



ERCF v2.5 BUILD GUIDE

v2.5 EDITION

Even the smallest one can change the world.

—Peter Rabbit

VERSION 2025-08-13



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

This machine can potentially maim and electrocute you if you are not careful.

Please do not become the first ERCF fatality.
There is no special Discord flair for that.

Please, read the entire manual before you start assembly.

As you begin wrenching, please check our Discord channels for any tips and questions that may halt your progress.

Most of all, good luck!

The ERCF Team

THANKS!

Thanks are in order to several groups of people:

Dr. Lorincz Robert for his work on stepper motors and his help understanding the physics of stepper motors. His help was integral to the design of the Direct Drive system.

Blamm! for the inspiration of the Disco Stick, **Shammy** for his work adapting it to an ERCF-friendly format, and **Fabreeko** for their work with **XR Bunker** co-producing the Carrot on a Stick and Carrot on a Twig boards. **Shammy** again for being a PCB design resource for other ideas!

LDO, SIBOOR, and BTT for working with us to prototype kits and bespoke kit solutions.

FizzyTech for giving us a dedicated online space to congregate and discuss ERCF while developing RC1.

The ERCF Team

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INTRODUCTION

WARNING



BEWARE

This project requires a well-tuned printer and ABS slicing profile, as there are many press fits and plastic on plastic mechanisms. Before you print all of the parts, you should first print the [ERCF_Calibration_Tool.stl](#) along with a [Tophat_xN.stl](#), and test fit the parts as shown on [page 24](#). You may need to tune your printer or printing profile before you print the rest of the parts!

Easily half of problems with this build that we see reported on Discord can be avoided by making sure that your printer is up to the task first.

If you haven't tuned your printer yet, please start by tuning:

- Your [Extruder](#) calibration
- Your [Pressure Advance](#) setting
- Your [Extrusion Multiplier](#), and
- Your [Cooling and Layer Time](#) settings

We can't speak highly enough of the [Tuning Guide](#) that Andrew Ellis has put together. The other steps are optional. If you encounter problems, try his [Troubleshooting Guide](#)!

KEEP THE ERCF PROJECT GOING!

ERCF is an all-volunteer, open-source project.

If you want to support the ERCF team, please donate to the Enraged Rabbit Community:

<https://opencollective.com/enraged-rabbit-community>

In the words of Marc, ERCF would be a dead brick of plastic without Happy Hare software.

Happy Hare is coded primarily by moggieuk, and Silverback_Attack wrote a lot of the documentation.

You can find Happy Hare here:

<https://github.com/moggieuk/Happy-Hare>

You can donate to support moggieuk and Happy Hare here:

<https://www.paypal.me/moggieuk>

INTRODUCTION

PRINT GUIDELINES

PART PRINTING GUIDELINES

The Voron Team has provided the following print guidelines. The ERCF Team have added our own recommendations atop their guidelines. Please follow them in order to have the best chance at success with your parts. There are often questions about substituting materials or changing printing standards, but we recommend you follow these.

FDM MATERIAL

The ERCF was developed for use only with ABS, so we strongly recommend you use ABS to build the ERCF. All reported community efforts to use different materials (PLA, PETG, resin) have failed for a variety of reasons.

Use only ABS. Not ASA, not ABS+, not EZ ABS, etc.
Use high quality filament, too, not bargain filament.

LAYER HEIGHT

Recommended : 0.2mm
First Layer: 0.25mm

LAYER HEIGHT EXCEPTIONS

(The [o]_Encoder_Wheel and Servo_Arms)
Recommended : 0.1mm or less if capable
First Layer: 0.2mm or less if capable

EXTRUSION WIDTH

Recommended: Slicer default width, or 0.4mm
Arachne is the preferred slicing engine.

SUPPORTS & PRINT ORIENTATION

All parts are oriented correctly for printing and include print in place supports where required.

INFILL TYPE

Rectilinear, Honeycomb, Triangle or Cubic.

Grid and Gyroid are specifically **not recommended**.

Grid infill creates high points that can catch the nozzle and cause inaccuracy. Gyroid subtly curls parts away from the build plate.

INFILL PERCENTAGE

Recommended: 40%

WALL COUNT

Recommended : 4

SOLID TOP/BOTTOM LAYERS

Recommended : 5 or more

INTRODUCTION

STL FILE KEY

FILE NAMING

By this time you should have already downloaded our STL files from the ERCF GitHub. You might have noticed that we have used the Voron naming convention for the files. This is how to use them.

PRIMARY COLOR

Example `End_Block.stl`

These files will have nothing at the start of the filename.

ACCENT COLOR

Example `[a]_End_Bypass.stl`

These files have an “[**a**]” prefix to denote that they should be printed with an **accent** color.

QUANTITY REQUIRED

Example `Filament_Path_xN.stl`

Files ending with “_x#” are telling you the **quantity** of that part required to build this system. For the ERCF, “N” means the number of channels.

COLOR REQUIRED

Example
`[c]_Cover_Lens_xN.stl`

These files have a “[**c**]”prefix to denote that they need to be printed in a **clear/transparent** material.

COLOR REQUIRED

Example
`[o]_Encoder_Slotted_Wheel.stl`

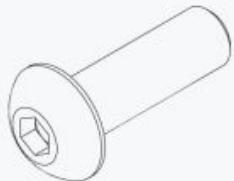
These files have an “[**o**]”prefix to denote that they need to be printed in an **opaque** material light can’t penetrate, preferably black.

OPTIONAL MULTIMATERIAL

Example
`[mm]_Selector_Door.3mf`

These files have a “[**mm**]”prefix to denote that they should be printed in **multiple** colors. We always include single-color versions of these files too, for your first build.

INTRODUCTION



BUTTON HEAD CAP SCREW (BHCS)

Metric fastener with a domed shape head and hex drive. Most commonly found in locations where M5 fasteners are used.

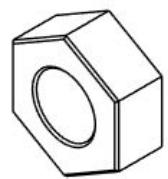
ISO 7380-1



FLAT HEAD COUNTERSUNK SCREW (FHCS)

Metric fastener with a cone shaped head and a flat top.

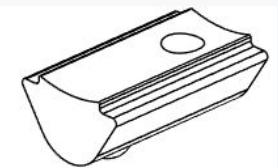
ISO 10642



HEX NUT

Hex nuts couple with bolts to create a tight, secure joint. You'll see these used in both M3 and M5 variants throughout this guide.

ISO 4032



POST INSTALL T-SLOT NUT (T-NUT)

Nut that can be inserted into the slot of an aluminium 2020 profile.

Often also called "roll-in t-nut."

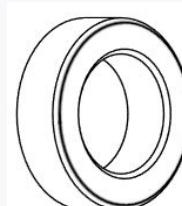
HARDWARE REFERENCE



SOCKET HEAD CAP SCREW (SHCS)

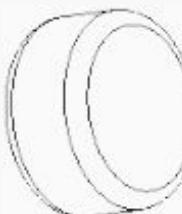
Metric fastener with a cylindrical head and hex drive. The most common fastener used on the ERCF.

ISO 4762



MR85 BEARING

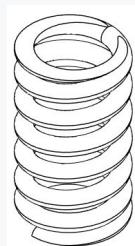
Used to center the drive shaft, and as a filament sensor actuator.



MAGNETS

How do they work?

These are cylinders 6mm in diameter and 3 mm tall. Shorter ones are OK, down to 2.7 mm. N52 are preferred, but N48 can work.



SPRINGS

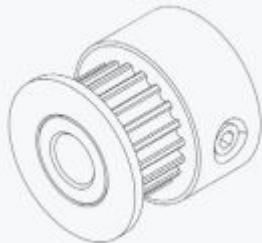
The main spring needed is for the Selector servo tensioner, which has a diameter of 6mm, length of 10-12mm, and uses 0.6-1.0mm thick wire.

INTRODUCTION



625 BEARING

Old ball bearing used in the Encoder.



PULLEY

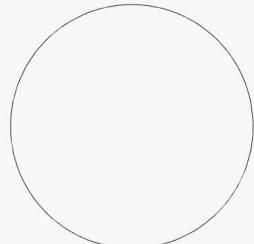
GT2 pulley used on the linear motion system of the ERCF.



SET SCREW

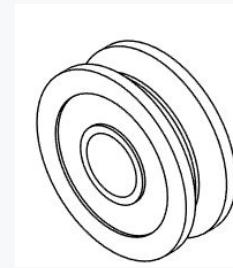
Small headless screw with an internal drive. Used in pulleys and other gears. Also called a grub screw.

ISO 4026



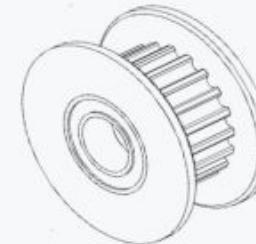
5.5MM BALL BEARING

A ball bearing used in the Filametrix toolhead sensors and / or CottonTail Buffer (both optional).



V623ZZ V GROOVE BEARING

A ball bearing used in the Encoder.



IDLER

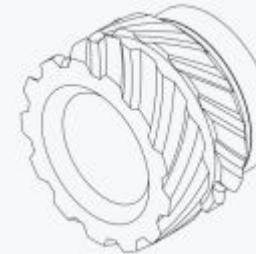
GT2 idler used in the linear motion system of the ERCF.



WASHER

Plain metal stamped washer.

DIN 125



HEATSET INSERT

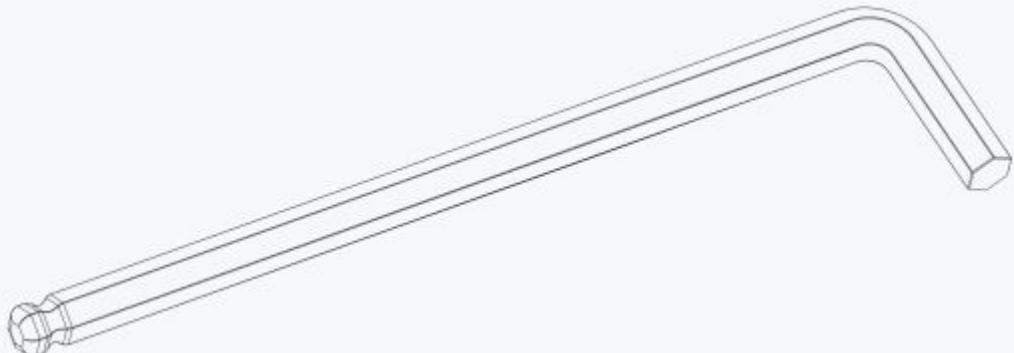
These are made of brass, threaded on the inside and has ridges on the outside. Heat them up to approx 250C with a soldering iron and push them into the plastic. As the plastic cools, it solidifies around the knurls and ridges on the insert for excellent resistance to both torque and pull-out.

INTRODUCTION

TOOLS

BALL-END DRIVER

Some parts of this design require the use of a 2.5mm ball-end hex driver for assembly.



STRAIGHT HEX DRIVER

Sometimes the extra grip from a straight hex driver helps with small or stubborn fasteners.

We need a 1.5mm driver for M2 fasteners, a 2.0mm driver for clearing the filament pathway and tightening M3 BHCS and FHCS bolts, and a 3.0mm driver for the M5 fasteners.

Refer to the sourcing guide for suggestions.



ADDITIONAL TOOLS

The tools needed are similar to those used building a Voron. For recommendations, visit https://vorondesign.com/sourcing_guide and switch to the “Voron Tools” tab at the bottom of the page.

INTRODUCTION

SOLDERING IRON

We use this for setting heat-set inserts into parts. Depending on your sensor choice, you might be soldering some wires together.

ANGLE GRINDER/DREMEL

If you need to cut your 8mm smooth rods, nothing less than an angle grinder is going to cut it, literally. Leave your grandfather's trusty hacksaw in the toolbox: rods are usually hardened steel.

VISE / HAND CLAMP

A vise is handy if you have to cut your 8mm rods. A vise or hand clamp may also be helpful when press-fitting bearings into the Selector.

WIRING CRIMPER

You'll need this to terminate your wiring. There are also turnkey wiring solutions out there you can buy, check Discord.

CAD SOFTWARE

[ERCF_v2.5/CAD/ERCF_V2.5_v69.step](#)

Software is a tool too! The CAD file for the ERCFv2.5 was designed to be used along with this manual as a supplement or reference, even if you aren't a CAD Pro. You can use the free edition of Fusion360, or your choice of CAD program such as TinkerCAD or FreeCAD.

TOOLS

SUPERGLUE

Yes, we consider this a tool. Superglue is useful as a plastic safe thread locker, and magnet glue. Cheap, single-use gel tubes are fine.

80T GEAR WHEEL GUIDE

[ERCF_v2.5\Stls\Tools\80T_Cog_Guide.stl](#) †

(Optional) This tool helps you align your printed 80T gear when you are assembling it.

SLOTTED WHEEL PUSH TOOL

[ERCF_v2.5\Stls\Tools\Slotted_Wheel_Push_Tool.stl](#) †

Helps you set the depth and align the Encoder slotted wheel without damaging it.

PRINTED PART TRACKER SPREADSHEET

There is a helpful interactive Printed Part Tracker for ERCFv2.5 here:

[Printed Parts Tracker Google Sheet](#)

GOOD FILAMENT

Not optional! You're never going to get consistently good results with the bargain bin \$8 roll of ABS from five years ago. Get yourself some good, known quantity filament, and it has to be plain ABS, not EZ ABS, not ABS+, not High-Speed ABS. Plain ABS, preferably pure!

Names to look for in **North America**: Atomic Filament, Polymaker, Jessie, Push Plastic

Europe: ColorFabb, PolyMaker, Das Filament

Elsewhere: Esun, Sunlu, Overture

This project aims to bring multi material capabilities to 3D printers using a single Direct Drive toolhead. While this project is mainly designed to be used on VORON printers, it can also be used (or adapted) on any 3D printer that runs Klipper.

Find all the project information on the Github page : https://github.com/Enraged-Rabbit-Community/ERCF_v2.5

The project is composed of 6 different components, some of which are optional:

- **Enraged Rabbit Carrot Feeder (ERCF).** The Carrot Feeder is the main unit and allows use of a high number of different filaments (up to 15 channels reported in the community) and feed them, one at a time, into the printer toolhead on an as-needed basis.
- **Enraged Rabbit CottonTail (ERCT)** is an integrated (but optional) filament buffer system to handle the filament when it is ejected from ERCF on a tool change. It can handle up to 1.5m bowden tube lengths. This has been specifically designed to minimize friction when setup, taking into account the natural filament memory. It has options for LED gate indicators and entry sensors.
- **Enraged Rabbit Filametrix (ERF):** This filament cutter is an optional toolhead modification to cleanly cut the tip of the ejected filament, so it can be loaded easily on next use. This option alleviates the frustrating job of tuning tip formation through movement of the filament within the extruder, which often still results in strings of filament causing clogs.
- **Toolhead Sensors:** These are a set of modifications for popular extruders that provides filament detection capability within the toolhead. Although optional, it is highly recommended, and makes filament change far more reliable.
- **Happy Hare Firmware:** This has become the go-to extension to Klipper for controlling various types of MMU. It is optimized to support ERCF. Moggieuk writes the software and much of the documentation for Happy Hare.
- **Enraged Rabbit Filamentalist:** The Filamentalist is a bufferless solution for managing filament unloads. The design ingeniously uses the stiffness of the filament to drive the spool, making it rewind as the filament unloads. The choice between Filamentalist and ERCT is up to you; Filamentalist only works with stiff filaments, so no flexibles.

This is the place to recognize the origins and evolution of this project. ERCF was originally envisioned and created by Ette and the v1.1 release credits Tircown, the Voron Dev team (special mention to Dunar), Benoit, Dustin Speed, Kageurufu and the HonHonHonBaguette people!

Over time and significant adoption the shortcomings of ERCF v1.1 design came to light, and that inspired a set of modifications to address them: SturdyBunny, TripleDecky, Springy, Binky and other strange names appeared. It was then that Moggieuk, the author of Happy Hare, rounded up these project authors and created the beginnings of the ERCF v2 community release. As the project developed, Kinematicdigit developed and contributed CottonTail, Sorted01 developed and contributed Filametrix and we were joined by some awesome talent that polished, tested and documented to complete the project.

Many hundreds of hours of volunteer effort have gone into this project and we hope it pays tribute to Ette's wonderful original design. **The BMW of MMU's!**

- @moggieuk V0.1503 | V2.4088 (Happy Hare Developer & Chief whip)
- @gneu V2.5345 (Filament Block Designer and Bling Innovator)
- @sneakytreesnake V2.3804 (Sturdy Bunny Designer)
- @mneuhau5 VT.483 (Binky and Encoder Designer)
- @miriax (Manual Monster and Tester)
- @kinematicdigit (Cottontail Designer & Doc Illustrator)
- @ningpj (Tester, Breaker & Doc's)
- @fizzy (King of CAD)
- @gsx8299 (Test Builder Extraordinaire)
- @sorted (Filametrix "don't get enraged" filament cutting system Designer)
- @kieranthe man (Thumper Designer)
- @silverback_attack (Videographer, Happy Hare Documenter)



With the release of ERCFv2 RC1, it quickly became apparent that the Gearbox was the weakest feature of the release. Kinematic Digit consulted with Dr. Róbert Lőrincz, a professor of stepper motor design, and determined that the optimal motor configuration for ERCF is a single NEMA17 in a direct drive configuration, with a phase resistance of less than 2 ohms.

With the knowledge that the Gearbox needed to be redesigned to be serviceable without total disassembly, and to accommodate new motor configurations, Miriax and Silverback_Attack took up this design task. Silverback_Attack made the new Gearbox Foot, End Block with Bypass, and Split Coupler. Miriax made the new Gearbox and Motor Mounts.

Along the way, several inadvertent design problems in the Filament Blocks became apparent, and so the Filament Blocks needed to be modified. Kinematic Digit took up this design task, and then Miriax made a new version from scratch, but based on Kinematic Digit's earlier work. Kinematic Digit also invented the Carrot Puller and Filament Brakes.

The Selector also became a problematic focus, so Miriax heavily modified it. He added a few more QoL and alignment features to the Linear Axis, invented the PTFE tool, printable 7x7 cablechain, new MMBv2 mount, and several User Mods.

Thousands of hours of volunteer effort have gone into making and documenting this project, and we hope it delivers on the promise of Ette's wonderful original design. **The BMW of MMU's!**

- @moggieuk V0.1503 | V2.4088 (Happy Hare Developer)
- @gneu V2.5345 (Filament Block C7 Designer and Bling Innovator)
- @sneakytreesnake V2.3804 (Sturdy Bunny Designer)
- @mneuhau5 VT.483 (Binky and Encoder Designer)
- @miriax (Gearbox, Filament Block C10D, and Selector Redesigner, Printability Expert, Manual Monster)
- @kinematicdigit (Filament Block C10 designer, Cottontail Designer & Doc Illustrator)
- @ningpj (Tester, Breaker & Doc's)
- @gsx8299 (Test Builder Extraordinaire)
- @sorted (Filametrix "don't get enraged" filament cutting system Designer)
- @kieranthe man (Thumper Designer)
- @silverback_attack (Gearbox Feet Redesigner, Coupler Designer, Videographer, Happy Hare Documenter)
- @skibikemake (Filamentalist Rewinder Buffer Designer)

INTRODUCTION

V2.5 DESIGNER ACKNOWLEDGEMENTS

[This spot reserved for Beta Bunnies thanks and acknowledgments]

INTRODUCTION

HOW TO GET HELP

If you need assistance with your build you can head over the new ERCF Discord group. It is the primary medium to help people with their ERCF build and tuning! You can also check the Github page for the latest releases.

If you need help making ERCF work with your VORON printer, head to the VORON Discord group and post your questions in the **multimaterial_and_u** channel.

ERCF



<https://discord.com/channels/1267663557999329371/>

GitHub

https://github.com/Enraged-Rabbit-Community/ERCF_v2.5

VORON



<https://discord.com/channels/460117602945990666/909743915475816458>

INTRODUCTION

INTRODUCTION

Constructing and operating a multi-filament system can be a challenging endeavor, often more intricate than assembling the 3D printer itself. Approach this task patiently, addressing each issue methodically. Be aware that minor complications during assembly can accumulate, potentially leading to greater challenges later. If you encounter any uncertainties or roadblocks, feel free to seek guidance on Discord - remember, the only foolish question is the one left unasked!

You might have heard about the frequent challenges associated with multi-filament systems. Indeed, they can be demanding. However, the Enraged Rabbit Project aims to provide a system that is not only innovative and reliable but also user-friendly. Despite these efforts, encountering some difficulties is not uncommon. In such instances, consult the available documentation and guides, and don't hesitate to ask for help on Discord. Many common issues have likely been encountered and resolved before, so assistance is readily available.

Enjoy the process of building as much as utilizing your Enraged Rabbit Carrot Feeder!

This design relies heavily on heatset inserts. If you've never worked with heatset inserts before, watch this guide:

<https://www.youtube.com/watch?v=cyof7fYFcwQ>

Here is a list of all the pages of this manual where you need to add the heatset inserts into the 3D printed parts, so you can add the heatset inserts all at once if desired:

- [Page 43](#) (**Gearbox**, 3 heatset inserts)
- [Page 44](#) (**Gearbox**, 7 heatset inserts)
- [Page 45](#) (**[a]_Hatch**, 2 heatset inserts)
- [Page 106](#) (**[a]_Selector_Cart**, 3 heatset inserts)
- [Page 109](#) (**Drag_Chain_Anchor** †, 2 heatset inserts)
- [Page 121](#) (**Encoder_Right**, 3 heatset inserts)
- [Page 132](#) (**Linear_Axis_Selector_Motor_Support** and **[a]_Drag_Chain_Anchor_Bottom** †, 4 and 2 heatset inserts)
- [Page 152](#) (**COAS_Holder_Female_x2** and **COAS_Holder_Male_x2**, 2 and 2 heatset inserts)
- [Page 164](#) (**Base.STL** and **MMB_mount_hinge**, 6 and 1 heatset inserts)

We have provided the ERCFv2.5 CAD files ([ERCFv2.5/CAD/ERCFv2.5_v69.STEP](#) and [ERCFv2.5_v69.F3D](#)), so that you can follow along with the instructions in a 3D view, if you like.

If you see files with newer version numbers, you can assume there has been an improvement and you should use those files.

The CAD file is organized into folders / units based on the instructions in this manual. If you hide all of the units after the step you are on in this manual, the CAD should closely track what you are building. That's why you'll see titles like **3.1 INSTALL BONDTECH IDLER GEAR** - the **3.1** denotes the folder / unit in the CAD.

We did our best to keep the CAD units and the manual steps in sync, but even so, sometimes we'll be doing units slightly out of numerical order, or repeating units (eg. **1.2, 1.3, 1.2, 1.3, 1.4, 1.3, 1.4...**). Don't worry about the unit order, just follow along with the manual.

In summary, The unit numbers are just our way to link together the CAD and the manual. You can ignore them if you aren't looking at the CAD, and still successfully build the base ERCF with just this manual.

INTRODUCTION

If you are upgrading from ERCFv1.1 or v2.0, you can re-use some of the printed parts. These parts will have a dagger † every time we mention the file name, in case you want to re-use those parts. Here is a list of all the reusable parts:

ERCF_v2.5 / STLs / 0._Tools

Pulley_Tool_NEMA14.stl †
Pulley_Tool_NEMA17.stl †
80T_Cog_Guide.stl †
LED_Soldering_Tool_24mm.stl †
Slotted_Wheel_Push_Tool.stl †

ERCF_v2.5 / STLs / 2._Motor_Mounts_Drive_Shaft / 2.3_Drive_Shaft

[a]_Bearing_Spacer_x2.stl †
[a]_Knob.stl †
[a]_M4_80T_Wheel.stl †
[a]_Side_Latch_x2.stl †

ERCF_v2.5 / STLs / 4._Gear_Box_Part_2 / 4.3_Apron_Leds

[c]_Cover_Lens_xN.stl †
Cover_Body_xN.stl †
Holder_COAS_x2.stl †

/ Options

[c]_Cover_Lens_No_Support_xN.stl †
Cover_Body_No_Support_xN.stl †
Holder_PCB_LED_xN.stl †
Holder_SIBOOR_LEDs.stl †
Holder_Strip_Leds_xN.stl †

ERCF_v2.5 / STLs / 6._Selector

Belt_Tensioner.stl †
Drag_Chain_Anchor.stl †
Selector_Door.stl †
Selector_Spring_Cap.stl †

UPGRADING FROM EARLIER VERSIONS

ERCF_v2 / STLs / Supports / Adjustable_Mount

[a]_Screw_x3.stl †
Junction_Plate_Flat_x2.stl †
Junction_Plate_Gear_Box.stl †

ERCF_v2 / STLs / Supports / Adjustable_Mount / 2020

2020_Mount.stl †
2020_Mount_Mirrored.stl †

ERCF_v2 / STLs / Supports / Adjustable_Mount / 3030_(SW_with_panels)

3030_Flat_Mount.stl †
3030_Flat_Mount_Mirrored.stl †

ERCF_v2 / STLs / Supports / Adjustable_Mount / 3030_(SW_without_panels)

3030_Mount.stl †
3030_Mount_Mirrored.stl †

ERCF_v2 / STLs / Supports / Adjustable_Mount / Option

ERCF_Easy_Brd_Bracket_Mount.stl †

ERCF_v2 / STLs / Supports / V1_V2

[a]_Support_Feet_4mm_x4.stl †
[a]_Support_Feet_5mm_x4.stl †

INTRODUCTION

There are optional printed parts that we have created in order to make ERCF v2.5 compatible with different components. We have made an interactive [Printed Parts Tracker](#) in order to help keep it straight, but here is a list for posterity:

ERCF_v2.5 / STLs / 2._Motor_Mounts_Drive_Shaft

Motor_Mount_NEMA17_Direct_Drive_v81.stl
(used for the default Direct Drive motor configuration)

ERCF_v2.5 / STLs / 2._Motor_Mounts_Drive_Shaft / Alternate_Motor_Mounts

Motor_Mount_NEMA14_Metal_80T_v3.stl
Motor_Mount_NEMA14_Printed_80T_v3.stl
Motor_Mount_NEMA17_Metal_60T_v3.stl
Motor_Mount_NEMA17_Metal_80T_v3.stl
Motor_Mount_NEMA17_Pancake_Direct_Drive_v2.stl
Motor_Mount_NEMA17_Printed_60T_v3.stl
Motor_Mount_NEMA17_Printed_80T_v3.stl
(alternatives for other motor configurations)

ERCF_v2.5 / STLs / 2._Motor_Mounts_Drive_Shaft / 2.3_Drive_Shaft

[a]_Bearing_Spacer_x2.stl †
[a]_Knob.stl †
[a]_M4_60T_Wheel.stl
[a]_M4_80T_Wheel_v2.stl
[a]_Split_Coupler_A.stl
[a]_Split_Coupler_B.stl
(only used with Geared Drive motor configurations)

ERCF_v2.5 / STLs / 6._Selector / Servo_Options

Servo_Mount_DS041MG.stl †
Servo_Mount_Savox.stl †
(alternative Servo mounts)

OPTIONAL PARTS

ERCF_v2.5 / STLs / 7._Encoder / 623_Bearing

623_Encoder_Left.stl
623_Encoder_Left.stl
(623 Bearing Encoder option)

ERCF_v2.5 / STLs / 7._Encoder / v623zz_Bearing

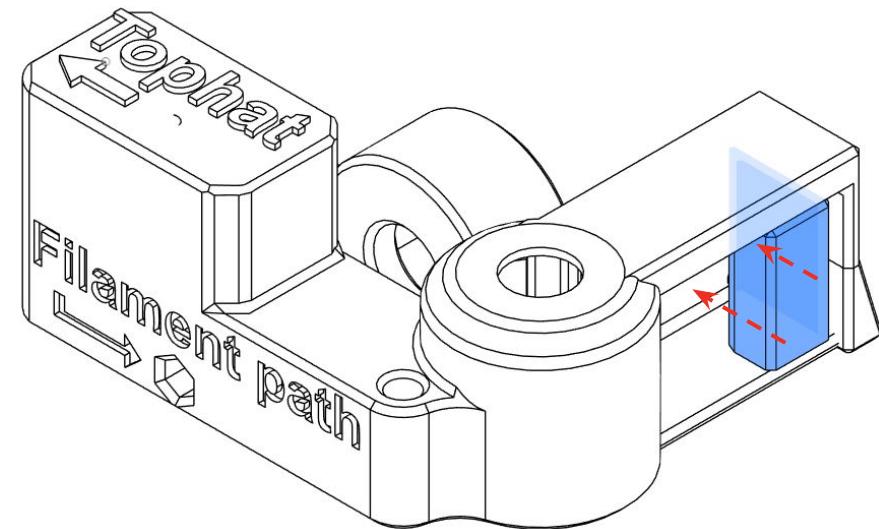
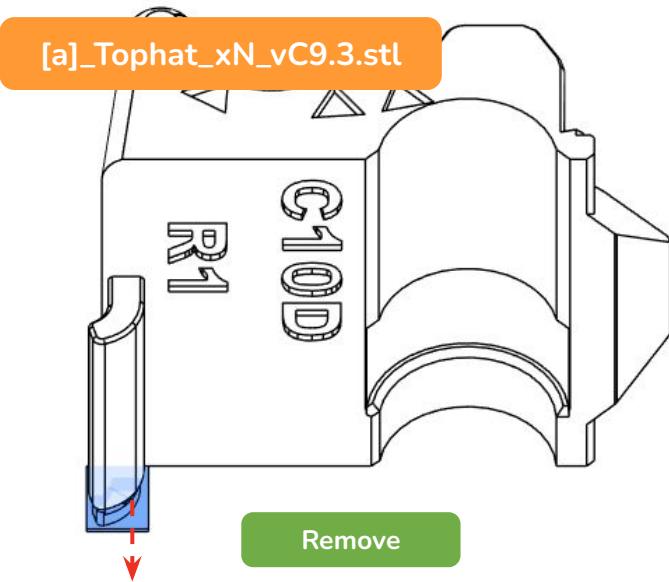
V623zz_Encoder_Left.stl
V623zz_Encoder_Left.stl
(V623zz Bearing Encoder option)

ERCF_v2.5 / STLs / 8._Linear_Axis

Linear_Axis_Idler_Block.stl †
Linear_Axis_Idler_Block_10mm.stl
(option for 10mm tall idlers)
Linear_Axis_Selector_Motor_Support.stl †
Linear_Axis_Selector_Motor_Support_Precise.stl
(option for precisely-cut 8mm rods)

INTRODUCTION

TOPHAT



Print the calibration piece ([Calib_test_For_C9_v2.stl](#)) and a single **Tophat** to ensure your printer and slicing profile are tuned.

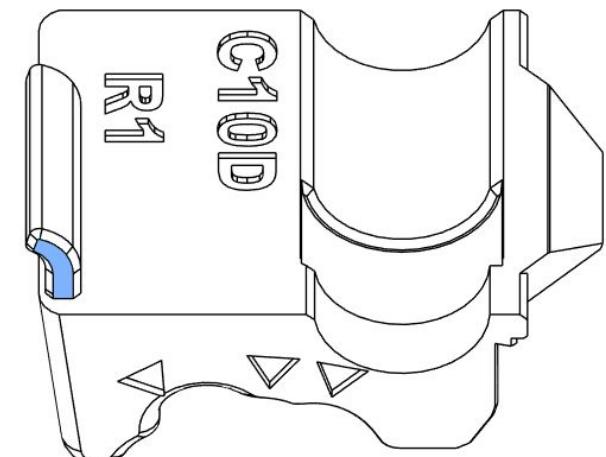
Before you begin you will need to remove the print-in-place support from both your **Tophat** and your calibration piece.

Using a hobby blade may help. Please take care that you don't accidentally damage the parts (or yourself!). Make sure that the bottom of the hook is clear of any stuck support.

The print-in-place support on the calibration piece doesn't do anything but test how easily the print-in-place support works. Secondarily, looking at the ceiling near the print-in-place support can tell you how well your bridging settings are dialed-in.

Take a picture or two of your calibration test with a crumpled piece of paper displaying your Discord username and the date. We may ask for these pictures as part of your support request on Discord.

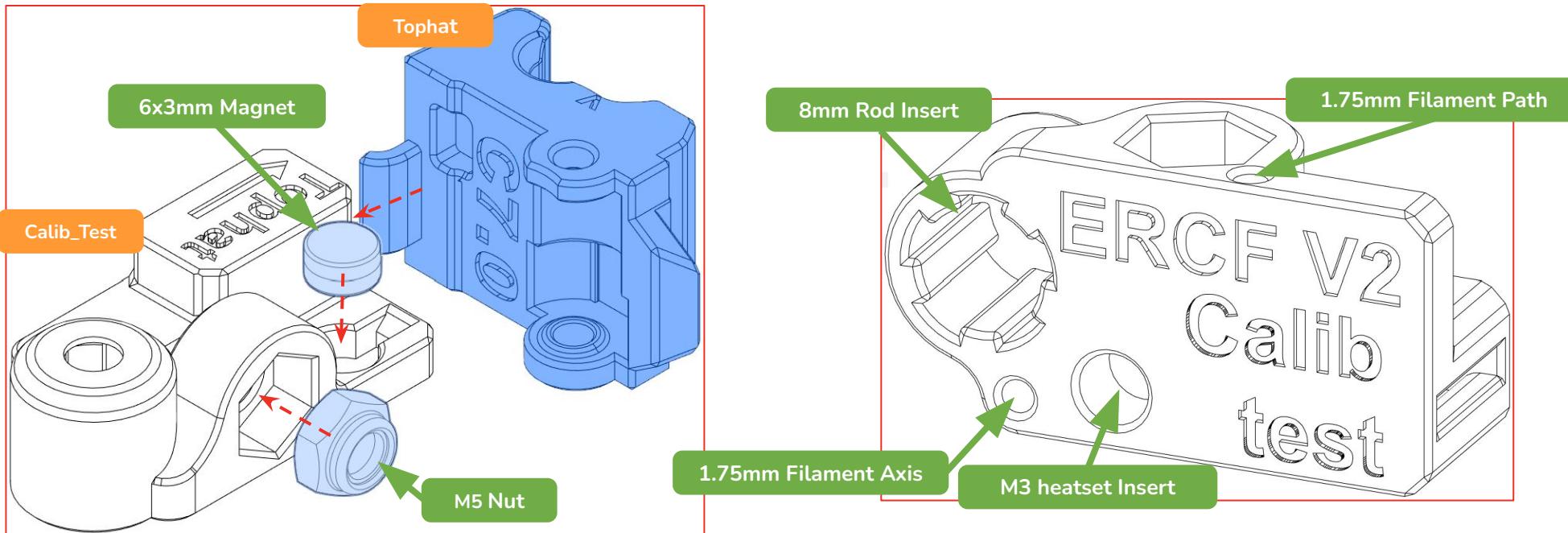
Proceed to the next page to test your print calibration.



INTRODUCTION

CALIBRATION TOOL

Print the calibration piece ([Calib_test_Forum_C9.stl](#)) and a single **Tophat** to ensure your printer and slicing profile are tuned.



CALIBRATION TESTS

Insert the different pieces of hardware in their dedicated slots: 6x3mm magnet, M5 nut, and 8mm rod. They should grip the hardware so that they don't fall out easily, but they should not be very difficult to insert or remove.

Test the heatset insert hole using a soldering iron and insert. There should not be any "squish out" around the insert.

Use the Filament Path to check that 1.75mm filament slides through without friction. The Filament Axis should have some light friction. It is normal for the horizontal hole not to be round, this is simply due to layer height / resolution.

To check the **Tophat**, insert the arm of a **Tophat** into the slot. It should insert without much force. Once inserted, the **Tophat** should be able to move up and down easily. To remove the **Tophat**, pull it up while rotating it.

If these tests fail, [**stop and tune your filament profile**](#). 50%+ of issues we see on Discord are due to poorly printed parts.

THREAD LOCKER PAGES

Thread locker compound is a pressure-based adhesive, not an air-curing adhesive. As such, we can treat the fasteners we want to have thread locker, and set them aside to dry for later. Then, when we go to use the fasteners, the thread locker will be ready to use, with no mess or risk of getting the liquid thread locker on ABS parts, which degrades them and makes them brittle.

Here is a list of pages where threadlocker is used. If you want to treat your fasteners in advance, please use this as a guide.

[Page 189](#) - All the BMG gear M3x2 set screws need thread locker.

[Page 149](#) - Both M3x12 SHCS for the 8mm rod tensioners need thread locker.

[Page 150](#) - Both M3x3 grub screws for the GT2 pulley need thread locker.

LOCAL MCU VS REMOTE MCU

LOCAL MCU VS REMOTE MCU

When we say “**local MCU**” we mean a “buddy board” or other dedicated MCU that will be mounted near the ERCF. Examples include the BTT MMBv2 (our preferred option) and the EASY BRD.

When we say “**remote MCU**” we mean the dedicated MCU(s) for your printer. It is unusual to have enough spare motor, servo, and endstop ports to run an ERCF unless you’re using a dual SKR setup or one of the “XL” mainboards like Octopus or Leviathan. If that’s you, then you can save some money on the buddy board by using this option.

Remote MCU setup has been moved to its’ own sub-manual to avoid confusion.

WIRING (LOCAL MCU)

WIRE PREP

WIRE PREP

Prep the following wires for a typical 8-channel ERCF. Optional wiring is indicated. **These values assume you are using the side-mounted electronics.** Other mounting positions may need different wire lengths.

Use 22-24awg silicone wire for all wiring. All wiring bundles include the colors black, and red except the Endstop.

Channels`	N	4	5	6	7	8	9	10	11	12	13	14	15	# Wires	Add'l Color to Black & Red	Connector 1	Connector 2
<u>Pregate Sensors</u>	150 + 25N	250	275	300	325	350	375	400	425	450	475	500	525	1	Just Blue	3-pin F JST-XH	Microswitch Or F JST-XH
<u>Pregate Grounds</u>	200	200mm pigtail from MMBv2 pregate bus connector, and N * 30mm piggyback wires.												1	Just Black	3-pin F JST-XH	Microswitch Or F JST-XH
<u>Endstop</u>	300 + 25N	400	425	450	475	500	525	550	575	600	625	650	675	2	Just Black, Blue	3-pin F JST-XH	Microswitch Or F JST-XH
<u>Gear Motor*</u>	300 + 25N	400	425	450	475	500	525	550	575	600	625	650	675	4	Green, Blue	4-pin F JST-XH	Motor*
<u>Encoder</u>	150 + 50N	350	400	450	500	550	600	650	700	750	800	850	900	3	Green	3-pin F JST-XH	3-pin F JST-XH
<u>Servo</u>	100 + 50N	300	350	400	450	500	550	600	650	700	750	800	850	3	Yellow	3-pin F JST-XH	Servo / MicroFit 3.0
<u>Exit LEDs</u>	100	100mm pigtail (3-pin JST XH Female to 3-pin Dupont Female for COAS). Optional.												3	Gray	3-pin F JST-XH	Neopixels
<u>Gearbox LED</u>	100	100mm pigtail from Exit LEDs (3-pin Dupont Male from COAS to Neopixel). Optional.												3	Gray	3-pin M Dupont 2.5	Neopixel
<u>Gearbox LED (Direct)</u>	175 + 25N	275	300	325	350	375	400	425	450	475	500	525	550	3	Gray	3-pin F JST-XH	Neopixel
<u>Selector Motor*</u>	200	200mm pigtail from Selector Motor to Local Mainboard.												4	Green, Blue	4-pin F JST-XH	Motor*
<u>Entrance LEDs</u>	200	Varies by placement - typically 200mm. Connectors vary by application. Optional.												3	Gray	3-pin F JST-XH	Neopixels

*Only needed if your motors are not hard-wired.

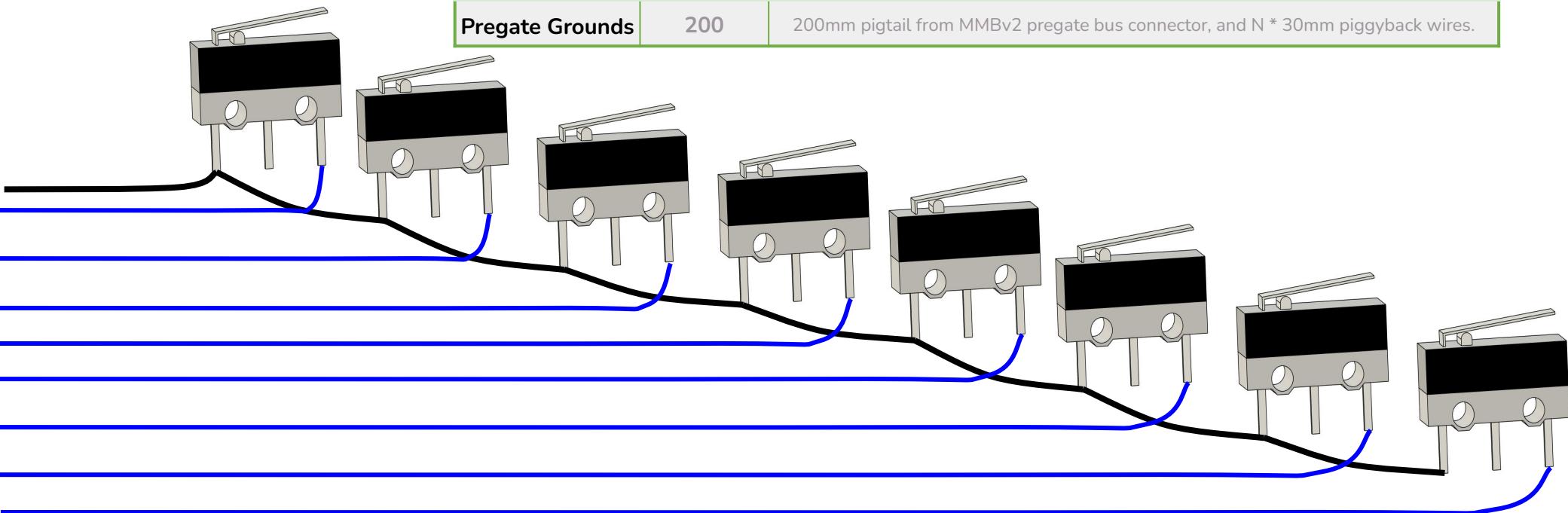
Pregate Sensors are technically optional, but if you can, you should use them,

WIRING (PREGATE SENSORS)

PREGATE SENSORS WIRING PREPARATION

D2F-L Microswitch

Channels`	N	4	5	6	7	8	9	10	11	12	13	14	15
Pregate Sensors	150 + 25N	250	275	300	325	350	375	400	425	450	475	500	525
Pregate Grounds	200												



WIRING OPTIONS

You have two main options for wiring your Pregate Sensors: Solder and JST Connectors.

If you have the one-piece PCBs that combine the microswitch with a JST XH connector, you may use those where the guide shows normal microswitches, and use JST connectors instead of soldering. Most people will need to solder their pregate sensors.

Each blue wire for the pregate sensor needs to be the length shown under its' channel number. The first black (Common / ground) for the pregate sensors needs to be 200mm. After that, you daisy-chain the grounds together to save wire. Use 30mm lengths of black wire between each Common / ground so they have plenty of room to pivot independently.

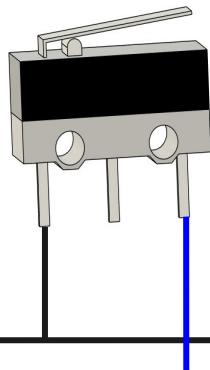
Termination depends on the board you are using - most boards use 3-pin JST-XH wired the same as the Selector Endstop on the [page 30](#), but the MMBv2.0 uses a [14-pin Molex plug](#).

WIRING (DUAL SENSORS)

DUAL SENSOR SETUP

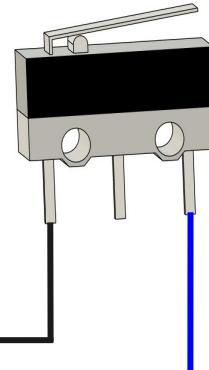
D2F-L Microswitch A

Pregate Sensor



D2F-L Microswitch B

Runout Sensor



State	A	B	Output	Happy Hare
No Filament	1	1	1	0
Filament in Buffer, Not Pregate	0	1	1	0
Runout	1	0	1	0
Filament in Buffer, at Pregate	0	0	0	1

DUAL SENSOR WIRING OPTION

You can wire two sensors Normally Closed in parallel in order to gain the advantages of having a pregate sensor right next to the gate, as well as the advantages of having a runout sensor on the buffer (ie ERCT or Filamentalist),

This means that the system won't try to load while you're still pushing filament to the gate. This also means that runout should occur before the system loses its grip on the filament, in which case the system will require manual intervention. The cost is complexity in wiring - you may need a surprising amount of blue and black wire, as well as cable ties. This setup still only uses one endstop port, which is nice.

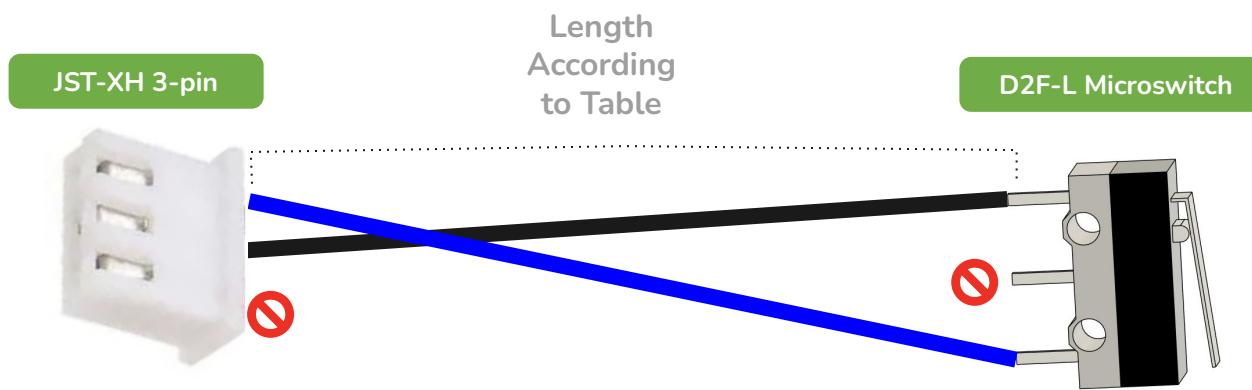
If you are daisy-chaining the ground for the pregate sensors as shown on the previous page, you can connect the ground leg up to the buffer sensor to the daisy-chain as well.

This is all made much simpler by the use of the one-piece PCBs that combine the microswitch with a JST XH connector. In that use case, you simply double the wires into the JST XH crimp, and add heatshrink if you're fancy.

Termination depends on the board you are using - most boards use 3-pin JST-XH wired the same as the Selector Endstop on the [next page](#), but the MMBv2.0 uses a [14-pin Molex plug](#).

WIRING (SELECTOR ENDSTOP)

MICROSWITCH PREP



Channels	N	Selector Endstop Wire Length (mm)
		300 + 25N
4		400
5		425
6		450
7		475
8		500
9		525
10		550
11		575
12		600
13		625
14		650
15		675

PREP THE MICROSWITCH

If you are using a kit, the microswitch should have come pre-wired.

Otherwise, solder one blue wire to the Normally Closed leg, and one black wire to the Common leg. Add a little heatshrink tubing if you're fancy. Then crimp the other end for JST-XH and put the wires into the connector as shown.

We wire switches Normally Closed so that if they fail, they fail in the triggered state, which makes solving the problem easy. If they failed in the untriggered state, we wouldn't know until a homing or other move crashed.

WIRING (LOCAL MCU)

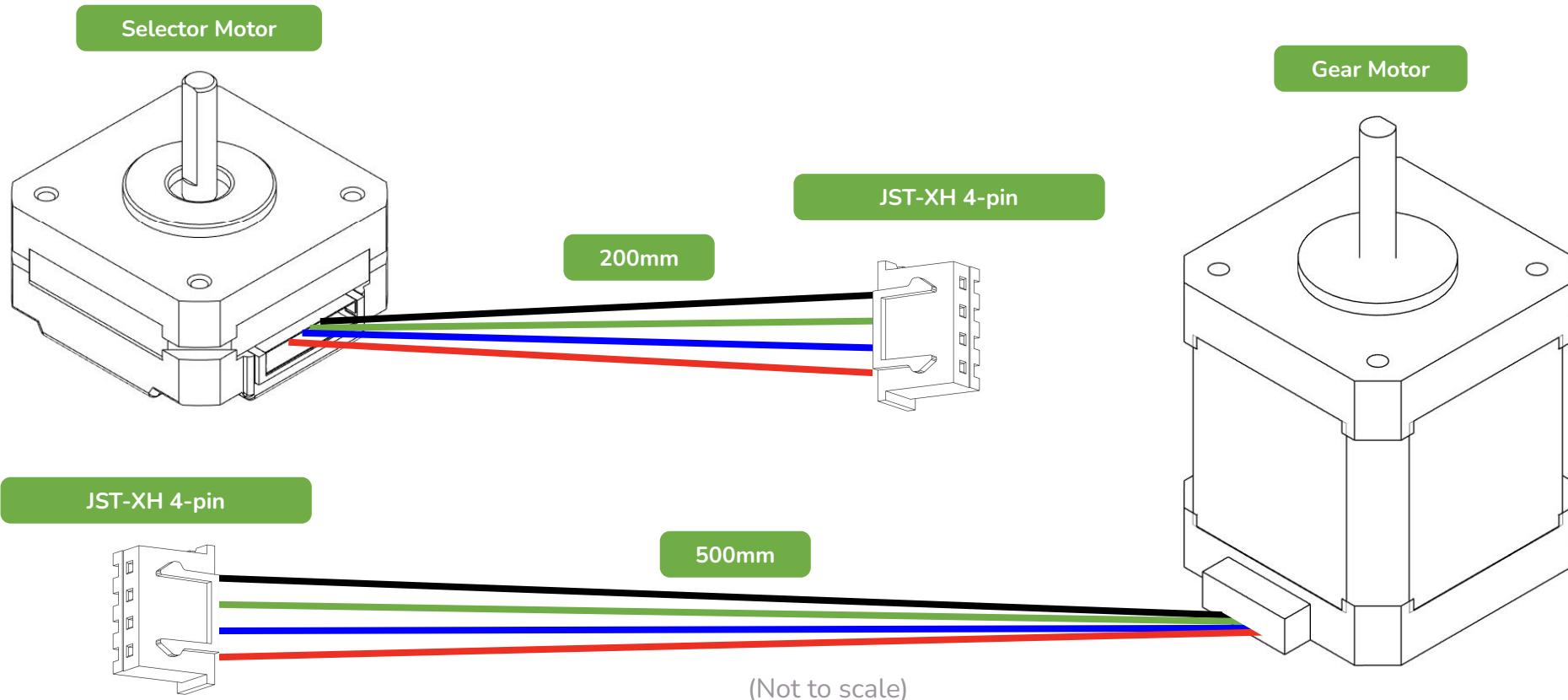
GEAR MOTOR WIRE

WIRING THE MOTORS

If your motors are directly wired, then you can trim them to length, if you desire. **These values assume you are using the side-mounted electronics.** Other mounting positions may need different wire lengths.

Trim Selector Motor wires to 200mm, then crimp and add a 4-pin JST-XH connector.

Trim Gear Motor wires to 500mm (for a typical 8-channel ERCF, see the previous page for other sizes), then crimp and add a 4-pin JST-XH connector.



WIRING (SERVO AND ENCODER)

SERVO AND ENCODER WIRING

PREP FOR WIRING THE LEDs

The Encoder and Servo wiring is relatively straightforward.

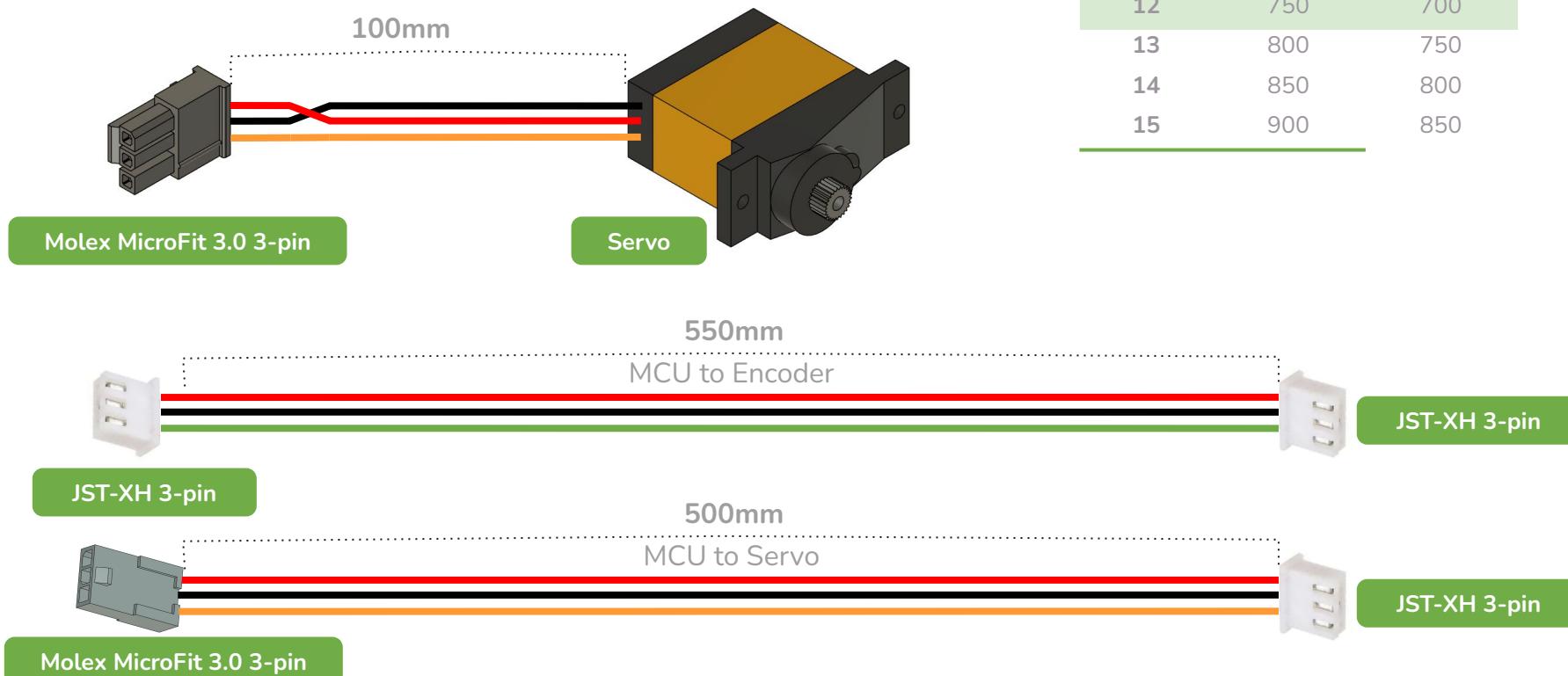
If you are using a closed cable chain, it will be easier to pull these wires through before crimping.

You will want to refit connector coming from the Servo itself with a MicroFit 3.0 3-Pin Male if it doesn't already have one.

Strip back the ends of all of the wires between 1.5mm to prep for crimping.

Crimp the Encoder to Local MCU wires for JST-XH and insert into the connectors.

Crimp the Servo to Local MCU wires for JST-XH and Microfit 3.0. Insert the wires into their respective connectors.

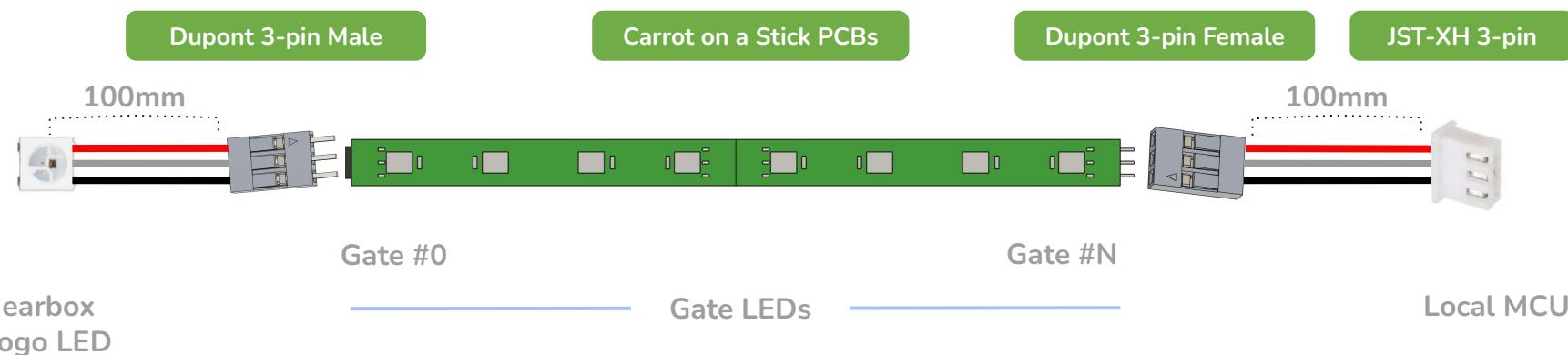


Channels	Encoder Wire Length (mm)	Servo Wire Length (mm)
N	150 + 50N	100 + 50N
4	350	300
5	400	350
6	450	400
7	500	450
8	550	500
9	600	550
10	650	600
11	700	650
12	750	700
13	800	750
14	850	800
15	900	850

CARROT ON A STICK

The new default LED option is the Carrot on a Stick LED PCB, which has perfect LED spacing with no soldering involved! Thanks to **Blamm** for letting us modify his Disco on a Stick design, **Shammy** for designing the modifications, and **XR Bunker** and **Fabreeko** for initial manufacturing of the Carrot on a Stick.

We still need one wiring pigtail to feed the Carrots on a Stick LEDx, and one pigtail for the optional Gearbox Logo LED.. If you bought a kit, the wiring should be pre-assembled and ready to use. If not, you will need to crimp and solder the pigtails as shown.



WIRING (DIY LEDS)

LED WIRING

PREP FOR WIRING THE LEDs

If you are using NeoPixels or individual LED PCBs, we provide a wiring jig with instructions on the next page. 22-24ga silicone wire is recommended for this use, preferably in the colors: Red for +5v, gray for signal, black for ground.

To prep for the soldering step, make sure you have the 100mm lengths of wire for the connection between the Gearbox Logo LED and the Exit LEDs, as well as the 200mm lengths of wire for the connection from the end of the Exit LEDs to your local MCU.

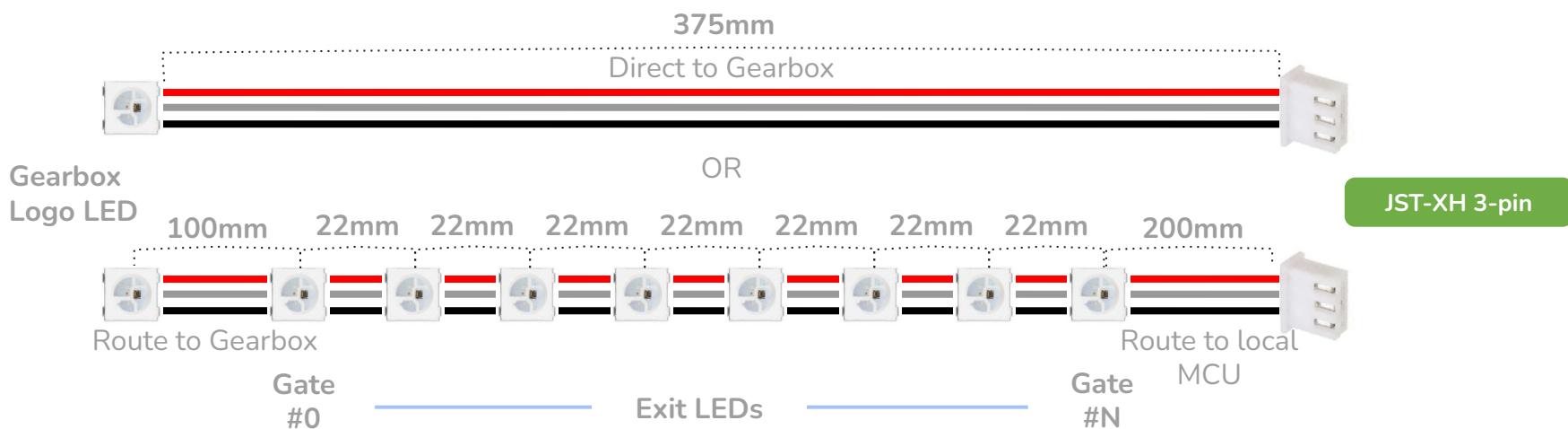
Next, cut your red Exit LED connection wires to 22mm +/- 1.5mm. You need the same number of inter-LED wires as your number of filament channels, minus one. That's seven wires for the standard 8-channel build.

Now repeat the Exit LED connection wire steps above in gray and black.

Strip back the ends of all of the wires between 1.5 and 3mm to prep for soldering.

Crimp the Exit LED to Local MCU wires for JST-XH and insert into the connector.

Channels	Direct to Gearbox Wire Length (mm)
N	175 + 25N
4	275
5	300
6	325
7	350
8	375
9	400
10	425
11	450
12	475
13	500
14	525
15	550



WIRING (DIY LEDs)

SOLDERING THE LEDS

WIRING UP THE LEDS

There is a jig for wiring the LED PCBs together in the Tools folder: [/STLs/0._Tools/LED_Soldering_Tool_24mm.stl](#)

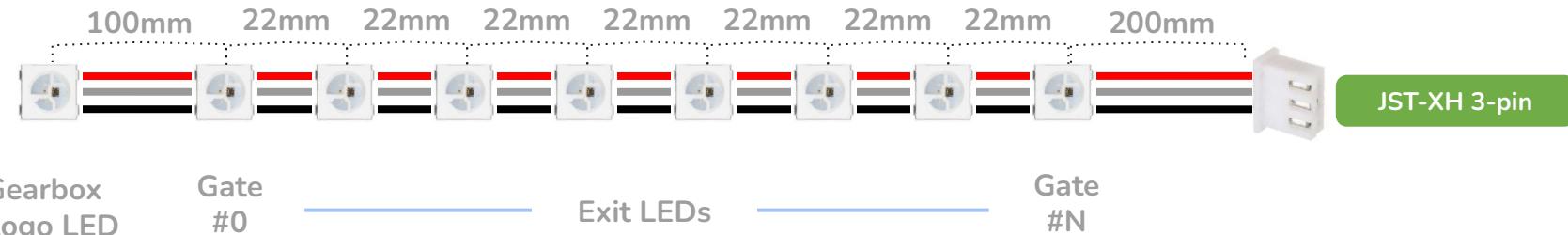
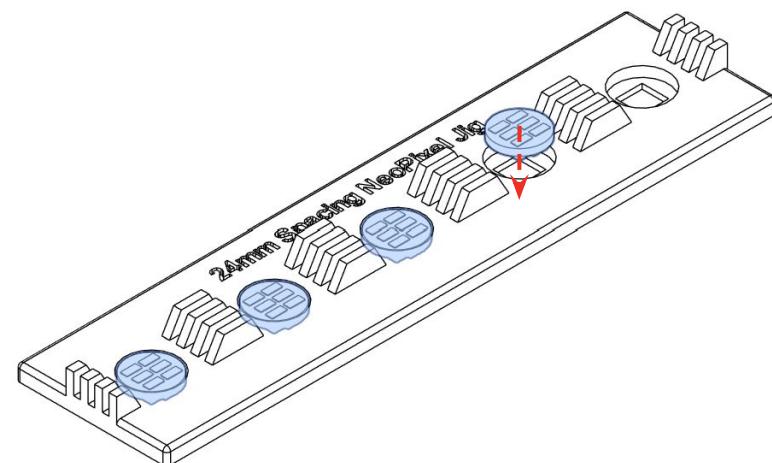
It is spaced to 24mm instead of 23mm to allow for the wires to flex slightly.

22-26ga Silicone wire is the recommended wire for this use case.

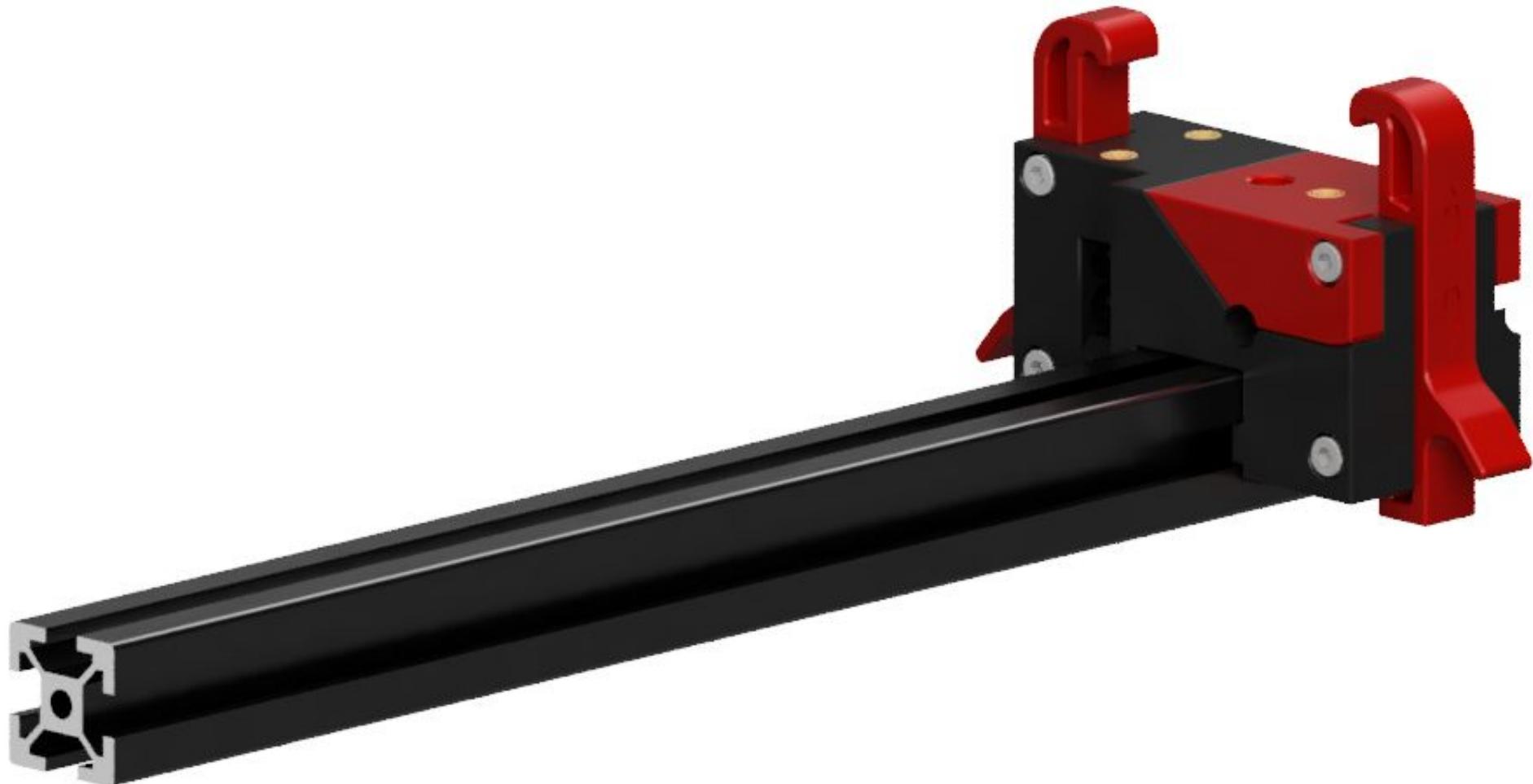
1. Place the Gearbox Logo LED into the first position on the jig. Make sure the LEDs are always positioned with the input (Din) on the left side.
2. Position your 100mm wire on the left of the LED. Flux and solder all three connections and unload the jig.
3. Load the jig with 4 LEDs and position the wires from previous steps on the right. Add the pre-cut 22mm wires between each LED. Flux and solder all the connections. Unload the jig.
4. Repeat Step 3. You should now have 9 LEDs wired in a chain.
5. Place the last LED in the chain into the first position on the jig.

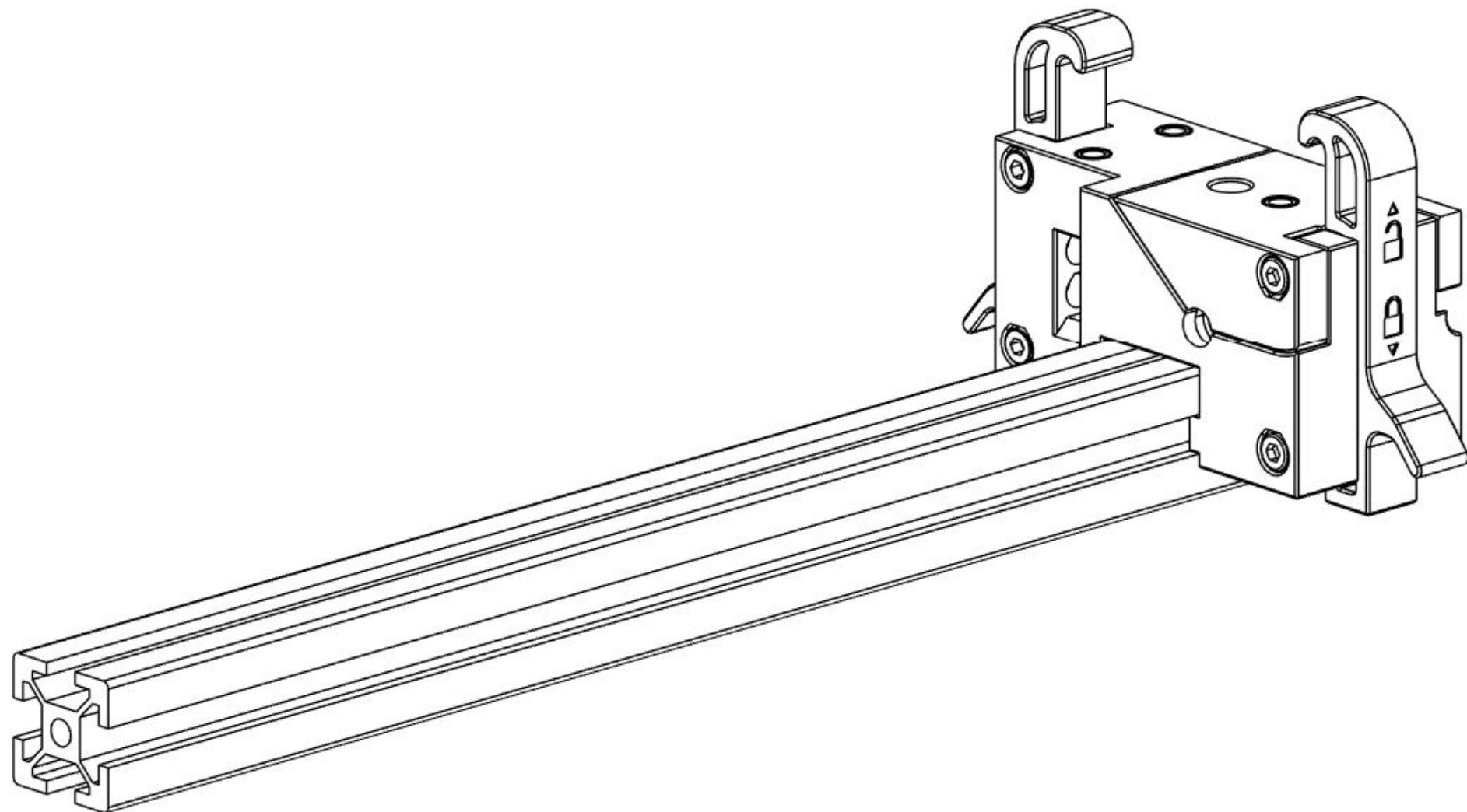
Position the 200mm wire (with connector) on the left of the LED. Flux and solder all three connections and unload the jig.

The result should look like this:



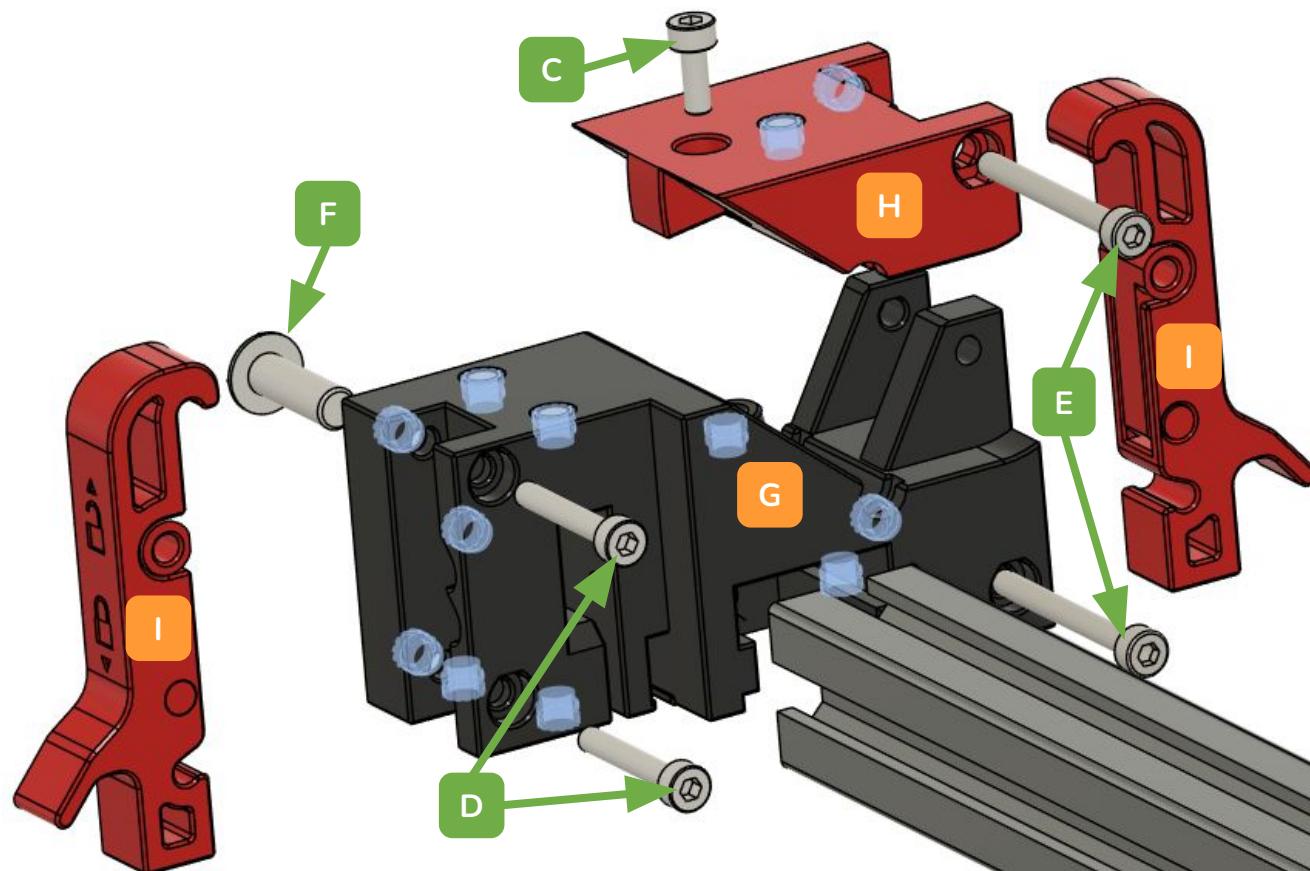
Consistent with the ethos of the Voron community, the ERCF is open-source. This means that it uses open-source Happy Hare software, and its designs are freely available for anyone to use, modify, and improve, fostering a collaborative and innovative environment.





GEARBOX PART 1

EXPLODED VIEW



GEARBOX SUB-BOM FOR PART 1

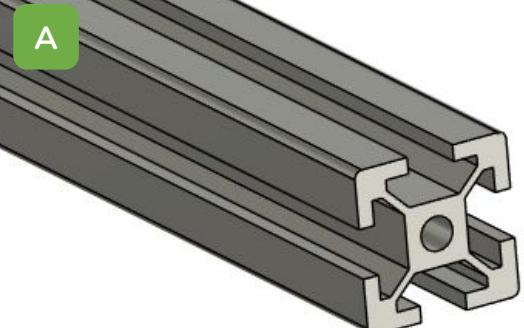
A	1x 2020 Extrusion
B	12x M3 Heatset Inserts*
C	1x M3x8mm SHCS**
D	2x M3x20mm SHCS
E	2x M3x30mm SHCS
F	1x M5x16mm BHCS

G	1x Gearbox.stl
H	1x [a]_Hatch.stl
I	2x [a]_Side_Latch_v2_x2.stl

*Not labelled

**Shown for completeness, but not installed until the Motor Mount steps.

Channels	N	4	5	6	7	8	9	10	11	12	13	14	15
2020 Length (mm)	55 + 23N	147	170	193	216	239	262	285	308	331	354	377	400



1.1 2020 EXTRUSION PREPARATION

If you bought a v2.5 kit, the 2020 should be pre-tapped.

If you are upgrading or self-sourcing, you will need to tap one end of your 2020 extrusion for M5x0.8mm threads to a depth of at least 10mm. An M5 taper tap is perfect for this. The hole in your 2020 must be 4.2-4.4mm in diameter. You may need to drill your 2020 hole larger, if it is too small.

Do not attempt to tap 2020 while there are things mounted to it, especially *not* your old ERCF. Take everything off first, or you will get tapping oil on your parts, and will have a hard time using the jig.

Use appropriate PPE such as gloves and safety glasses. Use oil, preferably a light oil. WD-40 works in a pinch. The primary purpose of the oil is to keep the aluminum from welding to the tap and ruining it!

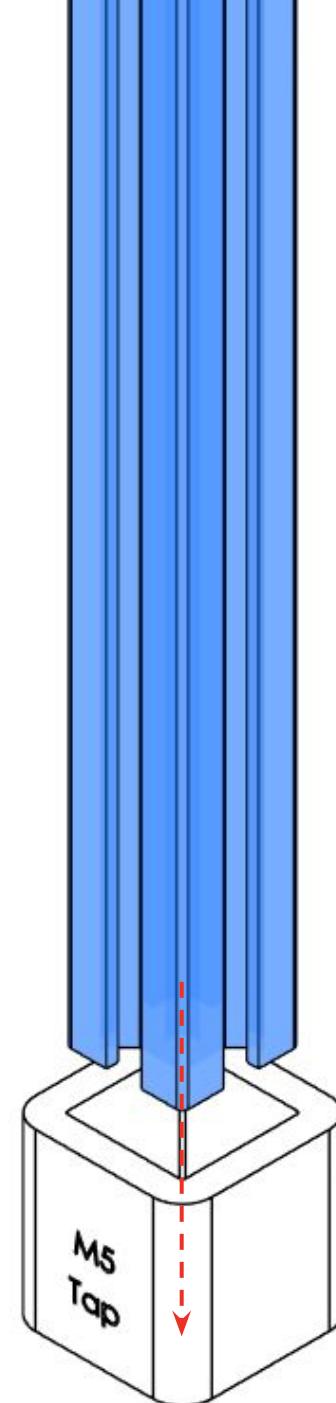
Take care to tap the start the threads straight, preferably using a hand tap and **not** a hand drill. Remember to stop and reverse direction to break the chip every turn or two. The first 5 minutes of this video are a good reference:

<https://www.youtube.com/watch?v=2dvbn0rWA60>

The supplied tap guide is here: [ERCF_v2.5 / STLs / 0._Tools / M5_Tap_Guide.stl](#)

There is an alternate jig to help keep your tap straight to the 2020, with thanks to 2nd Layer Printing Designs: <https://www.printables.com/model/1008892>

Remember, if you mess up the first hole, you can usually flip the 2020 and try the other side. Just don't break your tap!



1.1 V-SLOT AND EUROPEAN STANDARD EXTRUSION PREPARATION

If your extrusion already has a hole that is 5mm or more, you have two options. The first option is to use the M6 version of the Gearbox.

