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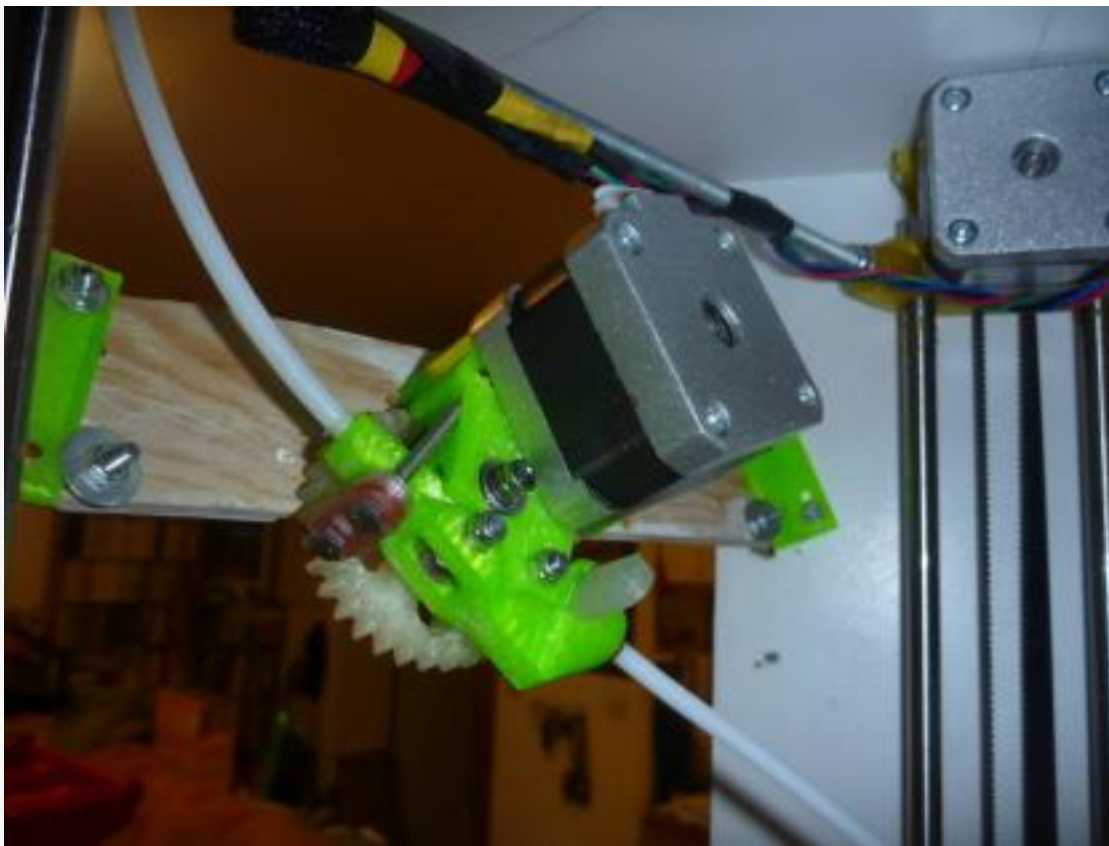
Geared extruder

Geared extruder for 3D printer. It was initially designed for *Fisher beta*, then extended for other uses (with an option for top mount). It is now the extruder of the *HXM printer*.

Entirely new design.







As installed on HXM printer (view from inside)

It does present the following advantages over the Fisher 1 extruder:

- Better filament path with spool on top
- Easy access to the tensioner adjustment
- Easy access to the hobbed insert for cleaning
- More powerful extruder allowing thicker layers (gear ratio 3.1 instead of 2)
- With spool on top, the path is the most direct possible
- Bowden length reduced to 390mm, with more straight route.

and in addition:

- With a hole in the side panel, you can dye filament for extrusion calibration

as inconvenients :

- Retract speed is reduced - I use 80mm/sec
- You hear retraction due to play in gears (corrected with a larger pinion)
- potential wear on gears, but as it is printed in PETG, the risk is low
- Bowden tongue more difficult to access, however you can see it from top

