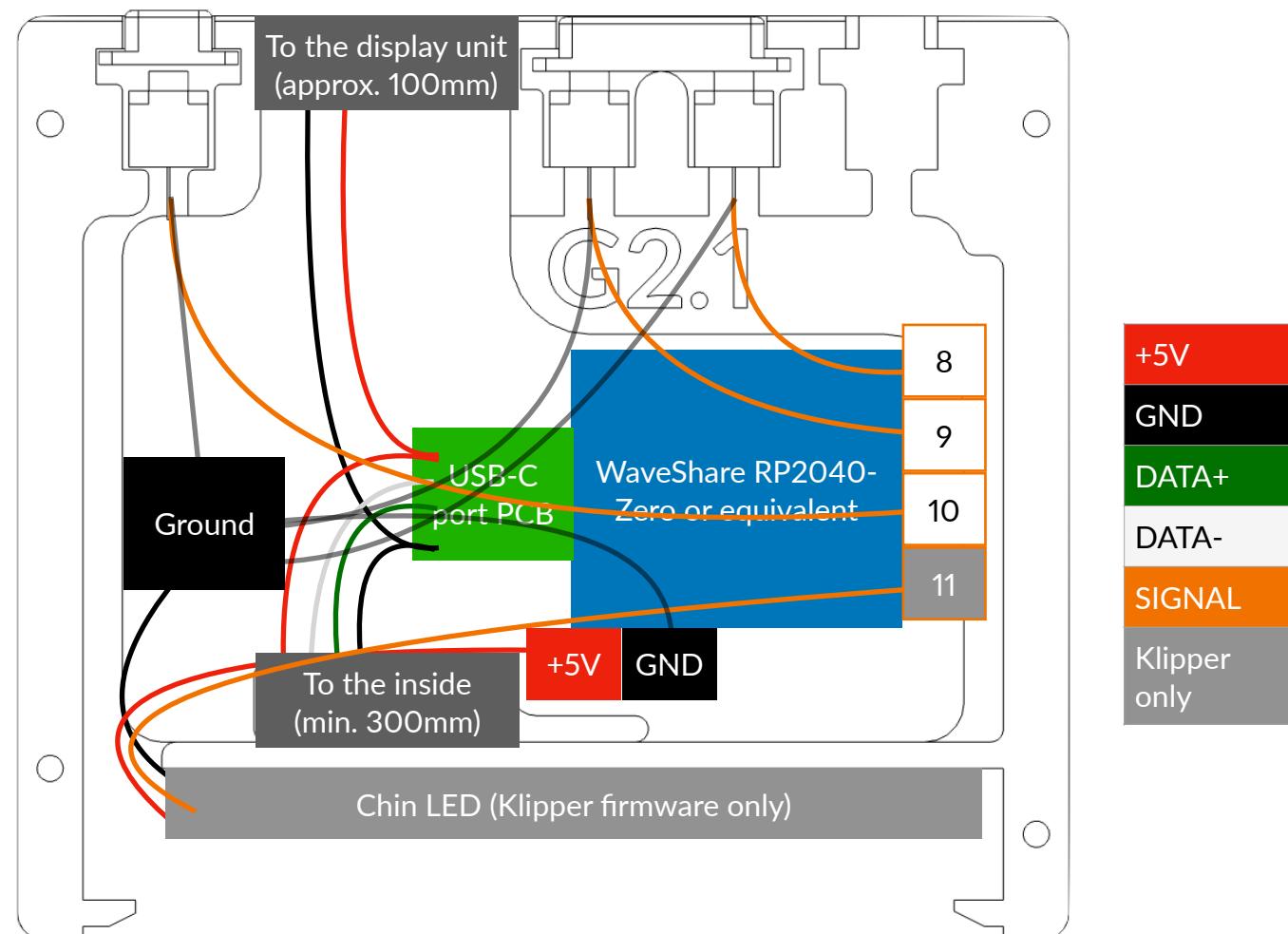


If the magnets fall off unintentionally, or just for the preventive measures, you can use RTV silicone or superglue to stick magnets to the slots.

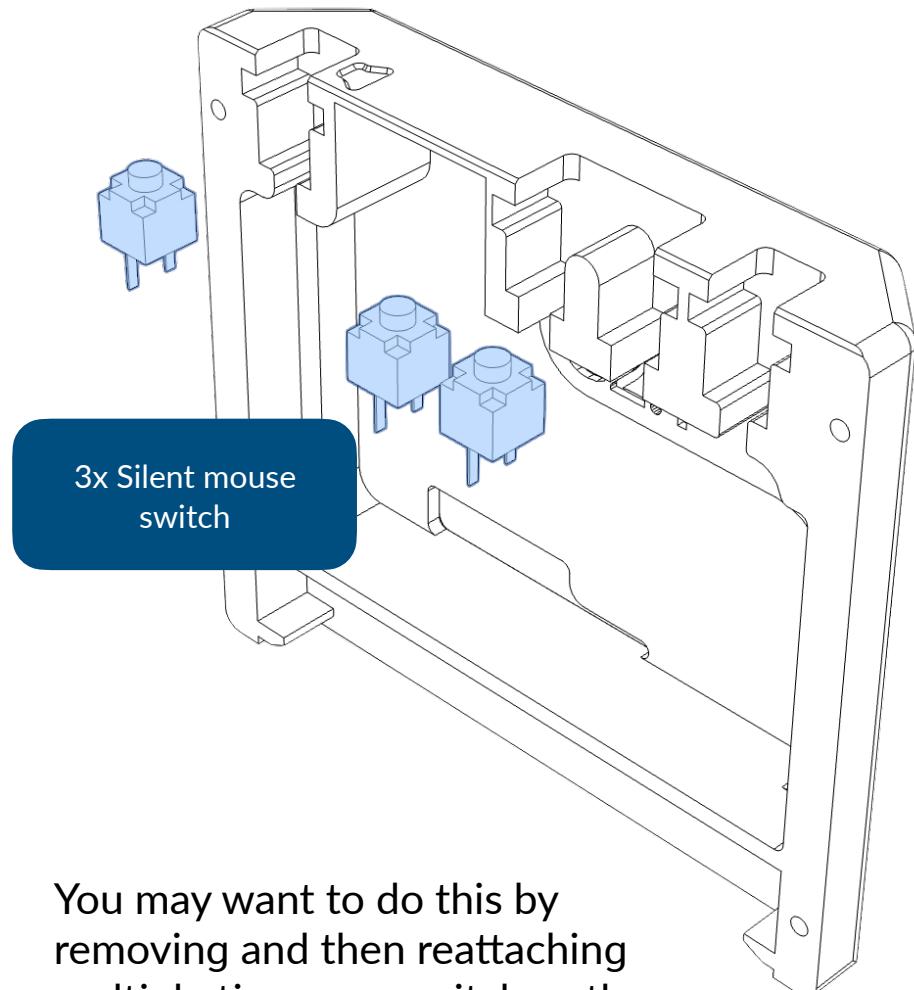
## Volume buttons

Requires Gen 2.1 hatch.