The M6 gearbox option in the User Mods-

[ERCF_v2.5 / User_Mods / Miriax / Gearbox_for_M6 / Gearbox_v61_for_M6.stl](#)

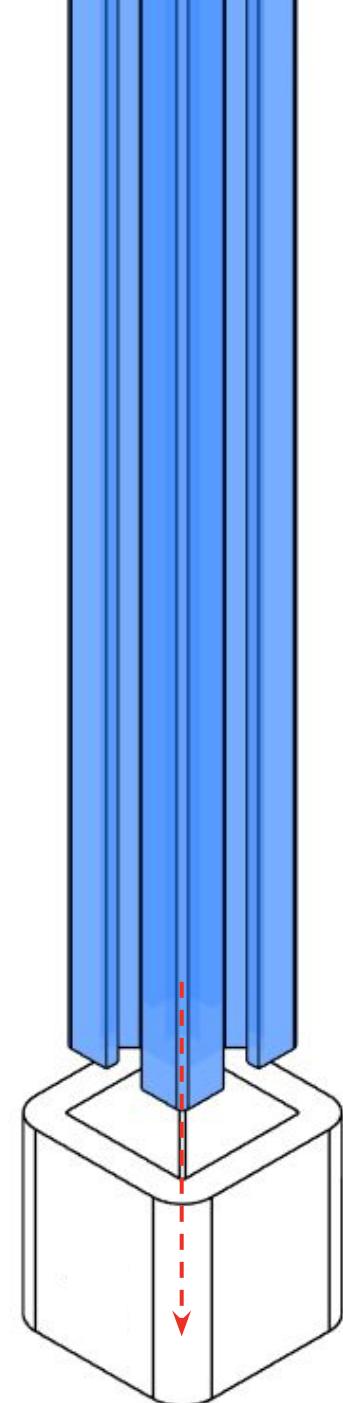
You will need to hand-tap your extrusion for M6, and use an M6x16mm BHCS instead of the M5 bolt in the BOM. Refer to the tapping instructions on the previous page.

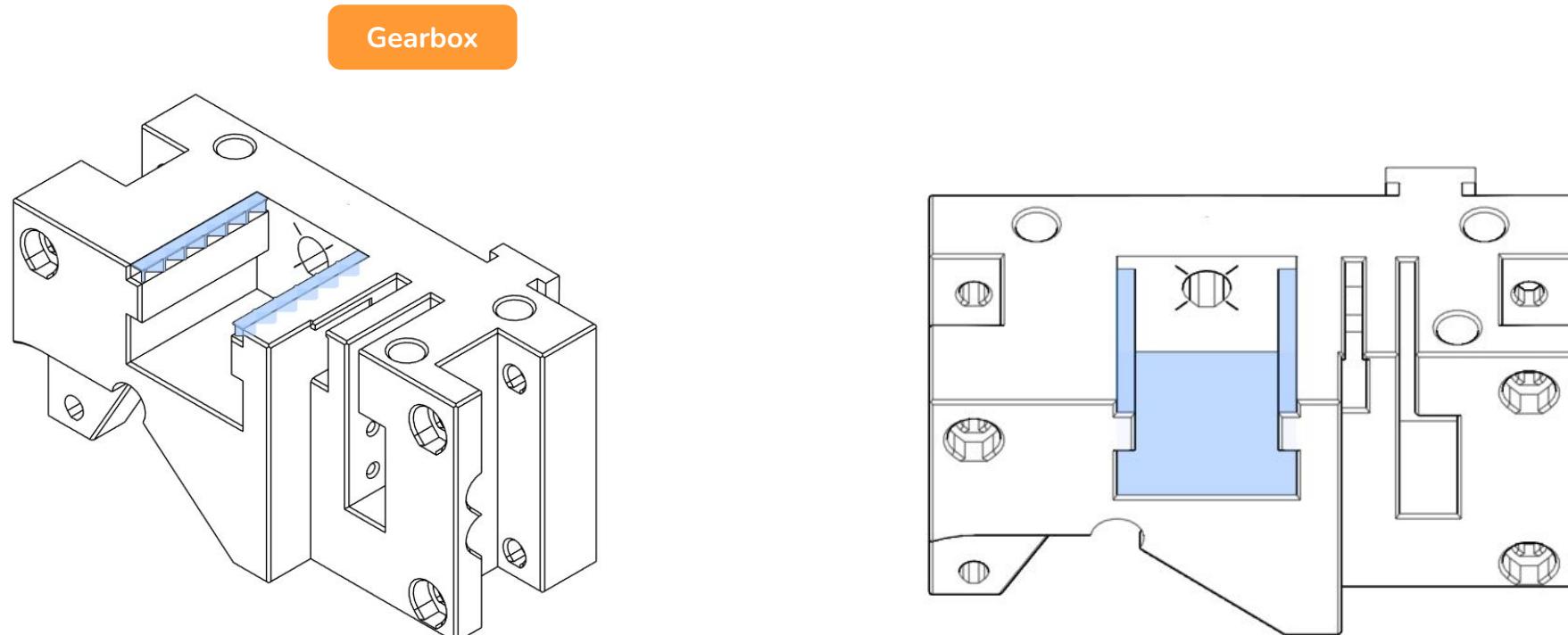
THREADED INSERT OPTION

The second option is to buy a threaded insert kit (the most popular brand is Heli-Coil) which will enable you to add a steel threaded coil that will fit an M5 bolt.

Here is a video on Heli-Coil: <https://youtu.be/sQHRB2ElZJ0>

This is a good option for parts of the world where it is expensive to source extrusion - if 2020 extrusion is cheap where you live, it may make more sense to just buy new pre-tapped 2020 for \$7-8!



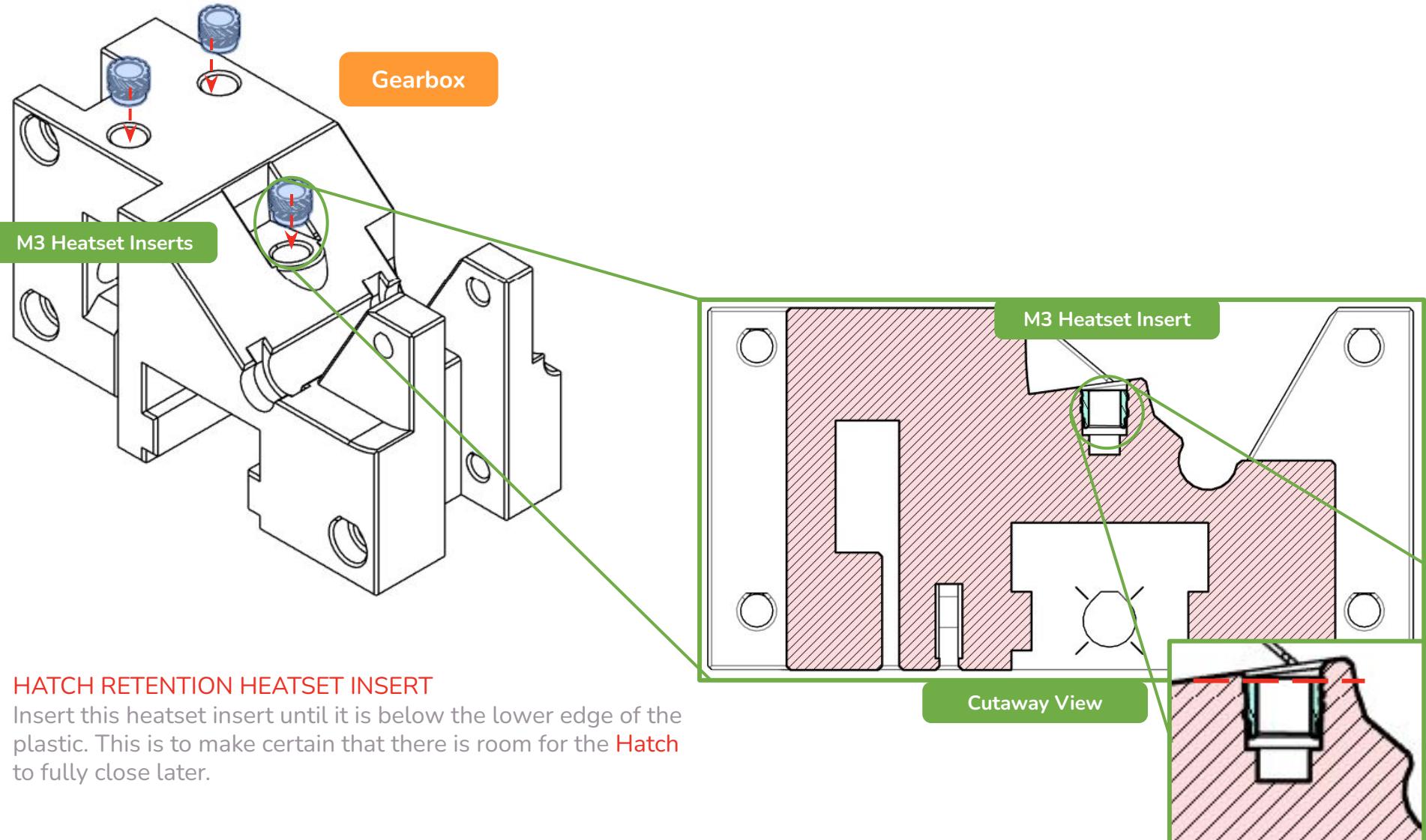


1.2 PRINT-IN-PLACE SUPPORTS

Remove the Print-In-Place supports from the Gearbox as shown. Carefully use a hobby knife, file, or a small flat-bladed screwdriver to remove any stuck pieces of support or loose bridges so that the Gearbox is ready to receive the 2020 extrusion.

1.2 HEATSET INSERTS

The list of pages with heatset inserts is on [Page 19](#).



HATCH RETENTION HEATSET INSERT

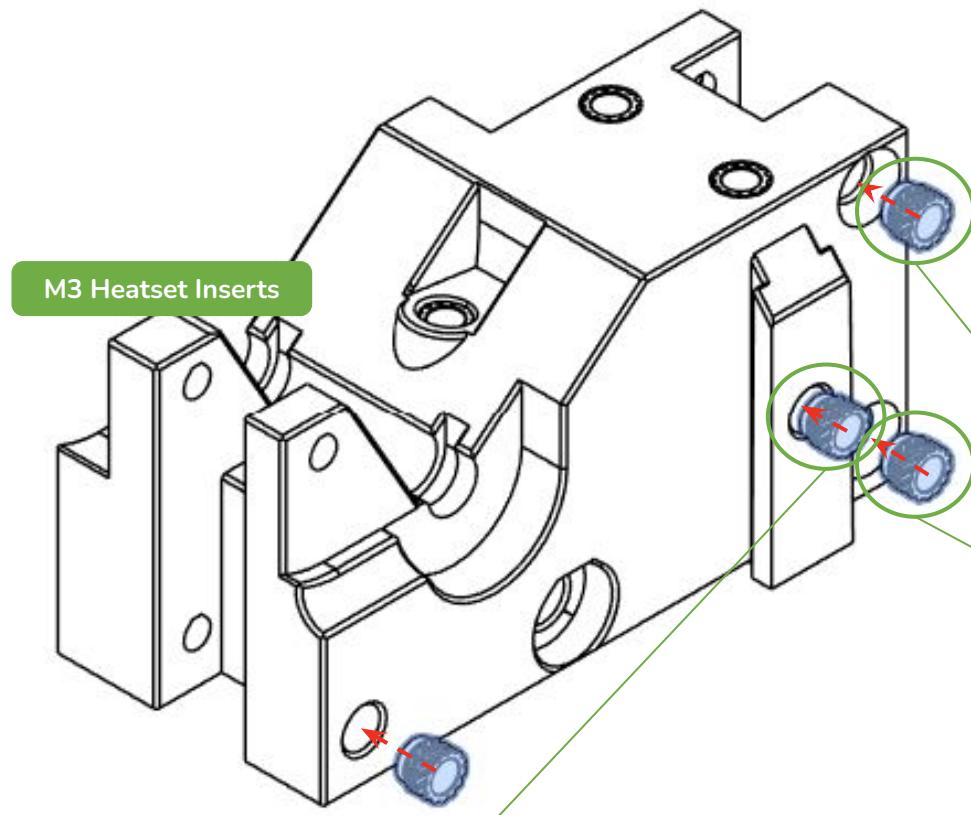
Insert this heatset insert until it is below the lower edge of the plastic. This is to make certain that there is room for the **Hatch** to fully close later.

GEARBOX PART 1

GEARBOX PREPARATION

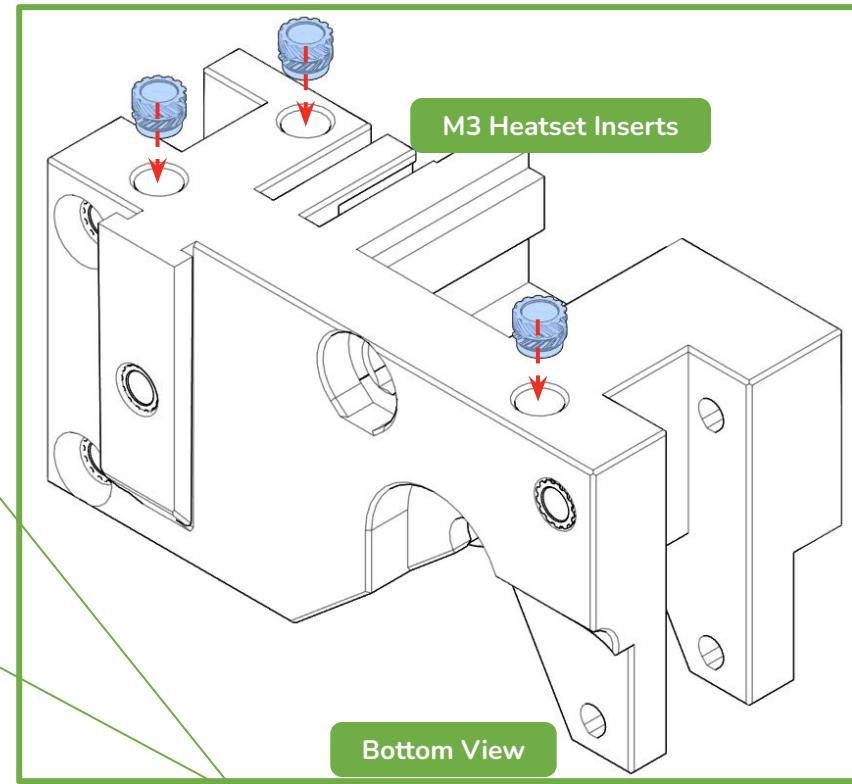
1.2 HEATSET INSERTS

The list of pages with heatset inserts is on [Page 19](#).



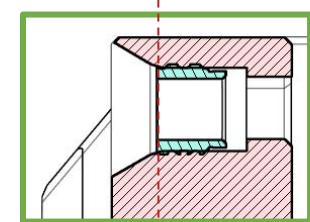
DOVETAIL HEATSET INSERT

Insert this heatset insert until it is just below the edge of the plastic. This is to make certain that the dovetail for the Motor Mount works smoothly and doesn't catch on the heatset insert.



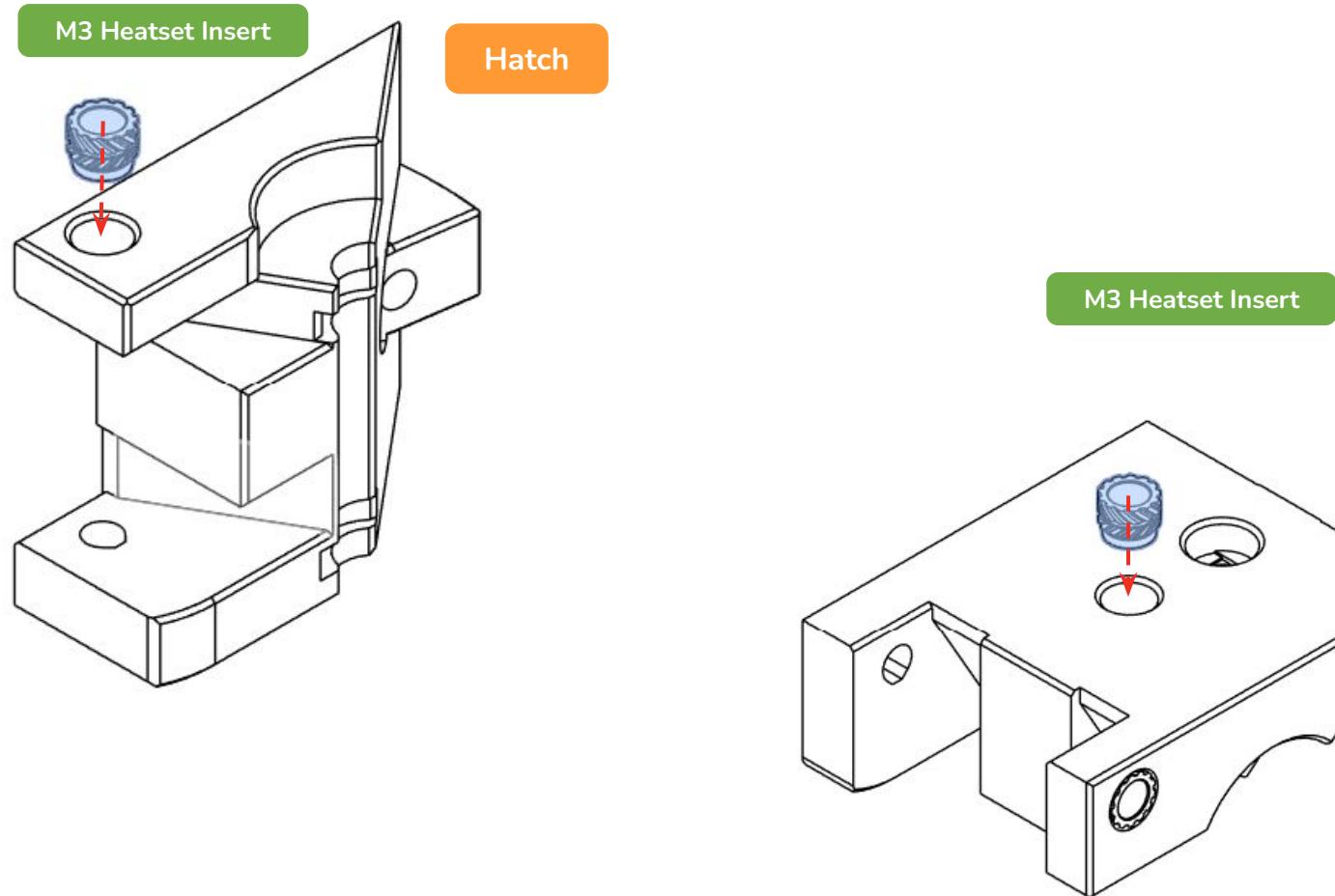
DEEP HEATSET INSERTS

These inserts are set deeply into the Gearbox. This is so that we can re-use some screws from v2.0, and also so that there is plenty of clearance for the motor mount to slide past these heatsets. Don't sweat it, this isn't an area that needs high precision. There is built-in overtravel for the heatset insert.



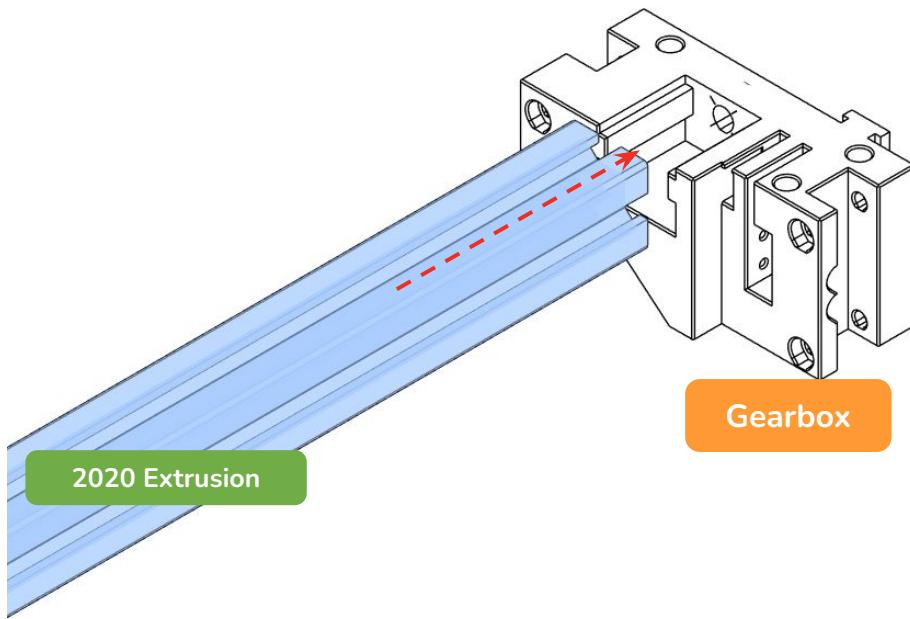
1.3 HEATSET INSERTS

The list of pages with heatset inserts is on [Page 19](#).



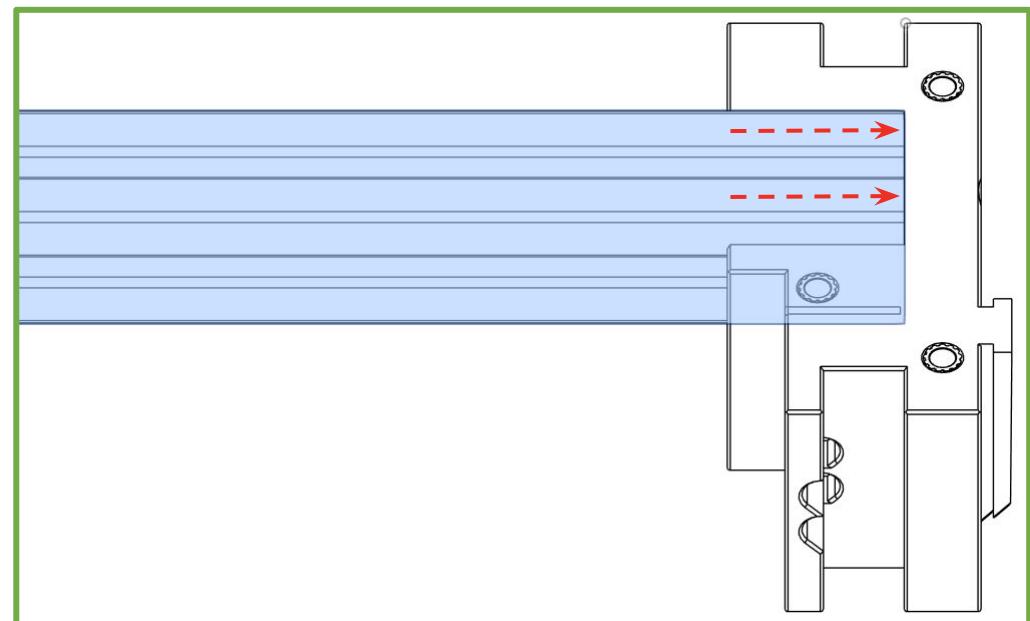
GEARBOX PART 1

2020 INSTALLATION



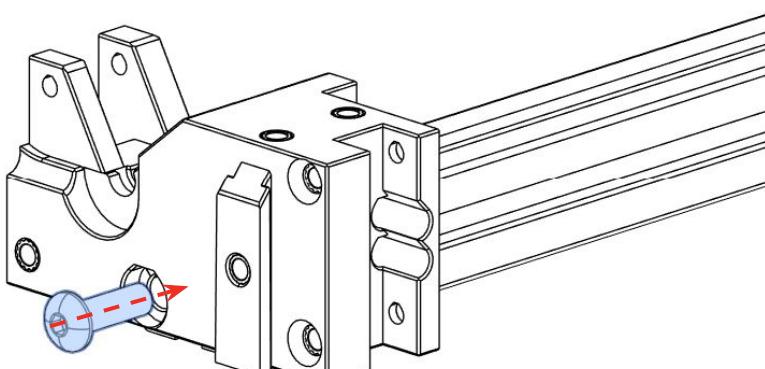
1.2 SEAT THE 2020

Align and fully seat the tapped side of the 2020 into the Gearbox. If it doesn't sit flush, remove the 2020 and check the Gearbox for loose plastic from failed bridging. You may need to remove the 2020 and clean up any plastic that the 2020 has shaved off during installation. It's a snug fit, and 2020 may have sharp cut edges, so be careful not to cut yourself on them.

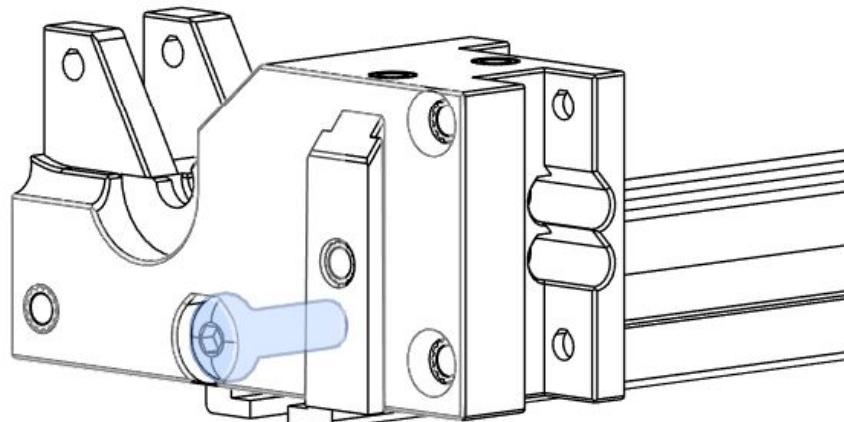


GEARBOX PART 1

2020 INSTALLATION



M5x16mm BHCS

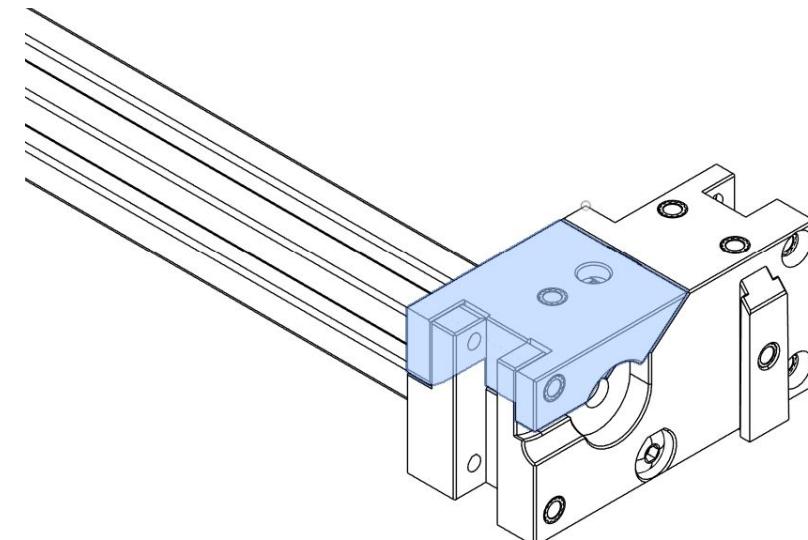


1.2 ADD M5x16mm BHCS

Add the M5x16mm BHCS. Tighten the 2020 to the Gearbox. Go ahead, hulk it down if you like, it's designed to take it! It only needs to be snug enough to pull the gearbox squarely into alignment.

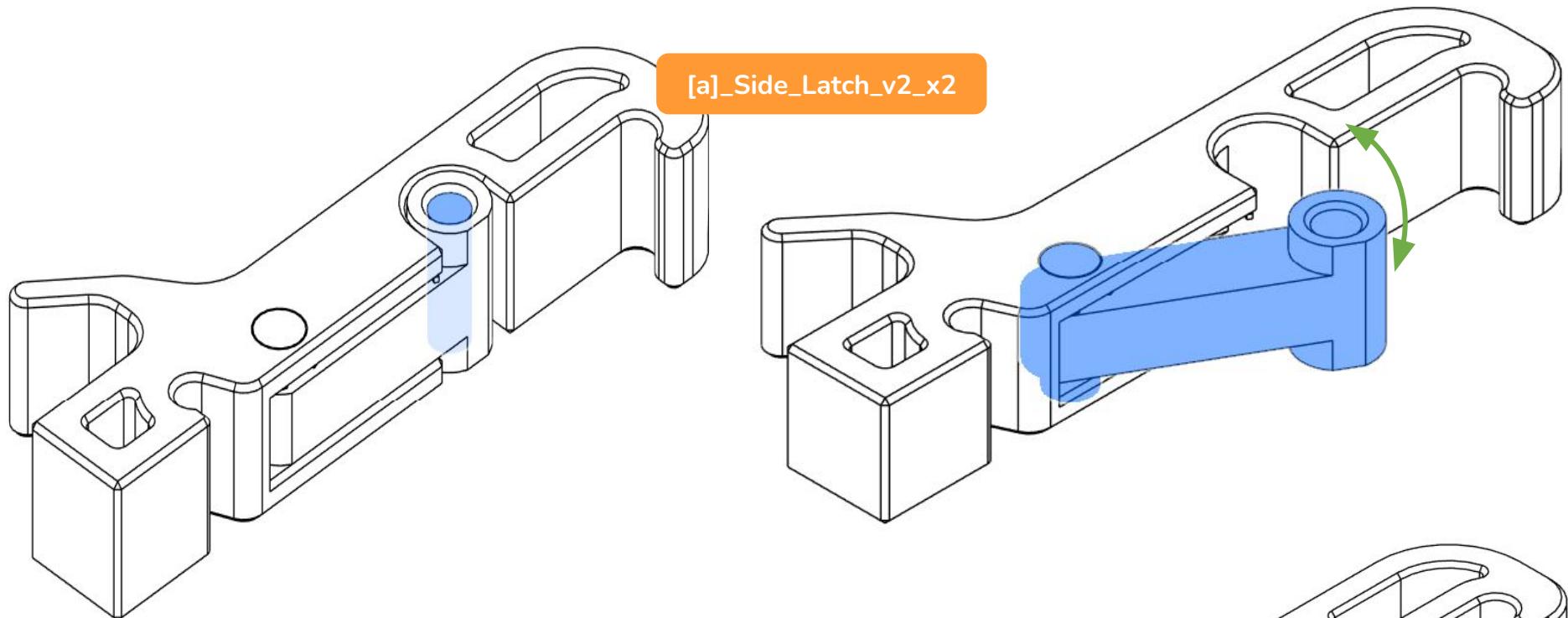
There is a gearbox designed to take an M6x16mm BHCS here:

[ERCF_v2.5 / User_Mods / Miriax / Gearbox_for_M6 / Gearbox_v61_for_M6.stl](#)



1.3 ADD THE HATCH

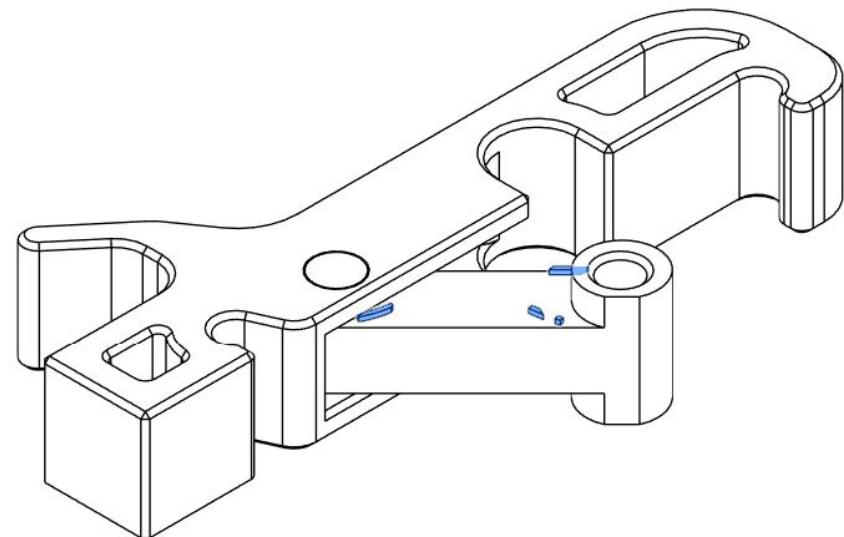
Dry fit the Hatch. We will attach it in the next steps.



1.4 HINGE UNLOCK

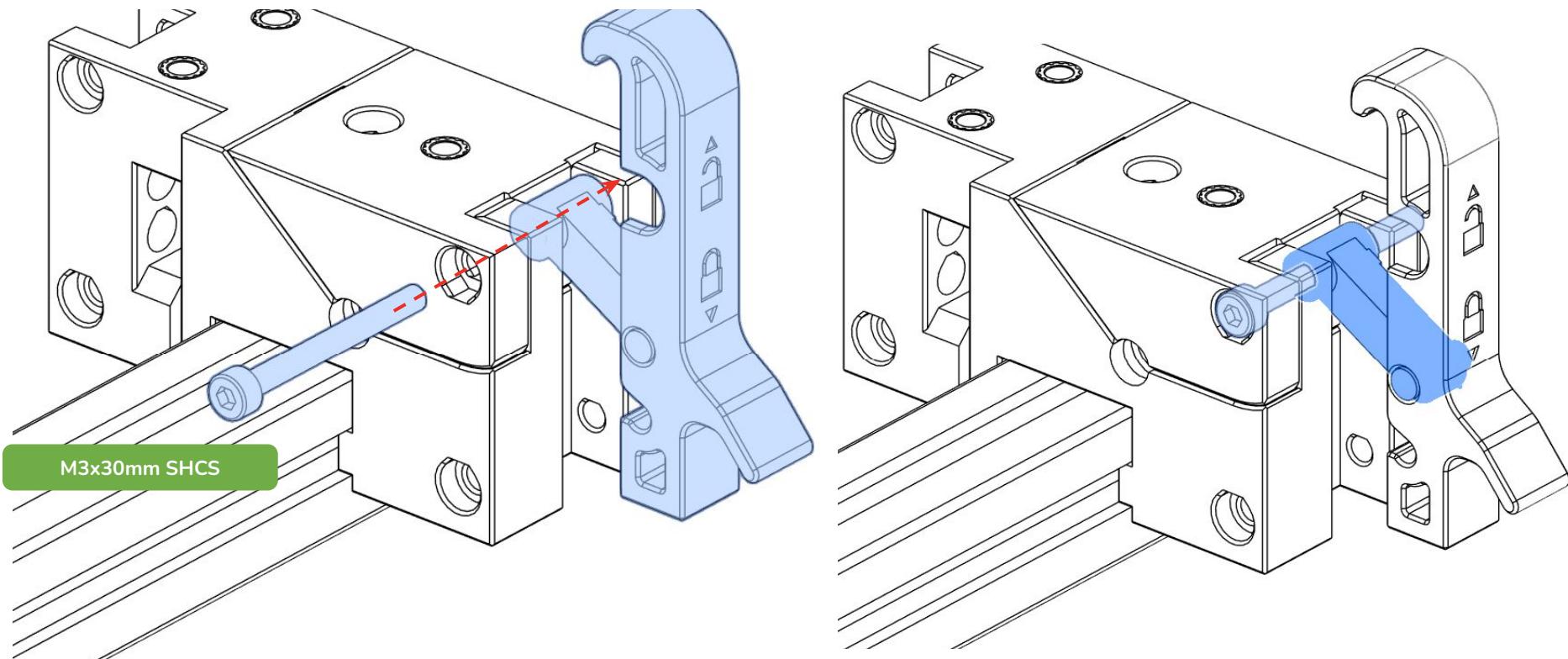
Use a small tool like an allen key or an M3x30mm SHCS inserted into the hinge hole to free the print-in-place mechanism and ensure it rotates freely. You may need to scrape the micro-supports off of the arm if the fit is too tight, but they are designed to either break off or be unobtrusive.

Do this for both of the [Side_Latch_v2](#).



1.3 INSTALL M3x30mm SHCS

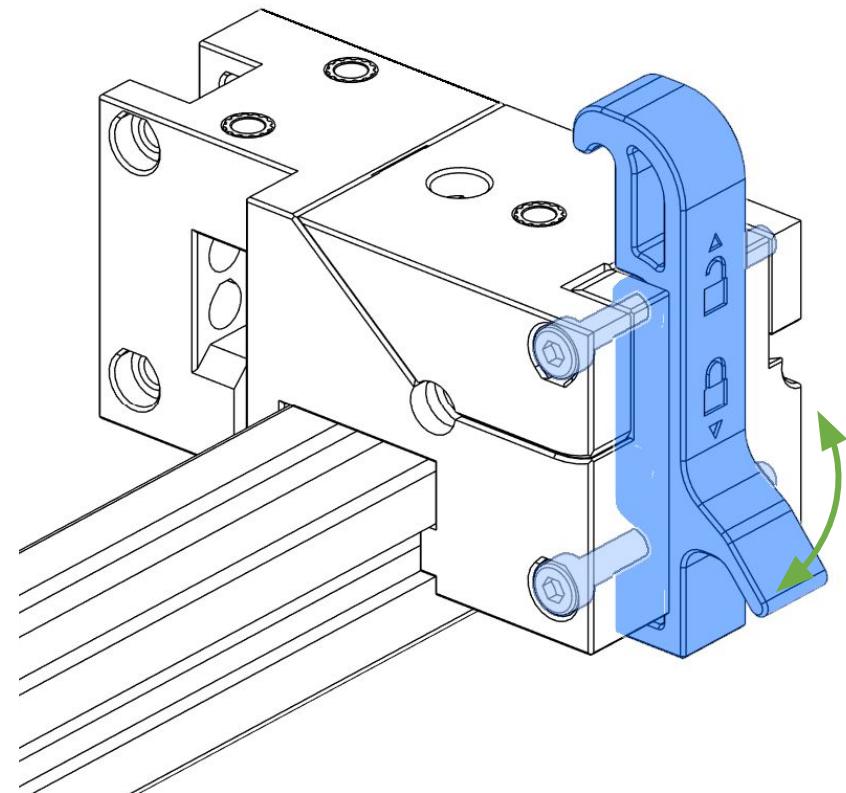
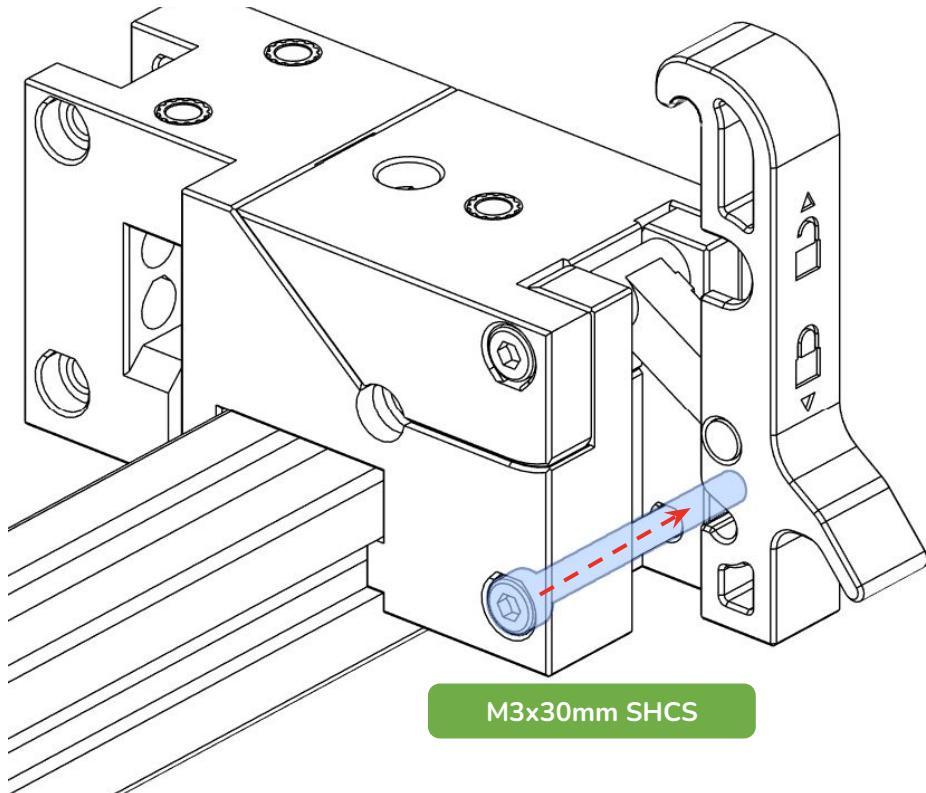
Slide the M3x30mm SHCS bolt through the hole in the arm of the **Side_Latch_v2**. Then snug the bolt. It doesn't need to be very tight - this bolt functions as a hinge for both the **Hatch** and the **Side_Latch_v2**.



1.4 FINISH MOUNTING SIDE_LATCH_v2

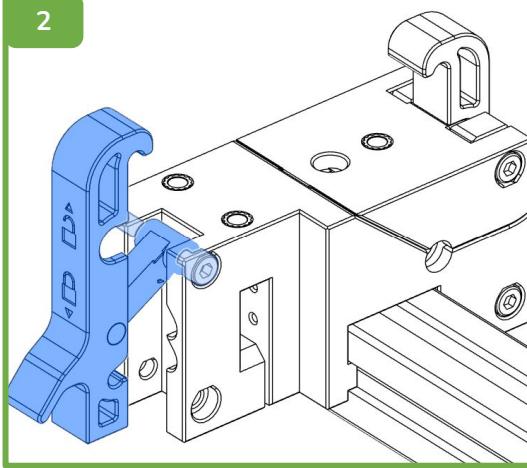
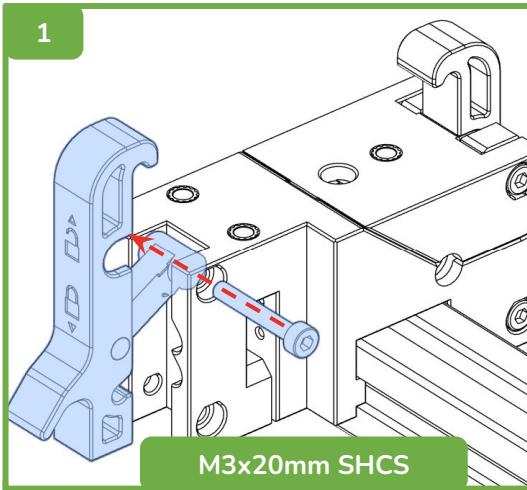
Line up another M3x30mm SHCS on the bottom hole and snug it into place.

You should be able to swing the **Side_Latch_v2** down and snap it into place. Practice opening it with the lever arm - If your bolts are too tight, or it's going to break, it's easier to fix now.

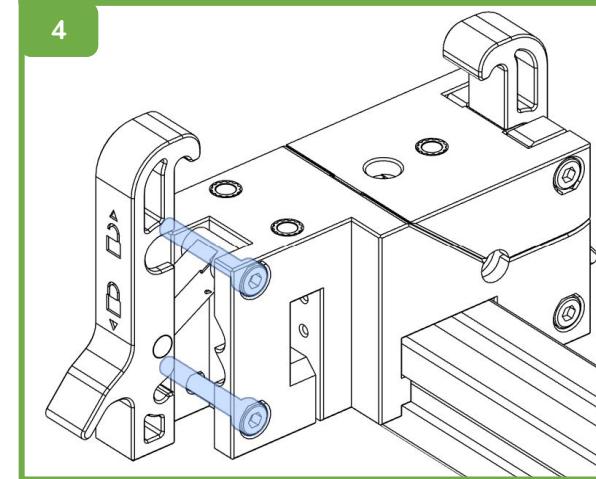
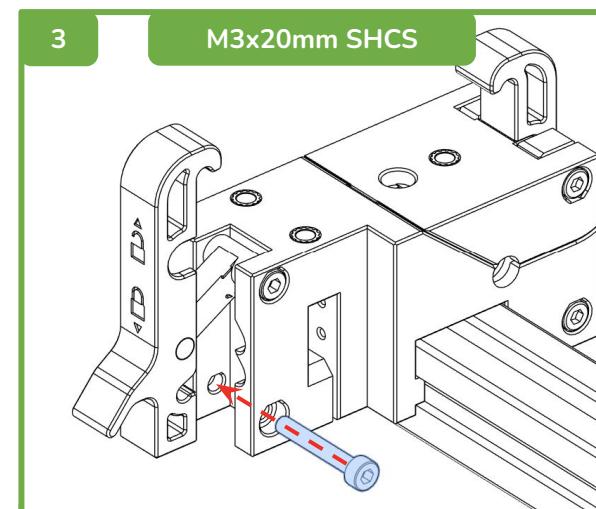
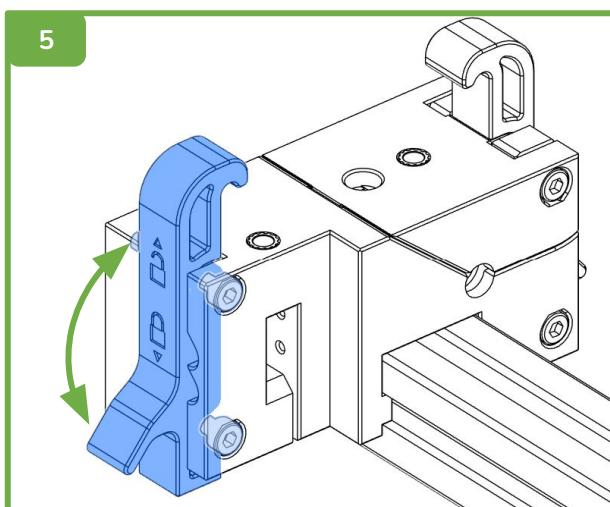


GEARBOX PART 1

SECOND LATCH INSTALLATION



- 1.4 MOUNT THE SECOND SIDE_LATCH_v2
 1. Line up an M3x20mm SHCS with the hole in the **Side_Latch_v2** arm.
 2. Snug the bolt into place. It doesn't need to be very tight - this bolt functions as a hinge for the **Side_Latch_v2**.
 3. Line up another M3x20mm SHCS on the bottom hole
 4. Snug it into place, the same as the first bolt.
 5. You should be able to swing the **Side_Latch_v2** down and snap it into place. Practice opening it with the lever arm - If your bolts are too tight, or it's going to break, you want to know now!



Remember to **always** make sure the latches are closed when running the machine, and especially for calibration!

The first 3D printer was invented in 1986 by Chuck Hull, who called the process "stereolithography".

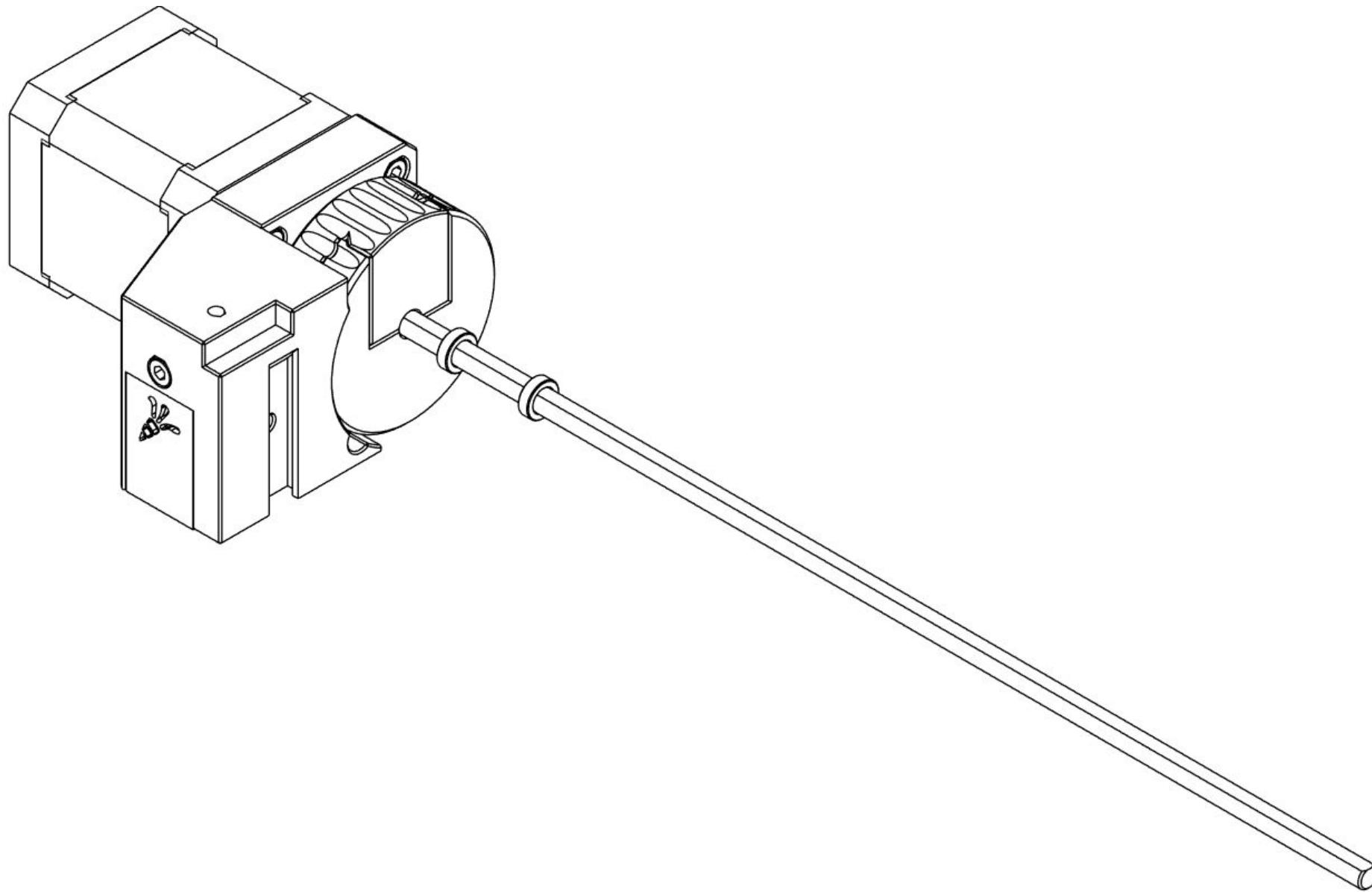
MOTOR MOUNT

OVERVIEW

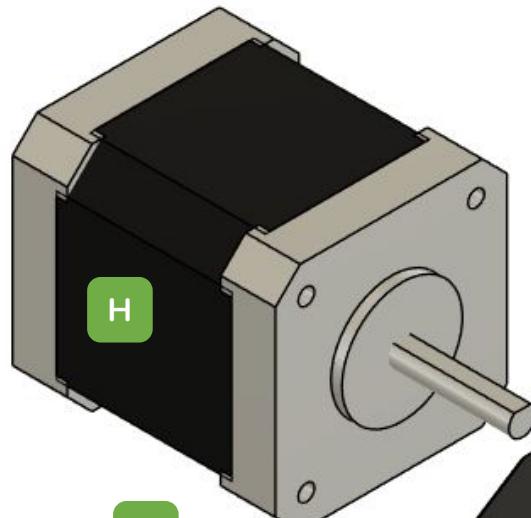


MOTOR MOUNT

OVERVIEW

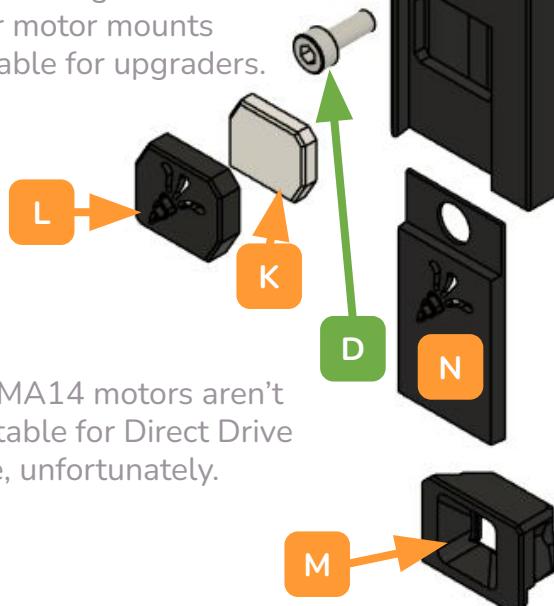


MOTOR MOUNT



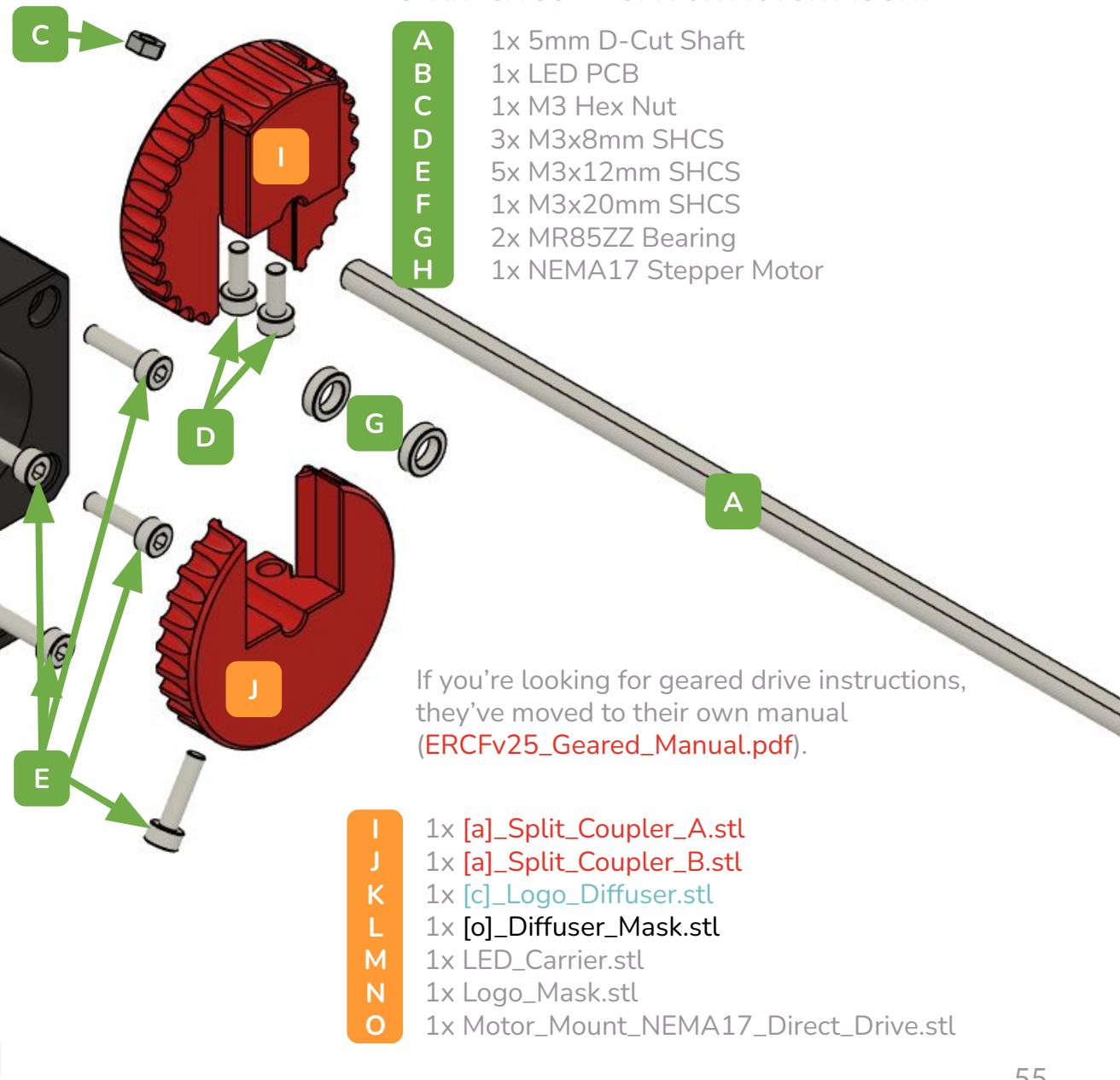
NOTE: VARIATIONS

This is the recommended motor configuration. There are other motor mounts available for upgraders.

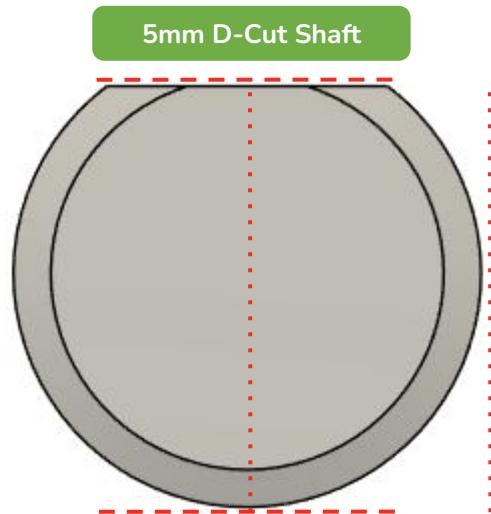


NEMA14 motors aren't suitable for Direct Drive use, unfortunately.

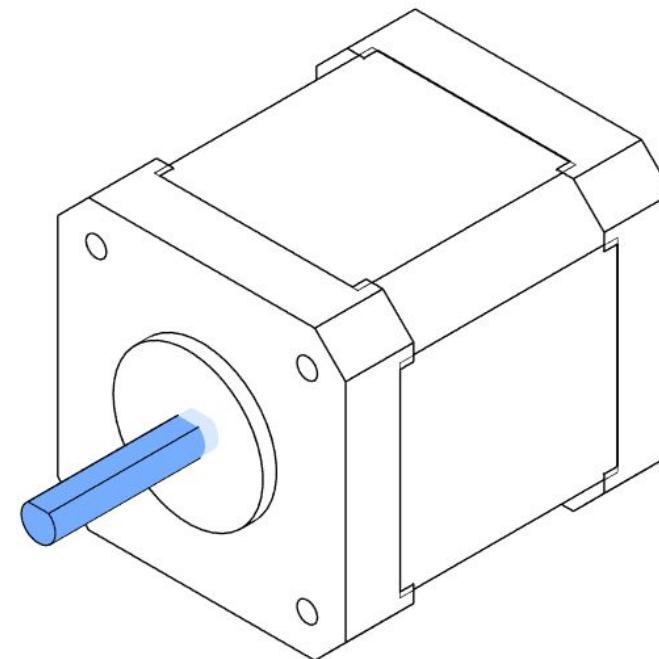
EXPLODED VIEW



MOTOR MOUNT



SHAFTS PREP



MEASURE YOUR SHAFTS

First, lay your drive shaft flat-side down against a very flat surface such as granite countertop. Check whether it is straight or not. If your drive shaft is not flat, you can try bending it back into shape very gently. A small amount (0-1mm) of deviation is normal, but a large amount of deviation (>1mm) will cause problems during operation.

Next take a micrometer, calipers, vernier, gauge, or your word for an accurate measuring device, and measure your D-cut shaft from the round side, across the flat. Do the same for the motor shaft flat. The desired reading is 4.50mm. If both of your shaft flats are 4.45-4.50mm, you can use the default [Split_Coupler](#) parts with no modification.

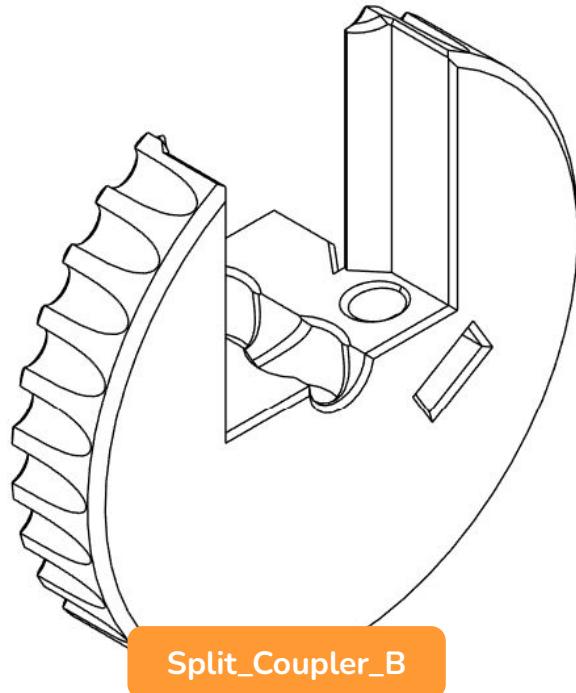
If your flats measure less than 4.50mm, for example a motor shaft reading of 4.26mm and a drive shaft reading of 4.44mm. Round the last digit up or down depending on whether it is equal to or less than 0.05mm. So in this example, round up the motor shaft to 4.30mm, and round down the drive shaft to 4.4mm.

Open the file [Stls \ 2._Motor_Mounts_Drive_Shaft \ 2.3_Drive_Shaft \ \[a\]_Customizable_Split_Coupler_B.3mf](#) in your slicer. Delete all of the options you don't need, so in this example, keep Motor_4.3mm and Drive_4.4mm.

Printing this customized [Split_Coupler_B](#) should give you a perfect fit.

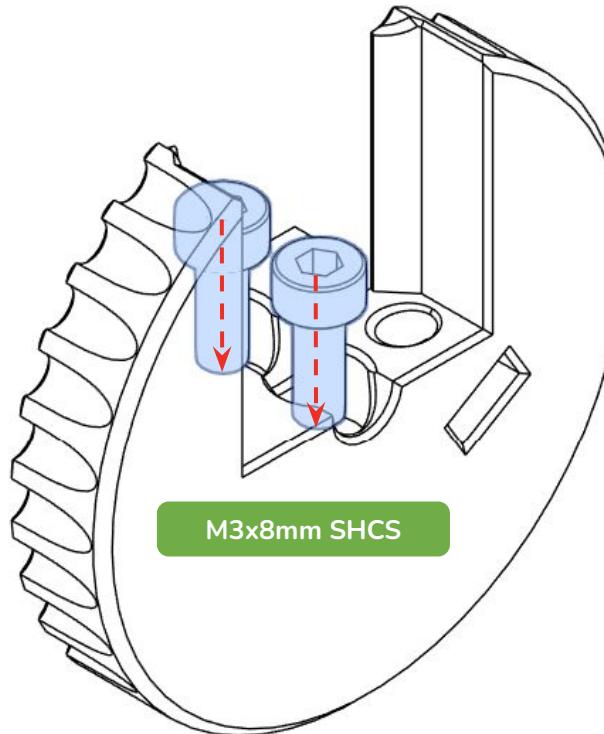
If your flats measure significantly more than 4.50mm, contact your vendor for replacement, or break out your file.

MOTOR MOUNT

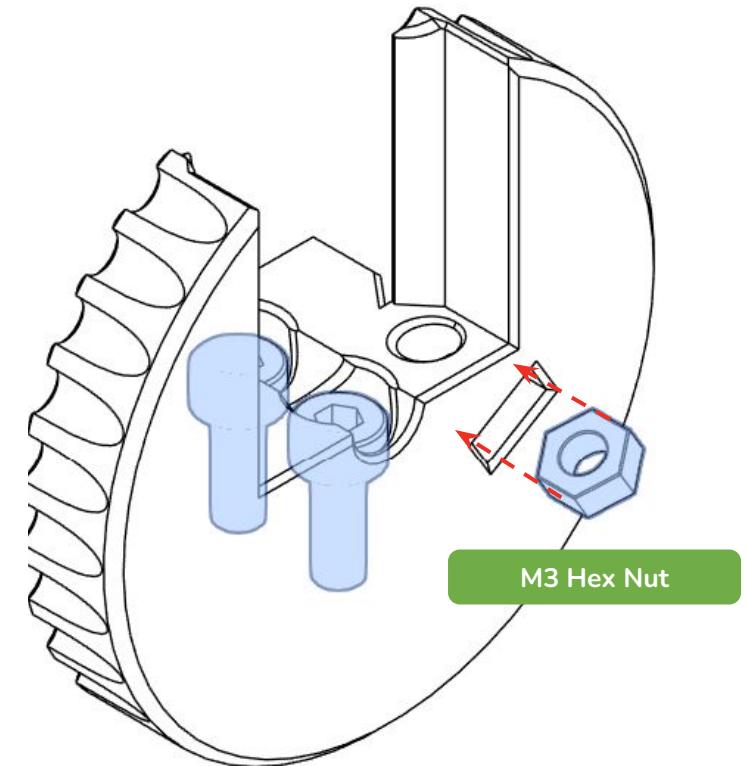


Split_Coupler_B

PREP COUPLER



M3x8mm SHCS



M3 Hex Nut

PREPARING THE COUPLER

Take two M3x8mm bolts and place them into the [Split_Coupler_B](#). It should just barely grip the bolts with no threading necessary,

Using pliers, align an M3 hex nut point-first to the slot in the [Split_Coupler_B](#). Carefully slide it into the slot. Next, switch to a small flathead screwdriver to push the nut all the way into the slot.

Set aside the [Split_Coupler_B](#) for now.

MOTOR MOUNT

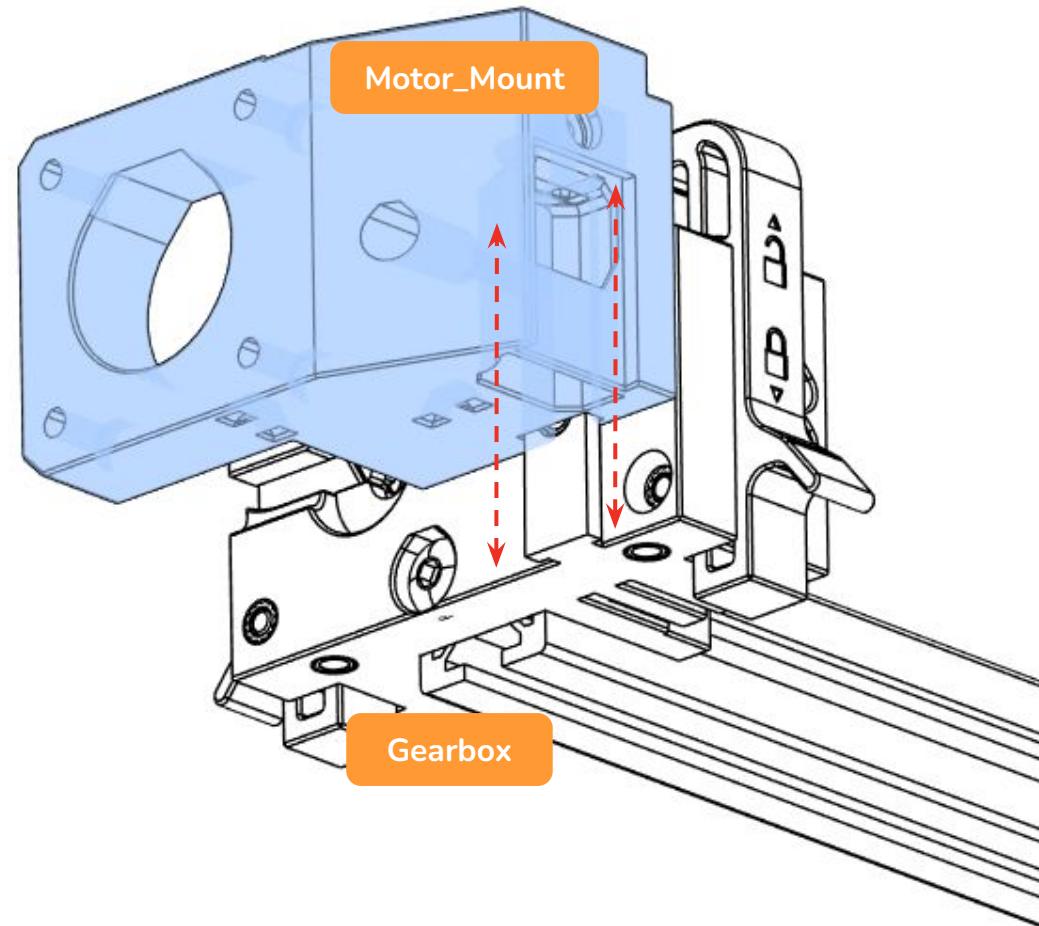
GEARBOX PREPARATION

2.1 MOTOR MOUNT MESHING

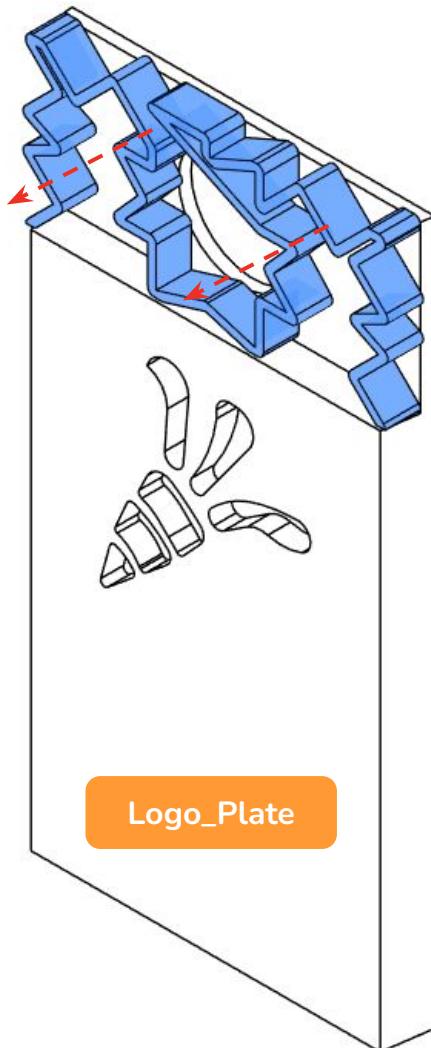
Take your choice of **Motor_Mount** and carefully mate the dovetail on the **Gearbox** to the slot in the **Motor_Mount**. One face of this dovetail is a zero-tolerance fit, so print defects will matter here! If it is a very tight fit, take sandpaper, a file, or a hobby knife to the parts that are rubbing so that it meshes and unmaches without too much force. We want this dovetail to mesh with only a little effort so that later assembly steps are easy. It should take both hands to put together and take apart, but it shouldn't hurt your hands or stick so much that it comes apart violently.

If the fit between these parts is too tight to put together or pull apart, it's a good sign that you either need to reprint the parts, or possibly tune your printer more, especially the Extrusion Multiplier. The parts are designed to fit together and come apart with your hands alone, and without straining. It is normal for the first 3-4 times fitting together to be "sticky," but simply meshing and remeshing the dovetail several times should smooth things out. It is also normal for the area around the dovetail to wear!

Unmesh and set aside the **Motor_Mount** for now.



MOTOR MOUNT

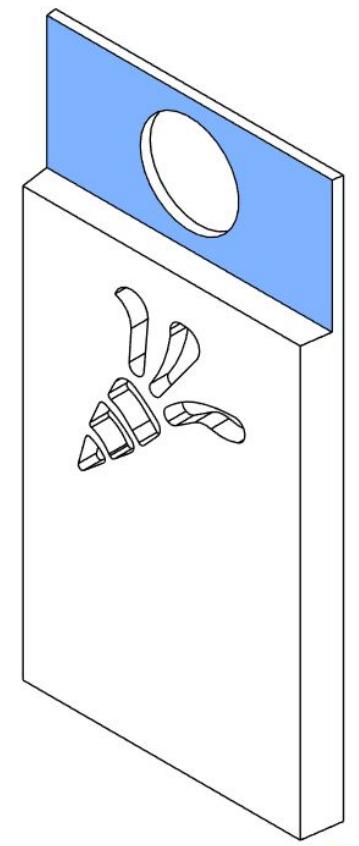


LOGO PLATE

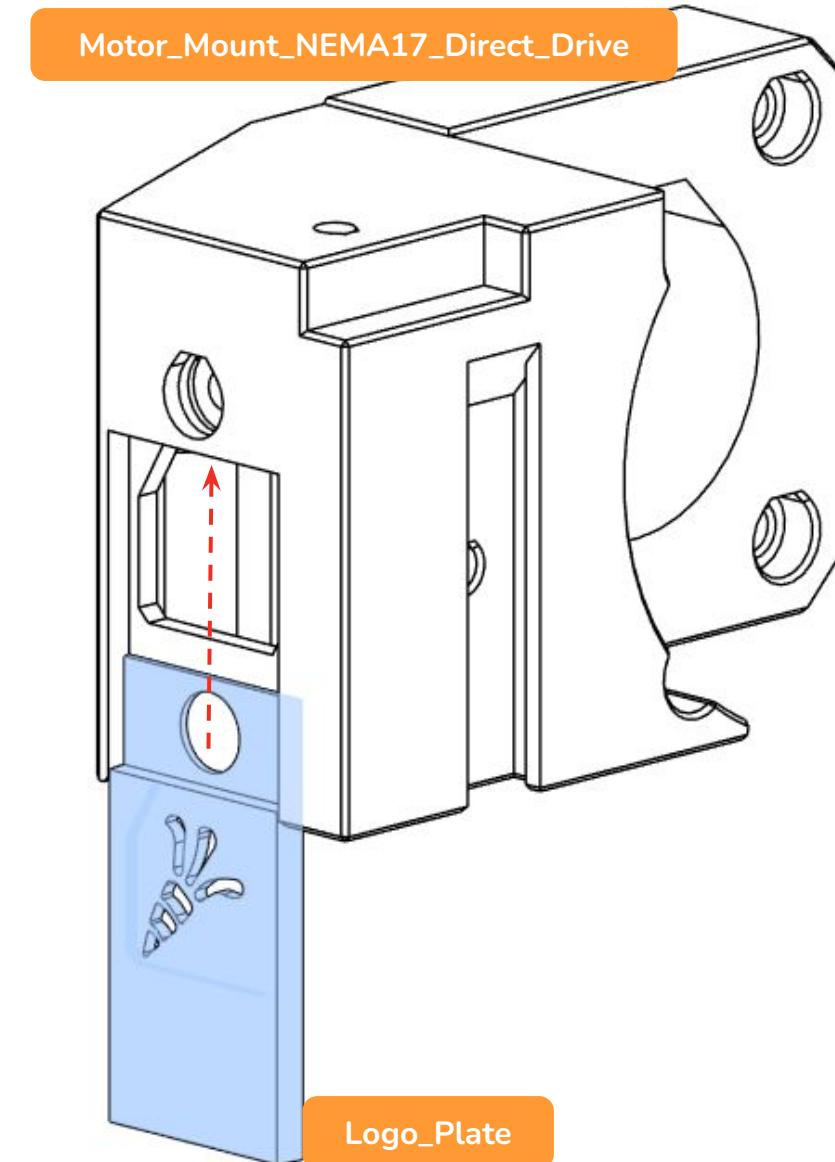
2.2 PREPARE THE LOGO MASK

Carefully remove the supports from the [Logo_Mask](#). If needed, file or carve away any stuck support or bad bridges.

We need the locking tab surface to be clean so that it will seat in its' slot.



MOTOR MOUNT



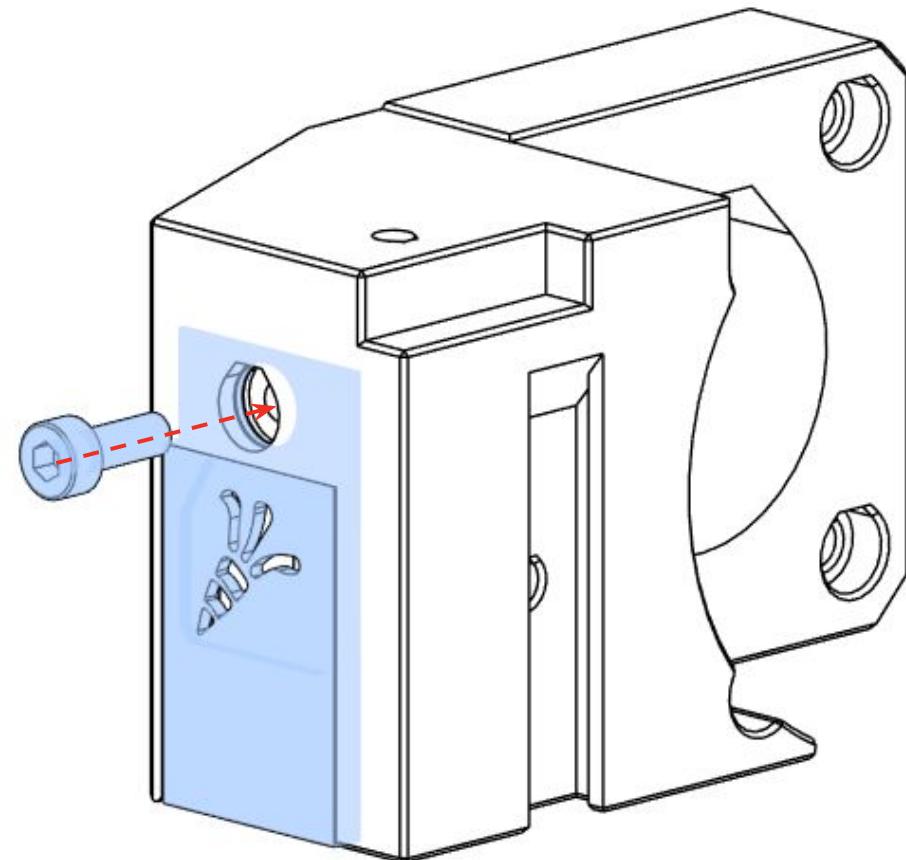
LOGO PLATE

2.2 INSTALLING THE LOGO PLATE

The **Logo_Plate** interlocks with the **LED_Diffuser** and **Diffuser_Mask**, so it must be installed first and uninstalled last.

Align the **Logo_Plate** with the slot in the bottom of the **Motor_Mount**, and slide it upwards until it is flush.

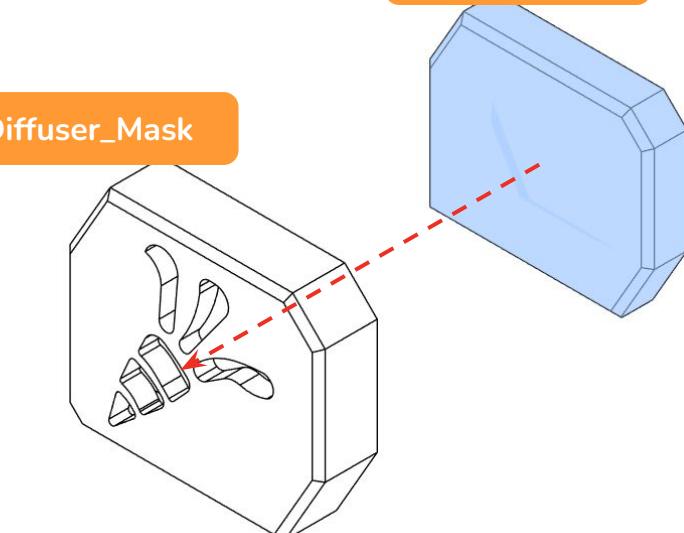
Fasten the **Logo_Plate** with an M3x8mm SHCS threaded into the Gearbox. Don't overtighten, or it may strip.



