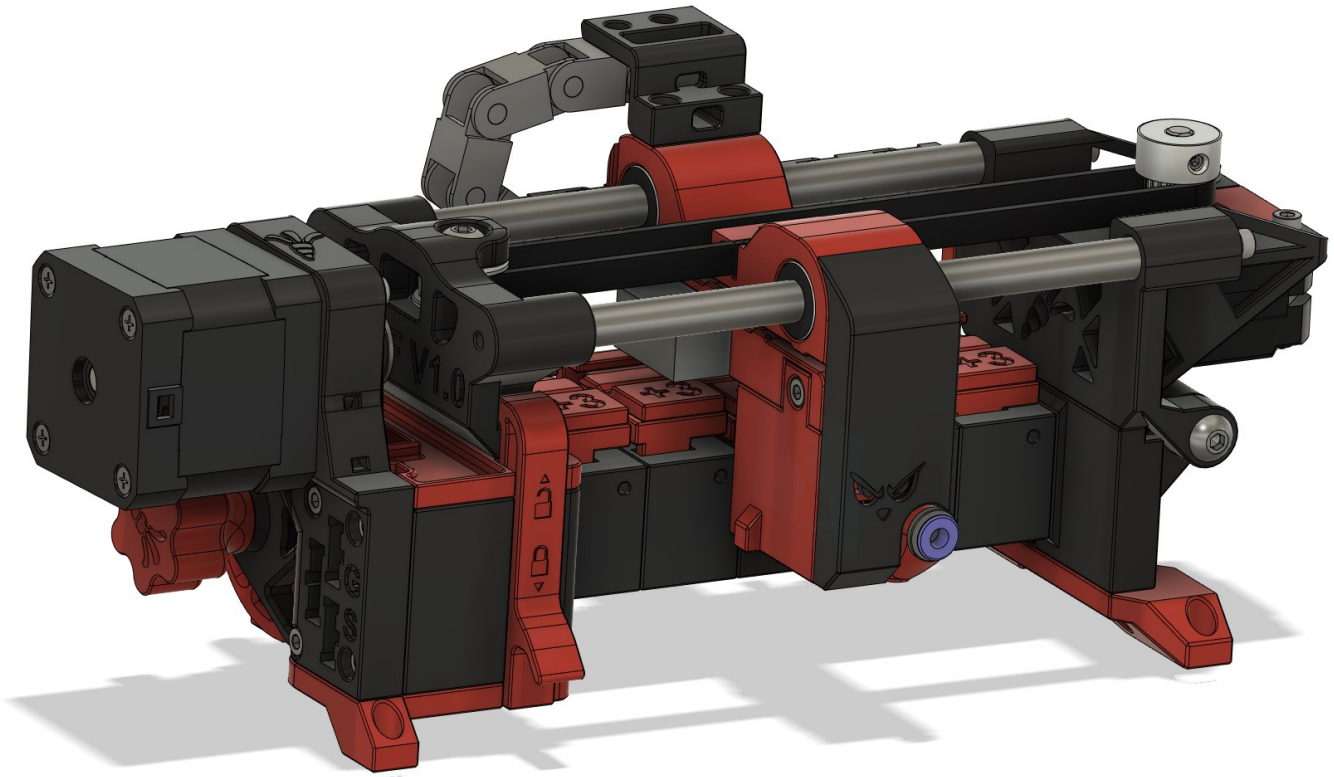
Enraged Rabbit Project
Carrot Feeder V1.0 assembly and setup

Printing tips :

- Use the printing tips found on the EnragedRabbit Github (Carrot Feeder section)



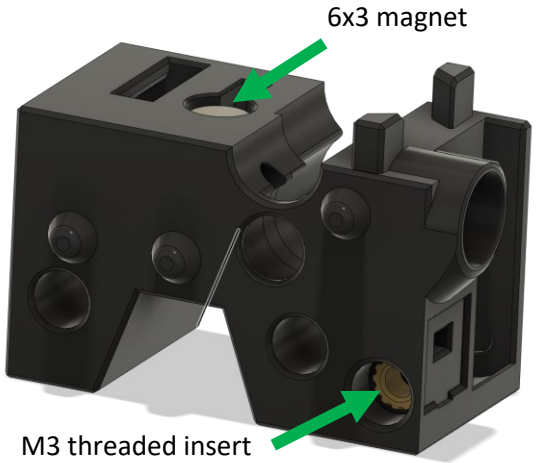
1 Prepare the filament blocks

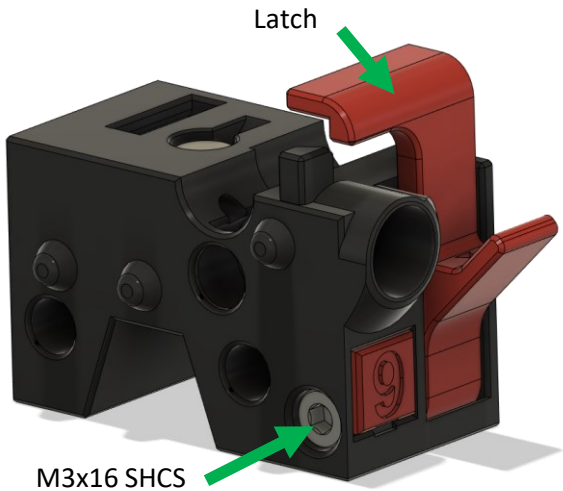
Top_Hat_Lockers have changed, but assembly process is still the same

- Each channel of the Carrot Feeder is one filament block
- There two available versions for the block : with or without the M3 threaded insert. The threaded insert is though to insert properly, so if you're not comfortable doing it, use the version without it (you'll screw the M3x16 directly in the plastic)

1-a Insert the magnet and the M3 threaded insert

Every 6x3 magnet insert on the Carrot Feeder has a small flat slot on the side : use it to easily remove the magnet if needed



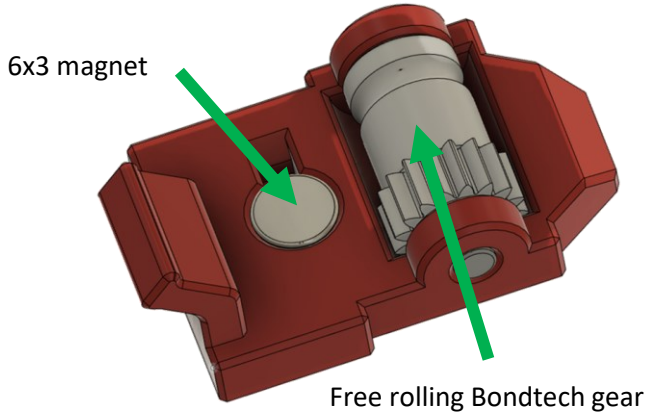


1-b Insert the latch, lock it with the M3x16 screw (don't screw too hard, be gentle) and insert the numbering plate (just click it in)

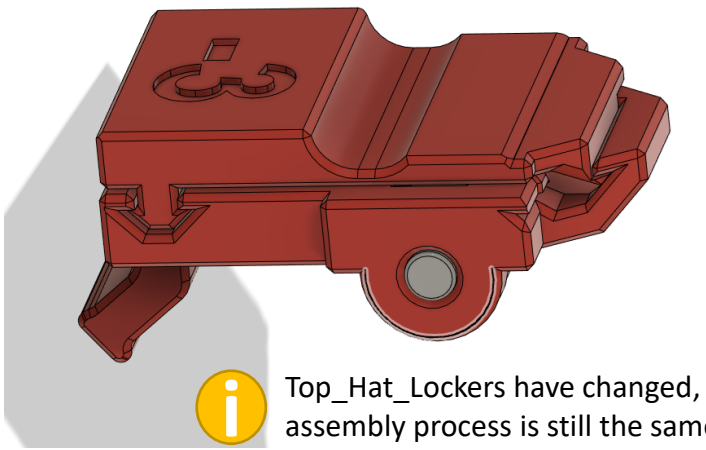
Numbering plates can be easily removed with a small flat-head screwdriver, using the bottom slot of the plate

1-c Prepare the filament block top hat

- Install the free rolling bondtech gear, take care of its orientation!
- Insert the 6x3 magnet : **IT SHOULD REPEL THE ONE FROM THE FILAMENT BLOCK**

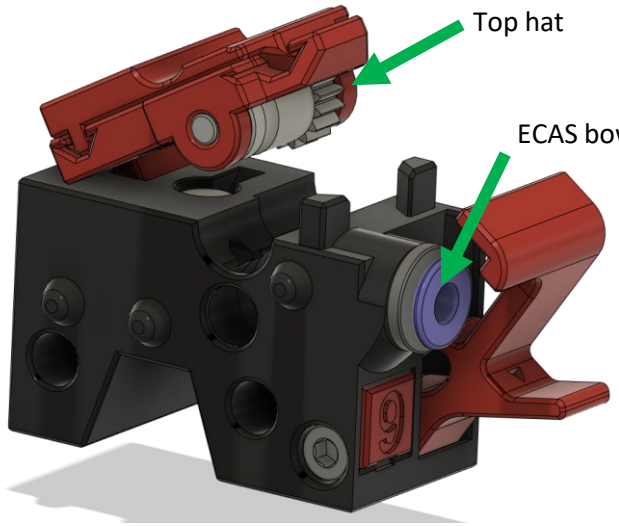


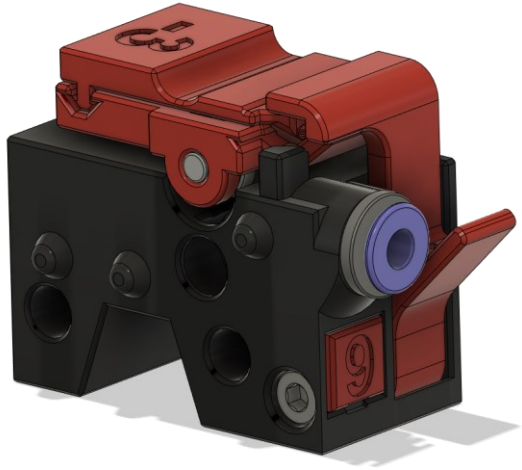
1-d Slide in the top hat locker plate (use the « 0 » value to begin with). Make sure it's fully inserted



Top_Hat_Lockers have changed, but assembly process is still the same

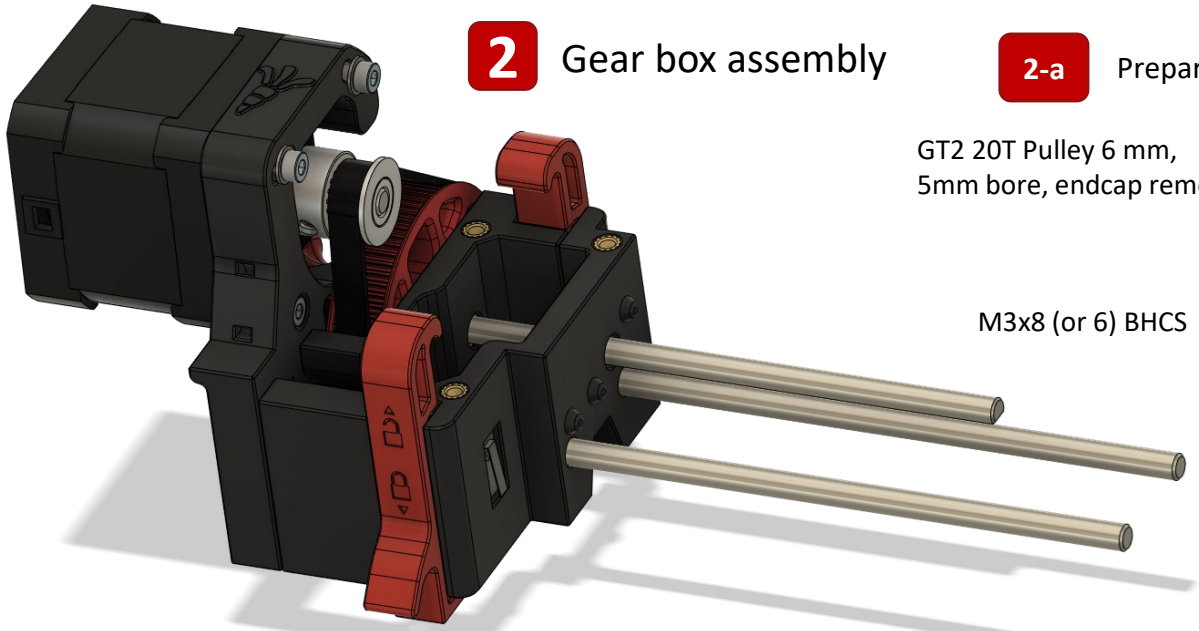
1-e Press-fit the ECAS bowden fit and install the top hat block you just did