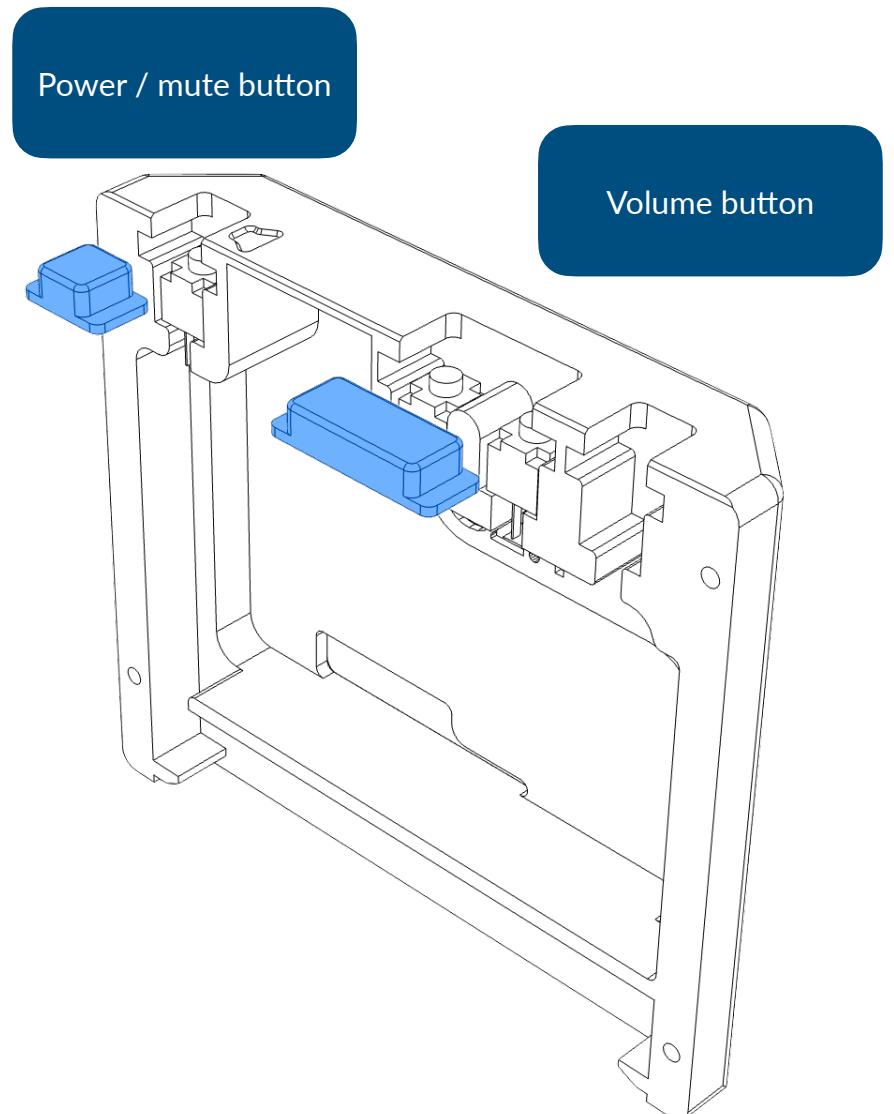
### Wiring reference / illustration

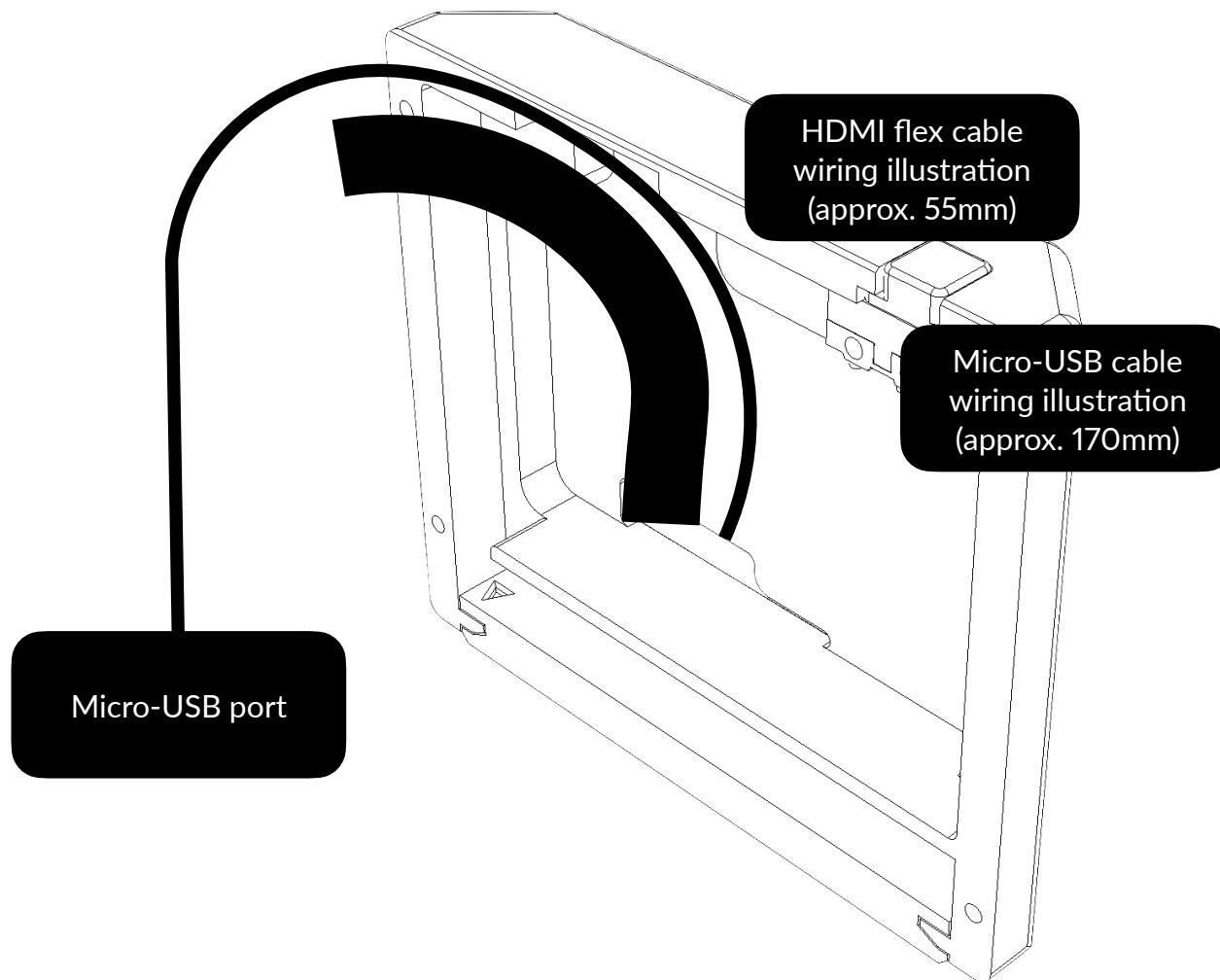


## Hatch Gen 2.1 assembly

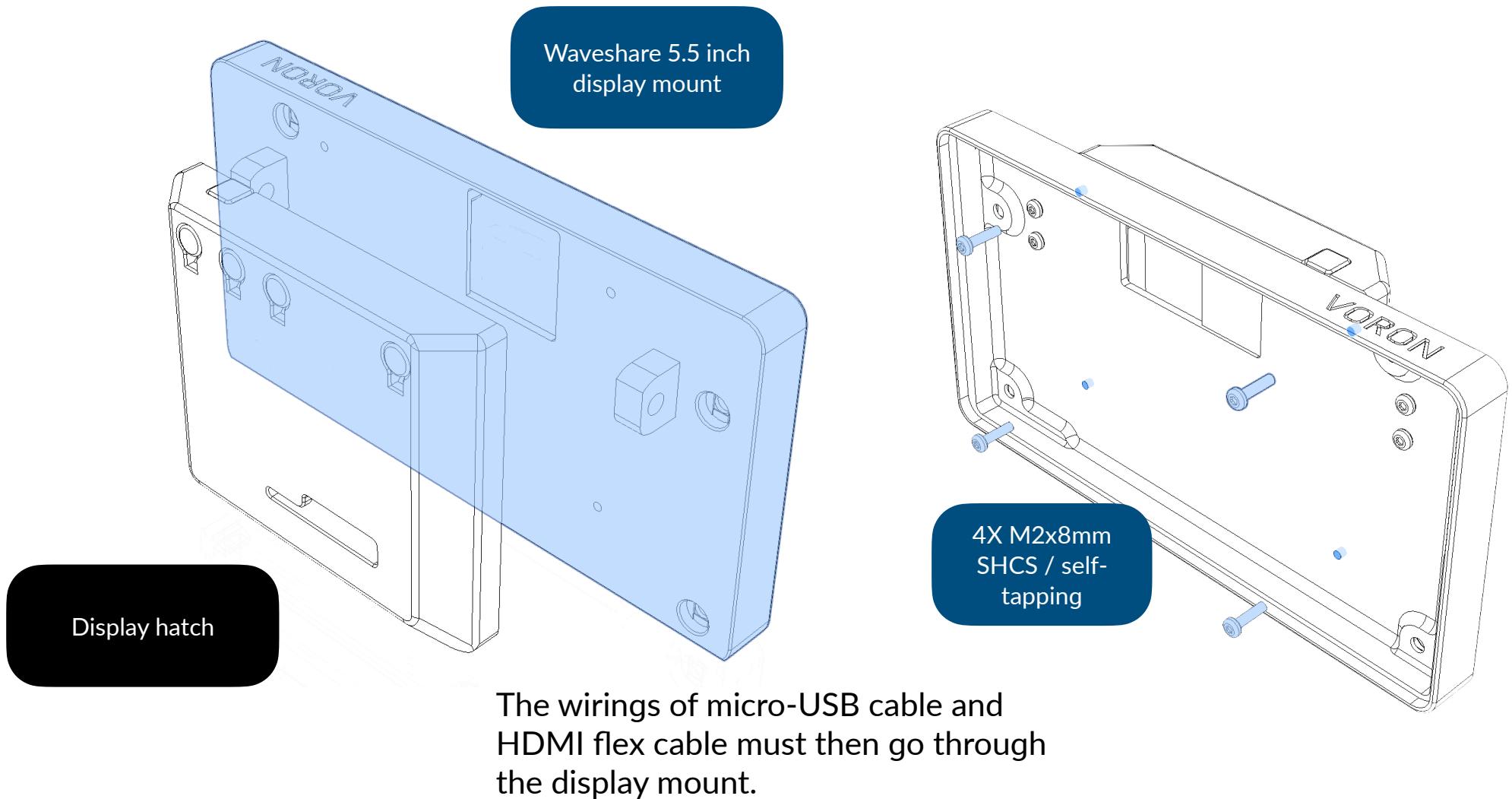


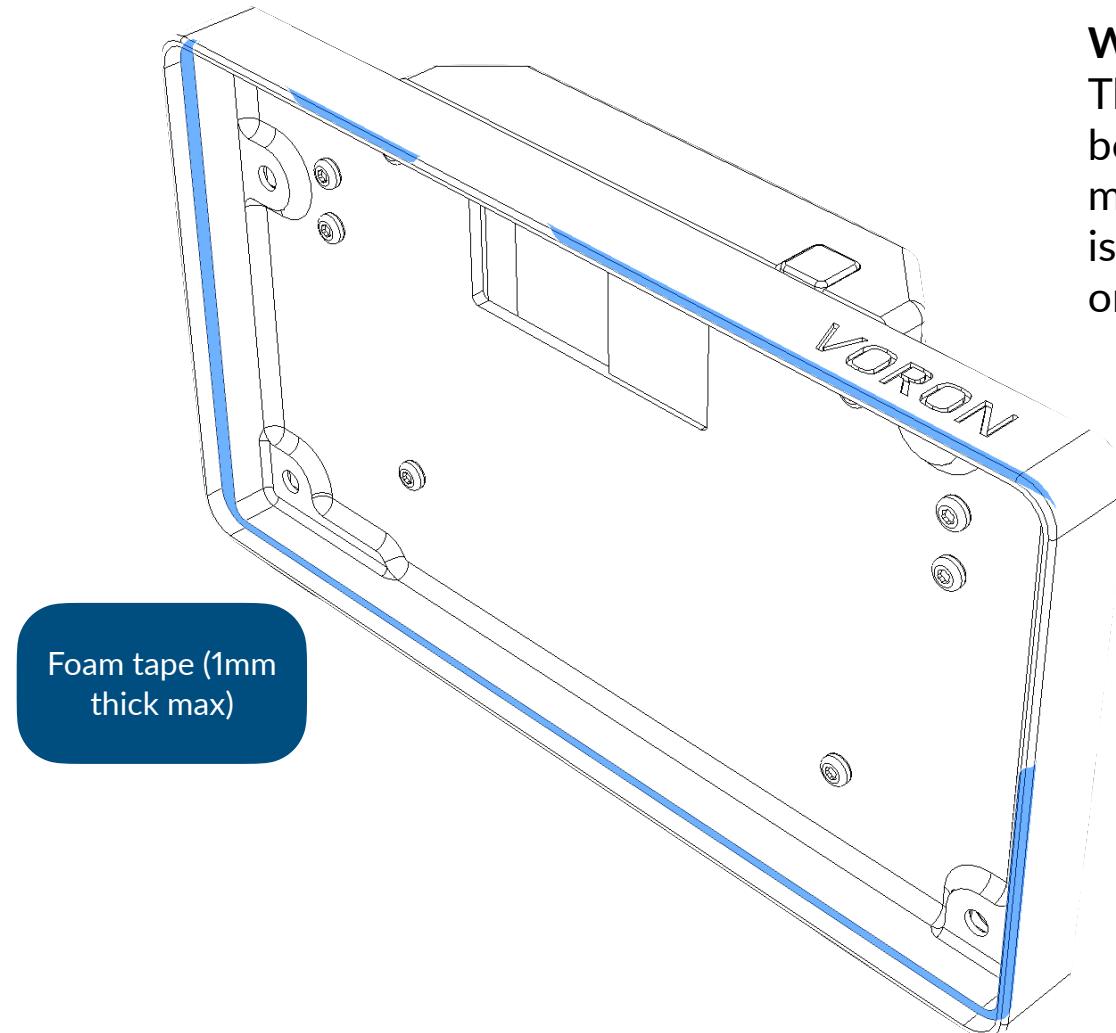
You may want to do this by removing and then reattaching multiple times per switch as the wirings are too short. You can refer to the previous page for wiring.





These wirings need to go from outside the hatch to the inside which is then go to the controller. Securing with tape is recommended.