MOTOR MOUNT

LED_Diffuser

Diffuser_Mask



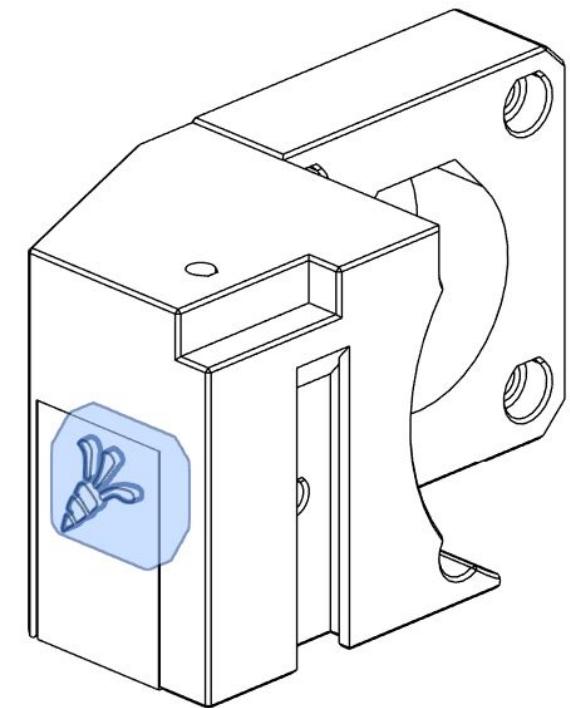
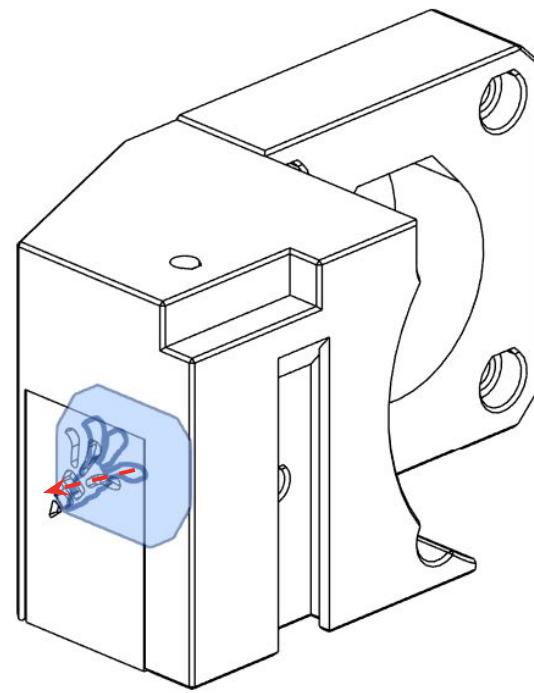
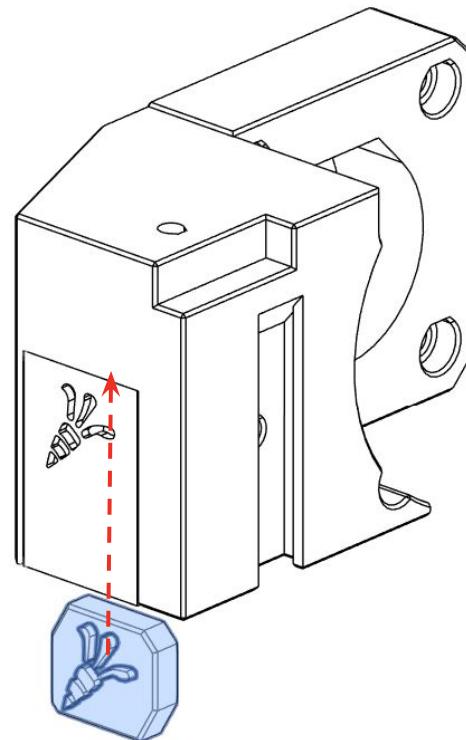
LED DIFFUSER

2.2 INSTALLING THE LED DIFFUSER

Insert the **LED_Diffuser** into the **Diffuser_Mask**.

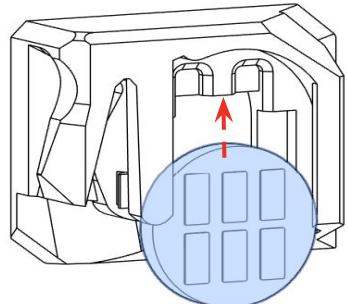
Insert the combined part into the **Motor_Mount** from the bottom.

Once the combined part is as far up as it can go, use an Allen key or screwdriver to push it sideways into the **Logo_Plate**.



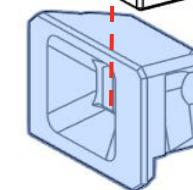
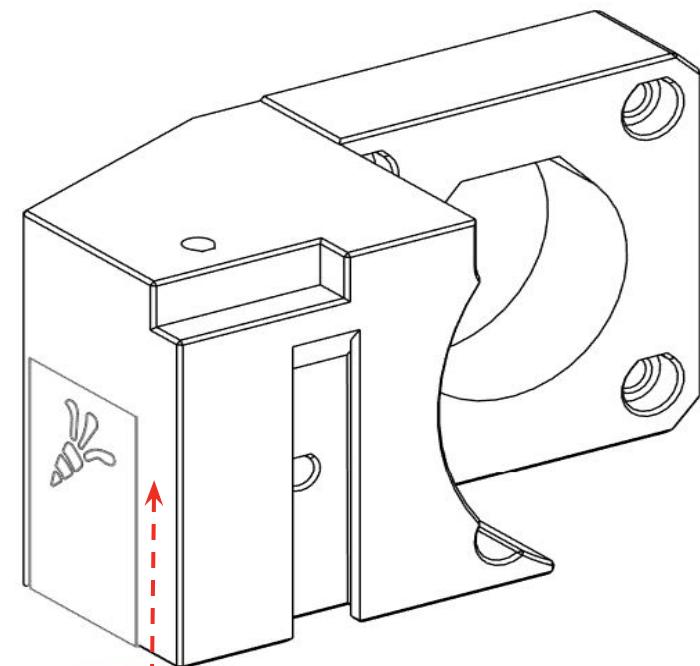
MOTOR MOUNT

LED_Carrier



LED PCB

LED CARRIER

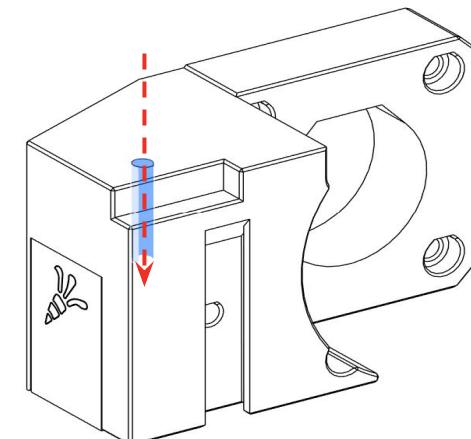


2.2 INSTALLING THE LED CARRIER

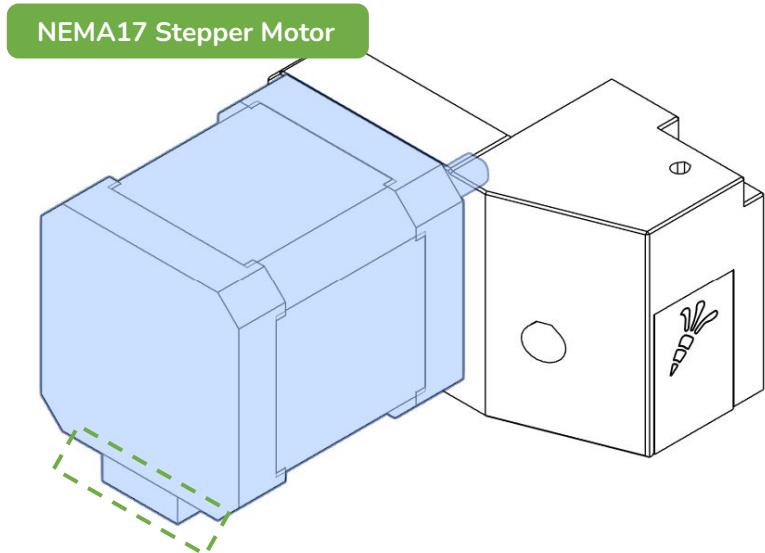
Insert the LED PCB into the **LED_Carrier**, so that the edges of the PCB clip into the **LED_Carrier**. Check the front of the **LED_Carrier** to make sure the LED is aligned with the window. The wires are omitted from the images for clarity.

Insert the combined part into the **Motor_Mount** from the bottom. Use an Allen key or screwdriver to push the combined part up as far as it can go.

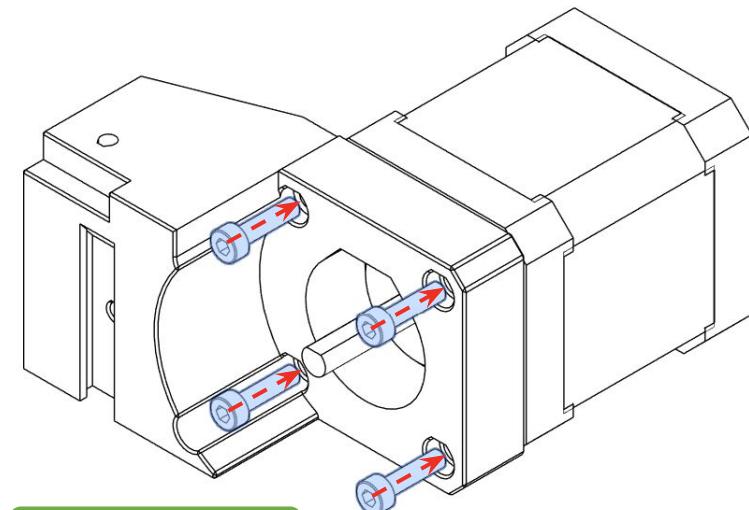
If you need to recover the LED for any reason, insert an Allen key into the hole in the roof of the **Motor_Mount** to push the **LED_Carrier** back out of the bottom.



MOTOR MOUNT



DRIVE MOTOR

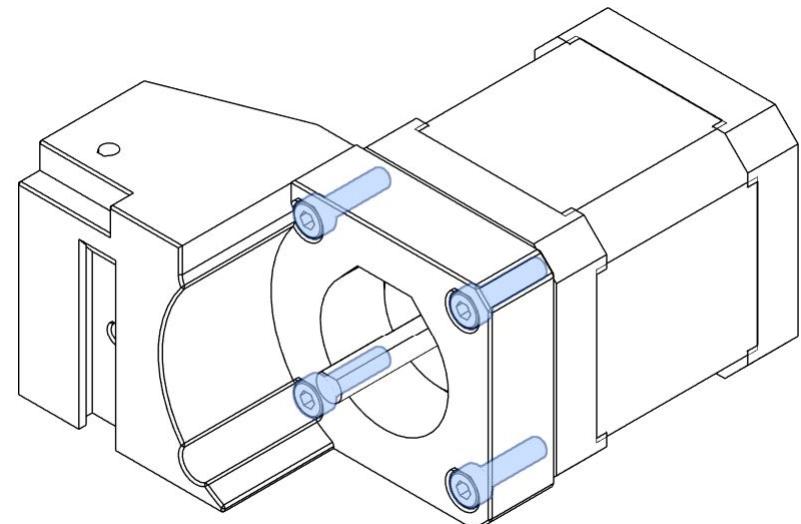


2.1 INSTALLING THE DRIVE MOTOR

Align the NEMA17 Motor with the [Motor_Mount](#) so that the wires or connector is facing down.

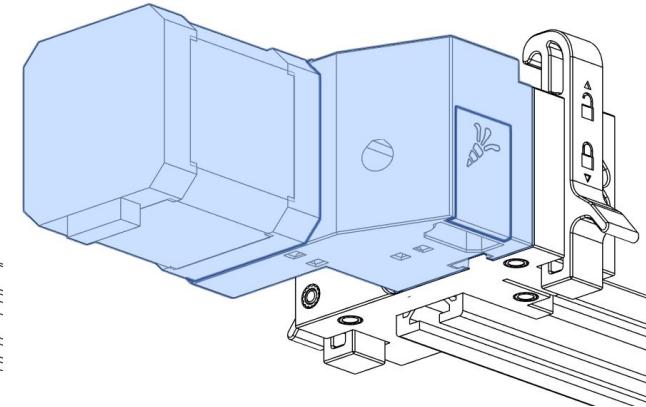
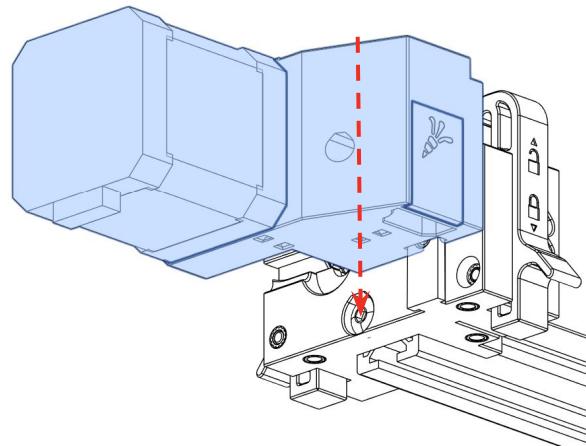
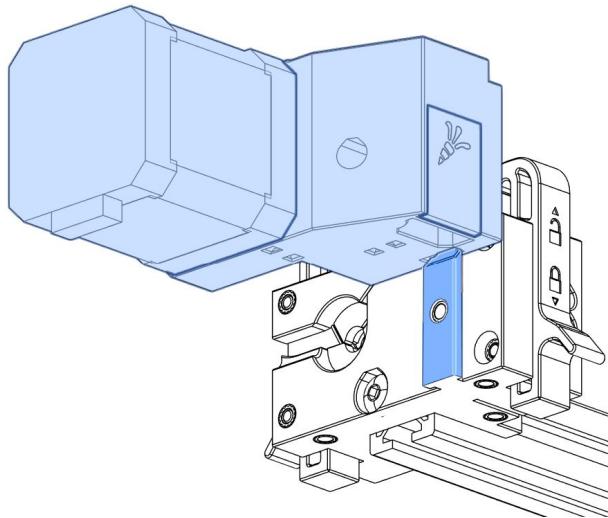
Insert four M3x12mm bolts into the [Motor_Mount](#) and tighten them in an alternating pattern until they are all very snug.

If you are using an alternative 5mm shaft coupler, you should install it loosely onto the motor shaft now.



MOTOR MOUNT

INSTALLING MOTOR MOUNT



2.1 INSTALLING THE MOTOR MOUNT

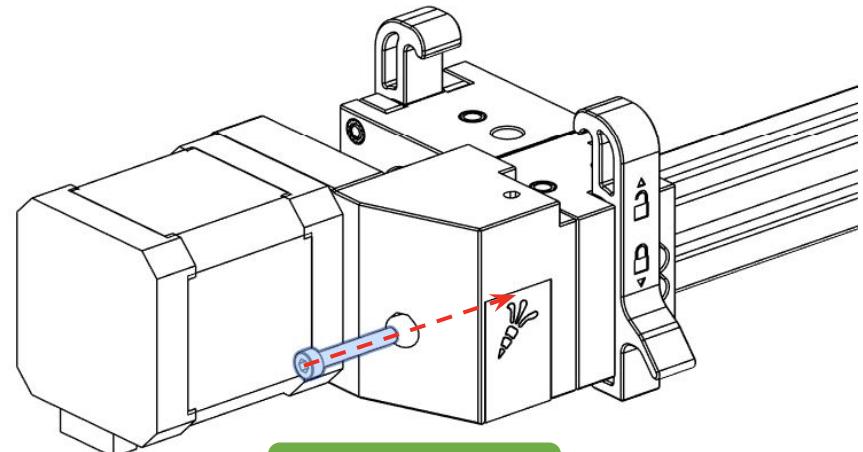
Align the slot in the **Motor_Mount** with the dovetail on the **Gearbox**.

Press down on the **Motor_Mount**. It should be a snug fit. If it's too tight, take the pieces back apart and make sure the slot and dovetail are clear and smooth. If it's a really tight fit, you may need to take a file to the slot and/or dovetail, or reprint one or both of the pieces with more printer tuning.

Keep going until the bottom of the **Motor_Mount** is flush with the bottom of the **Gearbox**.

Install the M3x20mm screw to keep everything in place.

If you have a particularly long setup (>12 channels) or bent drive shaft, take the screw back out and set it aside. This will help you use Filament Block Array Assembly Method 2 on [Page 87](#).



M3x20mm SHCS

MOTOR MOUNT

PREP DRIVE SHAFT

PREP THE DRIVE SHAFT

It is **critical** that the D-cut shaft is straight - check using a flat surface such as glass. If your shaft is not straight, you can either attempt to straighten it by hand, or contact your supplier for replacement. Some kit vendors supply a mild steel D-cut shaft which is too malleable!

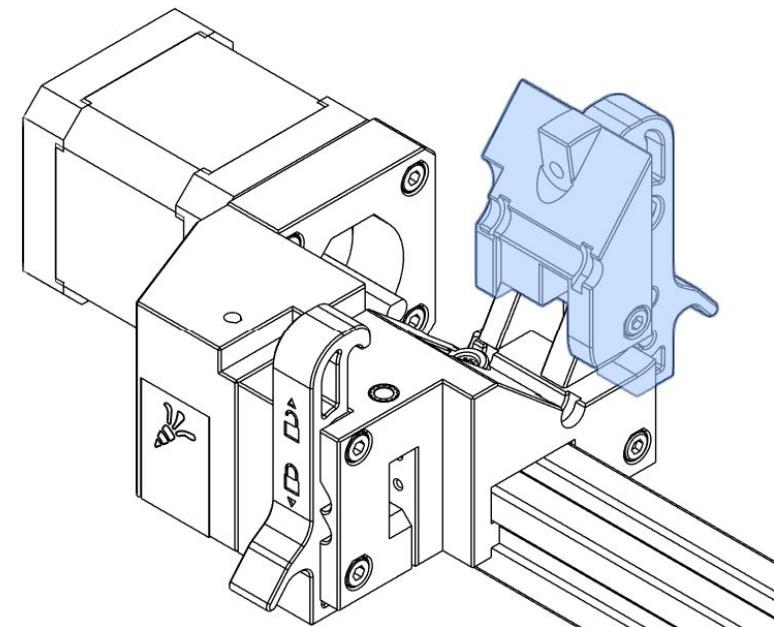
Take the Gearbox assembly and open the [Side_Latch_v2](#) on the side that shares a hinge with the [Hatch](#). Next, flip open the [Hatch](#).

Take the 5mm D-Cut Shaft and insert it into two MR85ZZ bearings.

If your D-Cut Shaft is rough or at-spec (4.98-5.00mm), it will be difficult to insert and move the bearings. It is important that we be able to move the shaft along its axis during assembly, so if this is a problem for you, this must be addressed.

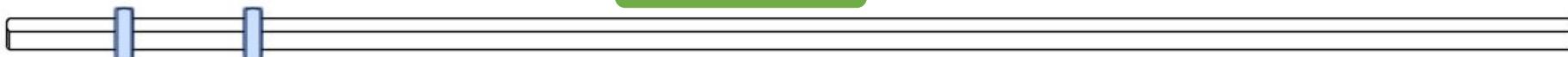
For many D-cut shafts, degreasing them with your favorite household cleaner (Simple Green is a top pick) can make the difference between a too-tight fit and a snug fit. If that doesn't work, follow up with a light-duty green abrasive pad.

If you still find that your D-Cut Shaft is too tight on the bearings, take a high-grit sandpaper (at least 300 grit, preferably 1000-1500) and sand the shaft. Use a light oil, wear gloves and take appropriate precautions while sanding. You barely want to take any material away at all.



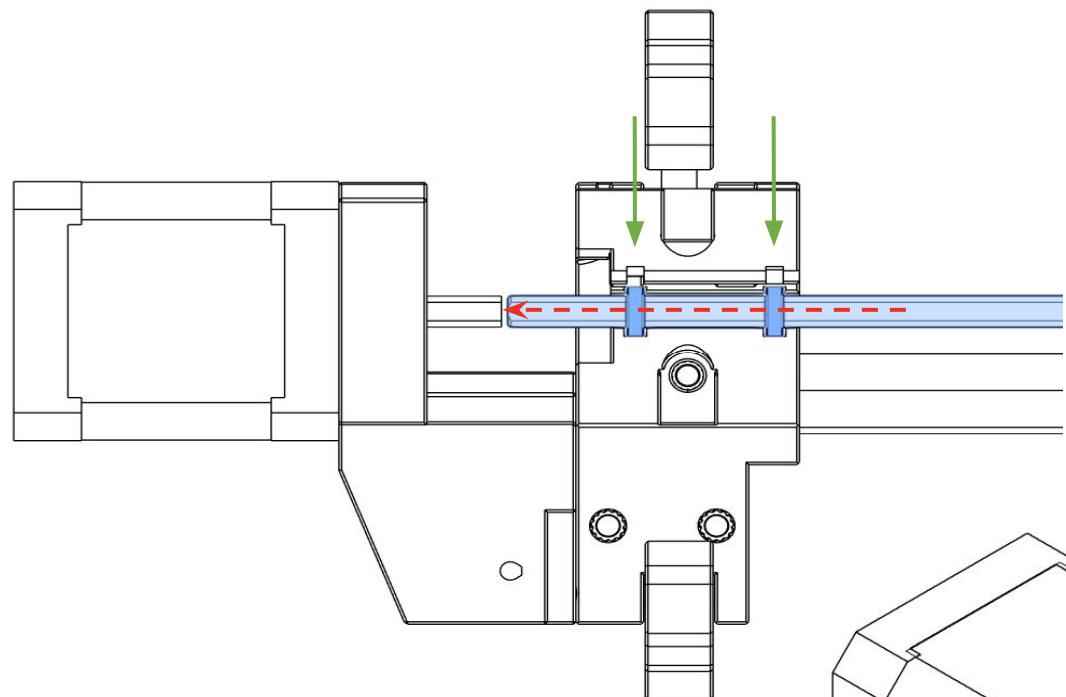
MR85ZZ Bearings

5mm D-Cut Shaft



Channels	N	4	5	6	7	8	9	10	11	12	13	14	15
D-Cut Rod Length (mm)	$72 + 23N$	164	187	210	233	256	279	302	325	348	371	394	417

MOTOR MOUNT



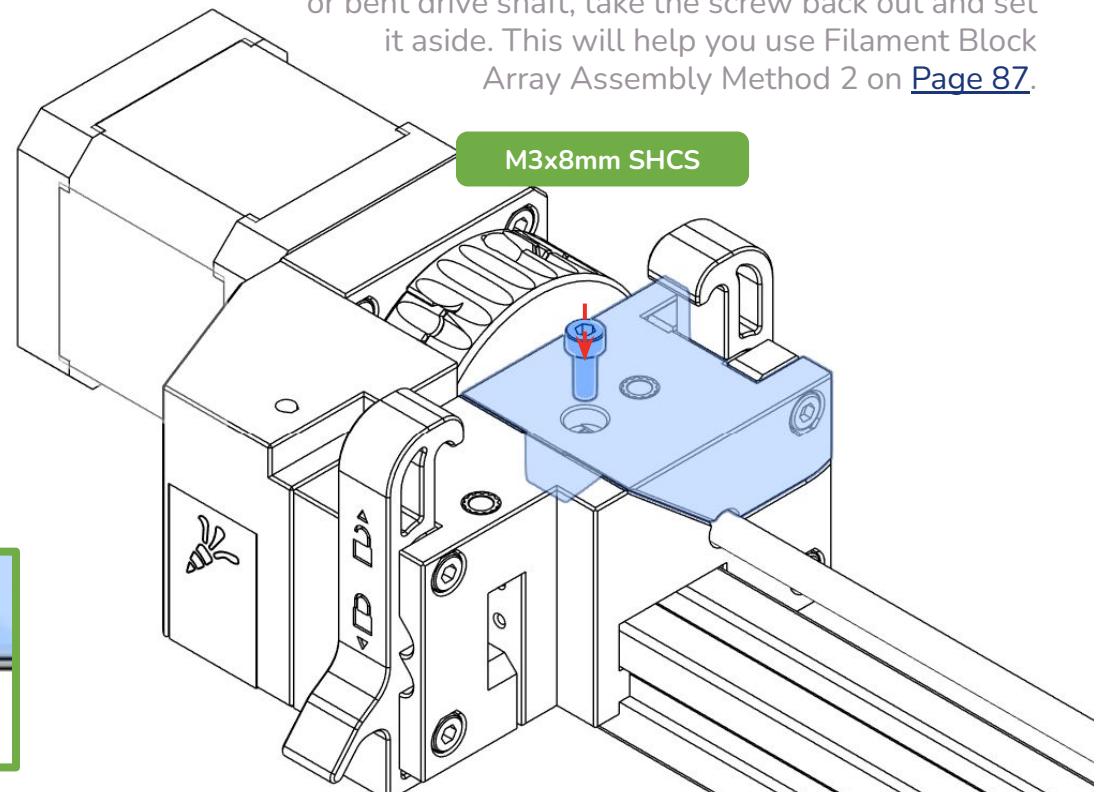
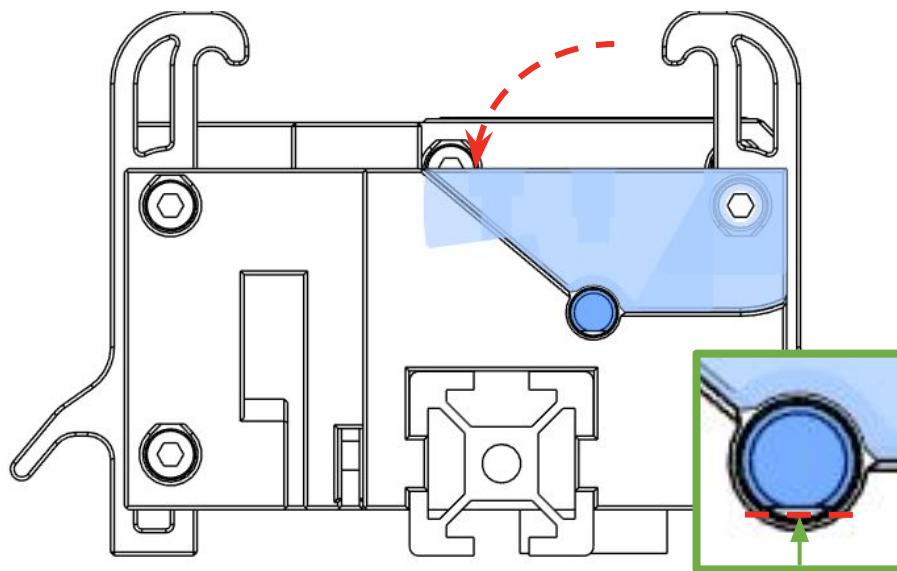
INSTALLING DRIVE SHAFT

2.3 INSTALLING THE DRIVE SHAFT

Align the bearings and shaft with the slots in the **Gearbox**. Close the **Hatch** over the bearings, and close the **Side_Latch_v2**. Slide the Drive Shaft down until it meets the motor shaft. Align both the motor shaft and the drive shaft with the flat facing down for the next steps.

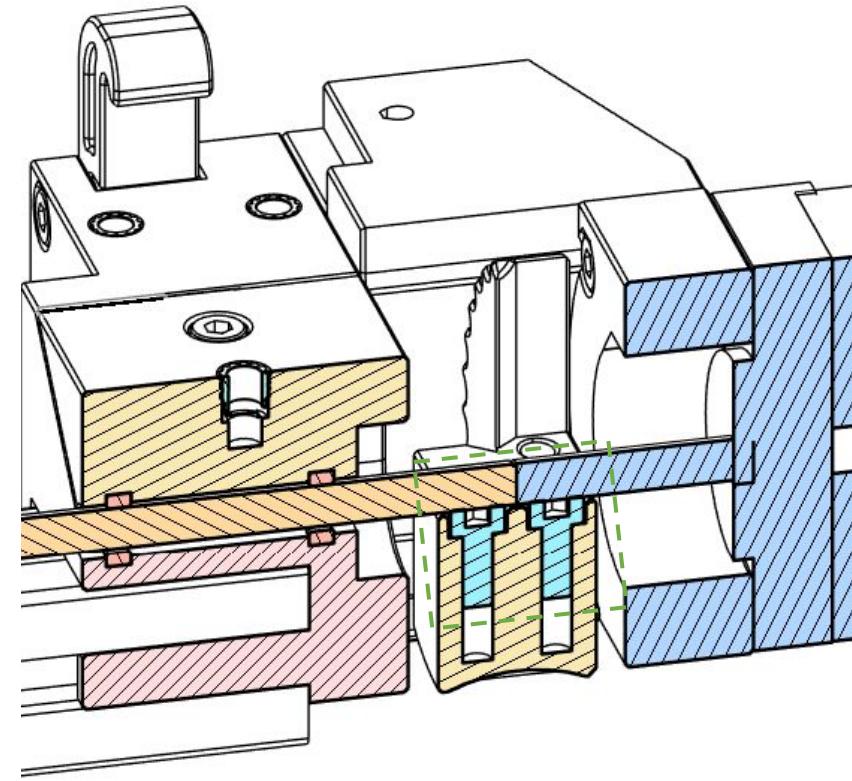
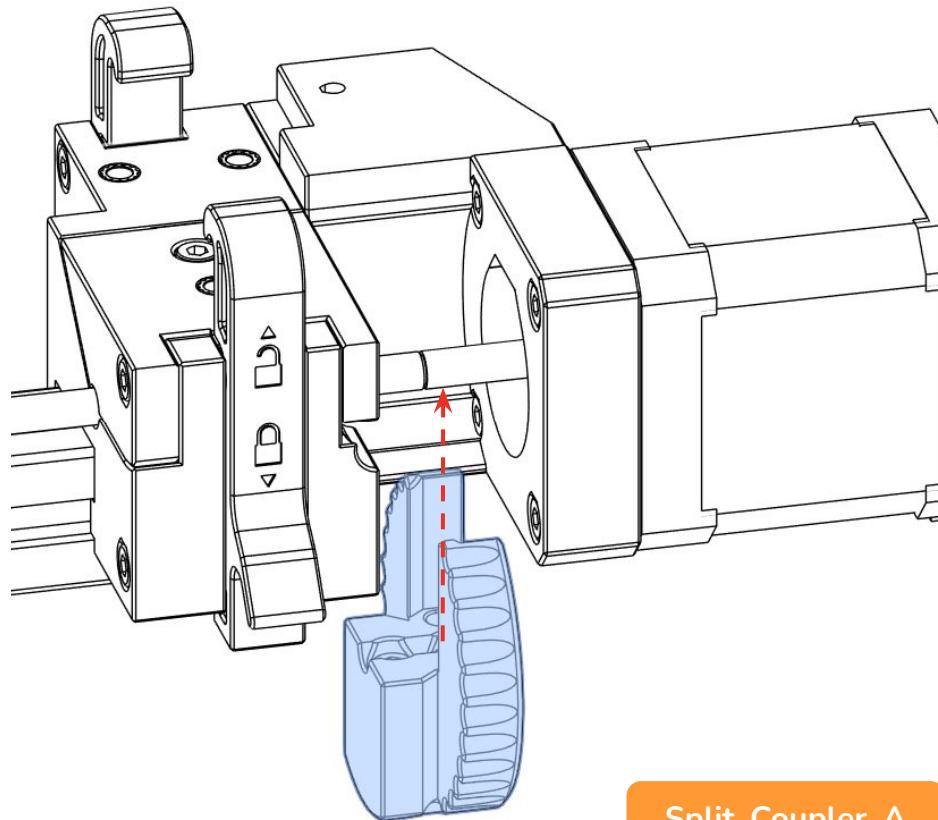
Install an M3x8mm bolt to hold the **Hatch** shut. It doesn't need to be super tight - it just holds the MR85ZZ bearings in place.

If you have a particularly long setup (>12 channels) or bent drive shaft, take the screw back out and set it aside. This will help you use Filament Block Array Assembly Method 2 on [Page 87](#).



MOTOR MOUNT

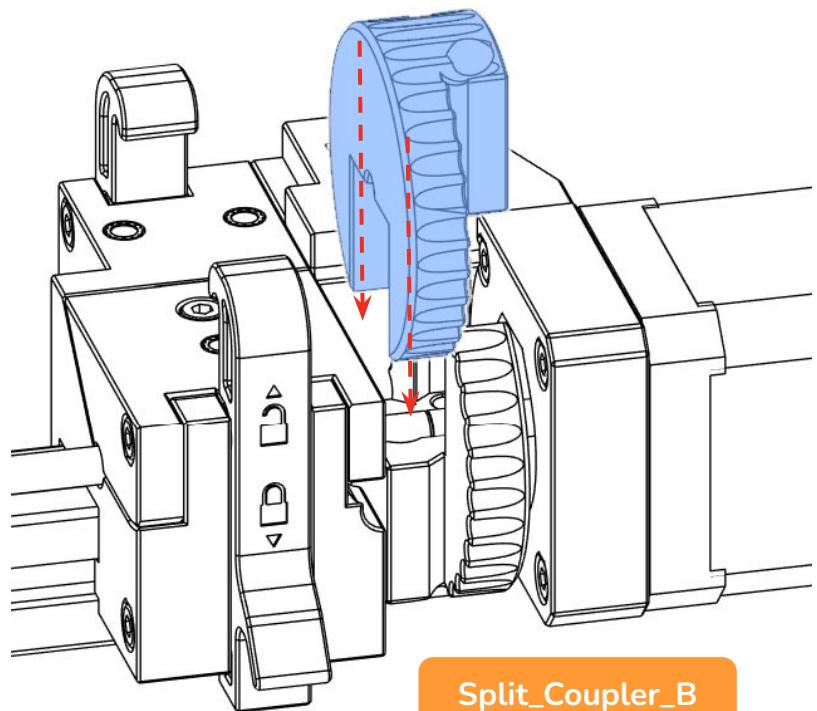
INSTALLING COUPLER



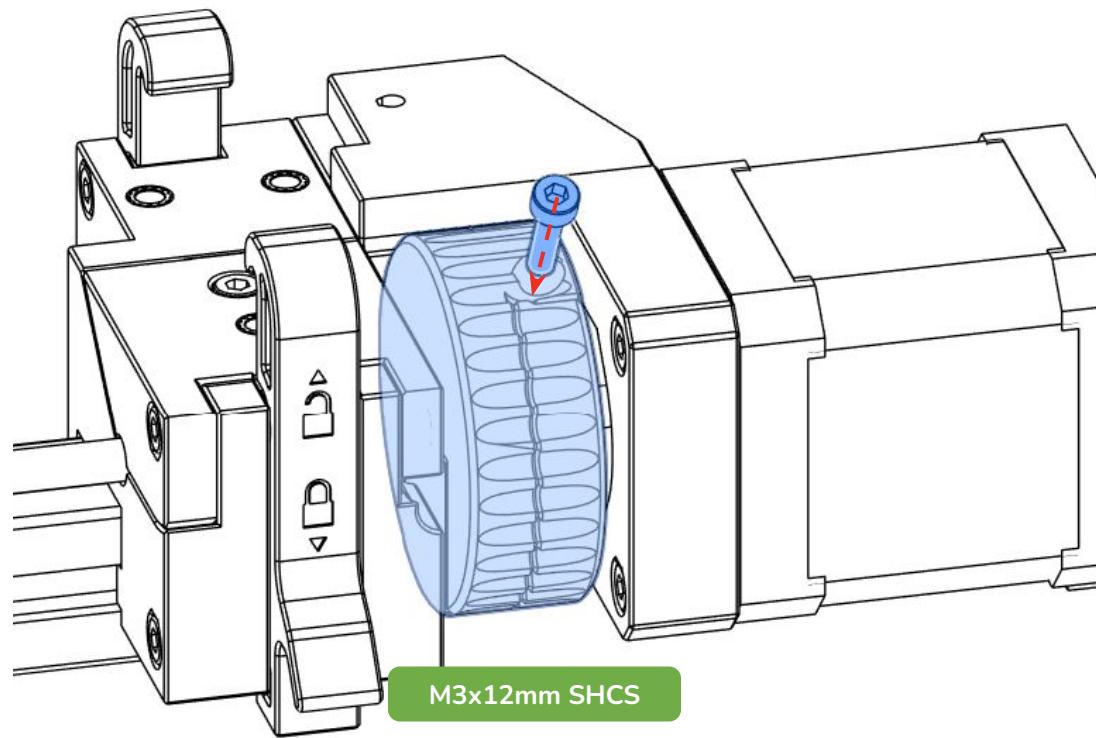
2.3 INSTALLING THE COUPLER

Lift up the main assembly and place the **Split_Coupler_B** that you prepared earlier onto the Drive Shaft with the circular face toward the motor. Align the screwheads in the **Split_Coupler_B** with the flats of the motor shaft and Drive Shaft.

MOTOR MOUNT



INSTALLING COUPLER



2.3 INSTALLING THE COUPLER

Next, slide the [Split_Coupler_A](#) onto the [Split_Coupler_B](#). Insert an M3x12mm bolt into the hole in the [Split_Coupler_A](#). Tighten it down until it is fully mated. The [Split_Coupler_A](#) should fully align with the [Split_Coupler_B](#). Make sure that the screwheads from the previous step stay pushed against the flats of both the motor shaft and the Drive Shaft.

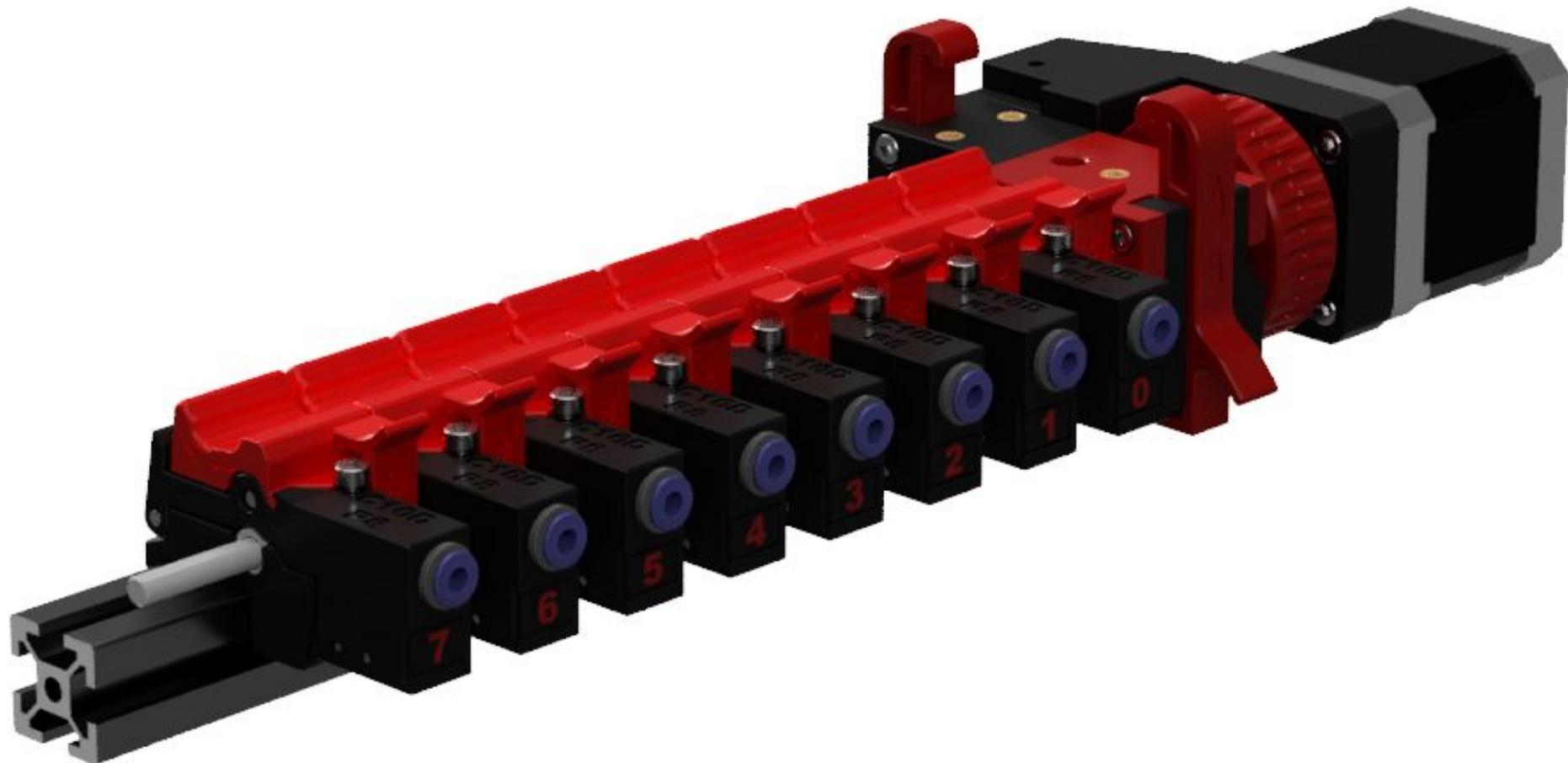
The drive shaft should now be tightly coupled to the motor shaft. If there is still slop, tighten the M3x12mm bolt more. Give the Coupler a spin. The shaft should spin freely, and be nicely centered on the bearings in the [Gearbox](#). If the Coupler needs to be adjusted or removed, loosen the M3x12mm. If the Drive Shaft wobbles, you will want to use [Method 2](#) when assembling the Filament Blocks.

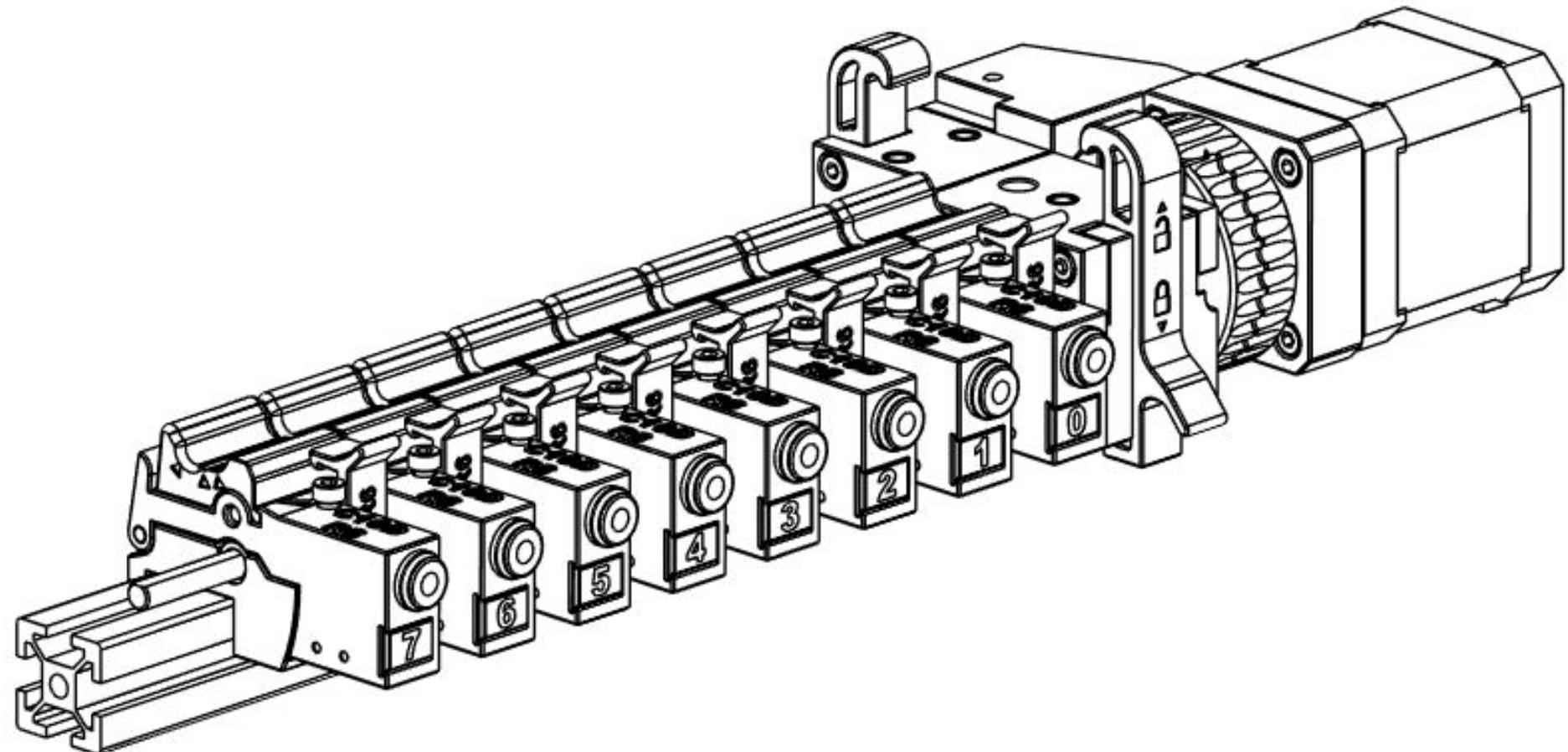
If you're using an alternative 5mm coupler to the Split Coupler (and you put it on the motor shaft on [Page 61](#)), you can simply slide it over onto the Drive Shaft and tighten it up.

Heft your mighty Rabbit Hammer to the sky and rejoice. You're done with motor mounting!

ERCF in space?

The first 3D printer in space was installed on the International Space Station in 2014 and used by astronauts to create tools and parts, demonstrating the potential of this technology for long-duration space missions and even interplanetary travel.



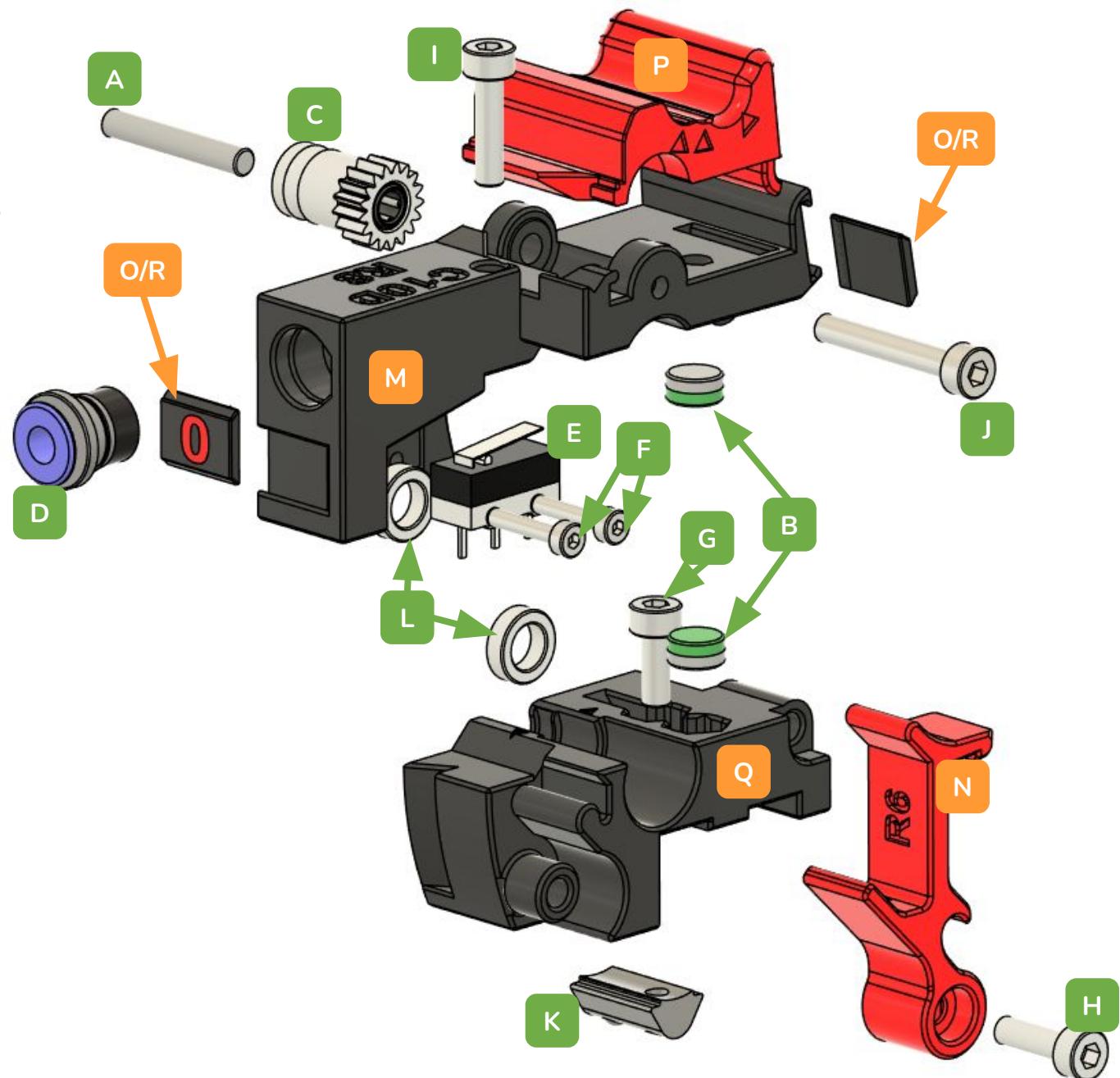


FILAMENT BLOCKS

EXPLODED VIEW

FILAMENT BLOCK SUB-BOM (PER FILAMENT BLOCK)

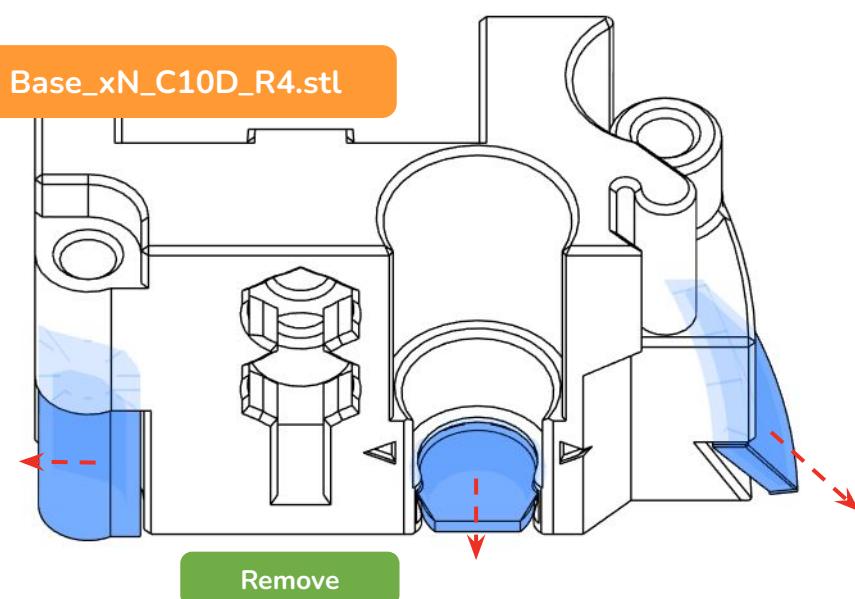
A	1x 3mm x 20mm pin
B	2x 6x3mm Magnets
C	1x BMG Idler Gear & Bearings
D	1x ECAS Coupler (2 piece)
E	1x D2F-L Microswitch
F	2x M2x10mm SHCS
G	1x M3x8mm SHCS
H	1x M3x10mm SHCS
I	1x M3x12mm SHCS
J	1x M3x20mm SHCS
K	1x M3 Roll-In T-Nut
L	2x MR85ZZ Bearing



M	1x [a]_Filament_Path_xN.stl
N	1x [a]_Latch_xN.stl
O	2x [a]_Tag_plates_N_x2.stl
P	1x [a]_Tophat_xN.stl
Q	1x Base_xN.stl
R	2x Tag_plates_DigitN_x2.stl

FILAMENT BLOCKS

PREPARATION

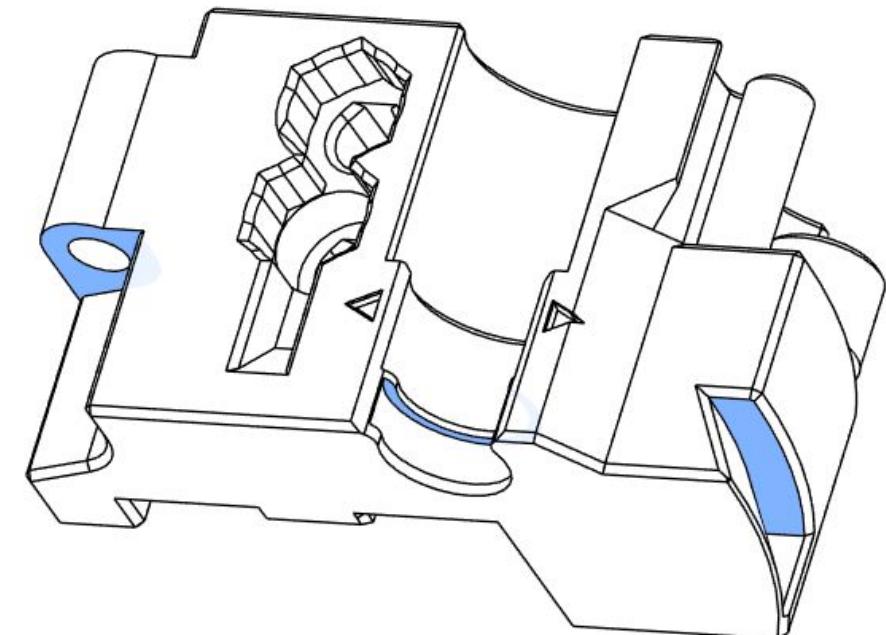
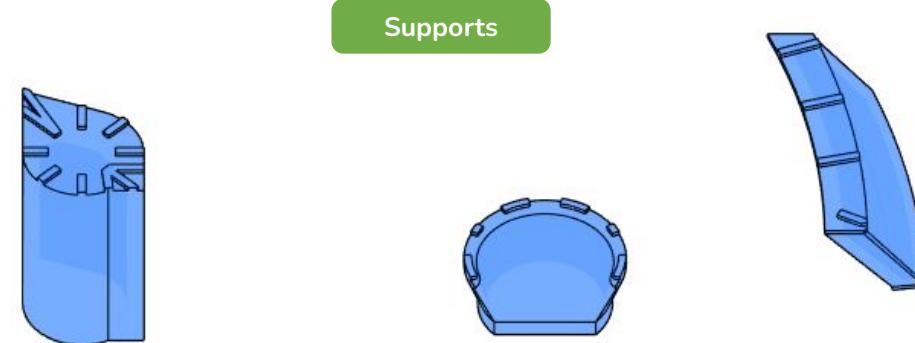


3.1 PRINT IN PLACE SUPPORTS

Before you begin you will need to remove all of the print-in-place supports from the **Bases**. They may look like either of the above.

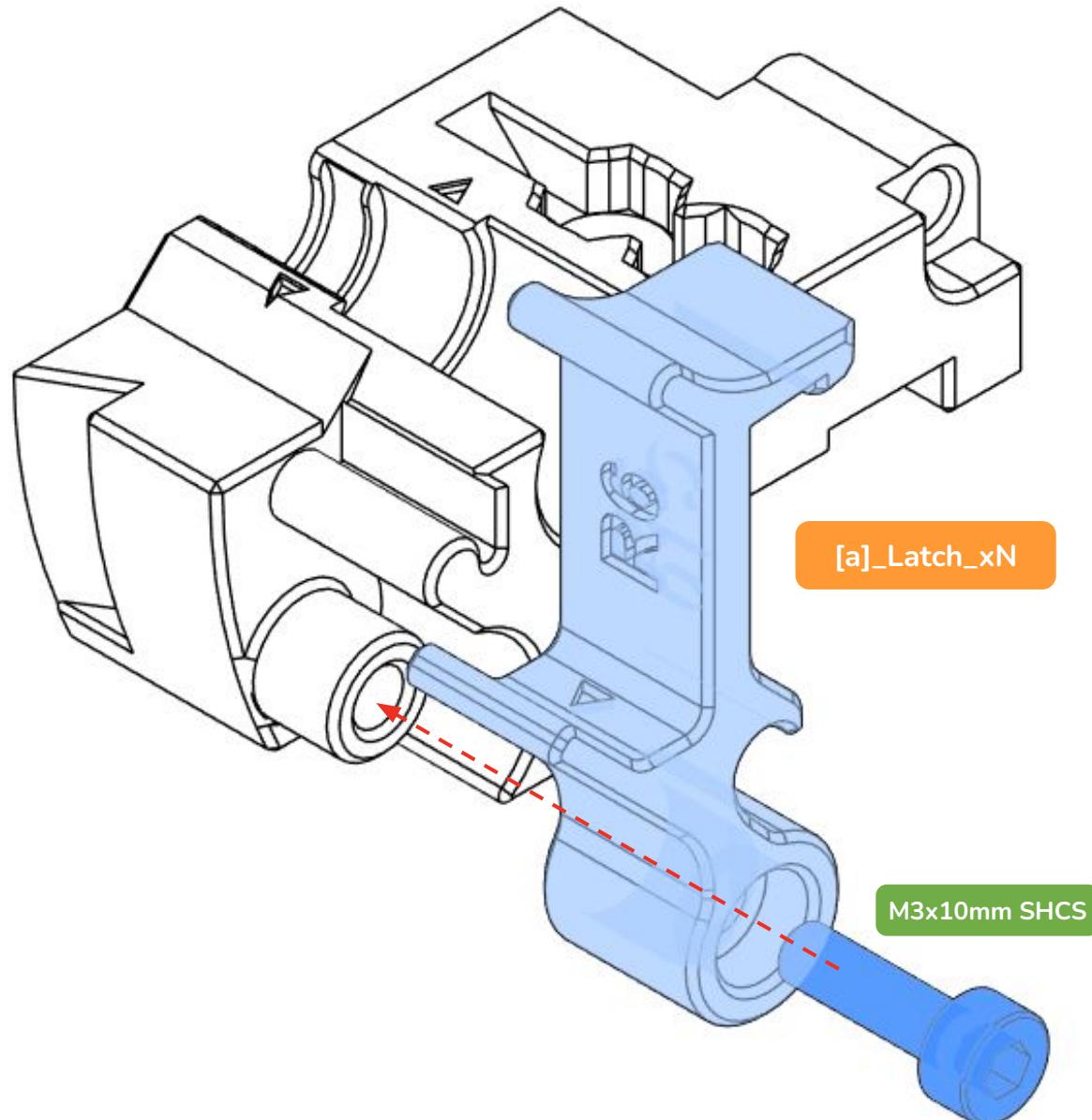
Using a small screwdriver or a set of needle nose pliers may help to remove the supports. Take care not to hurt yourself while prying! Make sure that the supported surfaces are free of any stuck-on micro-supports.

Repeat this for all of the **Bases**.



FILAMENT BLOCKS

LATCH



3.3 LATCH SCREW

Resist the urge to close the **Latch** before installing the screw. You might break the pivot off.

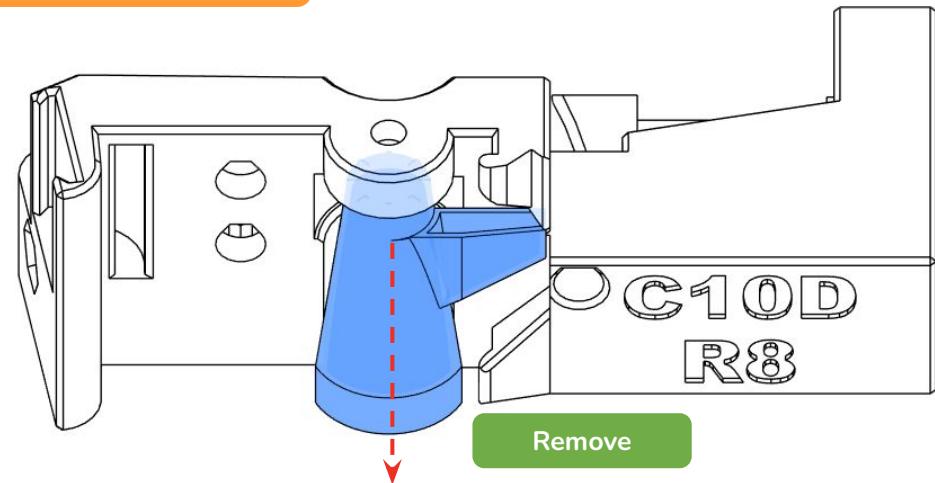
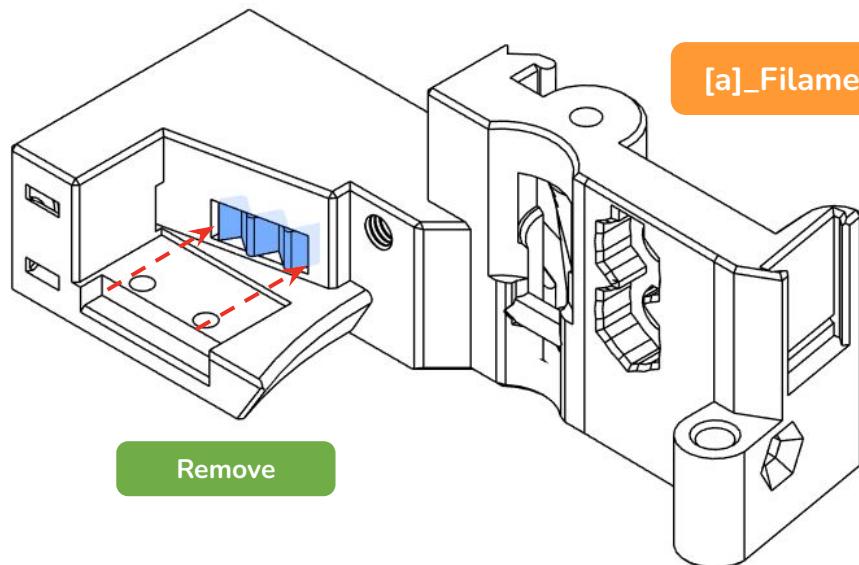
Drive the M3x10mm screw through the **Latch** into the **Base**. The screw taps directly into the plastic, so don't overtighten or it will strip! The screw should be loose enough that the **Latch** can pivot easily.

Once the screw is in, you can close the **Latch** with a satisfying click.

Repeat for all of the **Bases**.

FILAMENT BLOCKS

PREPARATION



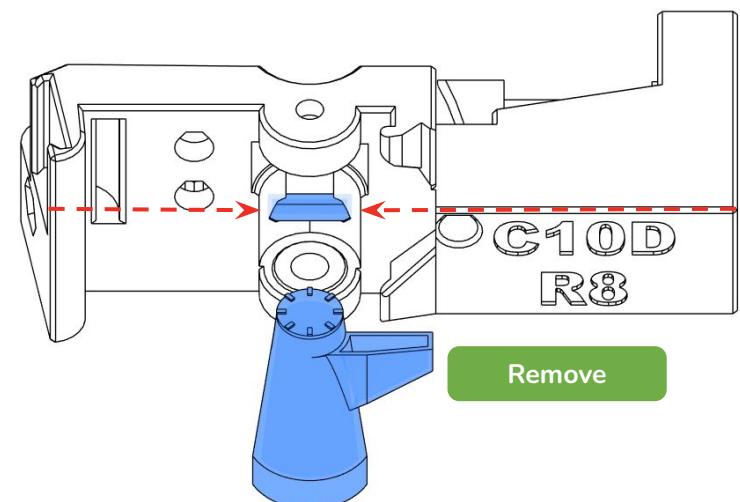
3.5B PRINT IN PLACE SUPPORTS

Before you begin you will need to remove all of the print-in-place supports from the [Filament_Paths](#).

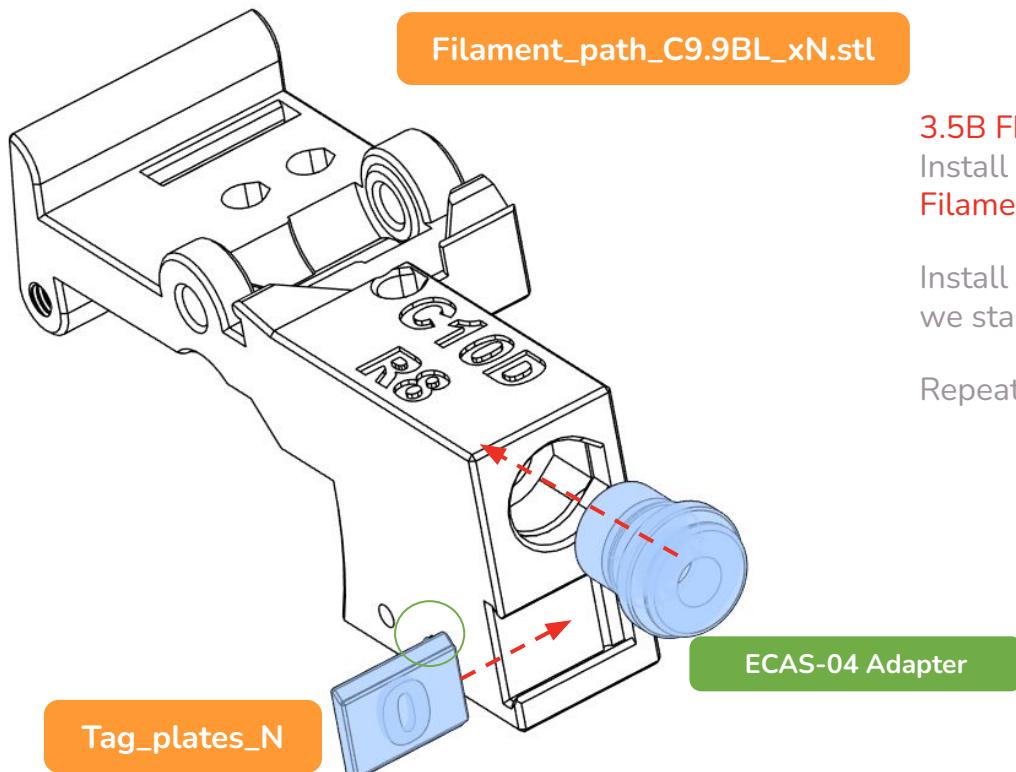
Using a small screwdriver or pliers may help. Please take care that you don't accidentally damage the part (or yourself!). Check the roofs of each support feature for bad bridging or stuck support pieces.

For the filament path bridge, sticking a 2mm hex key into the filament path is a quick way to both ream the filament path, and remove the support.

Repeat this for all of the [Filament_Paths](#).



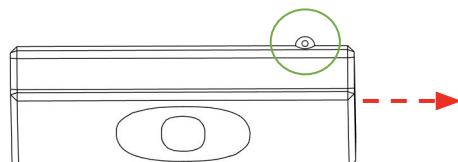
FILAMENT BLOCKS



Filament_path_C9.9BL_xN.stl

TAG PLATES

The side of the **Tag_plates_N** with the bump goes first for both tags.



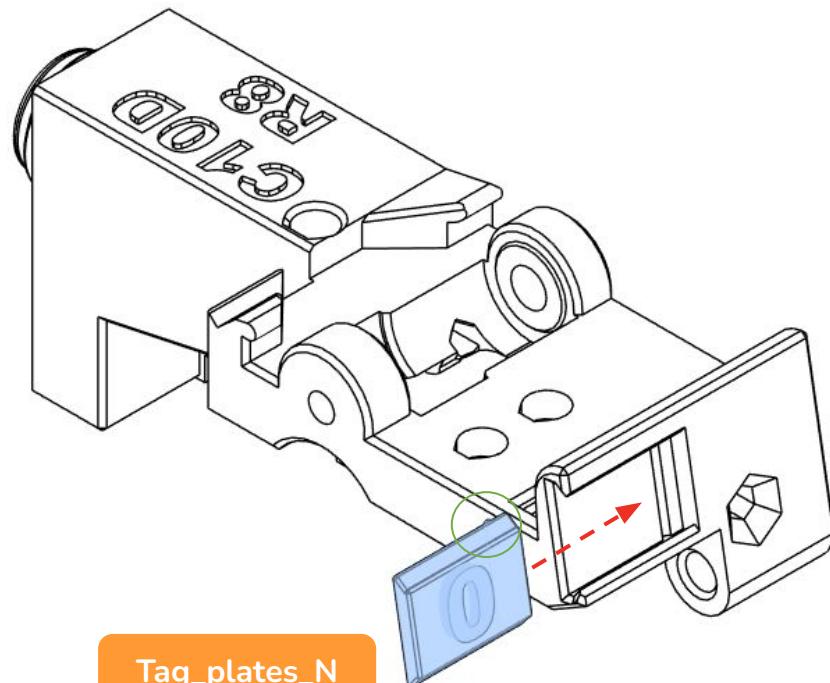
ECAS AND TAG PLATES

3.5B FILAMENT_PATH PREP

Install the ECAS fitting so that the collar is nearly flush with the **Filament_Path**. It is normal for there to be a very small gap.

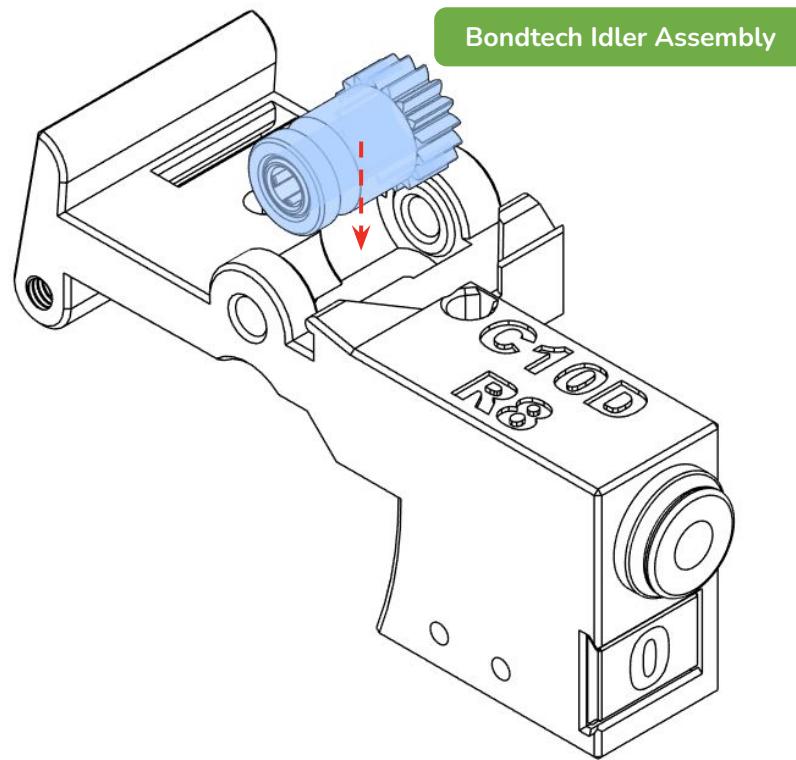
Install both the front and back Tag number plates. Remember, we start counting from 0 in this system!

Repeat for all of the **Filament_Paths**.

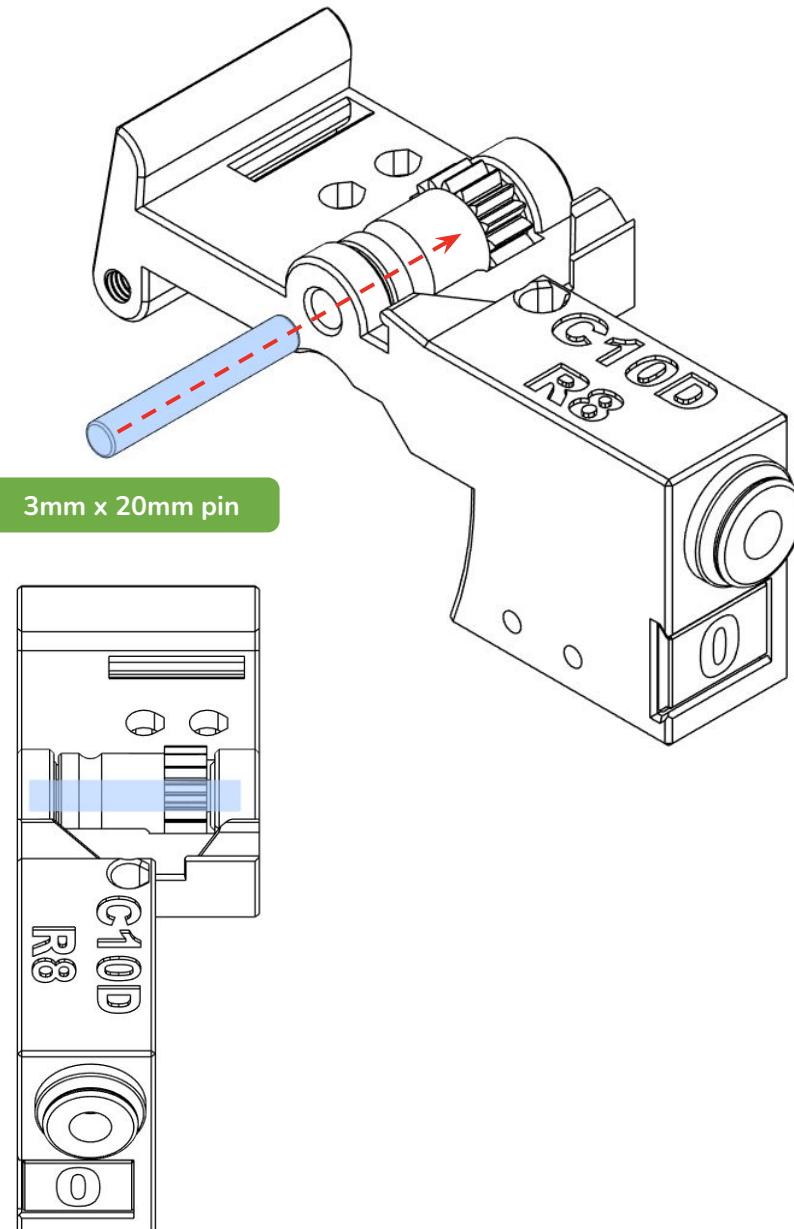


Tag_plates_N

FILAMENT BLOCKS



BMG IDLER



3.1 INSTALL BONDTECH IDLER GEAR

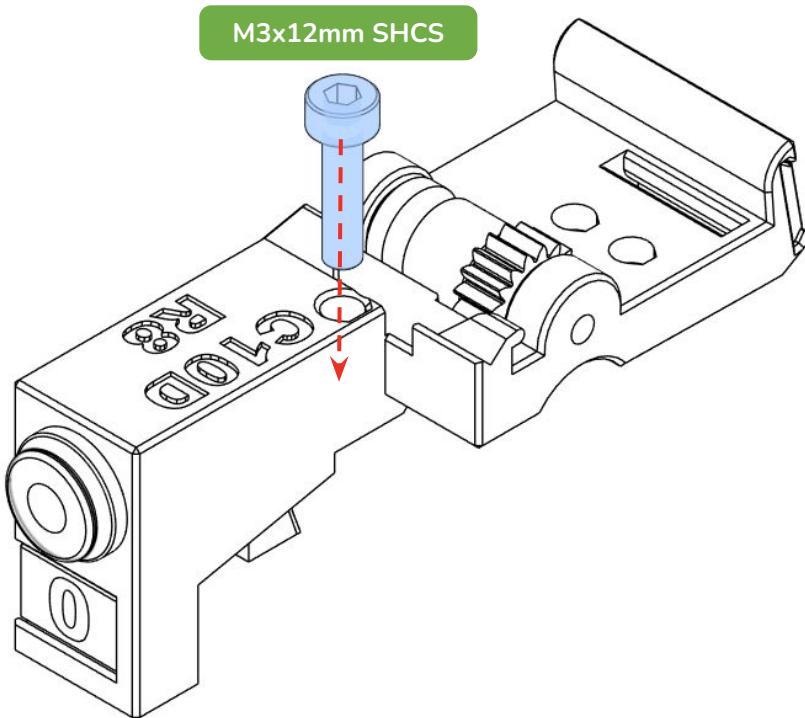
Insert the BMG Idler. Lightly grease the bearings with EP1/EP2 or Superlube before inserting the pin.

The pin should over-insert by about 1mm.

Once assembled, make sure the Bondtech Idler spins freely.

Repeat for all [Filament_Paths](#).

FILAMENT BLOCKS



ANTISQUISH SCREW

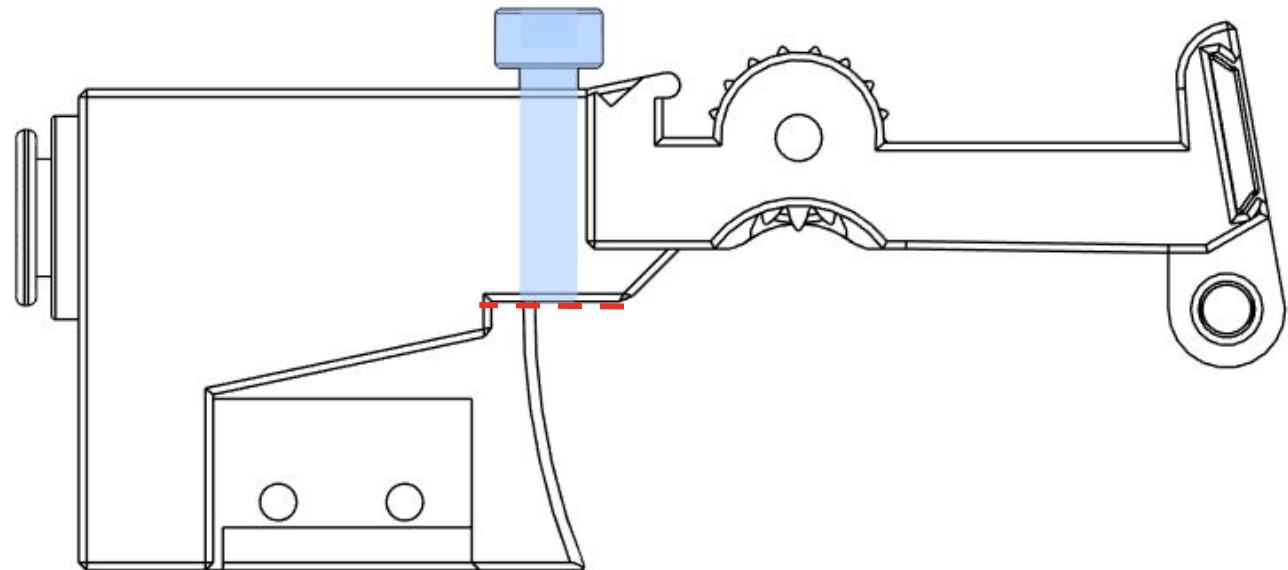
3.4A ANTISQUISH SCREW

This screw keeps softer filaments from being squished too much, and also prevents over-meshing of the BMG gears.

Drop the M3x12mm screw into the hole on the top of the [Filament_Path](#).

Screw the SHCS into the base until it is flush with the bottom face of the [Filament_Path](#). The height will be set during calibration, after assembly.

Repeat for all [Filament_Paths](#).



FILAMENT BLOCKS

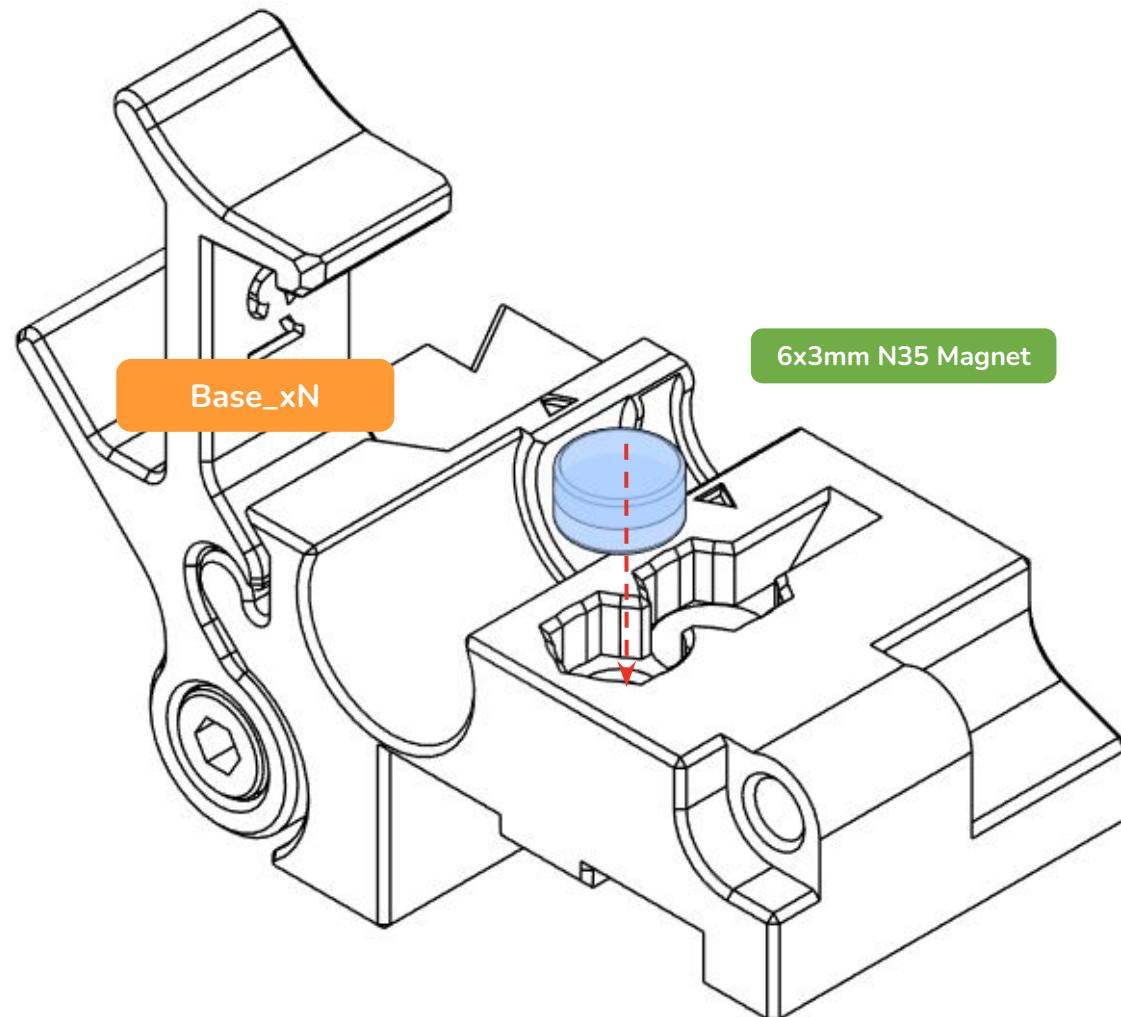
BASE MAGNET

3.2 MAGNET ORIENTATION

Polarity matters. Install the magnets in the outer recess so they repel against the magnets in the [Filament_Path](#), e.g. same poles facing each other on both magnets. In case your magnets are a little loose, add a drop of CA glue to hold them in place.