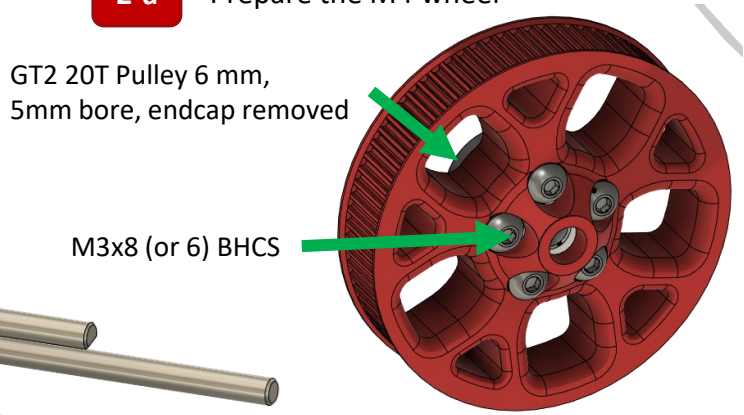


- Top hat should be inserted without forcing too much (play with the part orientation)
- Once inserted, rest position should be as seen on the left, thanks to the repelling magnets (with latch open)
- Push down the top hat and close the latch. You can now press on the top hat with a finger (it will go down) and release the finger (it will go up), like a spring mechanism

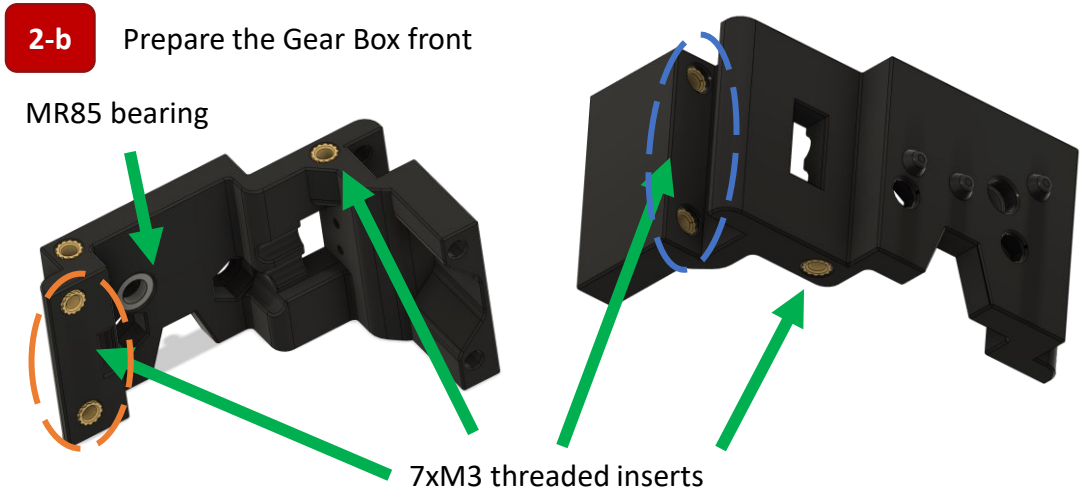
2 Gear box assembly



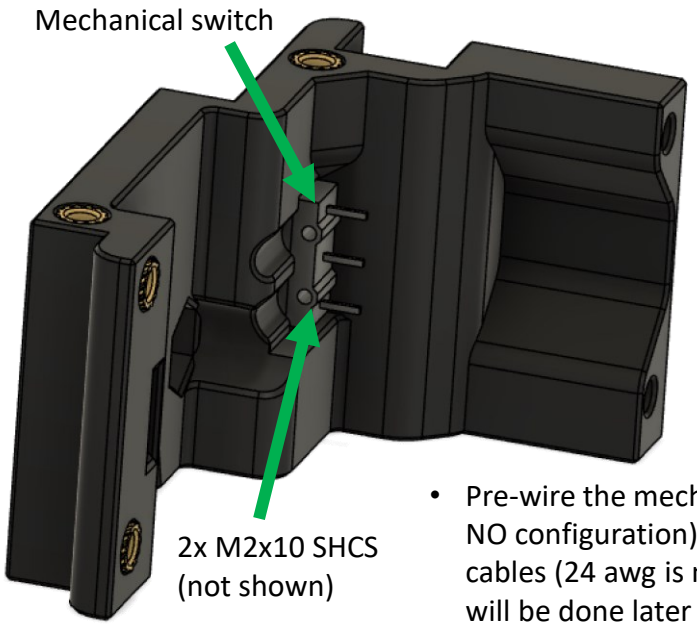
2-a Prepare the M4 wheel



2-b Prepare the Gear Box front

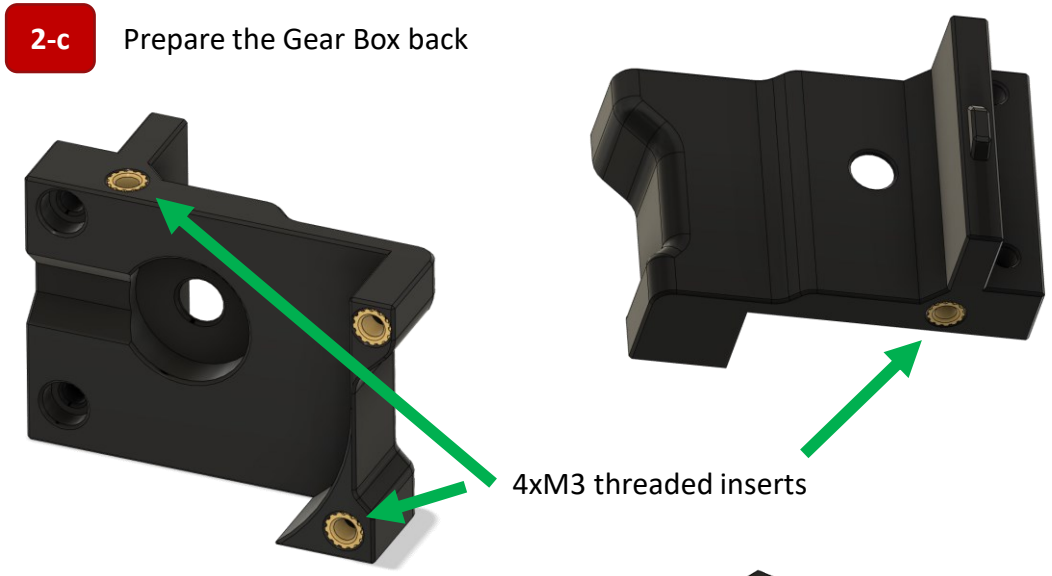


- Those M3 threaded inserts are difficult to insert (not much plastic behind), go slowly and do not put your soldering iron tip inside the insert if the tip sticks out of it
- Push those inserts using the soldering iron from the side, and take your time to make them well aligned with the holes

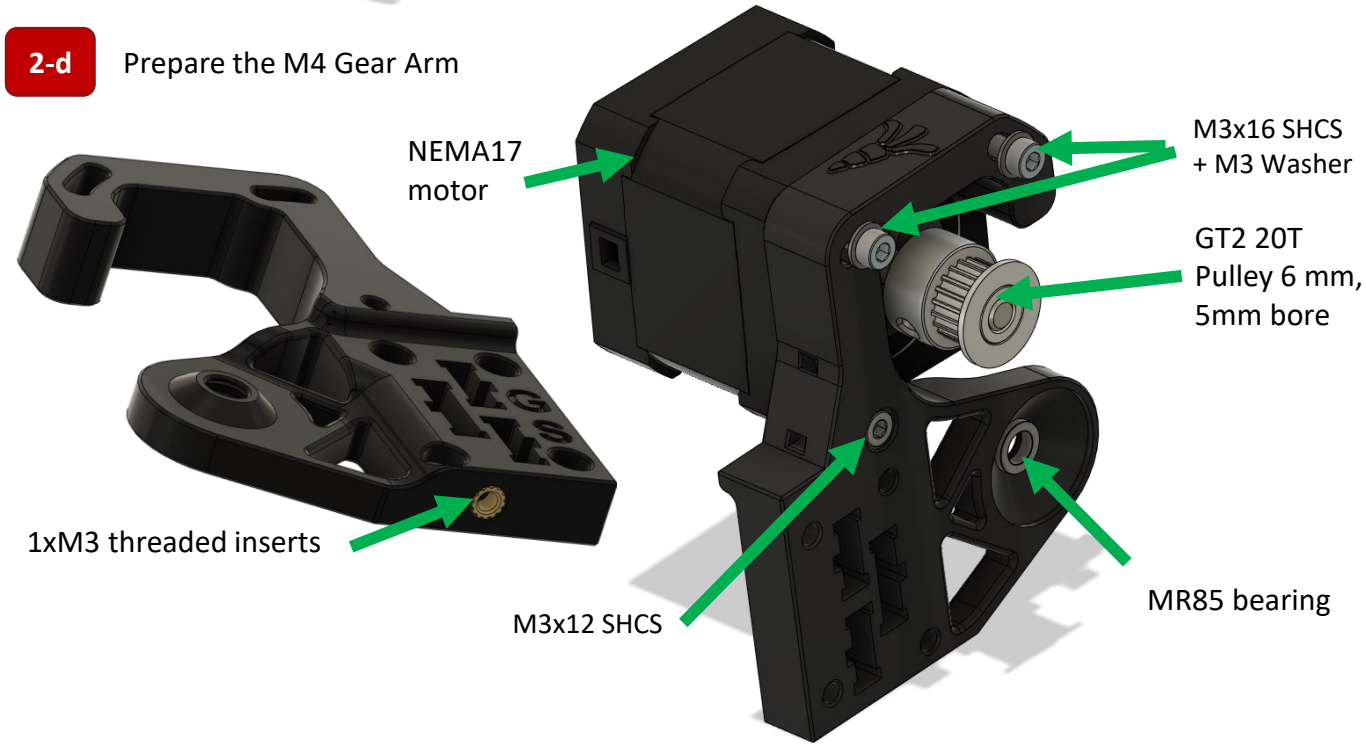


- Pre-wire the mechanical endstop (should be in a NO configuration). Prepare around 10 cm long of cables (24 awg is more than enough). Crimping will be done later in the build

2-c Prepare the Gear Box back

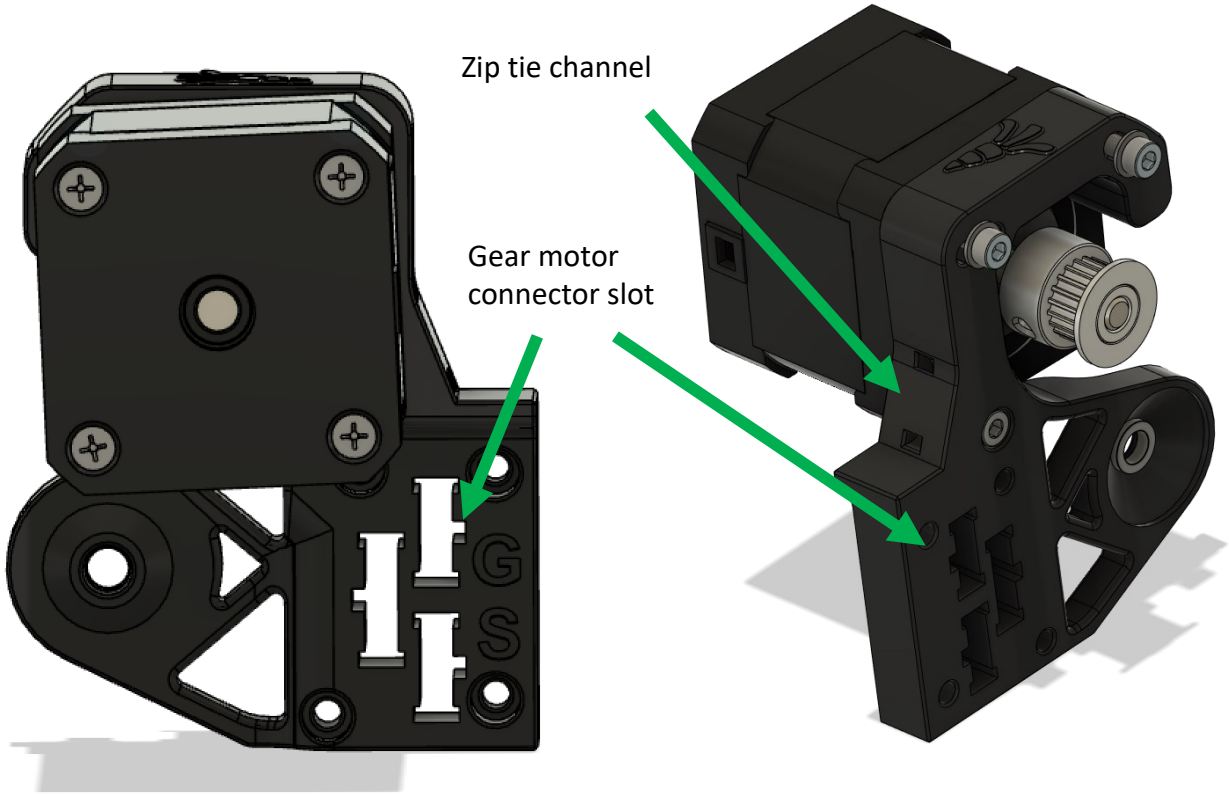


2-d Prepare the M4 Gear Arm



Don’t forget to put some blue Loctite or similar on the grub screw of the GT2 20T Pulley

- You can already install the Gear motor (G label on the connector plate) cabling. Connect the 4 pins molex microfit connector in the dedicated slot (press fit). Use the zip-tie channel to secure the cable path