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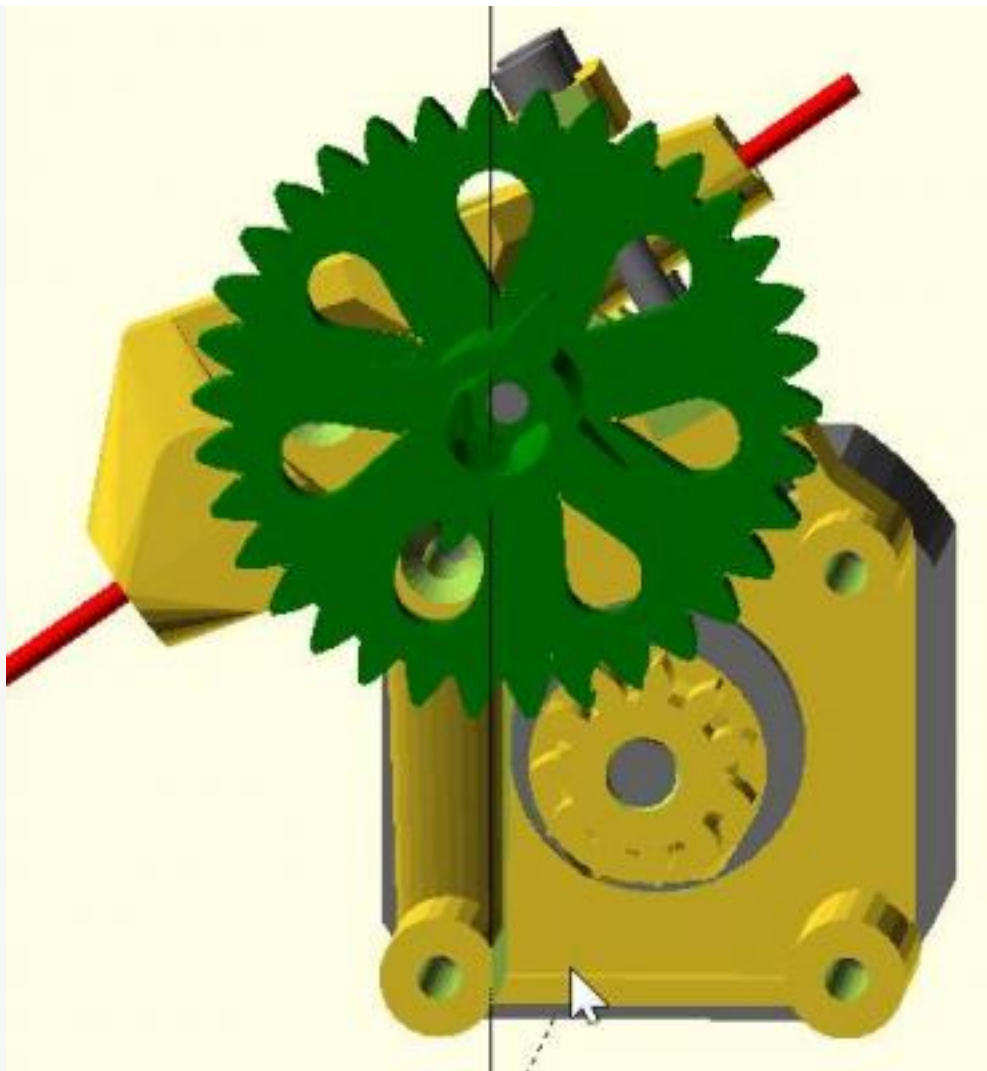
