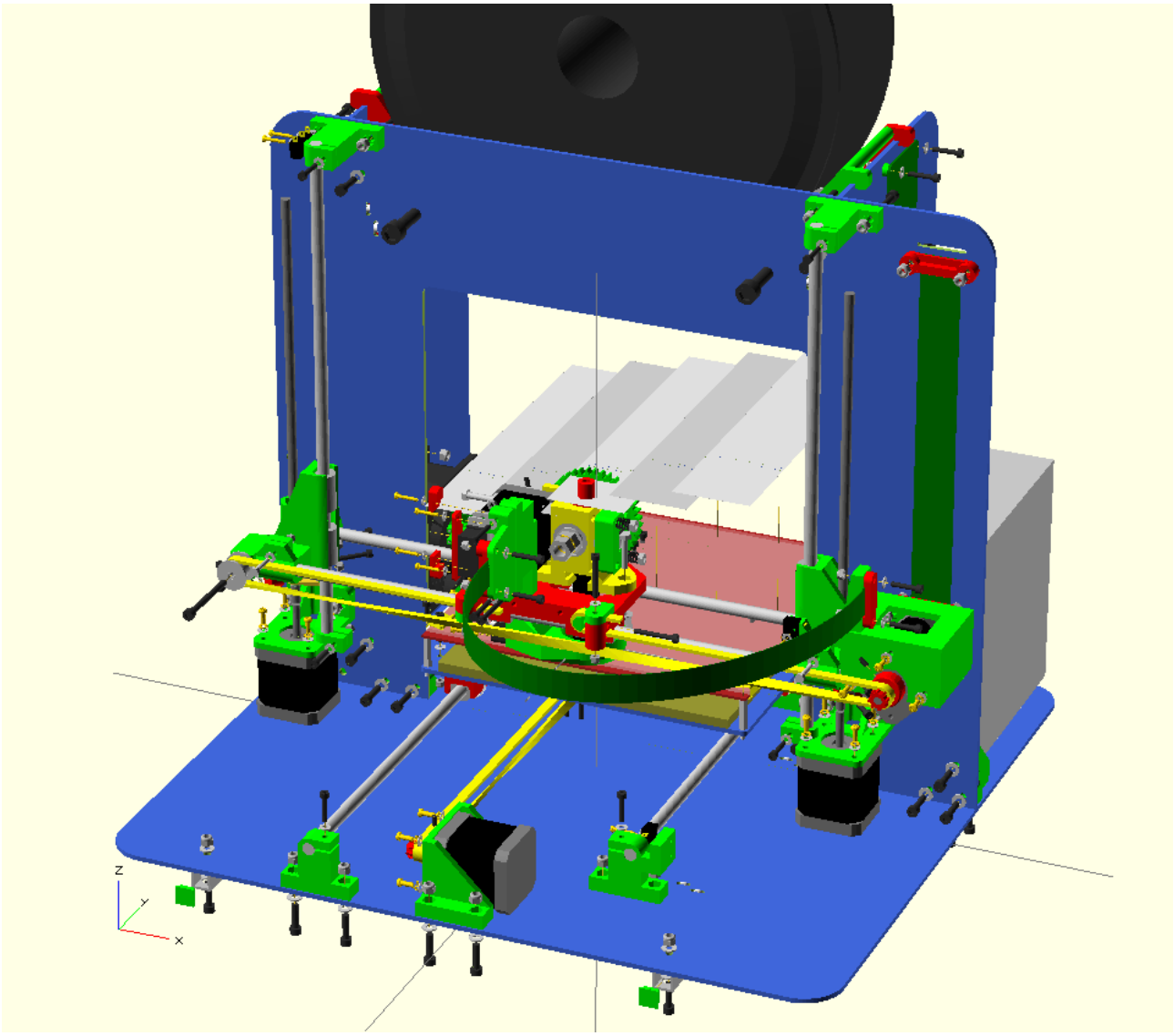
Mendel90 Kit Instructions



The build is broken down into sub assemblies that can be worked on by different members of the team in parallel. Each assembly starts on a new page so these instructions can be split up and handed out.

General Build Tips

- X is left / right. Y is backwards / forwards. Z is up / down.
- Bar lengths: The longest and shortest bars are the Y bars. Of the two pairs left, the longer ones are the X axis and the shorter two the Z axis.
- The longer belt is for X and the shorter one is for .
- All the motors are the same type but the two Z motors and the Y motor come with full length wires. The extruder motor has short wires to go into the terminal strip and the X motor has short wires to join to the ribbon cable. They are supplied trimmed so the wire can be recycled for the limit switches, bed thermistor, etc.
- All screws have a plain washer where they meet the plastic, to spread the load and prevent

the plastic being chewed up by the rotation of the screw head. Most fixings have a captive Nyloc nut to prevent them vibrating loose. **It is very important that the nut is fully seated in the nut trap while the screw is inserted.** They are quite a tight fit so sometimes it is necessary to pull or push them in with a long screw. The two M3 x 45mm screws in the kit are handy for this.

- Washers tend to have a smooth side and a side with a burr from being stamped out. Make sure the smooth side faces bearings and belts.
- Ribbon clamp notation is <number of wires>_<hole size>. An N suffix denotes with nut traps. B denotes no slot.

Frame Assembly

Vitamins

36 M4 cap screw x 16mm

2 Dibond sheet 166mm x 384mm x 3mm

1 Dibond sheet 465mm x 384mm x 3mm

1 Dibond sheet 465mm x 419mm x 3mm

36 Nyloc nut M4

1 Polypropylene strip 356mm x 25mm x 0.5mm

1 Polypropylene strip 270mm x 33mm x 0.5mm

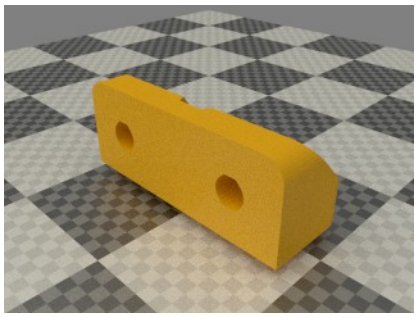
2 AL square tube 12.7 x 12.7 x 1.63 x 400mm

38 Washer M4 x 9mm x 0.8mm

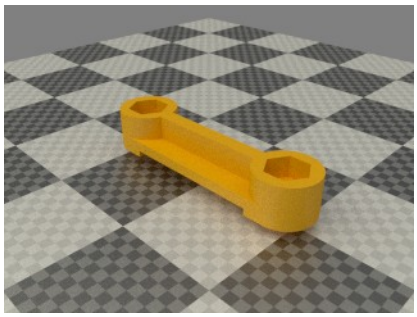
10 Ziptie 100mm min length

Printed parts

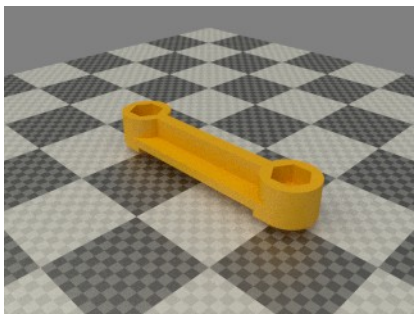
10 fixing_block.stl



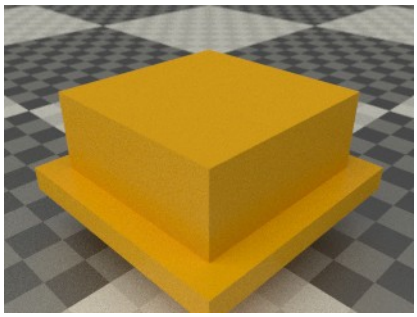
1 ribbon_clamp_20_44N.stl



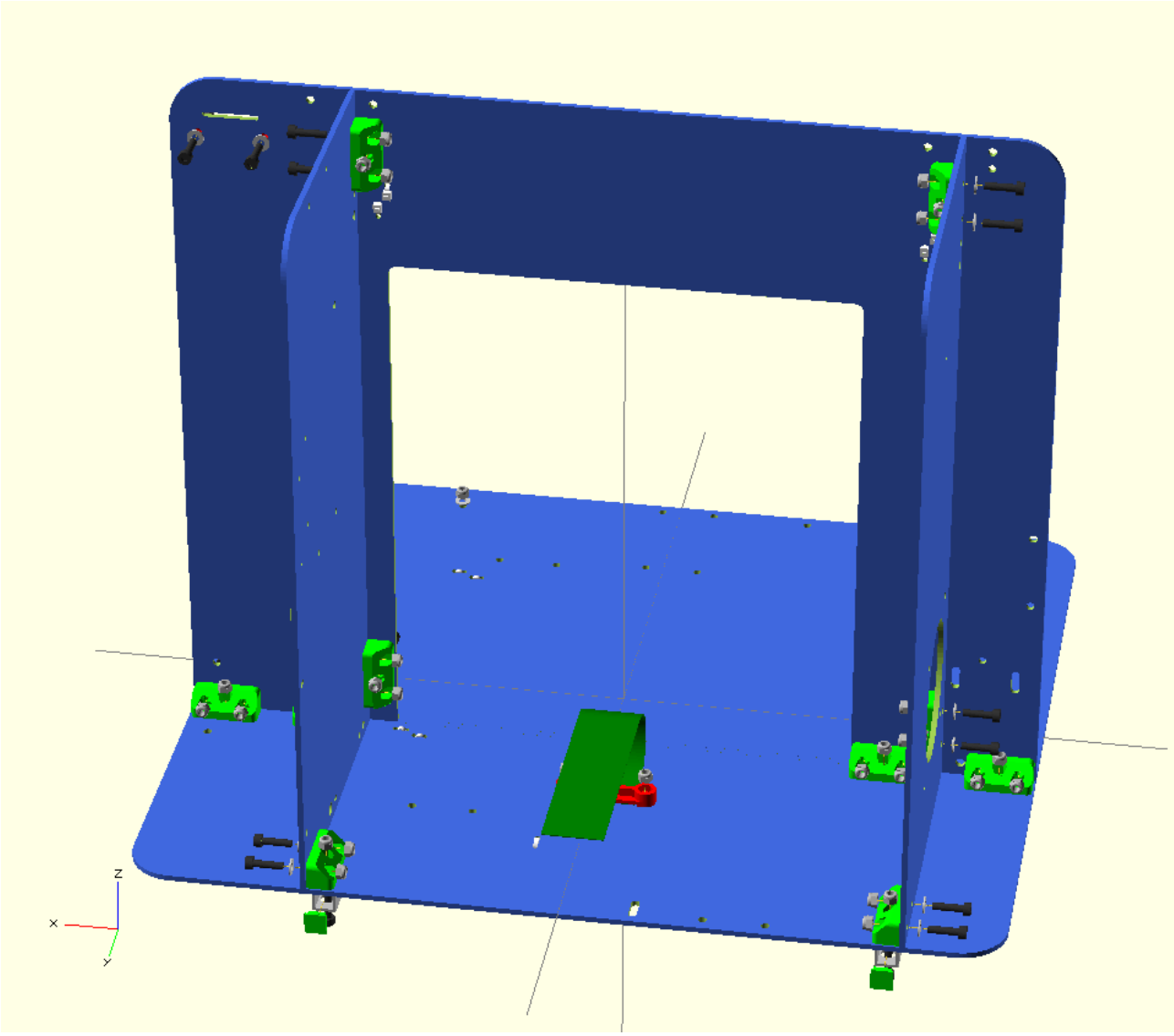
1 ribbon_clamp_26_44N.stl



4 tube_cap.stl



Assembly



1.Remove the protective film from the Dibond panels. They all have a matt side and a shiny side. The shiny side is up on the base, forward on the gantry and outside on the stays.