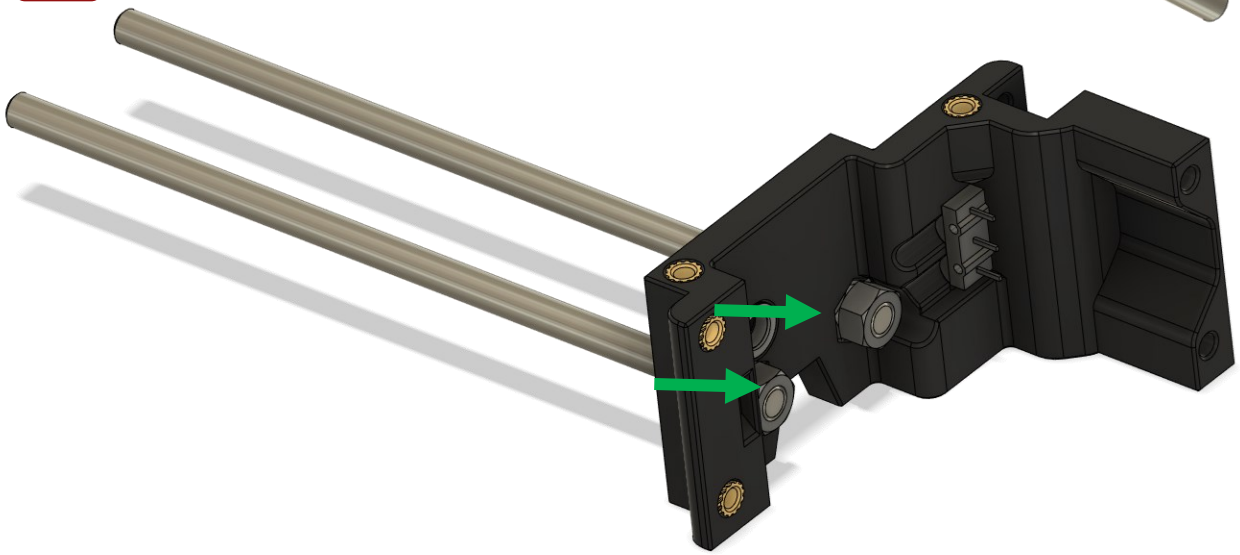
The microfit connector to install in the ERCF is the Female housing (with Male crimps). Just push them from the ERCF inside towards the exterior

Molex Microfit connector to install in the ERCF part

2-e Prepare the 2x M5 threaded rods

2xM5 nuts (nut + counter-nut) OR 1xM5 nut + 1xM5 Nylock nut (the outside one)

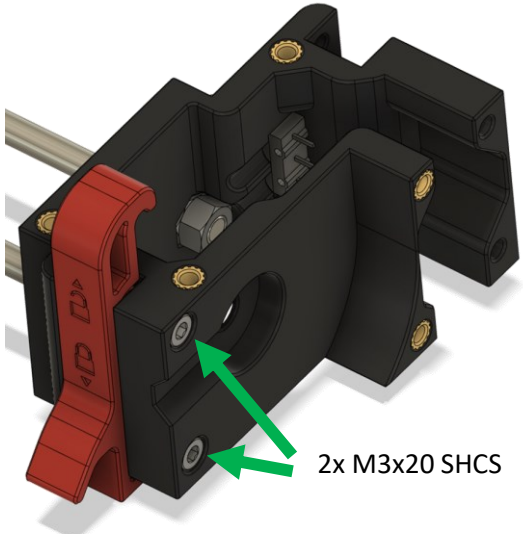
2-f Install the threaded rods in the Gear Box Front



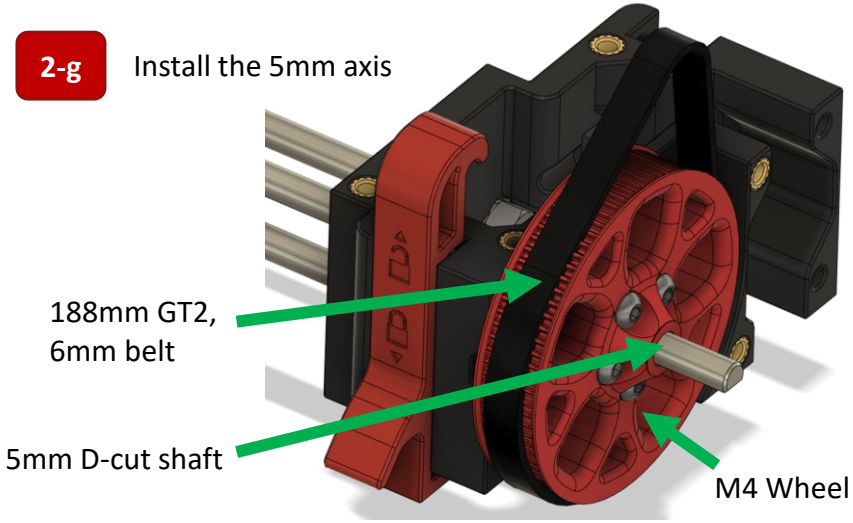
2-g Install the first Side Latch and the Gear Box Back

Before installing the Side Latches, make sure you've released their print-in-place mechanism (use a allen wrench in the arm's hole to unlock it if needed)

- Do not screw too hard the 2x M3x20 SHCS, you should be able to lock//unlock the latch without trouble



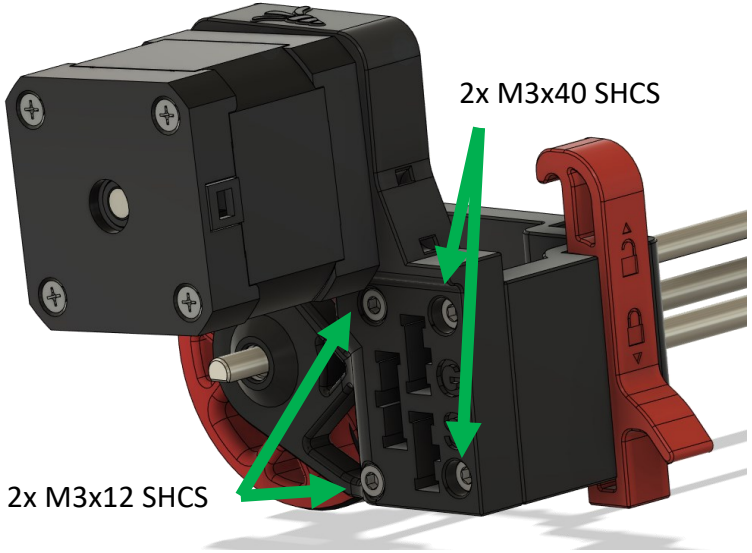
2-g Install the 5mm axis



Don't forget to install the belt!

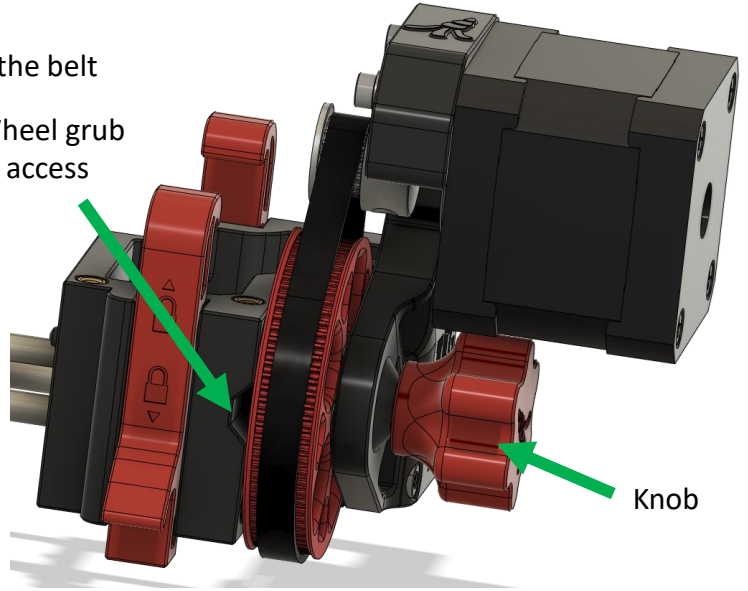
No need to tighten the grub screws for the M4 wheel yet, we'll adjust the wheel//shaft position later

2-h Install the 2nd Side Latch and the M4 Gear Arm



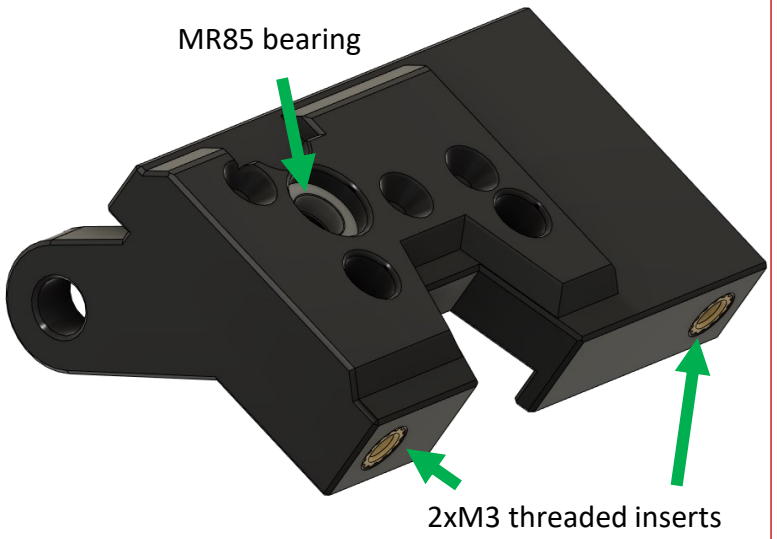
2-i Install the knob, tighten the M4 grub screw and tension the belt

- Press fit to the max the Knob on the 5mm shaft
- Put the Knob + Shaft assembly at around 1mm of the M4 Gear Arm part
- Tighten the M4 Wheel grub screws using the side access
- Tighten the belt by rotatin the motor around it's M3x12 SHCS screw
- Test the motion using the Knob, it should be smooth



2-j Take a break, eat some gummy bears (not provided) or whatever, if you want !

3 Prepare the Block End

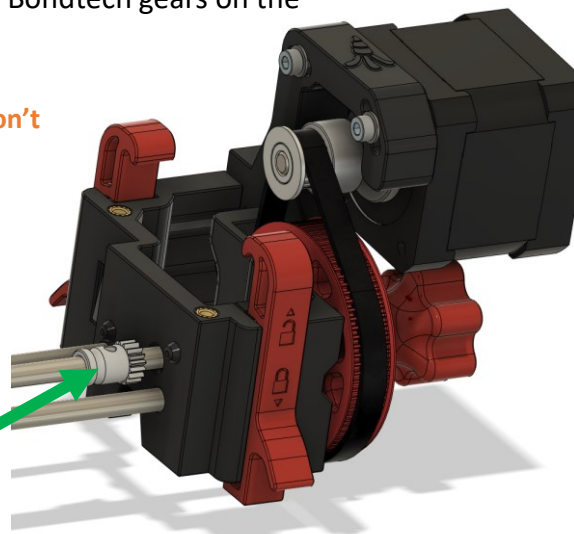


4 Install the Filament Blocks

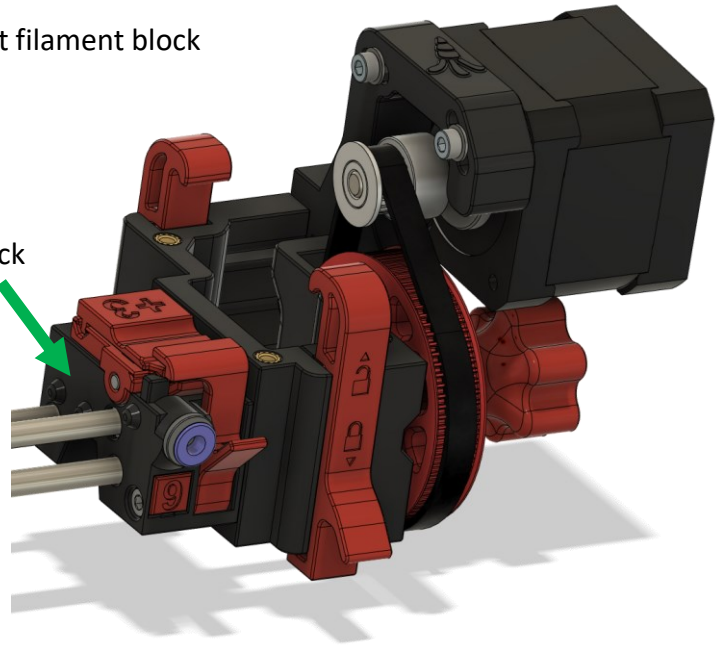
4-a Slide a single Bondtech gears on the 5mm shaft

Yes, only one ! Also don't tighten its grub screw

Take care of the gear orientation !!