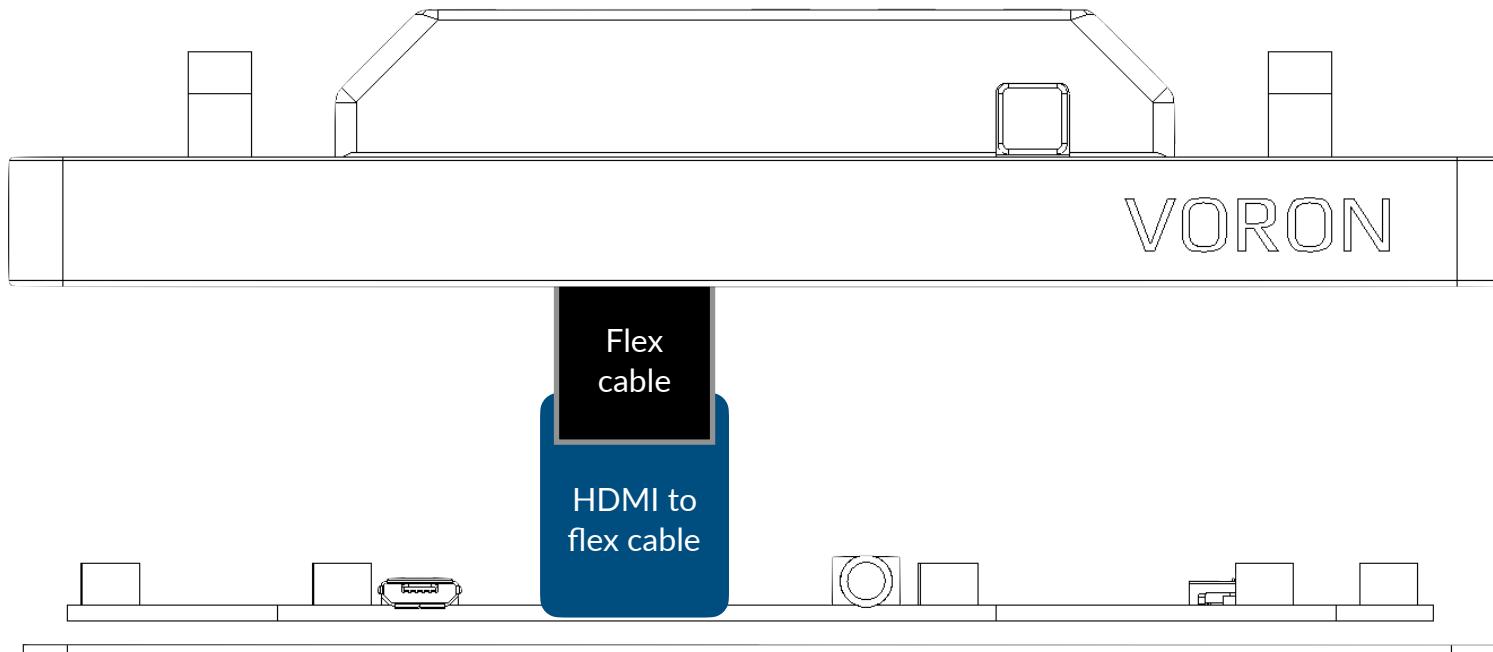




### Why foam tape the edge?

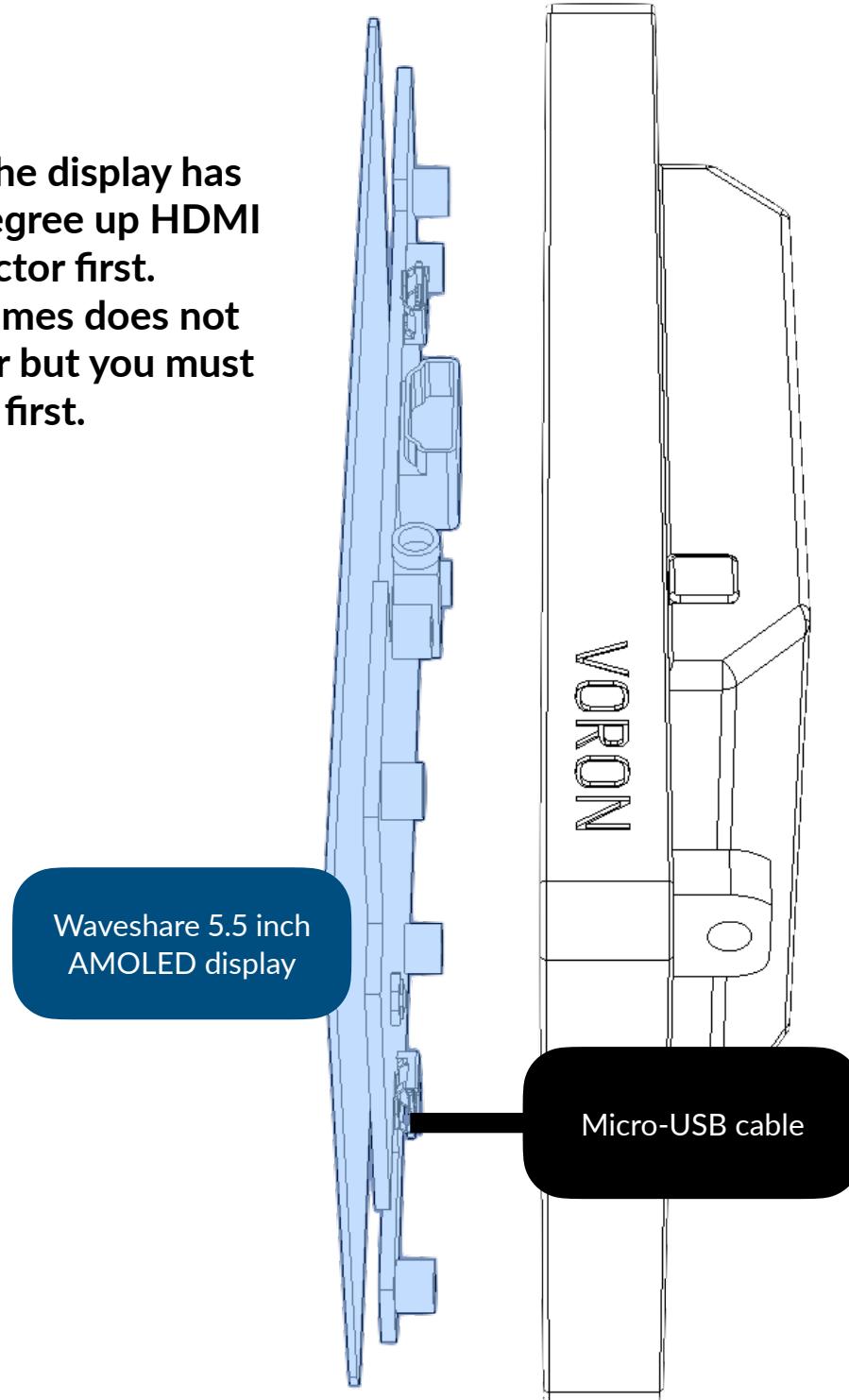
This is to address problem flushing the bezels of the screen and the edge of the mount. However, using foam tape that is too thick may result in screen bulging or even risk damaging the display.

## Display and HDMI to flex cable connection illustration

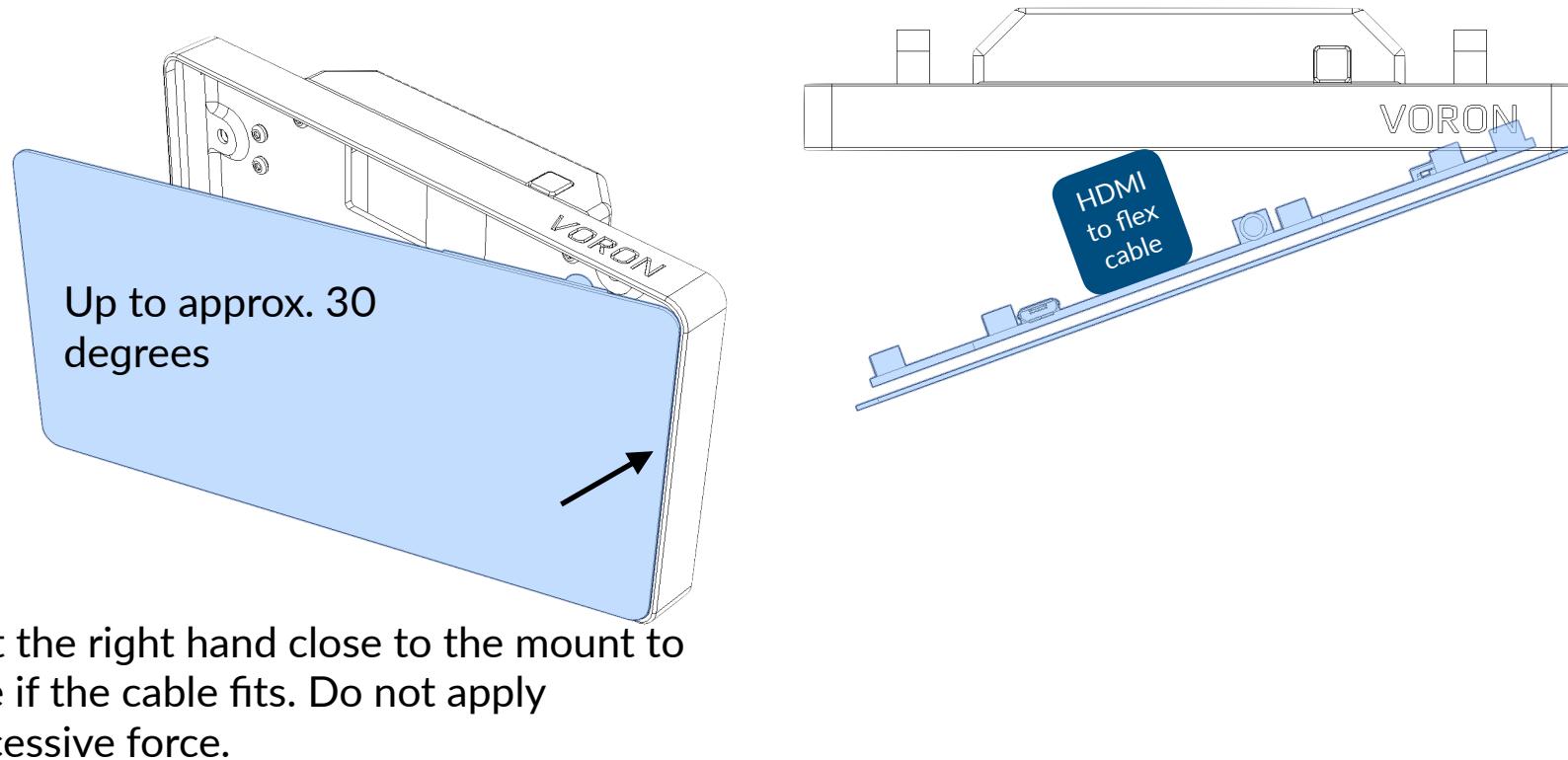


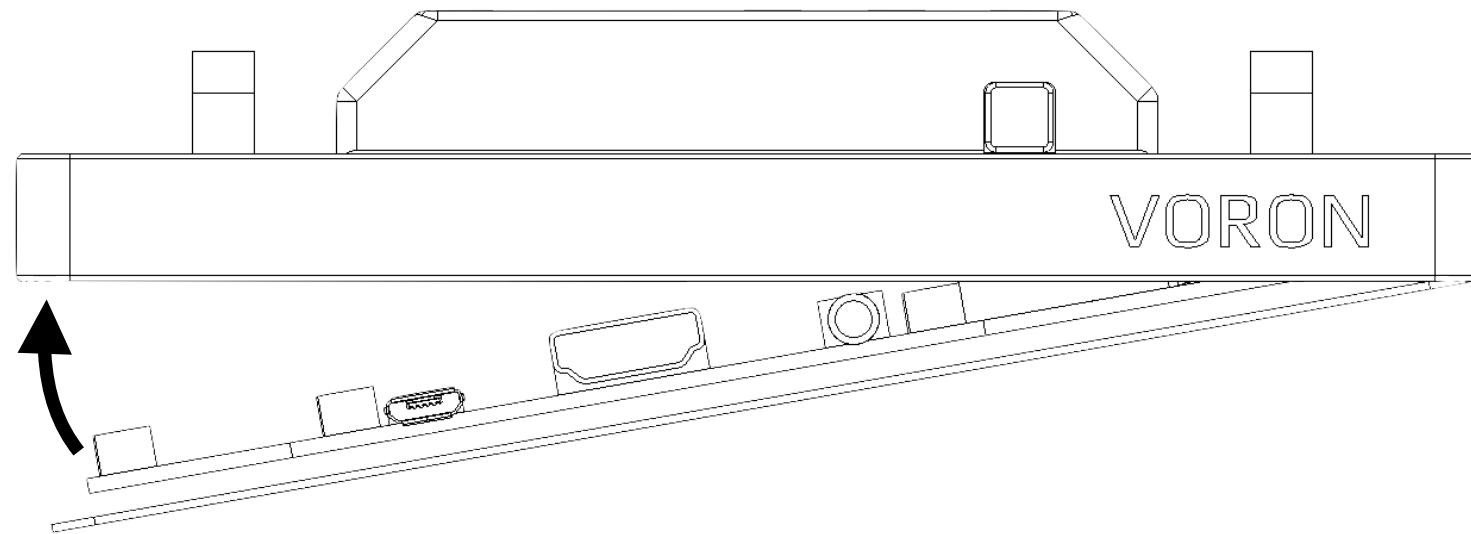
This step requires connecting the flex cable to the display's HDMI cable. First unlock by lifting the lever, then place the flex cable by sliding in, and finally lock the cable by pushing the lever. The next page will not show the flex connector.