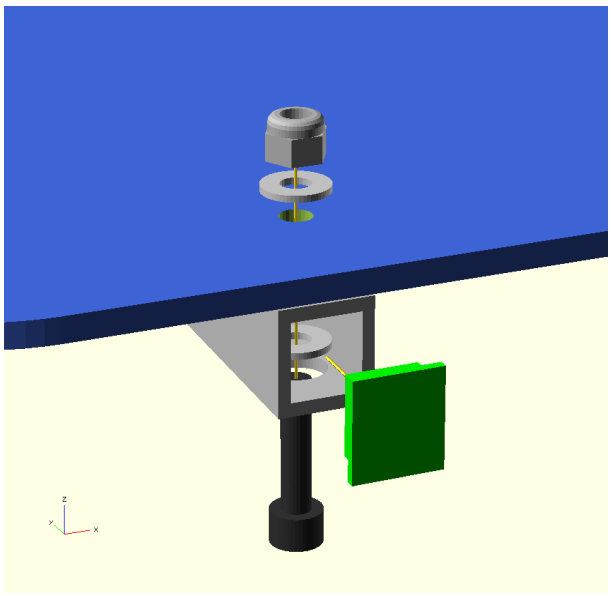
2.Insert M4 nyloc nuts into each of the three nut traps in the fixing blocks (a small pair of snipe nose pliers is useful for pressing them home).

3.Using a 3mm Allen key: attach three fixing blocks to the left and right stays with two M4 x 16mm screws each, noting that they go on the matt side that faces inwards. Stand the sheet on its edge on a flat surface and slide the block down to be flush with the edge before tightening the screws.

4.Fit the remaining four fixing blocks along the bottom of the back of the gantry in the same way.

5.Fix the stays to the back of the gantry using one screw in each fixing block. Note the shiny sides face outwards and the one with the fan hole is on the left hand side looking from the front.

6.Attach the two aluminium square tubes to the underside (matt side) of the front of the base by placing a washer in the end of the tube, passing a screw up through the large hole in the underside of the tube, through the washer, through the base and into a washer and nyloc on the top.



7.Screw the gantry to the base using six screws from below. Note that the rear two screws go through the aluminium tubes in the same way as at the front. Align the stays with the back edge before tightening.

8.Fit the four end caps to the tubes.

9.Loosely insert 5 pairs of zip ties into the pairs of small holes in the gantry and base.

10.Loosely attach the two ribbon clamps. The longer one goes at the back of the base for the bed wires. The shorter one goes at the top of the gantry for the X axis cable.

Bed Fan Assembly

The bed fan is optional. It speeds up the cool down period when the parts are finished. It is not included in the kit but the hole is cut out so you may add it later if you wish. In the meantime just fit the fan guard.

Vitamins

4 M4 cap screw x 16mm

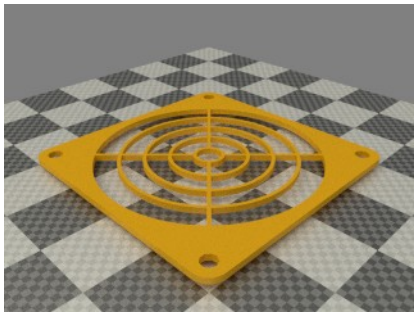
1 Fan 80mm x 38mm

4 Nyloc nut M4

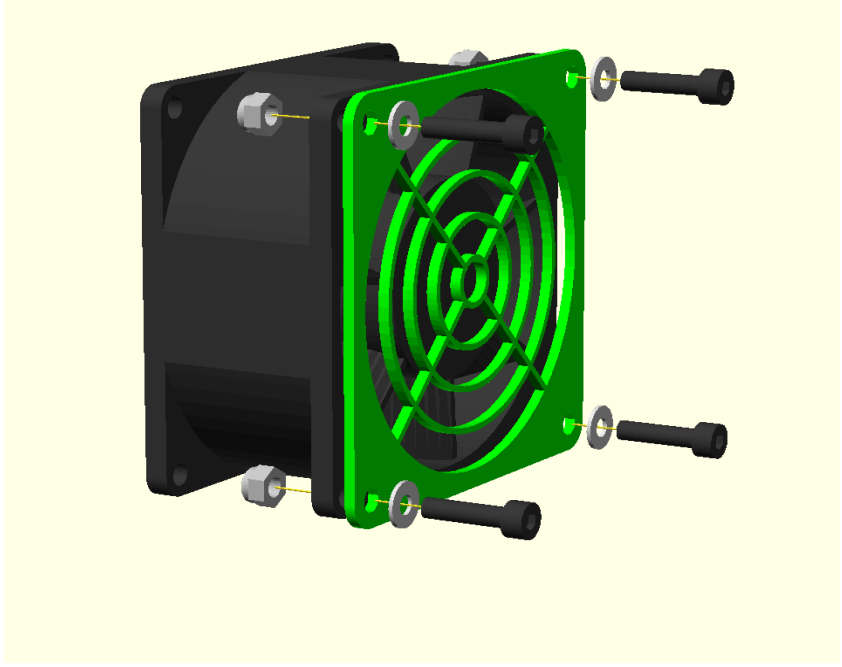
4 Washer M4 x 9mm x 0.8mm

Printed part

1 fan_guard.stl



Assembly



Make sure the fan is blowing inwards. This is usually indicated by an arrow on the frame and is

often the side with the label.

The four screws pass through a plain washer, the fan guard, the left stay, the fan (if fitted) and finally a nyloc nut. There isn't a washer behind the fan because fan frames tend not to have room for one.

X Idler Assembly

Vitamins

2 Ball bearing 624 4mm x 13mm x 5mm

1 M4 cap screw x 45mm

2 M3 hex screw x 16mm

2 LM8UU linear bearing

1 Brass nut M6

2 Nyloc nut M3

1 Nyloc nut M4

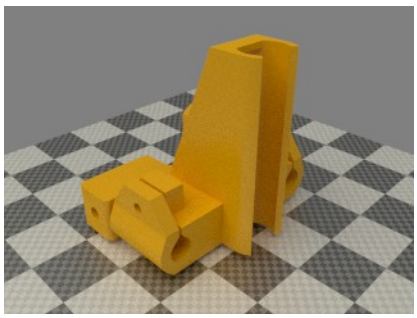
2 Washer M3 x 7mm x 0.5mm

2 Washer M4 x 9mm x 0.8mm

2 Washer M5 x 20mm x 1.4mm

Printed

1 x_idler_bracket.stl

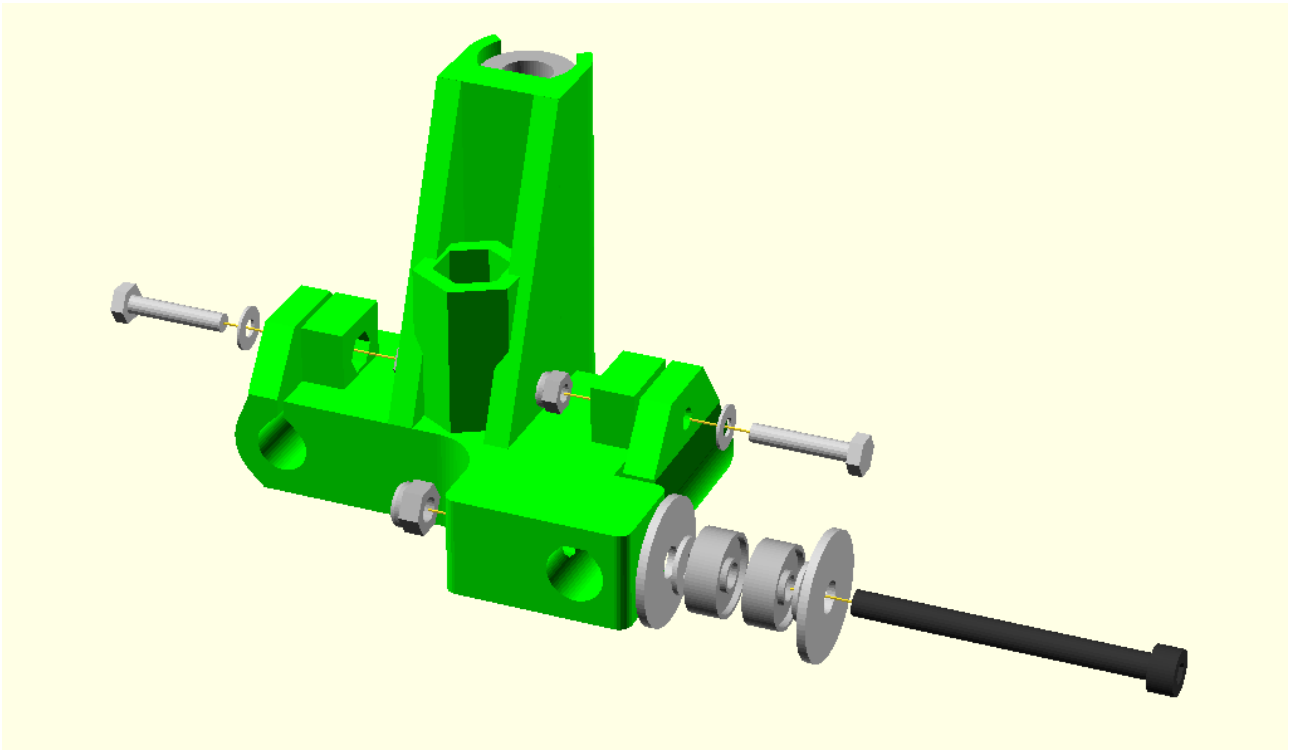


Assembly

To insert the two linear bearings it is easiest to push the end which is towards the middle in first. Then slide it up against the divider in the middle before pushing in the other end. Insert a rod to check they are aligned well.