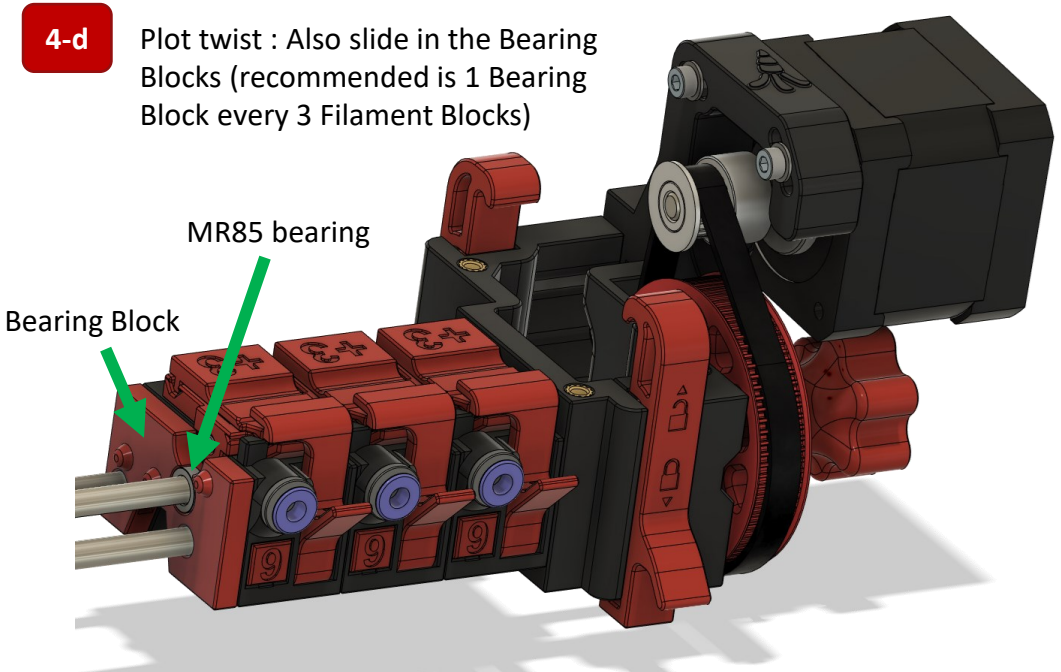


4-b Slide in the first filament block



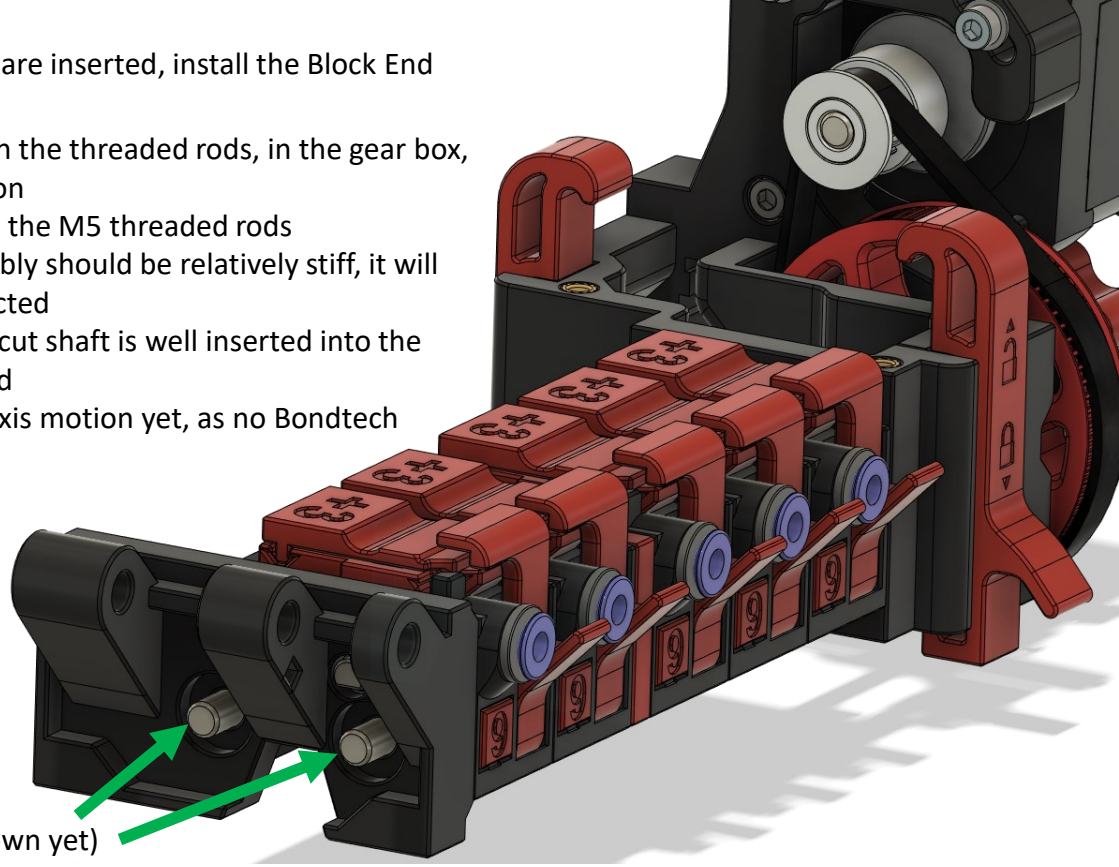
4-c Repeat steps 4-a and 4-b for all your Filament Blocks

4-d Plot twist : Also slide in the Bearing Blocks (recommended is 1 Bearing Block every 3 Filament Blocks)

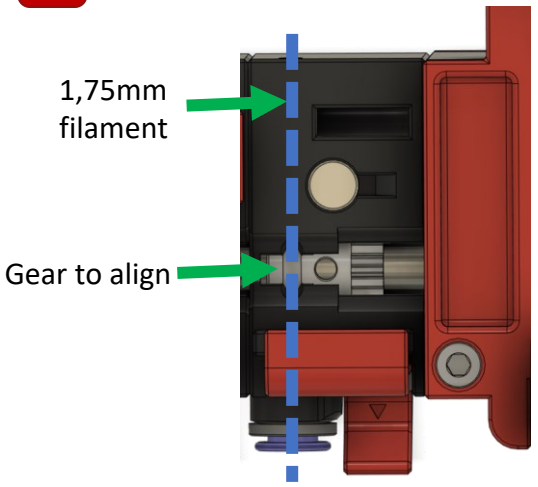


4-e When all blocks are inserted, install the Block End

- Use your fingers to push the threaded rods, in the gear box, into their proper position
- Tighten the M5 nuts on the M5 threaded rods
- While the whole assembly should be relatively stiff, it will flex//bend, this is expected
- Check that the 5mm D-cut shaft is well inserted into the bearing of the Block End
- Don’t check the 5mm axis motion yet, as no Bondtech gears are tighten yet

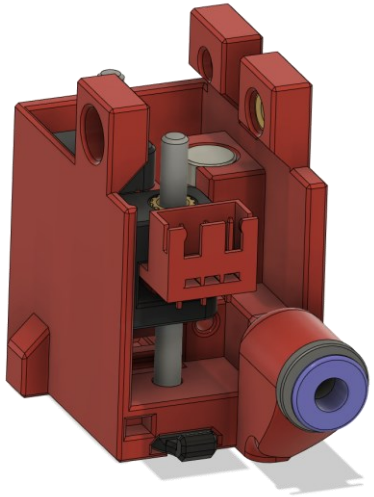


5 Align and tighten the Bondtech gears

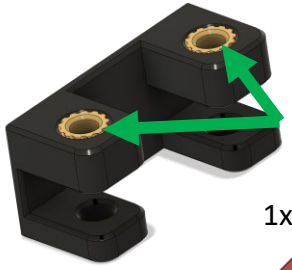


- Use a small ptfe tube (a few cms long is enough) and insert it in the first channel
- Use a some 1,75mm filament and insert it in the channel
- Use the knob to align the D-Cut shaft (cut facing the top)
- Align the Bondtech gears properly on the filament and screw it down, use some blue Loctite on the grub screw
- To check the proper alignement : Once done, let the filament in the filament block and turns by hand the gear axis using the knob (both directions). The filament should not move (it should not touch the Bondtech gears you’ve just fixed)
- Repeat this process for all channels

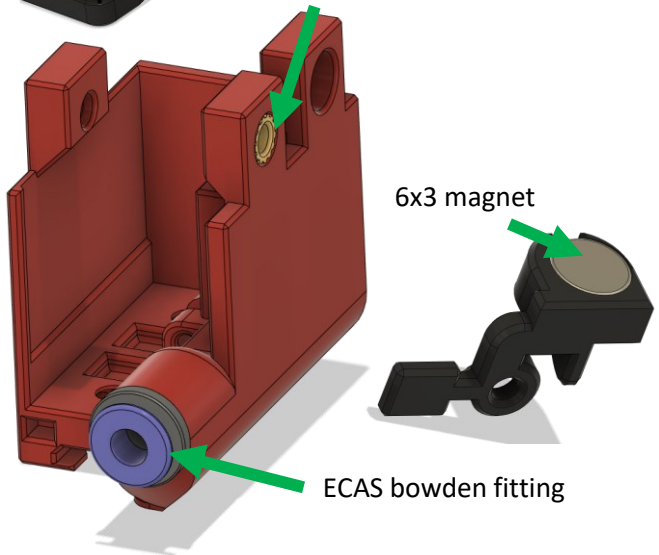
6 Assemble the detector cart



6-a Prepare the detector cart parts

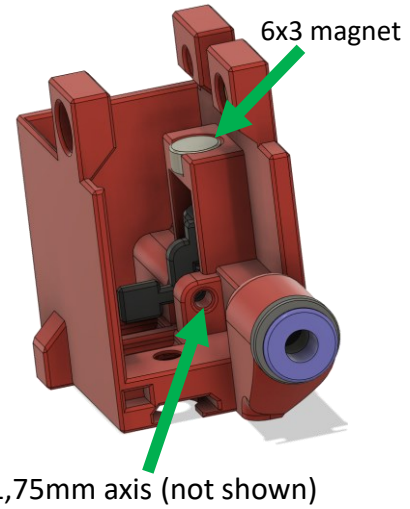


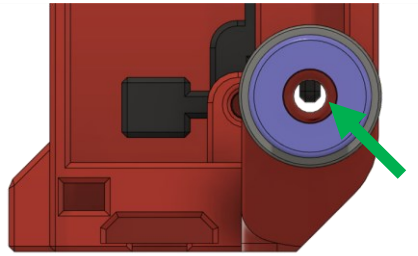
1xM3 threaded insert

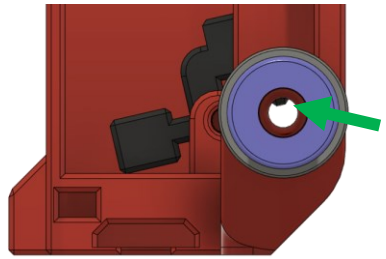


6-b Install the lever

- Make sure the lever spins freely around the 1,75mm filament axis
- Install the magnets so they repel each other !
- The rest position of the lever should be « down » (right picture) while the triggered position (using a 1,75 filament) should be « up » (left picture)

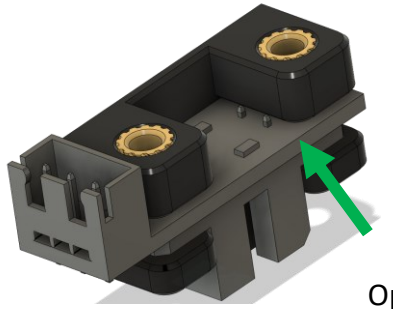




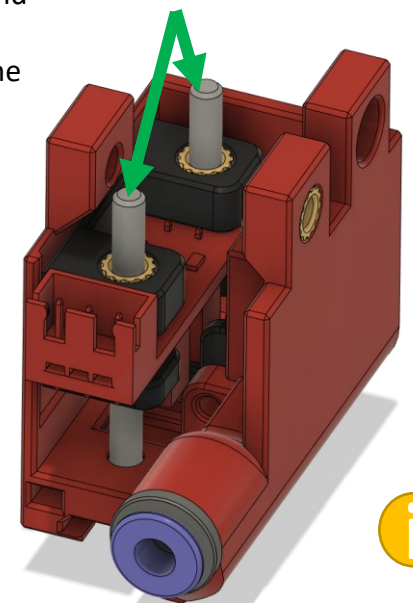


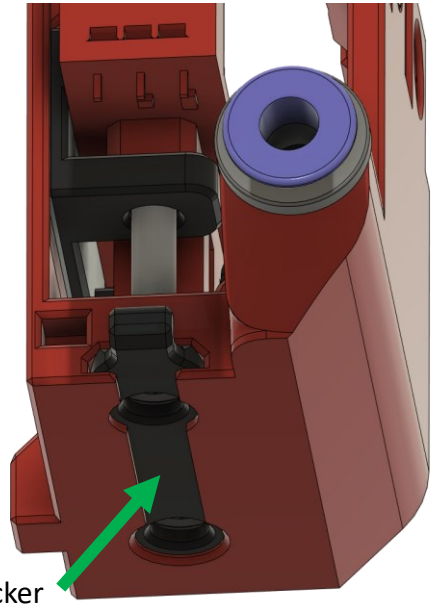
6-c Install the optical detector

- Slide the optical detector into its support
- Install the detector support in the detector cart and then slide//screw in the 2xM3x30 SHCS screws
- Use the screws to position the detector around the middle of his allow movement range
- Make sure the head of the 2 screws are well inserted in the bottom slots of the detector cart and then slide in the Sliding Locker