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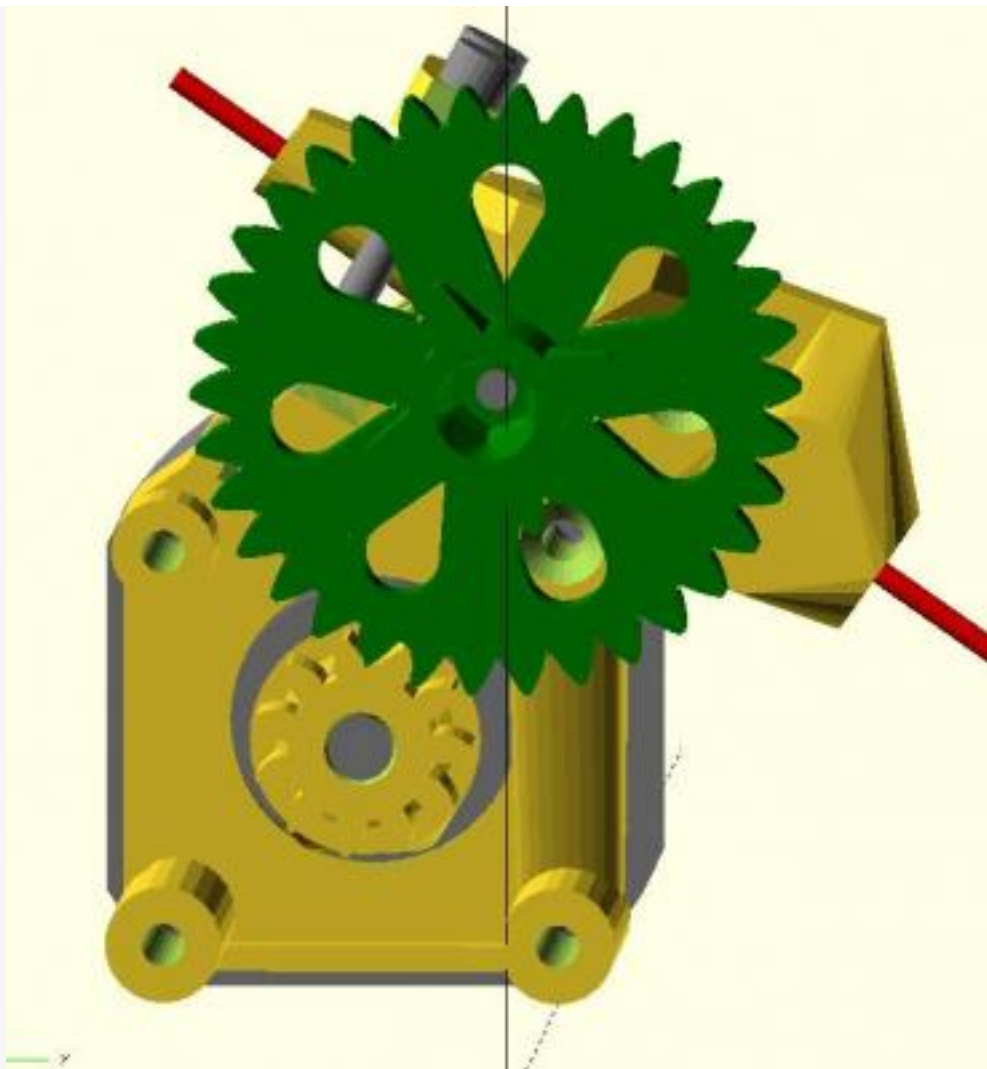
Installation