It can be easier to pull the M3 nuts for the bar clamps into their hard-to-reach traps using one of the longer screws from elsewhere in the design.

Leave the long bolt that forms the idler axle loose to allow the X bars to be inserted later.



X Motor Assembly

Vitamins

2 M3 cap screw x 16mm

4 M3 hex screw x 16mm

2 LM8UU linear bearing

1 NEMA17 x 47.5mm stepper motor

1 Brass nut M6

6 Nyloc nut M3

3 M3 pan screw x 8mm

2 No2 pan wood screw x 13mm

1 Microswitch

2 Washer M2.5 x 5.9mm x 0.5mm

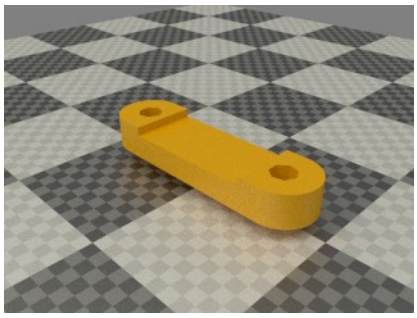
9 Washer M3 x 7mm x 0.5mm

3 Star washer M3 x 0.5mm

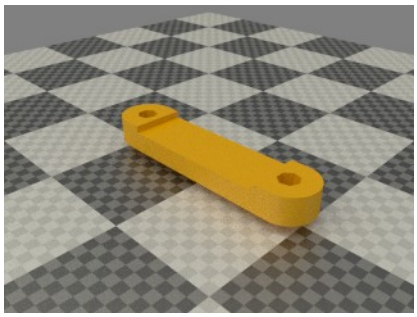
1 T5 metal pulley

Printed parts

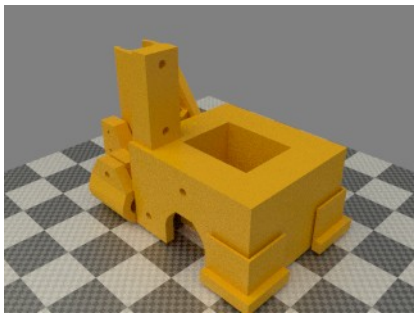
1 ribbon_clamp_14_33.stl



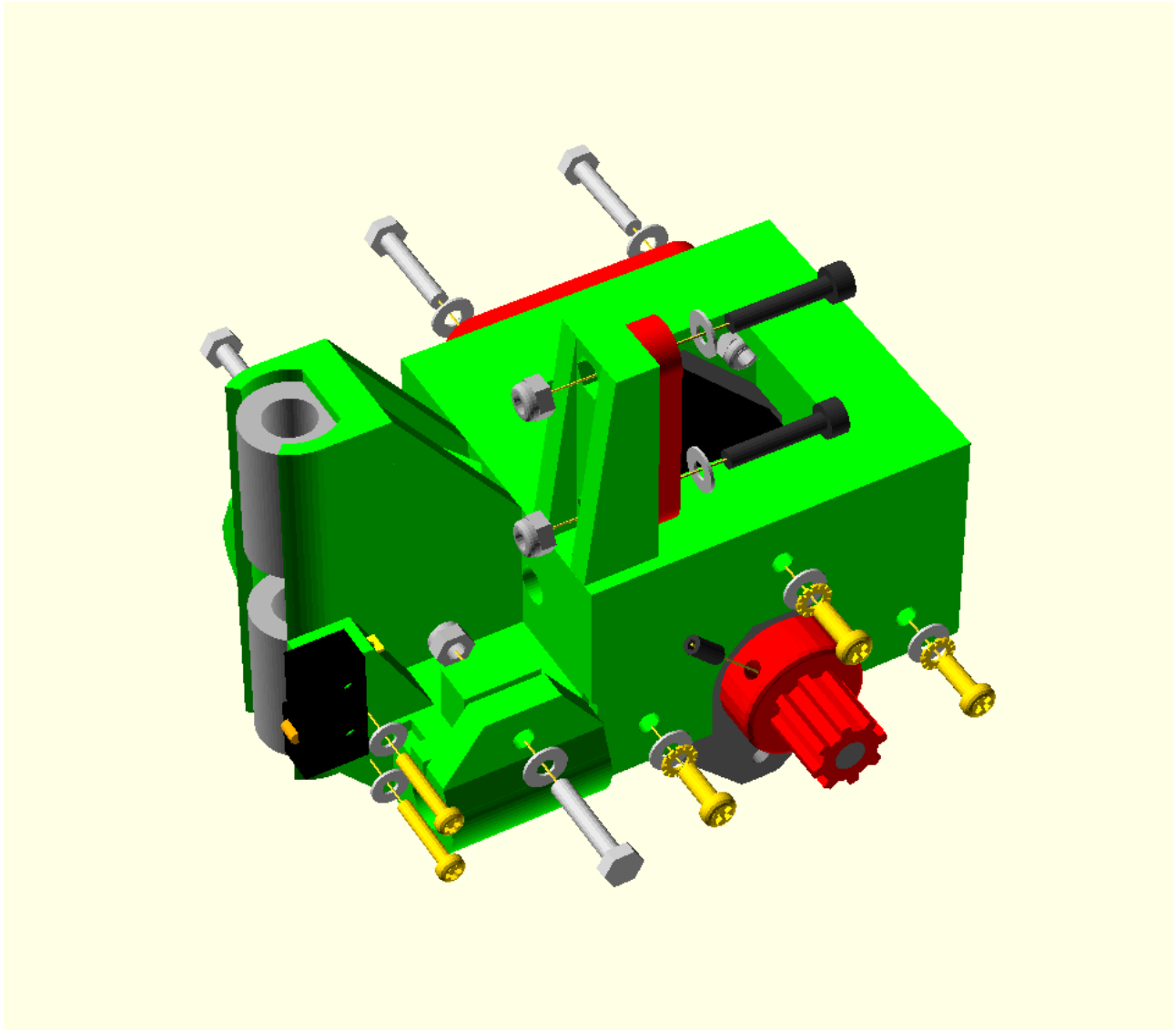
1 ribbon_clamp_20_33.stl



1 x_motor_bracket.stl



Assembly



Start by inserting M3 nyloc nuts in all the nut traps.

Pass the both ends of the ribbon cable attached to the motor up through the hole in the top before attaching the motor.

Note the kit is supplied with metal pulleys with the grub screw already fitted.