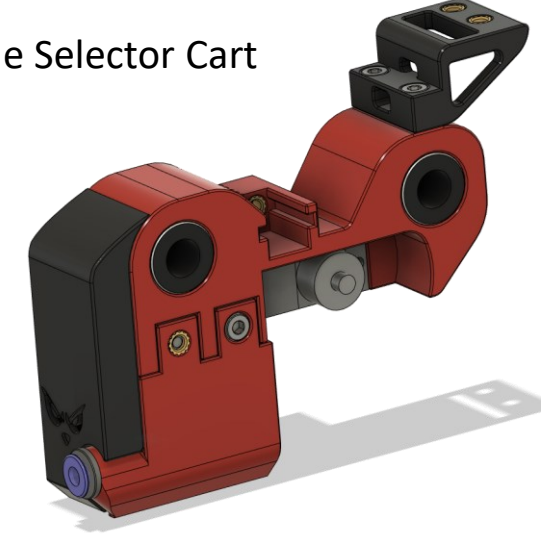
2x M3x30 SHCS





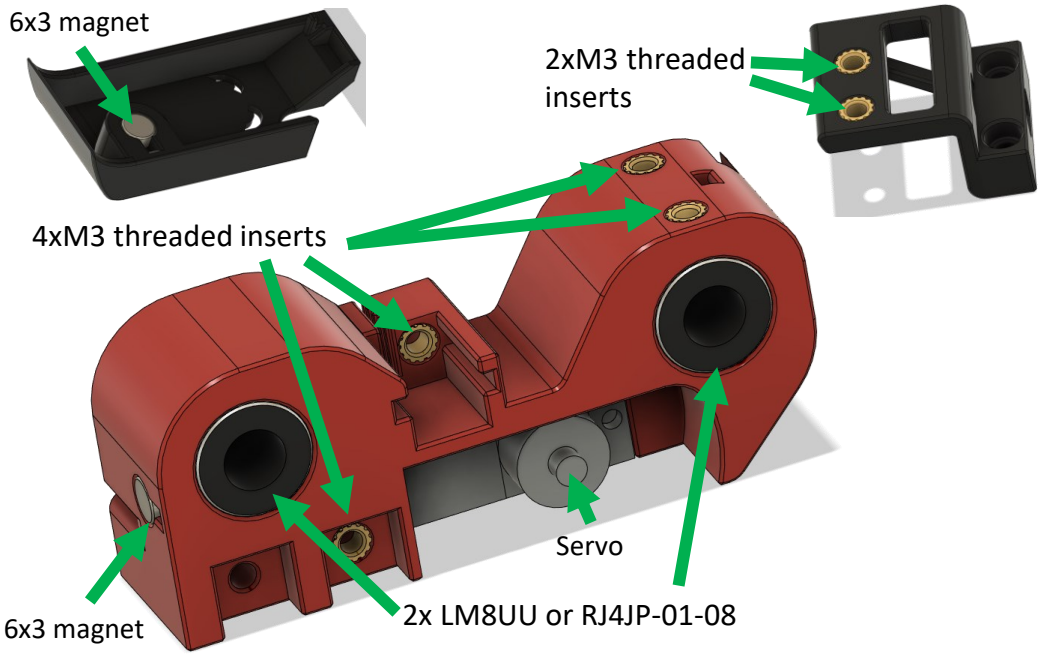
You can now use the two screws to precisely adjust the optical detector position (we'll do that later in the assembly//setup)

7 Assemble the Selector Cart

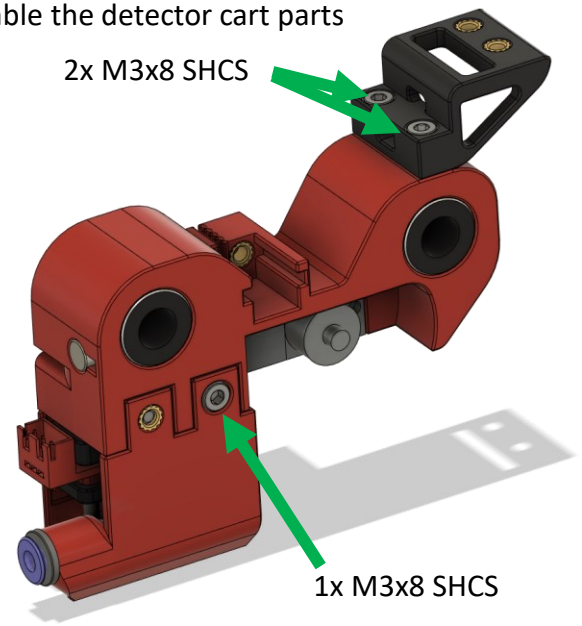


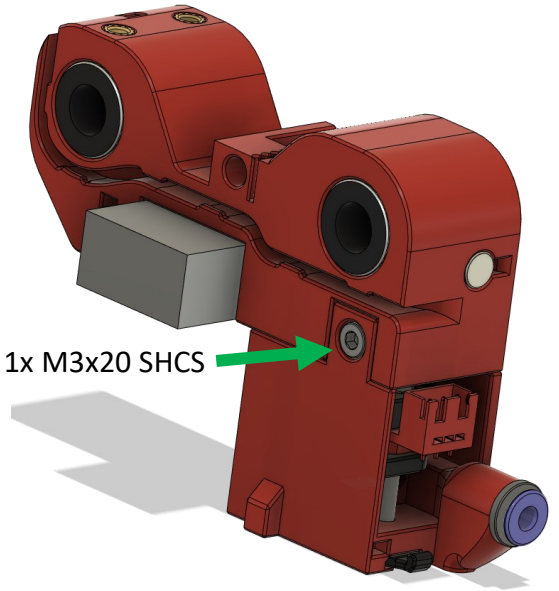
7-a Prepare the detector cart parts

- Make sure magnets (Selector Cart and the Selector Door) attract each other
- Use 2x M2x8mm screws (or similar) to fix the servo on the cart, directly screw in the plastic part
- The LM8UU (or the RJ4JP-01-08) are press-fitted in their slot



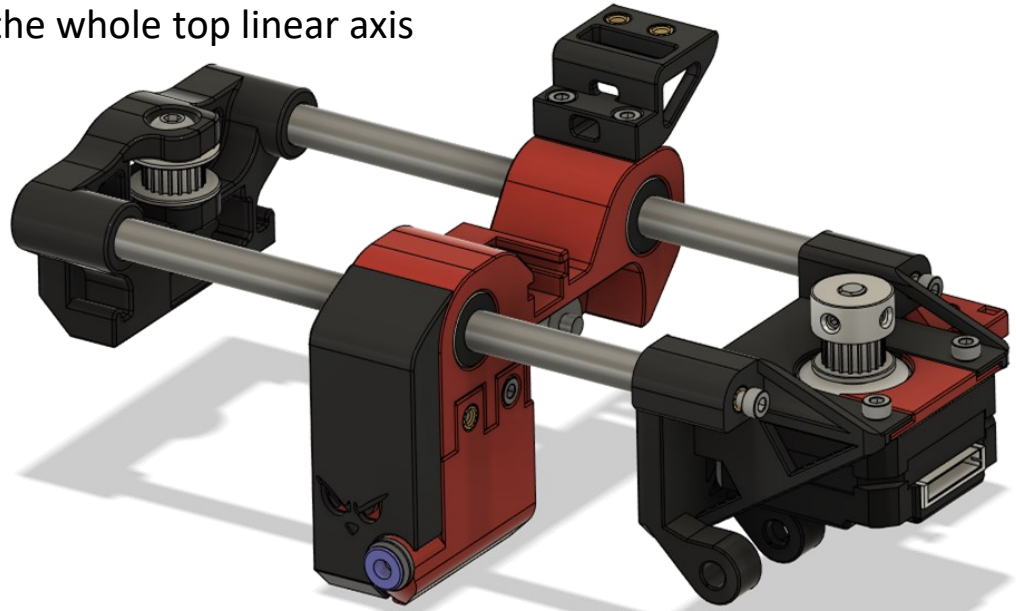
7-a Assemble the detector cart parts



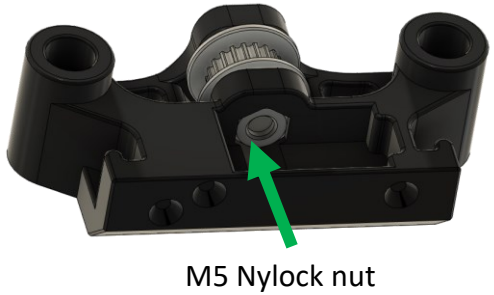


- Slide-in the Detector Cart, make sure the 2x M3X20 SHCS screws of the Detector Cart slides properly in their dedicated slots on the Selector Cart (they are not screwed-in, just guided)
- Just clip the door, as shown on the item #7. We'll deal with the wiring later on