Please check that the display has inserted with 90 degree up HDMI to flex cable connector first. This manual sometimes does not show the connector but you must be prepared with it first.

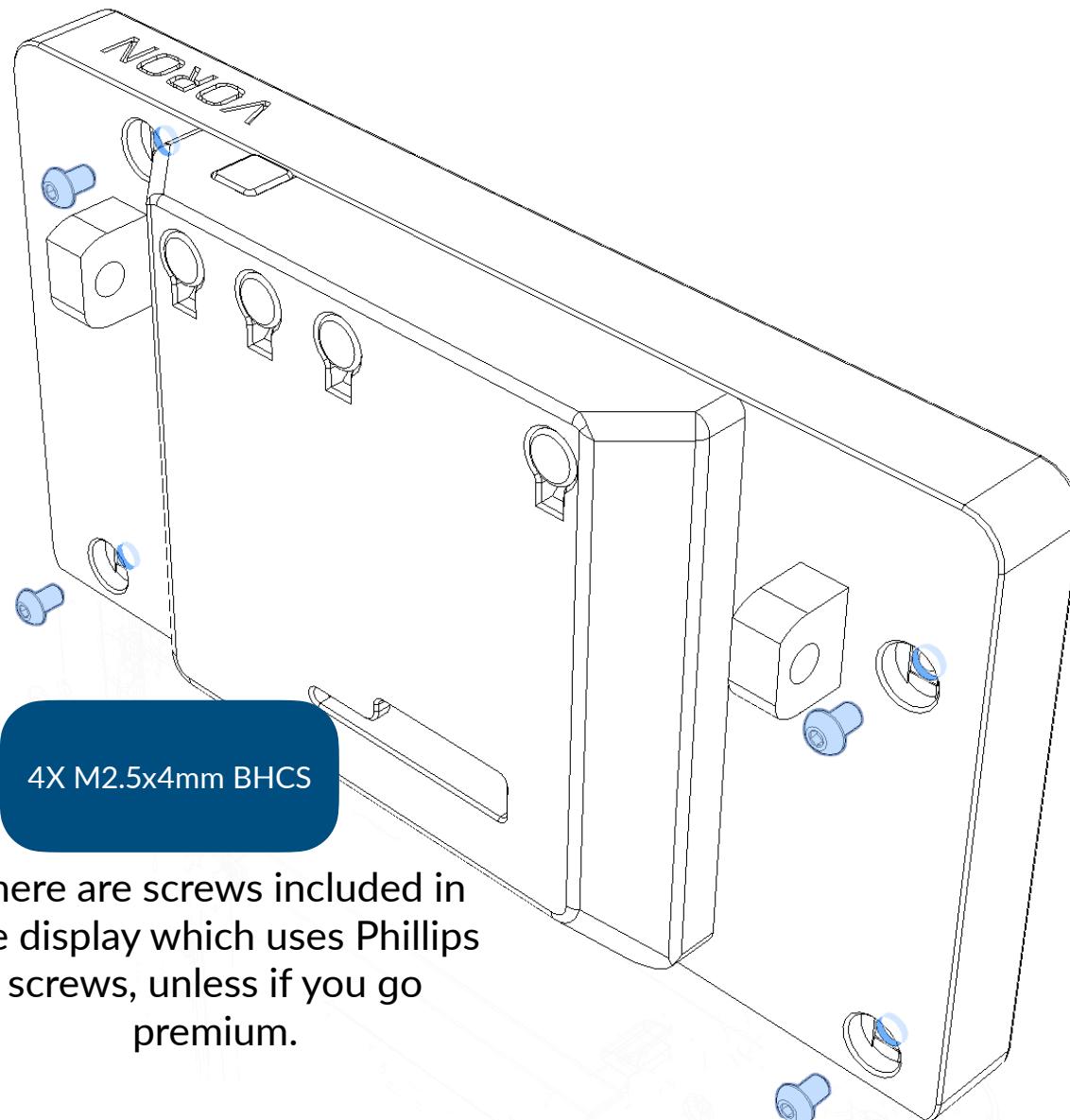


This step connects the micro-USB cable to the touch & power port of the display. There is another port at the top which only powers the display, and should not be used or connected. The next page will not show the cable.



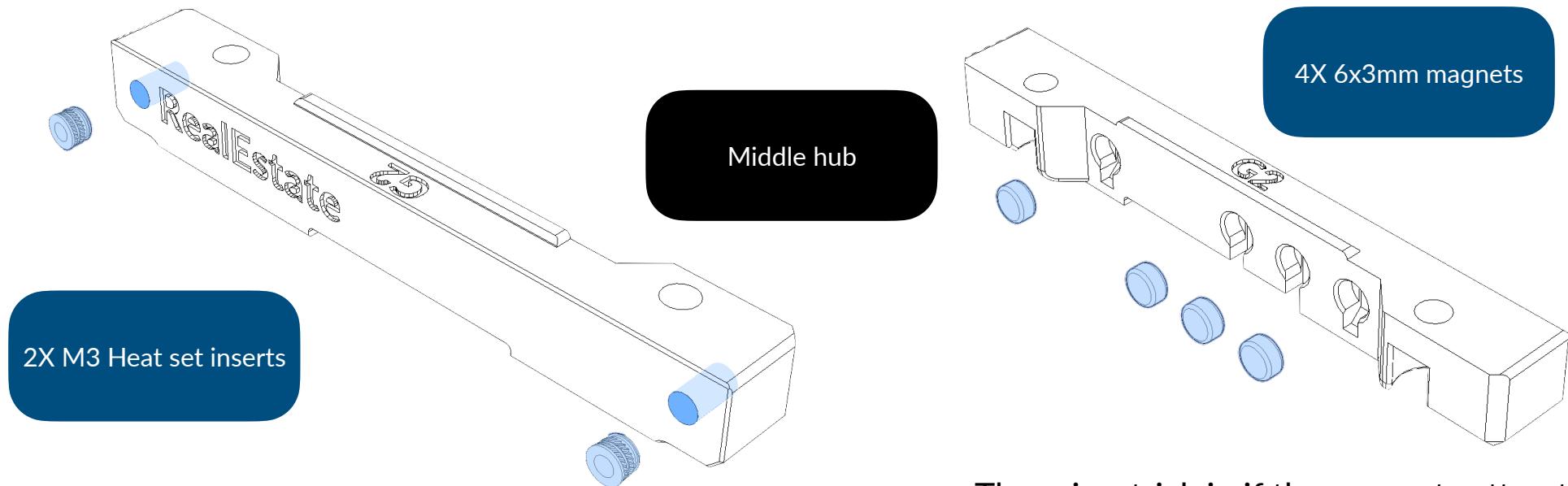


Be careful and slowly close the display to the mount. Do not apply excessive force or it may cause damage to the display.



There are screws included in  
the display which uses Phillips  
screws, unless if you go  
premium.