Z Motor Assemblies

Vitamins

2 M3 cap screw x 16mm

8 M3 cap screw x 20mm

4 M4 cap screw x 16mm

2 NEMA17 x 47.5mm stepper motor

10 Nyloc nut M3

4 Nyloc nut M4

8 M3 pan screw x 8mm

2 PVC aquarium Tubing OD 6mm ID 4mm x 16mm

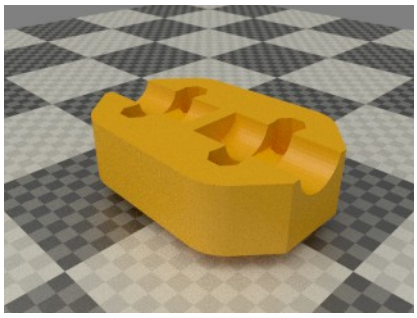
18 Washer M3 x 7mm x 0.5mm

4 Washer M4 x 9mm x 0.8mm

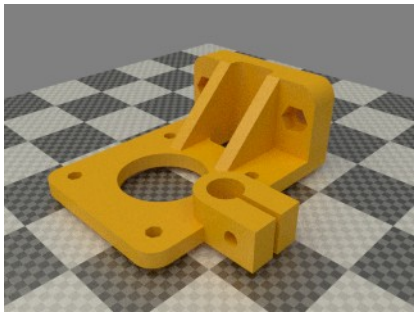
8 Star washer M3 x 0.5mm

Printed parts

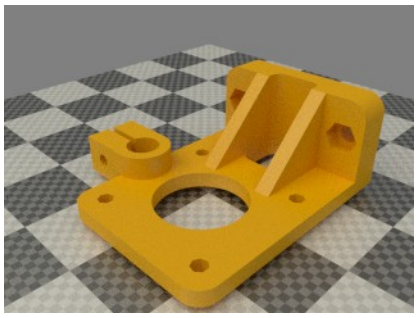
4 z_coupling.stl



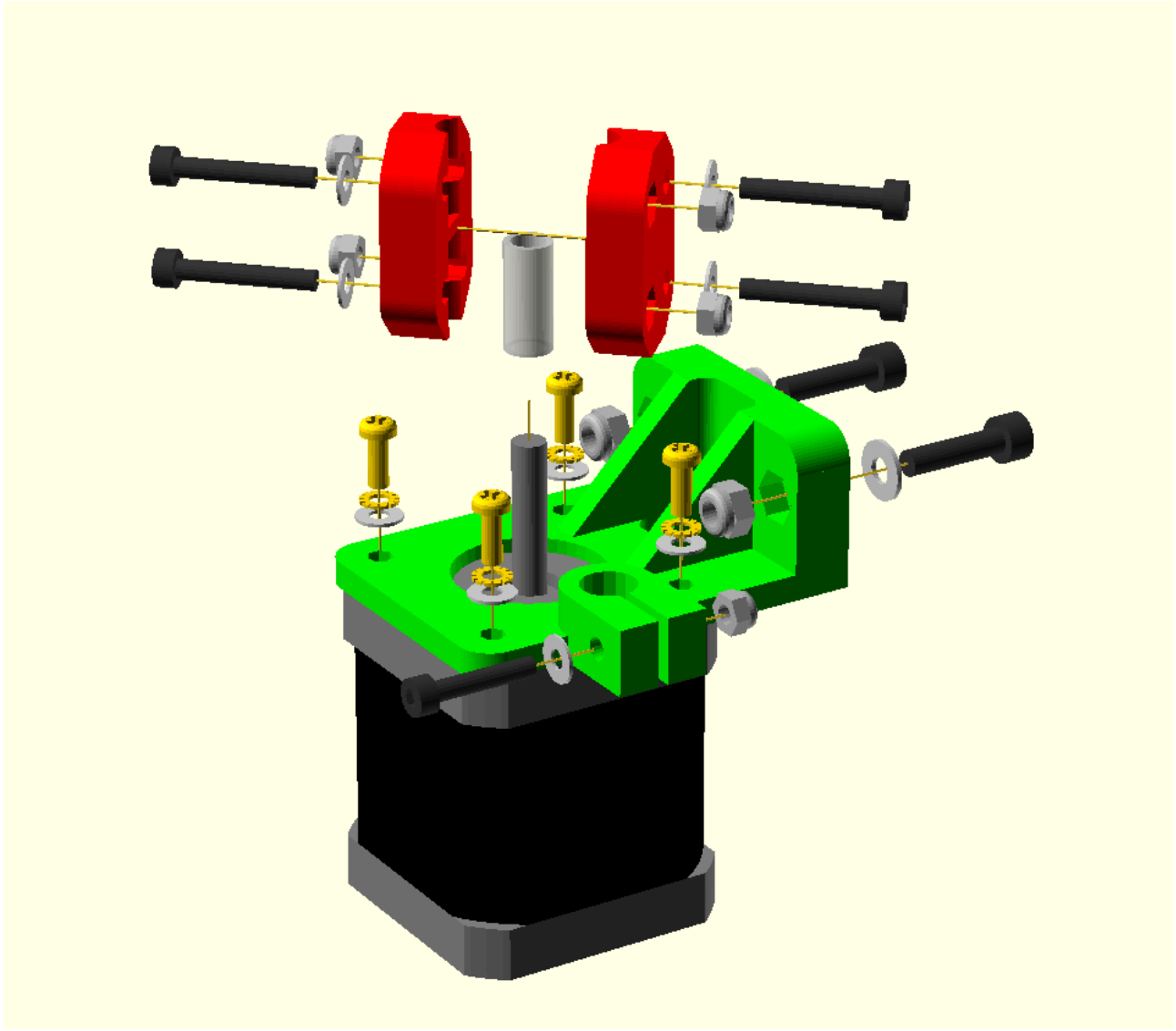
1 z_motor_bracket_lhs.stl



1 z_motor_bracket_rhs.stl



Assembly



•Degrease the motor shafts before fitting the plastic tubing but be careful not to degrease the bearings. Fit the coupling loosely over the tubing. The plastic tubing will also be a tight fit. Stretching it by opening a pair of pliers inside can help.

•Make sure the metal shaft of the motor protrudes slightly beyond the end of the tubing.

•Twist the motor wires in pairs and feed them through the hole in the gantry before attaching the motor assemblies. See below for the best way to do this.

Z Axis Assembly

Vitamins

2 M3 cap screw x 16mm

4 M4 cap screw x 16mm

2 Nyloc nut M3

4 Nyloc nut M4

2 No2 pan wood screw x 13mm

2 Smooth rod 8mm x 336mm

1 Microswitch with blue wires

2 Threaded rod M6 x 271mm

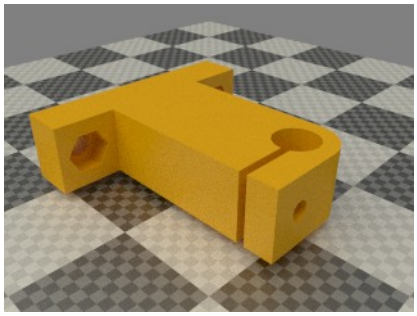
2 Washer M2.5 x 5.9mm x 0.5mm

2 Washer M3 x 7mm x 0.5mm

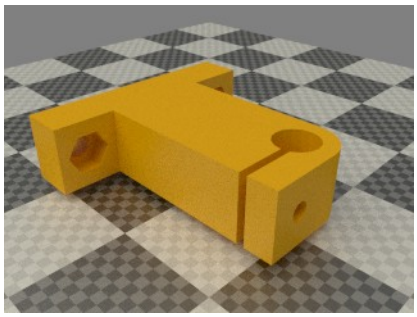
4 Washer M4 x 9mm x 0.8mm

Printed parts

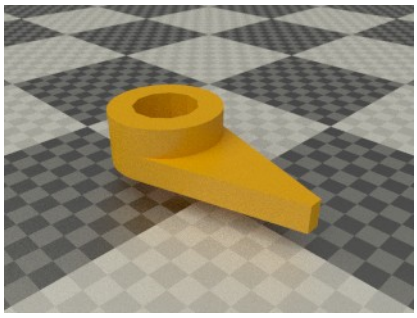
1 z_bar_clamp.stl



1 z_bar_clamp_switch.stl

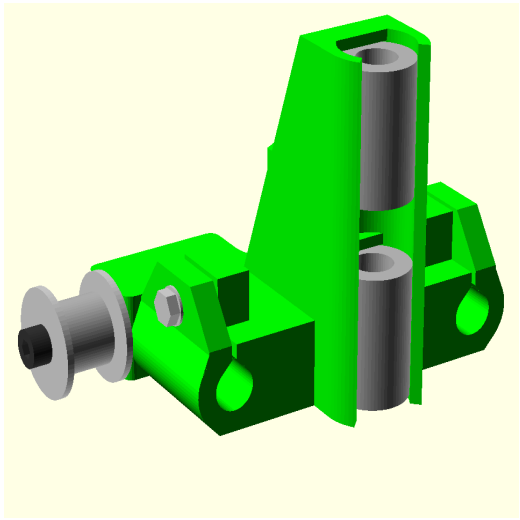


2 z_screw_pointer.stl

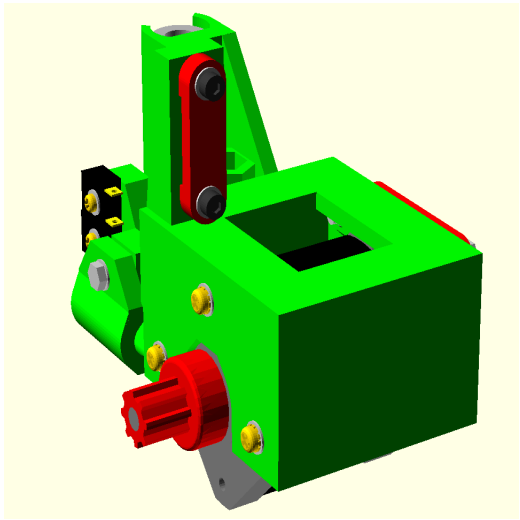


Sub-assemblies

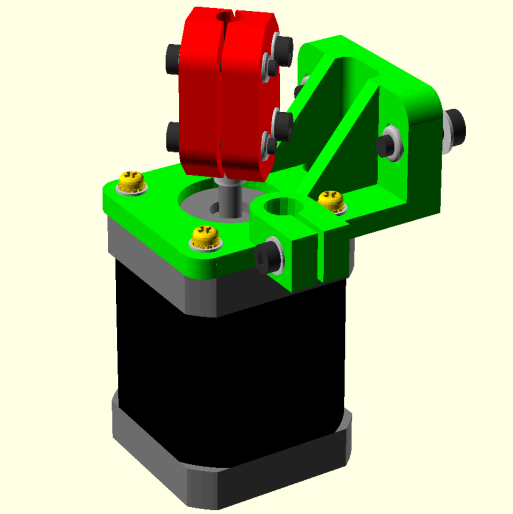
1 x_idler_assembly



1 x_motor_assembly



2 z_motor_assemblies



•Fit the top bar clamps, note that the one with small screw holes for the limit switch goes on the left and they both face the same way. Leave the screws loose.

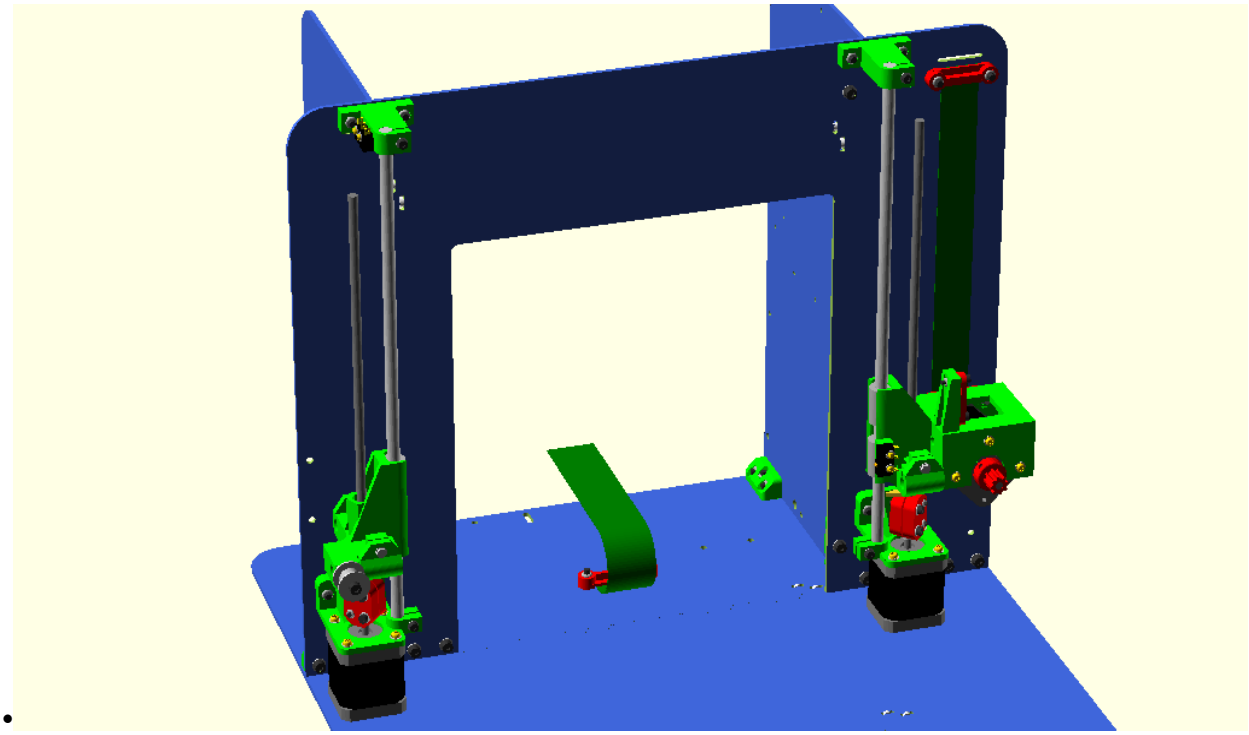
•Fit the top Z limit switch.

•Fit the Z bars, inserting them through the X ends. Tighten the left hand bar clamp but leave the right hand one loose.

•Finally fit the lead screws by screwing them though the X end brass nuts and the Z pointer. You may find it easier to thread on the X end nuts and then the Z pointers (which can be a bit stiff) before inserting them into the X ends from below. This will work if you run the X ends all the way up to the top.

•Once they are in, secure them to the motors using the couplings. You can assemble the couplings, loosely screwed together, before putting them in place.