It is designed to be bolted on a panel.

There are two options of installation, the second one being mirrored of the first.

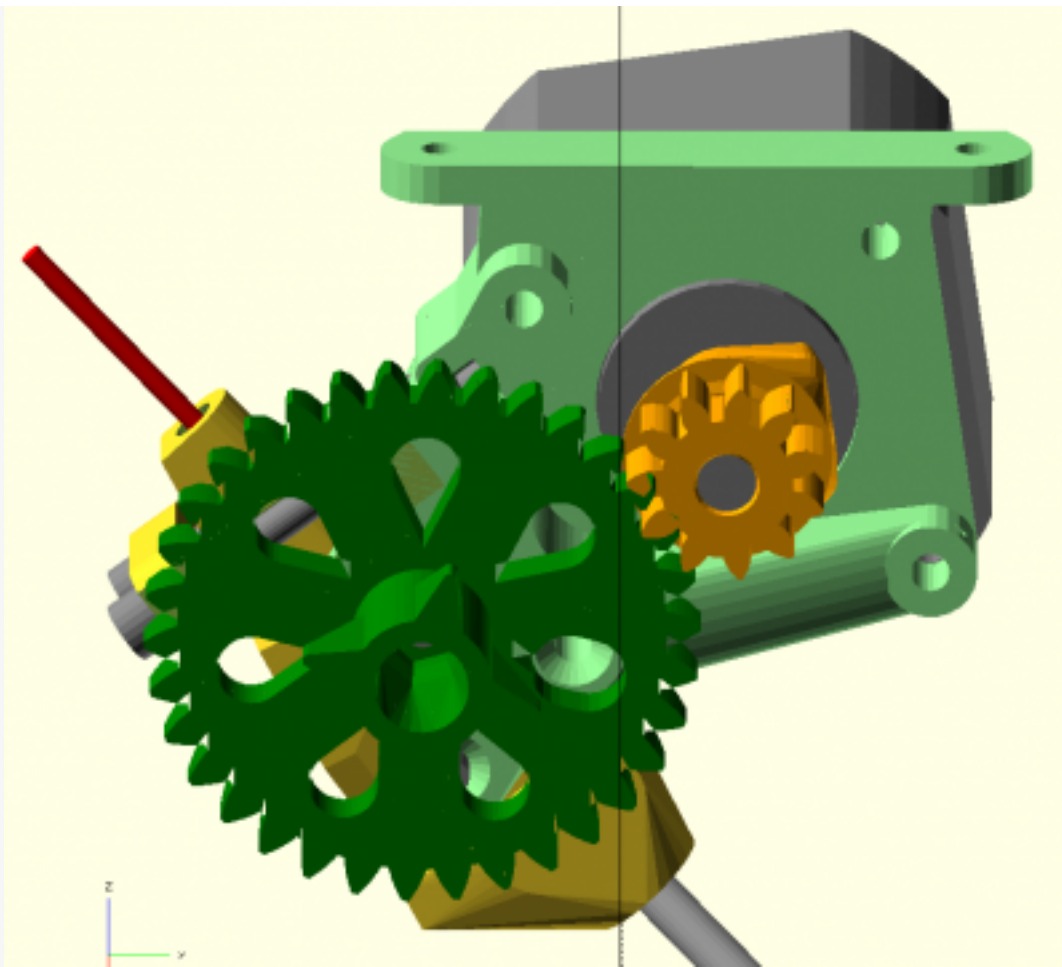
Standard position as shown on Fisher photos (white extruder) and mirrored position as shown on HXM printer (green extruder).





'Normal' position. _____ Mirrored position

An alternative with top mount is now proposed.



Open the lever for cleaning





Instructions:

Equipment design and all documents: Copyright Aug-Dec 2015 Pierre ROUZEAU .
Equipment license : OHL V1.2 Documents licence : CC BY-SA

GEARED EXTRUDER for the RepRapPro printer Fisher Delta
Use the specific M3 hobbed insert of RepRapPro (for Ormerod and other printers) but not the original hobbed insert of the Fisher.
Spring is the one of the Fisher extruder: external diameter 6.5mm, wire 0.8mm, length 7.5 mm

This extruder is specifically designed to fit in the tight space of the fisher (in the fisher the extruder is inside the printer, between the arms), but could be used for any printer with 'Bowden' hotend. A template to position the extruder is supplied. Be careful, the play between arms and motor with all carriages at top is less than 2mm (but your carriage are not supposed to go banging the supports, no ?)

The connection of the bowden is done with the specific RepRapPro 5mm brass insert. If needed, you could thread for another connection.

This is mechanics, so your machine shall be well calibrated and shall produce accurate dimensions. Gears (especially the pinion), shall be printed relatively slowly (50mm/sec) to produce more accurate teeth profile. Layer 0.2 for the gears. layers 0.2 or 0.25 for base and lever.

Printed in PETG on the Fisher, I really don't recommend to print it in PLA, that may be delicate to assemble without broke anything and there will be problem with the stepper temperature. ABS may be usable (but cannot be printed on a standard Fisher).