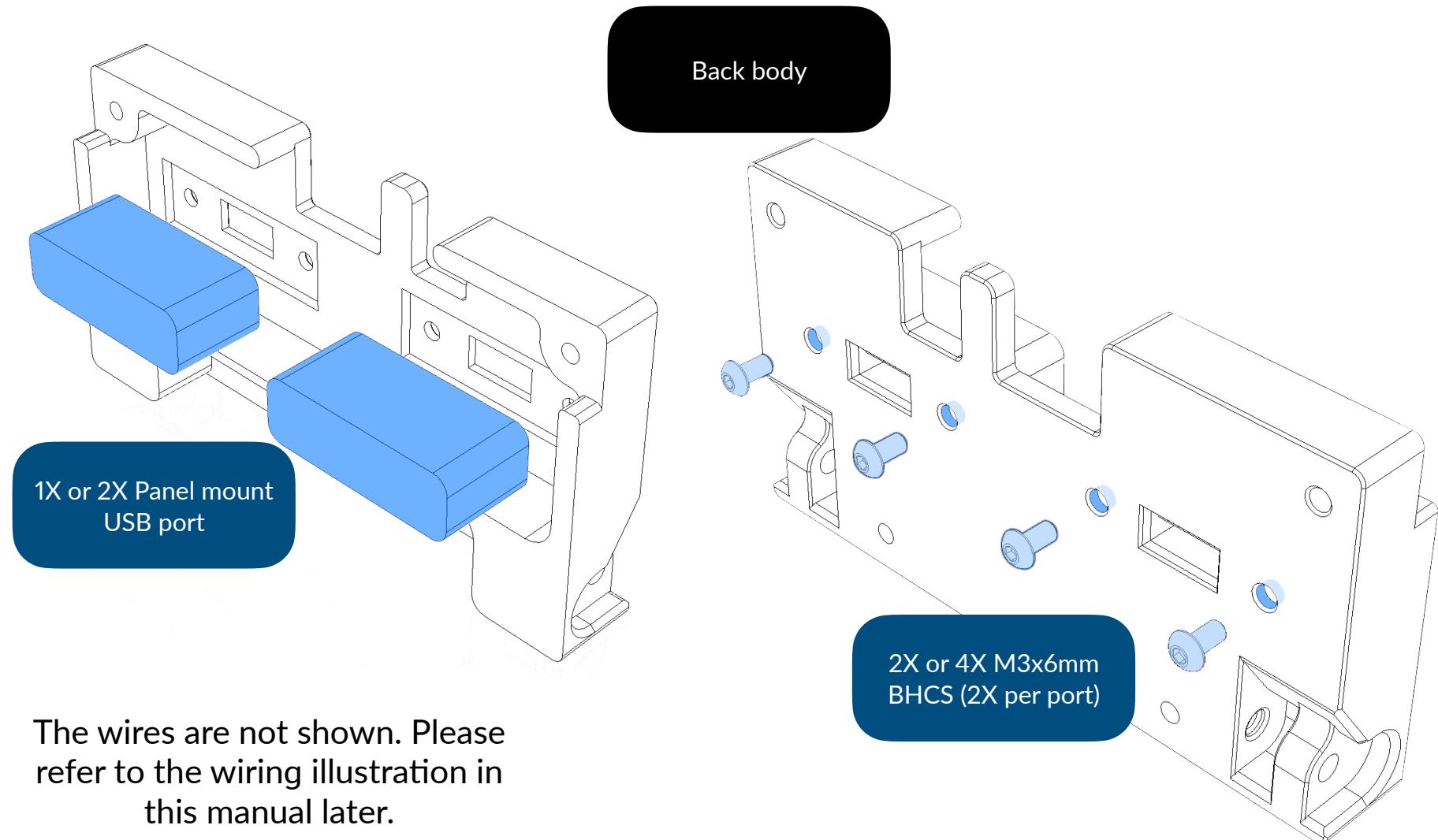
## Middle hub preparation

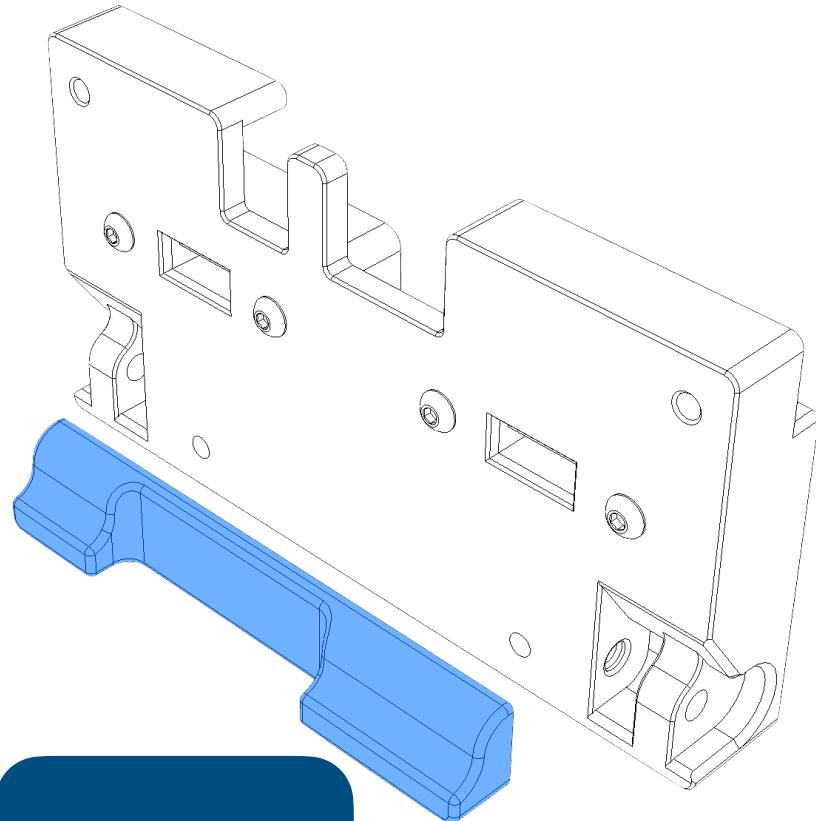


There is a trick in if the magnets attract each other, face the repelling side in the slots.

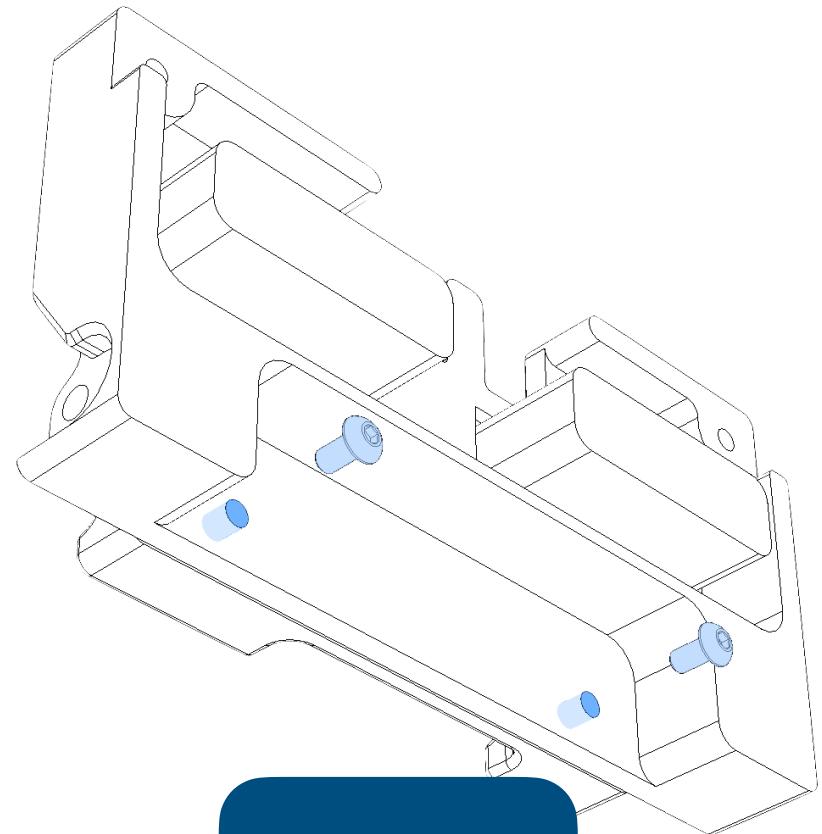
The attracting side must face front, otherwise it will not function.

## Back body preparation



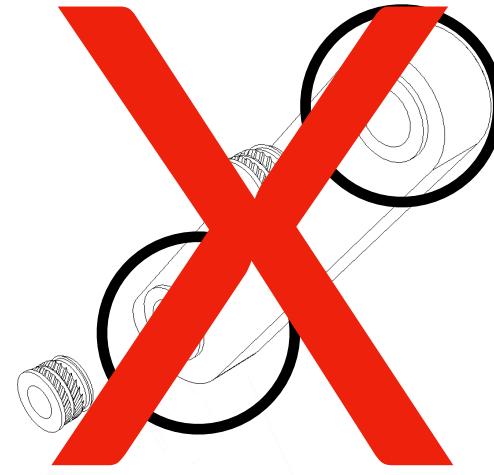
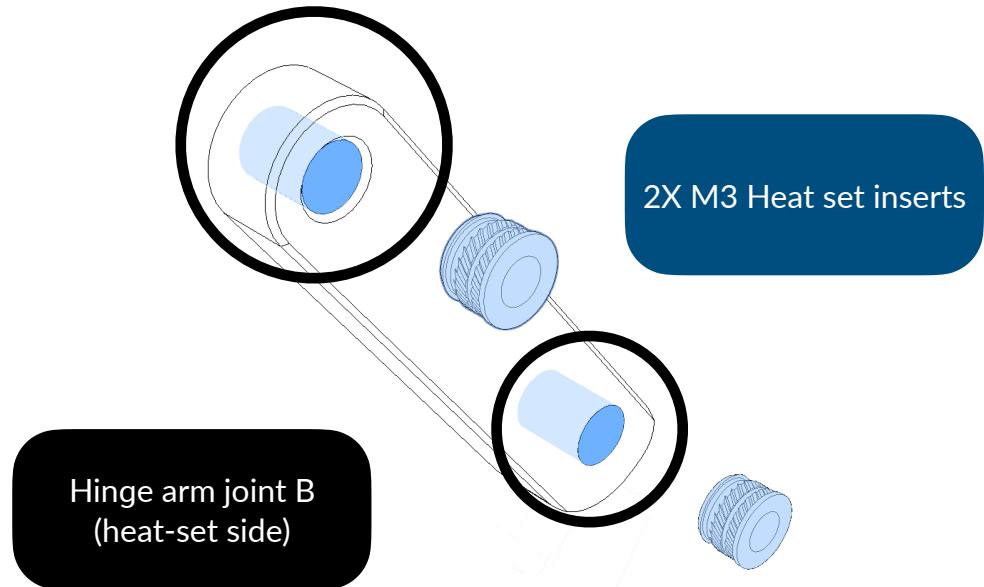


Tilt bump



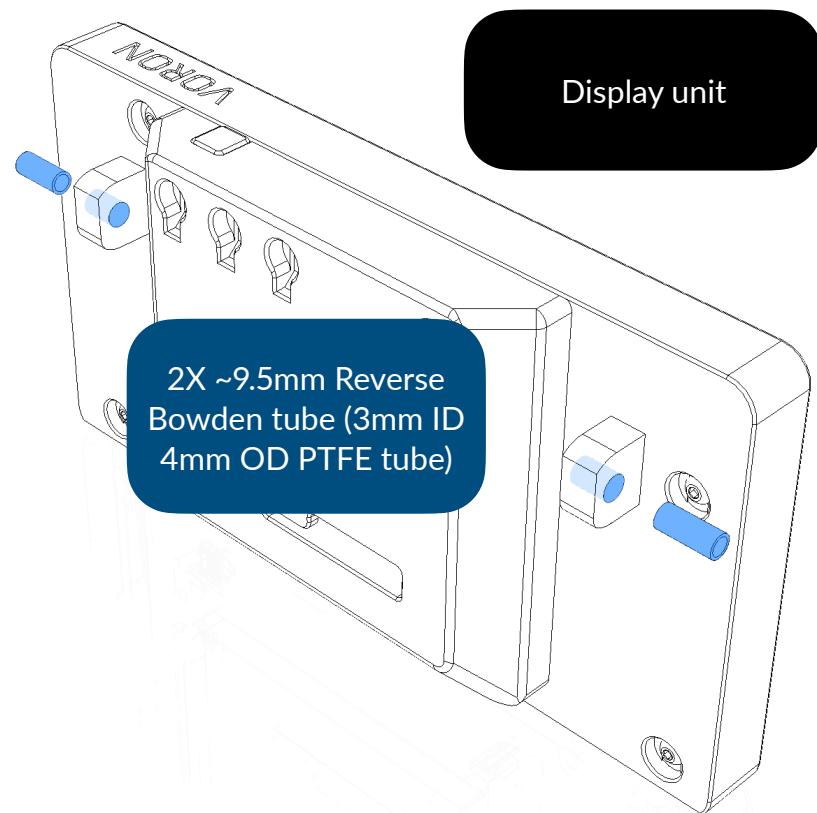
2X M3x6mm BHCS

## Hinge arm joint attachment



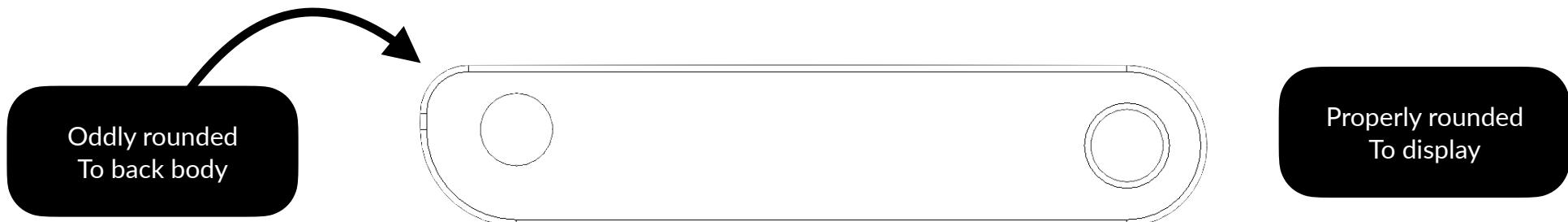
Please do not attach heat set inserts into the spacing sides. Check that the spacing is facing the opposite from the heat set insert.

This step is repeated on the right-hand side.