•



Y idler assembly

Vitamins

2 Ball bearing 624 4mm x 13mm x 5mm

1 M4 cap screw x 16mm

1 M4 cap screw x 30mm

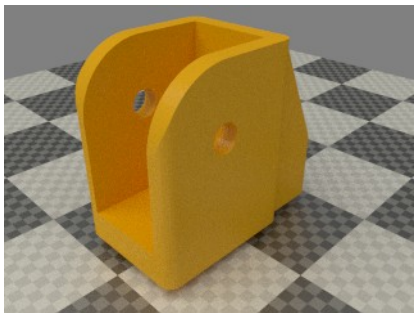
2 Nyloc nut M4

5 Washer M4 x 9mm x 0.8mm

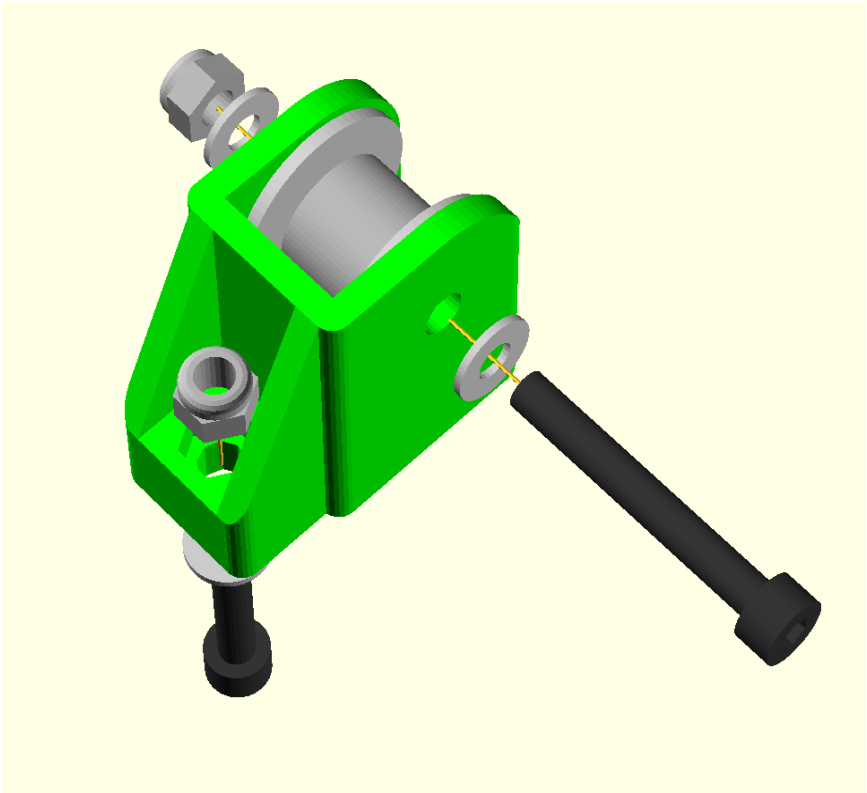
2 Washer M5 x 20mm x 1.4mm

Printed parts

1 y_idler_bracket.stl



Assembly



Y motor assembly

Vitamins

4 M4 cap screw x 16mm

1 NEMA17 x 47.5mm stepper motor

4 Nyloc nut M4

4 M3 pan screw x 8mm

4 Washer M3 x 7mm x 0.5mm

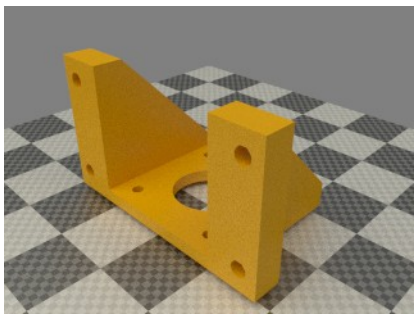
4 Washer M4 x 9mm x 0.8mm

4 Star washer M3 x 0.5mm

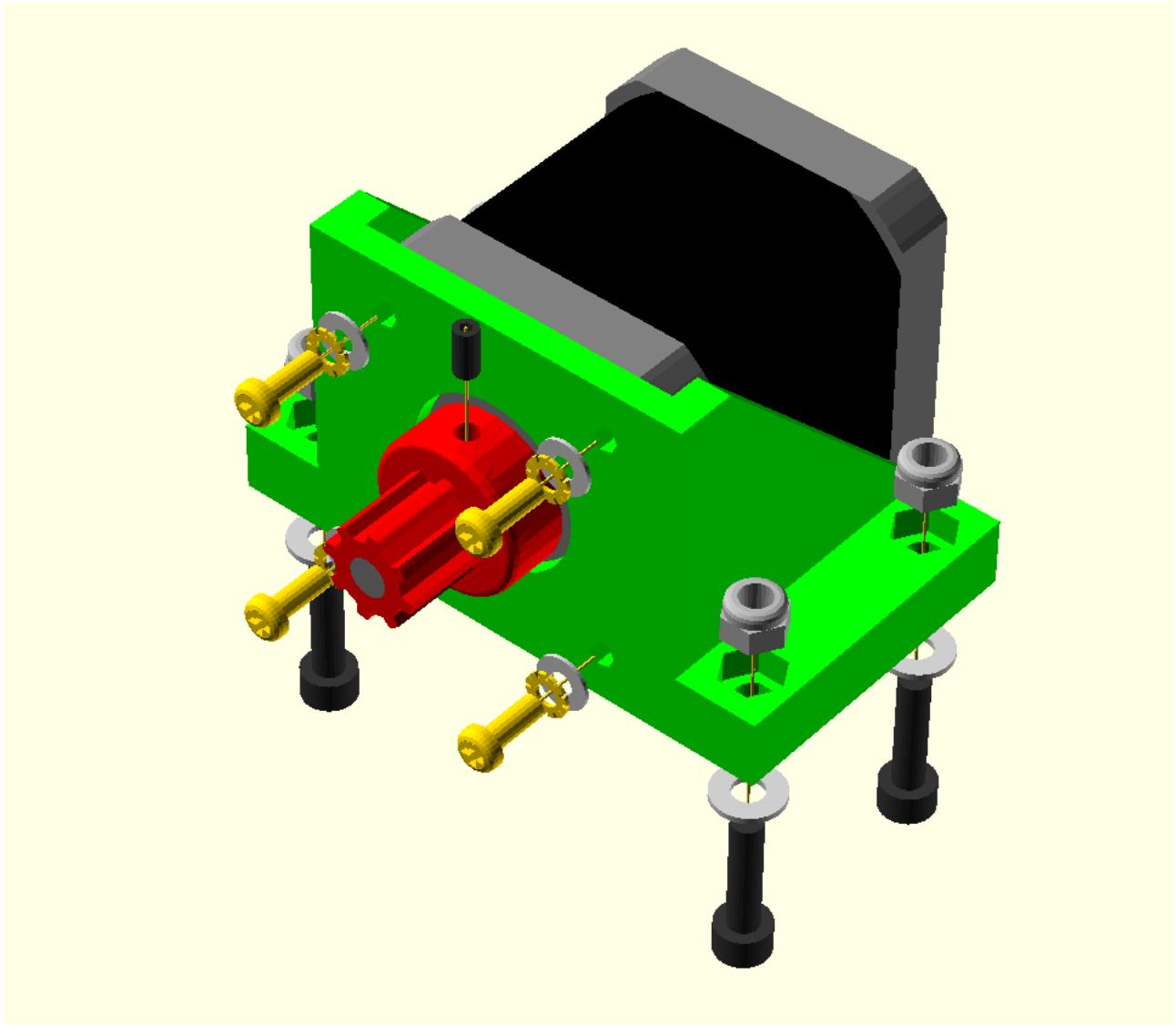
1 T5 metal pulley

Printed parts

1 y_motor_bracket.stl



Assembly



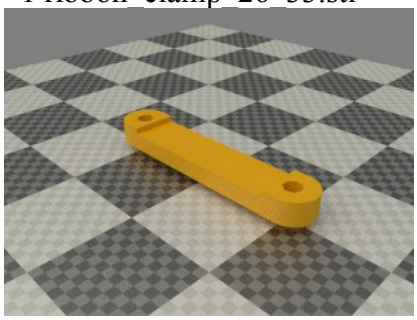
Y Carriage Assembly

Vitamins

14 M3 cap screw x 16mm
2 M3 cap screw x 20mm
1 Dibond sheet 216mm x 216mm x 3mm
3 LM8UU linear bearing
16 Nyloc nut M3
16 Washer M3 x 7mm x 0.5mm
3 Ziptie 100mm min length