Recommended PETG yet: Reprapper. eSun PETG is NOT recommended (unworkable without this geared extruder due to poor winding, so egg and chicken problem here).

For the base, supports are now incorporated in the design and are easier to remove, so you shall not activate support in your slicer and you can print lever and base in one go and possibly all parts as an ensemble. Your bridging shall have been properly adjusted.

It is an entirely original design, however the gears of the Ormerod extruder were reused (and slightly enlarged) and I get the idea to have the filament in the pressure lever from Ryan Carlyle [B'Struder](#).

Driven by default RepRapPro stepper 2.2 kg.cm. More powerful motor may need enlarged gears.

BOM

Fittings

- 1 M3x25 Hex head screw for the hobbled drive - updated
- 3 M3x35 countersunk screws for the stepper assembly on panel (thk 3mm)
- 2 M3x20 countersunk screws for lever articulation and push bearing
- 2 M3x40 screws (hex or cap head) for tensioner
- 1 M3x10 set screw for the pinion
- ordinary M3 nuts (lock is done with glue/resin)
- 1 medium size washer (large gear)
- 6 small sizes washer (4 for large gear and 2 for bearing)
- 3 bearings 623 (10x3x5) - there is an option for 1*623 + 2*MR93, as supplied in Fisher 1 kit
- nut locking glue
- 1 M3 insert (dia 8) (sold by [Think3DPrint3D](#))
- 1 spring diam ext 6.5mm, wire 0.8mm, len 7.5 mm (salvaged from Fisher extruder)

Printed parts (see files and program below):

- Base. Layer 0.2 or 0.25 mm - beware choosing the one corresponding to your bearings
- Lever. Layer 0.2 or 0.25 mm
- Large gear (34 teeth). Layer 0.2mm, 50mm/sec
- Pinion (11 teeth). Layer 0.2mm, 50mm/sec
- Lever pushing pad. layer 0.2 mm
- Template/screw holder for panel fixation. Layer 0.2 or 0.25 mm
- Tongue for Bowden brass end (original could be reused).

STL files supplied with holes 0.15mm larger in diameter than required (also apply for rectangular holes). Beware of your slicer settings, to not enlarge twice.

There is 3 sizes for the pinion, to adapt with minimum play. There won't be too much wear if there is play in gears, but that makes clik-clak noises during retract.

There shall be no hard point while rotating manually the thumbwheel. Most probably the size 0 (theoretical value) will be too small if your gears are printed carefully.

If you print pinion alone, you can print two in the same time as one, because the printing time is dictated by the cooling time between layers (25 sec. for PETG), so you could print size1 and size2.

Files

[Attach:Extruder_OpenScad.zip](#)

[Attach:Extruder_stl.zip](#) Includes all stl and configuration file.

Assembly:

Tensioner nuts



Tip: if it is more difficult on one side to introduce the nut, push the nut all trough from other side

(use a vise and screw).

Gear bearing

That shall be a reasonable tight fit.







Lever assembly

- countersunk screw M3x20
- M3 nut
- Two M3 small washers

Don't forget the washers.

Tip: gluing the washers to the bearing may help. You shall be very sparse with the glue, use a pin for glue deposit.







Test lever installation then remove it

removing the lever at the end will ease next steps.







Seat hexagonal head screw in main gear, then remove nut

Be careful to not bend the bolt (I have done that with a non drilled socket spanner), so use preferably a flat spanner.

The example shows a stainless steel screw, but class 8.8 screw may be a better choice. Tighten as firmly as possible without destroying the screw.