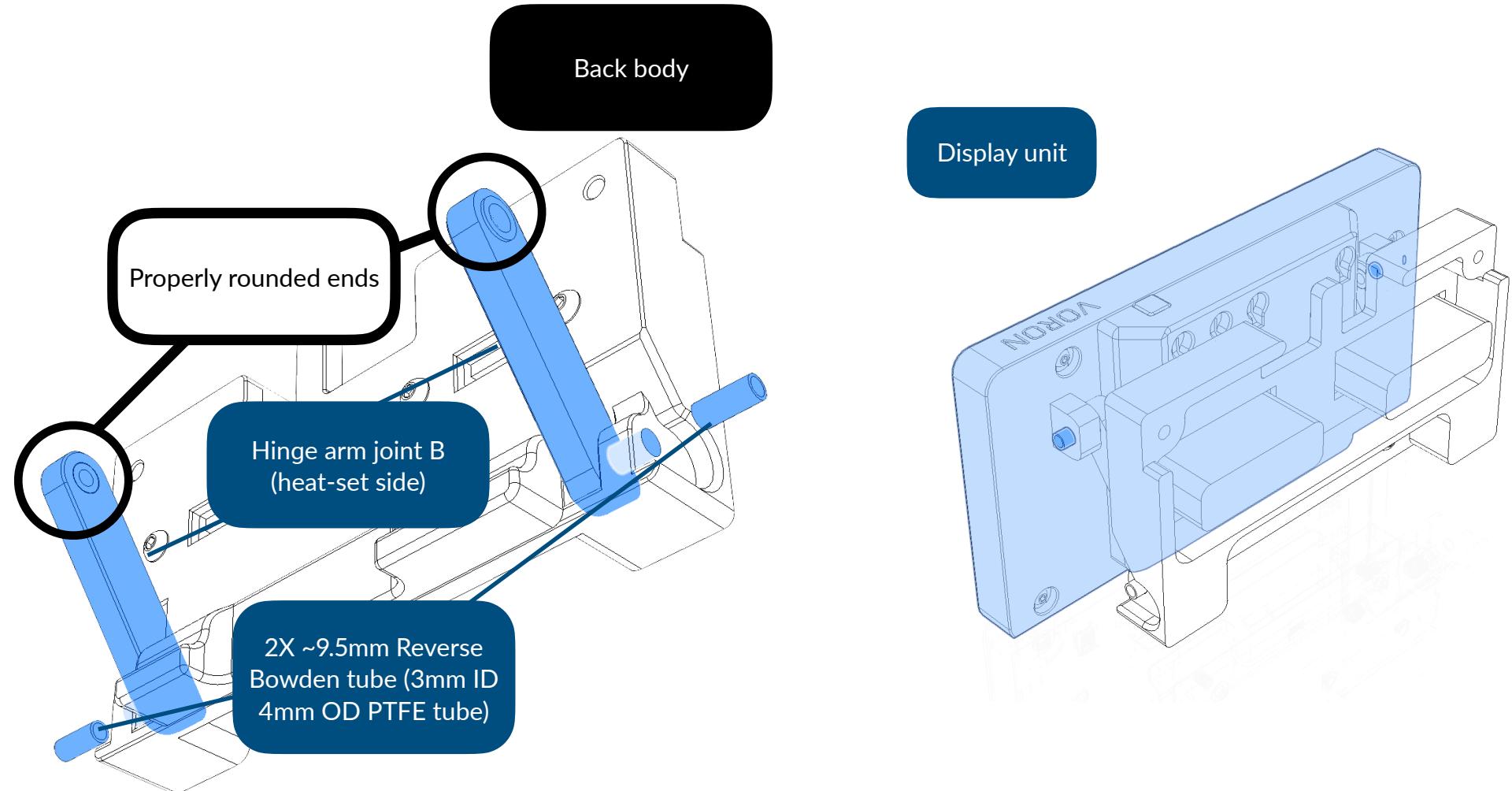


## Identifying sides of the arm joint

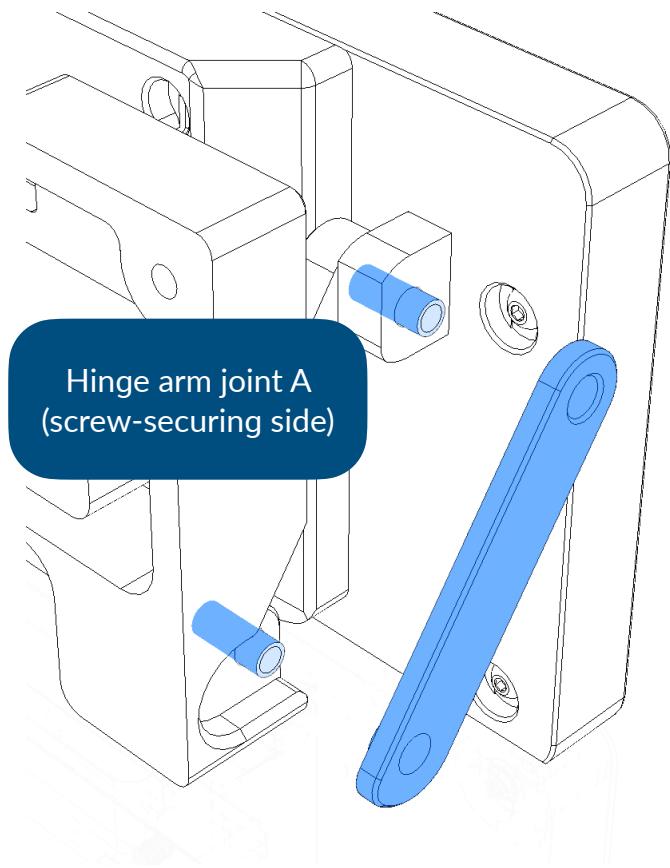
This part has different sides that are being jointed on respective components, in this part, the properly rounded end (the right side) goes to the display, while the oddly rounded end (the left side) will go to the back body.



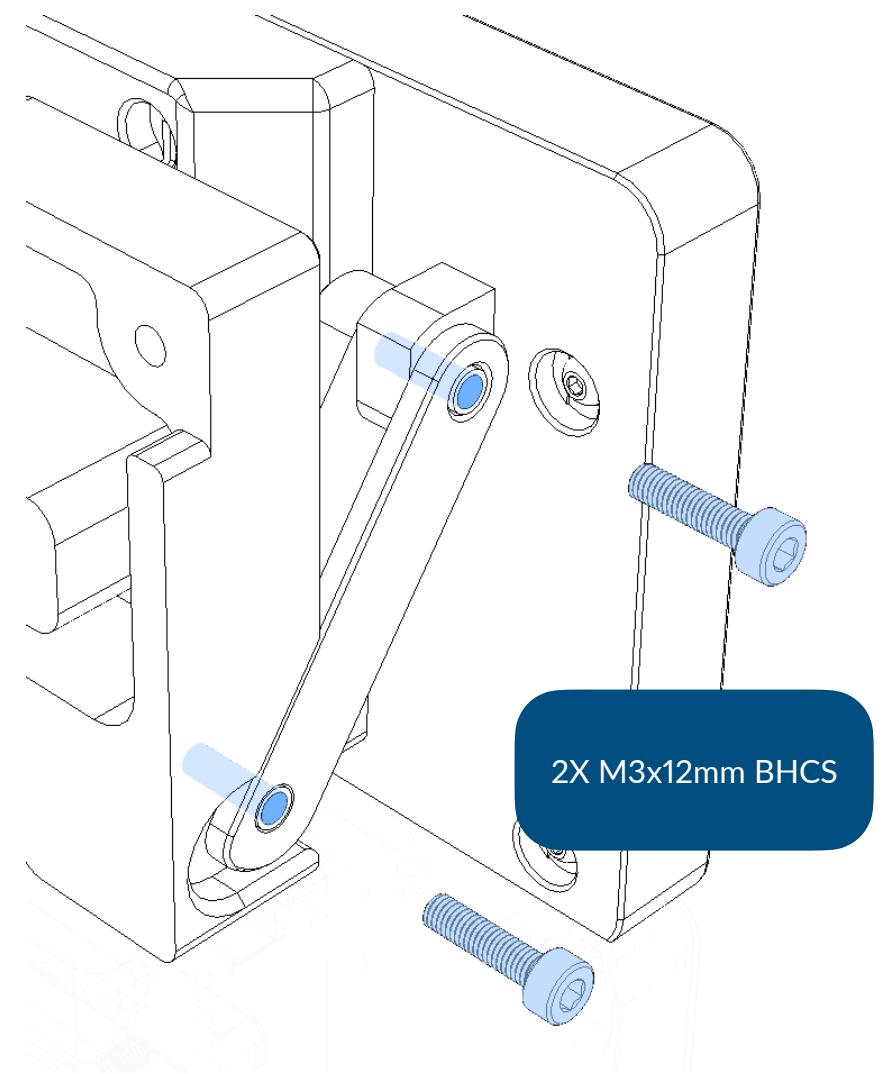
This applies on both joint A and B, which are screw-secure sides and heat set sides respectively. If these sides are reversed, it may not function properly, or even cause damage.



Please check that the spacings  
are facing at the screw holes.  
The properly rounded sides must  
not mount back body.



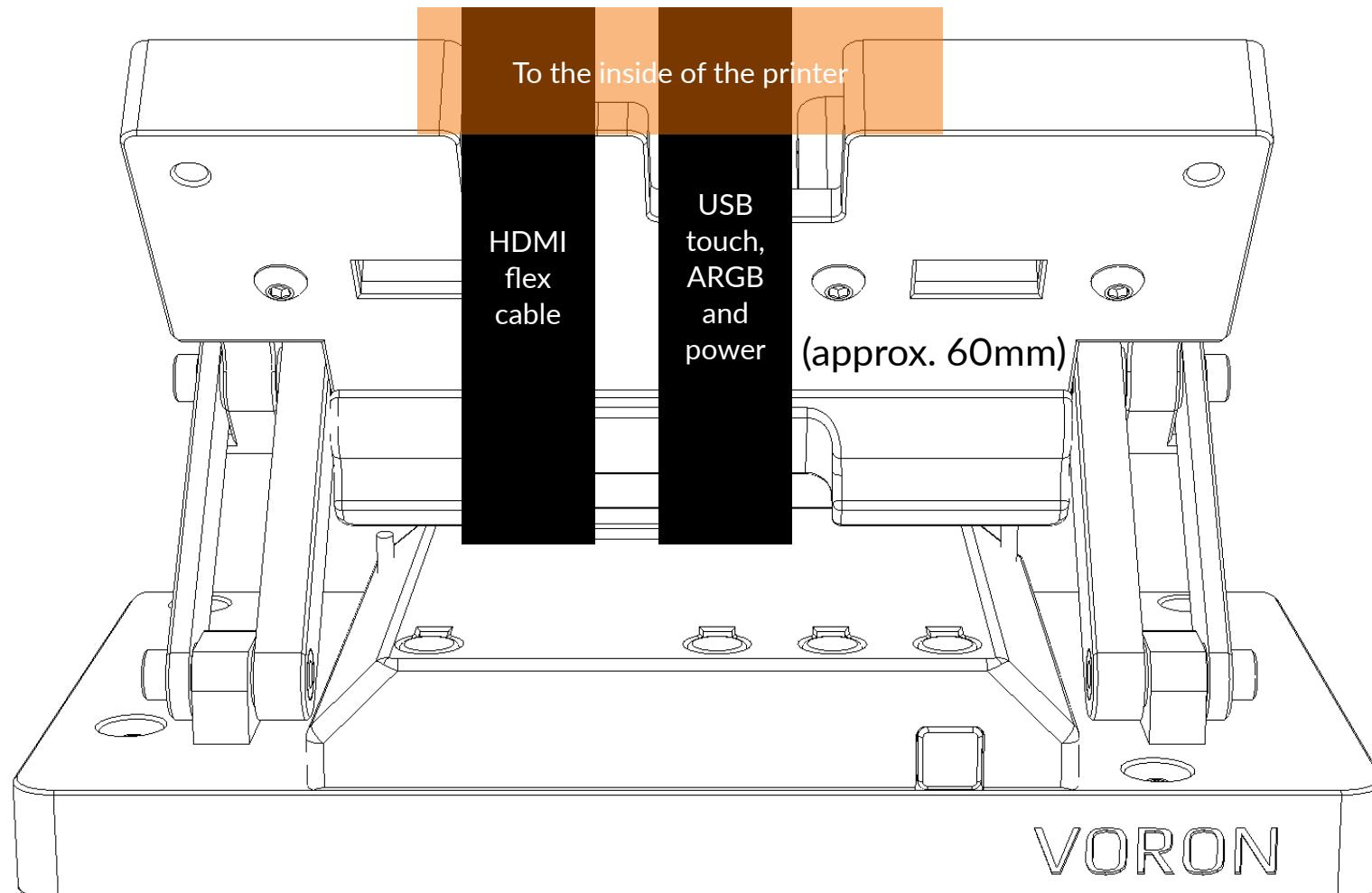
Hinge arm joint A  
(screw-securing side)