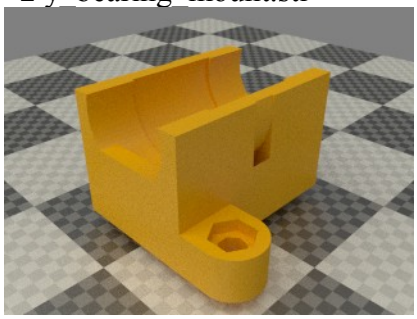
Printed parts

1 ribbon_clamp_26_33.stl

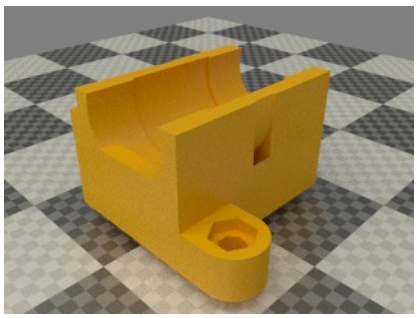


1 ribbon_clamp_26_33N.stl

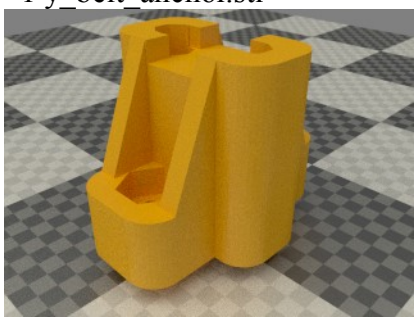
2 y_bearing_mount.stl



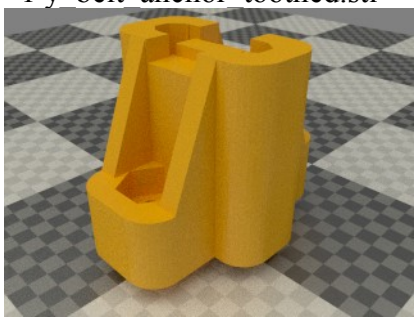
1 y_bearing_mount_switch.stl



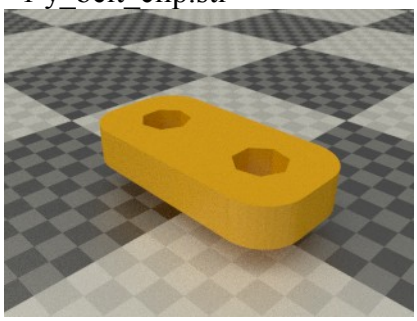
1 y_belt_anchor.stl



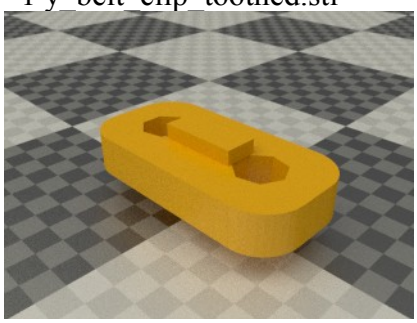
1 y_belt_anchor_toothed.stl



1 y_belt_clip.stl



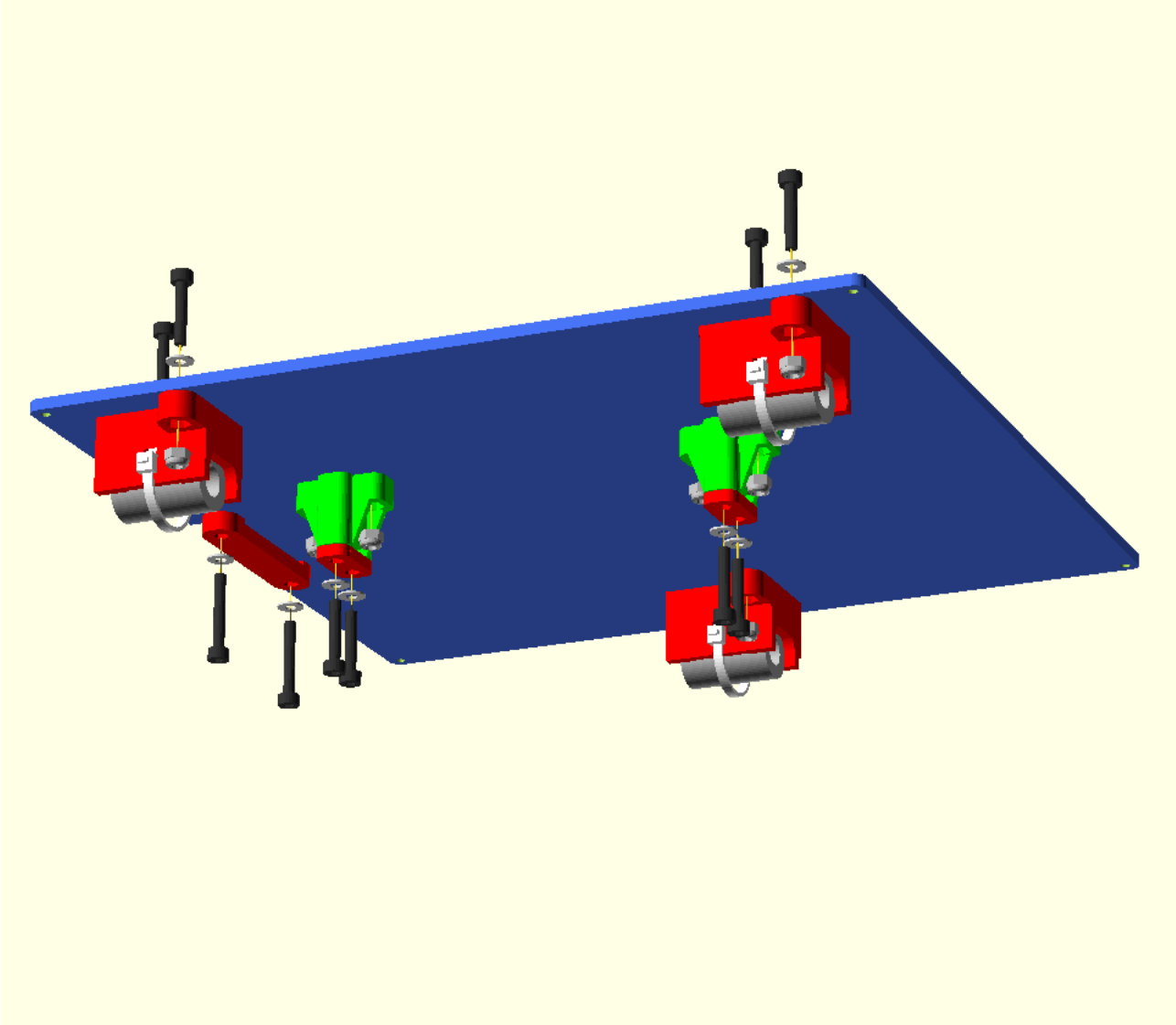
1 y_belt_clip_toothed.stl



Sub-assemblies

1 bed_assembly

Assembly



•The edge of the carriage with two holes in the middle is the back and the side with most holes is the left.

•In all cases except the cable clamps, the nuts go on the bottom and the screw heads on top . The cable clamps have the heads on the bottom to avoid a clash with the Y idler.

•Tie the bearings into the holders with the zip ties, and screw the holders to the carriage using M3 screws. Note that one of the bearing holders has a tab to trigger the limit switch. That goes on the right hand side with the tab facing forwards.

•Align the two bearings on the left by inserting a rod and lining up the tabs with the edge of the board before tightening the screws. Leave the third bearing loose.

•Insert captive nuts into the belt anchors. A long M3 screw can be used to pull them up to the top.

•Fit the belt clamps loosely to retain the nuts (don't forget washers), then fit the anchors to the carriage using M3 screws. Note that the anchor with the tooth goes at the back and the belt clamp

with the tooth at the front.

•Fit two wide ribbon clamps to the holes at the back of the board, both facing inwards, using M4 screws. The washers go next to the screw/nut, not the carriage.

Y Axis Assembly

Vitamins

1 Belt T5 x 6mm x 673mm (PU & Kevlar)

4 M3 cap screw x 16mm

8 M4 cap screw x 16mm

4 Nyloc nut M3

8 Nyloc nut M4

2 No2 pan wood screw x 13mm

1 Smooth rod 8mm x 270mm

1 Smooth rod 8mm x 417mm

1 Microswitch with green wires

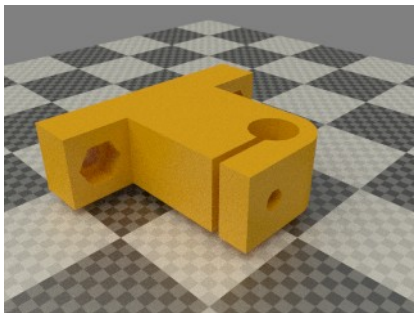
2 Washer M2.5 x 5.9mm x 0.5mm

4 Washer M3 x 7mm x 0.5mm

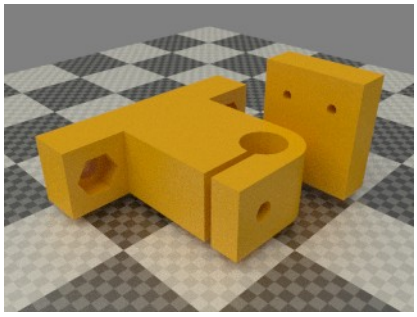
8 Washer M4 x 9mm x 0.8mm

Printed parts

3 y_bar_clamp.stl



1 y_bar_clamp_switch.stl



Sub-assemblies

1 y_idler_assembly

1 y_motor_assembly

Assembly

•Insert the captive nuts and clamp screws in the Y bar clamps.

•Loosely fit the two left hand Y bar clamps to the base. Orient them so the rods are on the outside.

•Solder the wires on the Y limit switch and screw it to the bar clamp before fitting it front right and the other back right. Leave the right hand bar clamps loose.

•Fit the Y motor to its bracket, noting the wires come out of the face facing the base, and then fit the bracket.

•Assemble the Y idler assembly but don't screw it to the base.

•Thread the belt (the smaller of the two) through the idler (the right way :-) and attach both ends to the carriage noting the half twist. The ends of the belt should project 7.5mm, i.e. two teeth and a gap or a little over, when viewed from the side.

•Slide the Y bars into the carriage and the base, and slide the carriage up and down to align the right hand bearing and bar clamps. Tighten the bearing first and then move it to each end and tighten the clamps.

•Put the belt over the pulley and fasten the idler assembly to the base with enough tension on the belt to play a low note when plucked.