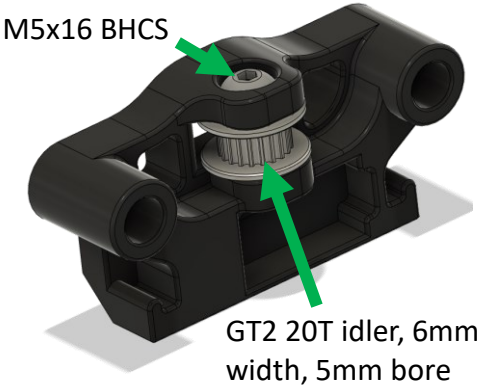
8 Assemble the whole top linear axis



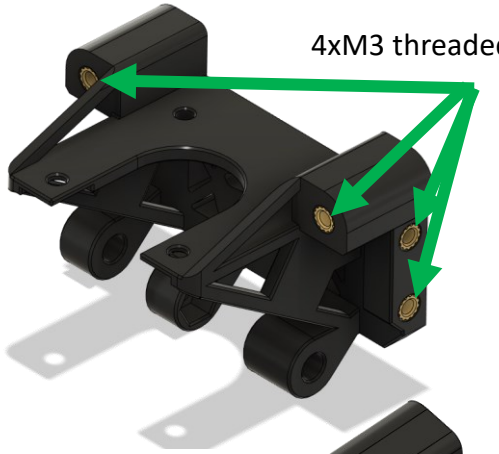
8-a Prepare the idler block

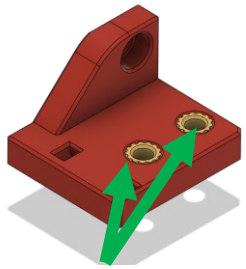


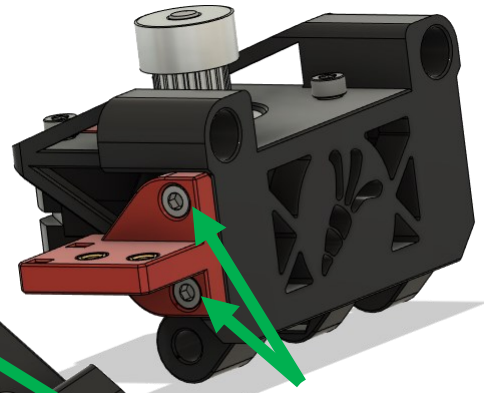
M5 Nylock nut

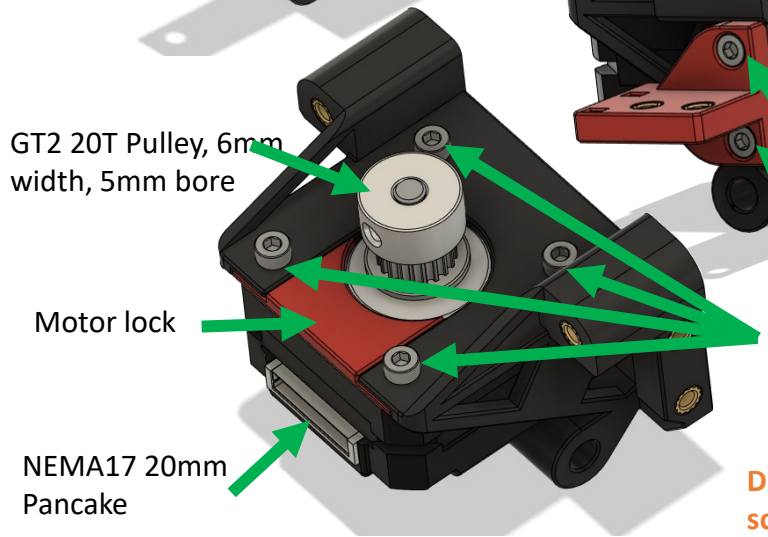


8-b Prepare the motor support





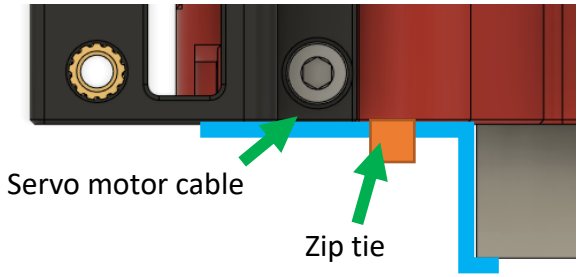


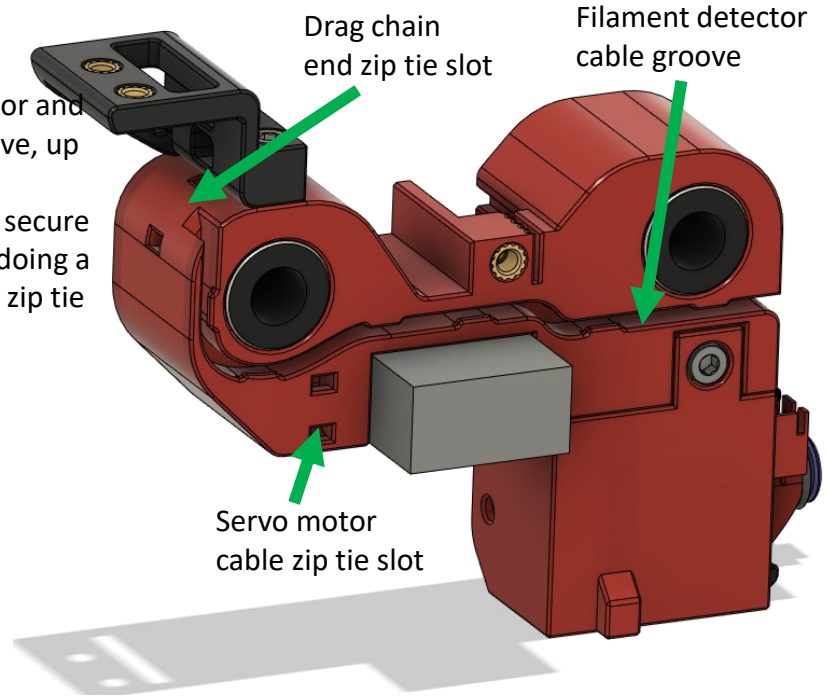


Don’t tighten the grub screw yet

8-c Prepare the selector cart cabling

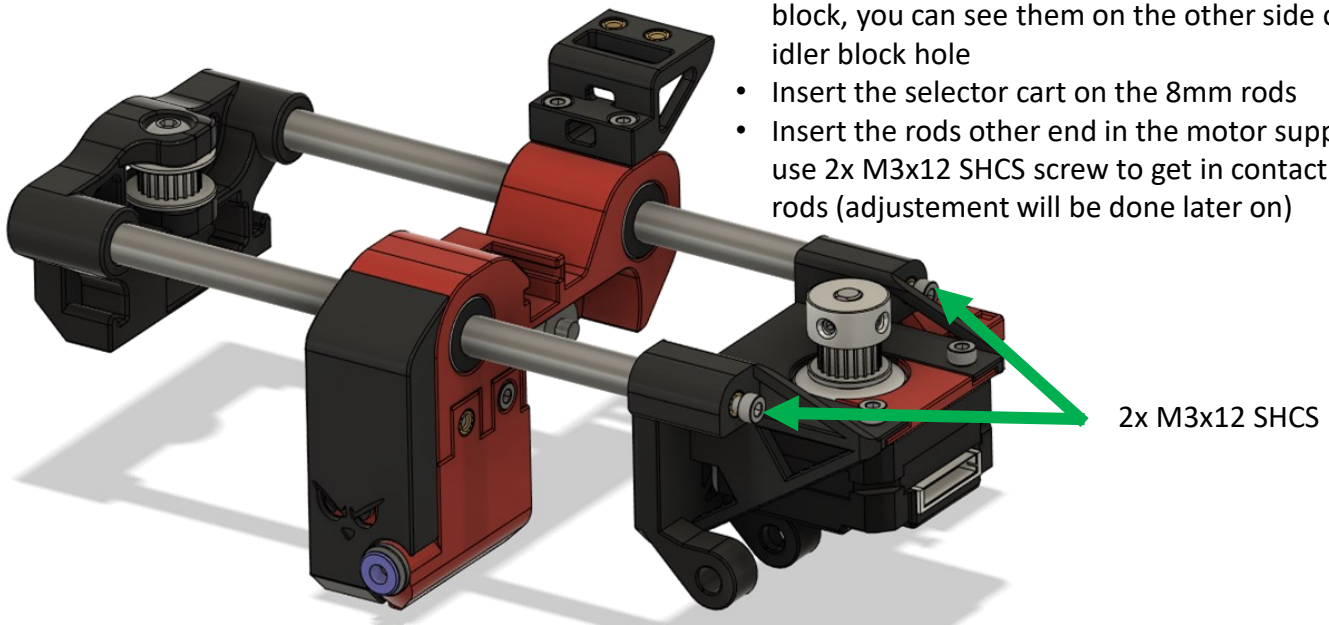
- Connect the optical sensor using a JST connector and then insert the 3 wires into the dedicated groove, up to the drag chain anchor point
- Use the servo motor cable zip tie slot to firmly secure the servo wiring, make sure the servo cable is doing a nice « 90° » turn in between the servo and the zip tie slot, as shown below





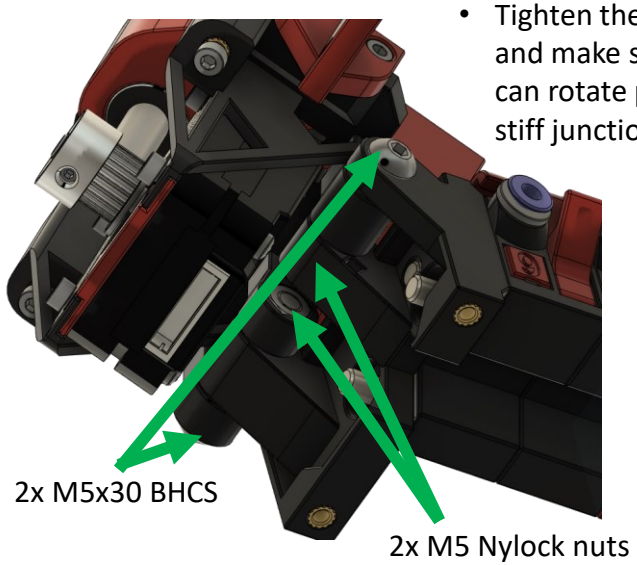
8-d Assemble the axis

- Insert **FULLY** the 8mm smooth rods in the idler block, you can see them on the other side of the idler block hole
- Insert the selector cart on the 8mm rods
- Insert the rods other end in the motor support, and use 2x M3x12 SHCS screw to get in contact with the rods (adjustement will be done later on)



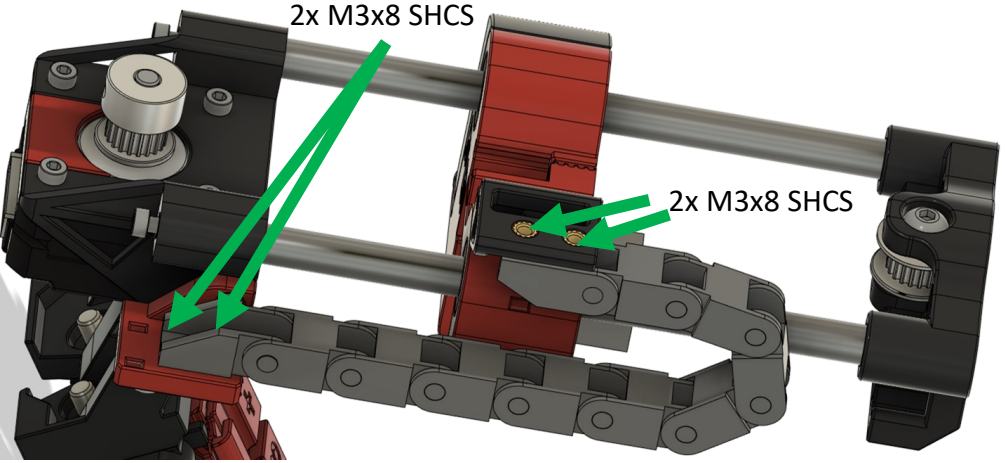
9 Assemble the top block to the bottom one

- Tighten the 2x M5x30 BHCS screws and make sure that the top block can rotate properly while having a stiff junction



10 Finish the cabling

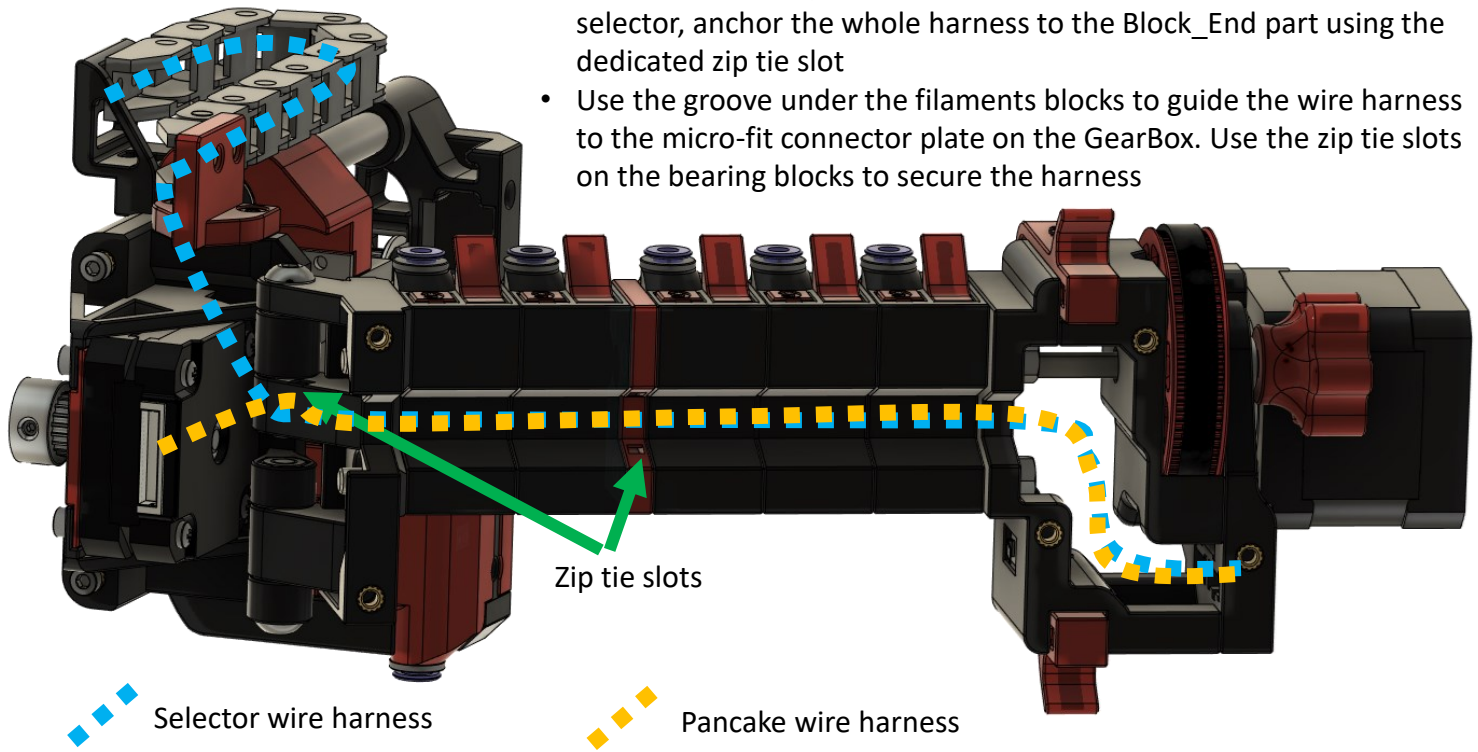
10-a Install the 7x7 drag chain



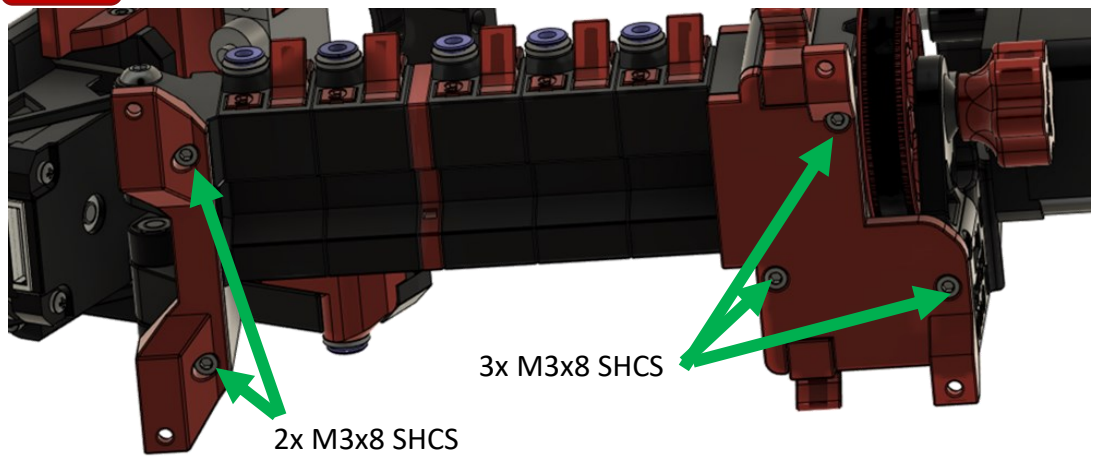
- Pass the servo and optical sensors cables into the drag chain, then fix the drag chain to the system
- Use zip-ties to secure cables at both ends of the drag chain