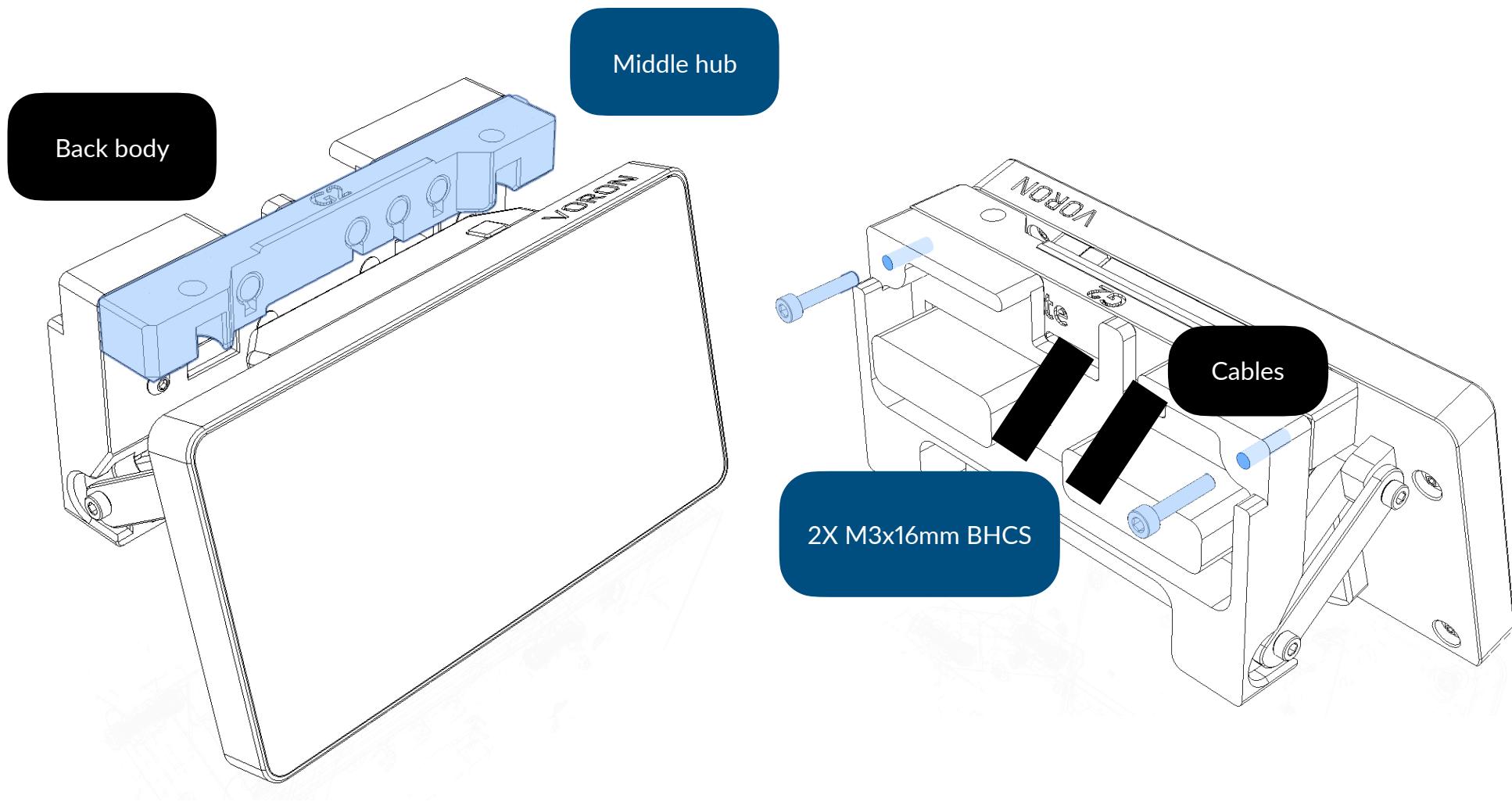


2X M3x12mm BHCS

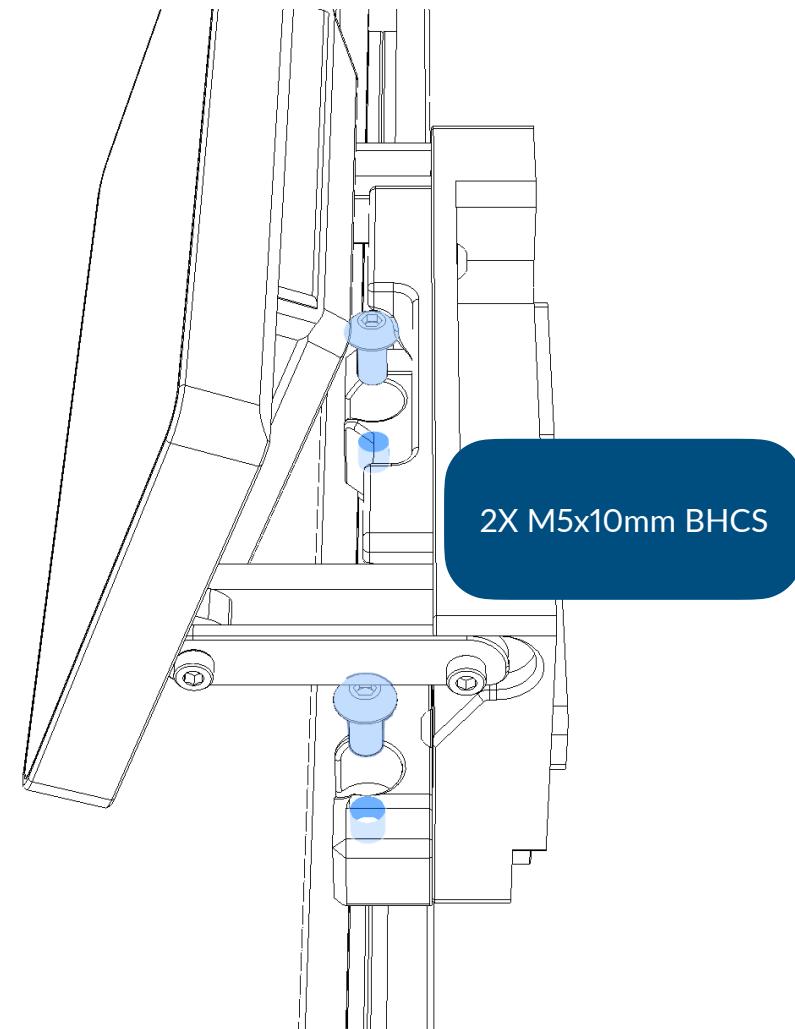
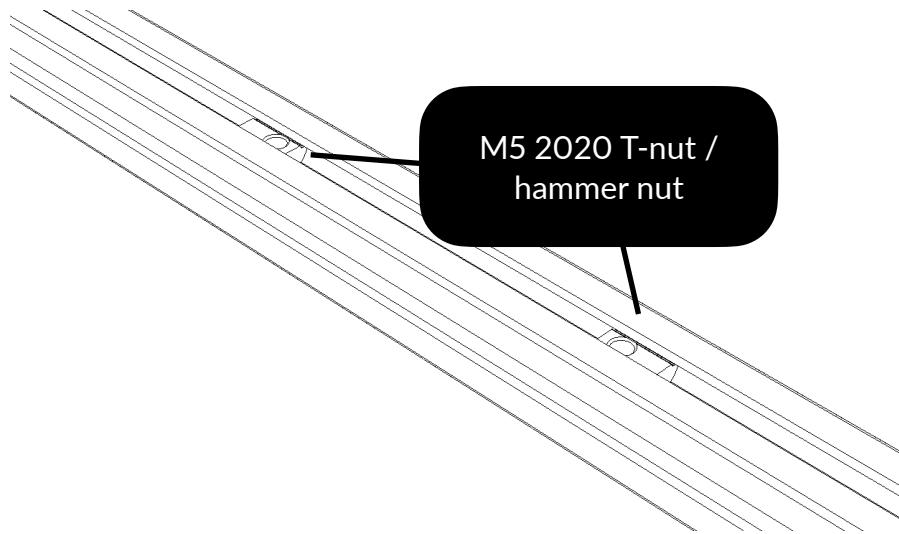
These steps are repeated on the right-hand side.

## Display to back body cabling illustration





## Mounting to printer



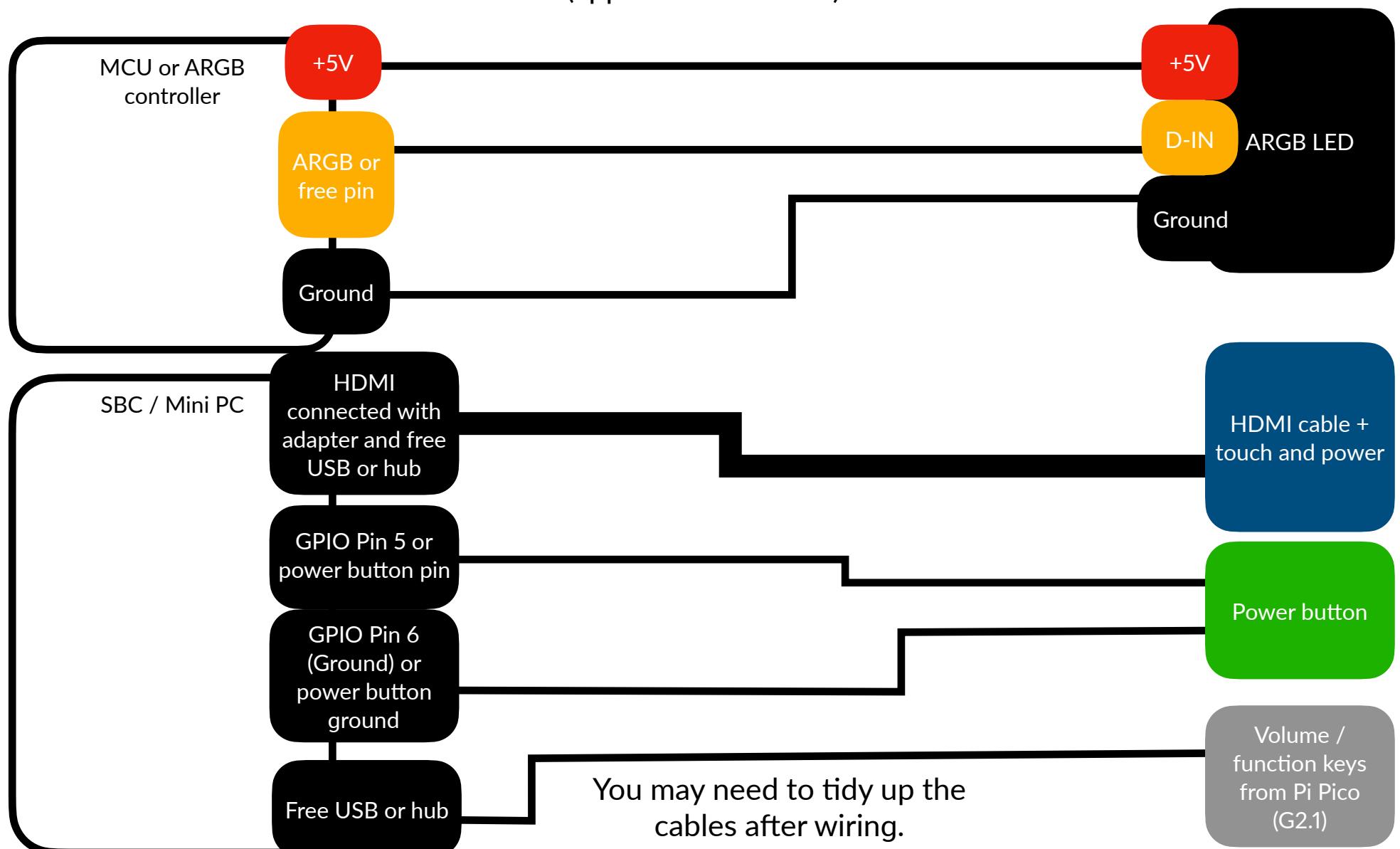
This step assumes the display placement is front-center.