X Carriage Assembly

Vitamins

1 M3 cap screw x 10mm

1 M3 cap screw x 20mm

2 M3 cap screw x 25mm

1 Fan 30mm x 10mm

3 LM8UU linear bearing

1 Nut M3

3 Nyloc nut M3

4 No4 pan wood screw x 16mm

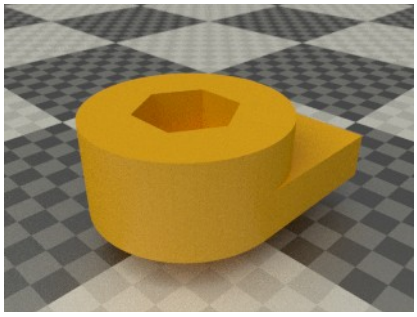
3 Washer M3 x 7mm x 0.5mm

2 Wingnut M4

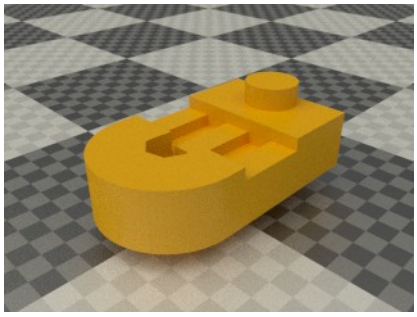
3 Ziptie 100mm min length

Printed parts

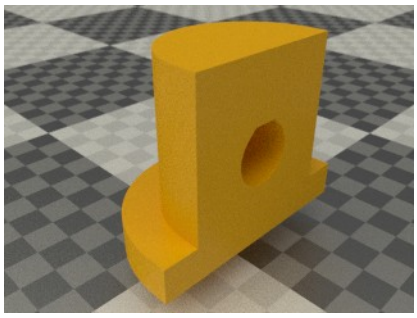
1 x_belt_clamp.stl



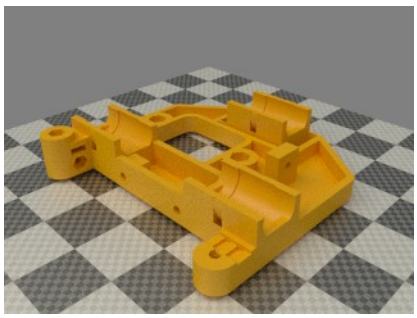
1 x_belt_grip.stl



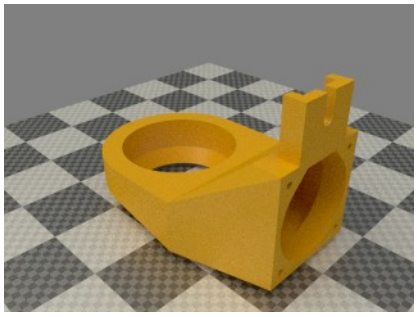
1 x_belt_tensioner.stl



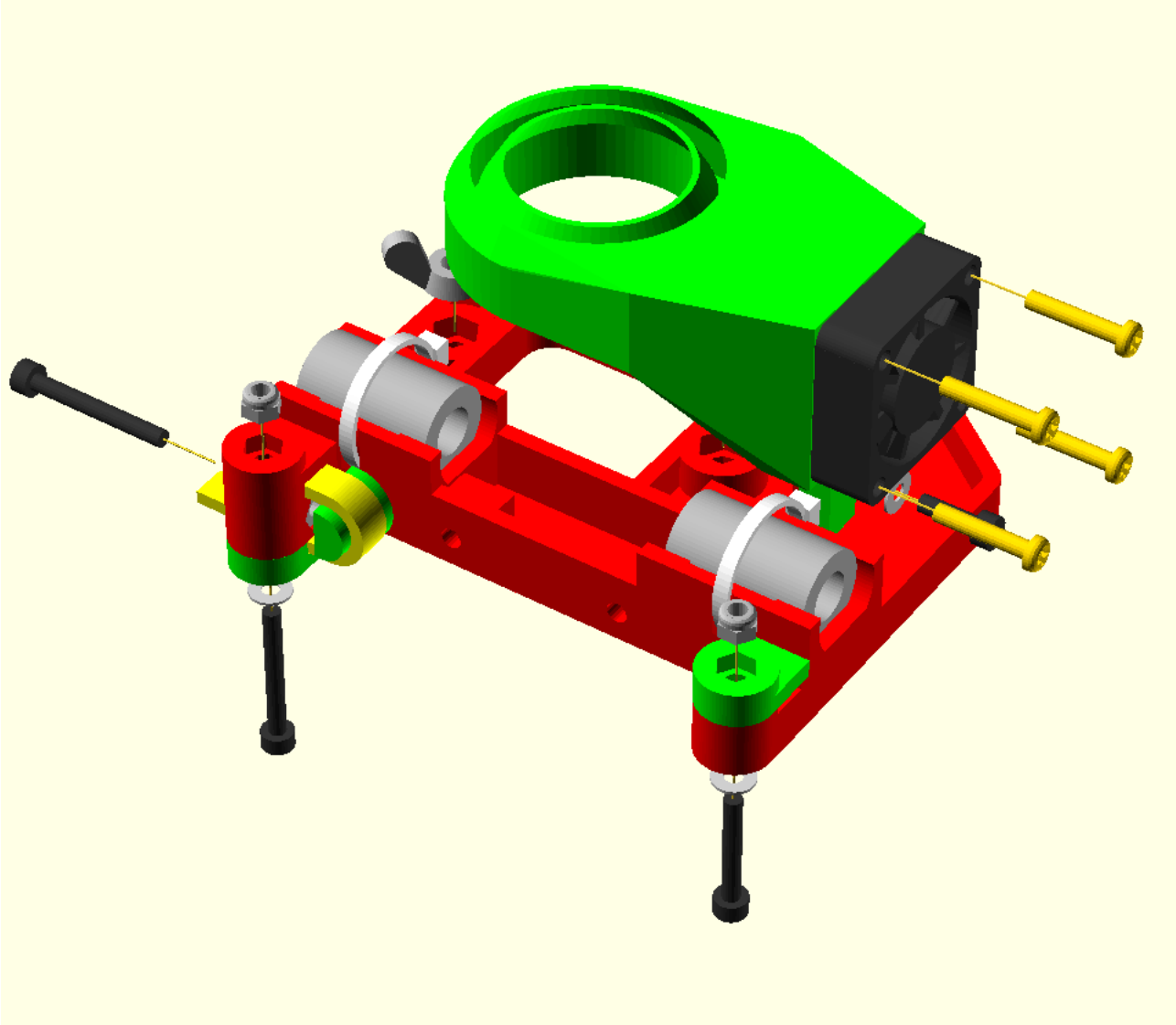
1 x_carriage.stl



1 x_carriage_fan_duct.stl



Assembly



•Attach the belt to the left side clamp with the teeth facing upwards and two teeth projecting from the clamp.

•Insert the captive nut and screw for the belt tensioner and put the tensioning piece on the end of the screw.

•Put one half twist in the belt and feed it though the slot below the right hand clamp with the teeth facing downwards.

•Double back the belt over the tensioner and clamp it with two teeth projecting.

•The fan should be mounted with the label pointing inwards.

X Axis Assembly

Vitamins

1 Belt T5 x 6mm x 864mm (PU & Kevlar)

1 Polypropylene strip 401mm x 18mm x 0.5mm

2 Smooth rod 8mm x 381mm

Sub-assemblies

1 x_carriage_assembly

•Put the X ends at the bottom of the axis.

•Slide the X bars through the idler end, the X carriage and into the motor end as far as they will go.

•Tighten the X bar clamps while the axis is at the bottom. Don't over tighten them, i.e. don't close the gap entirely, just enough until you feel it grips the bar solidly.

•Move the axis to the top and then tighten the top right Z bar clamp.

•Fit the motor, pulley and idler. The motor wires should be in the top right quadrant, and come out the hole in the top.

•Put the belt in place and tension enough to play a low note when plucked.

Bed assembly

Vitamins

4 19mm bulldog clip

1 PCB bed 214mm x 214mm

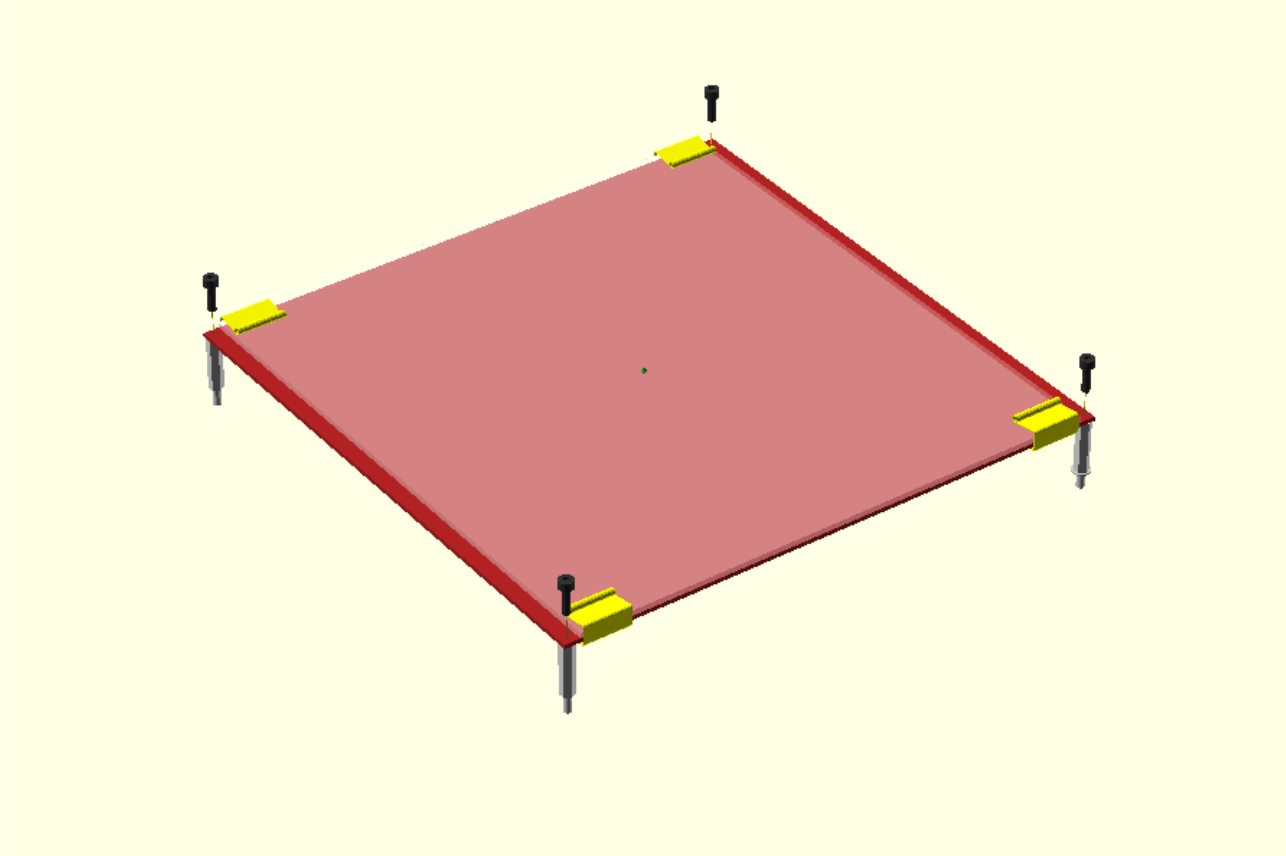
4 M3 cap screw x 10mm

1 Glass sheet 214mm x 202mm x 2mm

4 Hex male / female pillar M3 x 20mm

2 Washer M3 x 7mm x 0.5mm

Assembly



Note that the rear two pillars have a washer under them. The front two are initially spaced the same distance by using a washer as a temporary shim. They can then be adjusted up or down slightly to level the bed relative to the nozzle.

The bed is installed with the cable at the back. It initially leads off forwards and then loops back on itself under the top ribbon clamp. It then doubles back on itself under the Y carriage through the lower cable clip.