If you want to use dual magnets, hold off on installing the second magnet into the other recess until you finish attaching all the [Bases](#) to the 2020, because we need access to the bolt hole.

Repeat for all of the [Bases](#).



FILAMENT BLOCKS

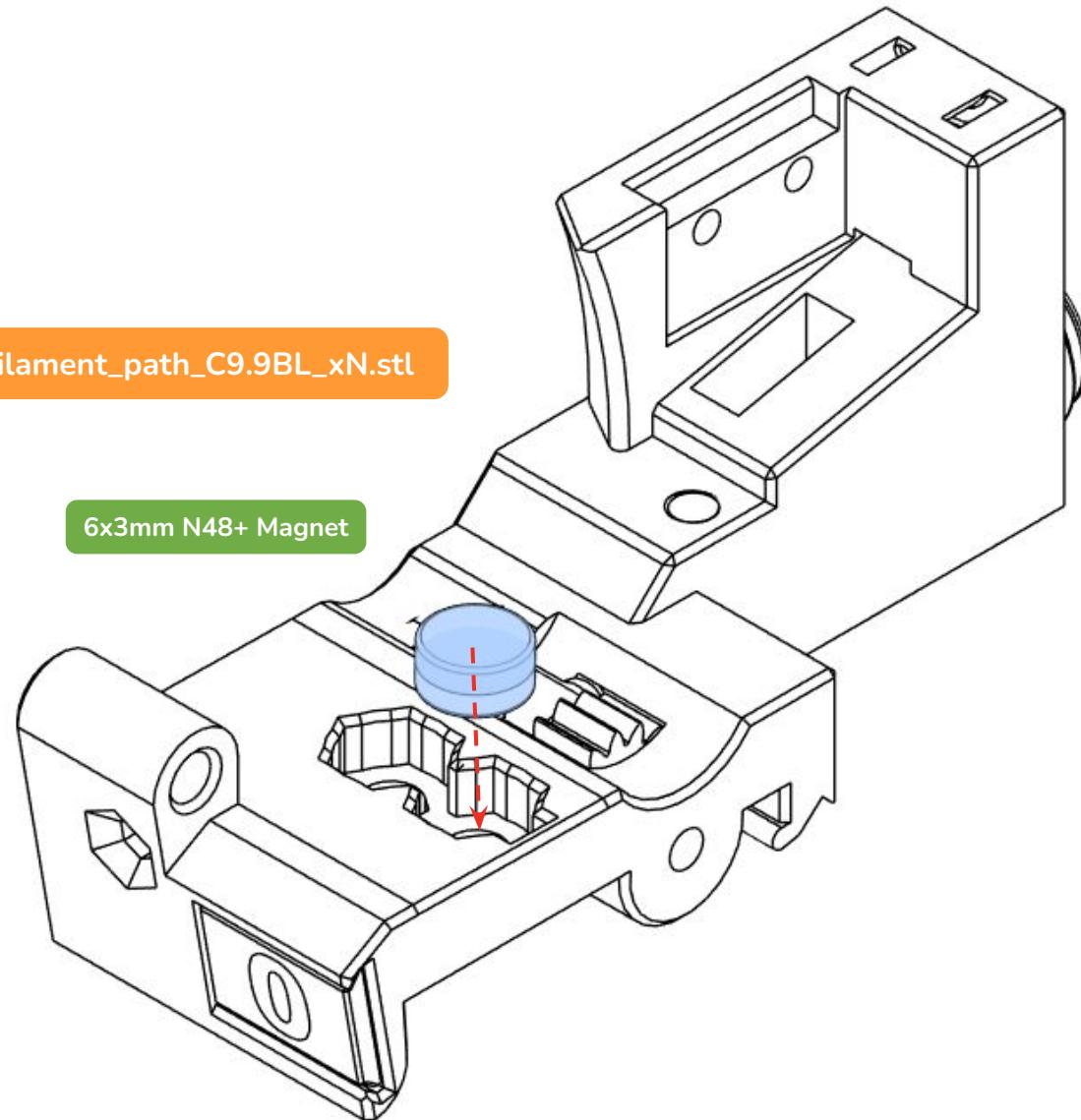
FILAMENT_PATH MAGNET

3.5B MAGNET ORIENTATION

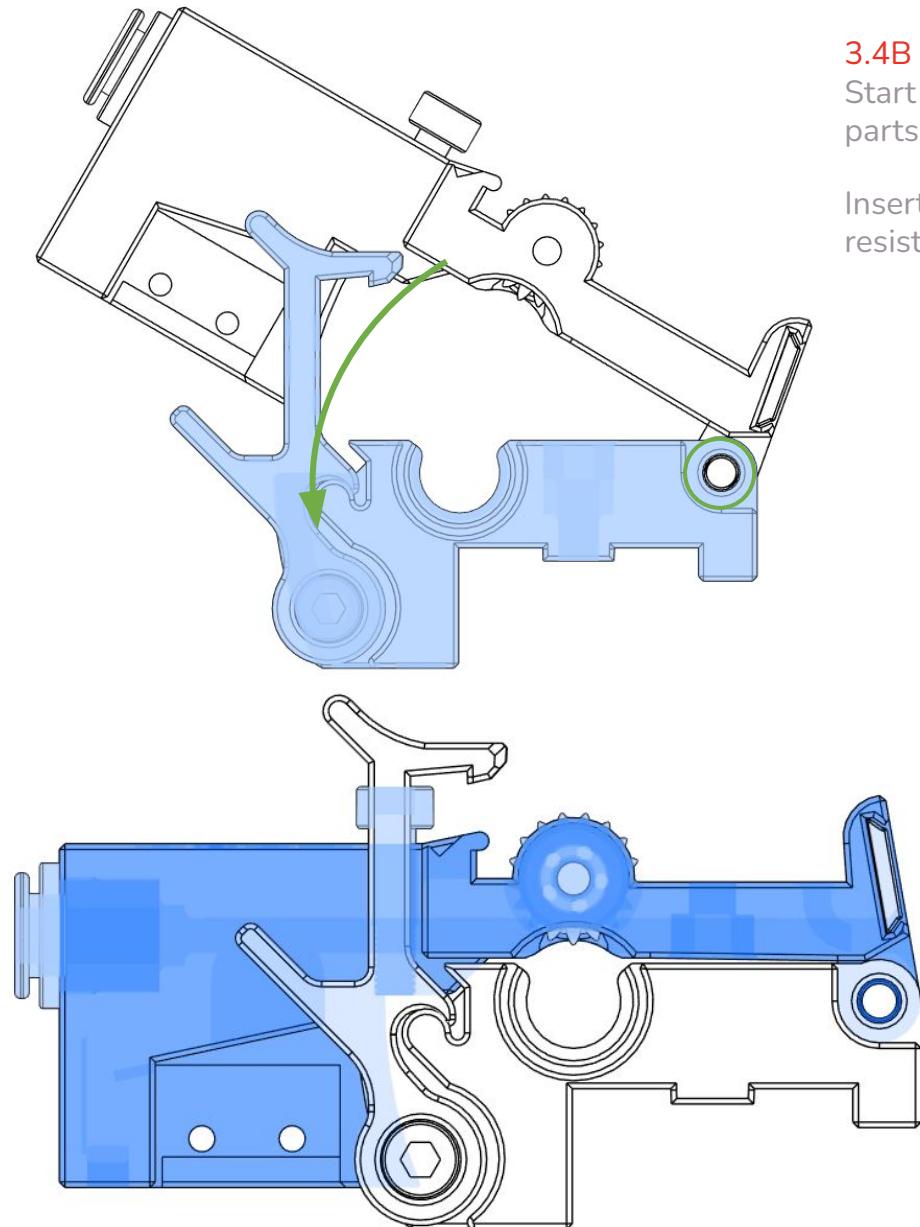
Polarity matters. Install the magnets in the outer recess so they repel against the magnets in the **Base**, e.g. same poles facing each other on both magnets. If your magnets are a little loose, add a drop of CA glue to hold them in place.

If you want to use dual magnets, you can install the second magnet now.

Repeat for all of the [Filament_Paths](#).



FILAMENT BLOCKS

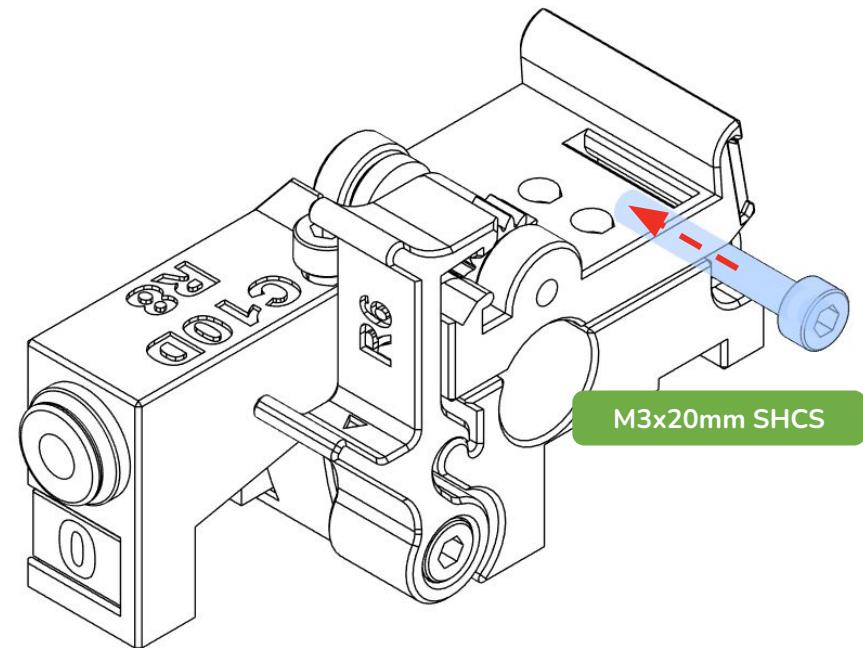


BLOCK ASSEMBLY

3.4B BLOCK ASSEMBLY

Start with the Filament_Path and Base aligned at the hinge. Close the parts together with the hinge so that they fit together.

Insert an M3x20mm screw into the hinge as far as it will go without resistance.



FILAMENT BLOCKS

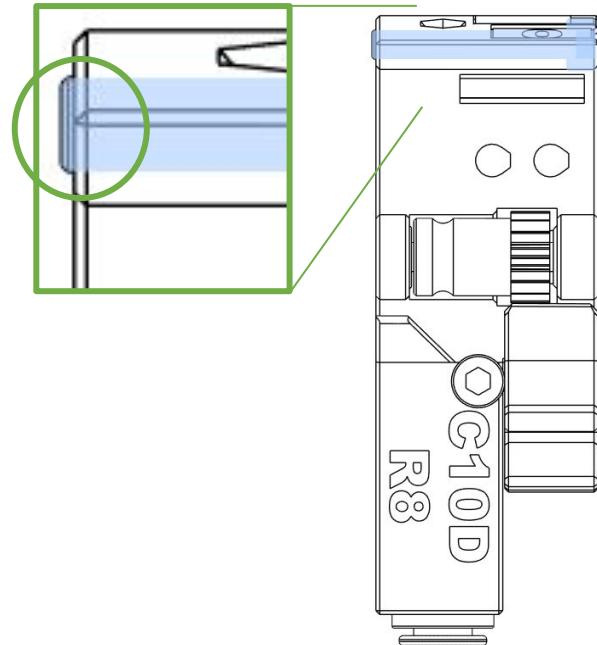
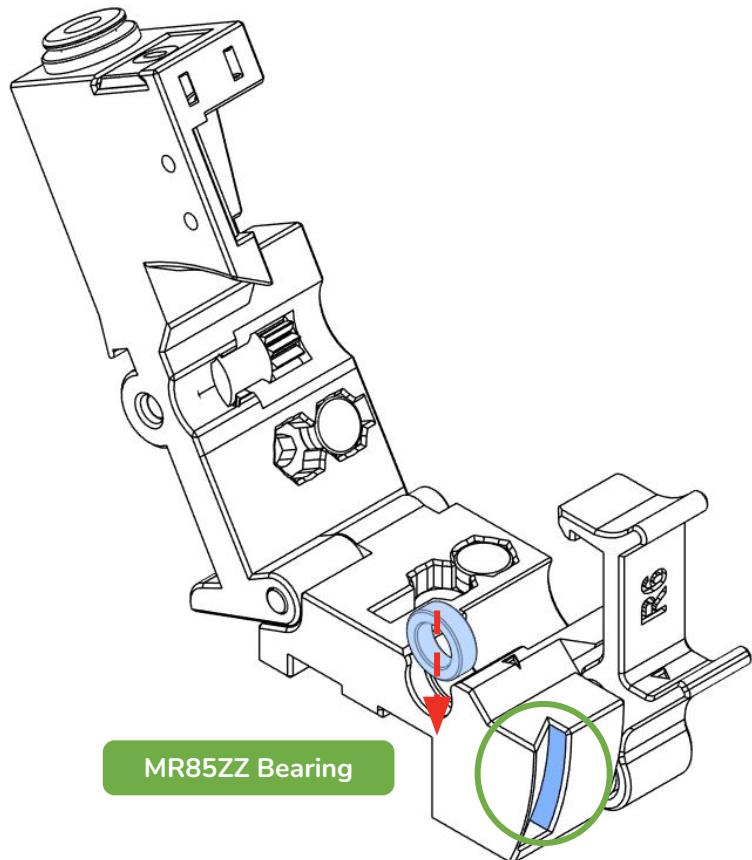
BLOCK ASSEMBLY

BLOCK ASSEMBLY

Screw the M3x20 bolt all the way flush. Then give it an extra $\frac{3}{4}$ of a turn, so that it is clamping the parts together and protruding from the side.

Work the hinge back and forth until it is smooth.

Unscrew the M3x20 bolt until it is flush again.



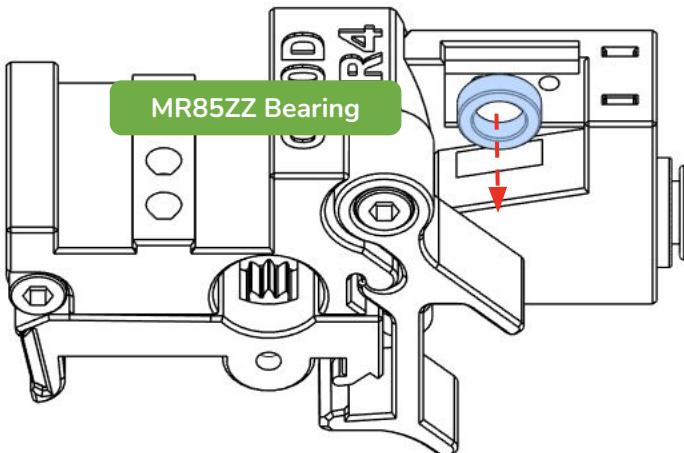
Use a screwdriver to help install the MR85ZZ bearing into its slot.

The magnets should repel each other strongly enough that the [Filament_Path](#) springs open about 10 degrees before hitting the [Latch](#). If the hinge isn't loose enough, work the hinge more.

If the interlocking fin is rubbing and creating too much friction, try lightly sanding or filing the supported surface of the [Base](#).

The block should now stay open even after being pushed shut. If it still sticks shut after following the directions here, you may need to reprint the parts with a lower extrusion multiplier.

FILAMENT BLOCKS



SENSOR INSTALL

3.5B SENSOR INSTALLATION

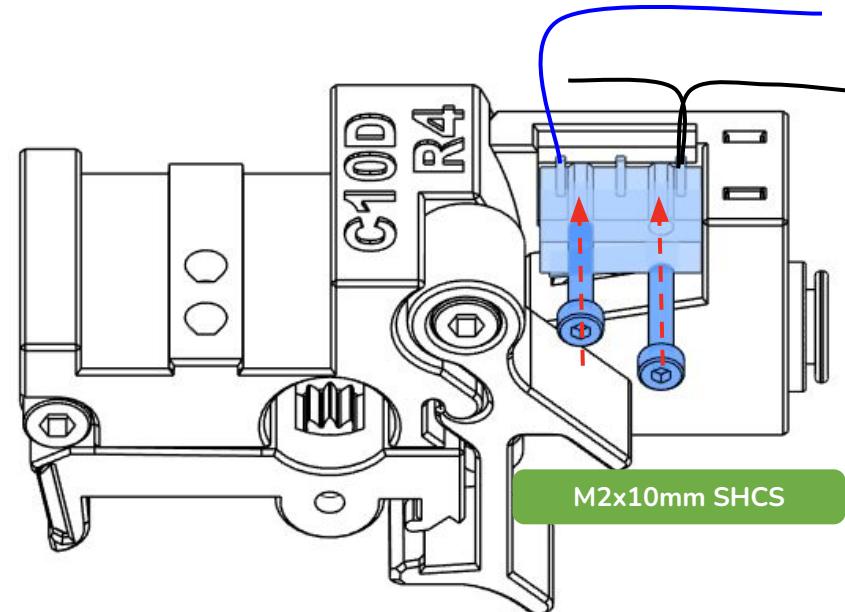
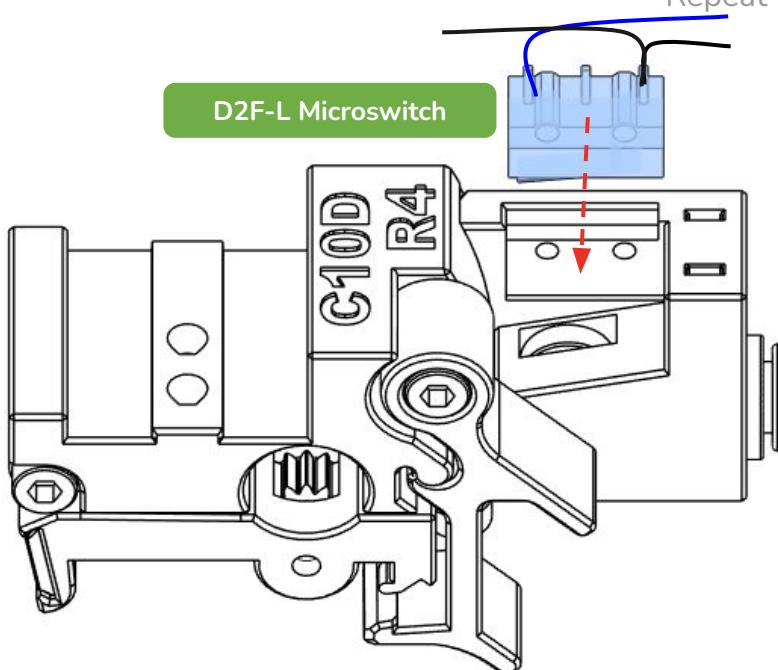
Drop an MR85ZZ bearing into the slot in the **Filament_Path**. If you are using the printed replacement lever (because your switches don't have them), install it now.

If you are using non-Omron microswitches, you may need to bend or trim the end of the lever arm to prevent it from catching on the **Base** during operation.

If you are using switches with directly soldered wires, you should wait to install them until the blocks are installed on the 2020 so that the wires aren't strained.

Align a D2F-L microswitch and install it into place using two M2x10mm screws tapped into the plastic. They only need to be tight enough to keep the microswitch in place.

Repeat for all of the **Filament_Paths**.

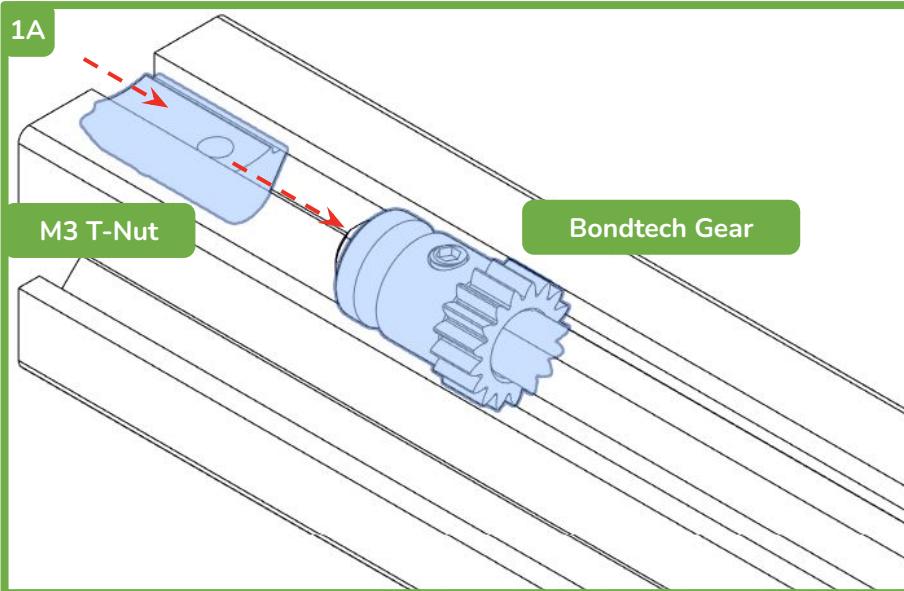


WIRING LENGTHS

The list of pages with wiring lengths is on [Page 27](#).

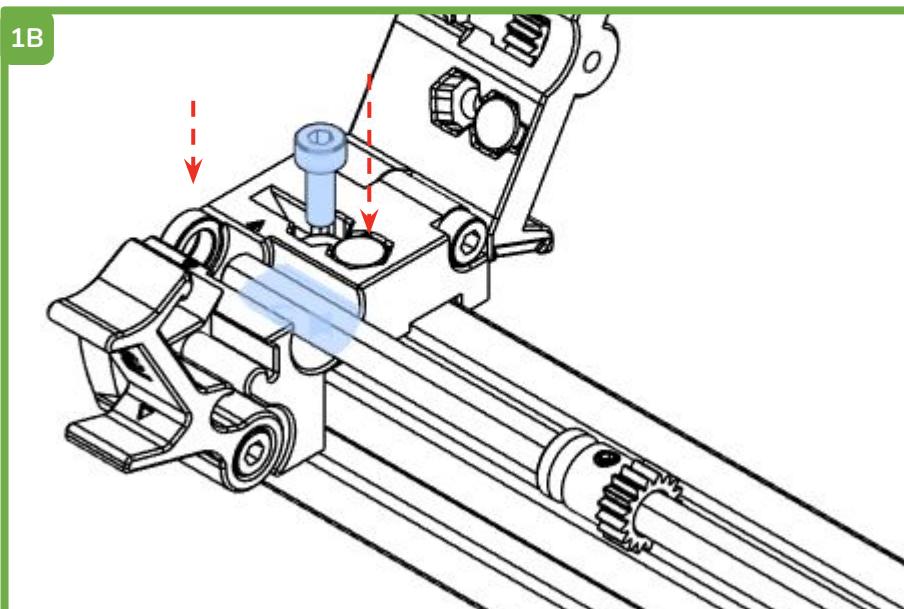
FILAMENT BLOCKS

FILAMENT BLOCK ARRAY ASSEMBLY (METHOD 1)



1A. PREPARATION

Slide a Bondtech gear onto the D-Cut shaft. Be aware of its orientation, gear side first. Then slide a roll-in T Nut into the top channel of the 2020 extrusion, with the M3 mounting hole toward the Gearbox.

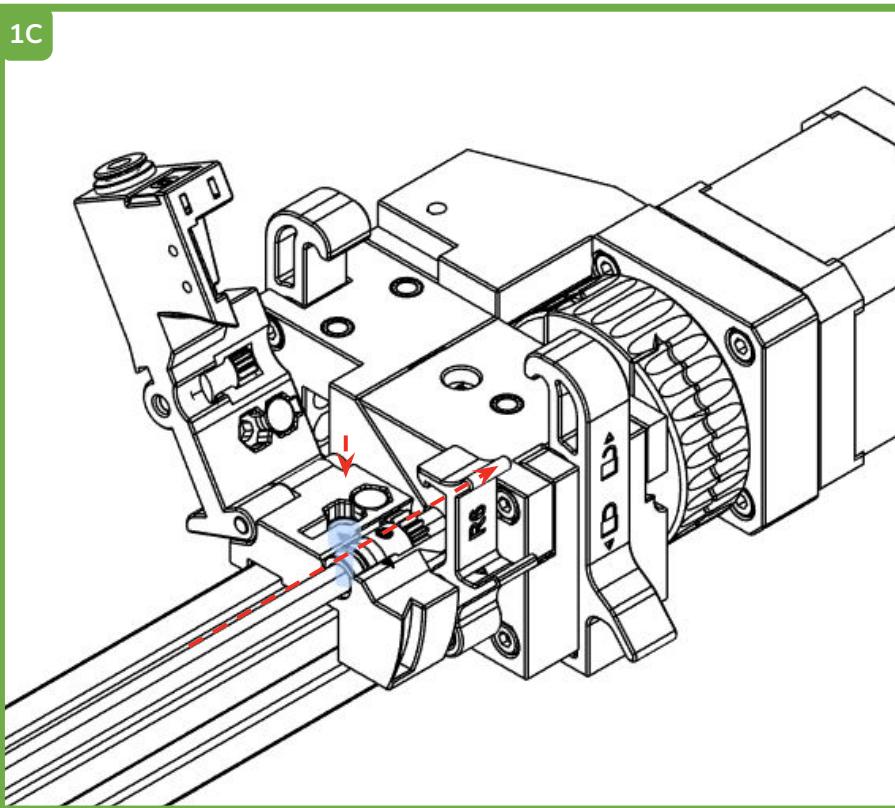


1B. BLOCK INSTALLATION

Slide the assemble Block onto the 2020. Line the Drive Shaft up with the MR85ZZ bearing first, then align the roll-in nut with the mounting hole, and secure the block using an M3x8mm SHCS.

FILAMENT BLOCKS

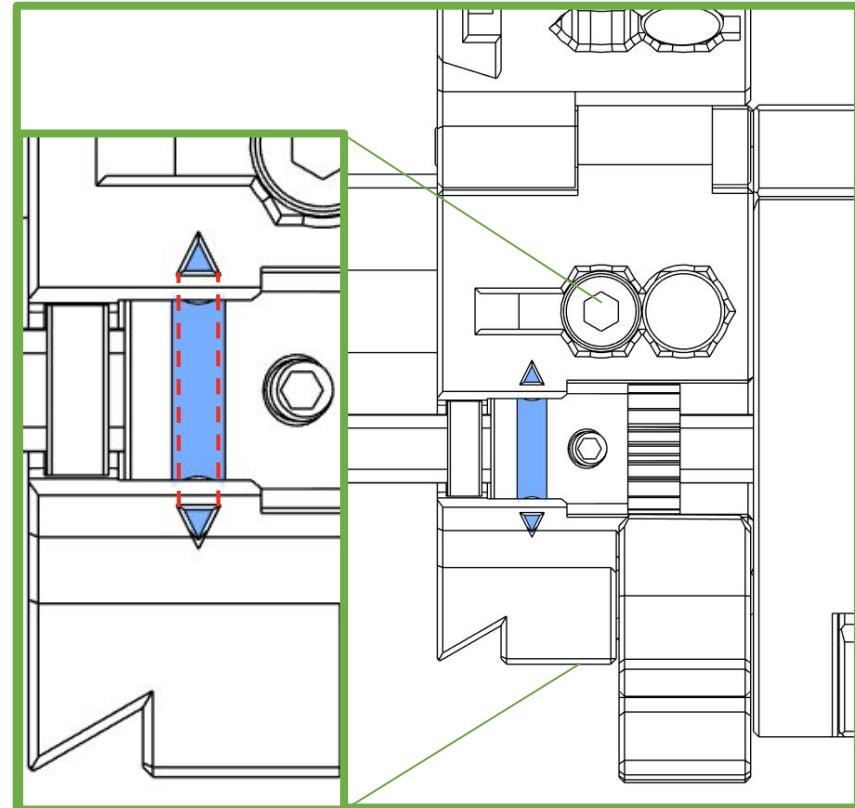
FILAMENT BLOCK ARRAY ASSEMBLY (METHOD 1)



1C. BASE MOUNTING

Push the Bondtech gear and **Base** to the Gearbox. The Drive Shaft should be able to spin freely.

Push the block snugly against the Gearbox and tighten the M3x8mm mounting screw to secure it.



1D. BMG GEAR POSITIONING

Carefully align the BMG gear with the markings on the Base. This is the only alignment step, so take care.

Use thread locker and snug the set screws on the BMG gear to secure them.

Repeat these 4 steps for all of the Filament Blocks.

FILAMENT BLOCKS

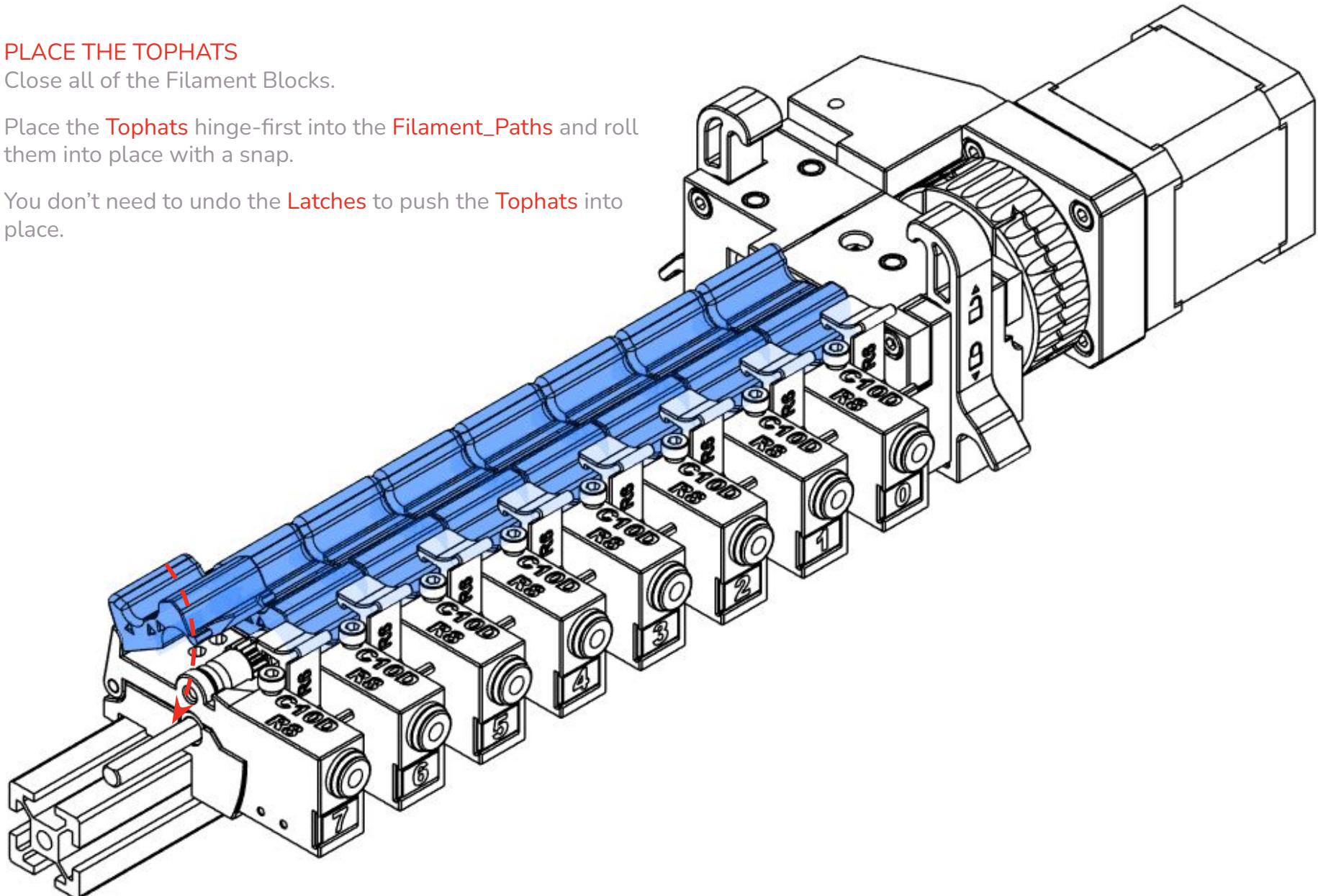
PLACE TOPHATS

PLACE THE TOPHATS

Close all of the Filament Blocks.

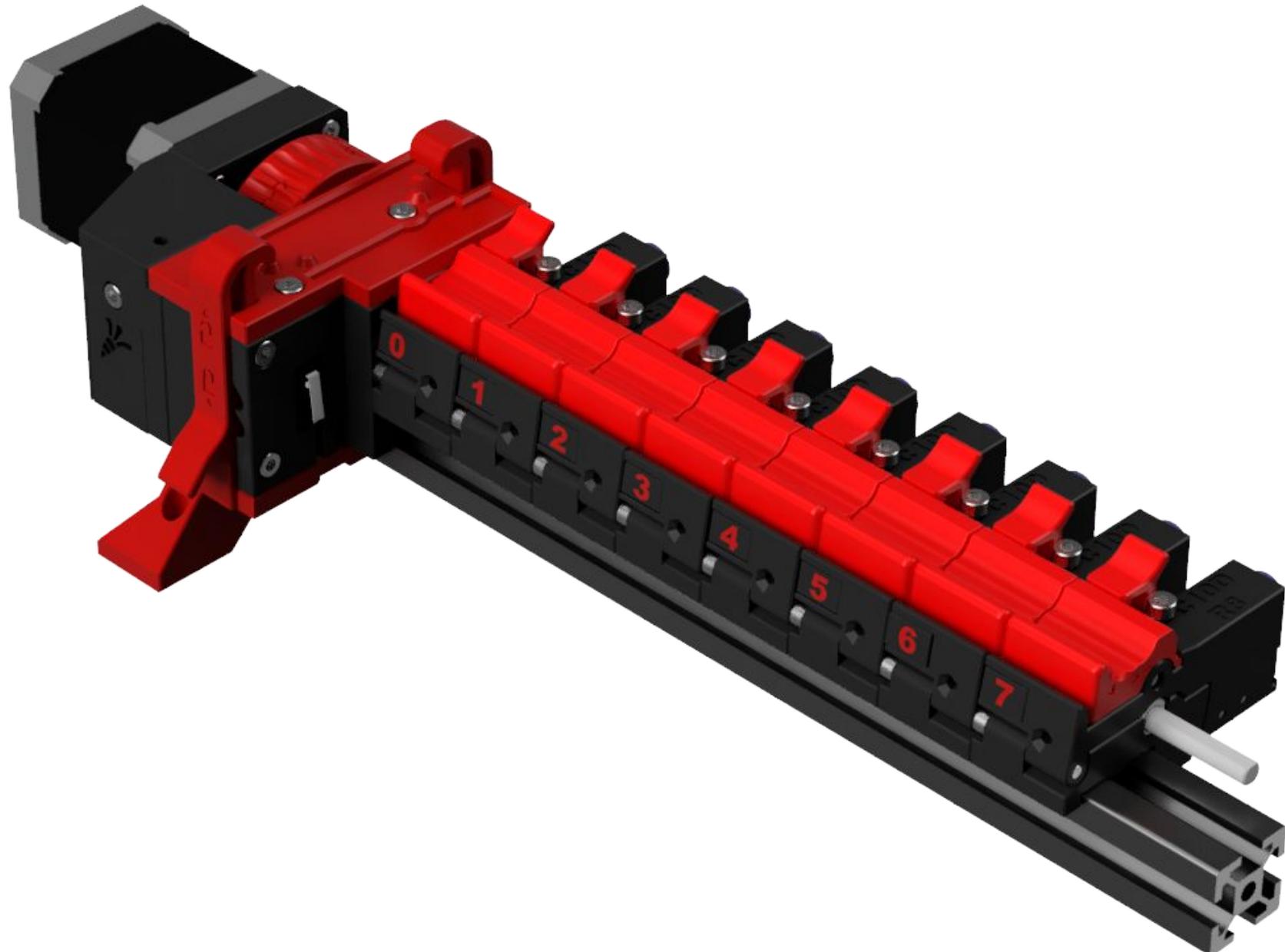
Place the **Tophats** hinge-first into the **Filament_Paths** and roll them into place with a snap.

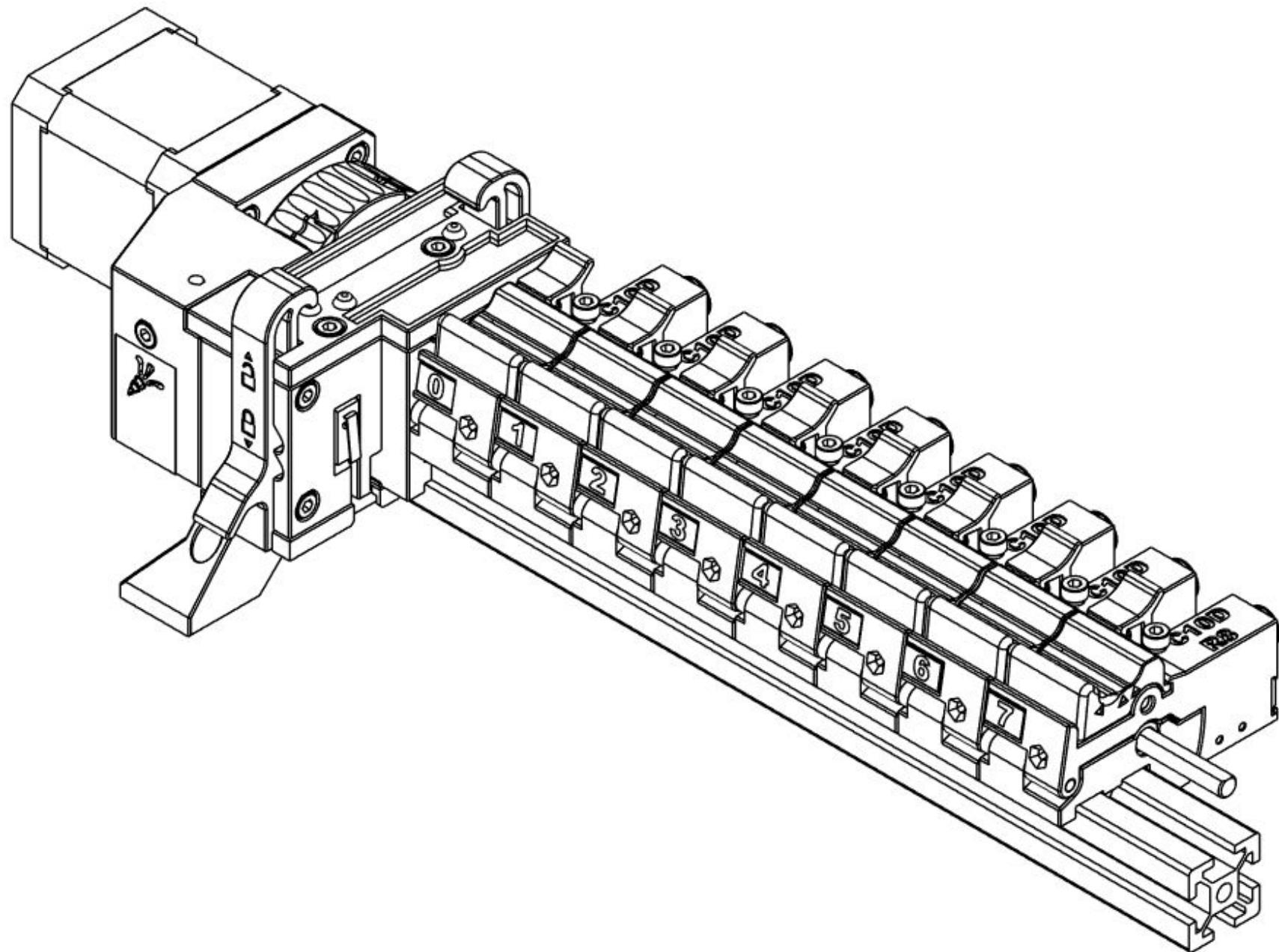
You don't need to undo the **Latches** to push the **Tophats** into place.



Surface finish can be improved by using multi-material techniques. Some materials are better suited for creating smooth, detailed surfaces, while others provide strength or flexibility. By mixing materials, the final product can have both an excellent surface finish and desirable mechanical properties.

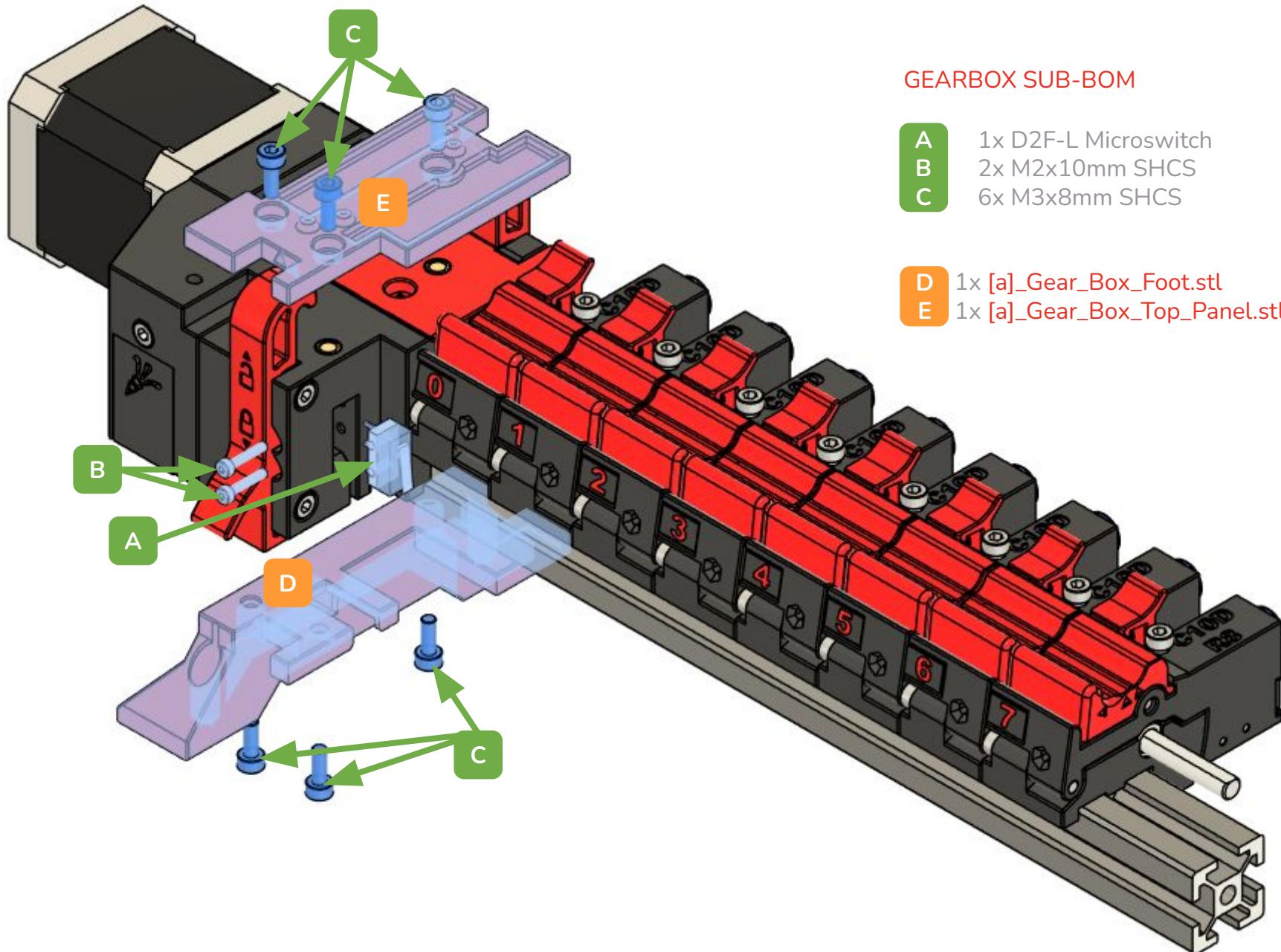
One example of this is a part made out of glass-fiber reinforced ABS, with a cosmetic outer shell of red ABS.

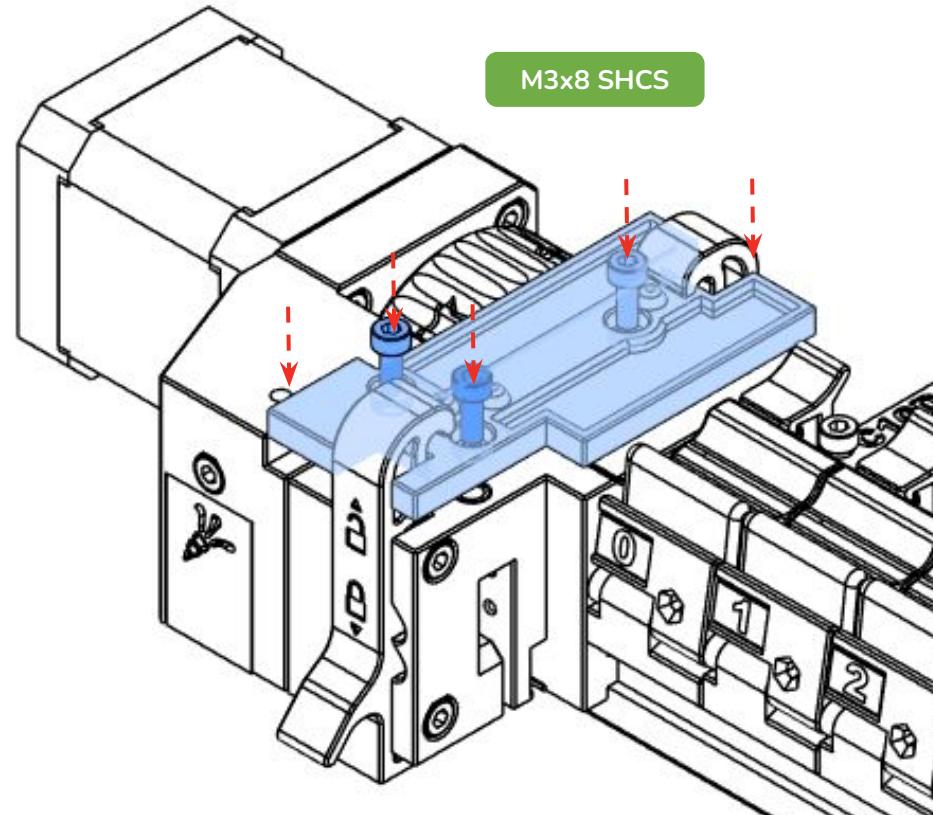




GEARBOX PART 2

EXPLODED VIEW





[a]_Gear_Box_Top_Panel

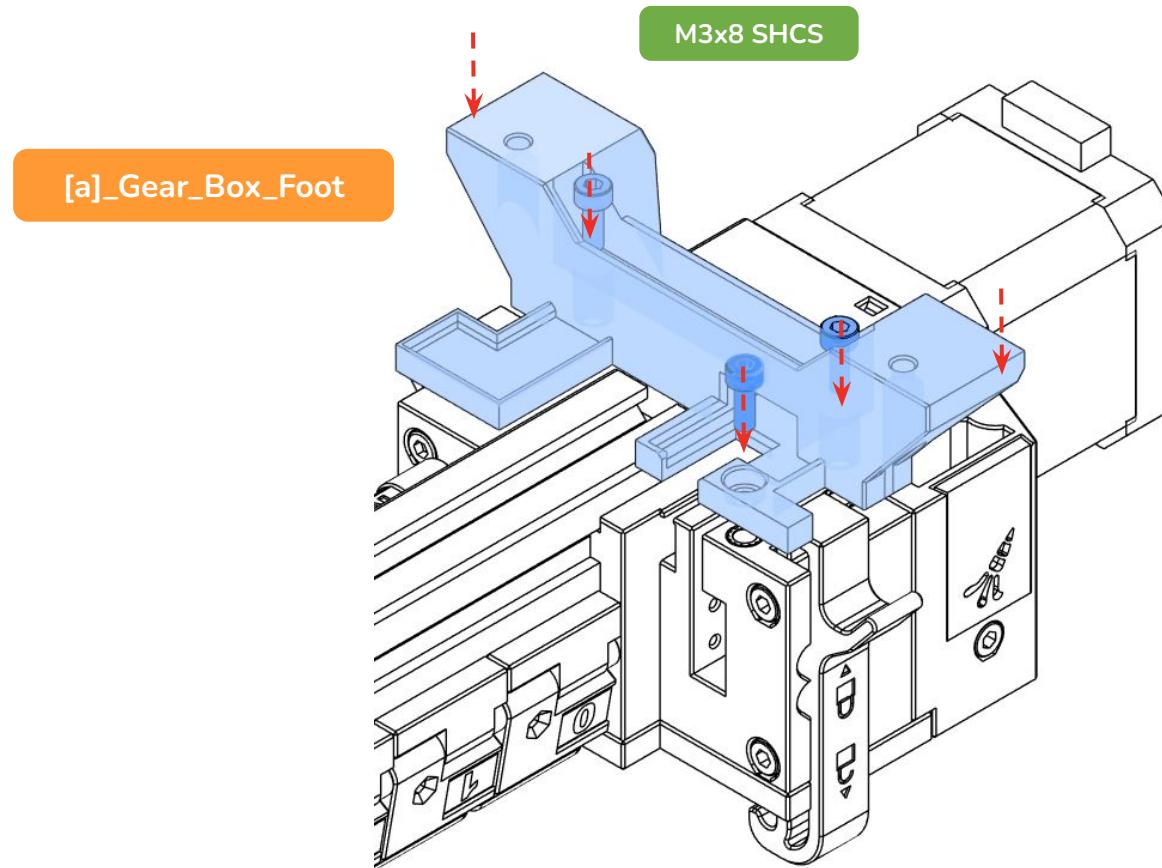
M3x8 SHCS

4.1 TOP PANEL

Install the [Gear_Box_Top_Panel](#) of the Gearbox using 3 M3x8mm screws.

GEARBOX PART 2

FOOT



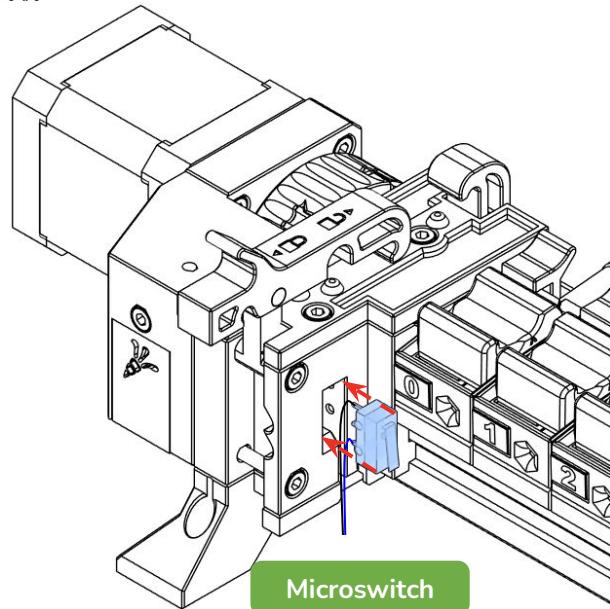
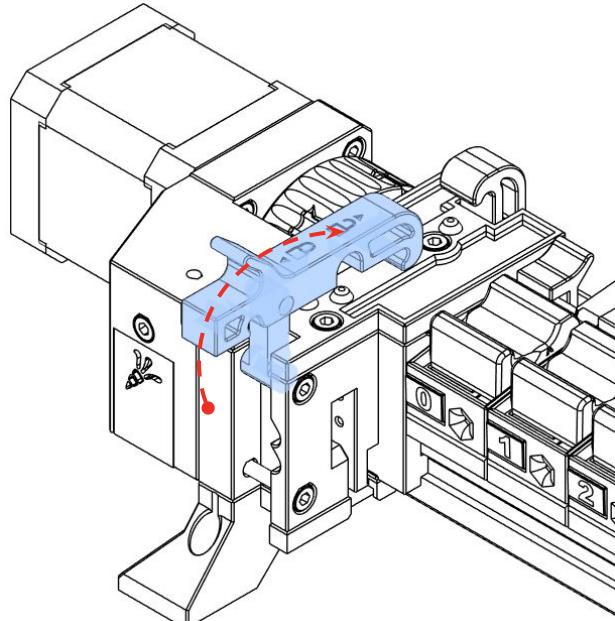
4.2 INSTALL THE FOOT

Align the **Gear_Box_Foot** with the **Gearbox**.

Use three M3x8mm bolts to secure the **Gear_Box_Foot**.

Wires are omitted from the diagrams for clarity.

GEARBOX PART 2



1.1 WIRING LENGTHS

The list of pages with wiring lengths is on [Page 27](#).

ENDSTOP SWITCH

4.3 INSTALL THE ENDSTOP SWITCH

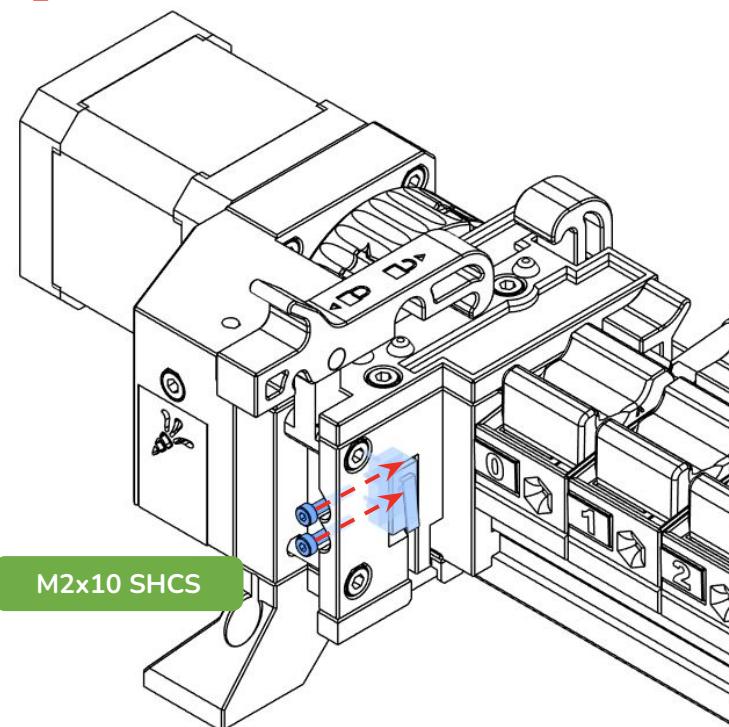
Open the [Side_Latch](#) and swing it up and out of the way.

There is a cutout in the [Gearbox](#) for the microswitch and its' wires. Line up the microswitch with the cutout as shown.

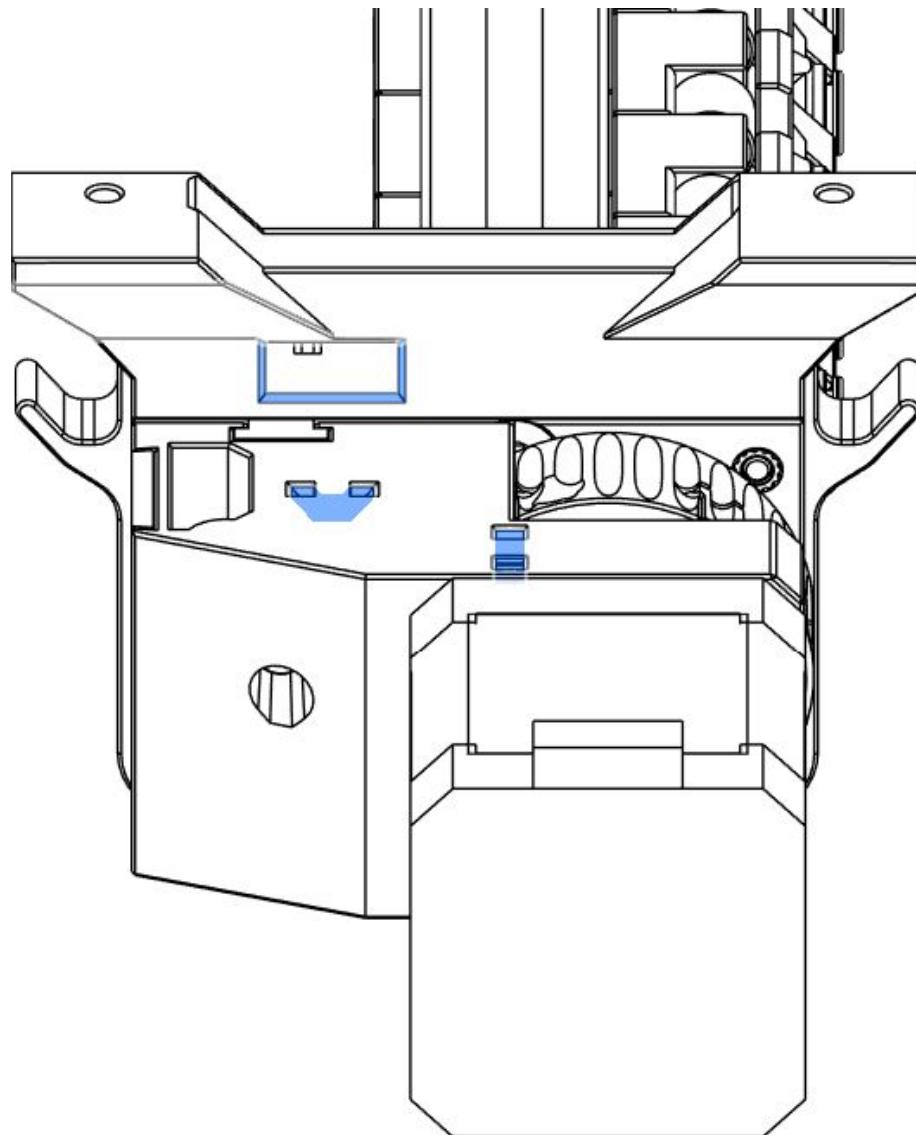
Push the microswitch into its cutout. Route the wires into the slot. The slot is sized to accept wires up to 16ga.

Insert two M2x10mm bolts and drive them through the microswitch into the [Gearbox](#). They only need to be snug enough to hold the microswitch.

Close the [Side_Latch](#).



GEARBOX PART 2



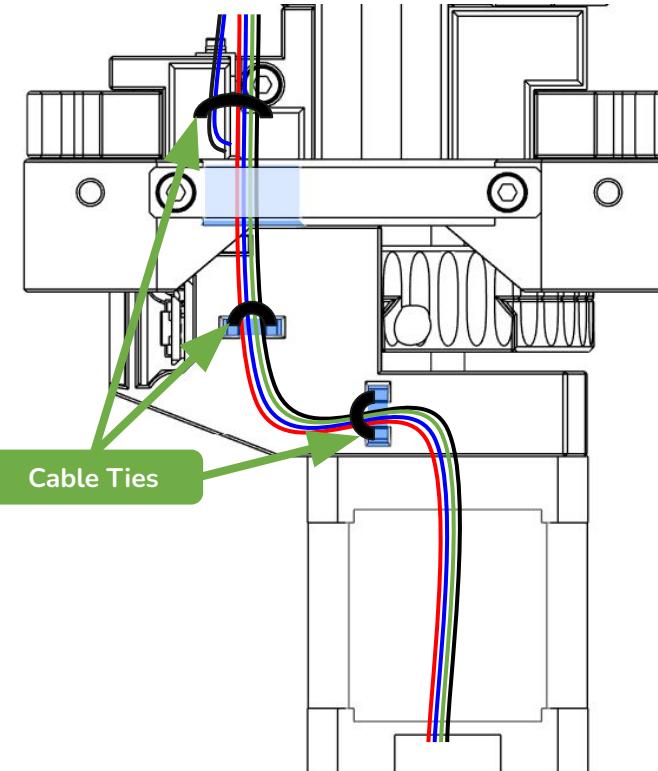
CABLE MANAGEMENT

CABLE MANAGEMENT

There is a cutout in the **Gear_Box_Foot** for the motor wires to fit through. Start by feeding the motor wiring through that cutout.

There are two cable tie slots on the bottom of the **Motor_Mount**. Use cable ties to secure the motor wiring to both of the slots. Don't skip this step - this is to prevent the motor wiring from getting wrapped onto the Drive Shaft.

Optionally, use a cable tie to bundle together the Endstop wires with the motor wires. This is just for neatness.



WIRING LENGTHS

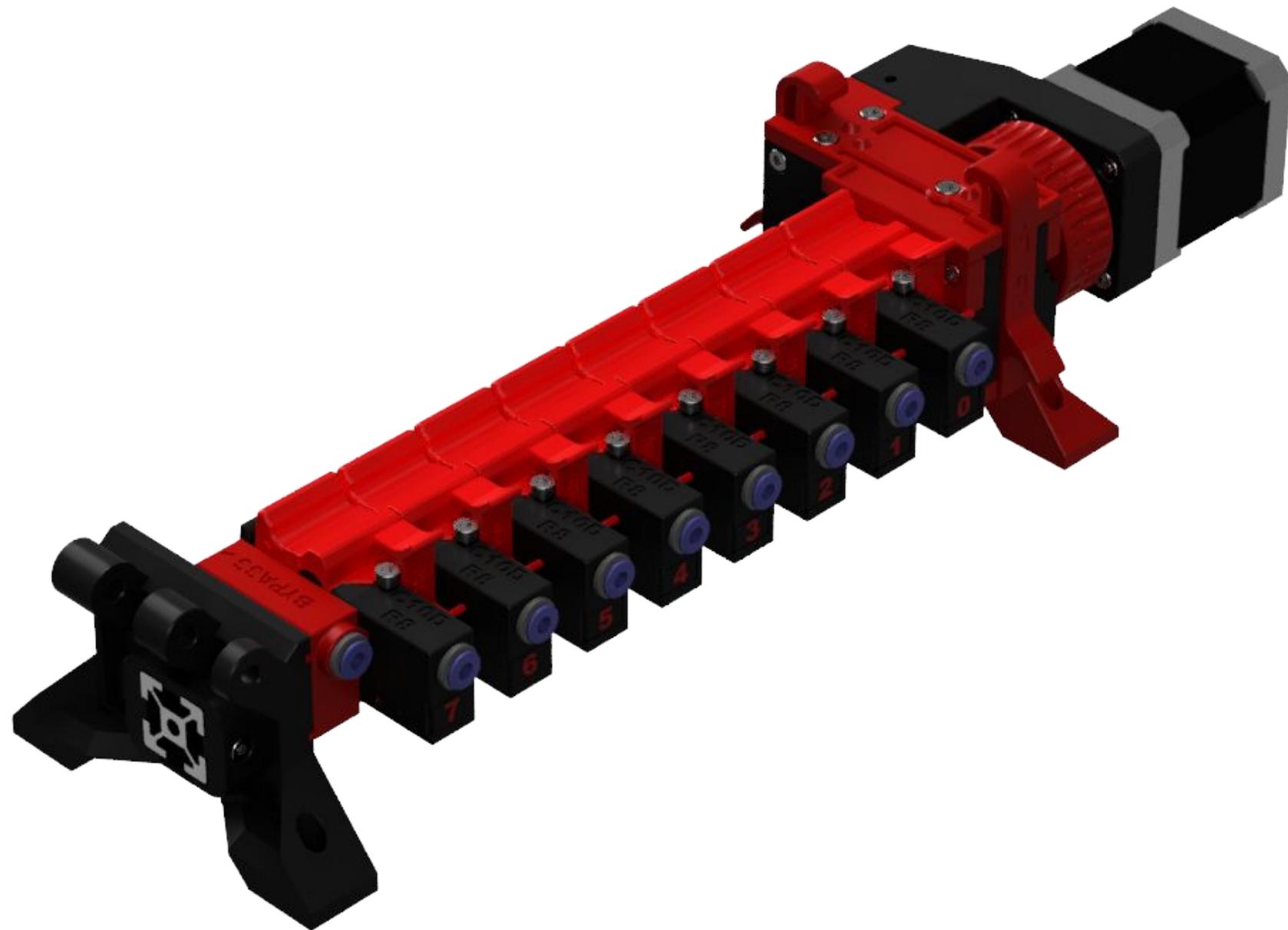
The list of pages with wiring lengths is on [Page 27](#).

Support structures benefit from multi-material printing. In multi-material setups, one material can be used for the object itself and another for supports, such as water-soluble PVA, which can be dissolved away after printing, leaving cleaner results.

Another option is to use materials that do not bond together as supports, such as PLA supports with PETG objects.

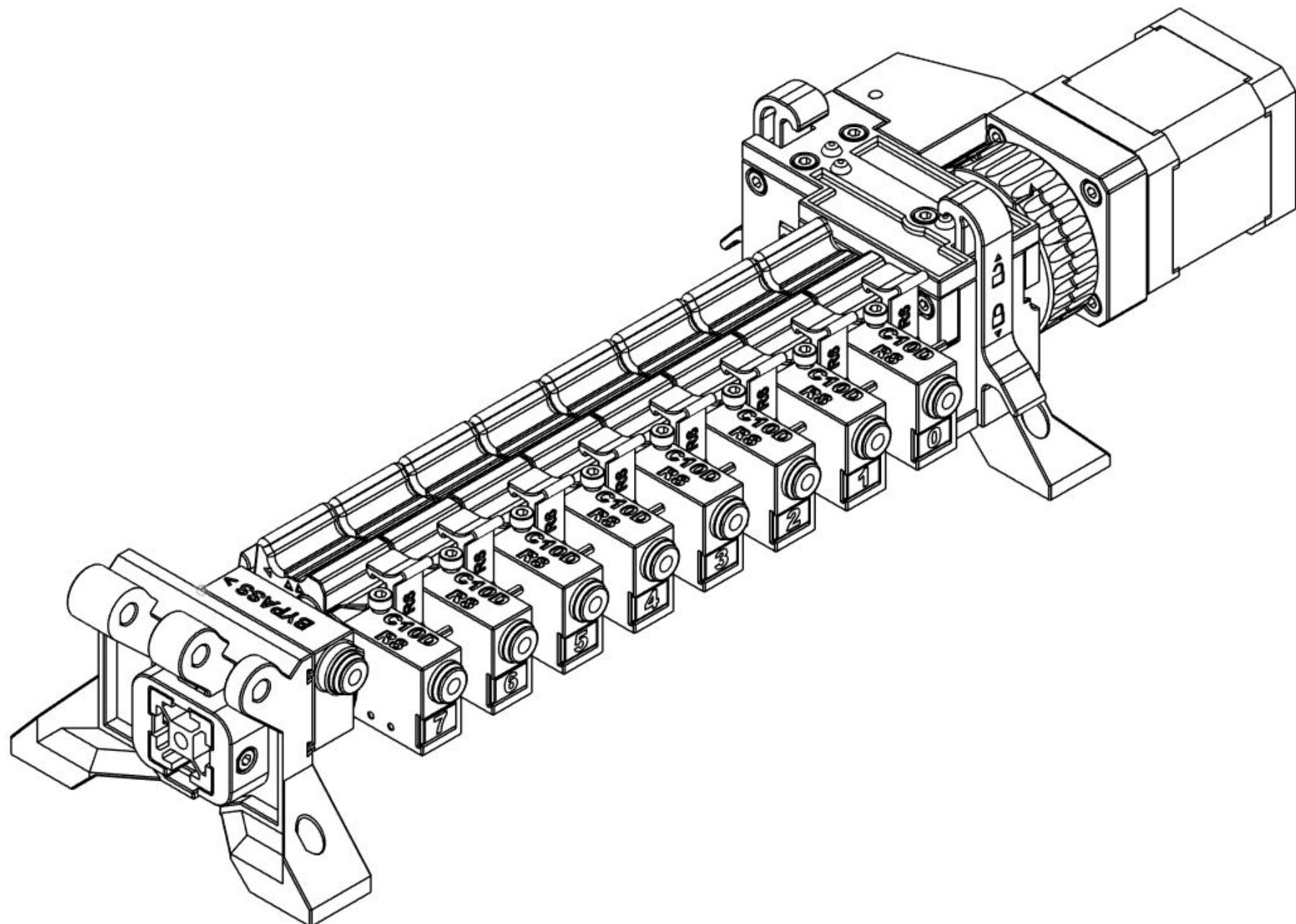
END BLOCK

OVERVIEW



END BLOCK

OVERVIEW



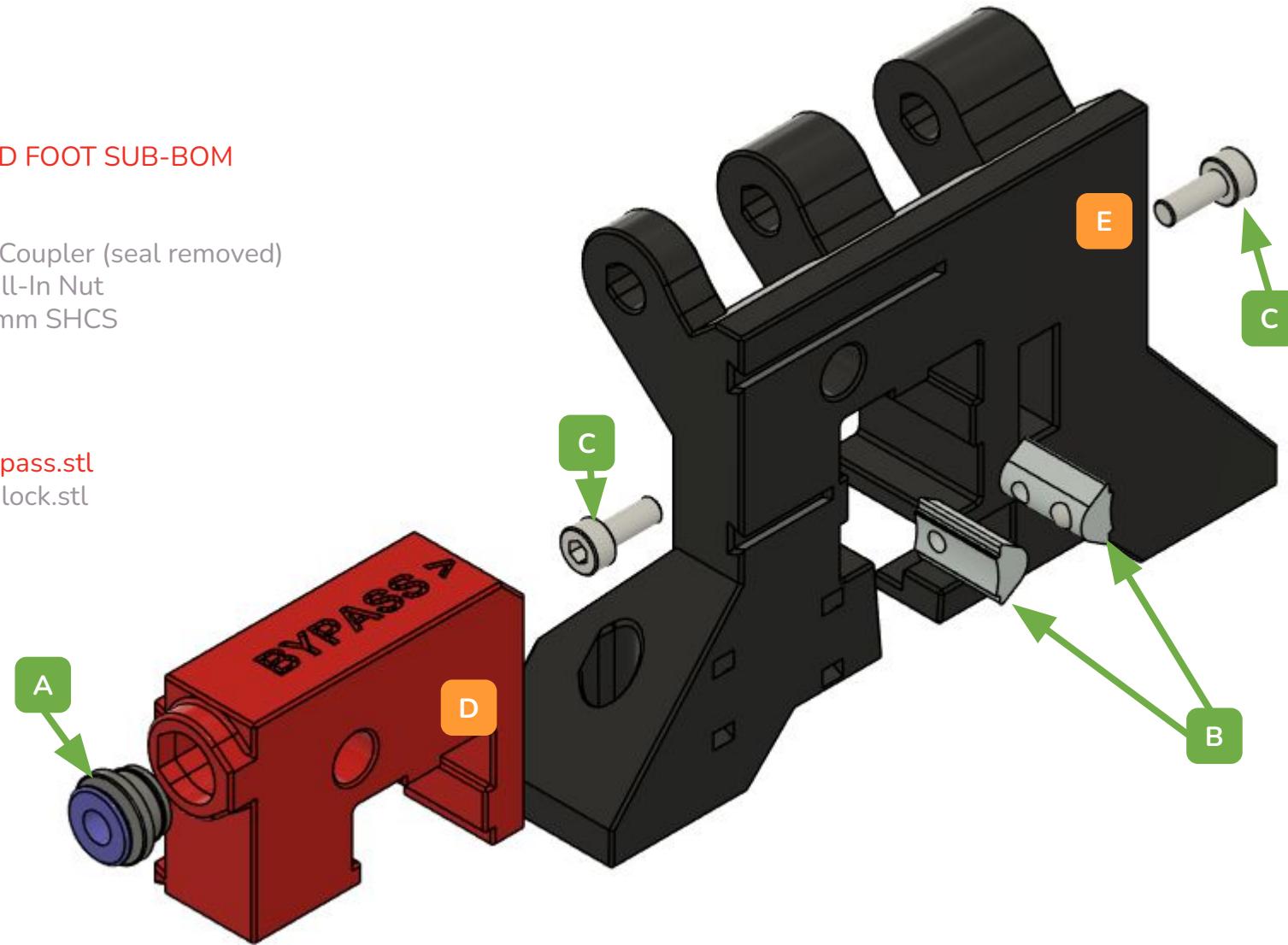
END BLOCK

EXPLODED VIEW

END BLOCK AND FOOT SUB-BOM

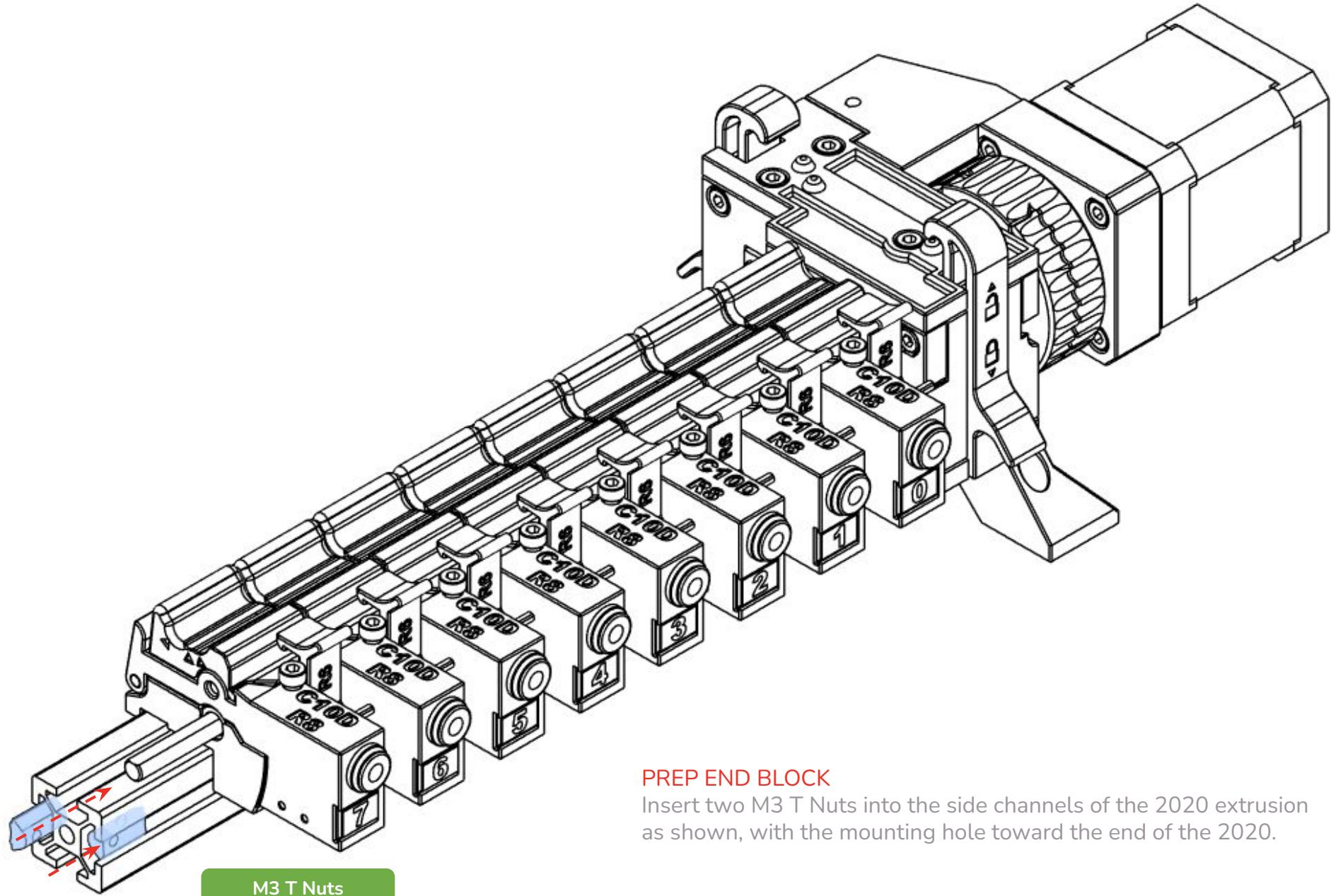
- A 1x ECAS Coupler (seal removed)
- B 2x M3 Roll-In Nut
- C 2x M3x8mm SHCS

- D 1x [a]_Bypass.stl
- E 1x End_Block.stl



END BLOCK

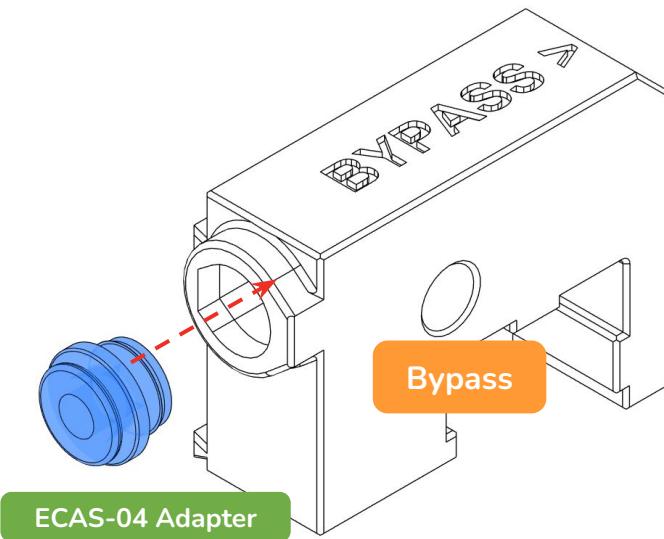
PREP END BLOCK



PREP END BLOCK

Insert two M3 T Nuts into the side channels of the 2020 extrusion as shown, with the mounting hole toward the end of the 2020.

END BLOCK



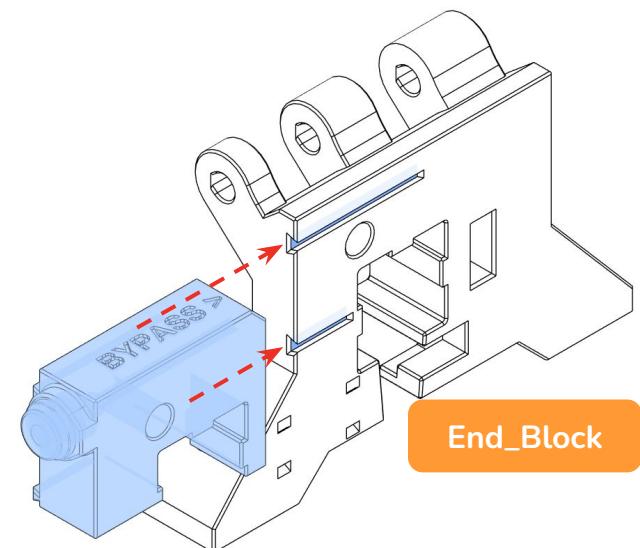
INSTALL END BLOCK

5.2 PREP BYPASS

Remove the rubber seal from the ECAS-04 adapter and then Insert it into the **Bypass**.