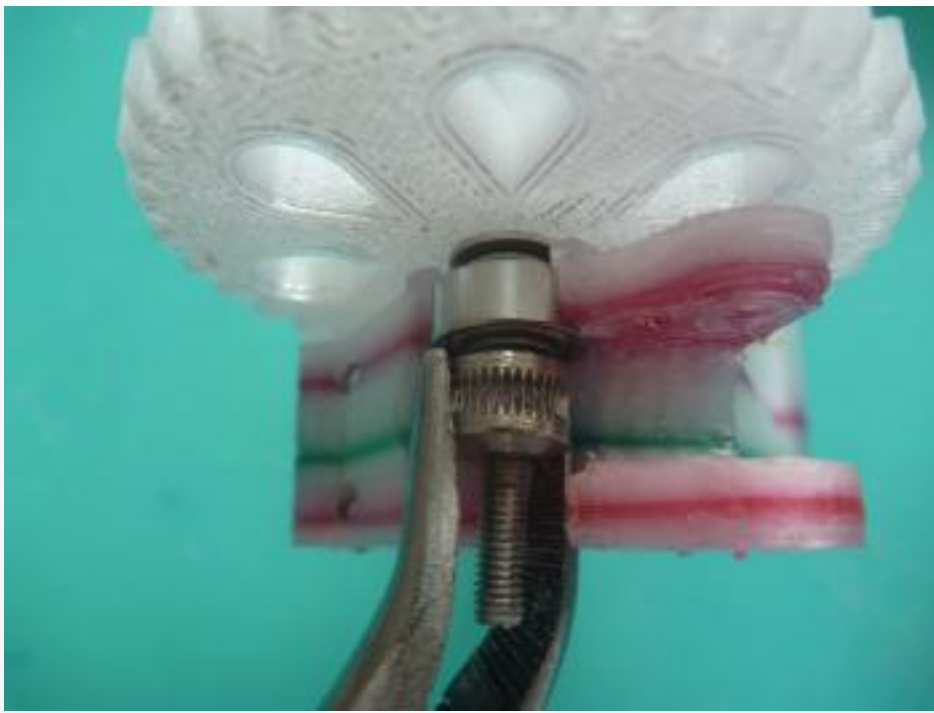


Hobbed drive assembly

The main gear may have some friction on the bearing support. If moderate, this is ok. Else, you may cut slightly the bearing stop with a sharp cutter. Do not add a washer, you may not have sufficient length for the counter nut.







Tighten as firmly as possible the hobbed insert, with care not to damage the hobbed part. Beware, false movement could break the support (I broke one...).



Do not glue the hobbled insert, it will make the ensemble impossible to disassemble. Only glue

the counter-nut.

Lever final assembly - don't tight

The nut is locked by the glue, not by tightening!
It shall be free moving, some friction is acceptable