10-b Pass the whole wire harness to the ERCF connector plate

- Add the NEMA17 pancake motor cable to the wire harness from the selector, anchor the whole harness to the Block_End part using the dedicated zip tie slot
- Use the groove under the filaments blocks to guide the wire harness to the micro-fit connector plate on the GearBox. Use the zip tie slots on the bearing blocks to secure the harness



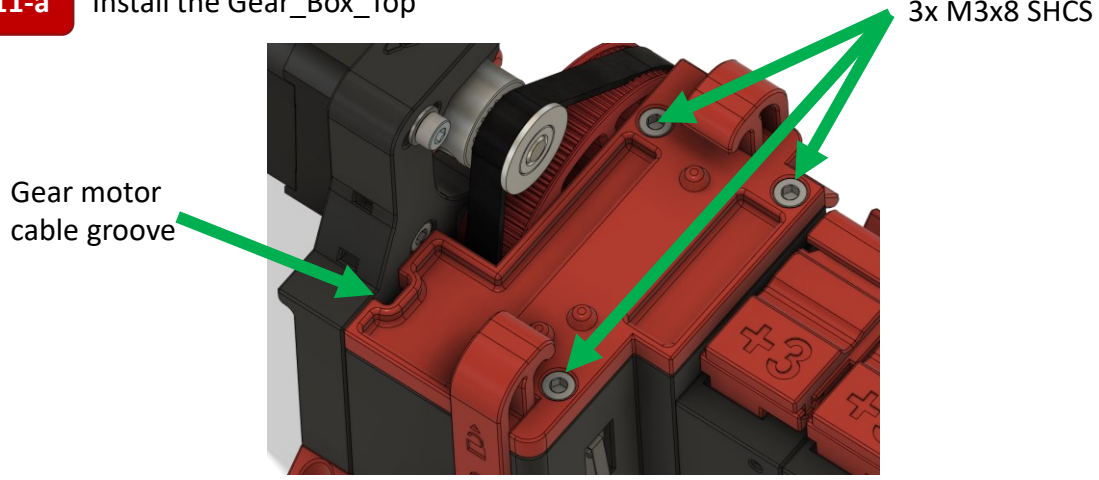
10-c Install the 2 ERCF feet



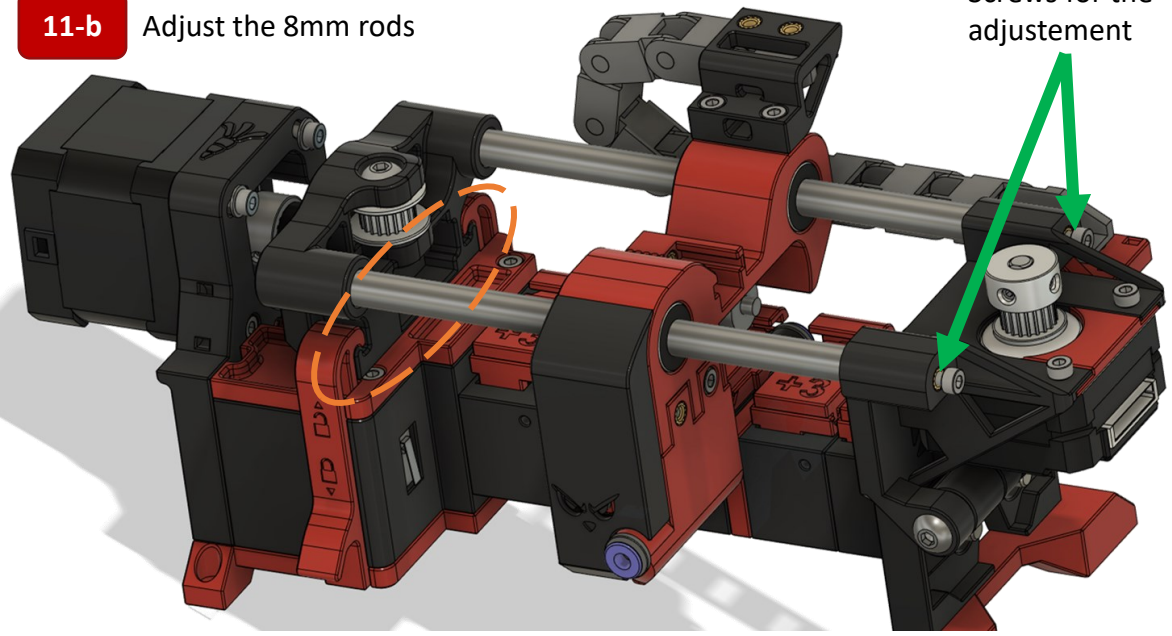
Don’t pinch the wire harness under the 2 feet!

11 Install the selector belt

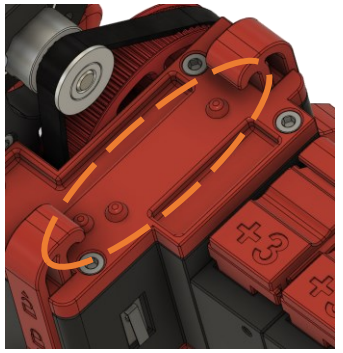
11-a Install the Gear_Box_Top



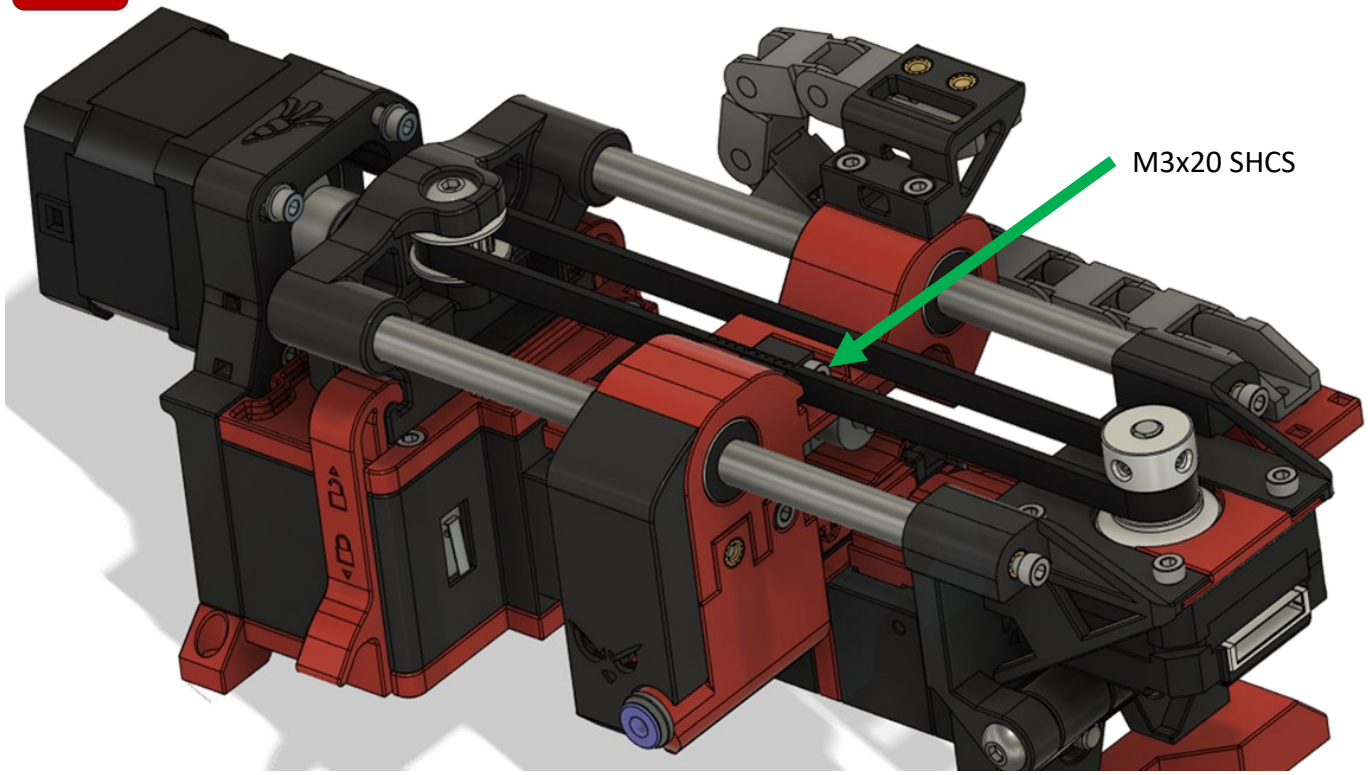
11-b Adjust the 8mm rods



- Use the screws on the selector-motor side to finely adjust the 8mm rods position. The goal is to match the 3 domes pattern on the Idler_Block on the ones of the Gear_Box_Top. You should be able to lock the two latches without any issues when you close the top block.



11-c Install and tension the selector belt



- Use the belt_tensionner and a M3x20 SHCS screw to tension the 6mm GT2 belt. Ensure nothing is bending due to overthightening

Main assembly of the ERCF is done!
Good job!

- You may have noticed that we didn't install the servo arm yet! Don't worry, this will be done in step 13!

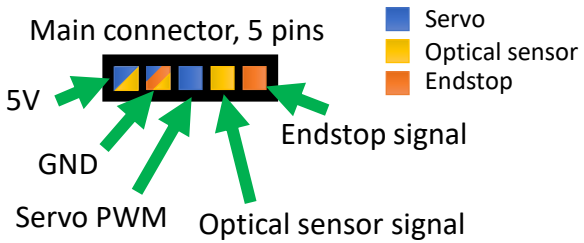
12 (Optionnal) Installation on a Voron V2

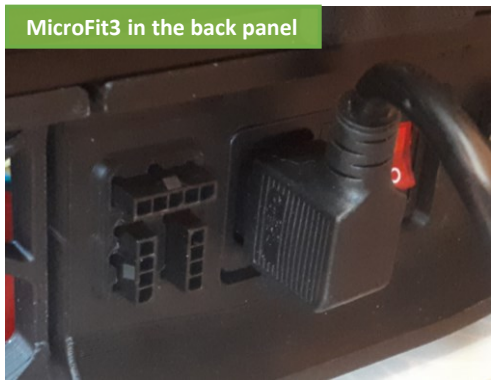
12-a Choosing a connector output

- There are two possibilities for you to wire the ERCF to your Voron V2, either using the MicroFit3 connectors leftovers you should have after building the V2 or using JST-SM connectors
- Build your ERCF cable accordingly, using the following guidelines :