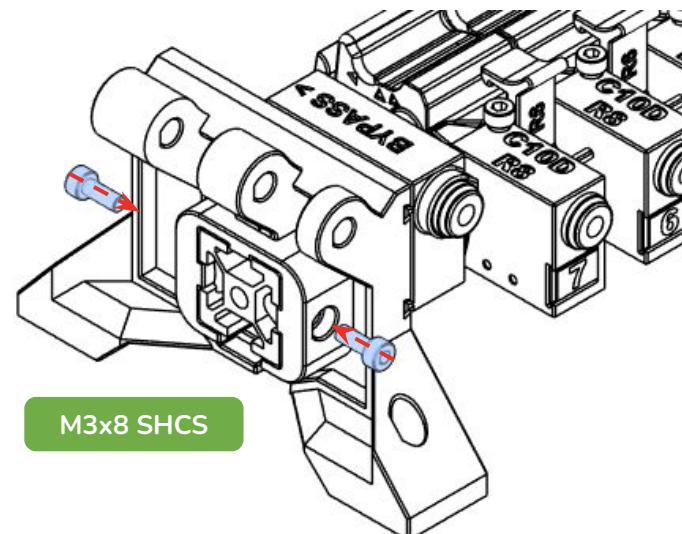
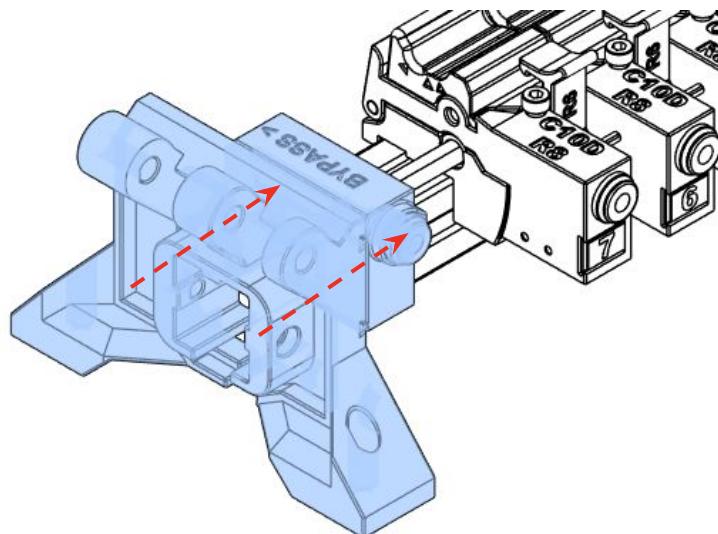
Slide the **Bypass** dovetails into the **End_Block** slots.

The **Bypass** dovetails are very sensitive to your printer's tuning, particularly the extrusion multiplier, and the layer cooling time / fan settings. If you are having trouble printing this part, start there.



INSTALL END BLOCK

Slide the **End_Block** assembly onto the 2020 and secure with 2 M3x8 SHCS screws.



Different material properties can improve functionality in a single print. Combining rigid and flexible materials, for instance, allows for integrated hinges, gaskets, or soft-touch surfaces, reducing the need for assembly in complex mechanical parts.

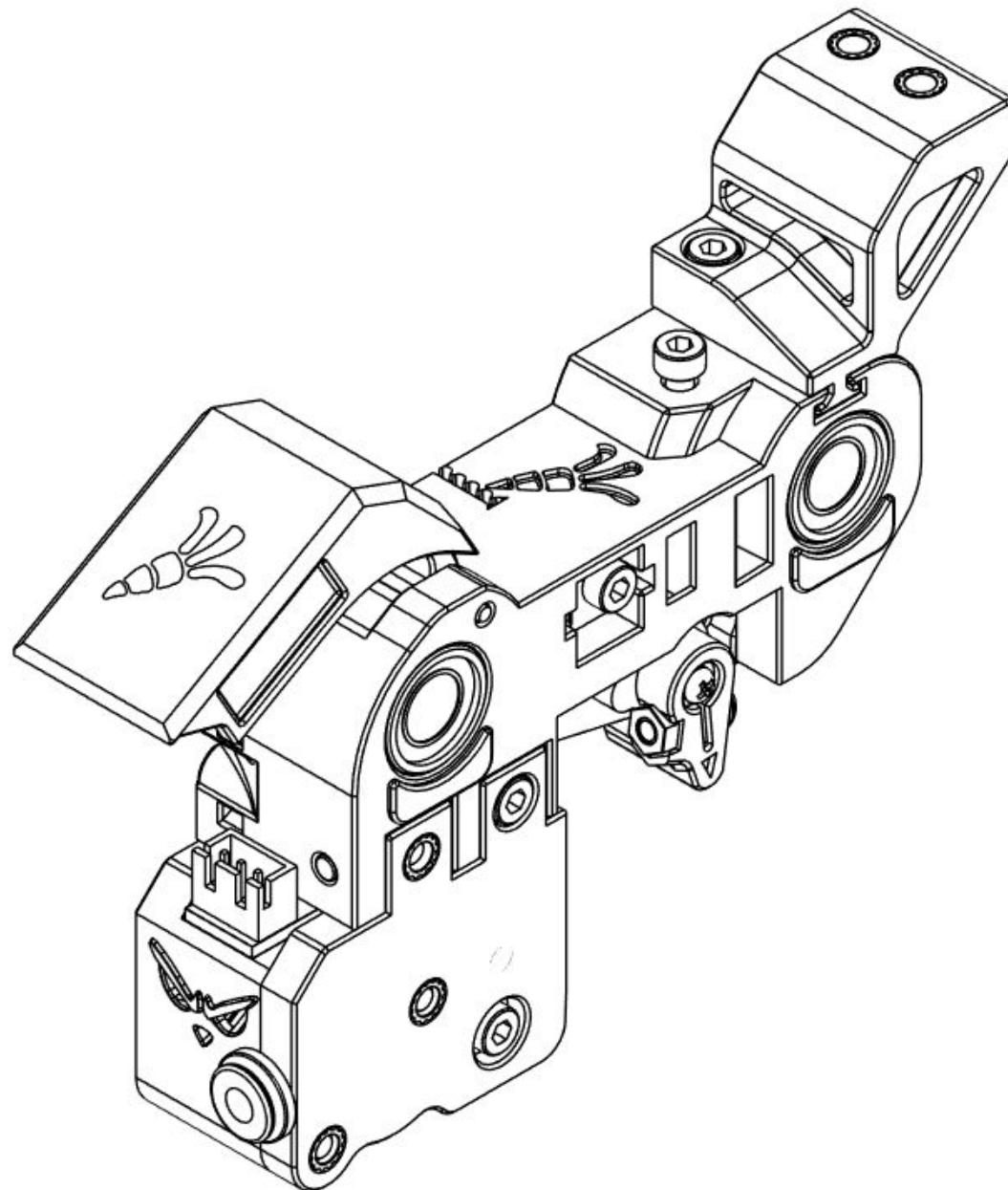
SELECTOR

OVERVIEW



SELECTOR

OVERVIEW



SELECTOR

SELECTOR SUB-BOM

A
B
C
D
E
F
G
H
I

- 2x 3x2mm Magnet
- 1x 6x12x1mm Spring
- 2x LM8UU*
- 2x M2x8mm SHCS
- 5x M3 Threaded Inserts
- 1x M3x8mm SHCS
- 1x M3x12mm SHCS
- 1x M3x20mm SHCS
- 1x Servo**

*Plastic bearings such as RJ4JP-01-08 are not suitable for this use.

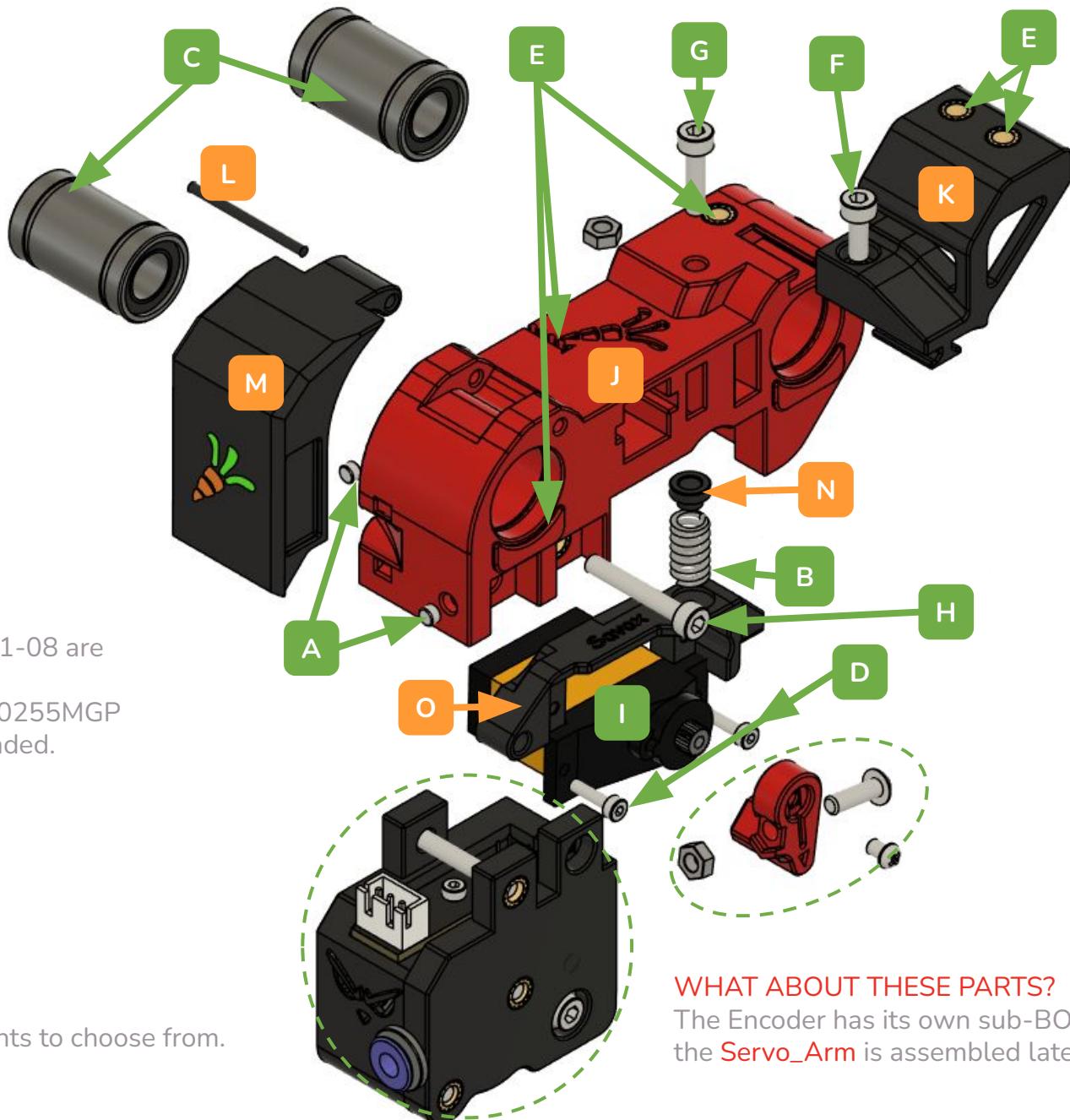
**Do not use MG90S! SAVOX SH0255MGP or Guo Hua A0090 are recommended.

J
K
L
M
N
O

- 1x [a]_Selector_Cart.stl
- 1x Drag_Chain_Anchor.stl †
- 1x Piece of Filament
- 1x Selector_Door.stl
- 1x Selector_Spring_Cap.stl
- 1x Servo_Mount_XXX.stl***

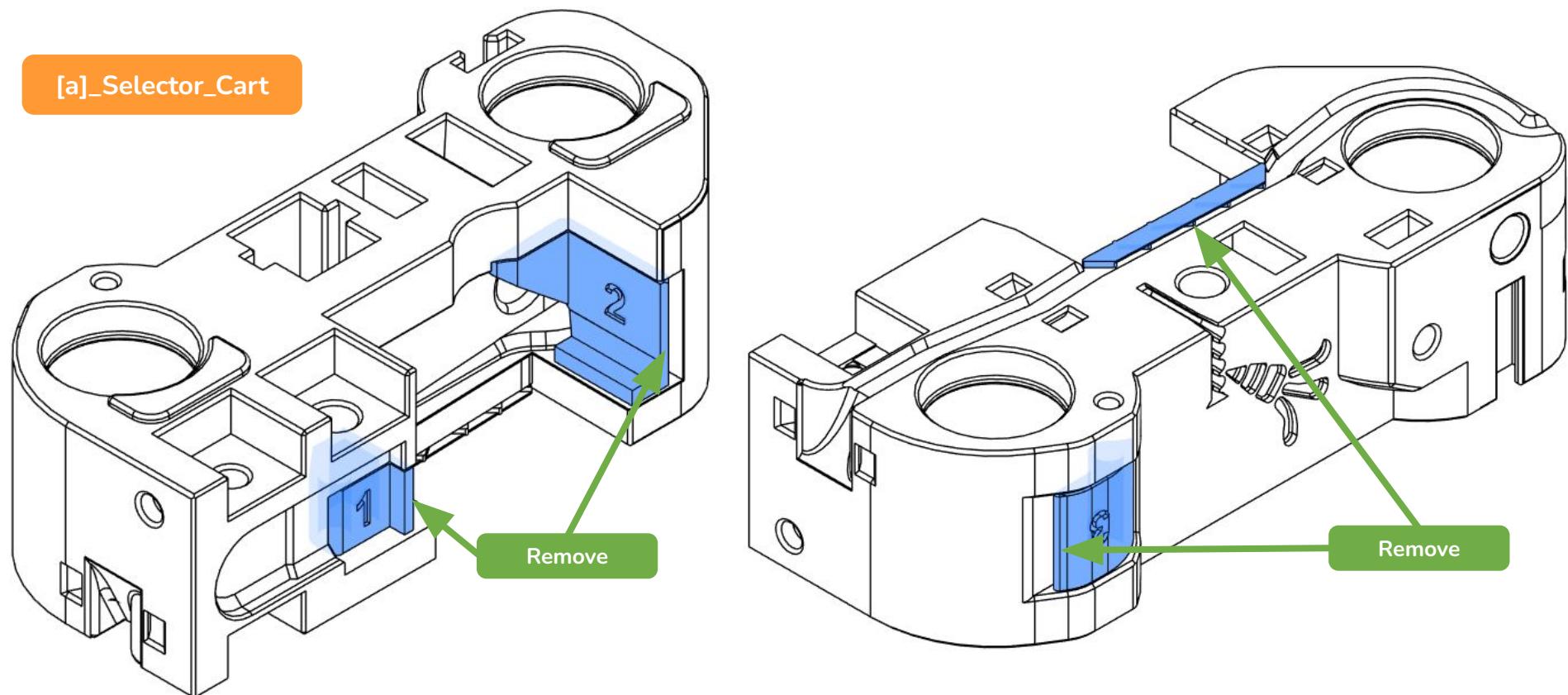
***There are multiple servo mounts to choose from.

EXPLODED VIEW



WHAT ABOUT THESE PARTS?

The Encoder has its own sub-BOM, and the **Servo_Arm** is assembled later.



6.1 REMOVE BUILT-IN SUPPORTS

Use a small tool, like a small flathead screwdriver, to carefully remove the built-in supports. Be careful not to hurt yourself.

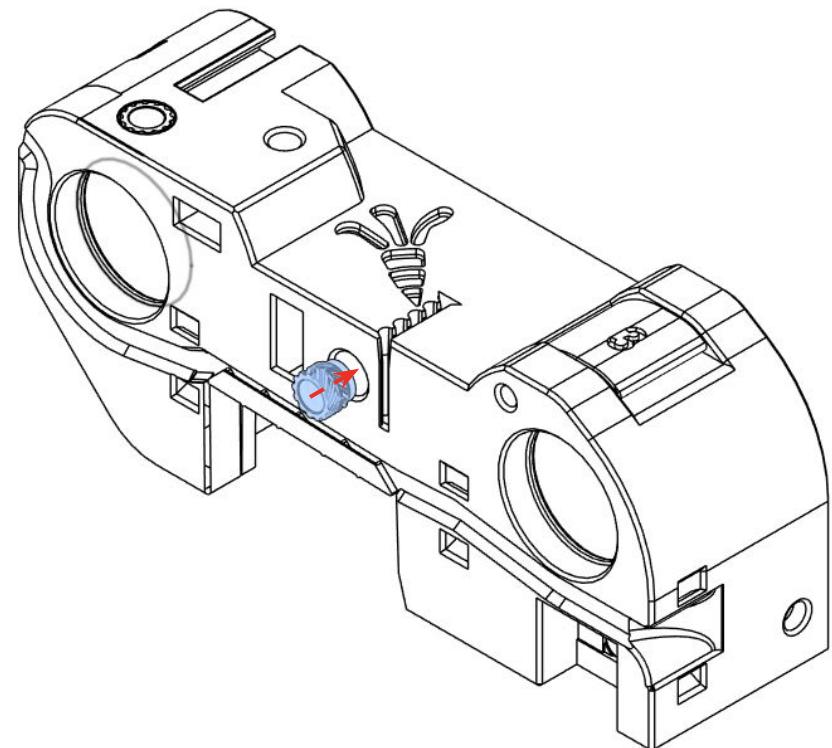
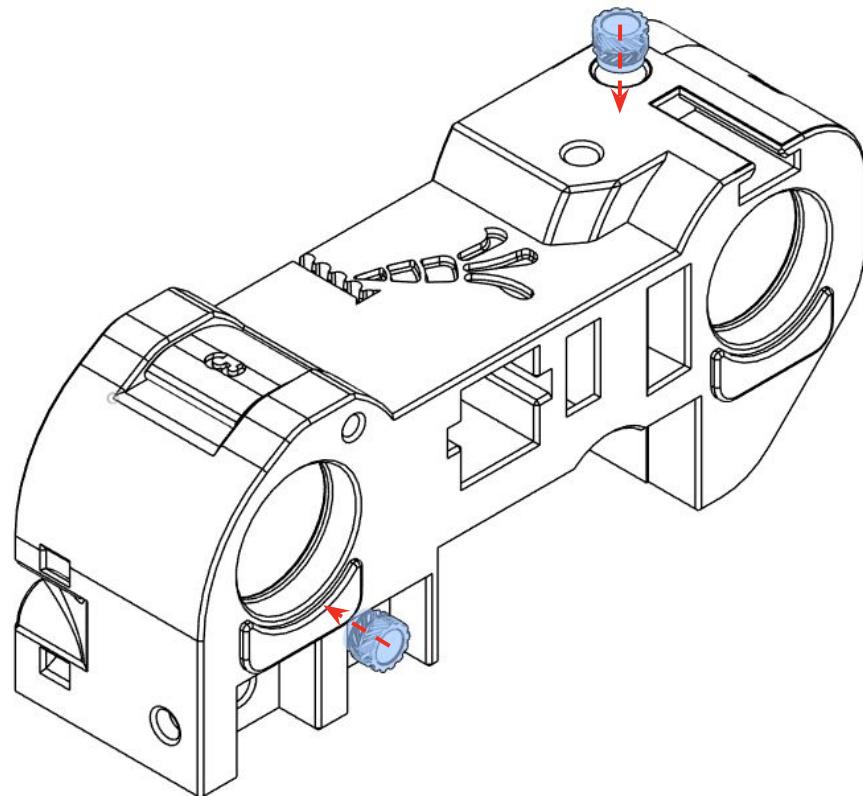
Check the supported surfaces for stuck support or loose bridges, and clean them up if needed.

SELECTOR

SELECTOR CART HEATSET INSERTS

6.1 HEATSET INSERTS

The list of pages with heatset inserts is on [Page 19](#).



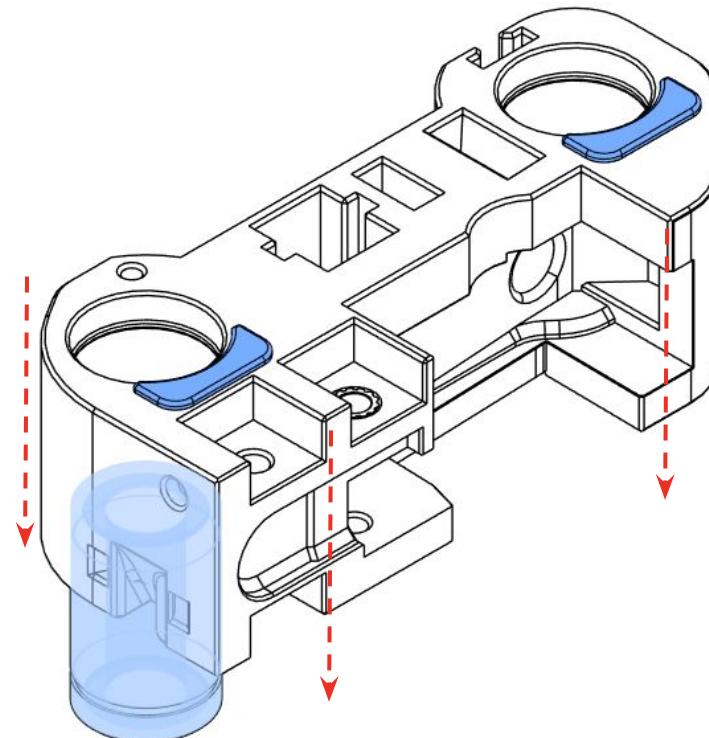
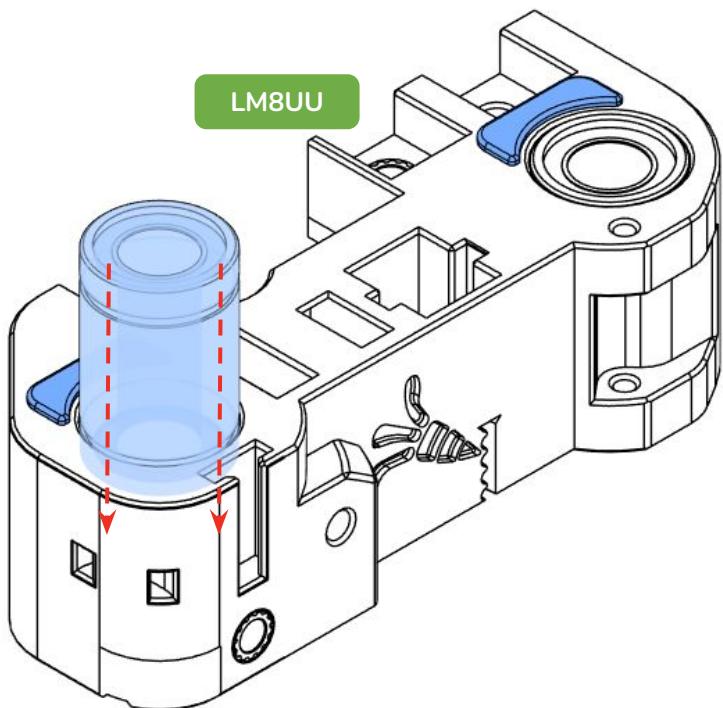
M3 Heatset Inserts

SELECTOR

SELECTOR CART BEARINGS

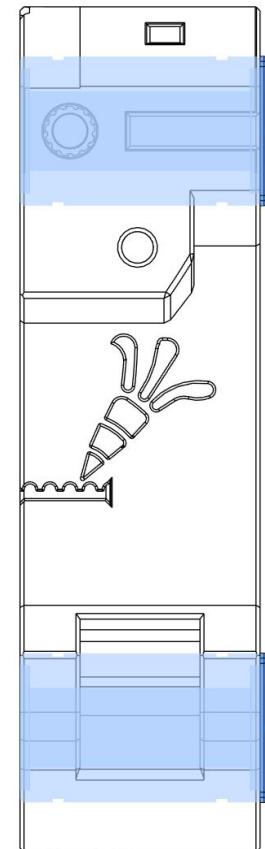
6.1 BEARING INSERTION

Using a soft jaw vice or flat object, carefully press-fit the bearings into their holes, starting from the print bed side of the [Selector_Cart](#). They should be flush with the both sides of the [Selector_Cart](#).



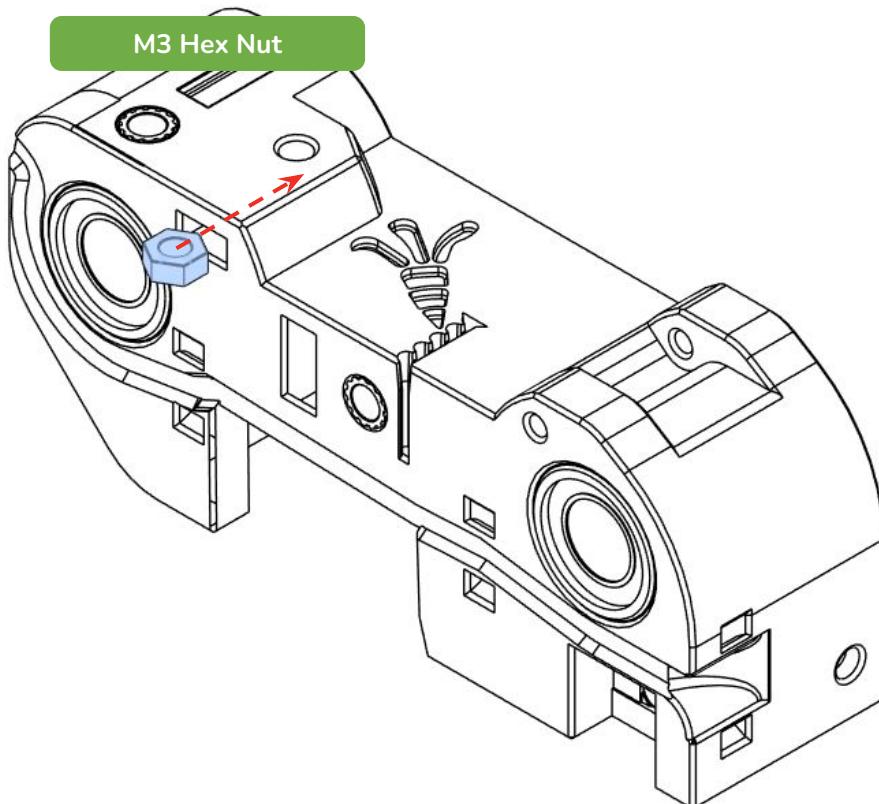
We specify a soft-jaw vice so that the bumper features are not marred. They are used to deliberately hit the end of travel, in order to automatically measure the Selector limits.

To remove the bearings, use a round, hard tool that is at or just under 15mm in diameter, such as a wrench socket, as a punch to ram out the bearings.



SELECTOR

SELECTOR CART HEX NUT



6.1 HEX NUT INSERTION

Using a pair of pliers, insert the hex nut point-first. Once the nut is partially inserted, switch to an Allen wrench or small flathead screwdriver to fully insert the nut.

If the nut is resisting being fully inserted, use a 2.0 or 2.5mm hex driver, or small flathead screwdriver to carefully pry it into place. Once it is nearly seated, drive any M3 hardware into the nut to pull it into position.

SELECTOR

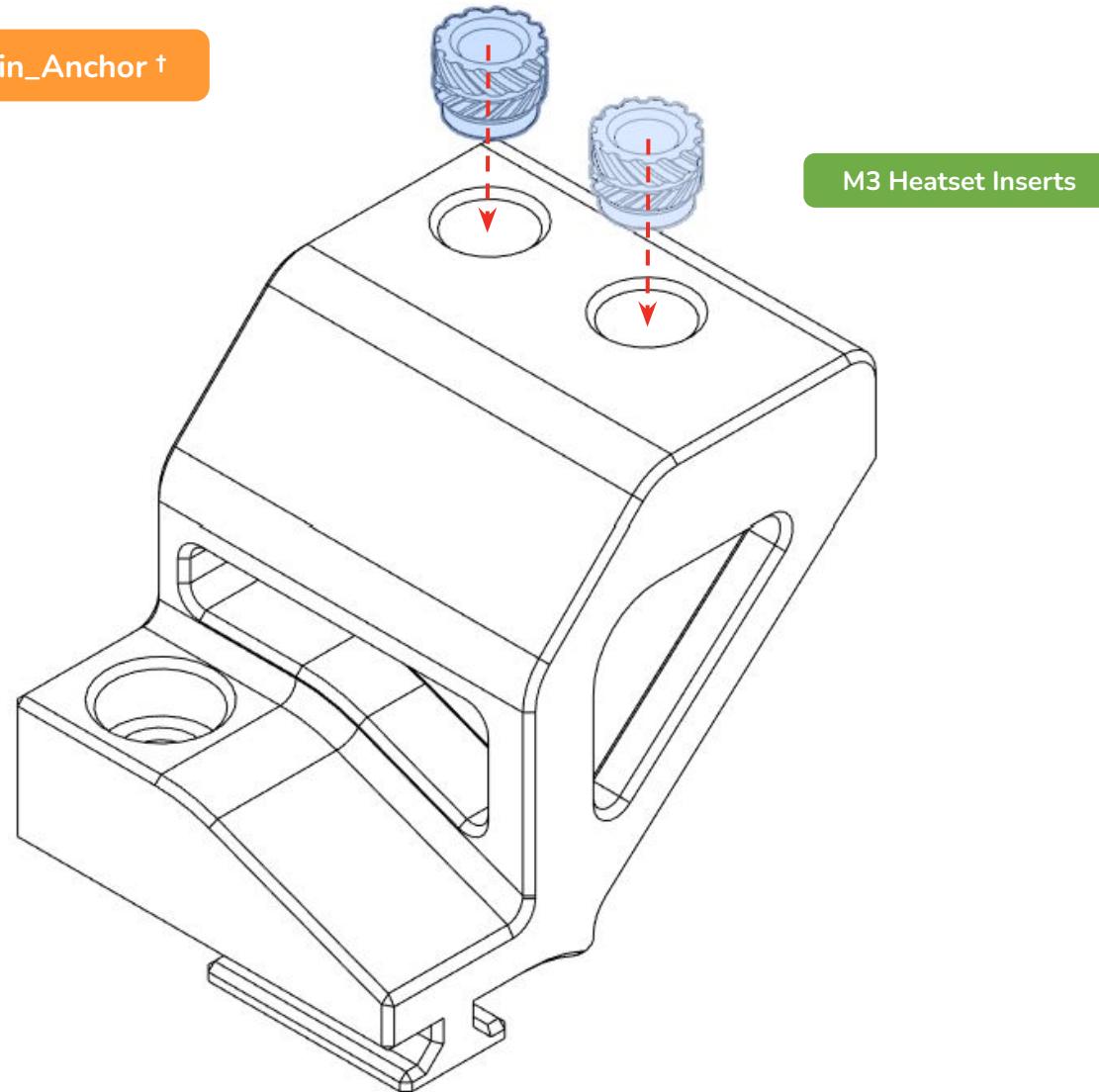
DRAG CHAIN ANCHOR HEATSET INSERTS

6.2 HEATSET INSERTS

The list of pages with heatset inserts is on [Page 19](#).

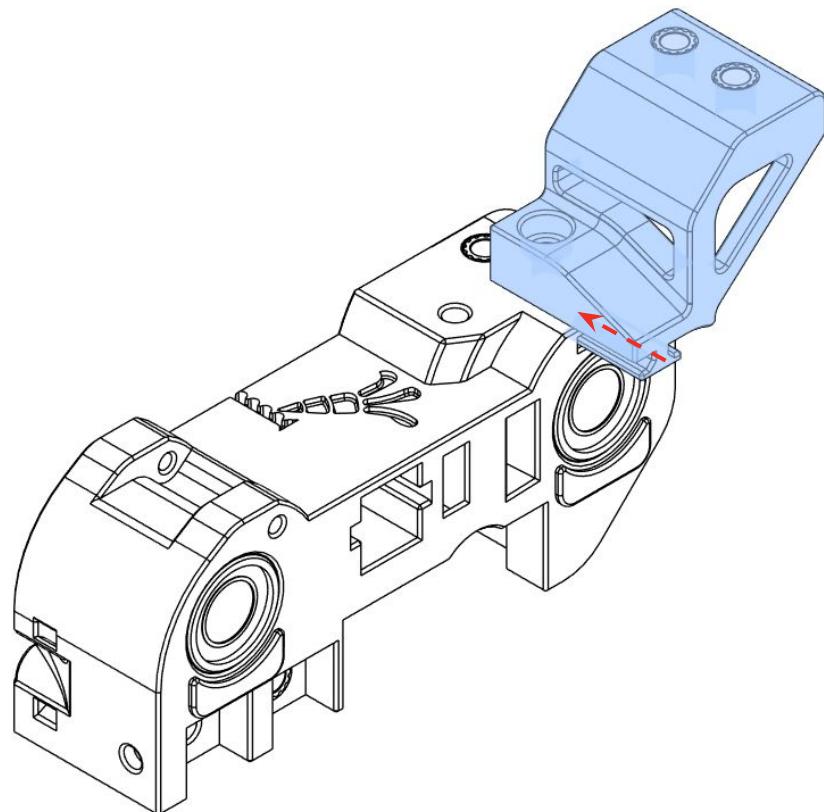
Drag_Chain_Anchor †

M3 Heatset Inserts

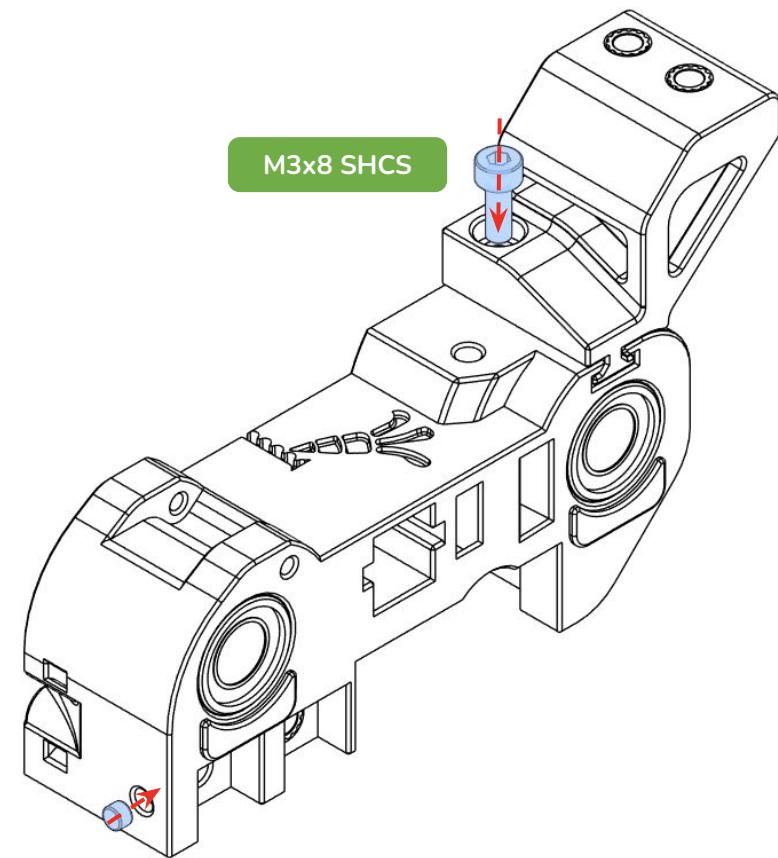


SELECTOR

DRAG CHAIN ANCHOR



Drag_Chain_Anchor †



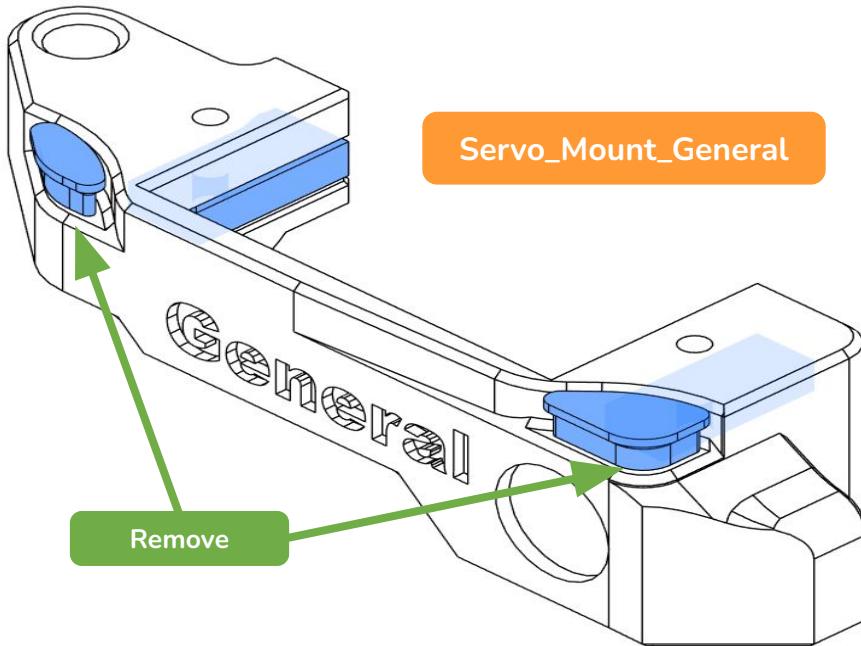
6.2 DRAG CHAIN AND MAGNET

Slide the [Drag_Chain_Anchor †](#) into the dovetail groove on the [Selector_Cart](#) and install with an M3x8 SHCS screw.

Add a drop of CA glue and insert the 3x2mm magnet into its slot.

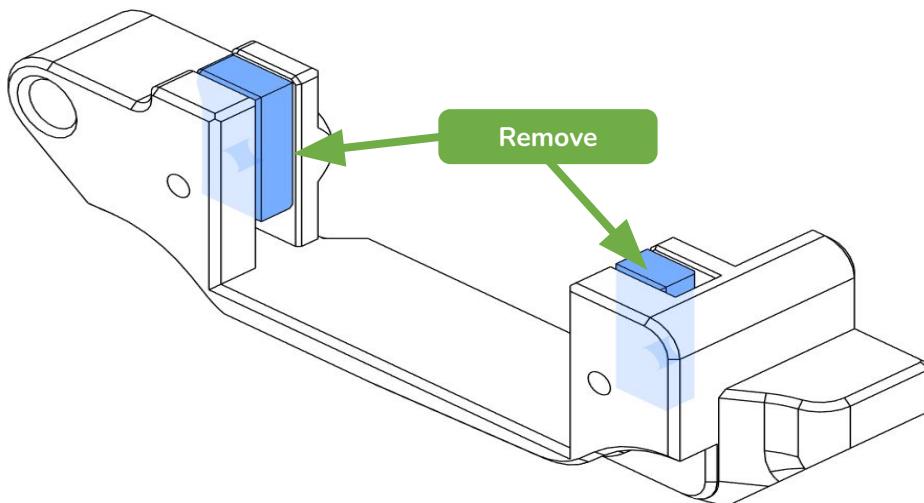
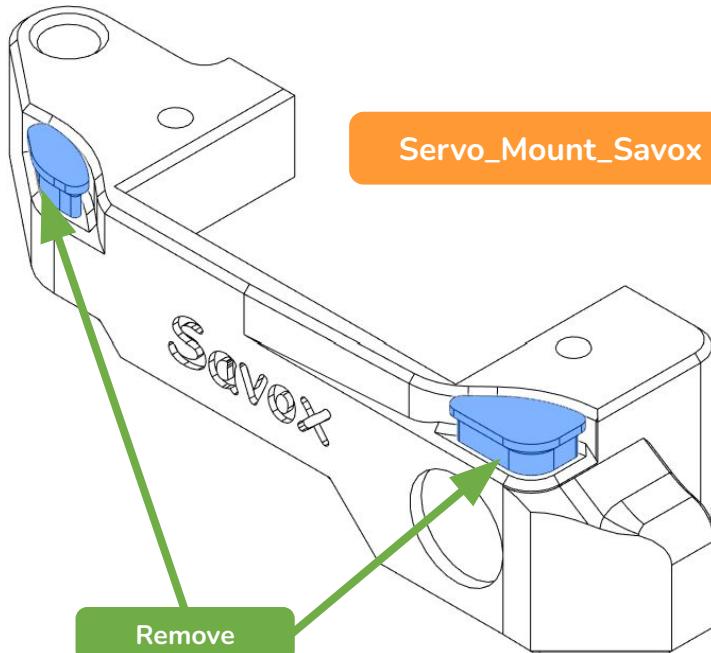
SELECTOR

SERVO MOUNT PREPARATION



Servo_Mount_General

Servo_Mount_Savox



6.3 SERVO MOUNT PRINT IN PLACE SUPPORTS

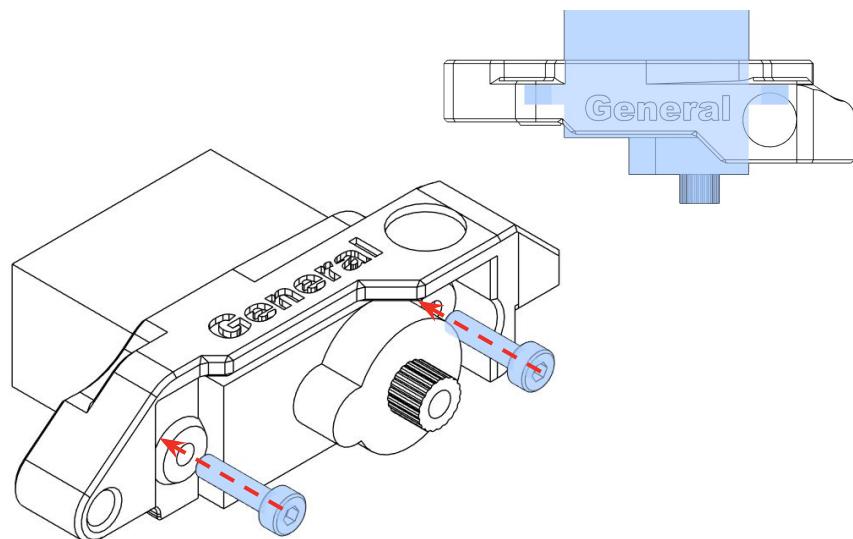
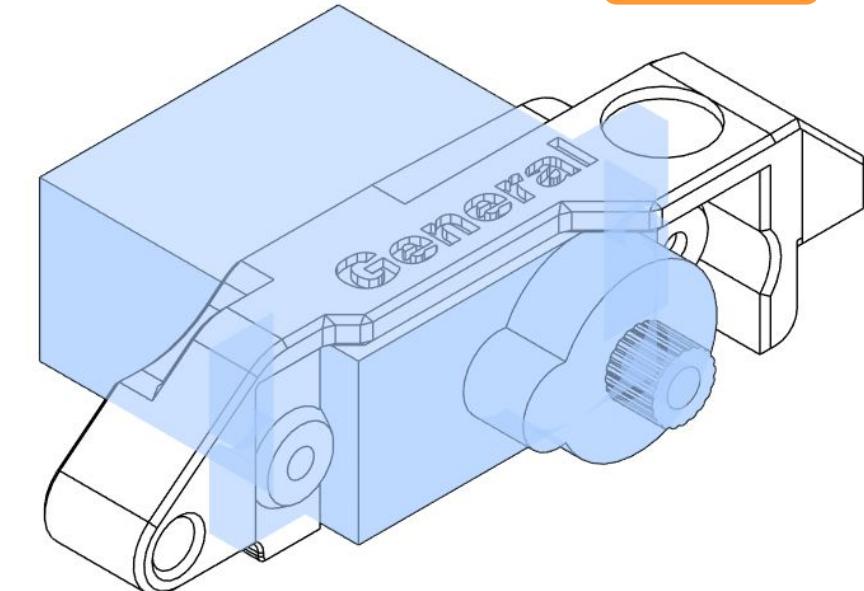
Use a small tool, like a small flat-head screwdriver to remove the built-in supports.

The General servo mount is designed to fit the “micro” form factor of servo. Both the General and DS041MG versions have 4 supports. If the inner supports don’t break out cleanly, you may need to clean up the slot with a file or hobby knife to get a good fit.

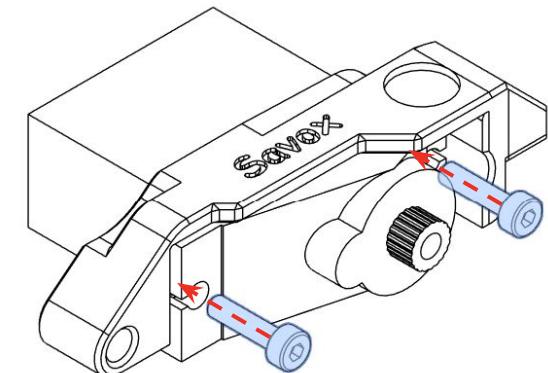
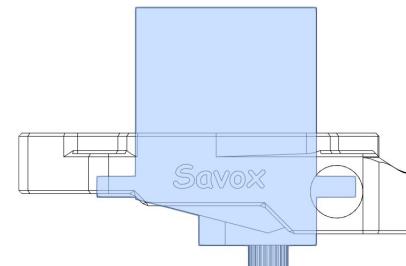
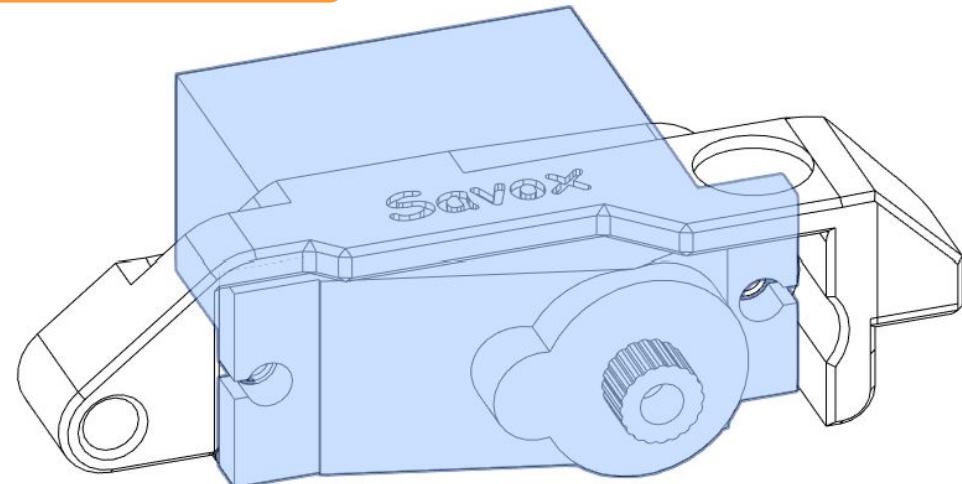
SELECTOR

SERVO MOUNTING

General



Savox SH0255MGP



6.3 SERVO SCREWS

Use M2x8mm SHCS to attach the servo to its mount.

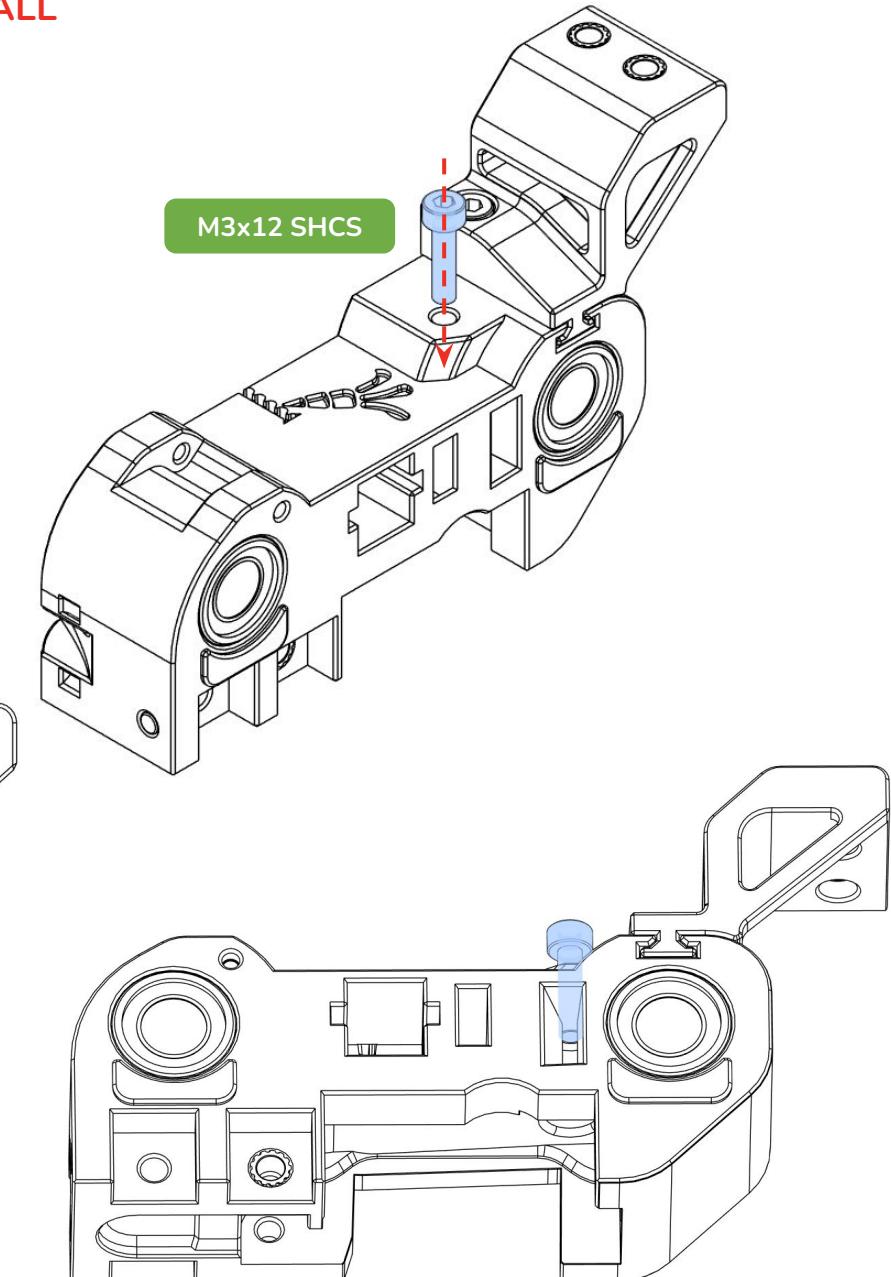
SELECTOR

TENSION SCREW INSTALL

6.3 SPRING TENSION SCREW

Install the M3x12mm Spring Tension Screw.

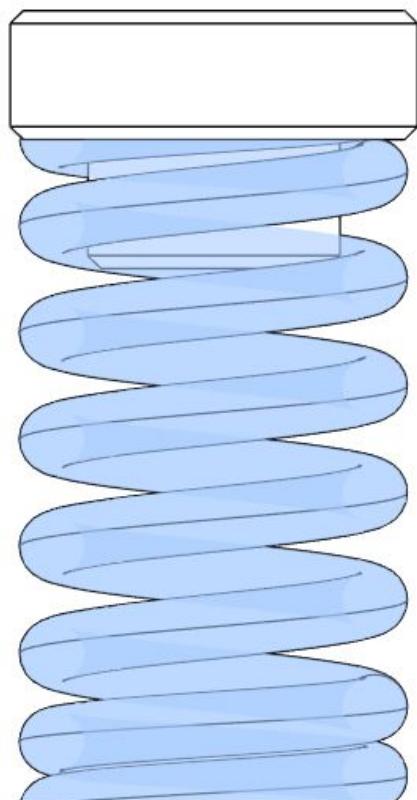
Insert the screw until it is flush with the roof of the spring cavity. You can check using the window in the side.



SELECTOR

SPRING INSTALL

Selector_Spring_Cap



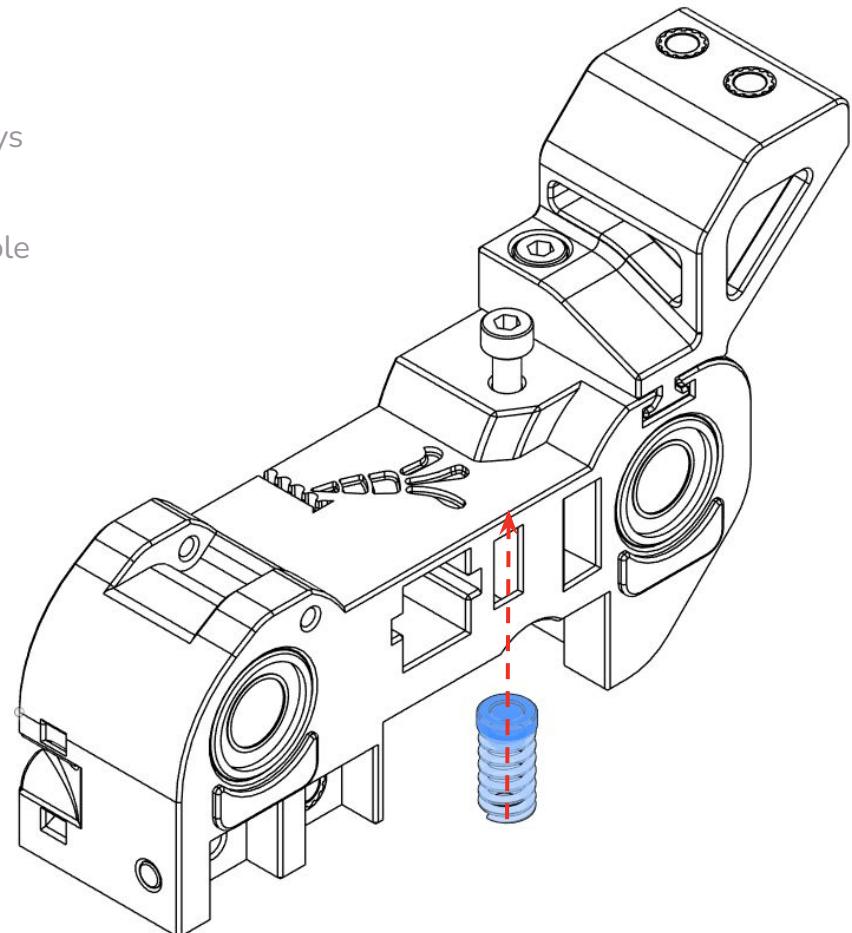
12x6mm OD
Compression Spring

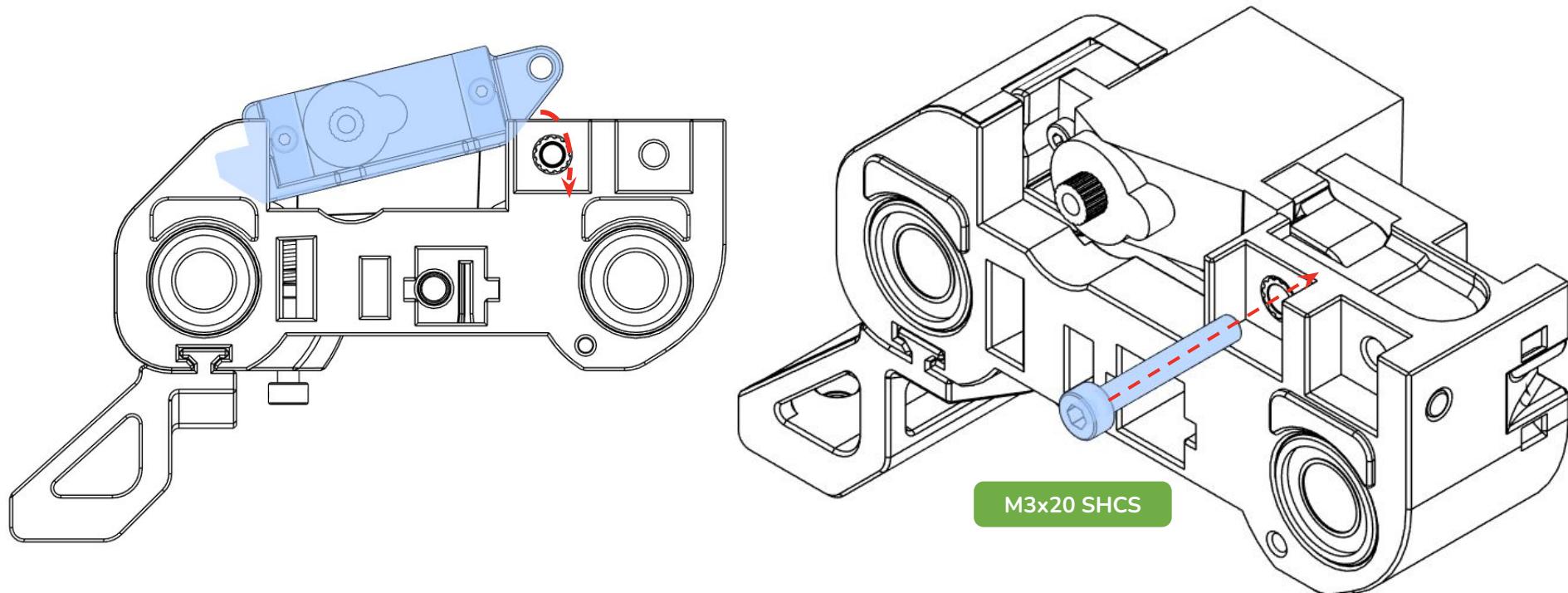
6.3 SPRING CAP

Twist the spring onto the **Selector_Spring_Cap** so the cap stays inserted into the spring.

Insert the spring and cap into the hole in the Selector

Shorter 10mm springs can be used as well with a longer 16mm screw.





6.3 SERVO INSTALLATION

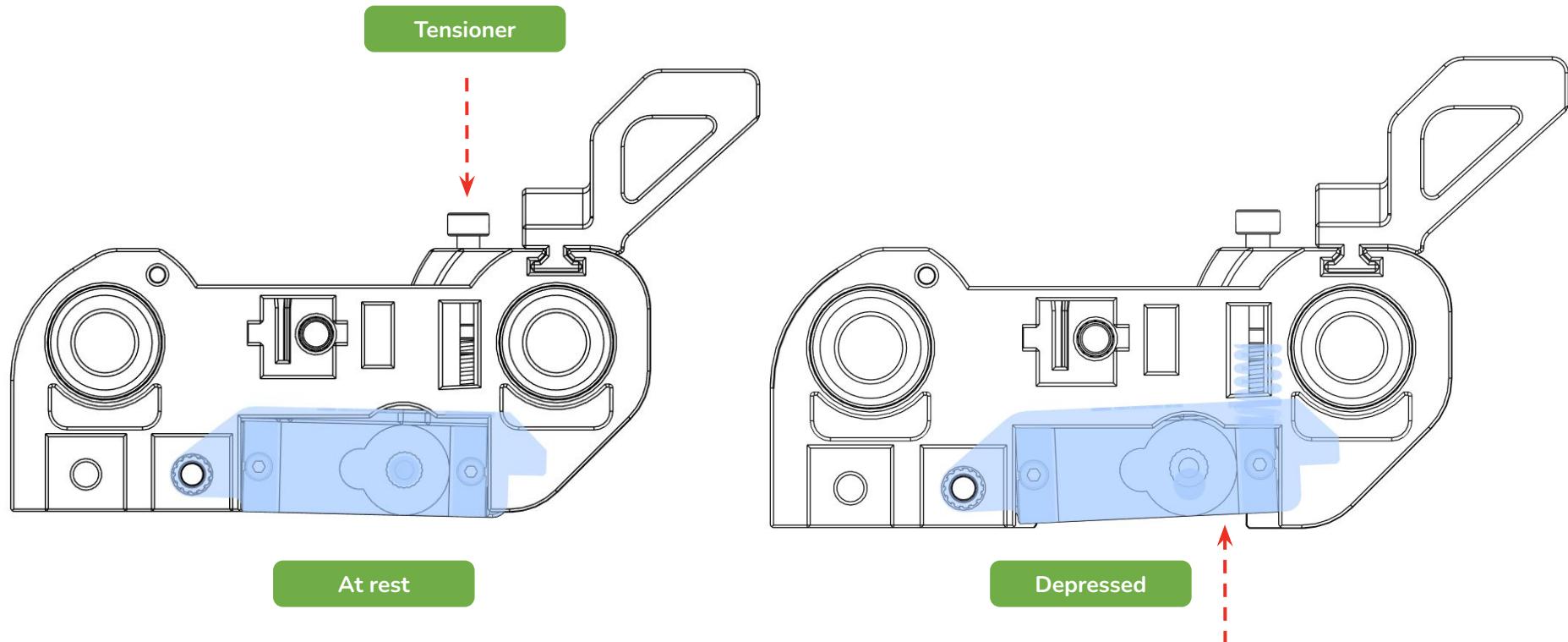
Angle the **Servo_Mount**, insert it into the captive channel in the **Selector_Cart** and press down into the pivot point. The spring should push lightly against the **Servo_Mount**, causing the to be sprung away from the fully seated position.

Push the **Servo_Mount** into place and temporarily secure it with an M3x20 screw used for mounting the encoder. **Do not tighten the screw all the way**, you will punch a hole in the Selector.

SAVOX SH-0255MGP servo option shown, installation is identical for the General servo and DS041MG.

SELECTOR

SPRING TENSION CHECK



6.1 SPRING TENSION CHECK

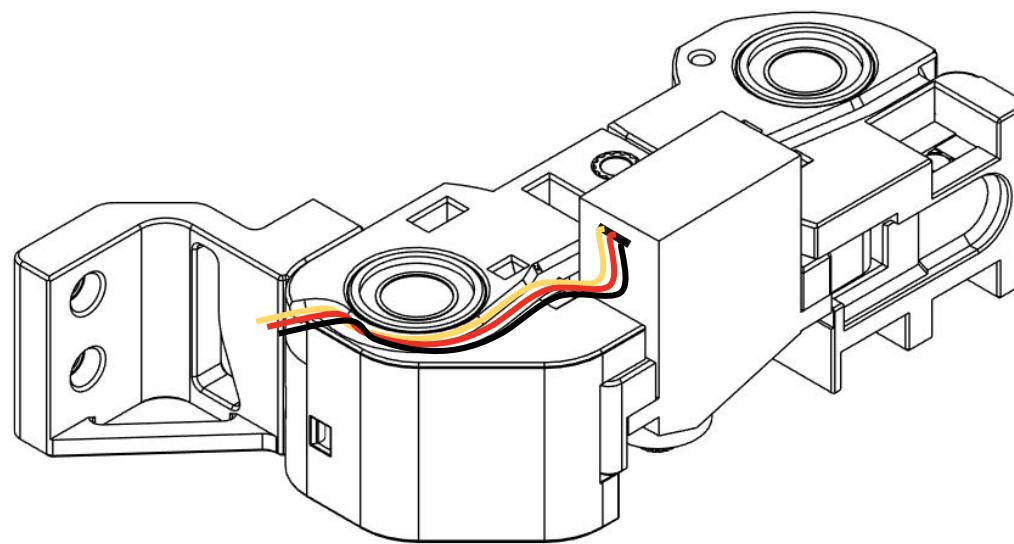
With the screw hinge in place, we can check the Servo action to see how the spring tension is. You should be able to depress the Servo about 3mm into the Selector housing using just one finger. The tilt is only 4 degrees, see the pictures.

If it is too tight, you must replace your spring. If it is too loose, turn the tension bolt half a turn and test it again. You want it to take similar force to depress the Servo, as flipping a light switch.

The depicted tension is arbitrary and is not in any way a goal. Go by the feel test above.

SELECTOR

SERVO WIRES

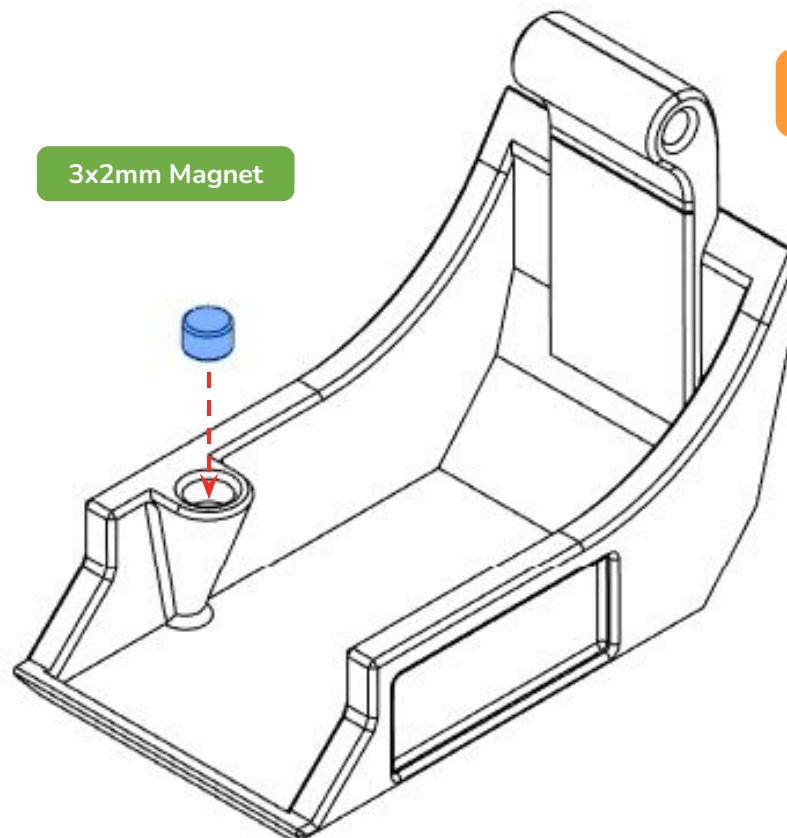


SERVO WIRES

Route the servo wires as shown. Don't cable tie the wires yet unless you're willing to redo it soon to add wires.

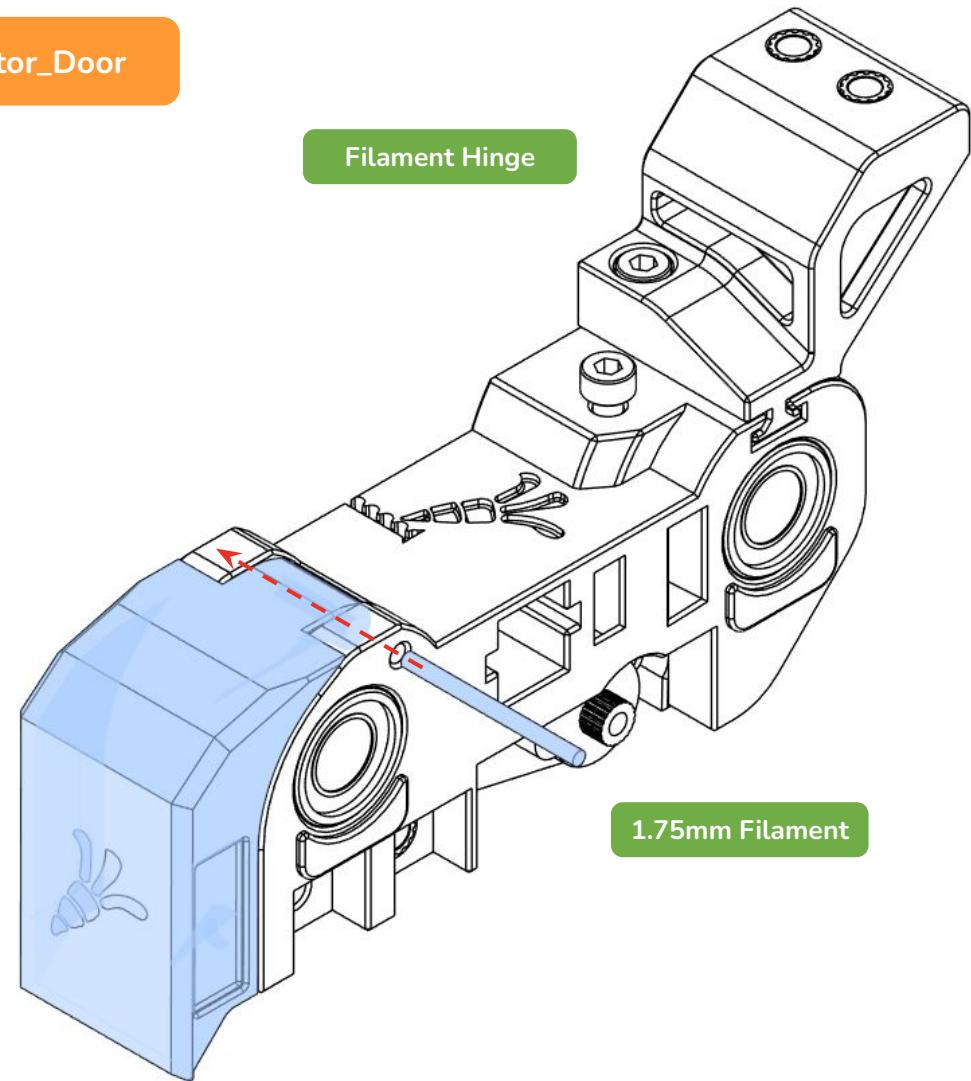
SELECTOR

DOOR INSTALLATION



Selector_Door

3x2mm Magnet



1.75mm Filament

6.4 DOOR INSTALLATION

This part is cosmetic - you could leave it off and print it in multicolor after your ERCF is running.

Add a drop of CA glue and install the 3x2mm magnet into the door recess so that the Selector magnet attracts the door magnet as a magnetic latch.

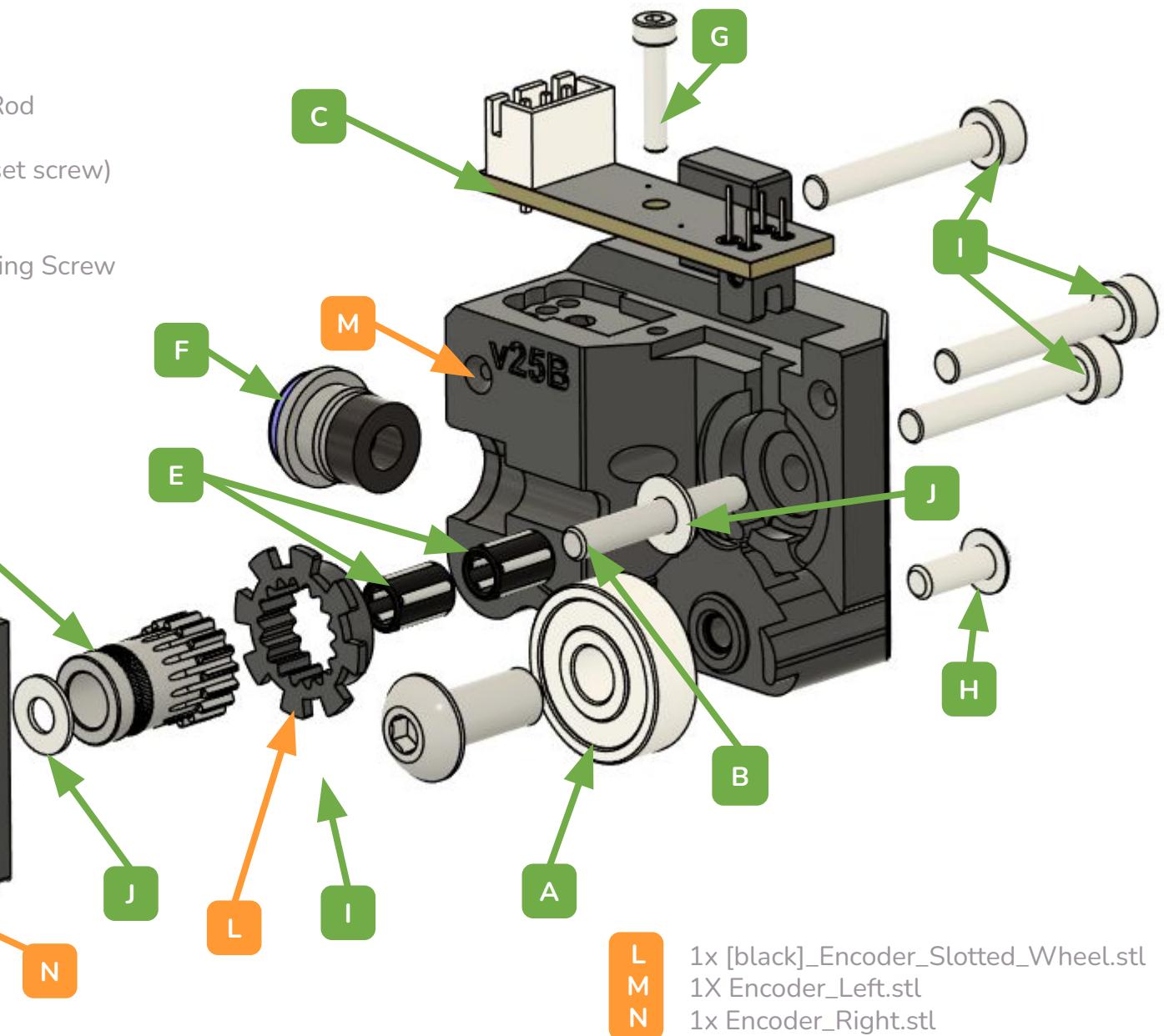
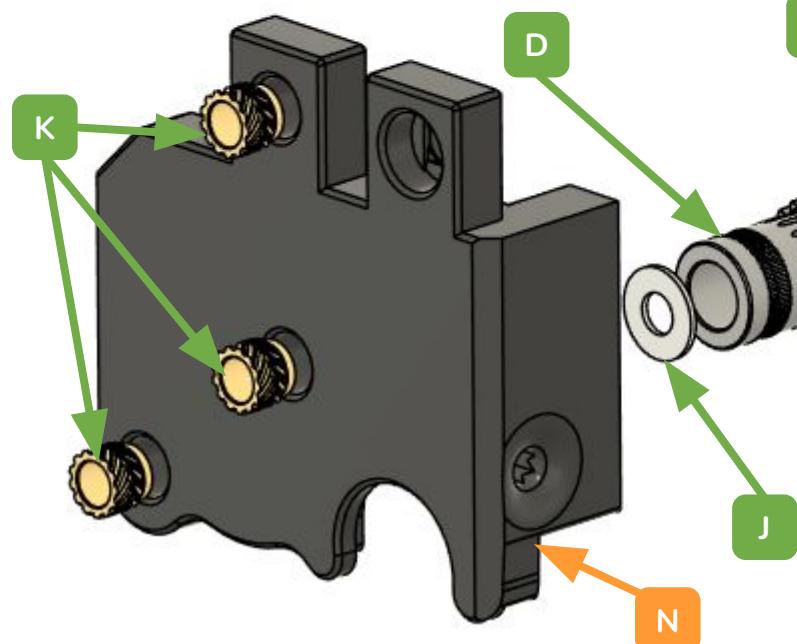
Attach the **Selector_Door** to the **Selector_Cart** using a piece of 1.75mm Accent filament & trim to length.

SELECTOR : ENCODER

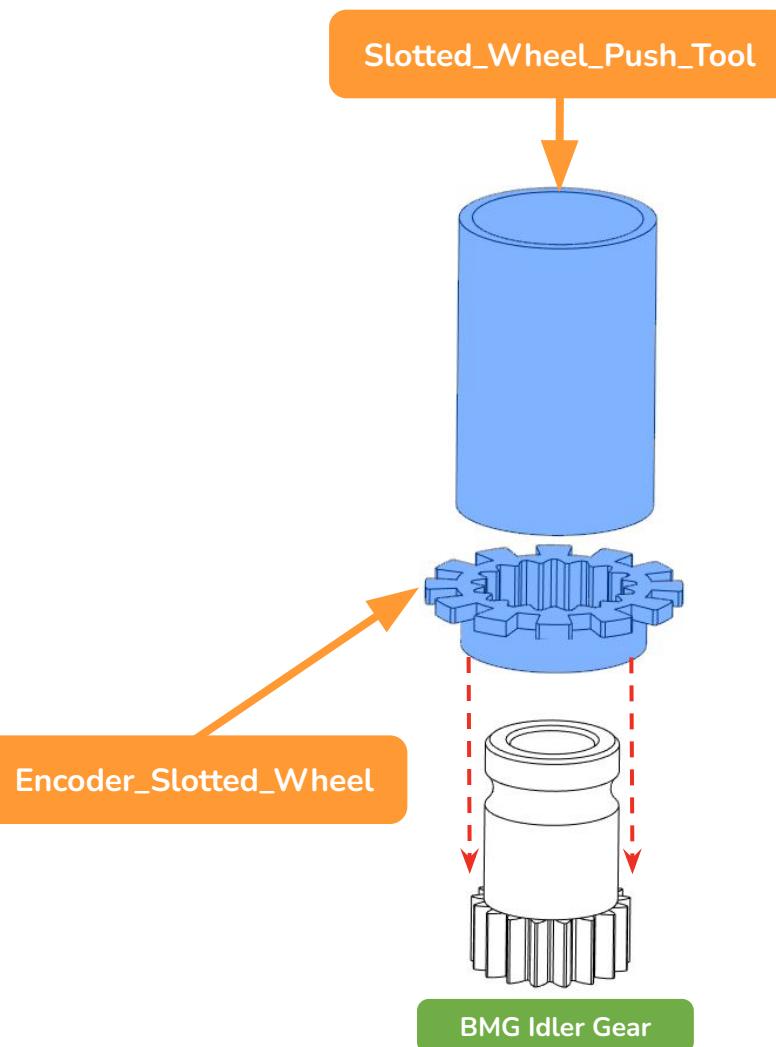
ENCODER EXPLODED VIEW

ENCODER SUB-BOM

- A 1x 625-2RS Bearing
- B 1x BMG 3x20mm Stainless Rod
- C 1x Binky PCB
- D 1x BMG Idler Gear (without set screw)
- E 2x BMG Needle Bearings
- F 1x ECAS Coupler (2 piece)
- G 1x M2x8 or 10mm Self-Tapping Screw
- H 1x M3x8mm BHCS
- I 3x M3x20mm SHCS
- J 2x M3 Shim Washer
- K 3x M3 Threaded Insert



SELECTOR : ENCODER



ENCODER PREPARATION

7.1 INSTALL ENCODER WHEEL

Before fitting the **Encoder_Slotted_Wheel** to the Bondtech gear, make sure the top surface of the wheel and its vanes are smooth and clean. If there are defects from printing, carefully sand or trim them so that they are flush.

Place the Bondtech gear as shown in the diagram on a hard surface and slide the **Encoder_Slotted_Wheel** onto the gear until it reaches the teeth.

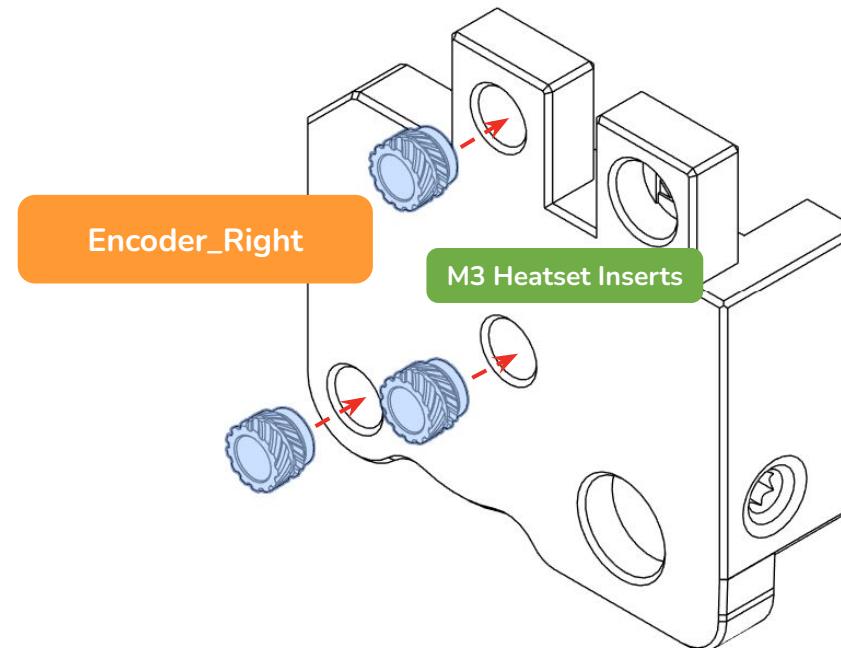
Use the **Slotted_Wheel_Push_Tool** to **gently** push the **Encoder_Slotted_Wheel** into place until it is flush with the end of the gear. Gently use a hammer or soft jaw vise if necessary.