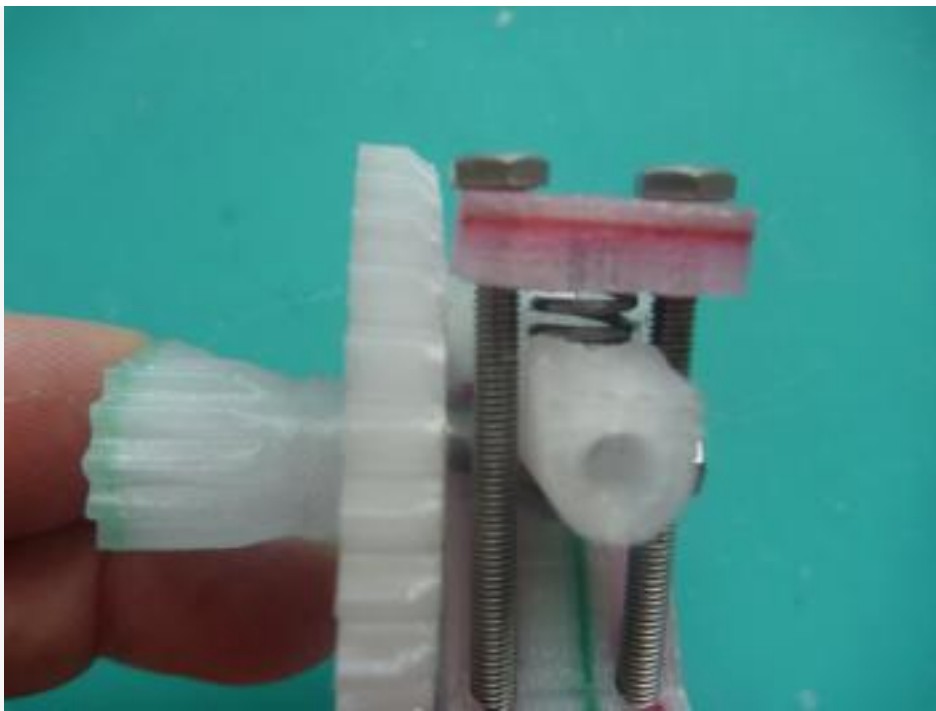
Installation on motor





Tensioner assembly







Gear assembly





Panels and top hole enlargement

You need to make room in the panels for :

- The thumbweel - a few mm shall be removed on top left (less than on photo, this was for tests)
- Access to the top lever on top plate. There is significant clearance needed to be able to fully open the lever.
- Hole for filament inlet (diam 5mm)
- Hole on side panel to dye filament for extrusion calibration.: 20mm diameter, on the photo it is 14mm, too small for a marker.

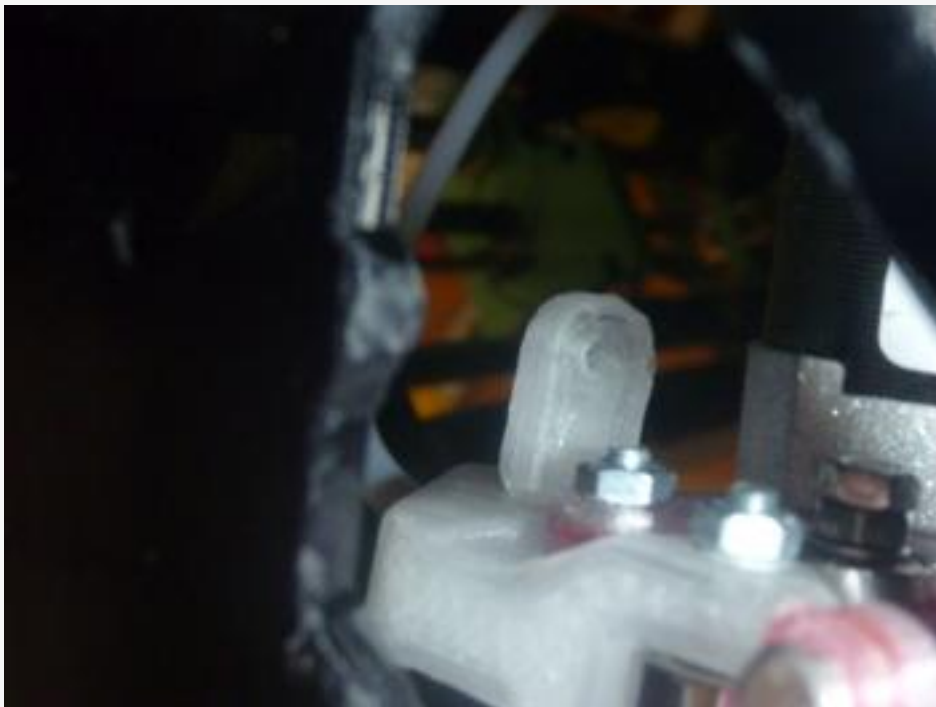
Panel bolt testing and assembly

The printed part in the file contains a template for positioning accurately the extruder. After drilling, cut the template part and use only the motor screw head support. Beware, there is only 2mm play with the arms when carriages are at top.





Tongue set



Shorten your Bowden to 390mm. As for first setup, beware not introducing PTFE chips in the bowden tube. 2.4 or 2.5 mm drill (see Fisher assembly manual).

Tips :

- 3.2, 2.8mm and 2.4mm drill bits could be found in Dremel bit sets. This is useful for 3D printer assembly.
- For holes which need preparation, use bits rotating in reverse to not cut the material. It works well on PETG, but it melt PLA.

Links for parts :

<https://www.think3dprint3d.com/>

<https://www.robofun.ch/en/3d-print-reprap/ormerod.html>

<http://www.replikeo.com/>

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