S for Selector Motor (the pancake), 4 pins

G for Gear Motor (the big one), 4pins

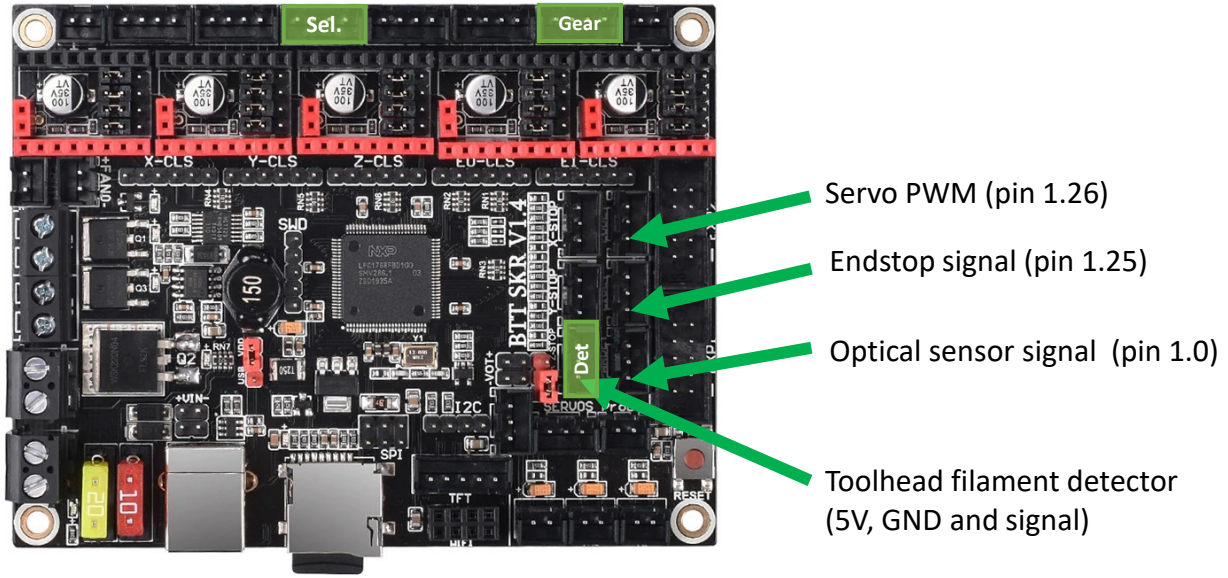




12-b Connections in the electronics compartment

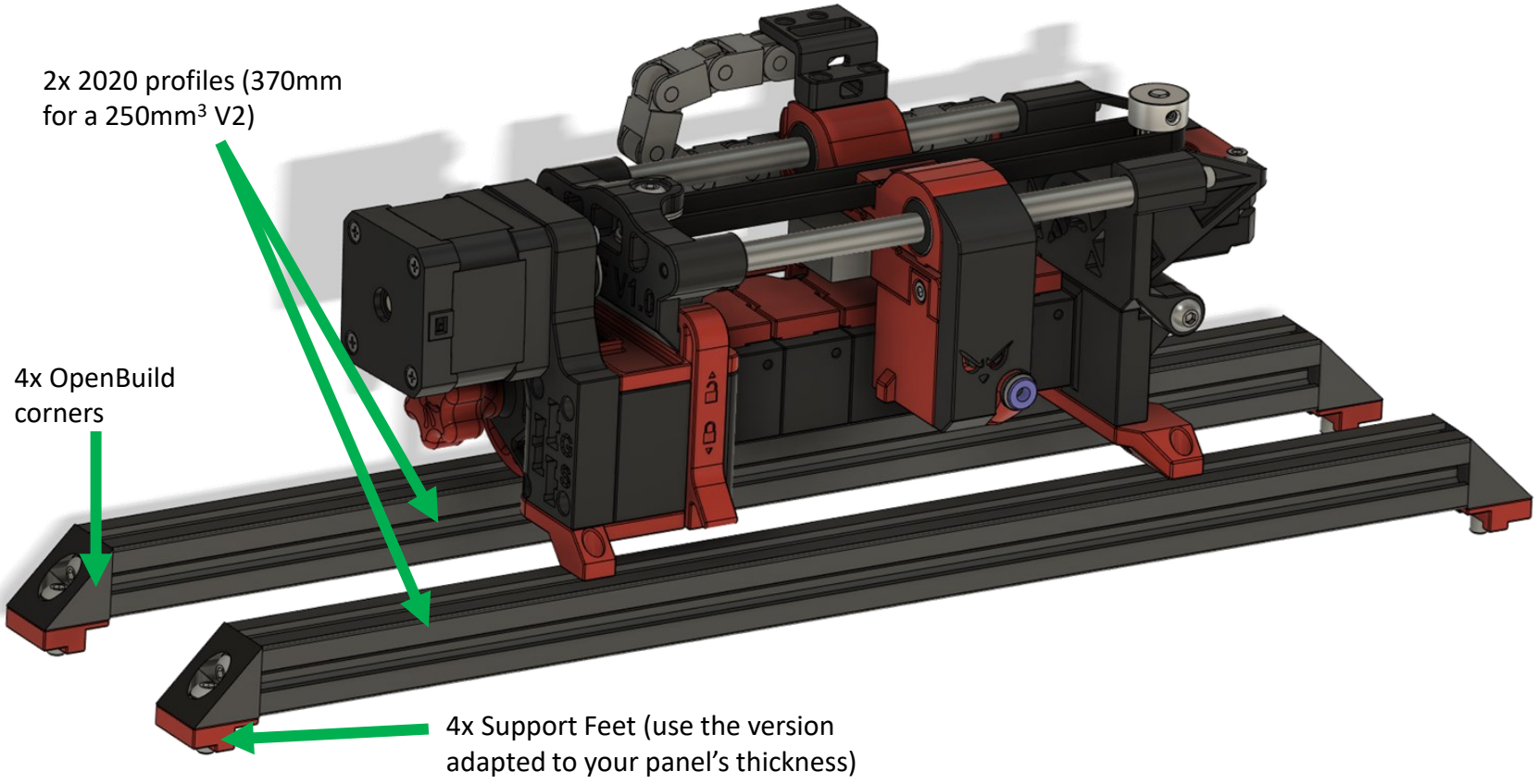
- This is an exemple, you can adapt it to your setup of course. **Only mandatory part is to use the 5V/GND from the Rpi power supply** (the 5V 5A you should have), servo are power hungry and it won't behave that well if the current is drawn from the SKR

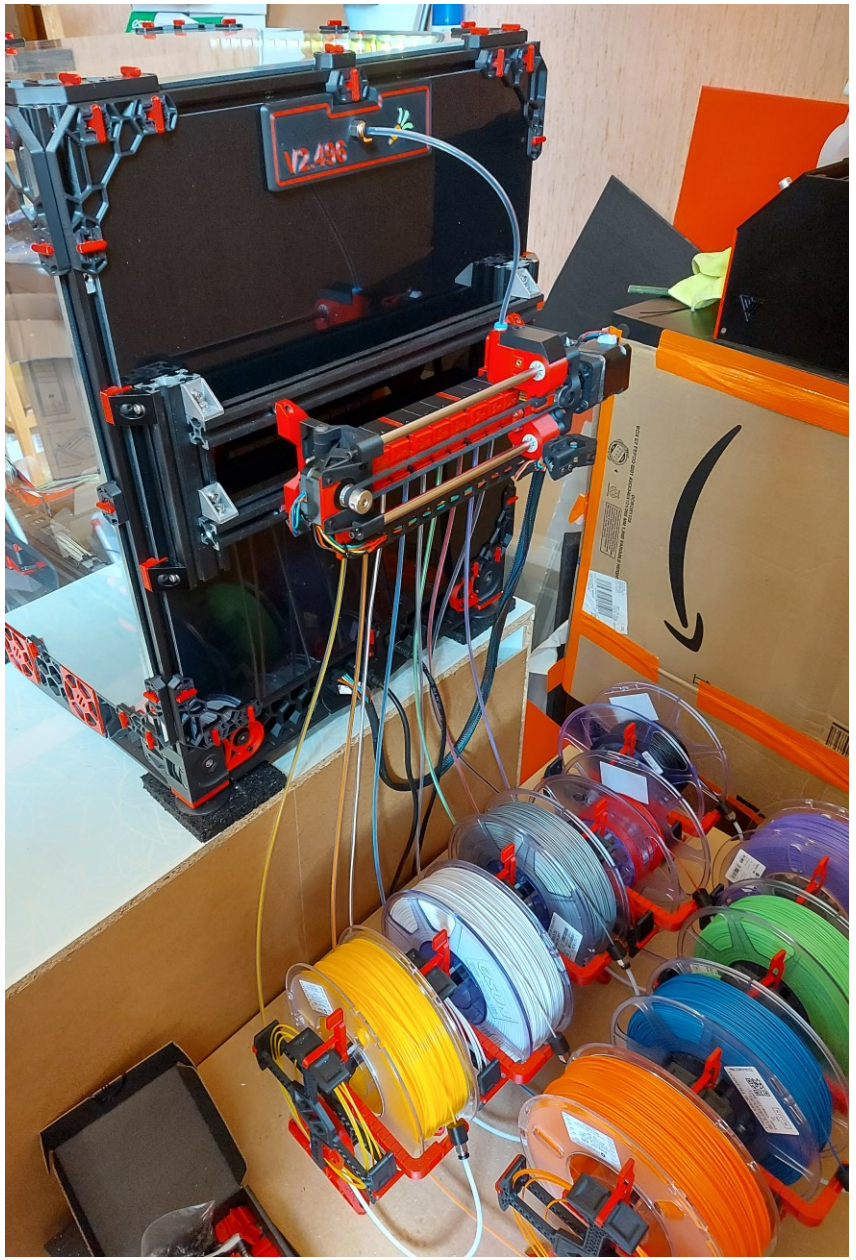
'XY//AB' SKR Board



12-c Mounting system

- You can install the ERCF in any position//orientation you want. If you wish to use the typical Vertical-at-the-back-of-the-V2 or the typical Horizontal-on-the-top-of-the-V2 installations, you can use the following mounting system





Example of my own setup (V2.4 300mm³, 9 channels ERCF). Don't mind the 2020 draft assembly, I don't have the proper 2020 lengths for the ERCF support yet.

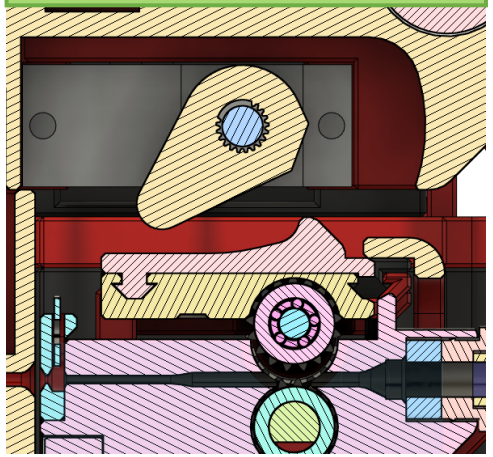
13 First steps with the ERCF

- Before you plug//unplug the ERCF from your printer, remember to turn off the printer motors

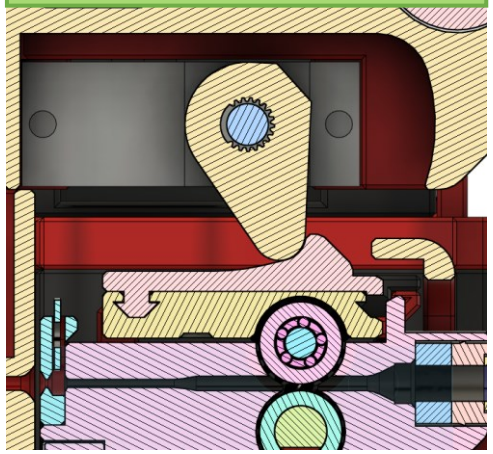
13-a Install the servo arm

- Once plugged-in, the first step is to install properly the servo arm
- Use the SERVO_DOWN command (you should hear the servo briefly turning)
- Insert the servo arm into the servo gear, so that the arm matches the « down » position, as shown below
- Use a M2x6//8mm screw to firmly attach the servo arm on the servo gear

Typical UP position

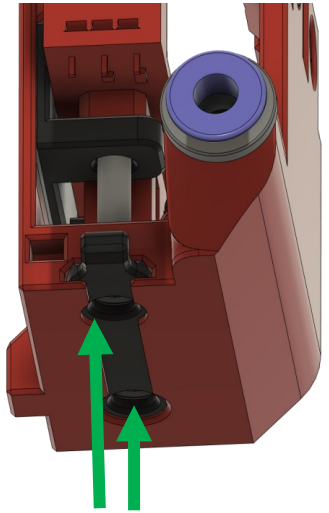


Typical DOWN position



- Once properly fixed, use the SERVO_UP and SERVO_DOWN macro to check that :
  - SERVO_UP puts the servo in a position where the arm won't hit anything when the selector is moving
  - SERVO_DOWN puts the servo arm in the proper filament locking position (same as shown above)
  - If necessary, you can adjust both angles in the ercf_macros.cfg header (resp. variable_servo_up_angle and variable_servo_down_angle values). Play with the SERVO_TEST VALUE=XX (XX being the angle) to test different values before editing the config file and rebooting the firmware.

13-b Calibrate the filament detector



Optical sensor calibration screws

- Open fully the ERCF (open the two side latch and rotate the top axis) to have a proper access to the selector bottom screws
- The 2 Optical sensor calibration screws are used to move the optical sensor up and down inside the detector cart
- Start with the sensor at the max high position (optical sensor as close as possible to the 8mm rods), you don't need to force at all. Also remember to keep the optical sensor « horizontal » (i.e. do one turn per screw at a time). Optical sensor should be « ON » (i.e. red light)
- Make sure no filament is inserted in the selector cart
- Make the optical sensor go down until the red light turns OFF (be very precise there, you want to be at the edge of the 'ON' signal
- Put a filament in/out of the selector cart to check that:
  - The light is OFF when there is no filament
  - The light turns bright red (ON) as soon as you push the filament through
- You can close the ERCF

13-c Check that both motors are ok

- First, use STEPPER_BUZZ STEPPER=<config_name> to check that the motors are properly connected
- Check that they're both rotating in the proper direction : going positive on the Gear Motor should make the filament go out of the ERCF (selector side) and going positive on the Selector motor should make the selector go away from the selector endstop (i.e. the mechanical switch). To do that just use MANUAL_STEPPER STEPPER=config_name SET_POSITION=0 followed by MANUAL_STEPPER STEPPER=config_name MOVE=<pos>, with pos being a small number (less than 10). If needed, change motor rotation direction in the cfg.
- Check both motors calibration (e-steps and steps/mm) and tune it properly

13-c Home the ERCF

- Make sure all previous steps are properly done and that the ERCF is properly closed
- Load filaments in the ERCF : put the filament in its channel, make it go through the filament block and even more, then push what's out of the filament block back in with your finger. Filament should be now flush at the filament block exit
- Use the HOME_ERCF macro : this will first eject a filament (if there is one detected, that should not be the case here), then home the selector and then try to preload the 1st channel
- Preloading means that the selector will reach the 1st channel (i.e. the one next to the selector endstop), engage the bondtech gears with the servo and push the filament until it is detected by the optical sensor in the ERCF. Once done, filament will be pushed slightly out of the selector cart, and then put back in its filament block
- Note that the parking position of the filament, when done by the ERCF, is deeper into the filament block : the filament tip won't be flush on the filament block exit, this is intentionnal

Check the console to see if everything went fine (it is quite verbal ;))

13-c Calibrate all channels

Next steps coming soon!!!