The **Encoder_Slotted_Wheel** should fit firmly on the Bondtech gear. Make sure it isn't damaged or cracked, and doesn't move easily.

NOTE The **Encoder_Slotted_Wheel** must be printed in 0.1mm or lower layers, in a black material to prevent light shining through the vanes of the wheel and causing false readings. Glossy materials can also cause problems with reflections.

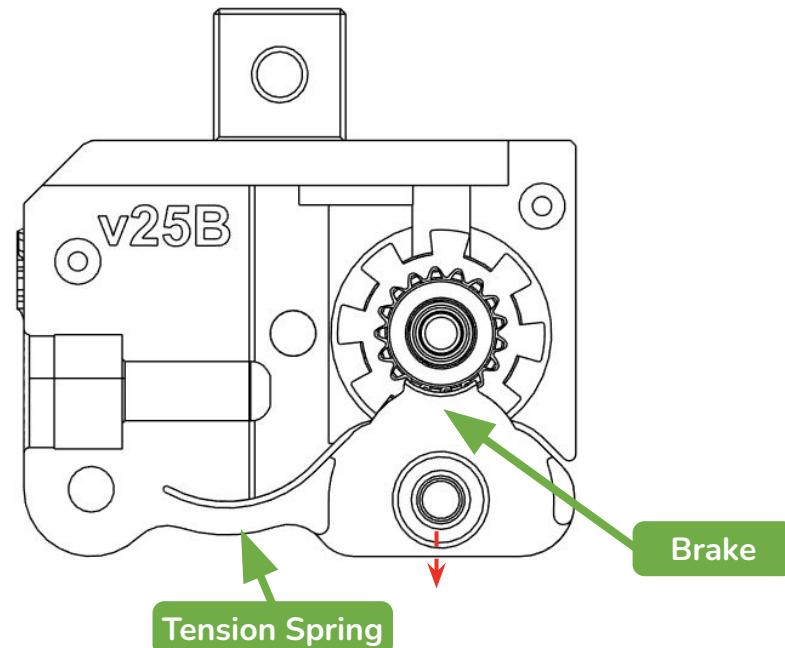
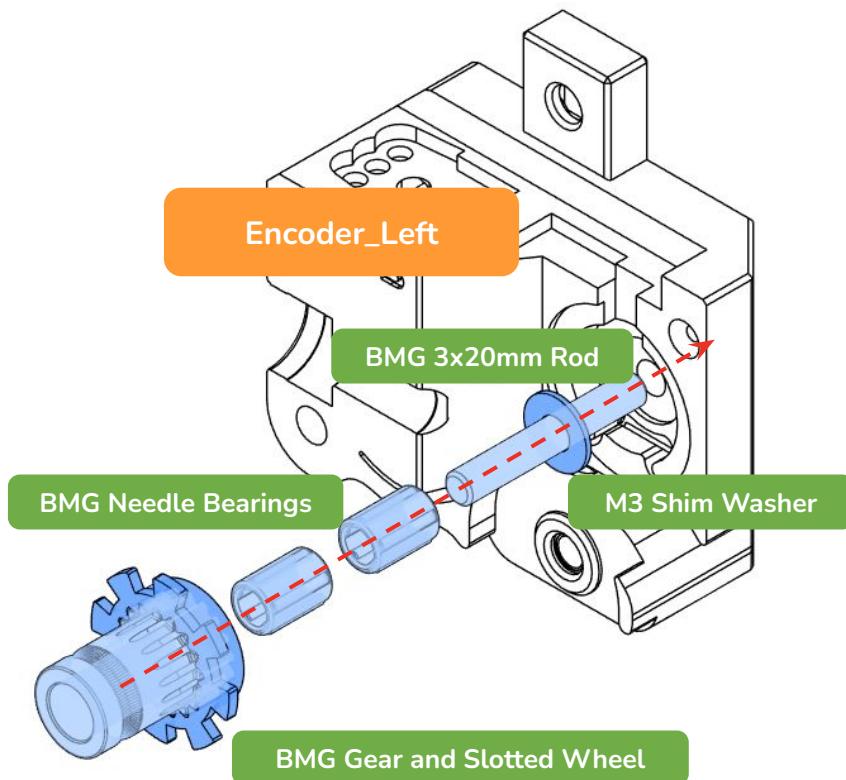
7.2 HEATSET INSERTS

The list of pages with heatset inserts is on [Page 19](#).



SELECTOR : ENCODER

ENCODER ASSEMBLY



ASSEMBLY

Start by fitting the 3x20mm rod into **Encoder_Left**. Next, slide on the M3 washer and needle bearings. Add a small dab of grease (EP1/EP2 or Superlube) on the bearings for lubrication.

Slide the BMG gear / slotted wheel assembly into place. You must pull the tension spring down 1-2mm in order for the slotted wheel assembly to clear the brake and seat correctly.

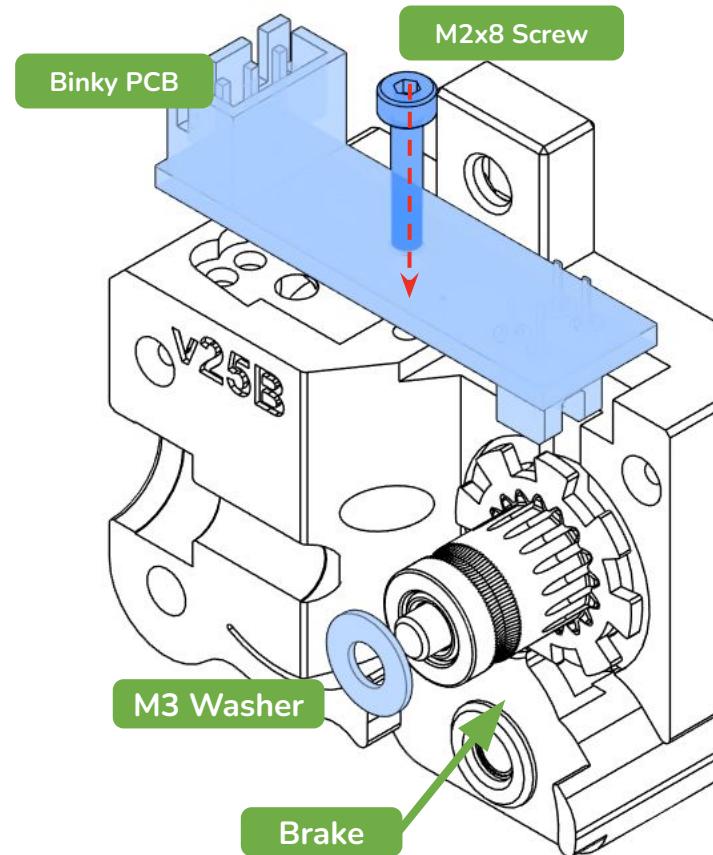
Gently pull down on the Brake to hold the Tension Spring open. It only needs to move 1-2mm. This will release the brake that prevents the encoder wheel from free spinning when filament is ejected.

With the Tension Spring open, the wheel should rotate easily and not rub on the Encoder housing or Binky optical sensor.

The slotted wheel should sit almost flush with the housing, but make sure it doesn't rub and cause friction.

SELECTOR : ENCODER

ENCODER ASSEMBLY



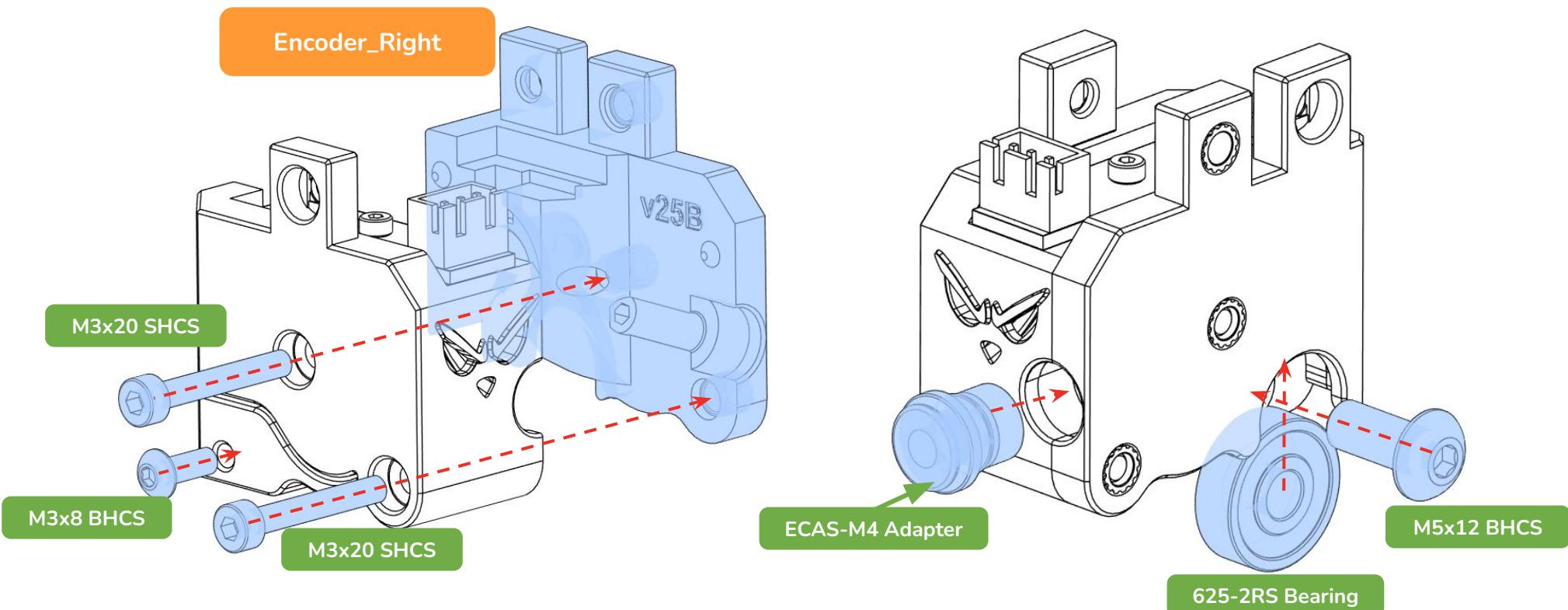
7.3 CHECK POINT

Next, Insert and secure the Binky PCB with either the provided Philips screw, or an M2x8 or 10mm SHCS. The sensor should fit snugly in the cutout provided.

Add the second M3 shim washer to the end of the BMG idler stack.

SELECTOR : ENCODER

ENCODER ASSEMBLY



7.1 ASSEMBLY

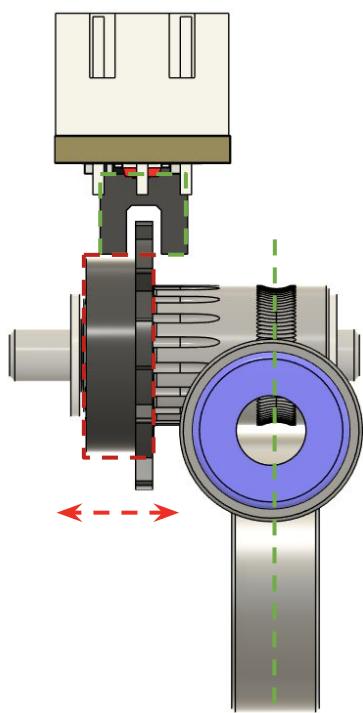
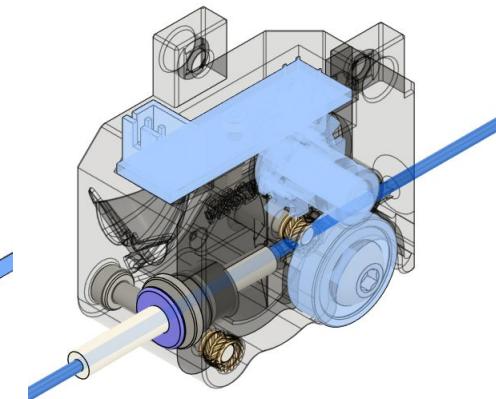
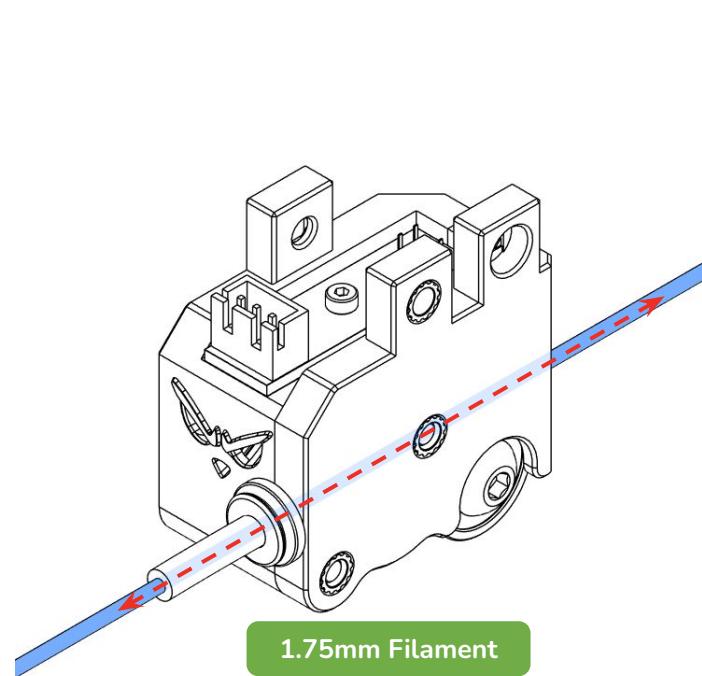
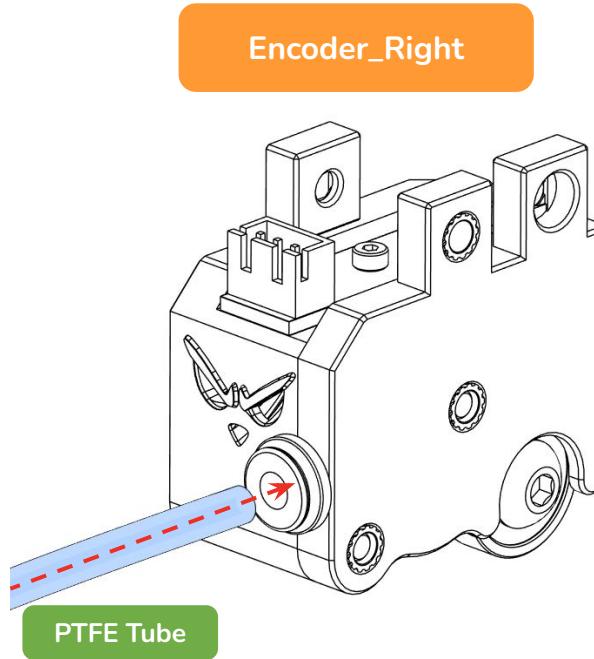
Align the two halves of the encoder and press them together. Attach the two sides together with two M3x20 SHCS screws. These screws don't need to be super tight, just flush with the surface of the Encoder, and may cause problems if overtightened.

Screw and self-tap the M3x8 BHCS into the plastic hole on the Tension Spring. This functions as the plunger for the endstop located in the gearbox housing. Tighten the screw all the way in, and then back it out about 2 turns. Later, during software setup, you can adjust the screw in or out to calibrate the home position. One full rotation of the screw will move it in or out 0.5mm.

Insert the ECAS Bowden Collet. If necessary, tighten the two M3x20 SHCS screws you inserted earlier. These screws do not need to be super tight, just flush with the surface of the Encoder. Finally, insert the 625-2RS bearing and fasten it with an M5x12mm bolt.

SELECTOR : ENCODER

ENCODER PATH CALIBRATION



7.1 ENCODER FILAMENT PATH

Insert a short piece of PTFE tubing into the ECAS, ensuring that it is fully seated into the channel behind the ECAS fitting. Then use a length of filament to verify that the filament path of the **Encoder** runs smoothly and the **Encoder_Slotted_Wheel** doesn't rub on the **Encoder** body or Binky Optical Sensor.

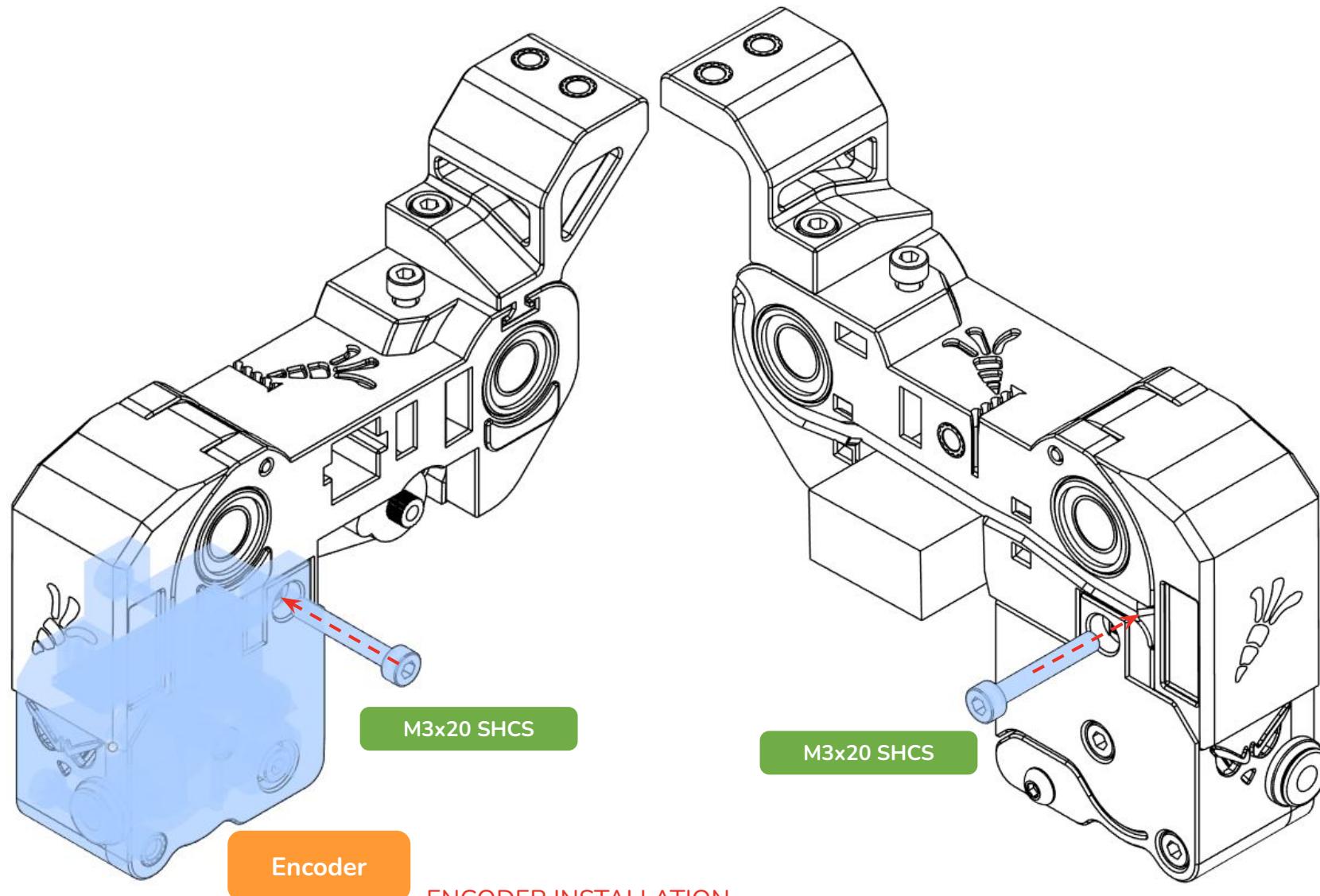
If you notice any issues, the first thing to check are overtightened M3x20 screws holding the **Encoder** together. If loosening the screws doesn't help, disassemble the **Encoder**. Adjust the position of the **Encoder_Slotted_Wheel** on the gear, being careful not to damage it or its vanes.

If the **Encoder_Slotted_Wheer** is centered but rubs against the ceiling of the Binky sensor, the **Encoder_Slotted_Wheel** must be reprinted - try a lower Extrusion Multiplier.

Once you have the Encoder running smoothly, it is ready to assemble it onto the **Selector**!

SELECTOR

ENCODER INSTALLATION

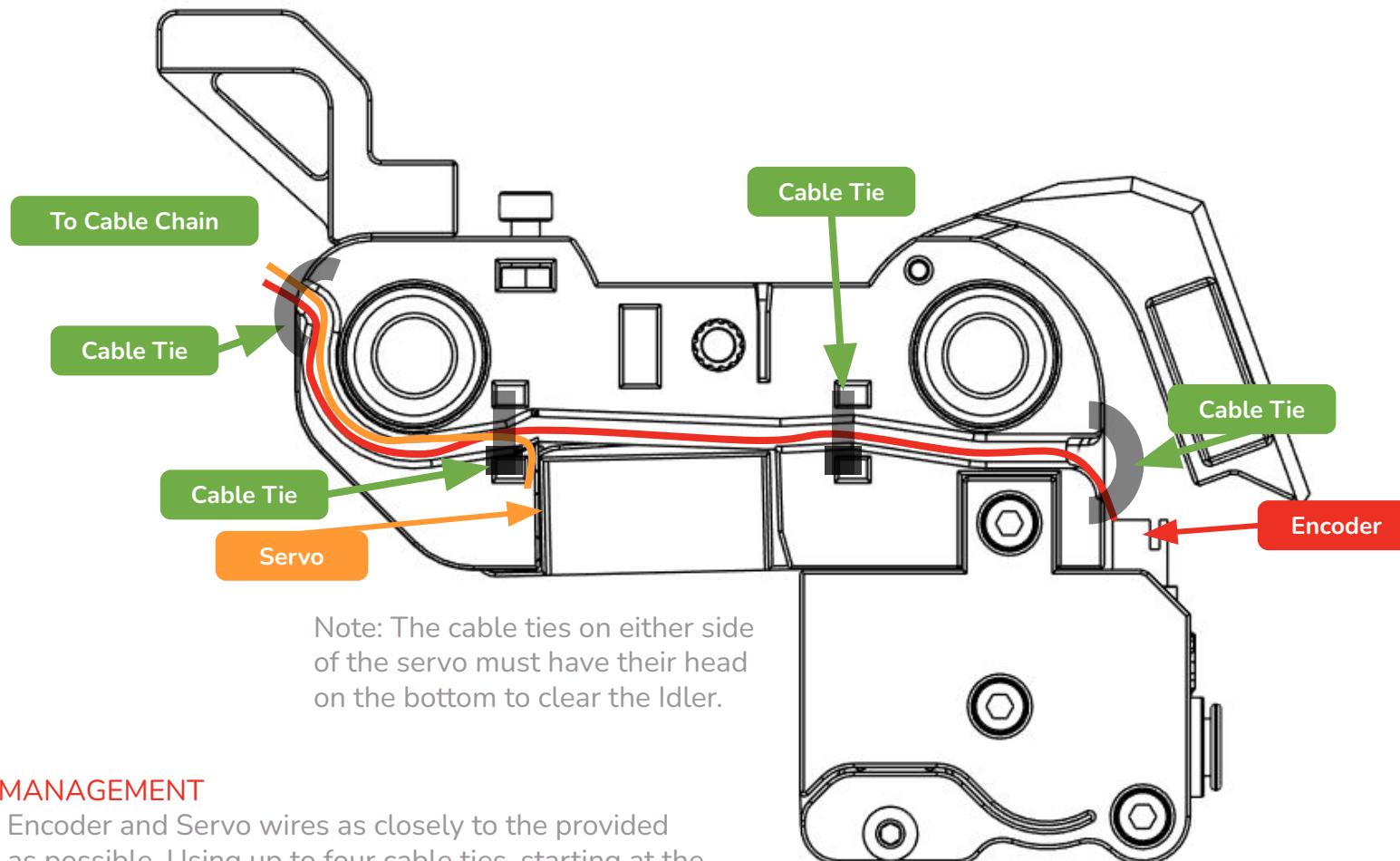


ENCODER INSTALLATION

Remove the M3x20 SHCS that you inserted on [page 125](#) to hold the servo mount. Then secure the Encoder to the **Selector_Cart** with two M3x20 SHCS screws. The first screw is also the Servo pivot - do not overtighten it or the Servo may bind.

SELECTOR

CABLE MANAGEMENT



CABLE MANAGEMENT

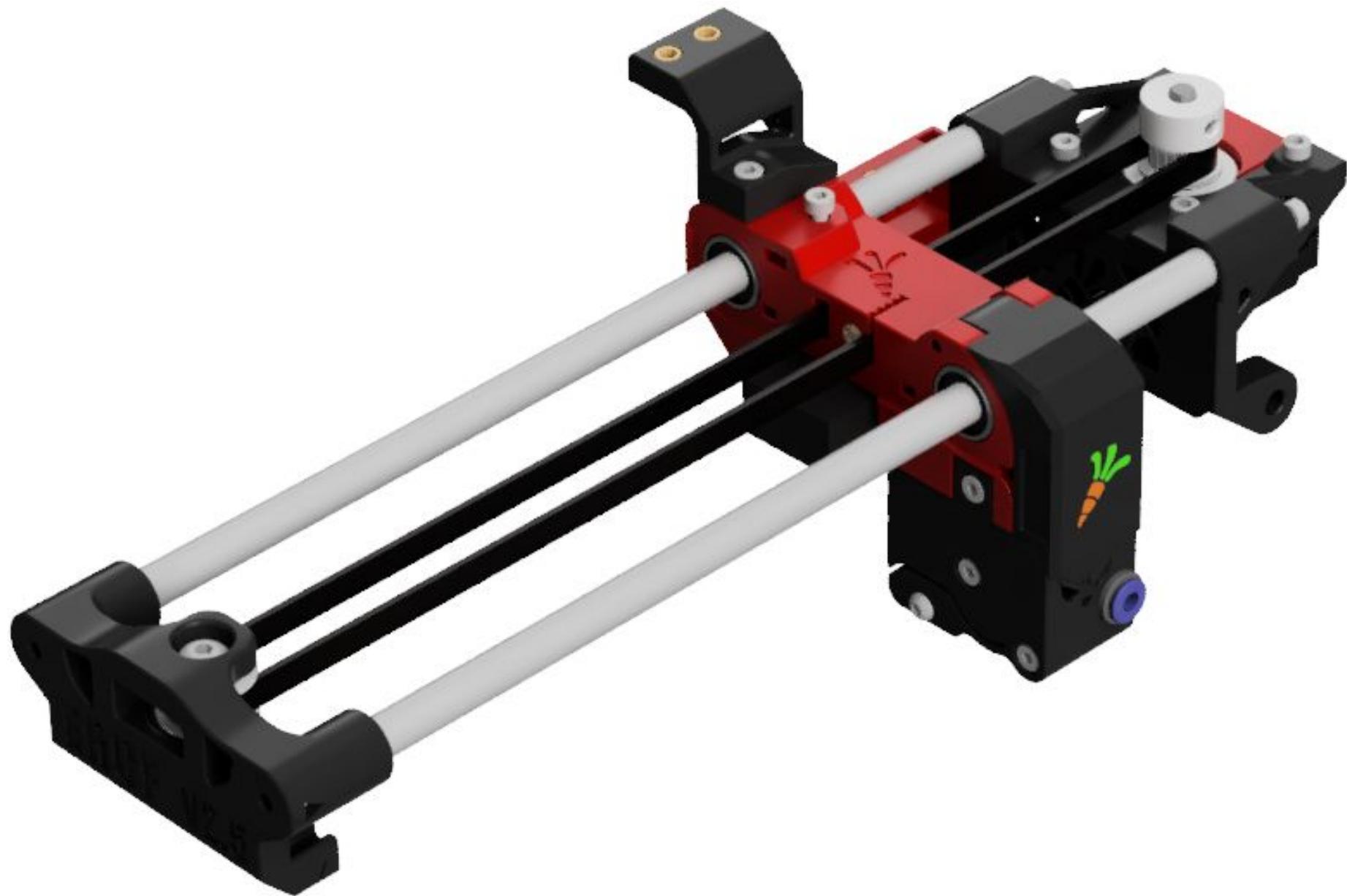
Run the Encoder and Servo wires as closely to the provided channel as possible. Using up to four cable ties, starting at the Encoder side, to secure the wiring to the [Selector_Cart](#).

Each bundle of three wires is represented by a single colored line for simplicity.

Infill patterns can vary between materials in multi-material prints. Using a stiffer material for the outer shell of an object and a lighter, more flexible material for the internal structure can reduce weight while maintaining strength, optimizing designs for performance.

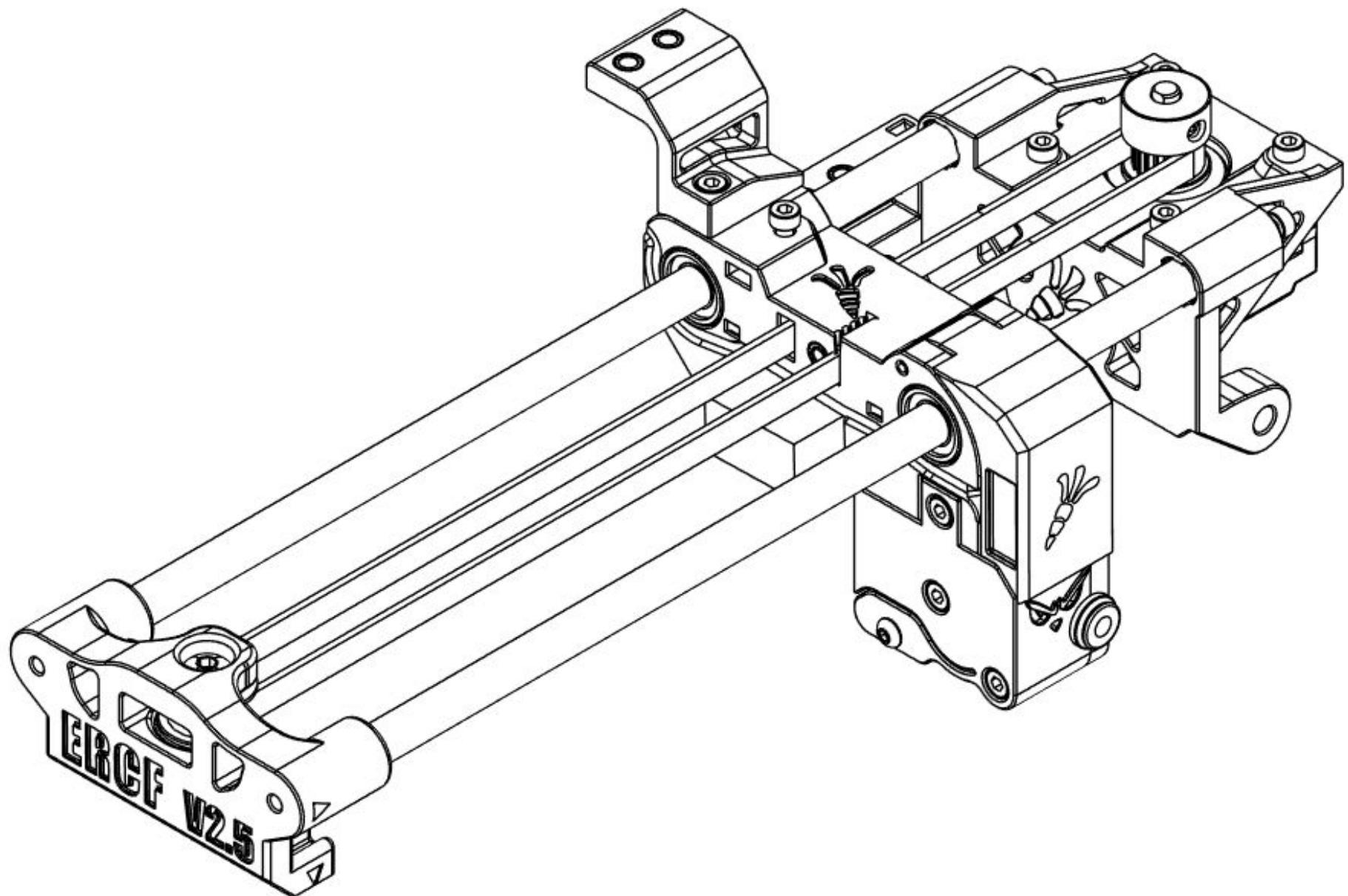
LINEAR AXIS

OVERVIEW

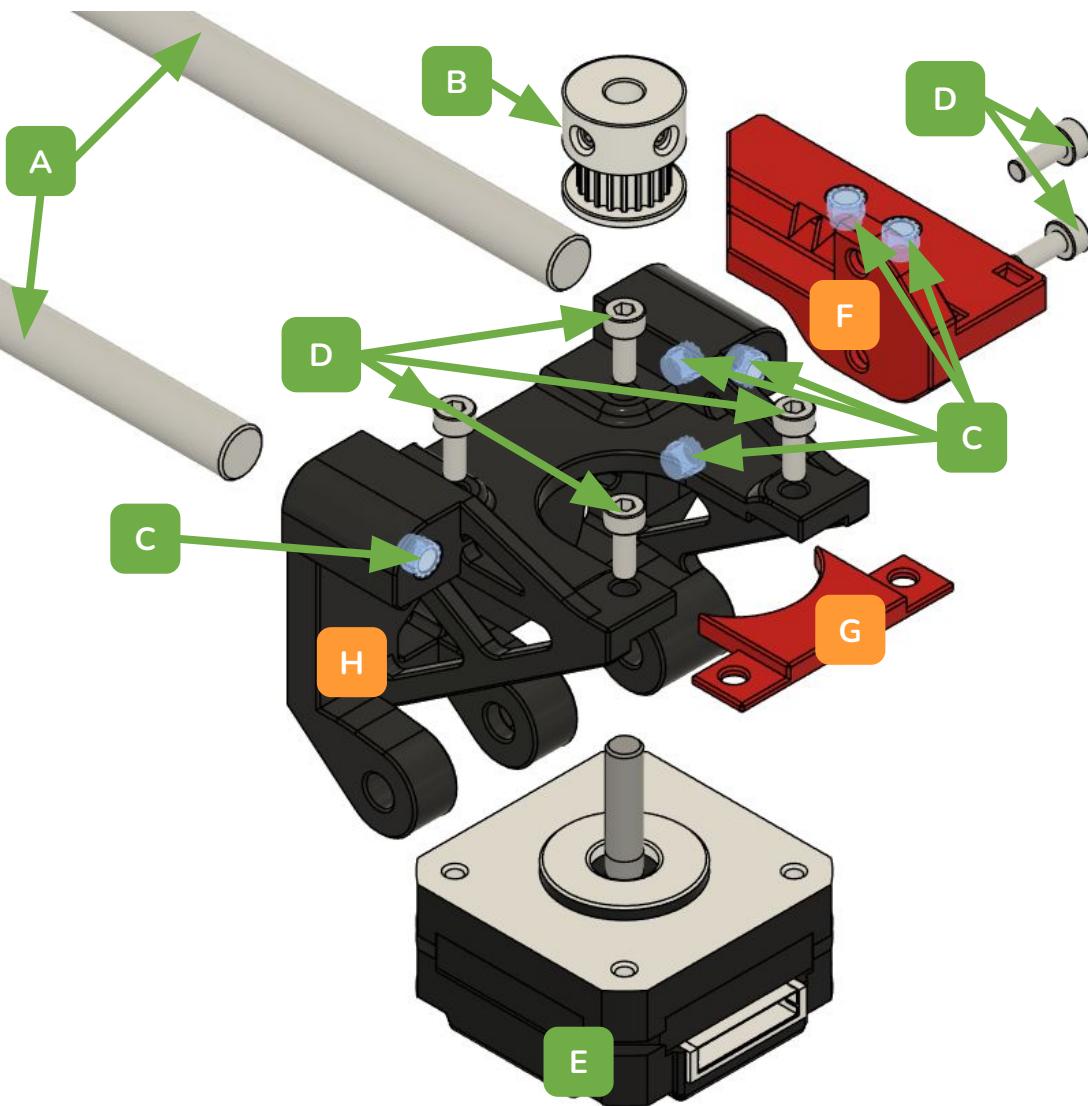


LINEAR AXIS

OVERVIEW



LINEAR AXIS HINGE



LINEAR AXIS HINGE EXPLODED VIEW

LINEAR AXIS HINGE SUB-BOM

A 2x 8mm rods
B 1x GT2 20T pulley
C 6x M3 Heatset Inserts
D 6x M3x8mm SHCS
E 1x NEMA17 Pancake Motor

Channels	Rod Length (mm)
N	53 + 23N
4	145
5	168
6	191
7	214
8	237
9	260
10	283
11	306
12	329
13	352
14	375
15	398

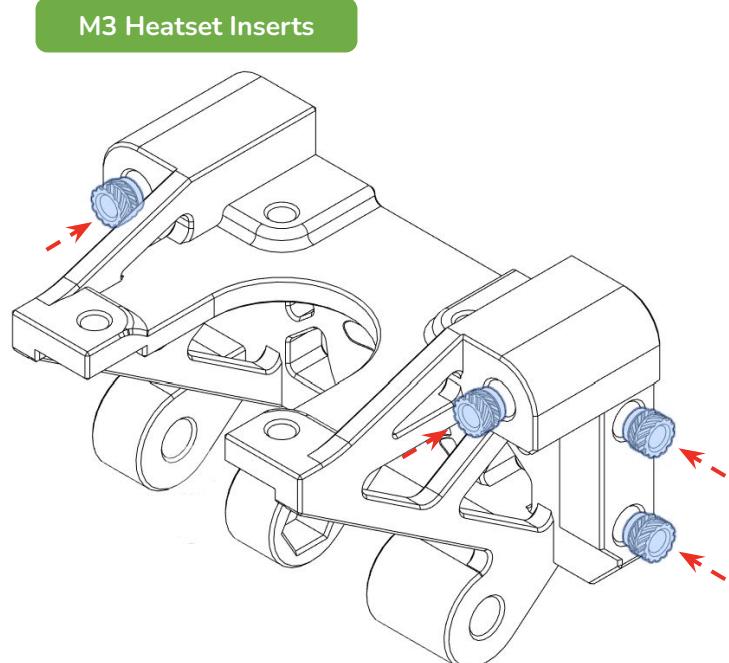
F 1x [a]_Drag_Chain_Anchor_Bottom.stl †
G 1x [a]_Motor_Lock.stl †
H 1x Linear_Axis_Selector_Motor_Support.stl

LINEAR AXIS HINGE

SELECTOR MOTOR SUPPORT

8.1 HEATSET INSERTS

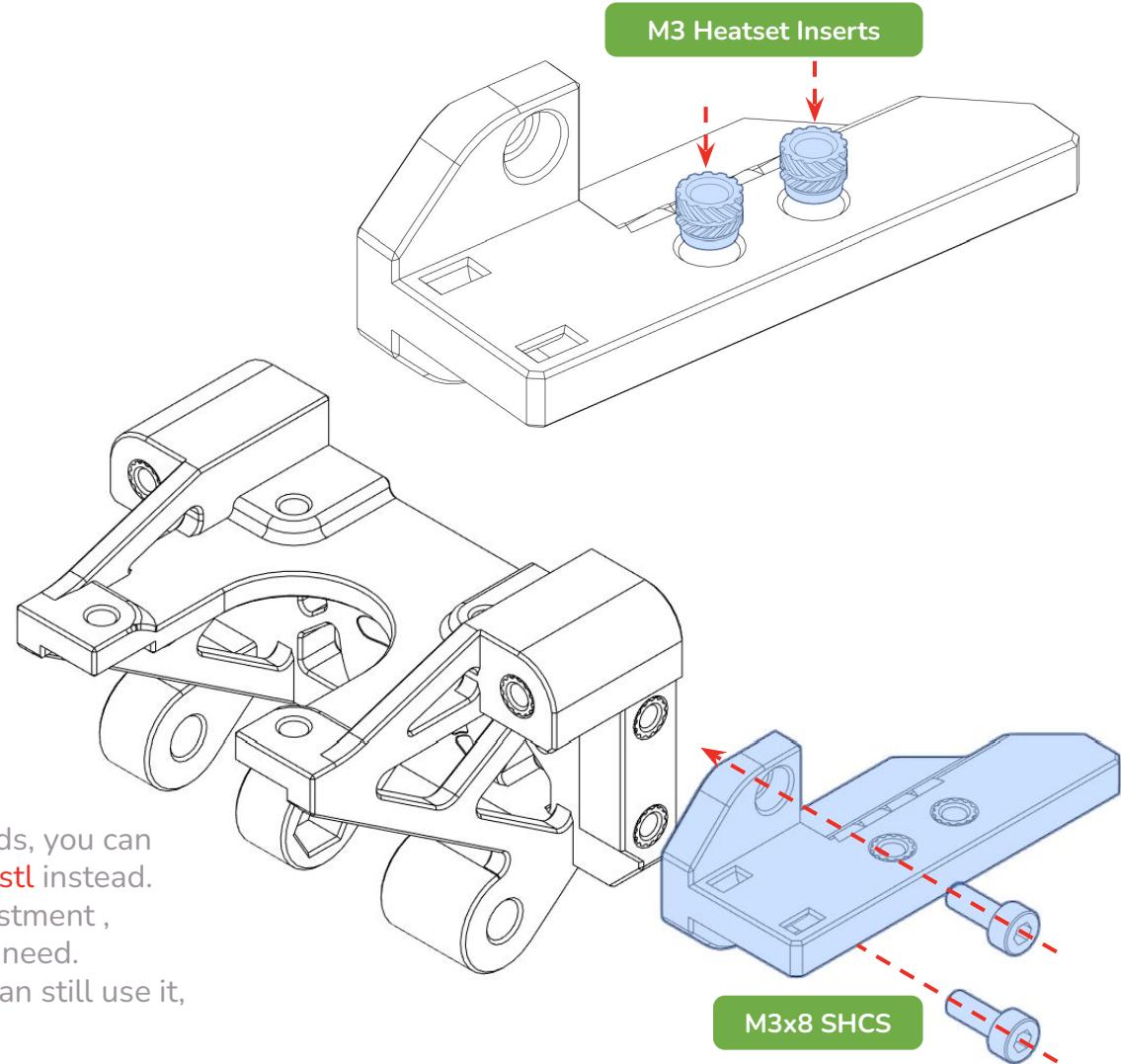
The list of pages with heatset inserts is on [Page 19](#).



[Linear_Axis_Selector_Motor_Support](#)

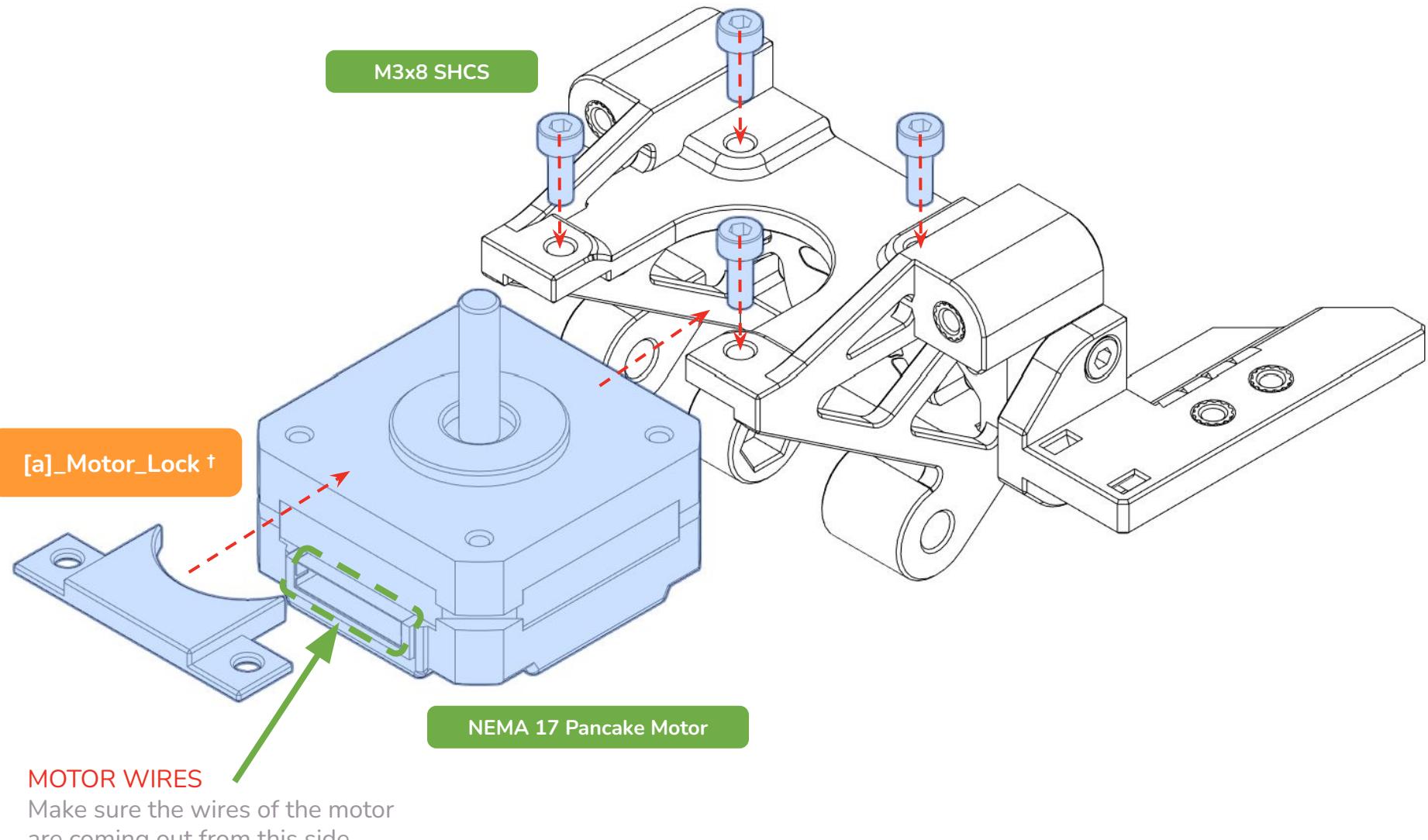
If you are using a kit or have precision-cut 8mm rods, you can use [Linear_Axis_Selector_Motor_Support_Precise.stl](#) instead. The “precise” version doesn’t have the length adjustment, heatsets / screws which imprecise or self-cut rods need. If you’ve already printed the original version, you can still use it,

[a]_Drag_Chain_Anchor_Bottom †



LINEAR AXIS HINGE

SELECTOR MOTOR SUPPORT



LINEAR AXIS IDLER

LINEAR AXIS IDLER SUB-BOM

- A** 1x GT2 20-tooth idler
- B** 1x M5x16mm BHCS
- C** 1x M5 Nylock nut

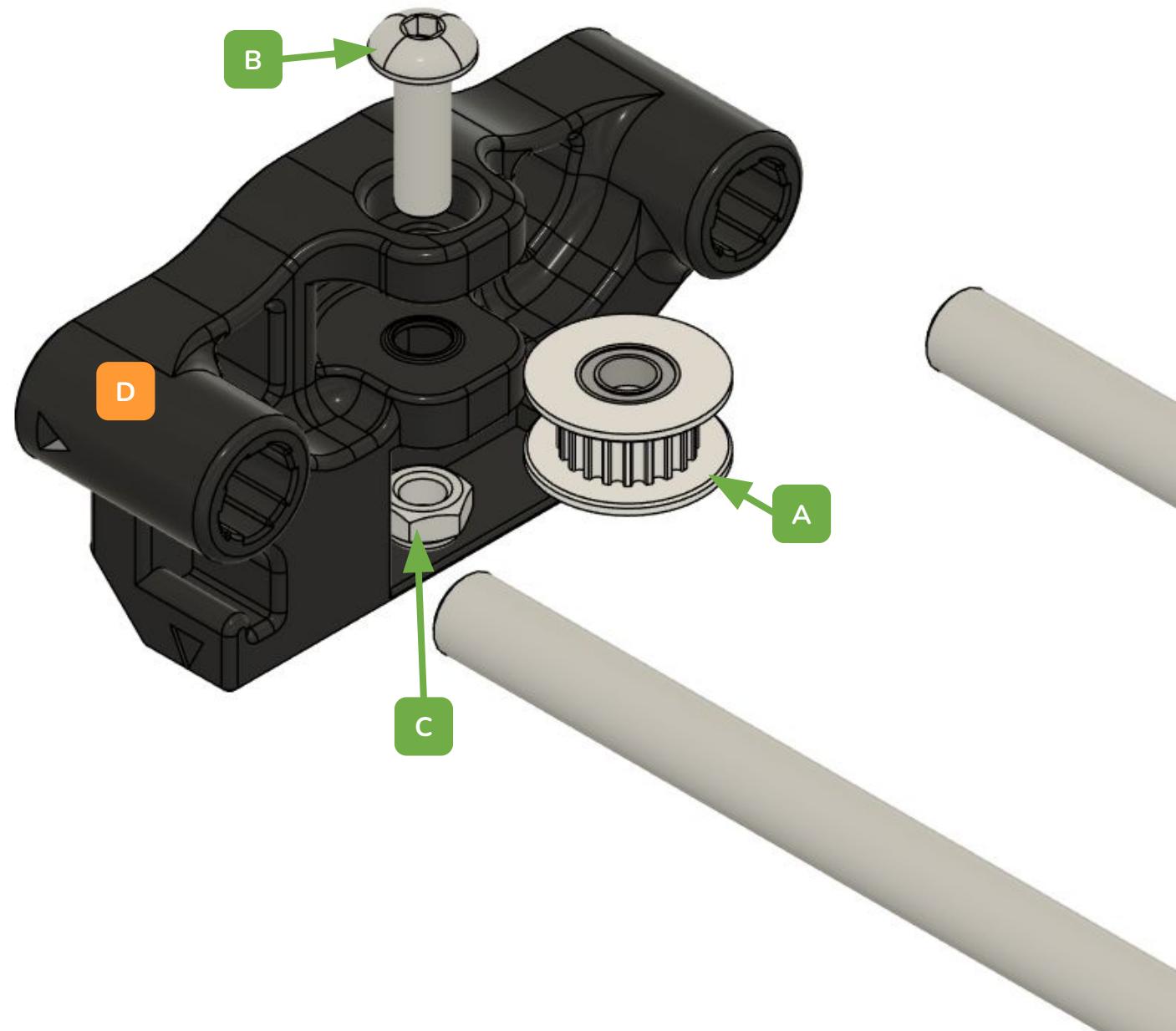
Not shown: GT2 Belt

- D** 1x Linear_Axis_Idler_Block.stl

Channels	Approx Belt Length (mm)
N	165 + 46N
4	349
5	395
6	441
7	487
8	533
9	579
10	625
11	671
12	717
13	763
14	809
15	855

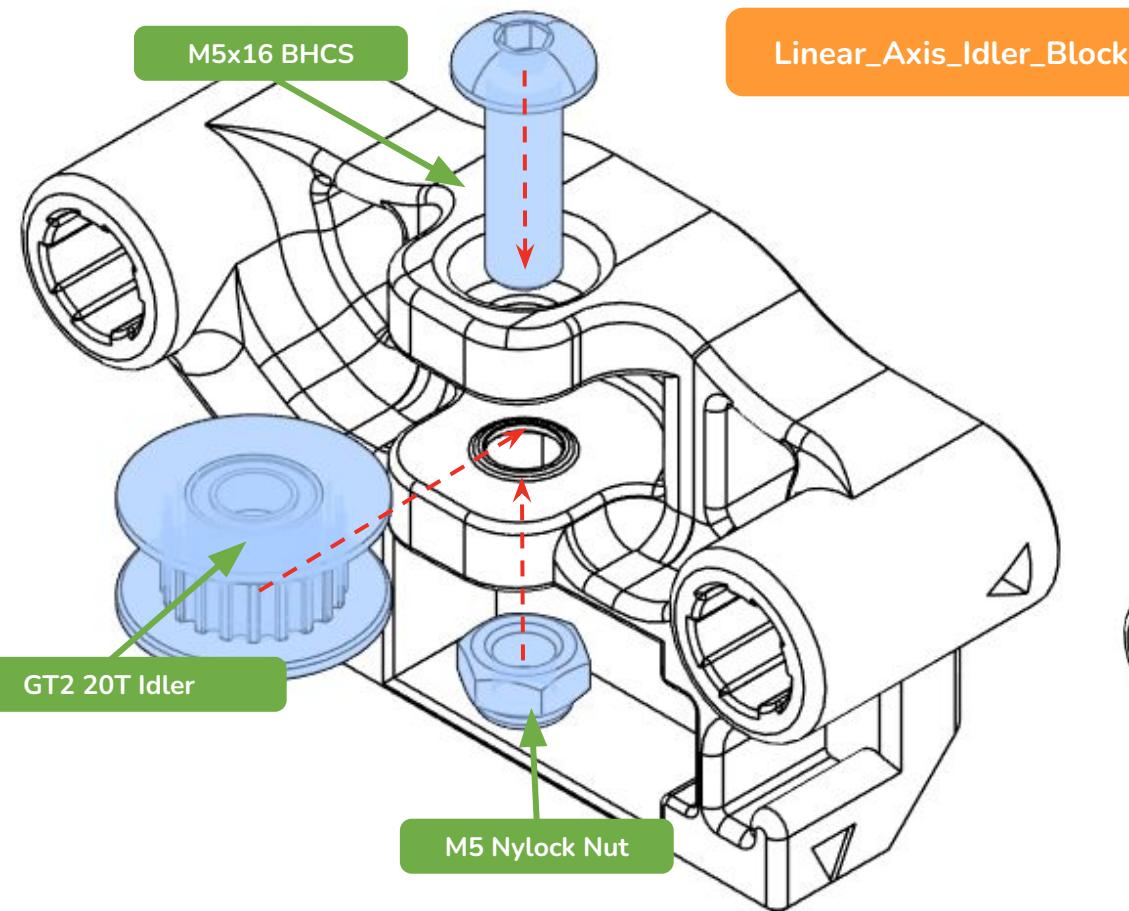
(Includes 10mm spare length)

LINEAR AXIS IDLER EXPLODED VIEW



LINEAR AXIS IDLER

IDLER BLOCK



Linear_Axis_Idler_Block

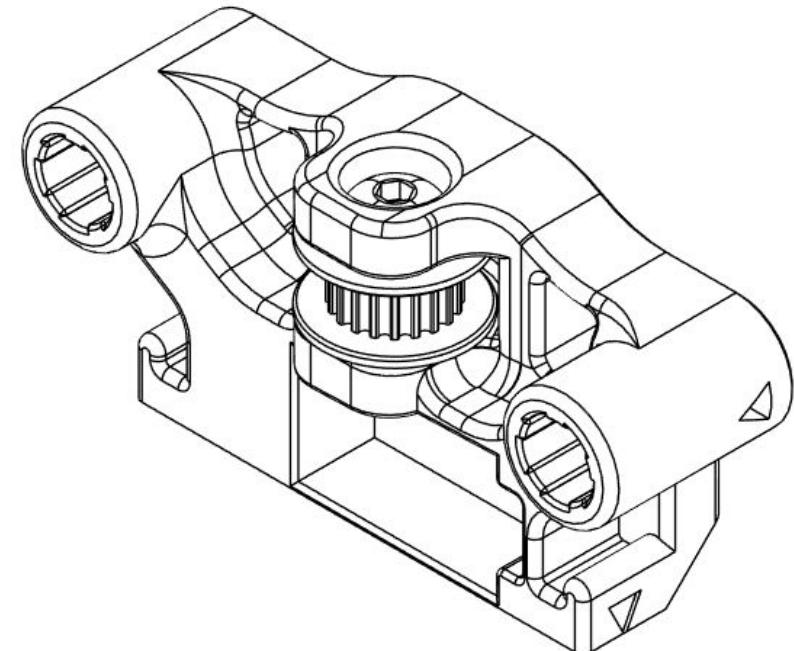
8.2 ASSEMBLE IDLER BLOCK

Fully insert the M5 locking nut into its cavity. Slide the GT2 Idler into its cavity.

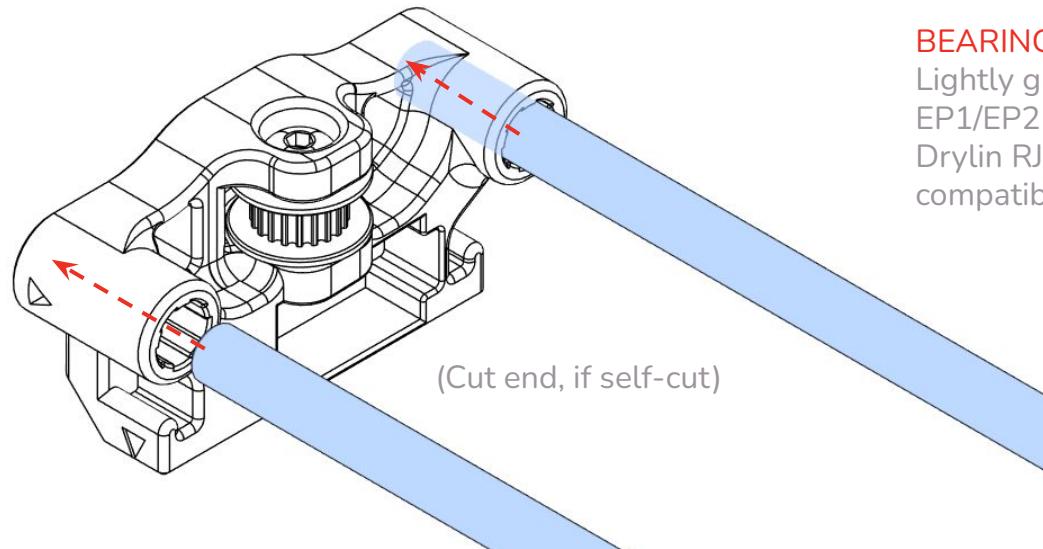
Insert the M5x16mm bolt and tighten it until snug, but not super tight. It's an idler, it needs to spin freely.

If you have a 10mm tall idler instead of a 9mm tall idler (such as provided in an LDO kit), there is a 10mm version of the Idler_Block here:

User_Mods \ Miriax \
Linear_Axis_Idler_Block_for_10mm_Idlers \
Linear_Axis_Idler_Block_for_10mm_Idlers.stl



LINEAR AXIS



IDLER ASSEMBLY

BEARING PREPARATION

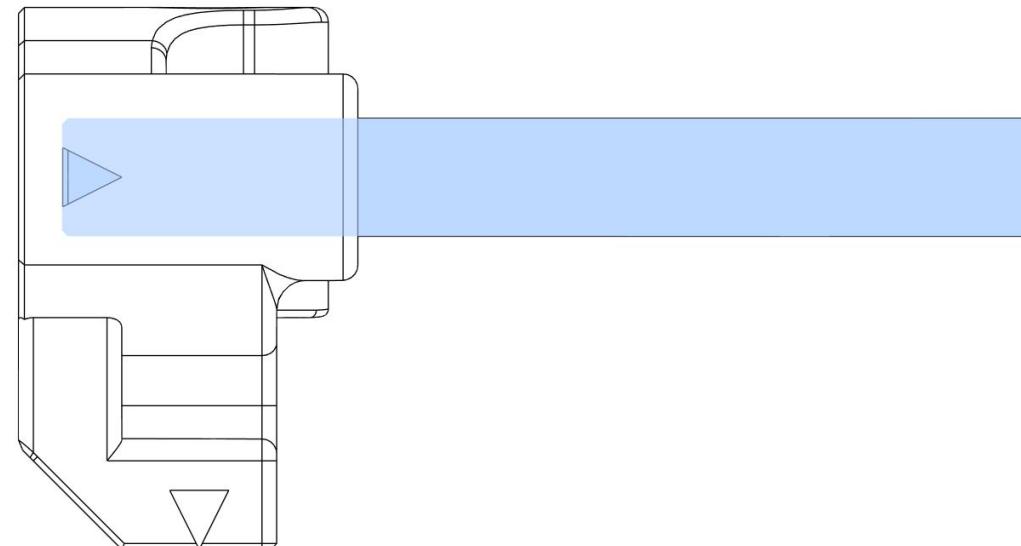
Lightly grease the LM8UU bearing's using EP1/EP2 or Superlube grease.
Drylin RJ4JP-01-08 style bearings are not compatible with this Selector!

8mm Smooth Rods

IDLER SIDE

Carefully insert the 8mm Smooth Rods into the Idler_Block, until they bottom out.

There are sight holes on the sides of the Idler_Block to check if the rods are fully seated, and holes at the end to allow you to eject them if necessary.

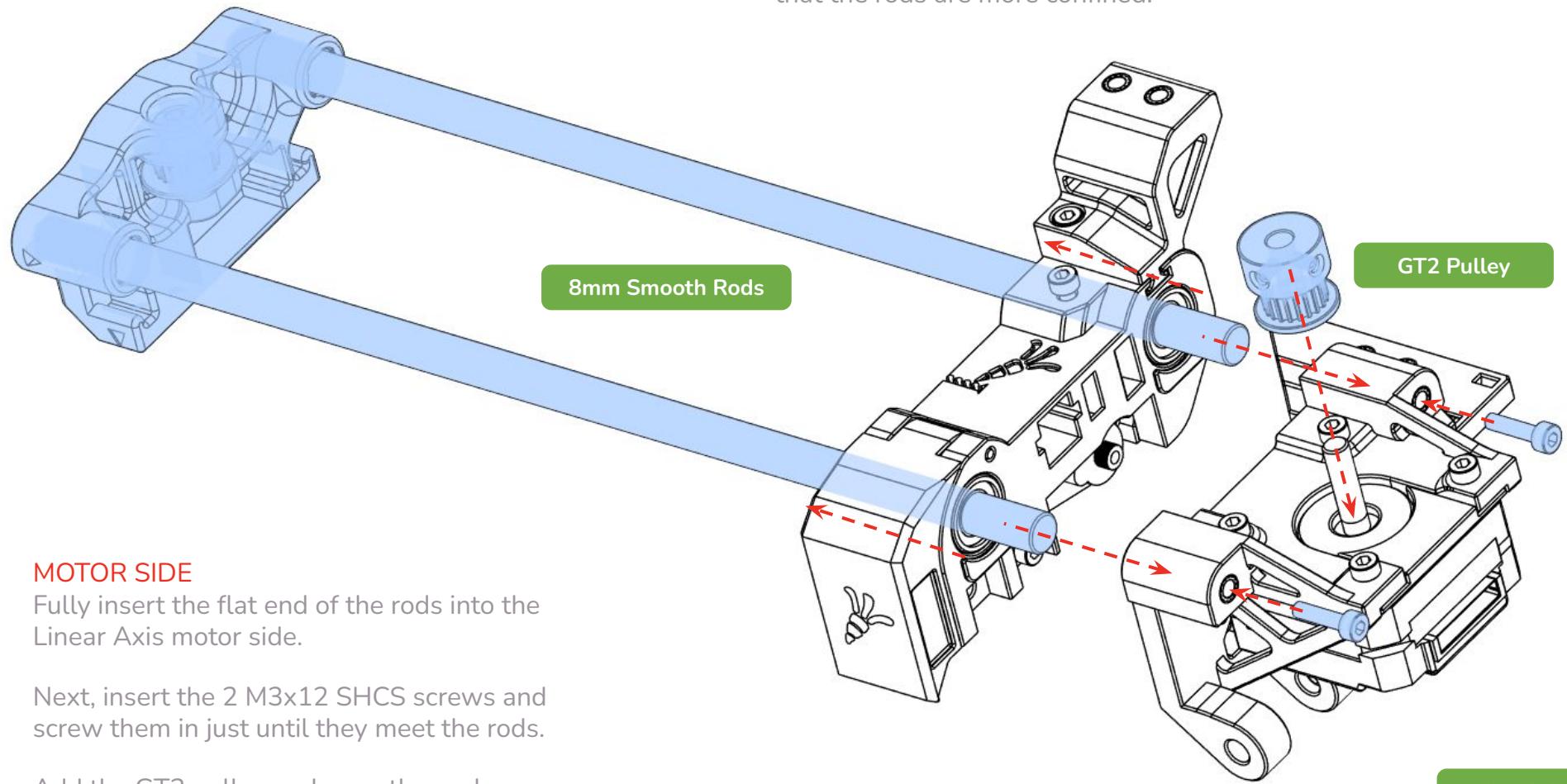


LINEAR AXIS

AXIS ASSEMBLY

SELECTOR

Insert the 8mm rods into the Selector's LM8UU bearings as shown. They should roll smoothly now that the rods are more confined.



MOTOR SIDE

Fully insert the flat end of the rods into the Linear Axis motor side.

Next, insert the 2 M3x12 SHCS screws and screw them in just until they meet the rods.

Add the GT2 pulley and snug the grub screw. We will adjust it soon.

LINEAR AXIS

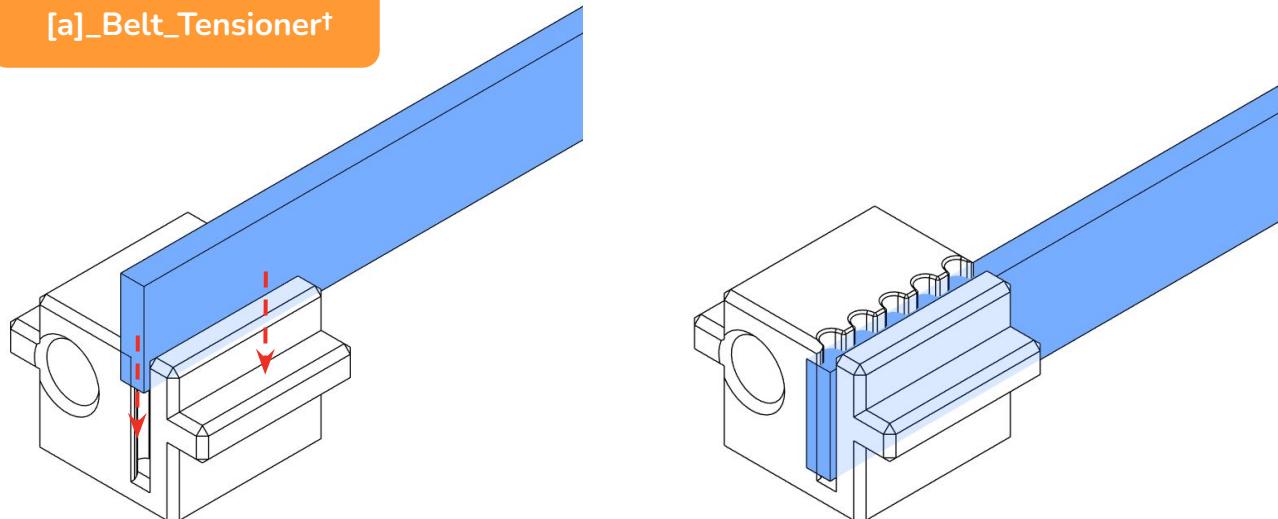
BELT PREP

BELT PREPARATION

First, cut your belt to the length prescribed in the table to the right.

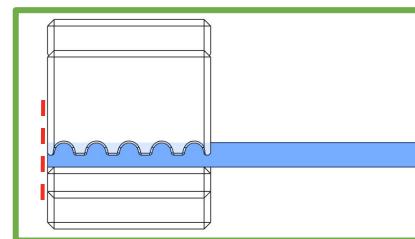
Next, install the belt into the **Belt_Tensioner** by pushing the end of the belt into the toothed slot on the top. You may need to use a flathead screwdriver or the dull side of a hobby knife to push the belt fully into place. Trim any overhanging belt.

[a]_Belt_Tensioner†



Channels	Belt Length (mm)
N	$165 + 46N$
4	349
5	395
6	441
7	487
8	533
9	579
10	625
11	671
12	717
13	763
14	809
15	855

Includes 15mm adjustment length



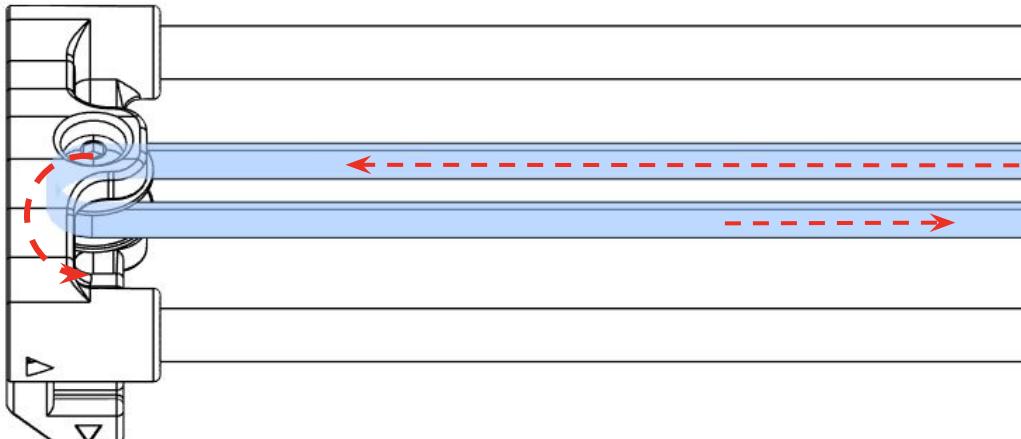
LINEAR AXIS

BELT INSTALLATION

BELT INSTALLATION

Next, install the [Belt_Tensioner](#) into the [Selector_Cart](#). Push it all the way into the [Selector_Cart](#) and fasten the [Belt_Tensioner](#) with an M3x20mm SHCS, all the way snug.

Next, wrap the belt counter-clockwise around the GT2 pulley, through the hole in the [Selector_Cart](#), around the idler, and finally back to the [Selector_Cart](#).

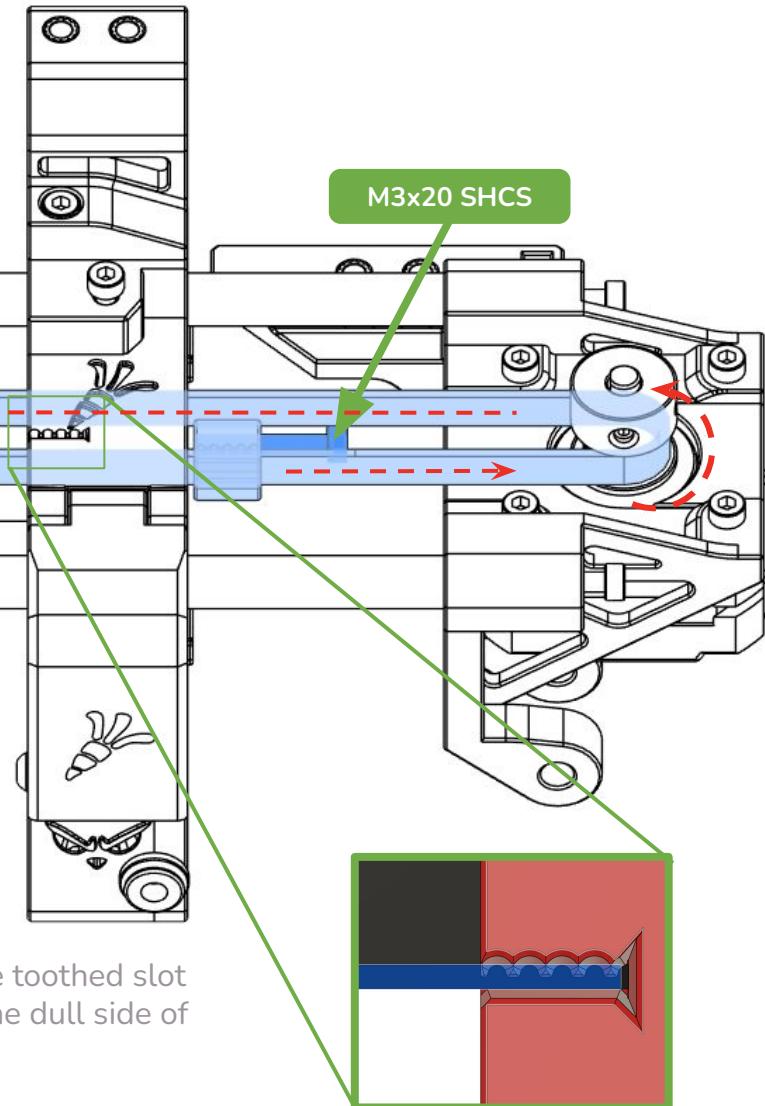


Mark the belt length to the near edge of the [Selector_Cart](#) with a pen or marker. Next, **measure an additional 20mm of length**, and then cut the belt. This ensures room for adjustment later.

Release some tension by unscrewing the [Belt_Tensioner](#) bolt. You may need to pull on the belt to make the tensioner move.

Attach the belt to the [Selector_Cart](#) by pushing the end of the belt into the toothed slot on the [Selector_Cart](#). You will need to use a thin flathead screwdriver or the dull side of a hobby blade to push the belt fully into place.

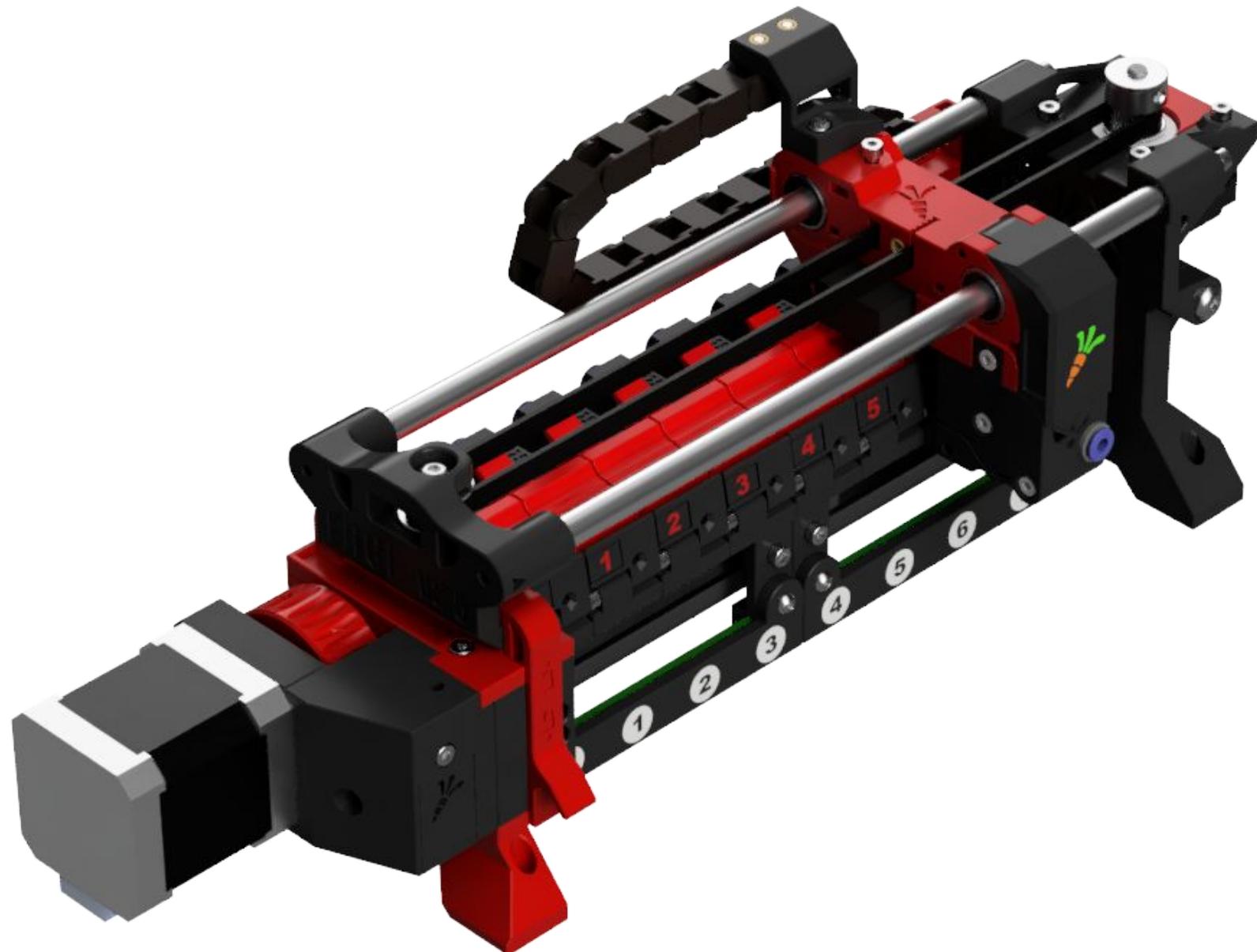
This is not the final belt length - the belt is supposed to be very loose at this point!



Multi-material bioprinting is being explored for medical applications. Researchers are developing methods to print with biological materials like hydrogels and living cells, allowing for the creation of complex tissues that mimic the structure of human organs.