The placement of T-nuts or hammer nuts are at the bottom of extrusion.

This step does not show the skirt assemblies.

## Wiring diagram

(approx. 40 to 75cm)



# Software configuration

## Debian native KlipperScreen

### Set up the display

You may need to set up the display to make sure it is displaying correctly.

Please visit <https://klipperscreen.readthedocs.io/en/latest/Hardware/> for more accurate information.

Basically, the display RealEstate uses is in portrait by default, which is a problem. To address the issue, you need to manually rotate the screen to landscape.

```
Section "Monitor"
```

```
Identifier "HDMI-0"
```

```
Option "Rotate" "right"
```

```
# This will address the display's portrait mode by default problem
```

```
Option "PreferredMode" "1920x1080"
```

```
EndSection
```

After this code has been pasted to /usr/share/X11/xorg.conf.d/90-monitor.conf, you need to restart KlipperScreen

If the touch panel isn't register correctly after completing the first step, you need to also rotate the touch panel to the correct orientation. First, find the touch controller.

```
DISPLAY=:0 xinput
```

If you have found the touch controller of the display, execute this command; remember to change the device name.

```
DISPLAY=:0 xinput set-prop "<device name>" 'Coordinate Transformation Matrix' 0 1 0 -1 0 1 0 0 1
```

If the touch panel is navigating correctly, you also need to make the change permanent, this is specially needed in case of host restarts. In /etc/udev/rules.d/51-touchscreen.rules , you need to add a line containing such code, and remember to change the device name.

```
ACTION=="add", ATTRS{name}=="<device name>", ENV{LIBINPUT_CALIBRATION_MATRIX}= 0 1  
0 -1 0 1 0 0 1
```

If the code above did not resolve the touch panel issue, you may head to /usr/share/X11/xorg.conf.d/40-libinput.conf and add the following code:

```
Section "InputClass"
    Identifier "libinput touchscreen catchall"
    MatchIsTouchscreen "on"
    MatchDevicePath "/dev/input/event*"
    Driver "libinput"
    Option "TransformationMatrix" "0 1 0 -1 0 1 0 0 1"

EndSection
```

This is then needs to be saved and the host needs to be restarted.

## **Windows 11 / 10 (experimental)**

To rotate the screen and touch panel in Windows, run Settings, then select display, find the display resolution section and set the display orientation to portrait (flipped)

The display was in portrait mode by default which result in Windows showing it as landscape even though it is in portrait orientation.

## Klipper LED

If you are using dedicated RGB controller, this section is not required.

If you want to use RealEstate glowing chin LEDs with Klipper MCU, you can use the following code:

```
[neopixel realestate_chin]  
pin: 'assigned_pin'  
chain_count: 5  
#color_order: GRB  
initial_RED: 1.0  
initial_GREEN: 0.0  
initial_BLUE: 1.0
```

Add new Neopixel feature  
Assign pin (you need to change to pin connected from)  
Chain count (number of LEDs chained)  
Color order (not required if using default)  
Emission value on start-up

Once assigned, the LEDs still didn't have animations or reflect status yet, you can then add this code which you can customize.

```
SET_LED LED=realestate_chin RED=<value> GREEN=<value> BLUE=<value> [INDEX=<index>]
```

If you have [Klipper LED Effect](#) installed, you can add the commands below. More information can be found [here](#). This is an example of the chin working. In the config file, add this sample line:

```
[led_effect realestate]
autostart:      true
frame_rate:     24
leds:
  neopixel:realestate_chin
layers:
  gradient 0.5 1 top (1.0,0.0,0.0),(0.0,1.0,0.0),(0.0,0.0,1.0)
```

You can then check to make sure the gradient plays automatically after restart. If you want to stop the animation, you can execute *SET\_LED\_EFFECT EFFECT=realestate STOP=1* in Klipper console. If you want to re-run such animation, you can execute *SET\_LED\_EFFECT EFFECT=realestate* in Klipper console.

If you are satisfied with such feature, you can rename *realestate* and tinker with your settings.

## Volume buttons

Requires Gen 2.1 hatch and CircuitPython in RP2040.

This requires a Raspberry Pi RP2040-based MCUs that is not running Klipper but rather as a media controller. We recommend WaveShare RP2040-Zero or equivalent.

This feature uses Adafruit CircuitPython, an easy-to-use coding firmware, and Adafruit HID library.

You can get these from [CircuitPython](#) (may select language) and the [library GitHub repository](#) there for the latest version. It may come outdated in OITSWILLIAMV2 repository.

You may need to do the following steps:

1. Get these files above and from OITSWILLIAMV2/Config/Non-Klipper/RealEstate repository.
2. Reboot the Pi Pico in bootloader mode by pressing reset and boot buttons, and then drop the CircuitPython firmware file to Pico's drive in bootloader mode, in order to flash it's firmware.
3. Drop boot.py, code.py and the library into Pico's drive that is later called CIRCUITPY.

You may copy the Adafruit CircuitPython HID into the drive's lib folder.

Note: if you did not put boot.py on this drive, the drive mass storage will keep showing up, but if you don't put code.py, it will not function as intended, and you will no longer access it's contents until you use a coding software like Mu Editor or Thonny.

4. Reboot Pico by pressing the reset button, or power-cycle by unplug-then-re-plug.
5. Test the three buttons, down, up, mute, and then press-and-hold mute, and then down and up.

You must expect it to raise up volume, drop down volume, mute, and then increase and decrease brightness.

Once these are done, you can continue assembling the hatch in the page 17.

## Function keys

Requires Gen 2.1 hatch and Klipper firmware in RP2040.

If you want to use RealEstate G2.1 with Klipper MCU, you may refer to OITSWILLIAMV2/Config/RealEstate.

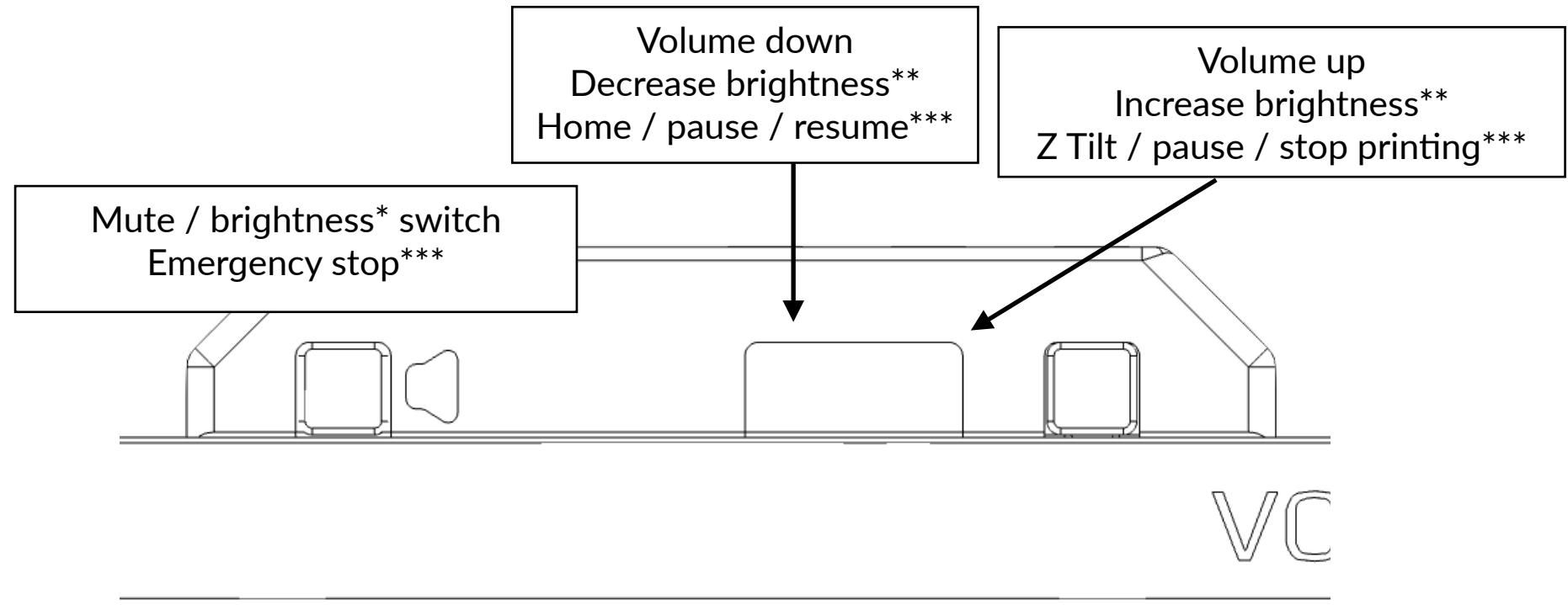
You may flash the RP2040 firmware in bootloader mode before assembling the hatch in the page 17.

The following changes that were made to adapt with Klipper:

- Mute button will be replaced with emergency stop button,
- Volume down button will be replaced with home, pause and resume,
- And volume up button will be replaced with Z-tilt, pause and stop.

You can change each button's behavior by changing their press Gcode.

## Buttons



\* Brightness control only applies to future models of display. Displays that do not have on-computer brightness control may not work as intended.

\*\* Must press the mute switch to access this function.

\*\*\* Klipper function. You can change depending on your needs. Conflicts with volume buttons.

# Assembly complete

Now you can unlock the superpowers of unusual usage of devices. However this manual does not include unusual guides and troubleshooting guides. This means, if you have problems with this mod, you need to head to [GitHub.com/Bunny350/OITSWILLIAMV2/issues](https://GitHub.com/Bunny350/OITSWILLIAMV2/issues), join and message in Oitswilliam Pang Discord server or message @officialbunny350 on Facebook.

You can also make content with RealEstate display unit, just because, you can.

It's done. While you are at my social  
platforms maybe should you follow me?

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