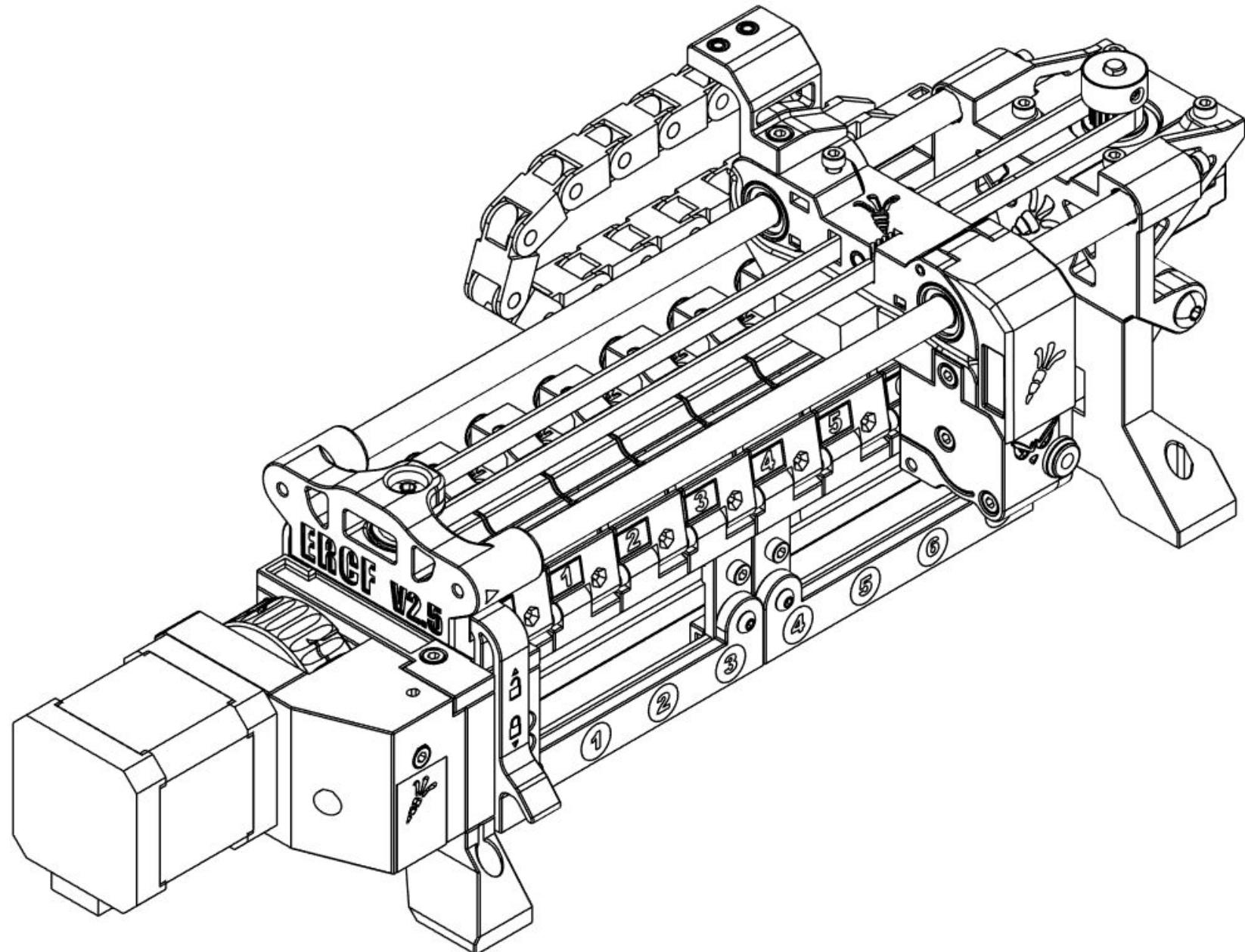
FINAL ASSEMBLY

OVERVIEW



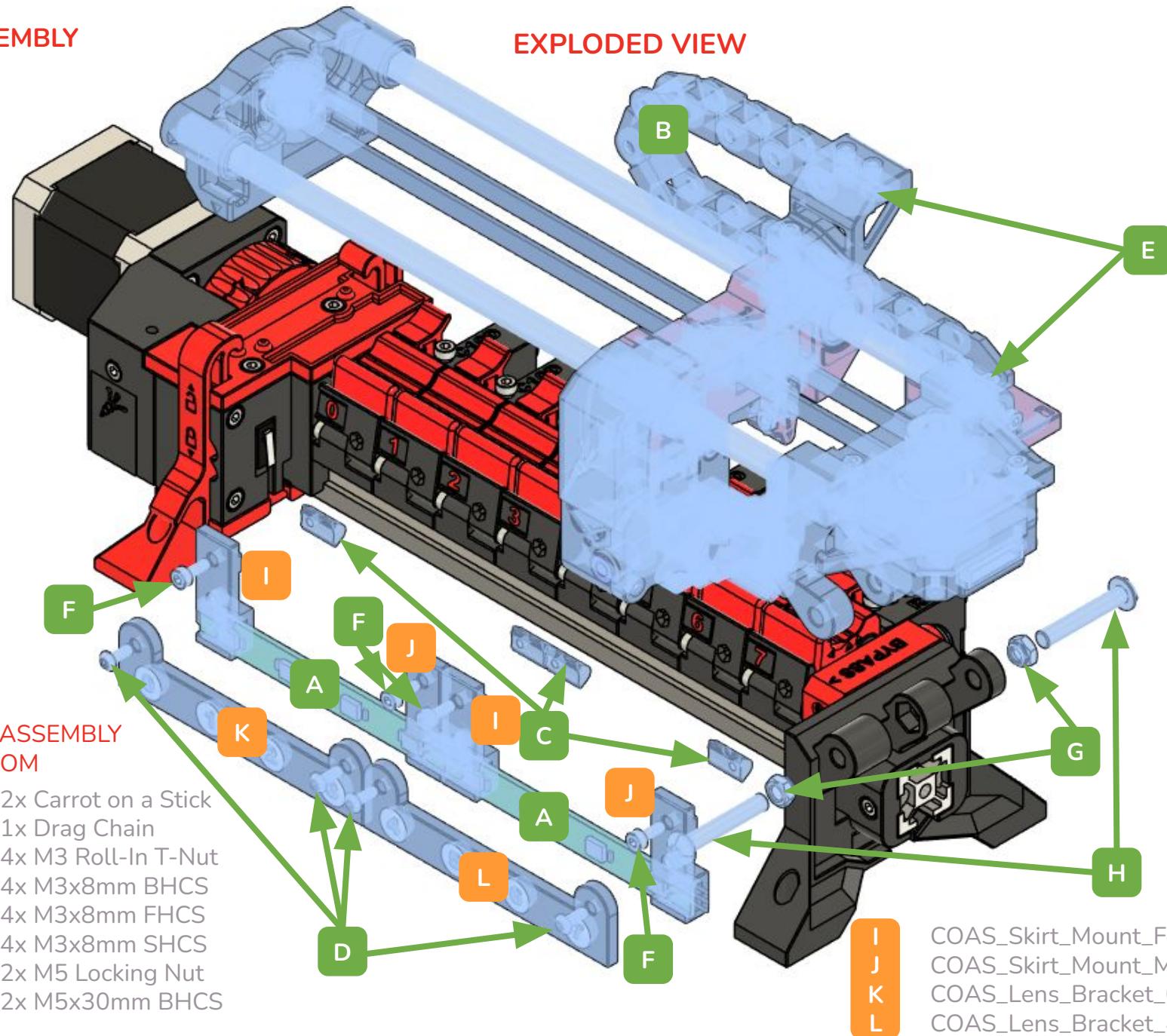
FINAL ASSEMBLY

OVERVIEW



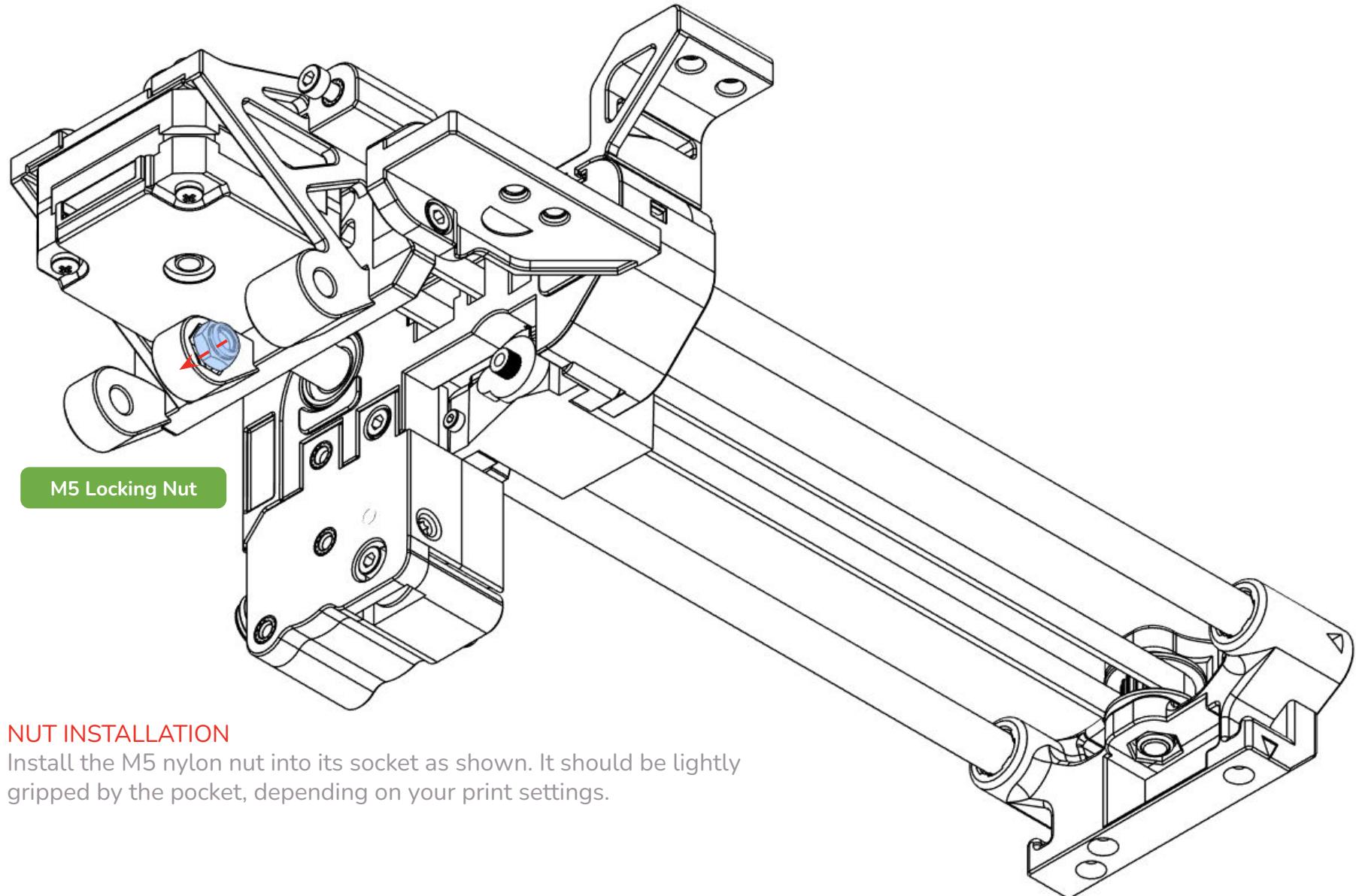
FINAL ASSEMBLY

EXPLODED VIEW



FINAL ASSEMBLY

ADDING THE LOCKING NUTS

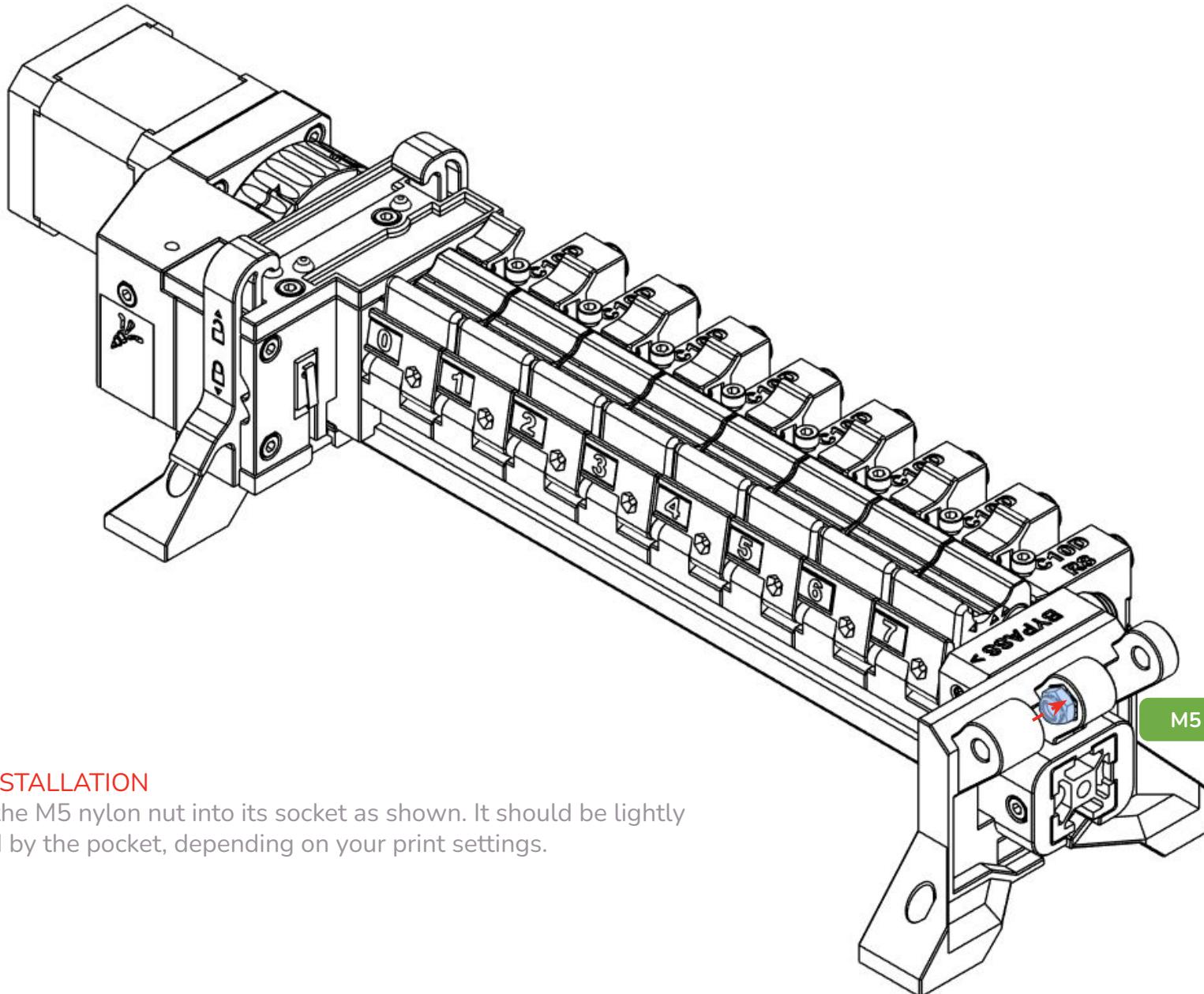


NUT INSTALLATION

Install the M5 nylon nut into its socket as shown. It should be lightly gripped by the pocket, depending on your print settings.

FINAL ASSEMBLY

ADDING THE LOCKING NUTS

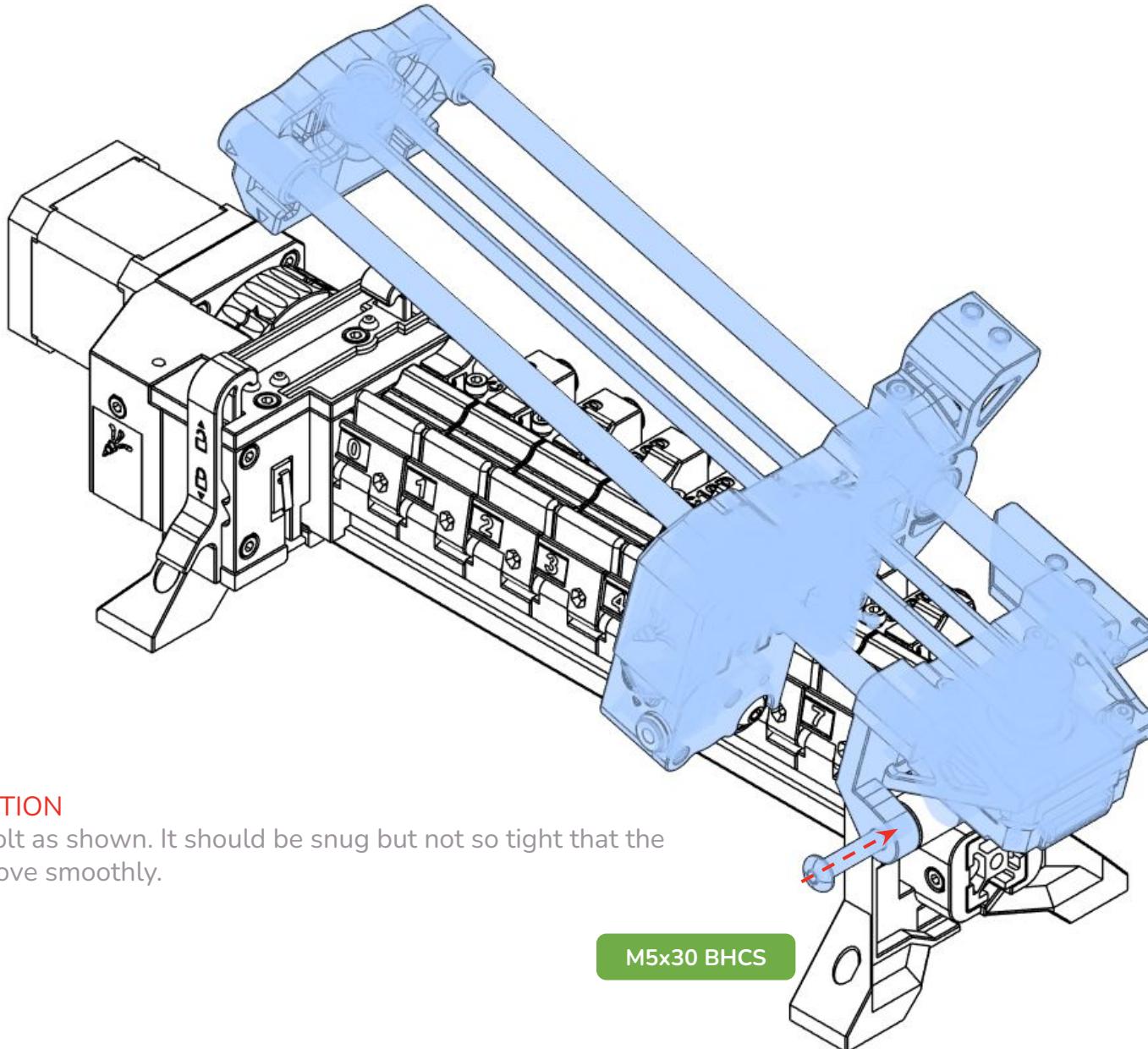


NUT INSTALLATION

Install the M5 nylon nut into its socket as shown. It should be lightly gripped by the pocket, depending on your print settings.

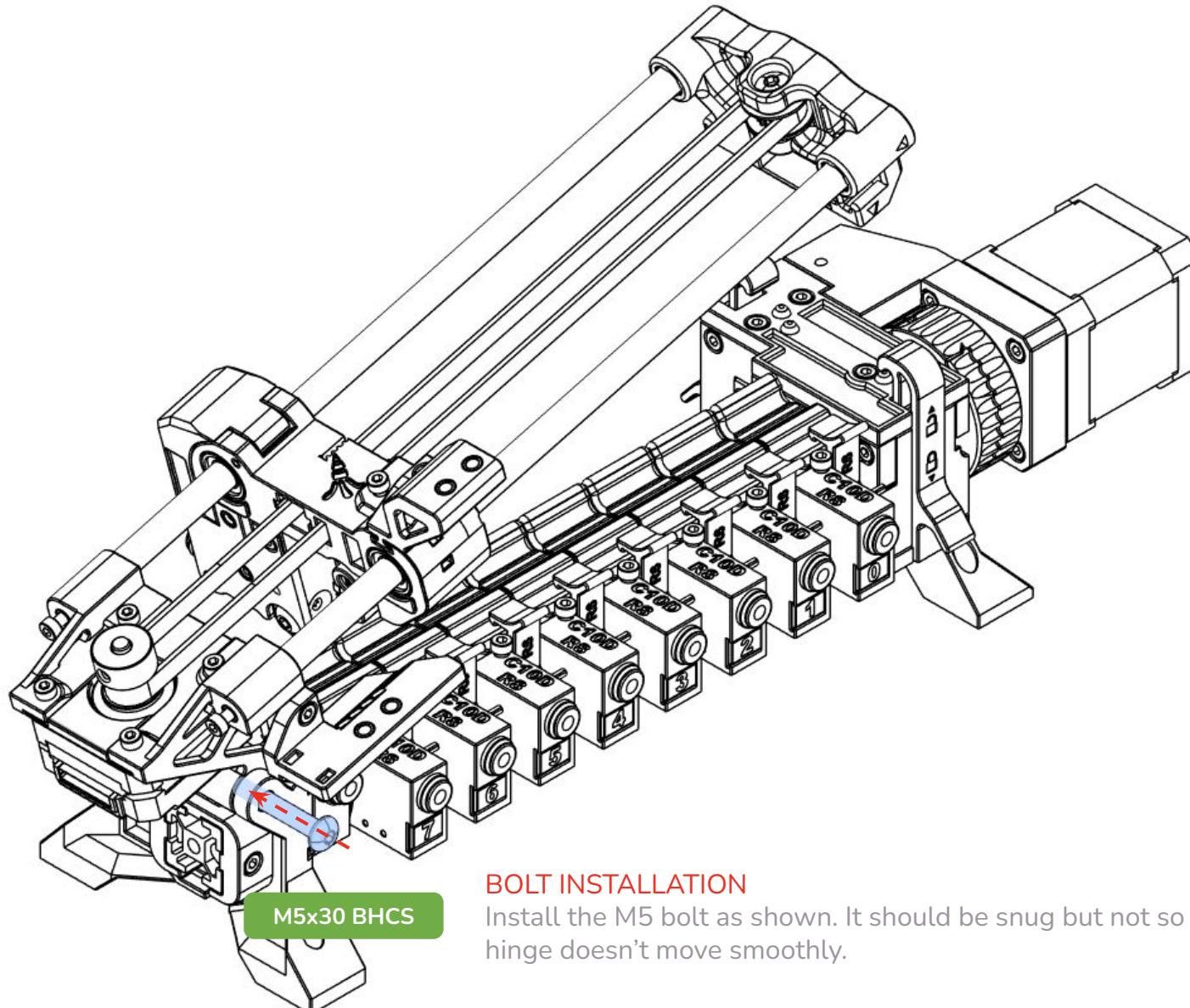
FINAL ASSEMBLY

JOINING THE TWO BLOCKS



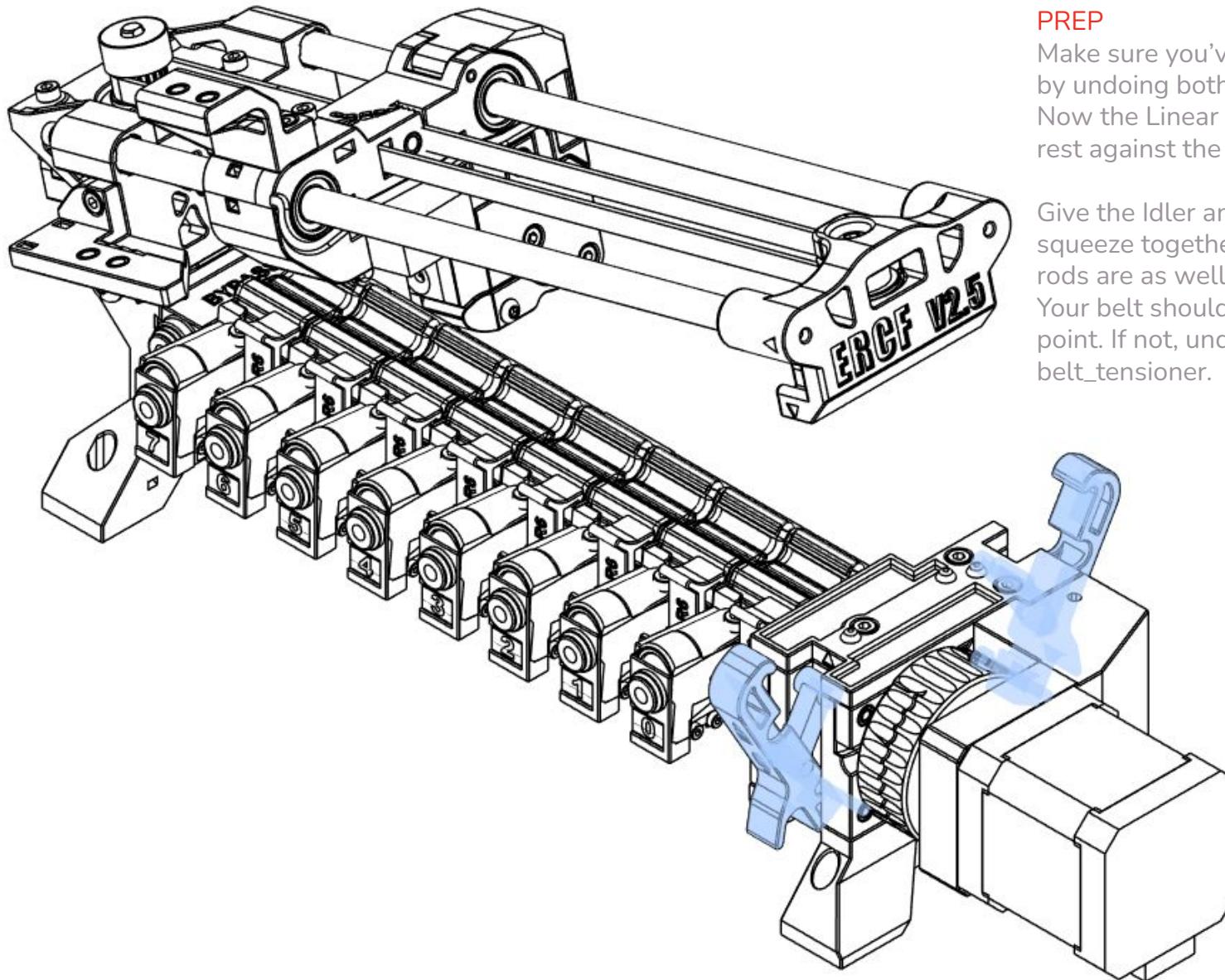
FINAL ASSEMBLY

JOINING THE TWO BLOCKS



FINAL ASSEMBLY

IDLER POSITION ADJUSTMENT



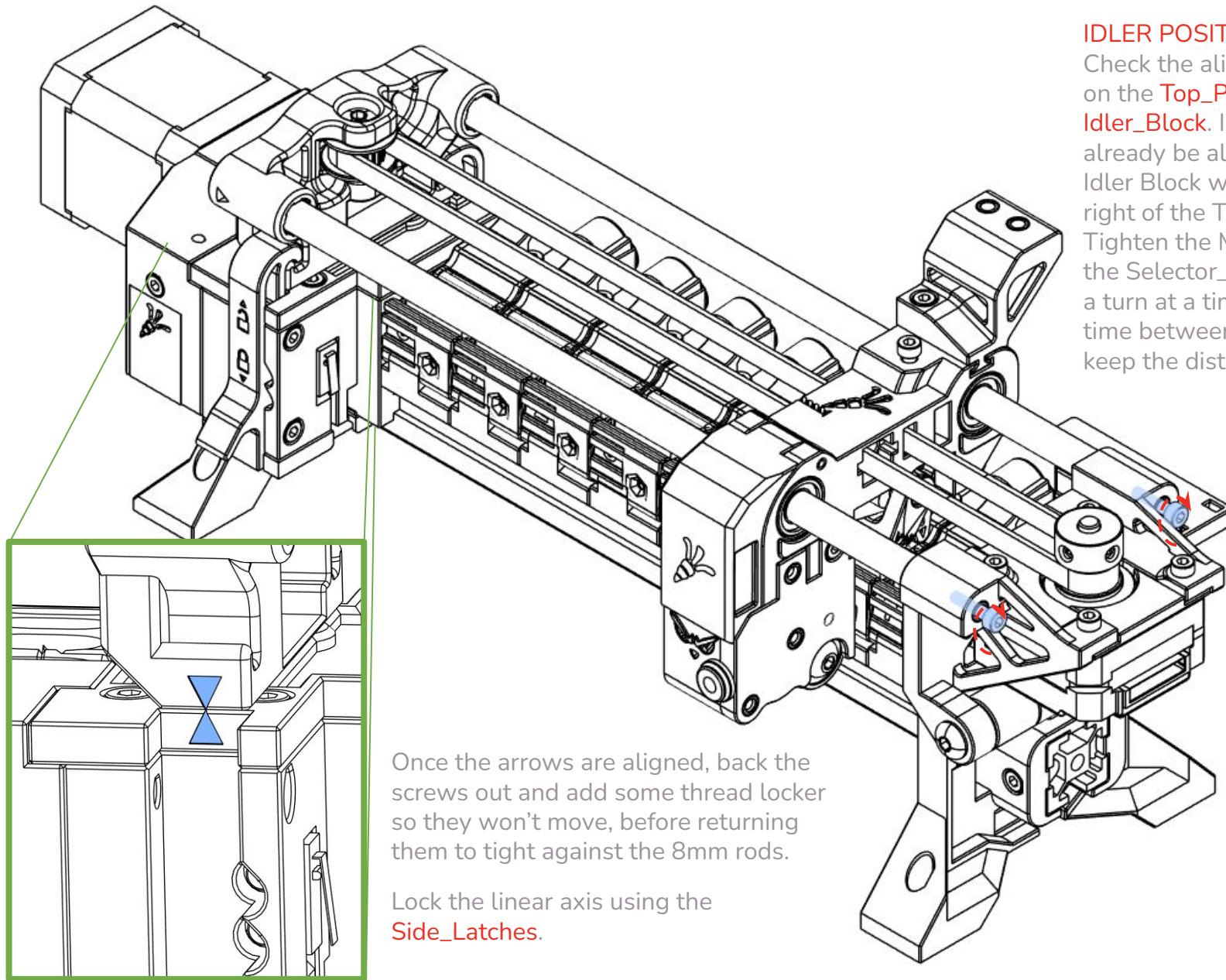
PREP

Make sure you've unlocked the linear axis by undoing both of the [Side_Latches](#). Now the Linear Axis can finally come to a rest against the gear axis.

Give the Idler and Motor end a good squeeze together to make sure the 8mm rods are as well-seated as possible. Your belt should be very loose at this point. If not, undo the bolt to the [belt_tensioner](#).

FINAL ASSEMBLY

IDLER POSITION ADJUSTMENT

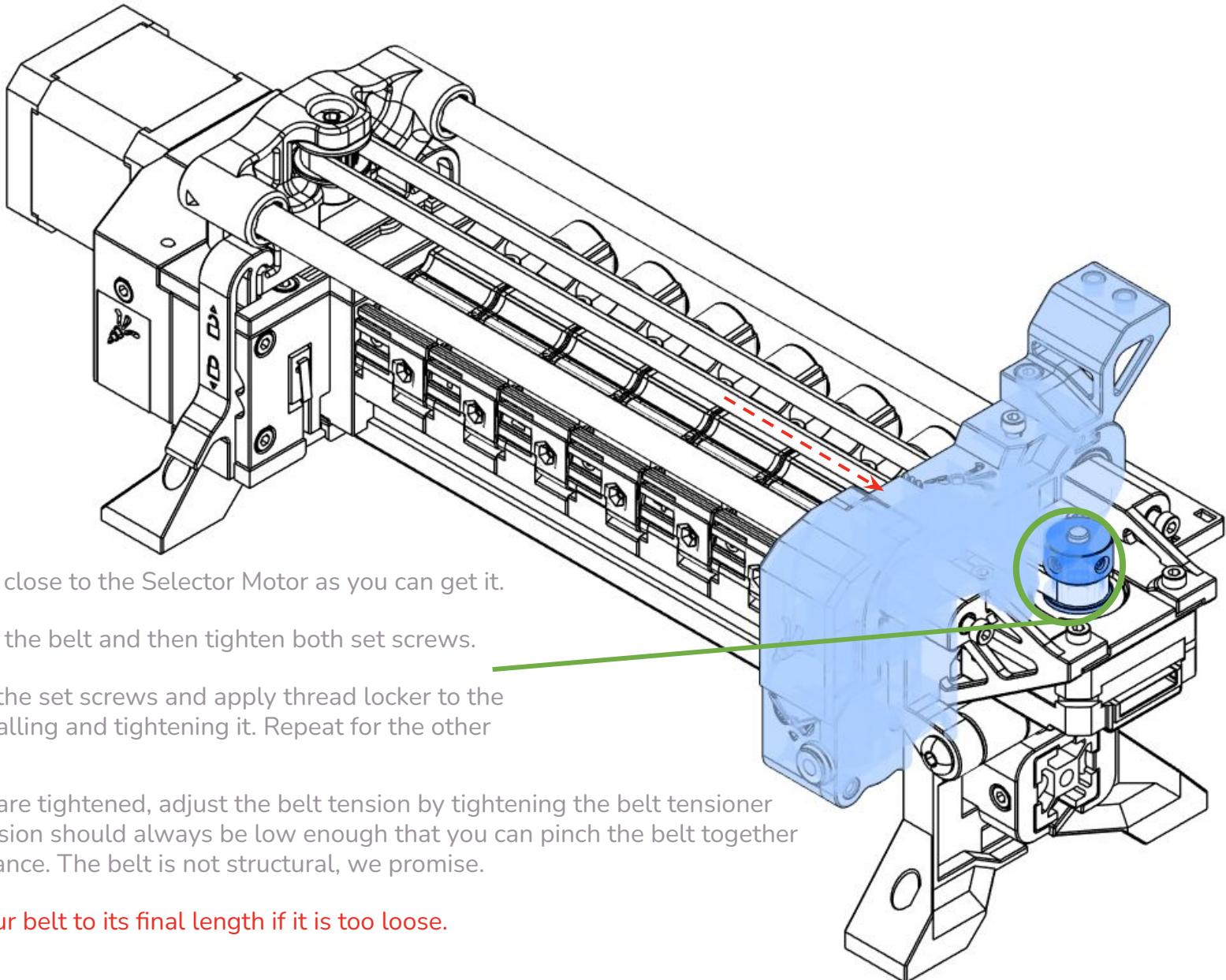


IDLER POSITION

Check the alignment indicators on the [Top_Panel](#) and the [Idler_Block](#). Ideally, they will already be aligned. Usually, the Idler Block will be a little to the right of the Top Panel. Tighten the M3x12mm screws on the Selector_Motor_Support half a turn at a time, switching each time between the two screws to keep the distance even.

FINAL ASSEMBLY

TENSIONING THE BELT

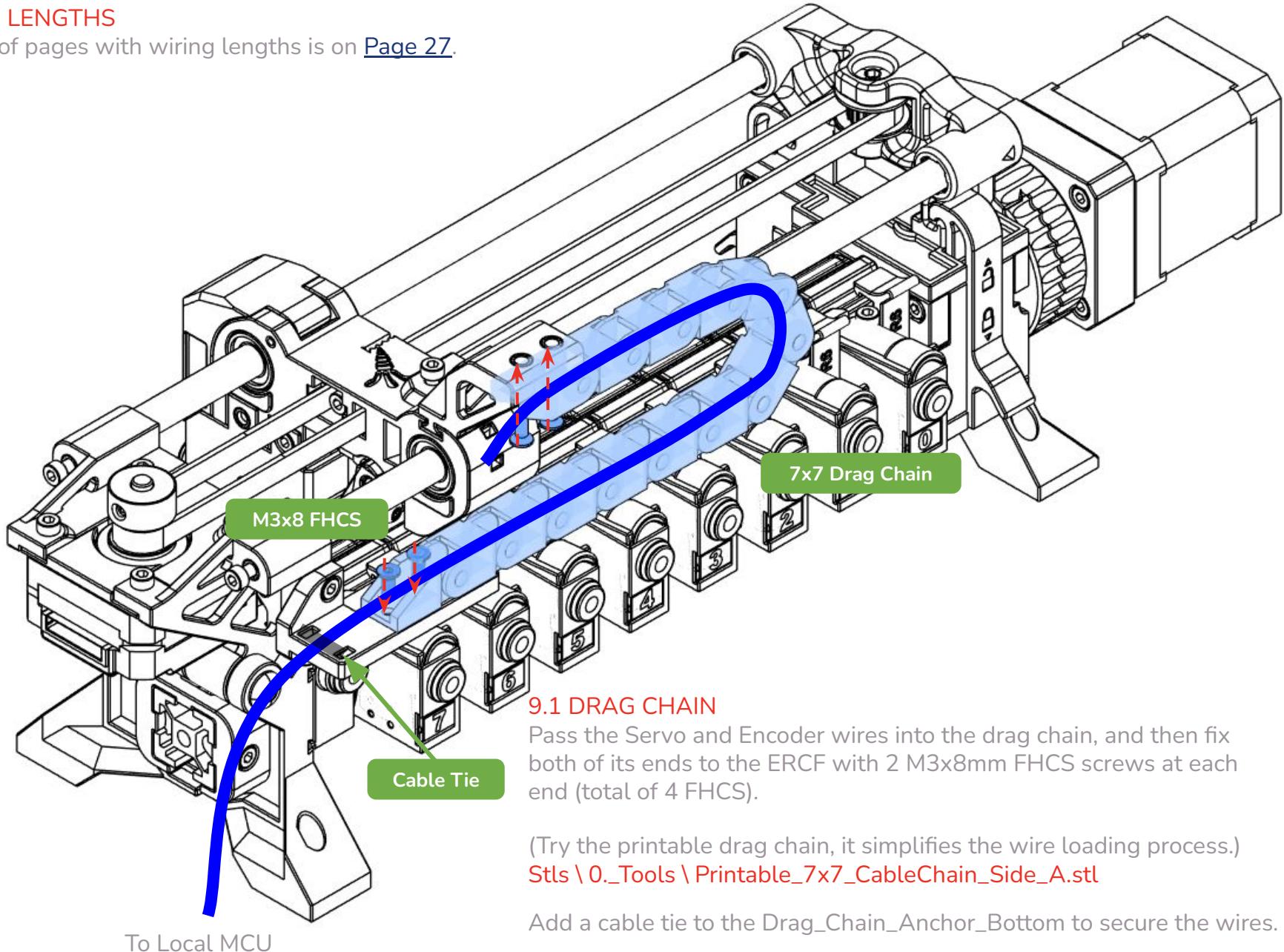


FINAL ASSEMBLY

DRAG CHAIN

WIRING LENGTHS

The list of pages with wiring lengths is on [Page 27](#).



9.1 DRAG CHAIN

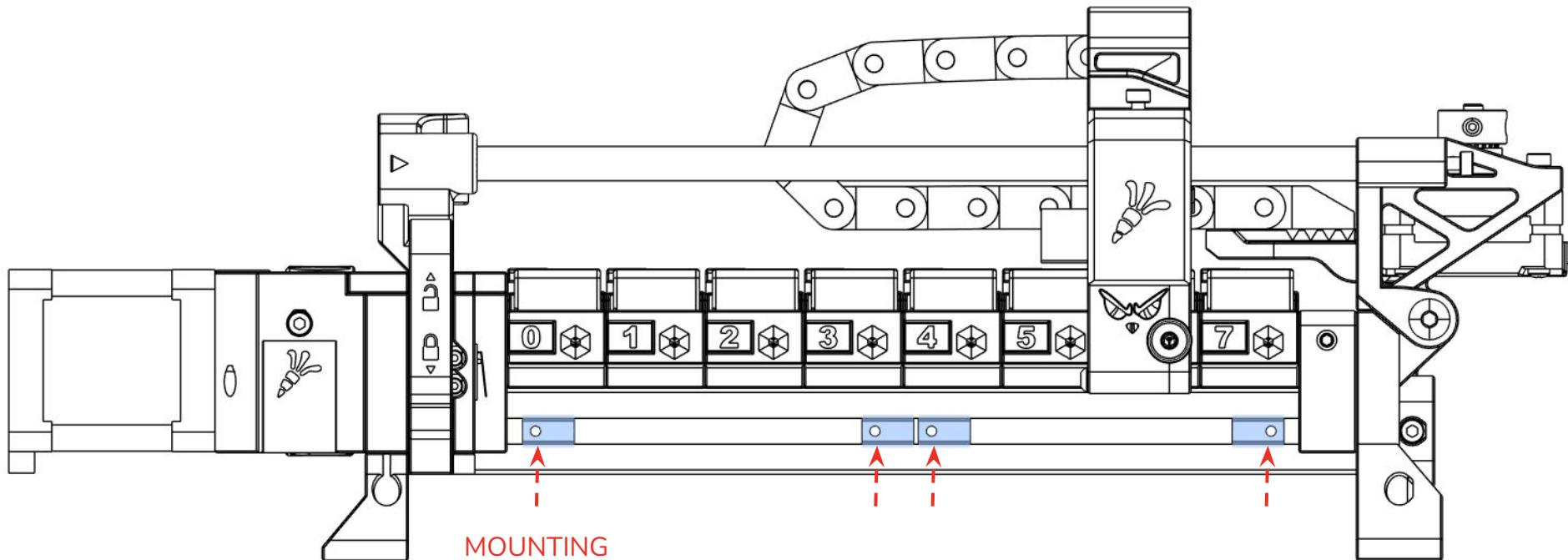
Pass the Servo and Encoder wires into the drag chain, and then fix both of its ends to the ERCF with 2 M3x8mm FHCS screws at each end (total of 4 FHCS).

(Try the printable drag chain, it simplifies the wire loading process.)
[Stls \ 0._Tools \ Printable_7x7_CableChain_Side_A.stl](#)

Add a cable tie to the Drag_Chain_Anchor_Bottom to secure the wires.

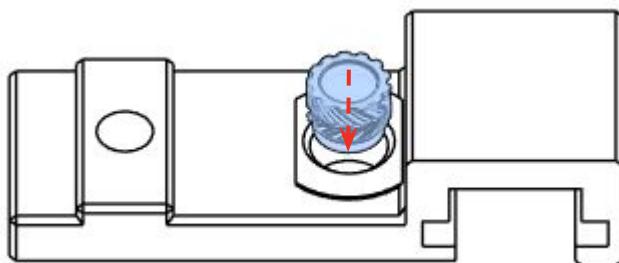
FINAL ASSEMBLY

COAS MOUNTING

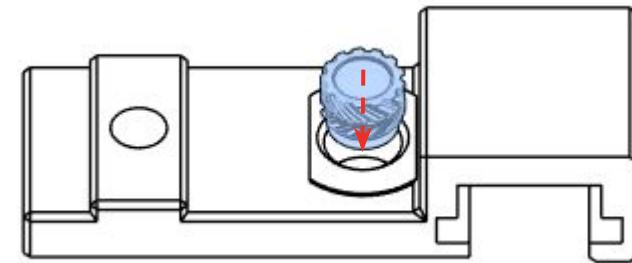


MOUNTING

Roll 4 M3 roll-in nuts into the front channel of the 2020 as shown.
Note the last nut is flipped in order to fit in the space allowed.



COAS_Holder_Female_x2

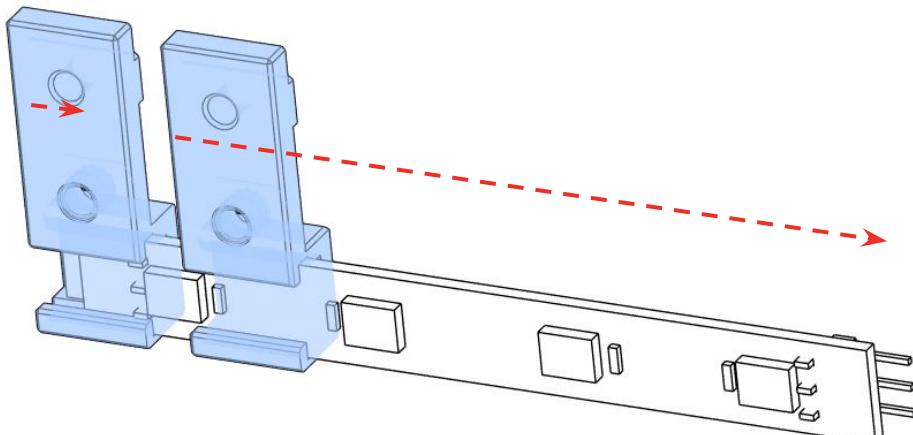


COAS_Holder_Male_x2

9.2C HEATSET INSERTS

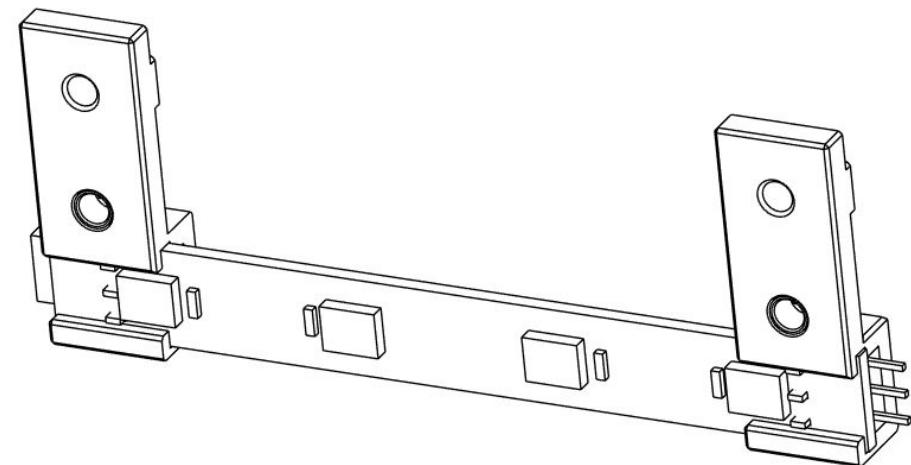
The list of pages with heatset inserts is on [Page 19](#).

FINAL ASSEMBLY



Carrot on a Stick PCB

COAS MOUNTING

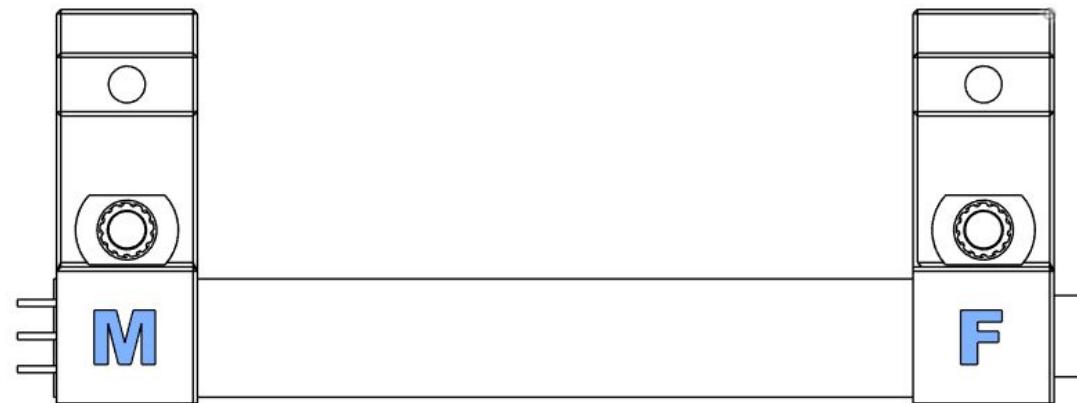


COAS MOUNTING

Insert the COAS into the mounts as shown, Male first and then Female, then slide the mounts out to either end.

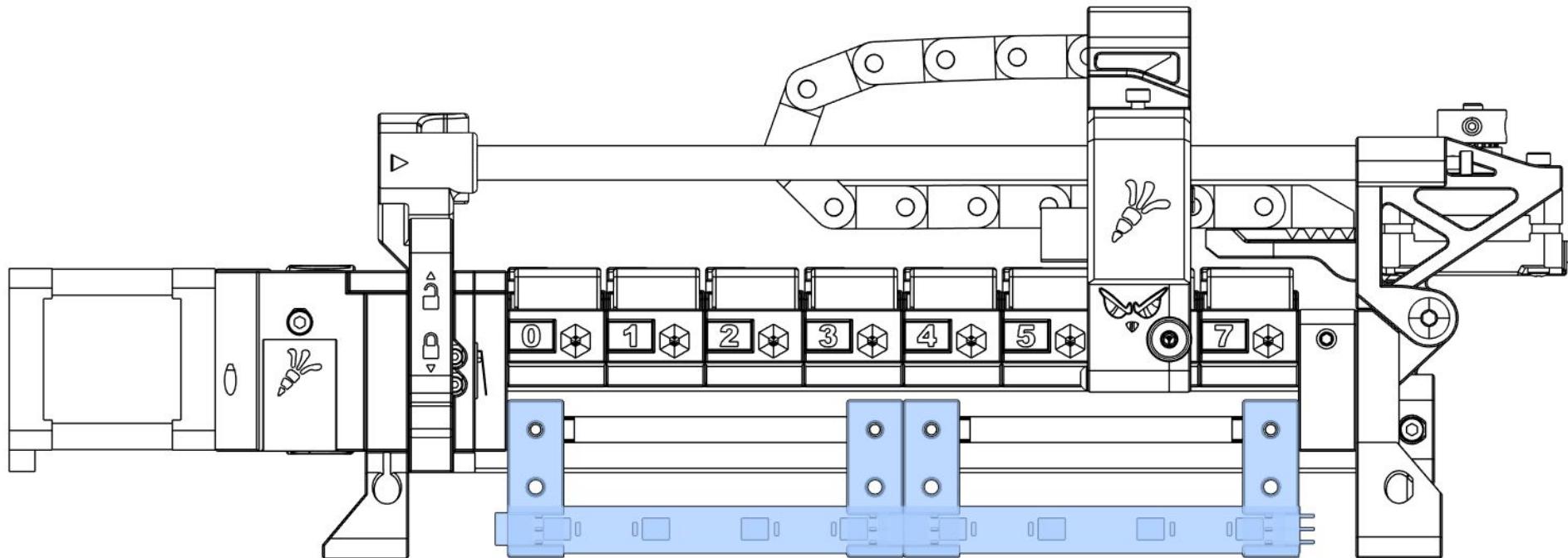
The mounts are labelled M and F for Male and Female end - they match the connectors on the COAS PCB, male to male, female to female.

Do this for however many COAS / COAT you have - 2 COAS for a standard 8-channel kit.



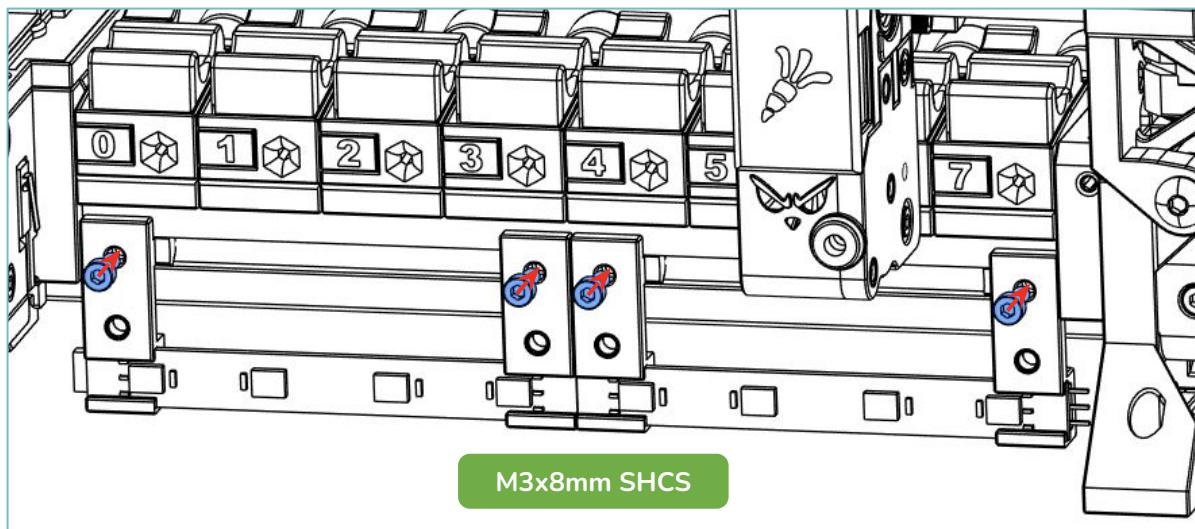
FINAL ASSEMBLY

COAS MOUNTING



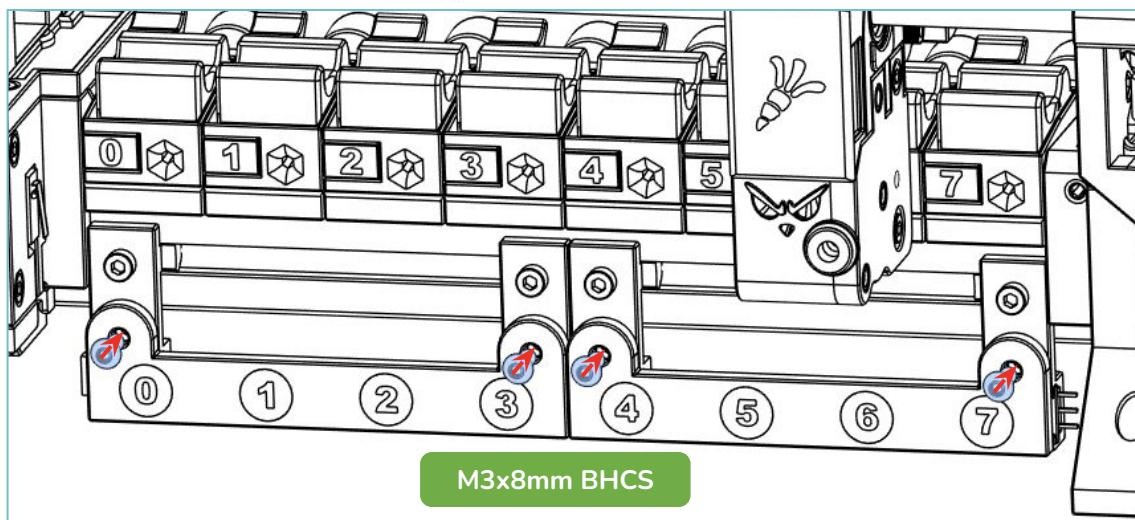
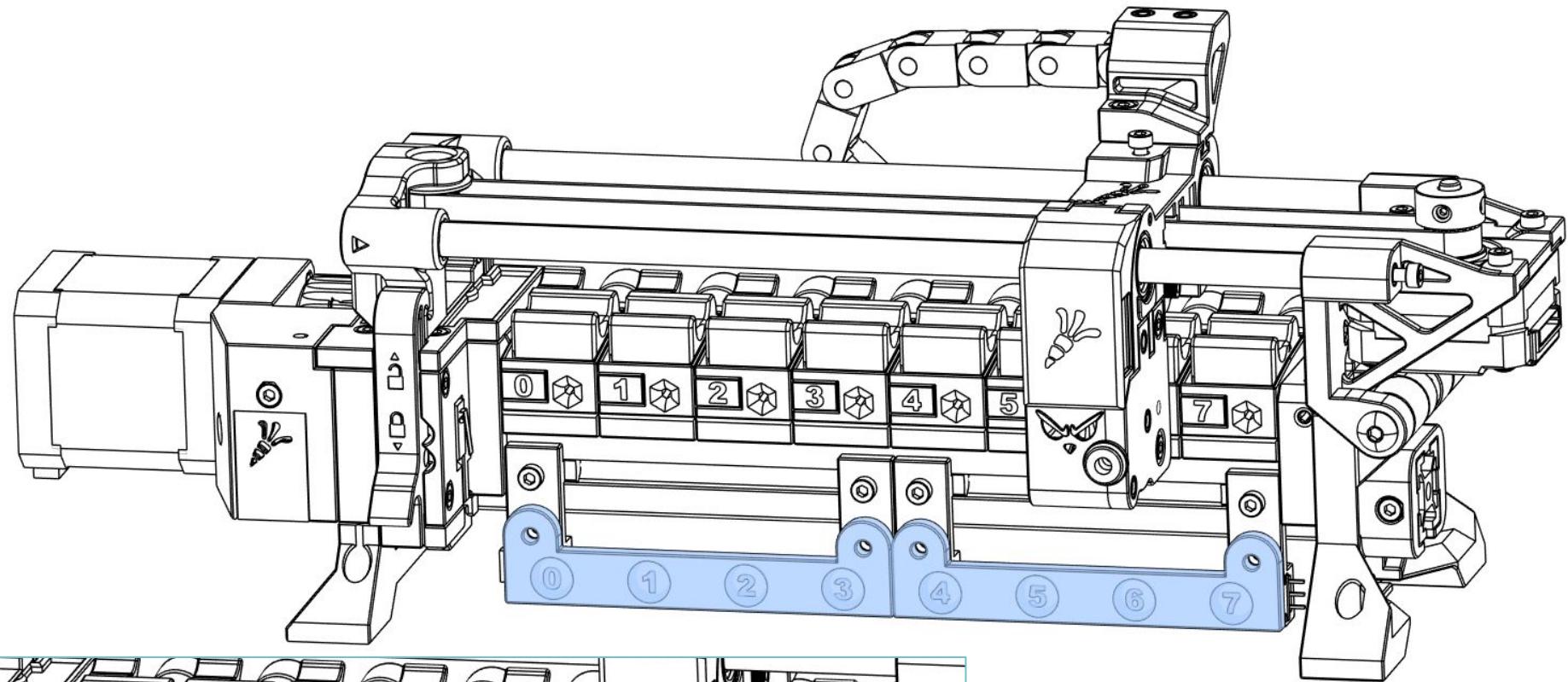
COAS MOUNTING

Link together your COAS, line it up against the nut you installed earlier, and fix them in place with 4 M3x8mm SHCS.



FINAL ASSEMBLY

COAS MOUNTING



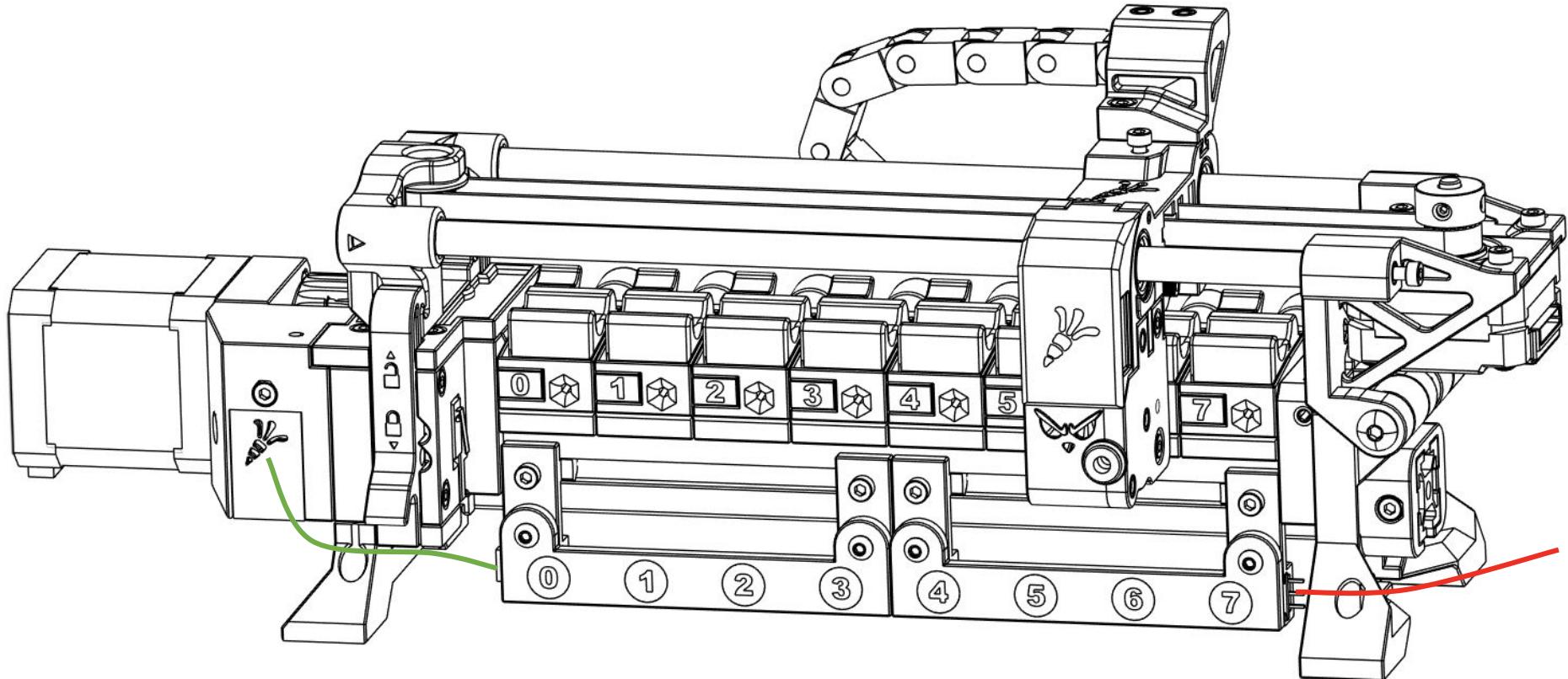
LED_BRACKET MOUNTING

These need to be printed in multiple colors, so you may need to wait until your machine is working to print them.

Line the brackets up over the COAS, and fix them in place with 4 M3x8mm BHCS.

FINAL ASSEMBLY

COAS WIRING



LED WIRING

The first pigtail (red) goes from the local mainboard, through the slot in the End_Block, to the pins Dupont 3-pin connector at the end of the COAS.

The second pigtail (green) plugs into the Dupont 3-pin connector at the start of the COAS, and goes through the slot in the Gearbox_Foot to the Gearbox LED (optional).

WIRING LENGTHS

The list of pages with wiring lengths is on [Page 27](#).

MOUNTING

[Ed. Note: This section is intended for the DIY-wired Neopixel LEDs.]



COAS_Holder_Female_x2

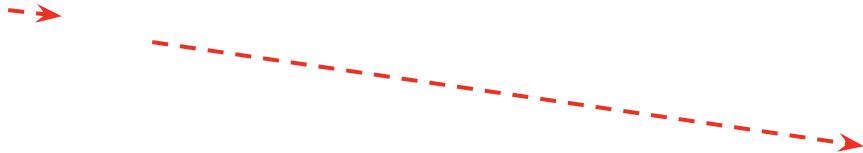
9.2C HEATSET INSERTS

The list of pages with heatset
inserts is on [Page 18](#).

COAS_Holder_Male_x2

FINAL ASSEMBLY

LED MOUNTING



[Ed. Note: This section is intended for the DIY-wired Neopixel LEDs.]

Carrot on a Stick PCB

COAS MOUNTING

Insert the COAS into the mounts as shown, Male first and then Female, then slide the mounts out to either end.

The mounts are labelled M and F for Male and Female end - they match the connectors on the COAS PCB, male to male, female to female.

Do this for however many COAS / COAT you have - 2 COAS for a standard 8-channel kit.

FINAL ASSEMBLY

LED MOUNTING

[Ed. Note: This section is intended for the DIY-wired Neopixel LEDs.]



M3x8mm SHCS

COAS MOUNTING

Link together your COAS, line it up against the nut you installed earlier, and fix them in place with 4 M3x8mm SHCS.

FINAL ASSEMBLY

LED MOUNTING

[Ed. Note: This section is intended for the DIY-wired Neopixel LEDs.]



M3x8mm BHCS

LED_BRACKET MOUNTING

These need to be printed in multiple colors, so you may need to wait until your machine is working to print them.

Line the brackets up over the COAS, and fix them in place with 4 M3x8mm BHCS.

[Ed. Note: This section is intended for the DIY-wired Neopixel LEDs.]



LED WIRING

The first pigtail (red) goes from the local mainboard, through the slot in the End_Block, to the pins Dupont 3-pin connector at the end of the COAS.

The second pigtail (green) plugs into the Dupont 3-pin connector at the start of the COAS, and goes through the slot in the Gearbox_Foot to the Gearbox LED (optional).

1.1 WIRING LENGTHS

The list of pages with wiring lengths is on [Page 26](#).

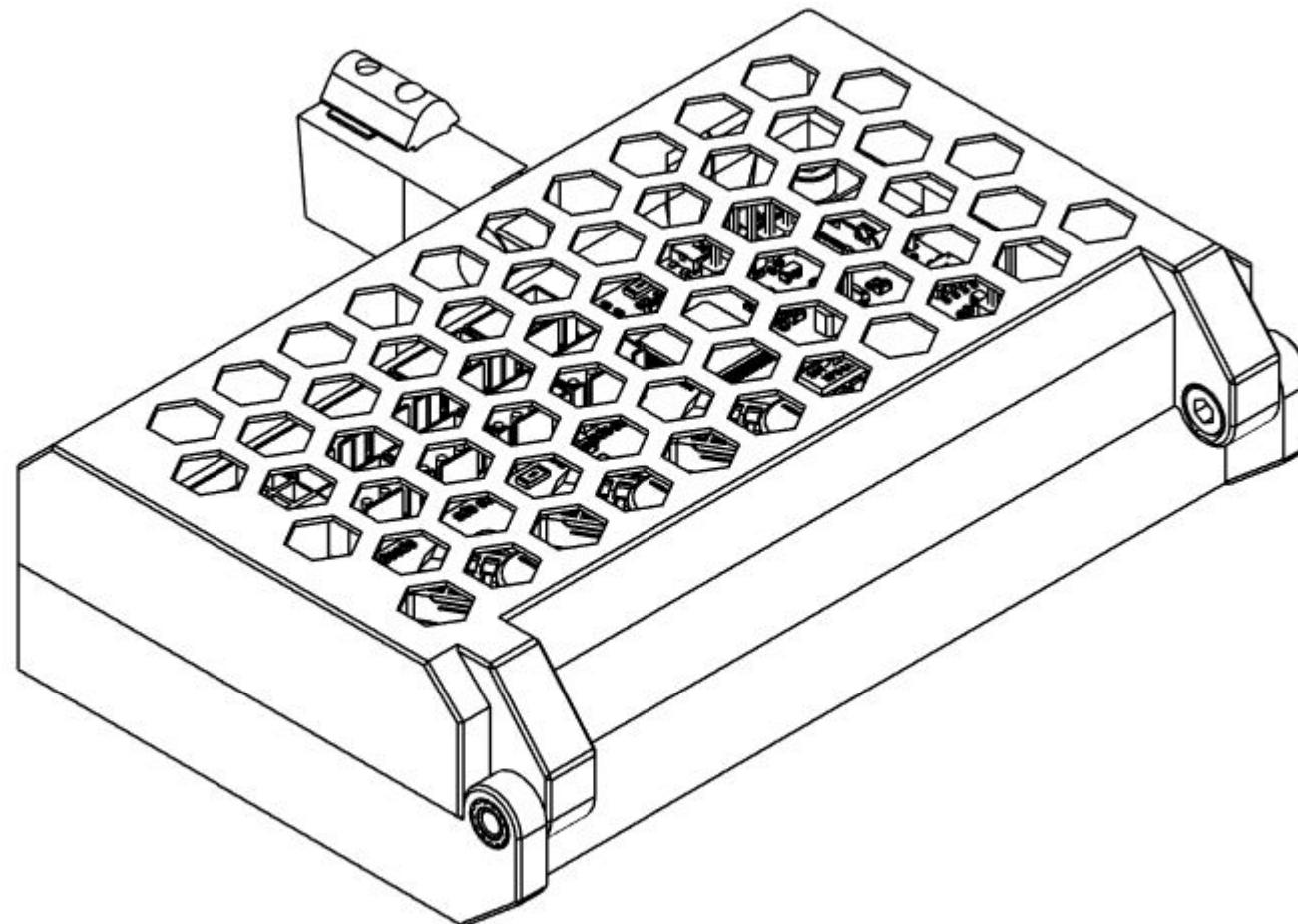
FINAL ASSEMBLY

MMBv2 / ELECTRONICS BOX



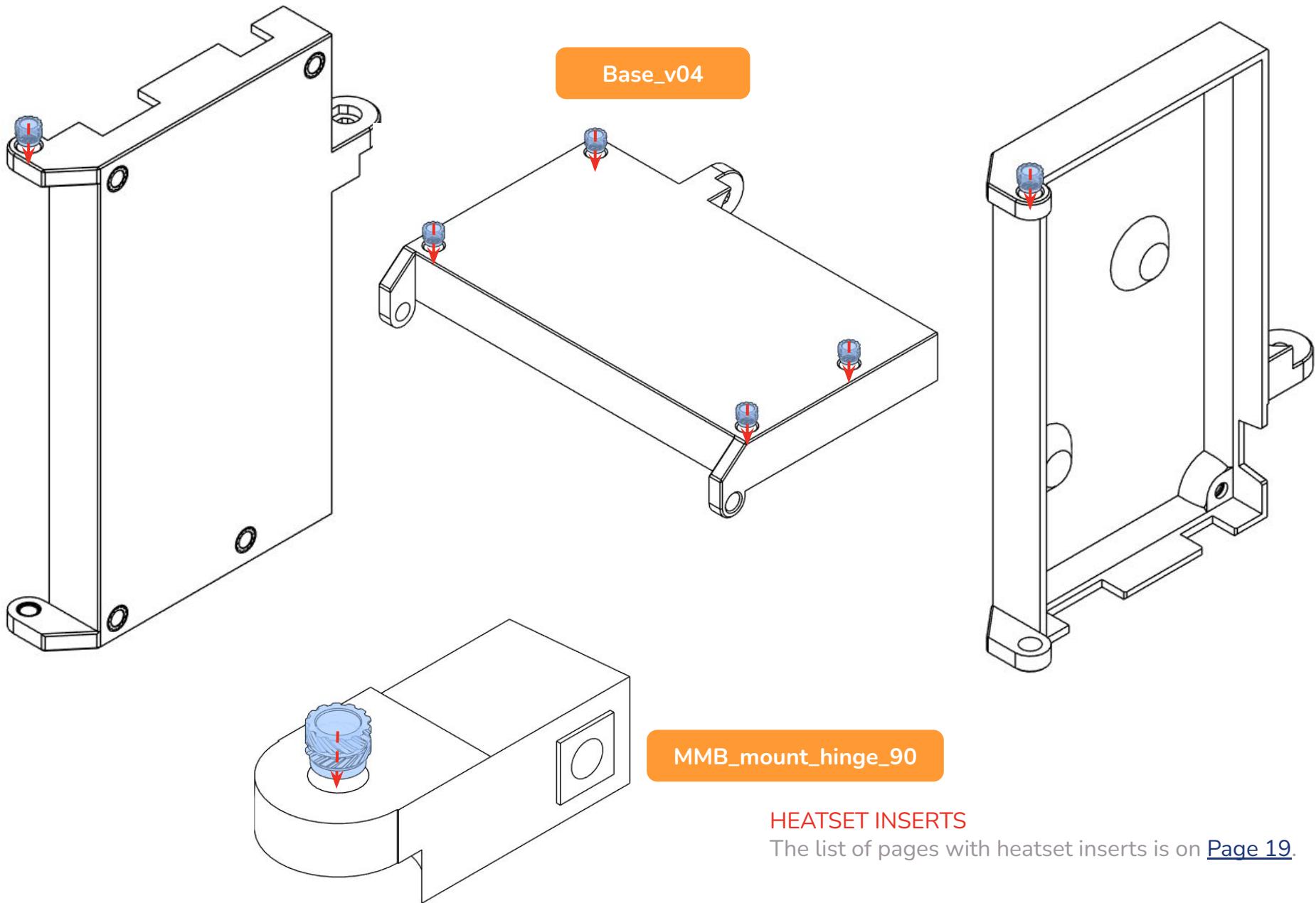
FINAL ASSEMBLY

MMBv2 / ELECTRONICS BOX



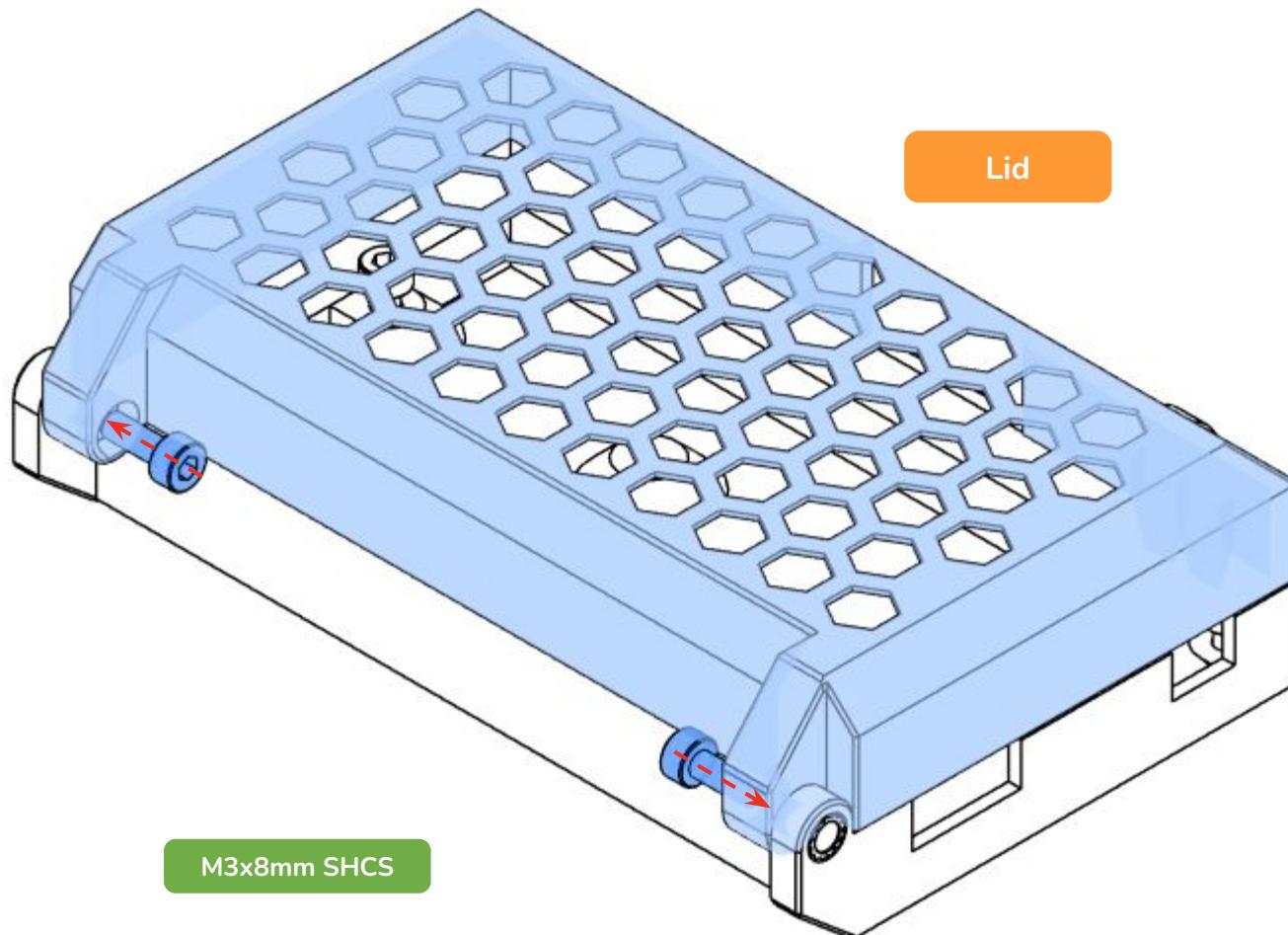
FINAL ASSEMBLY

MMBv2 / ELECTRONICS BOX



FINAL ASSEMBLY

MMBv2 / ELECTRONICS BOX

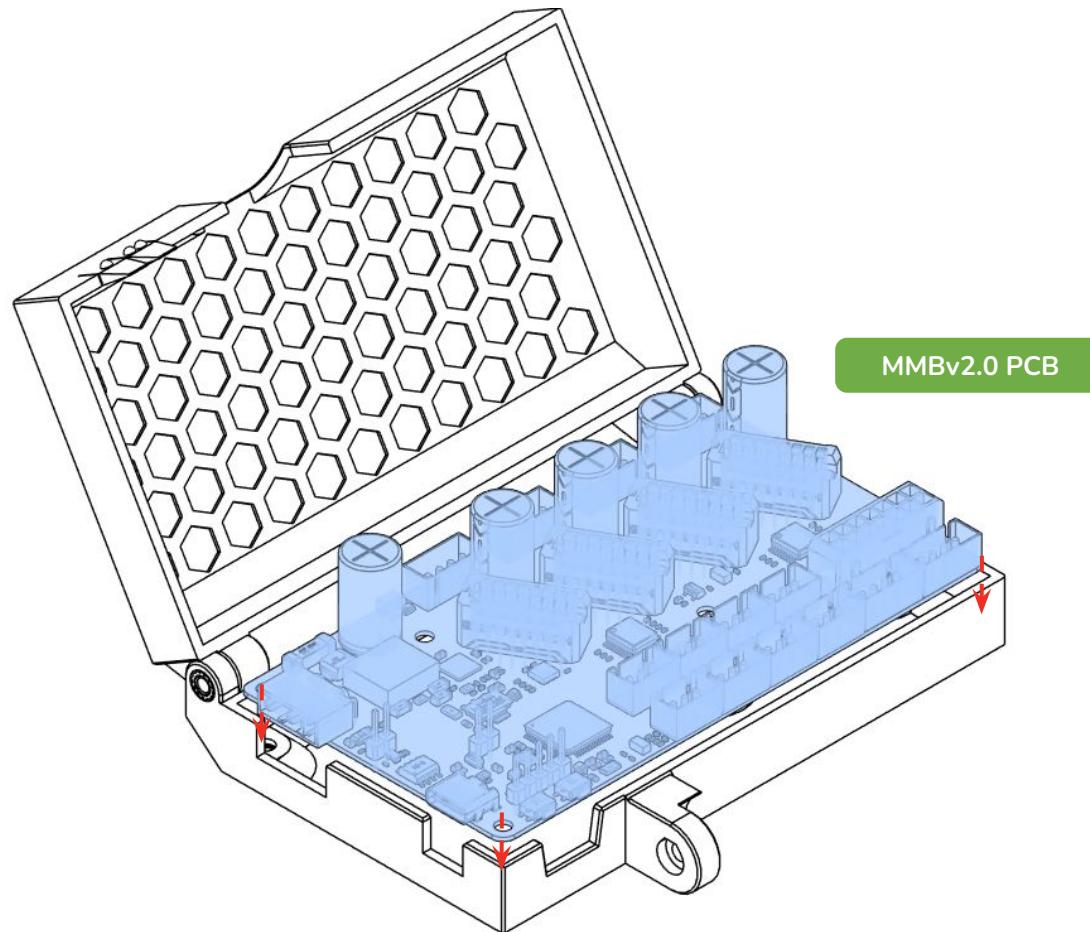


ELECTRONICS BOX LID

Place the Lid on top of the electronics box and secure it with two M3x8mm SHCS. They should be snug but not so tight that the hinge doesn't operate smoothly.

FINAL ASSEMBLY

MMBv2 / ELECTRONICS BOX

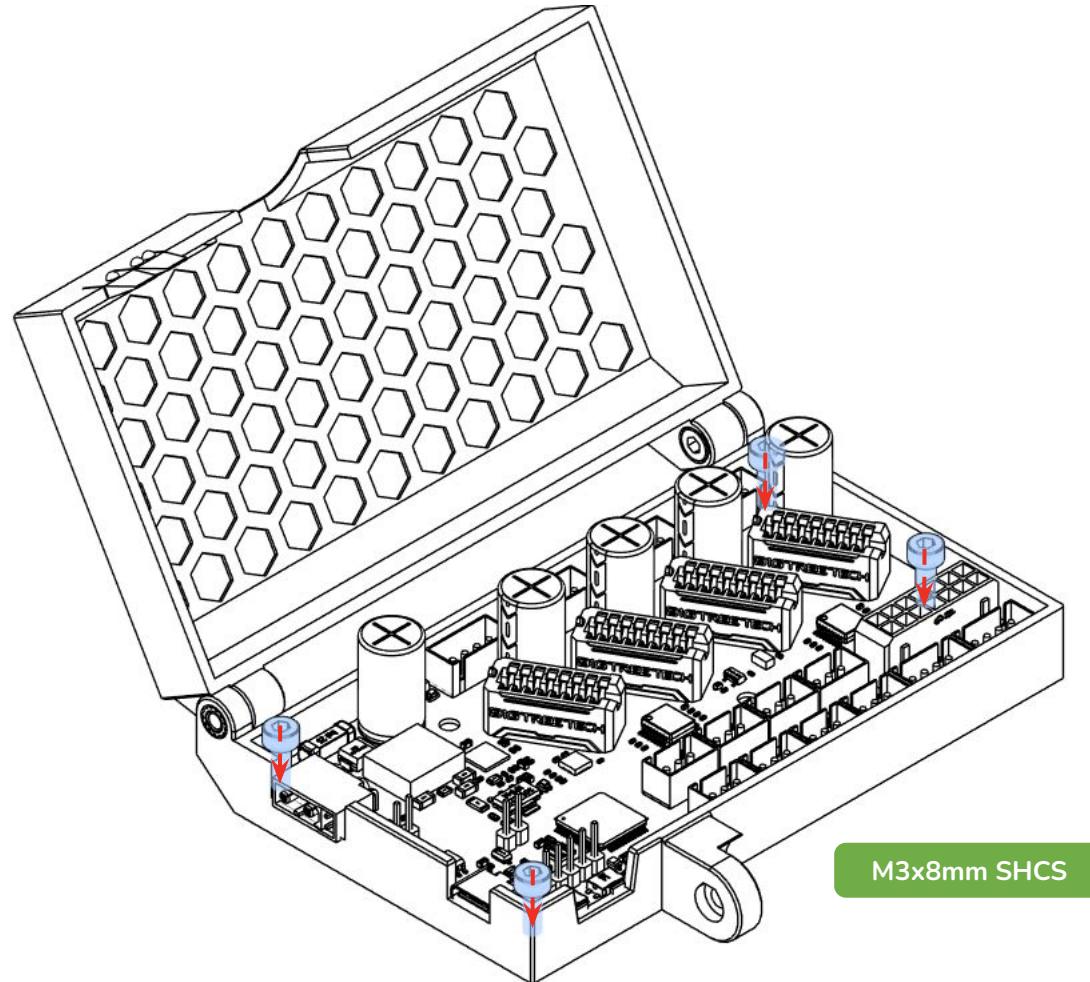


ELECTRONICS

Line up the MMBv2 or other electronics in its box.

FINAL ASSEMBLY

MMBv2 / ELECTRONICS BOX

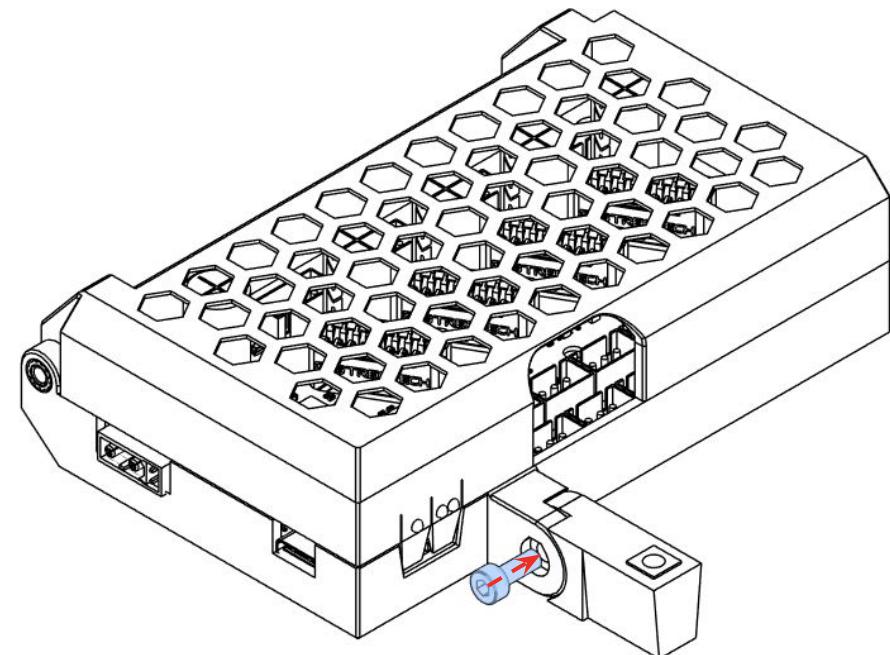
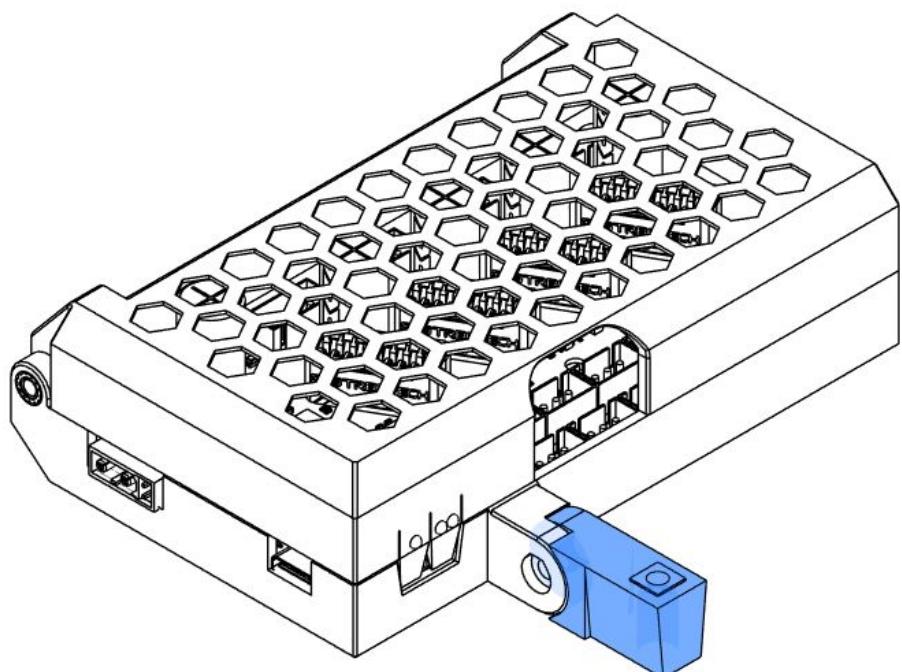


ELECTRONICS

Secure the electronics with 4 M3x8mm SHCS screws.

FINAL ASSEMBLY

MMBv2 / ELECTRONICS BOX



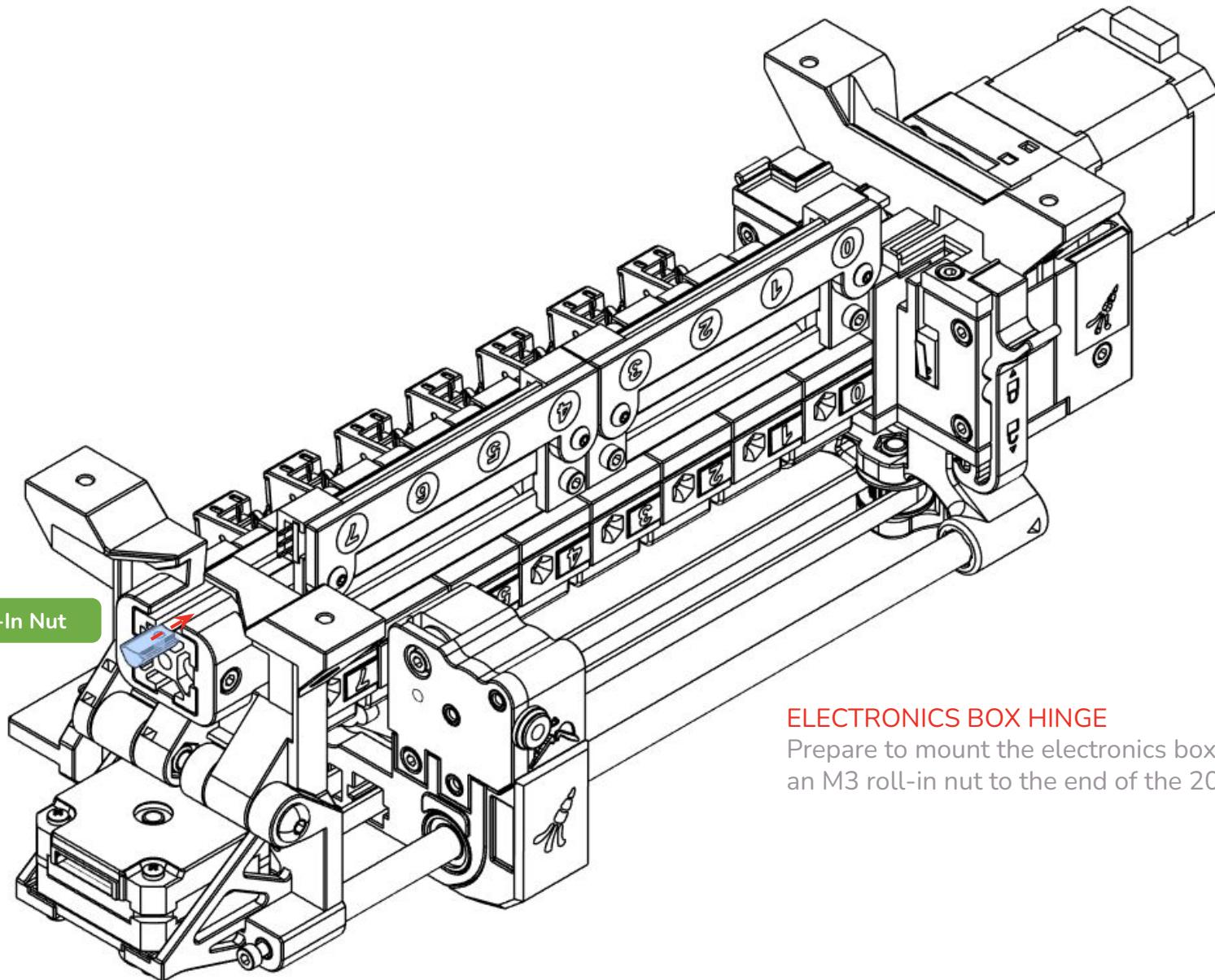
M3x8mm SHCS

ELECTRONICS BOX HINGE

Install the electronics box Hinge with an M3x8mm SHCS.

FINAL ASSEMBLY

MMBv2 / ELECTRONICS BOX



M3 Roll-In Nut

ELECTRONICS BOX HINGE

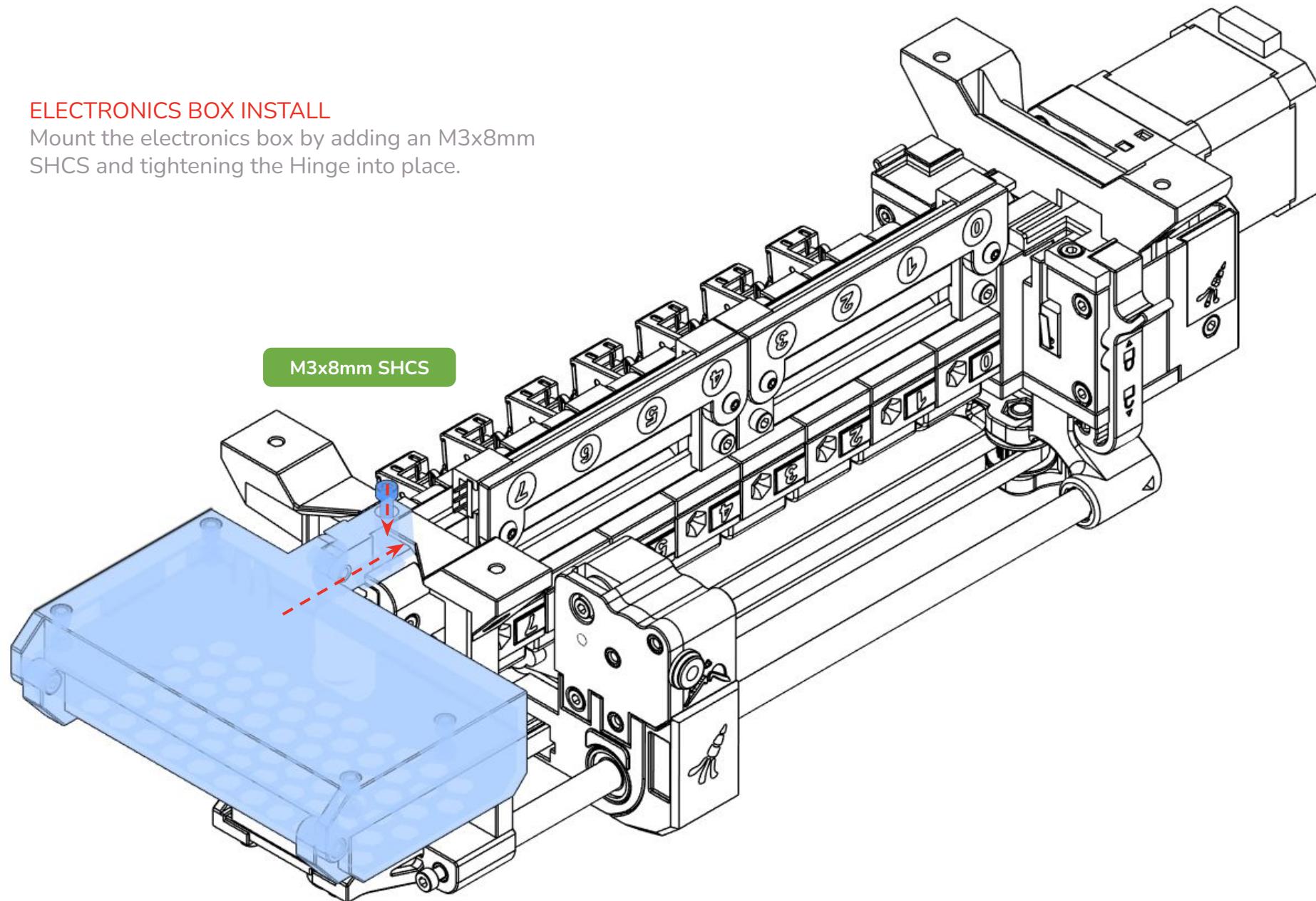
Prepare to mount the electronics box by adding an M3 roll-in nut to the end of the 2020.

FINAL ASSEMBLY

MMBv2 / ELECTRONICS BOX

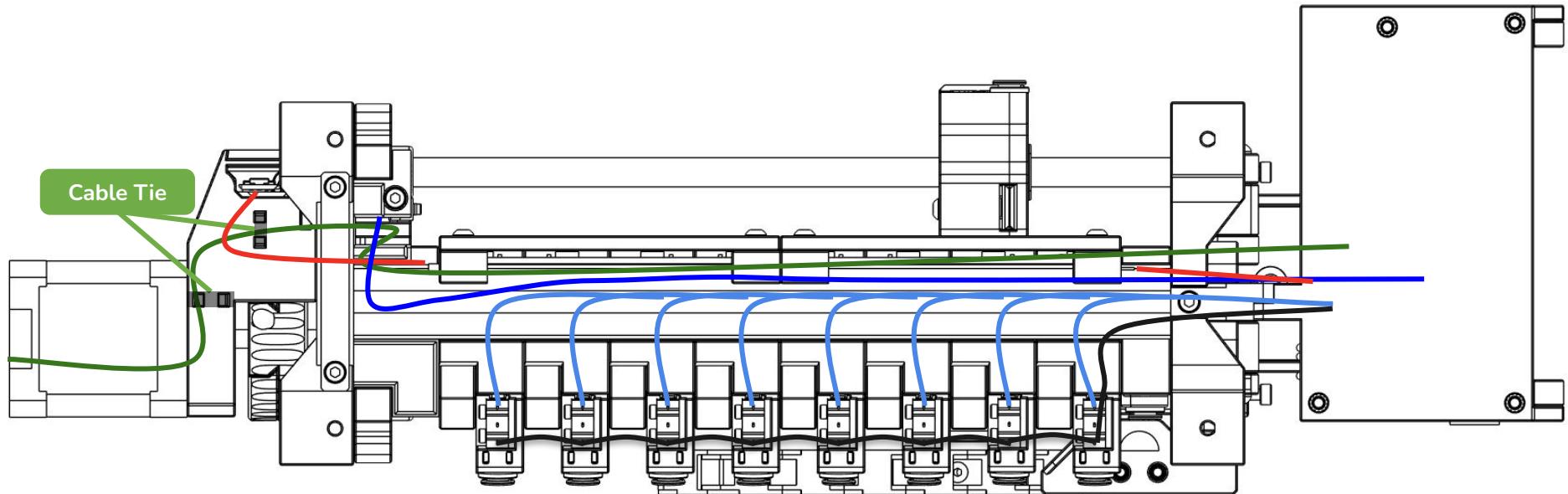
ELECTRONICS BOX INSTALL

Mount the electronics box by adding an M3x8mm SHCS and tightening the Hinge into place.



FINAL ASSEMBLY

CABLE MANAGEMENT



CABLE MANAGEMENT

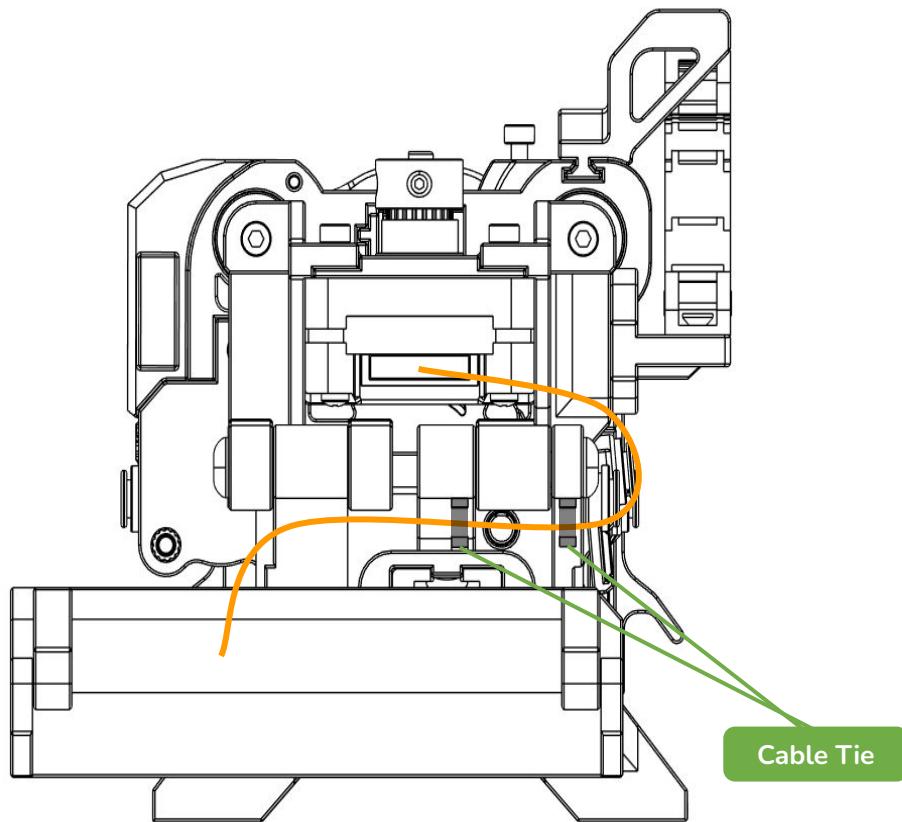
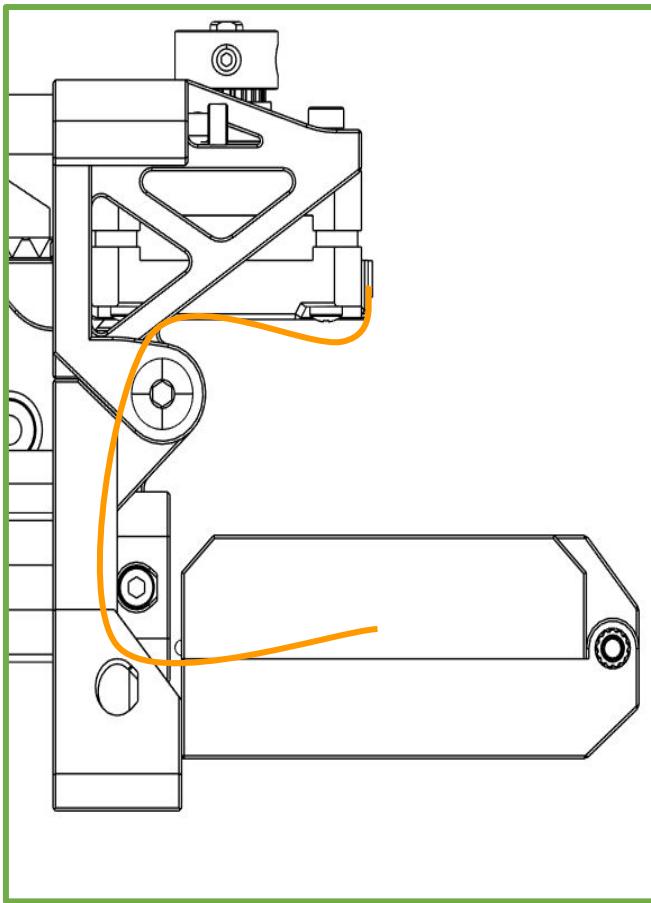
Run the Gear Motor wires (green), Endstop wires (blue), optional LED wires (red), and pregate sensor wires (light blue and black) as shown, along the underside of the 2020 to the MCU.

Use cable ties to secure the wires in place.

There are open-source PCBs designed to accept the microswitch legs and an XH connector, in order to make maintenance of the pregate sensor wiring easier. Because you don't want to have to solder all those wires, and then resolder them when a switch goes out. Thanks to Discord user TheRogueZeta!

FINAL ASSEMBLY

CABLE MANAGEMENT



CABLE MANAGEMENT

Loop the Selector Motor wires (orange) counter-clockwise around the 2020 to the MCU.

Use cable ties to secure the wires in place. This is particularly important for the Selector Motor wiring, to prevent pinching the wires when opening the Linear Axis.

WIRING LENGTHS

The list of pages with wiring lengths is on [Page 27](#).

WIRING

WIRING THE MMBv1.1

MMB JUMPER & DRIVERS

Connect the jumpers and install the EZ Drivers as shown in orange. Plug in the CANBUS and power.

120Ω Jumper

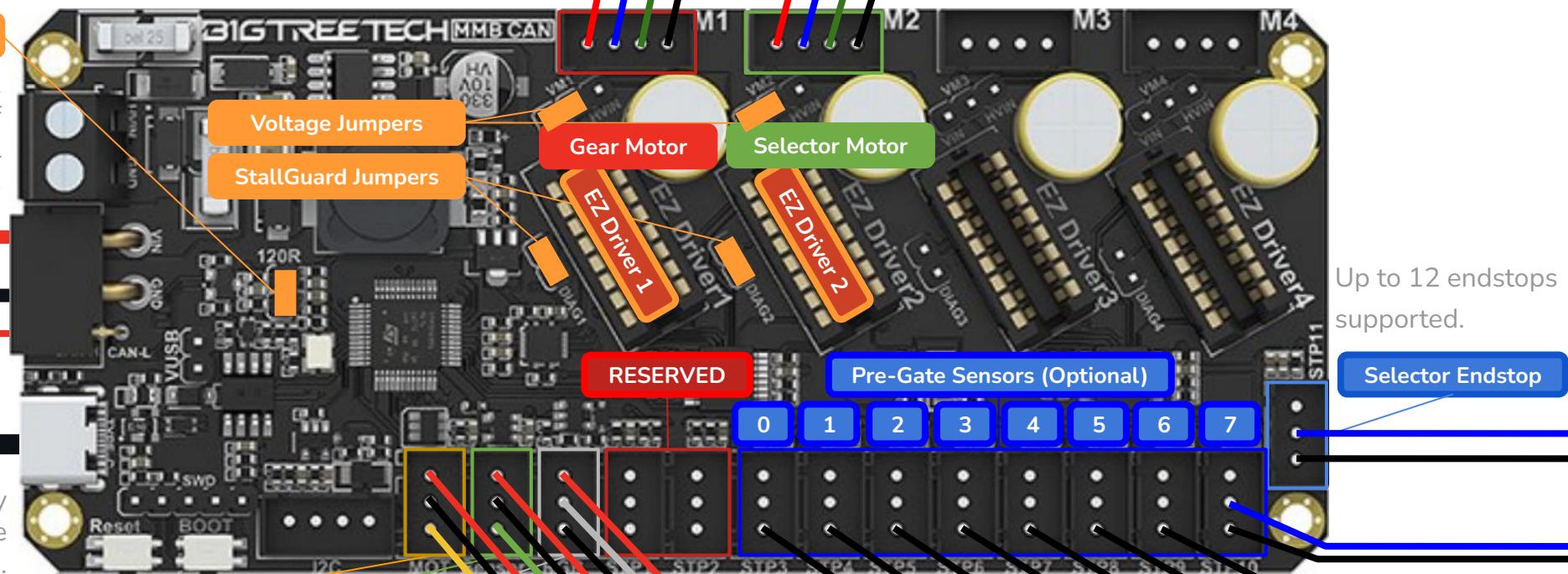
120Ω TERMINATOR
May not be needed if you have additional CAN devices.

24v Power

CANBUS High/Low

USB*

*USB is normally only used for flashing the firmware.



MMB WIRING

Connect the wiring as shown: Gear Motor and Selector Motor wires. Selector Endstop and optional Pre-Gate Sensor wires. Servo, Encoder, and LED wires.

Wiring color may vary between manufacturers for stepper motors and generally.

Keep a few cm of wiring slack in the MMB box, it will be very helpful for maintenance.

Note: HVIN does not supply +5v and USB +5v is insufficient, therefore:
+24v power on the CANBus is necessary!

WIRING

WIRING THE MMBv1.1 FOR 12 CHANNELS

SQUEEZING IN MORE ENDSTOPS

You can use the I2C port's data pins PB3 / PB4 as endstops with a shared ground, wired into a 4-pin JST XH connector,

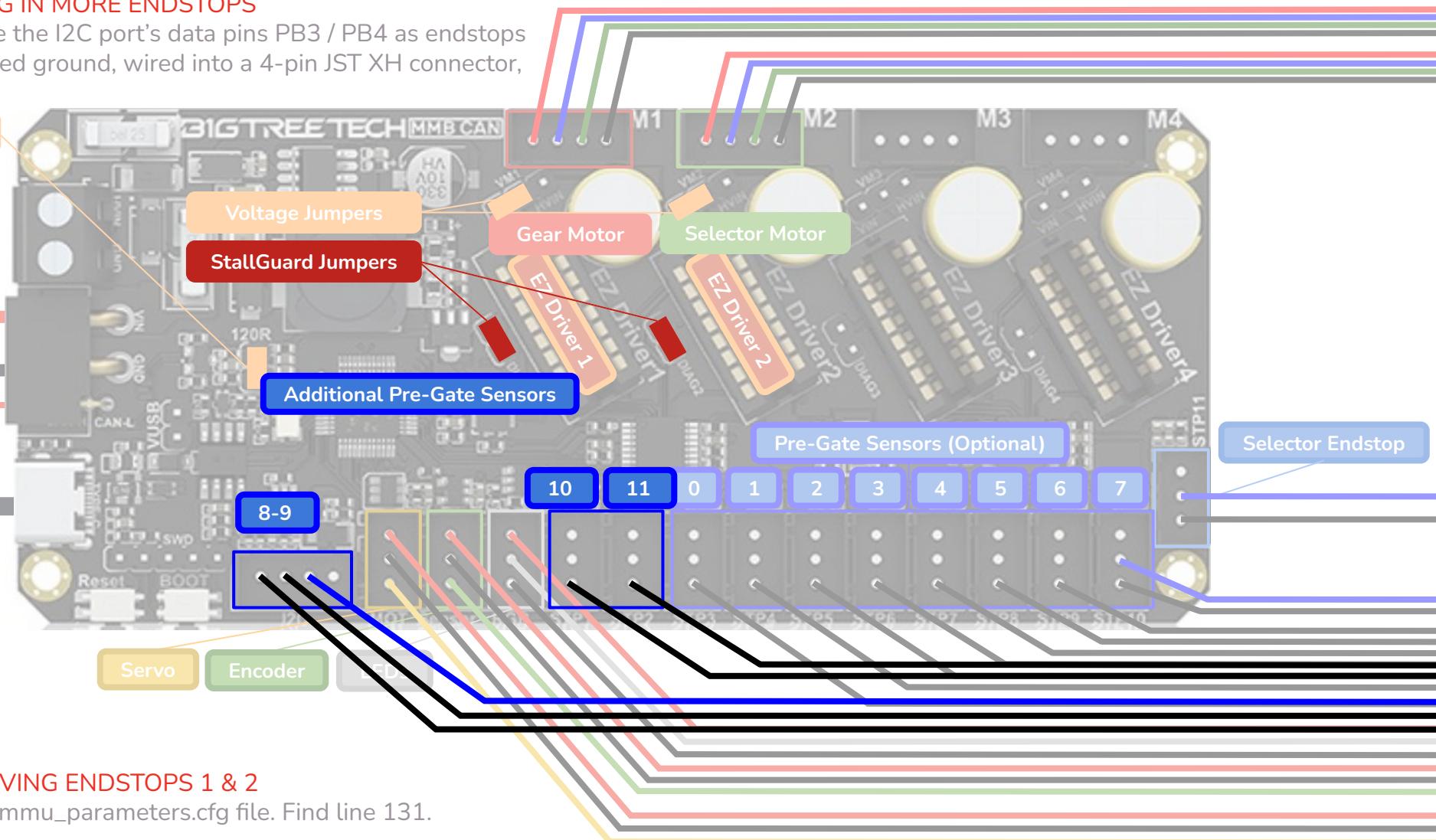
120Ω Jumper

HVIN FOR MOTORS
Only used by daredevils who want to hotrod their motors.

24v Power

CANBUS High/Low

USB*



UN-RESERVING ENDSTOPS 1 & 2

Open your mmu_params.cfg file. Find line 131.

Your selector_touch_enable: must be set to 0.

Next, find line 232. Your extruder_homing_endstop setting must **not** be mmu_gear_touch.

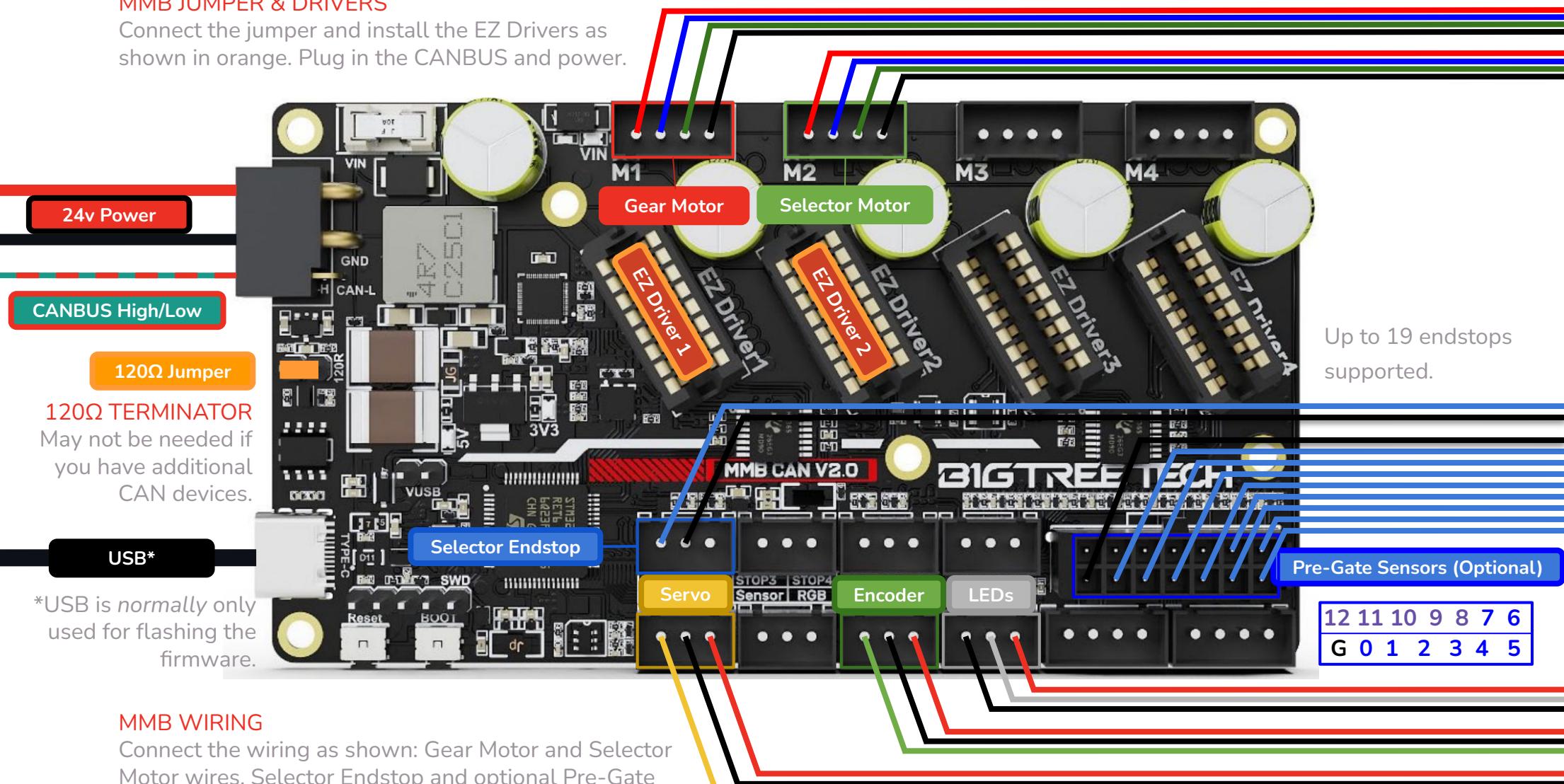
Don't forget to remove the StallGuard DIAG jumpers.

WIRING

WIRING THE MMBv2

MMB JUMPER & DRIVERS

Connect the jumper and install the EZ Drivers as shown in orange. Plug in the CANBUS and power.



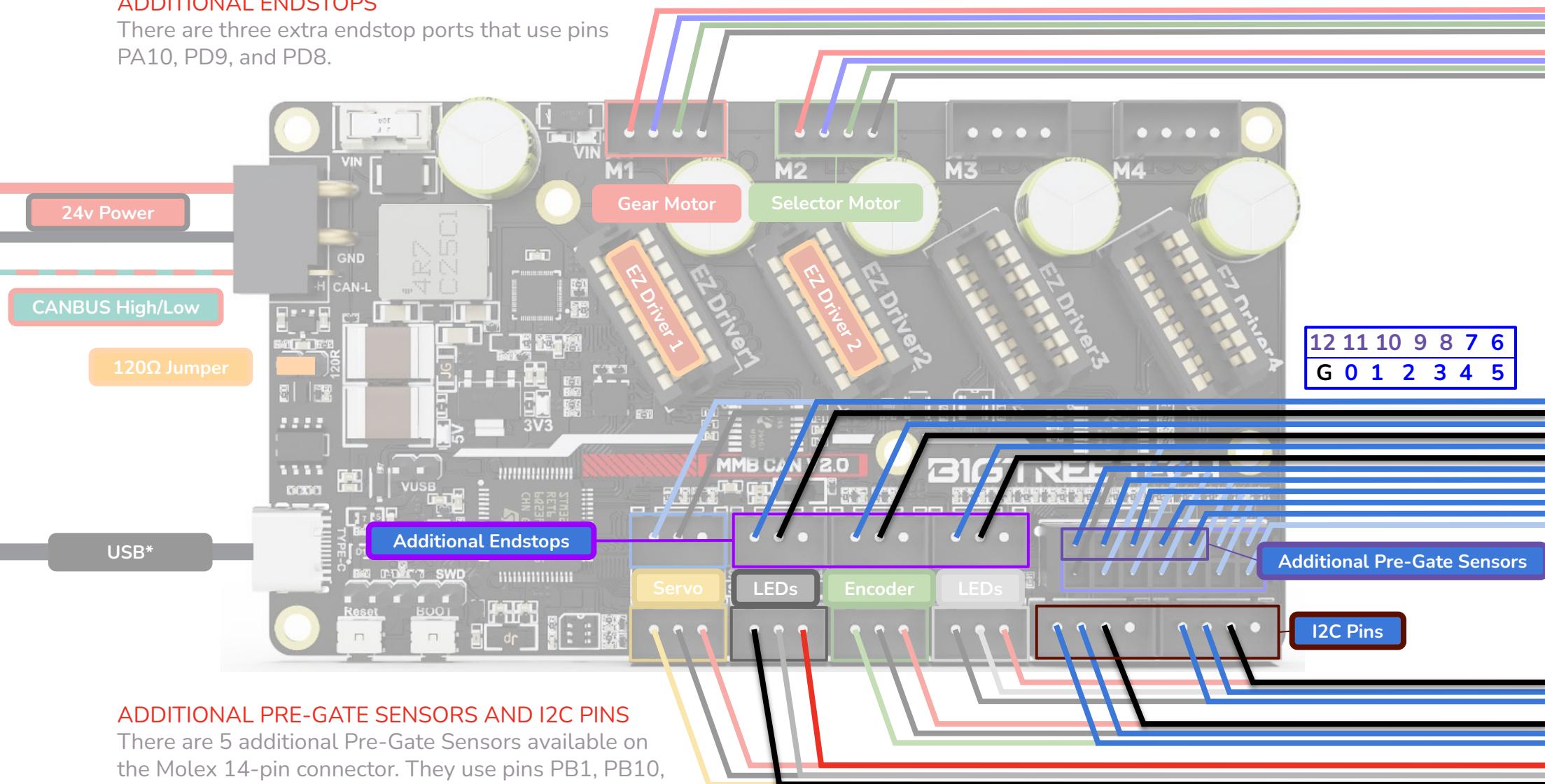
Note: USB +5v is insufficient, therefore:
+24v power on the CANBus is necessary!

WIRING

WIRING THE MMBv2 FOR 19 CHANNELS

ADDITIONAL ENDSTOPS

There are three extra endstop ports that use pins PA10, PD9, and PD8.



ADDITIONAL PRE-GATE SENSORS AND I2C PINS

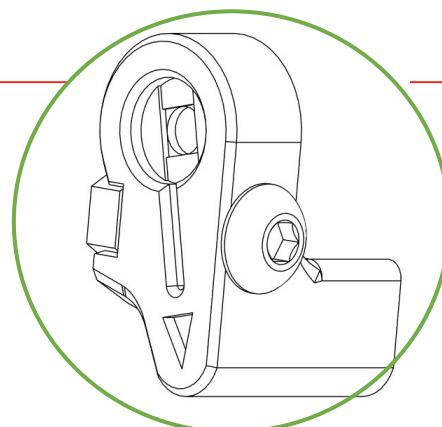
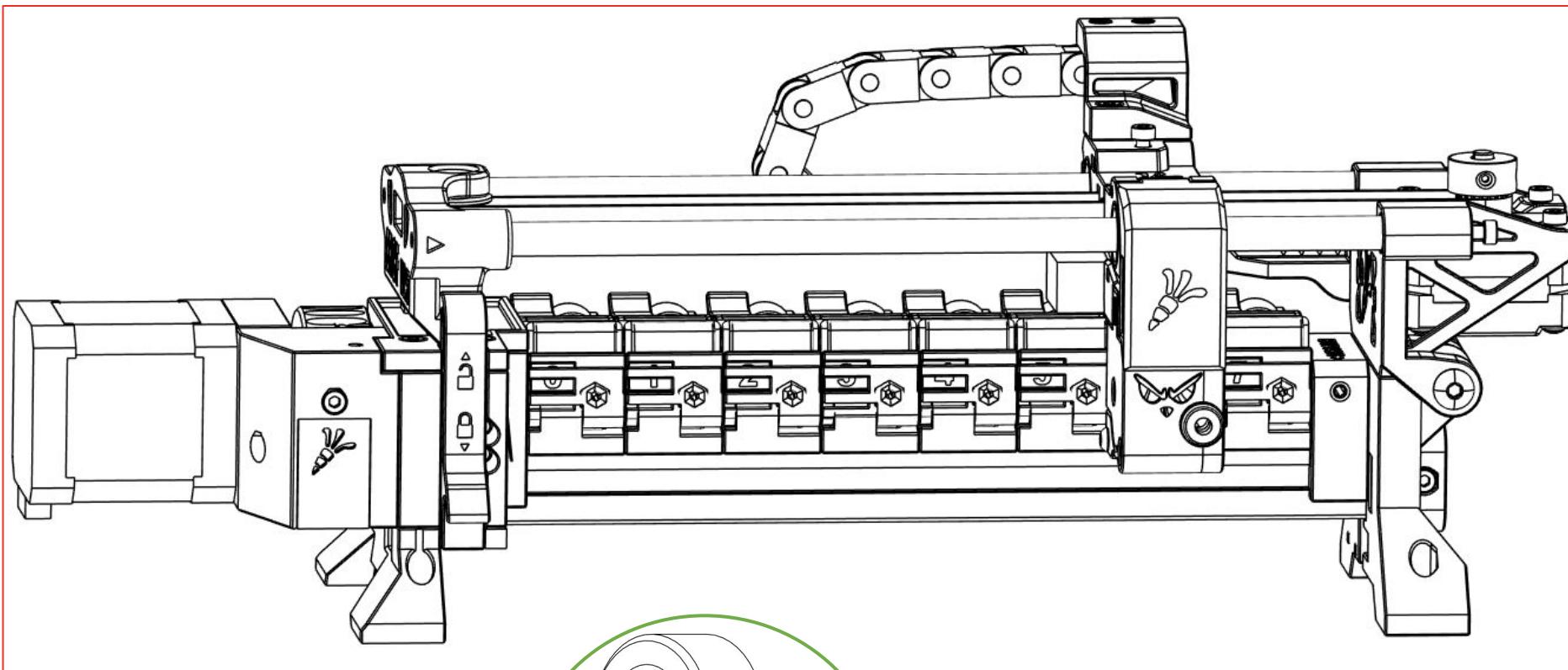
There are 5 additional Pre-Gate Sensors available on the Molex 14-pin connector. They use pins PB1, PB10, PB12, PA9, and PC7.

The I2C can also be used for endstops: pins PC1 and PC0.

You can also fit an additional LED chain (or other 5v accessory) on MOT2 / PA0.

FINAL ASSEMBLY

THE END! ... OR ALMOST :D



NEXT STEPS

The ERCF is now fully assembled, except, as you probably have noticed, for the **Servo_Arm**!

Its' installation on the ERCF will be done as part of the setup and calibration:

<https://github.com/Enraged-Rabbit-Community/ERCFv2.5/tree/main/Documentation>

SOFTWARE SETUP AND CALIBRATION

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

This manual is designed to be a reference manual for the build process of an Enraged Rabbit Carrot Feeder v2.5 MultiMaterial System. Additional details about the build and background on advanced topics can be found on our documentation page linked below. The software setup and other initial setup steps with your printer can also be found on our documentation page. We recommend starting here.



<https://github.com/Enraged-Rabbit-Community/ERCFv2.5/tree/main/Documentation>



<https://github.com/moggieuk/Happy-Hare/wiki>

REPORTING ISSUES

Should you find an issue in this document or have a suggestion for an improvement please consider opening an issue on GitHub:

(https://github.com/Enraged-Rabbit-Community/ERCF_v2.5/issues).

When raising an issue please include the relevant page numbers and a short description; annotated screenshots are also very welcome.

We will update the manual based on the feedback we get!

INTRODUCTION

HOW TO GET HELP

If you need assistance with your build you can head over the new ERCF Discord group. It is the primary medium to help people with their ERCF build and tuning! You can also check the Github page for the latest releases.

ERCF



<https://discord.com/channels/1267663557999329371/>

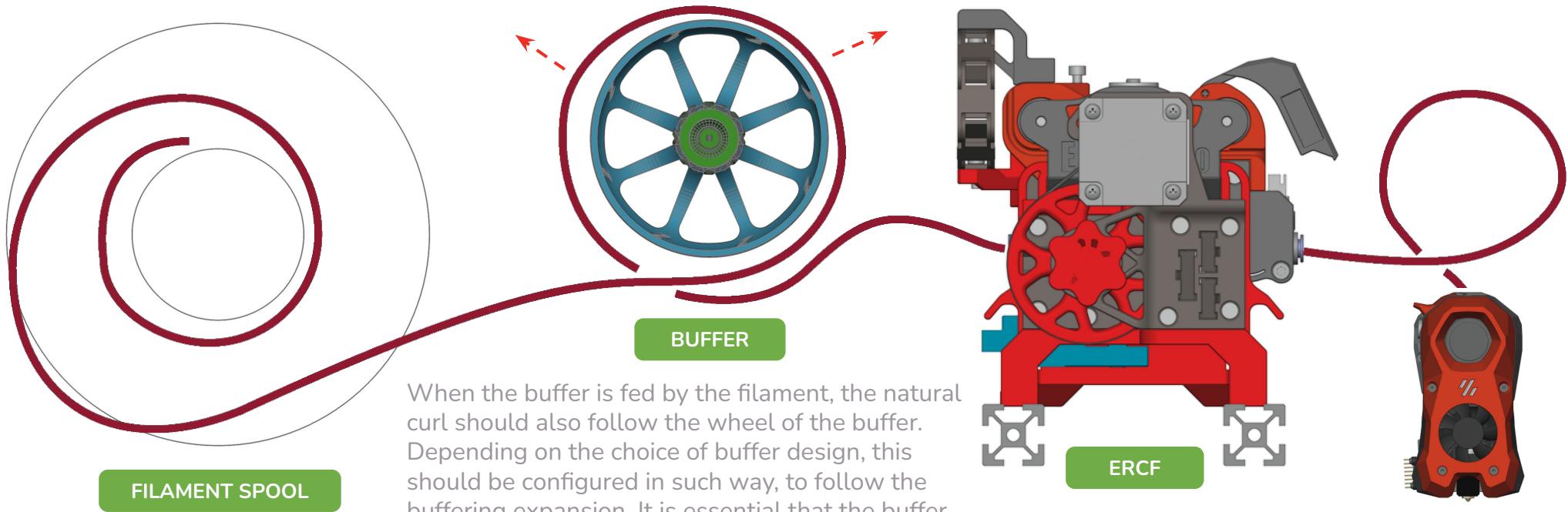


<https://github.com/Enraged-Rabbit-Community/ERCFv2.5>

FILAMENT TUBE MANAGEMENT

BEST PRACTICES FOR FILAMENT TUBE MANAGEMENT

It is important to optimize your tube path to reduce any resistance for your MMU setup. This is to ensure that the path you choose does not go against the natural curl of your filament. ERCT, as an example is designed to support many of these best practices.



The ideal location for your filament spool will depend on how it feeds the buffer. The curl should naturally work with the path (filament and tube) that goes into the buffer. In this example feeding around to the back and below allows for the natural curl to remain in the tube to the buffer. Feeding from the bottom prevents the spool from tipping over.

When the buffer is fed by the filament, the natural curl should also follow the wheel of the buffer. Depending on the choice of buffer design, this should be configured in such way, to follow the buffering expansion. It is essential that the buffer does not pull back filament on the encoder.

Many buffer designs require optimal paths that come into the ERCF to reduce pressure on the filament blocks. It is important to reduce that pressure by not allowing downward orientations. Also, we recommend a tube length of 1000mm or less where possible.

A final turn to the toolhead can help maintain the natural curl. This doesn't have to be small, and can be a large radius but shouldn't be too long that will introduce additional resistance.

Pages past this point are either old outdated info, or things that need to be reworked to be made useful. They will be reworked or discarded before release.



PTFE TUBING LENGTHS

PTFE TUBING LENGTHS

We call for 4mm OD x 2.5mm ID PTFE tubing. We've found in testing that an ID of 2.0mm is too restrictive of the filament, and that an ID of 3.0mm makes the tube too thin and fragile, leading to kinks in the tube and poor feeding.

You will need the following lengths of PTFE tubing:

[# Channels] x 1500mm for the Filament Spool to Buffer connections. This is the **maximum** usable length as determined in testing. The more this length can be reduced for your setup, the smoother and easier filament feeding will be. While it is technically possible to use a longer tube, we discourage it because of the added filament path friction.

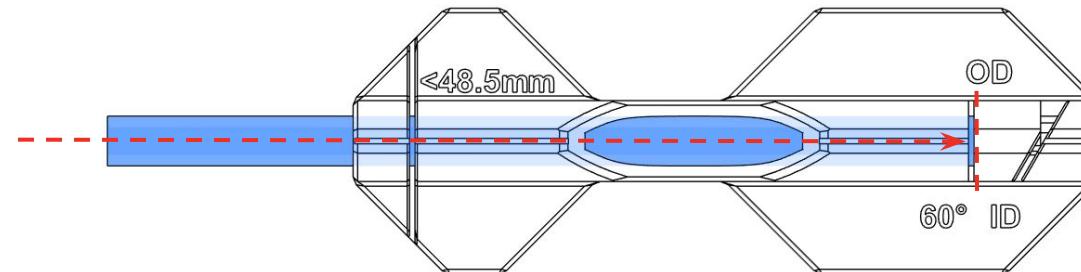
[# Channels] x 48.5mm for the Buffer to Filament Blocks connections.

1 x 1500mm for the Encoder to Toolhead connection. This is the **maximum** usable length. The more this length can be reduced for your setup, the smoother and easier filament feeding will be.

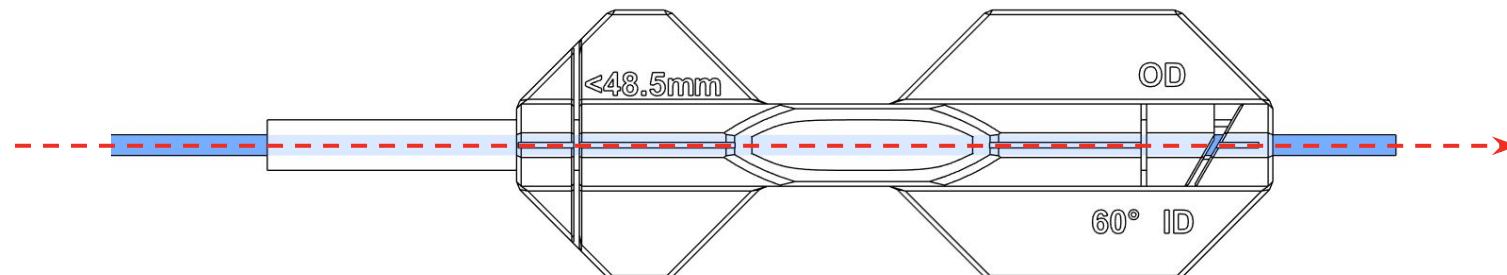
PREP PTFE TUBING

PREPPING PTFE TUBING

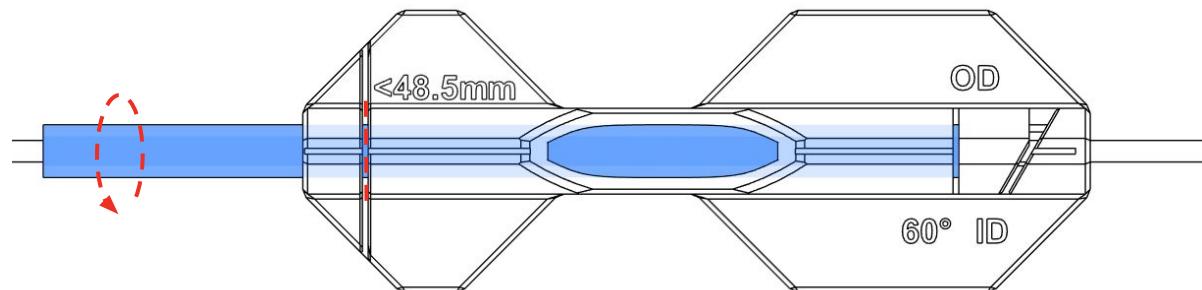
We have created a PTFE tool ([ERCFv2/STLs/Tools/PTFE_Tool.stl](#)) to aid in cutting and chamfering your PTFE tubing. To cut the short Buffer-to-Filament Block connection tubes, begin by inserting PTFE tubing into the tool until it hits the stop.



Next, feed a piece of filament, preferably PETG, through the tubing and PTFE tool.



Now, cut the PTFE tube at the **48.5mm** slot. Use a hobby knife to cut down until you hit the filament, then twist the PTFE while keeping the blade in place. You should now have a very flat cut PTFE tube at the perfect length! Use the cutout to push the PTFE out of the PTFE tool.

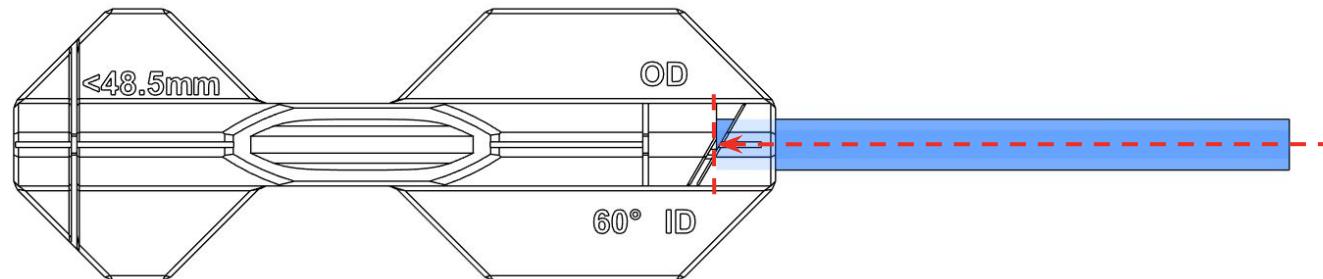


CHAMFER PTFE TUBING

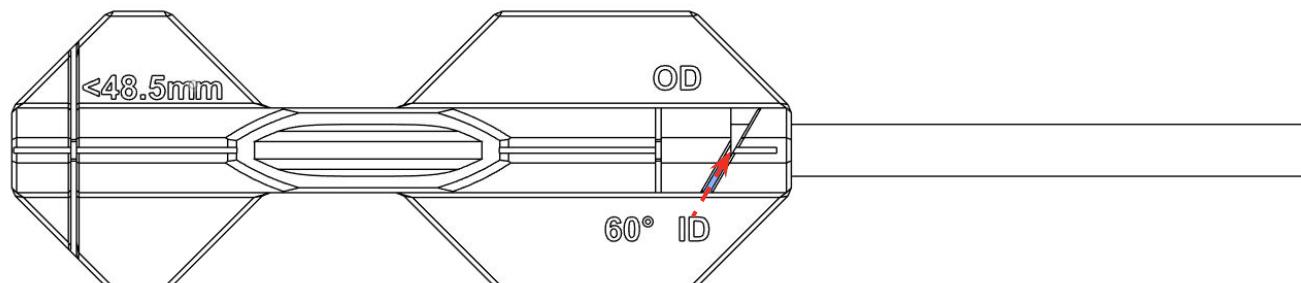
CHAMFER PTFE TUBING

We have created a PTFE tool ([ERCFv2/STLs/Tools/PTFE_Tool.stl](#)) to aid in chamfering your PTFE tubing.

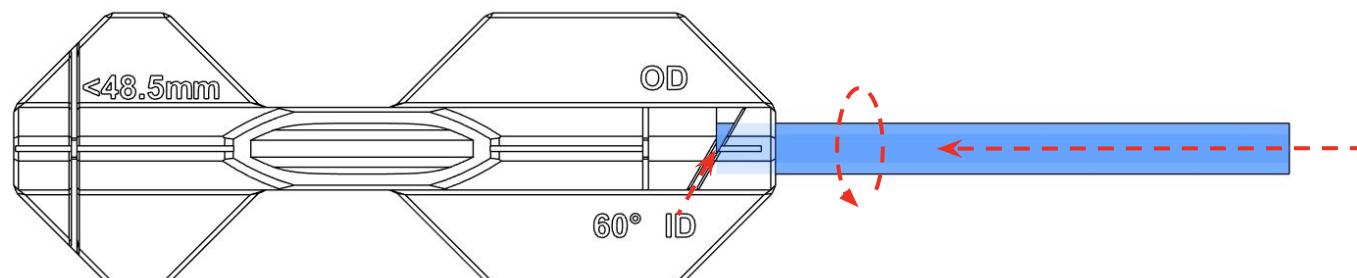
To chamfer a PTFE tubes, begin by inserting the PTFE tubing into the tool's chamfering side until it hits the stop.



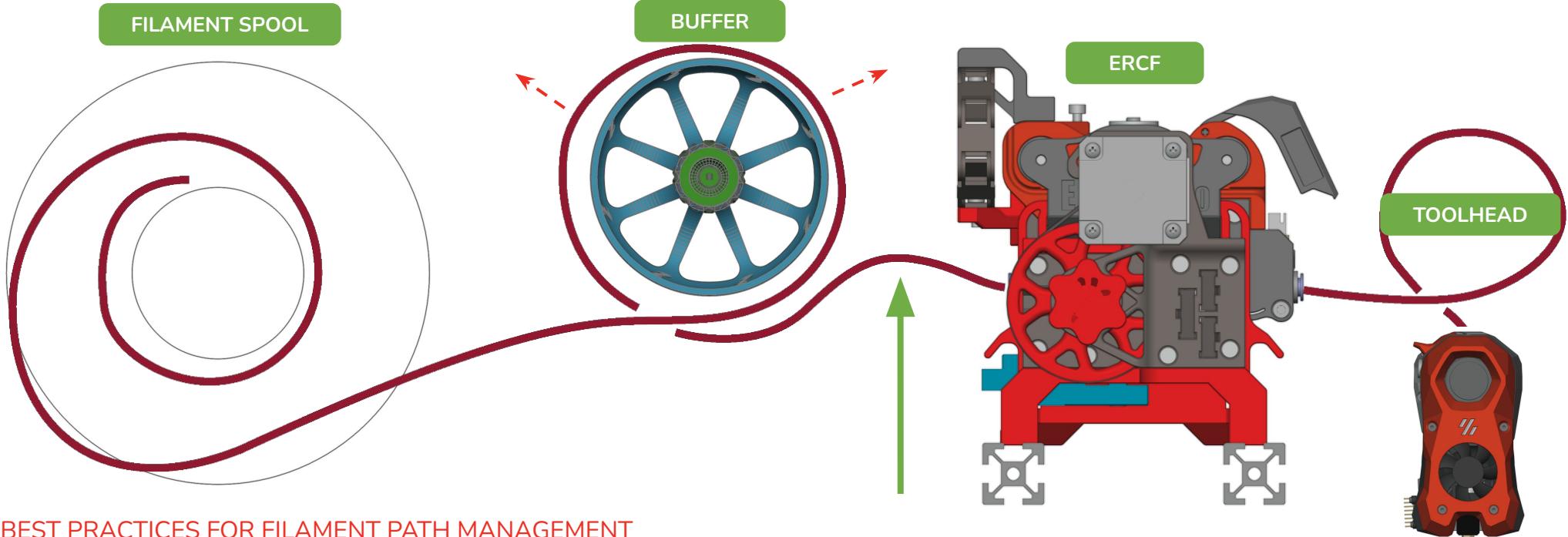
Next, take a sharp hobby knife, preferably #11, and place it into the **60° ID** slot. Be careful to align the tip of the blade to the centerline of the PTFE - you don't want to cut too far!



Keep the blade in place, and twist the PTFE tube, while maintaining pressure on the PTFE into the PTFE Tool. You should now have a nicely chamfered PTFE tube! It is recommended to do this for the entrance of every PTFE tube in the system, to prevent snags.



FILAMENT PATH MANAGEMENT



BEST PRACTICES FOR FILAMENT PATH MANAGEMENT

It is important to optimize your PTFE tube path to reduce any resistance for your MMU setup. One of the most common setup problems we see with ERCF is too much friction along the filament path, which keeps the filament from feeding consistently!

The ideal location for your filament spool will depend on how it feeds the buffer. The curl of the filament should naturally work with the PTFE tube path that goes into the buffer. In this example feeding around to the back and below allows for the natural curl to remain in the tube to the buffer.

When the buffer is loaded with filament, the natural filament curl should also follow the wheel of the buffer. Depending on the choice of buffer design, this curve should follow the buffering expansion. It is essential that the buffer does not pull on the filament feeding into the encoder.

Many buffer designs require that the filament paths into the ERCF angle slightly upward to eliminate any downward pressure on the filament blocks. It is important to reduce that pressure by orienting the tubes correctly, at a slight downward angle..

A final loop in the tube to the toolhead can help follow the natural filament curl. This can be a large radius, but shouldn't be so long that will introduce additional resistance.

We recommend testing each channel with a length of filament to make sure that the filament feeds smoothly. Adjust as needed.

Enjoy your MMU.

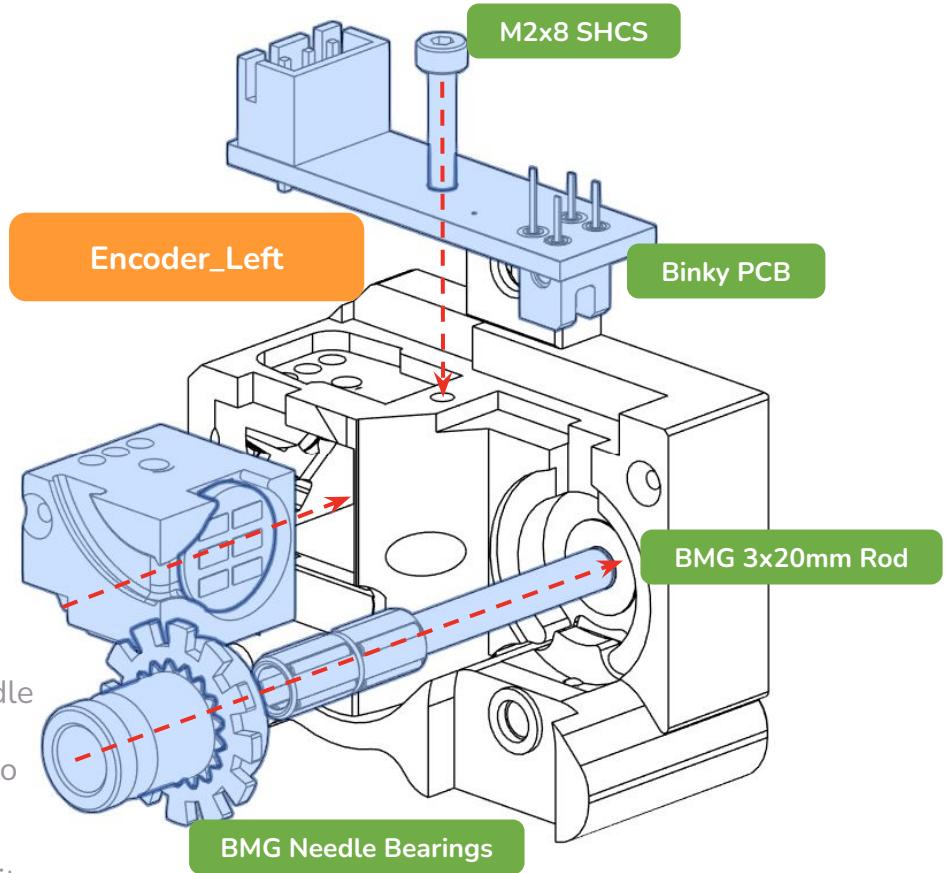
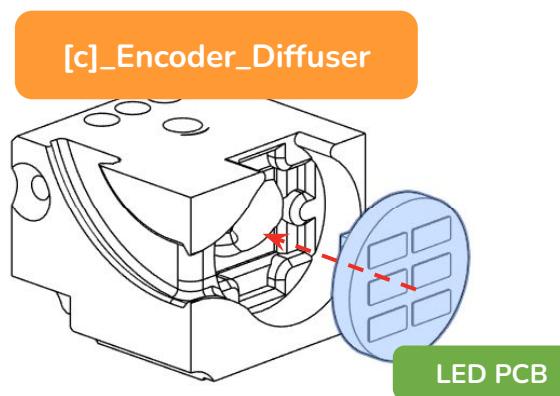


SELECTOR : ENCODER

ENCODER ASSEMBLY

7.3 ASSEMBLE ENCODER DIFFUSER

Take the LED PCB (wiring omitted in the first diagram for clarity) and insert it into the [Encoder_Diffuser](#), with the wires pushed into the channel as shown.



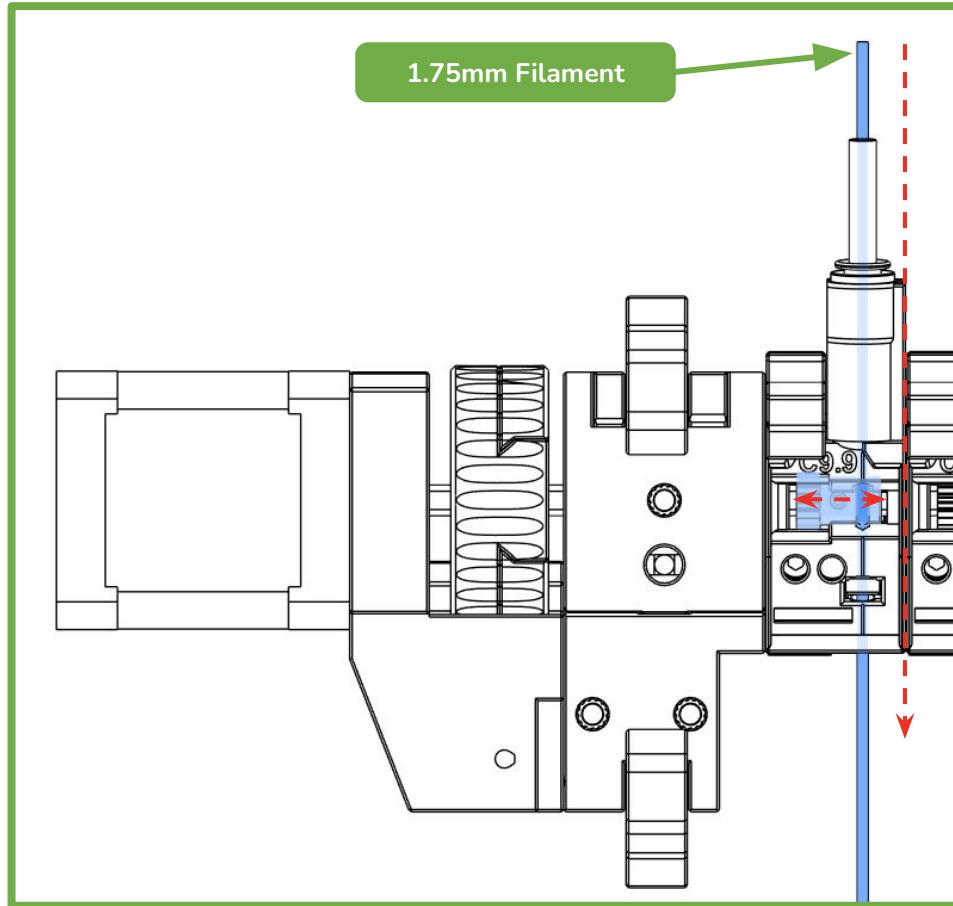
ASSEMBLY

Start by fitting the 20mm rod into [Encoder_Left](#). Next, slide on the needle bearings and the idler gear. Add a small dab of grease (EP1/EP2 or Superlube) on the bearings. Slide the gear / slotted wheel assembly into place.

The slotted wheel should sit almost flush with the housing. Make sure it doesn't rub on the [Encoder_Left](#).

Insert and secure the Binky PCB with an M2x8mm screw. The sensor should fit snugly in the cutout provided.

Insert the [Encoder_Diffuser](#) into the cavity in the [Encoder_Left](#).



View from the top of the ERCF.

FINE BMG GEAR ALIGNMENT

Insert a small piece of PTFE tube (a few centimeters is enough) into the Filament Block 0 ECAS. Insert a clean piece of filament through until it comes out the other side.

(Depending on the shape of the filament end, it may get caught by the **Trap/Brake**. In that case push the back of the **Filament_Path** down to release the trap. Now the filament should come out the other side.)

Make sure the flat surface of the Drive Shaft is facing up, towards the Bondtech M3 set screw. Press down on the **Filament_Path** and move the filament back and forth to align and center the gear with the filament. then tighten the set screw.

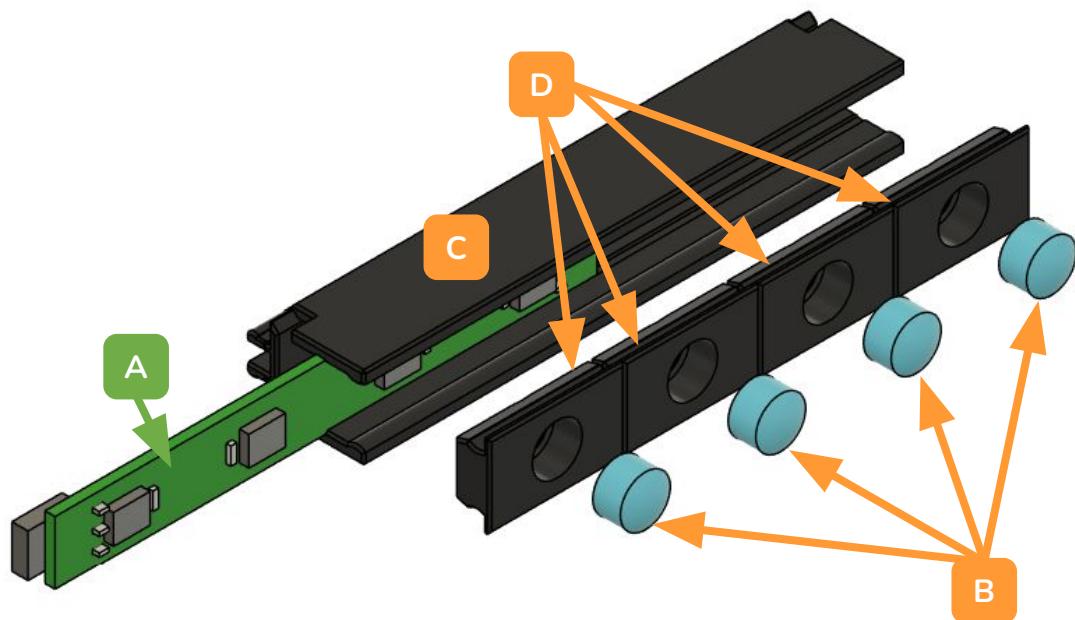
Do not over-tighten the set screw - if you really hulk it down, you can make the BMG gears oval-shaped instead of round! They only need to be tight enough to locate the gear and remove any slop between the BMG gear and the Drive Shaft.

Don't forget to use a little thread locker on the set screw, but be careful not to get it on printed parts. If you do, clean it immediately, because thread locker degrades ABS and makes it brittle. Alternatively, let the thread locker fully dry on the set screws before reassembly.

Proper alignment of the BMG gears prevents rubbing, which causes filament dust buildup. Misalignment can also cause undesirable noise and Encoder inaccuracy,

Repeat this process for all of the blocks..

CARROT ON A STICK EXPLODED VIEW



COAS SUB-BOM

A 2x Carrot on a Stick PCB

B 8x [c]_Cover_Lens_xN.stl**
C 2x CoaS_Holder.stl
D 8x Cover_Body_xN.stl

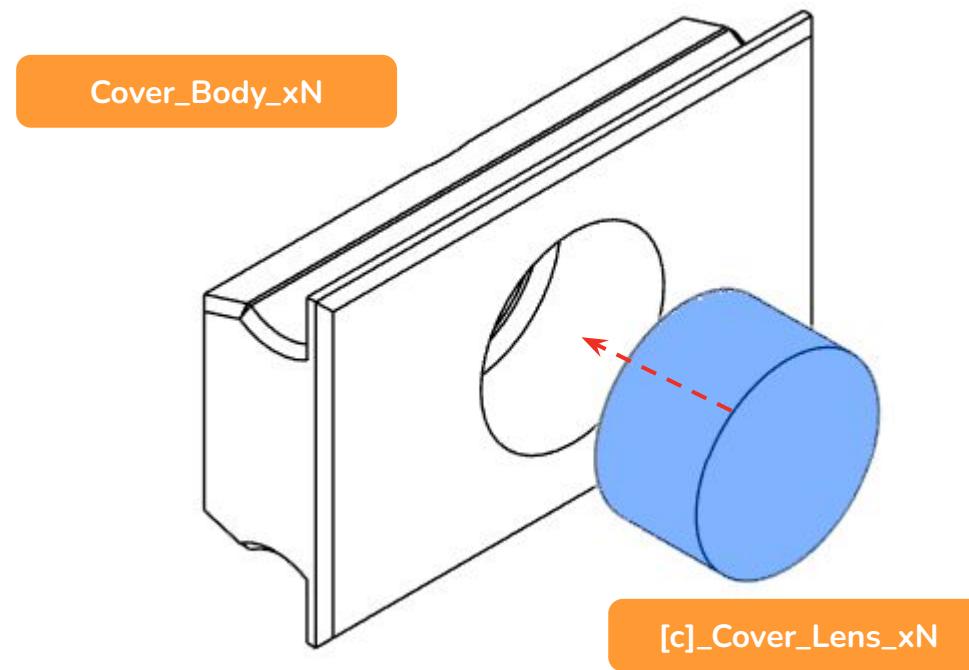
One unit shown out of two.

**See the note about multicolor printed parts vs single-color assembly.

ASSEMBLED VS PRINTED COVER LENS

This part is cosmetic. You can either print the covers lens as separate single-color pieces and then assemble them, or print them as a multicolor print once you have your ERCF running.

If you elect to assemble the two pieces, print one set first to check the fit. You may need to play with the size of the lens to get it to fit snugly. Once you do, print the rest and use a drop of superglue to hold the lens into the cover.

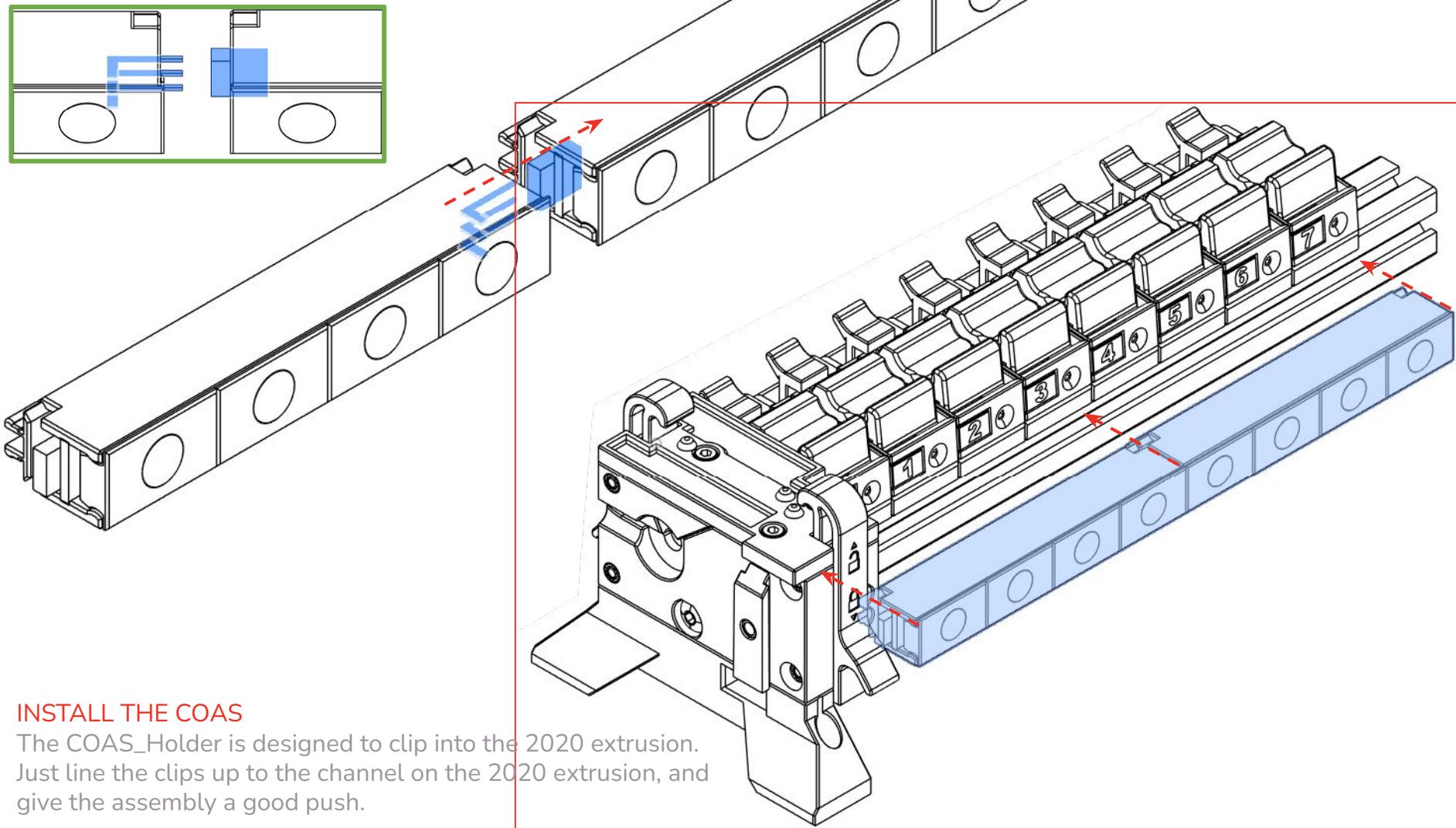


GEARBOX PART 2

CARROT ON A STICK

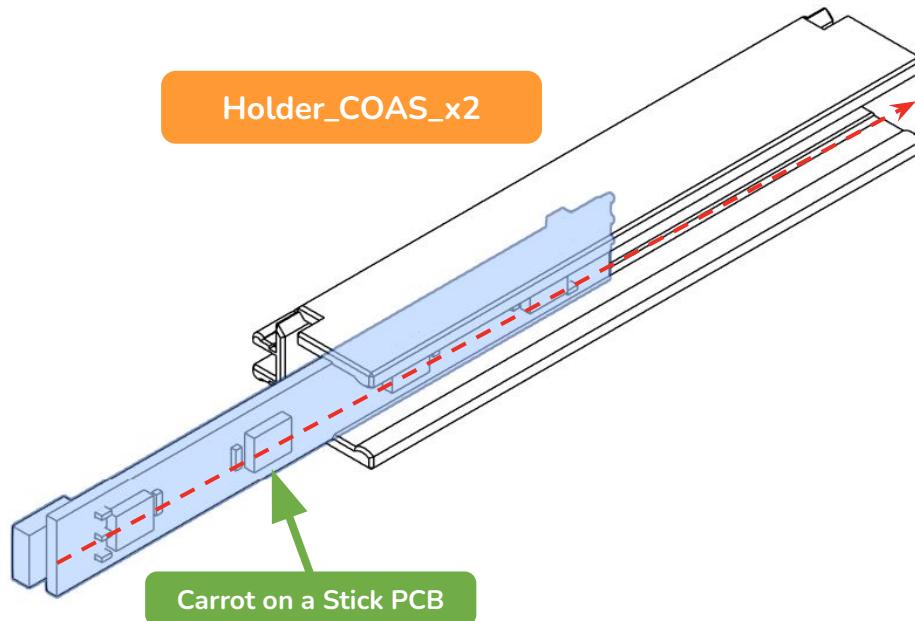
4.4 CONNECT THE COAS

Connect the Carrot on a Stick units together using the header pin connectors.



If you're using the alternative LED PCBs, install it the same way.

GEARBOX PART 2



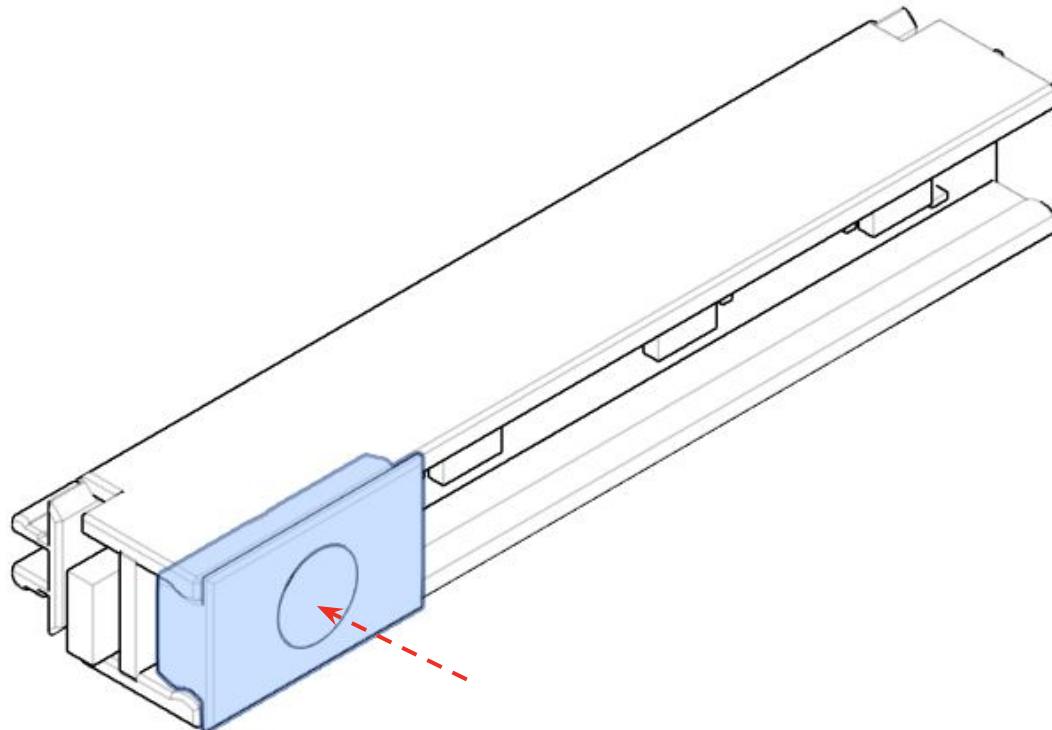
CARROT ON A STICK

4.4 CARROT ON A STICK

There is a groove in the **Holder_COAS_x2** for the Carrot on a Stick PCB to fit into. Start the PCB on one edge and it should slide along the groove into place.

Next, apply a drop of superglue to each Cover Lens assembly so that it doesn't slide around, and pop it into place on the Holder.

Repeat this for all four Cover Lens



Repeat this for a second Carrot on a Stick assembly.

This assumes you are building the standard 8-channel setup. You can easily daisy-chain more or less assemblies to get to any even number of channels using the Carrot on a Twig, which is just two LEDs.