Electronics assembly

Vitamins

1 THS15 Aluminium clad resistor 10R (pre-wired to the PSU).

1 THS15 Aluminium clad resistor 4R7 (pre-wired to the PSU).

1 PSU e.g. ALPINE500

4 M3 cap screw x 16mm

4 M4 cap screw x 16mm

1 Melzi

4 Nyloc nut M2.5

4 Nyloc nut M3

4 Nyloc nut M4

4 M2.5 pan screw x 12mm

2 6-32 pan screw x 9.5mm

4 Washer M2.5 x 5.9mm x 0.5mm

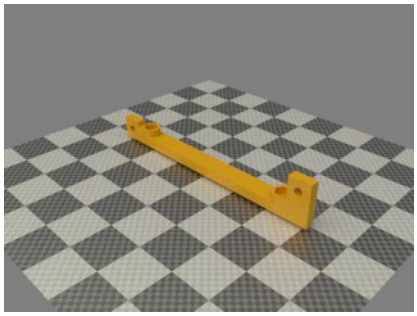
8 Washer M3 x 7mm x 0.5mm

6 Washer M4 x 9mm x 0.8mm

2 Star washer M4 x 0.8mm

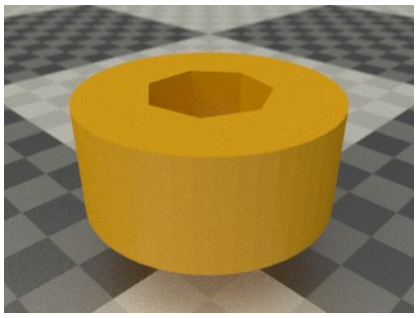
Printed parts

1 atx_long_bracket.stl



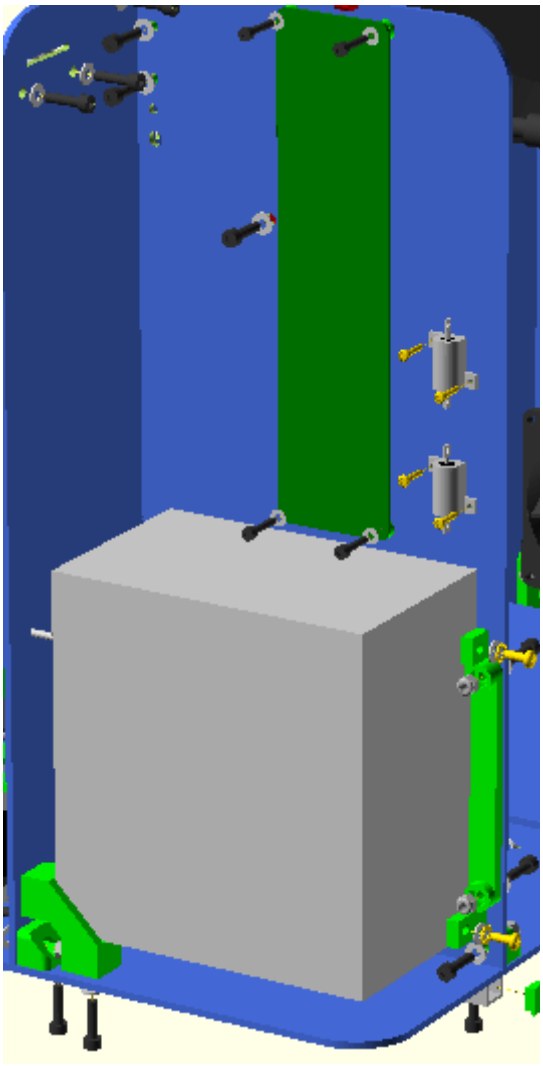
1 atx_short_bracket.stl

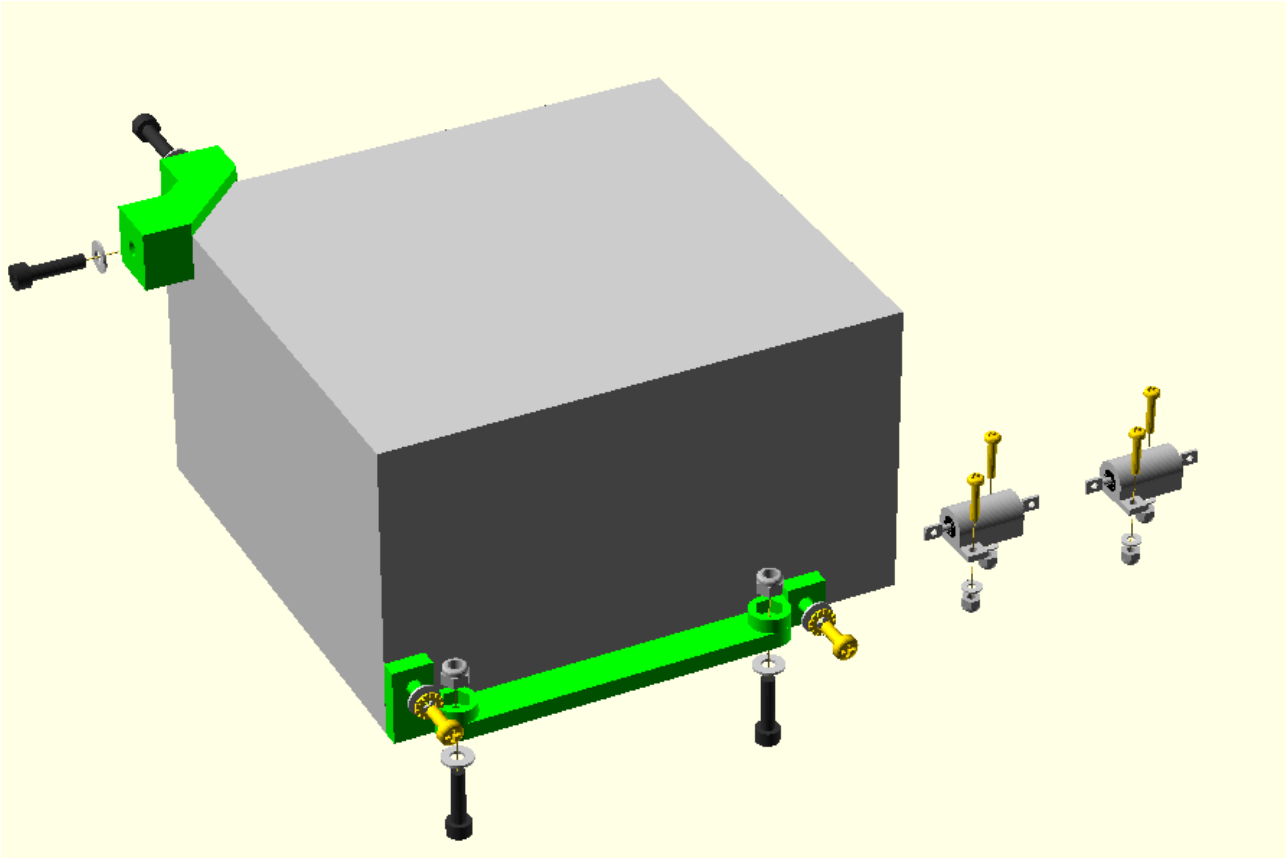
4 pcb_spacer.stl



Assembly

Run the wires from the right Z motor, the Y motor and the bed up the corner between the ganty and the right stay before fitting the PSU.

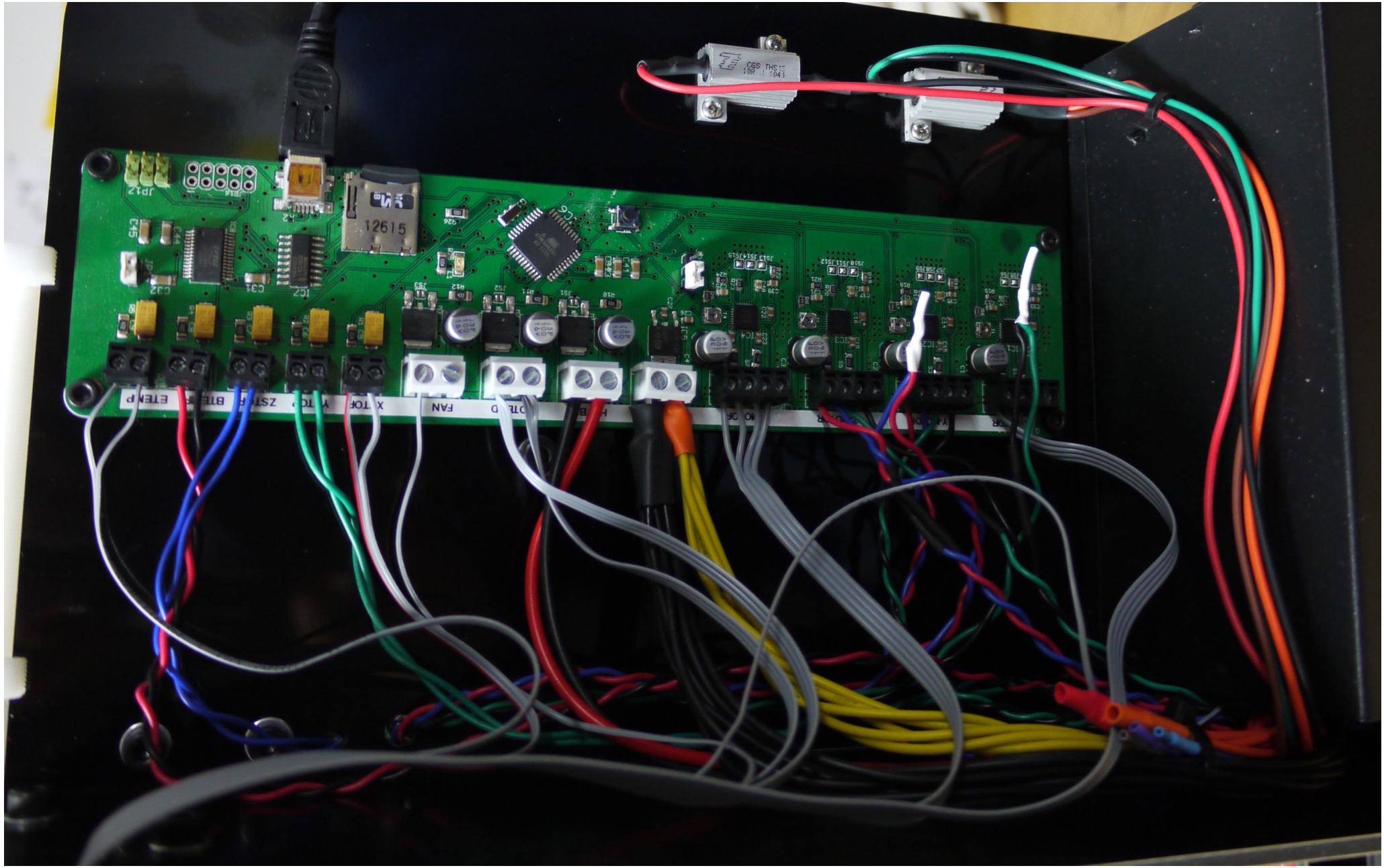




The wires all terminate at screw terminals on the Melzi board. The terminals are all labeled. The ribbon cable as the following pin out: -

Wire number	Signal	D type connector pin
1	X limit signal	
2	X limit GND	
3	Thermistor signal	Pin 1
4	Thermistor GND	Pin 9
5	Probe	Pin 2
6	+12V	Pin 10
7	+12V	Pin 3
8	+12V	Pin 11
9	Heater -	Pin 4
10	Heater -	Pin 12
11	Heater -	Pin 5
12	Fan -	Pin 13
13	Extruder motor red	Pin 6

14	Extruder motor blue	Pin 14
15	Extruder motor green	Pin 7
16	Extruder motor black	Pin 15
17	X motor red	
18	X motor blue	
19	X motor green	
20	X motor black	


12615
FAN

D connector Assembly

Vitamins

2 M3 cap screw x 16mm

2 M3 cap screw x 20mm

2 M3 cap screw x 45mm

2 Nut M3

2 Nyloc nut M3

2 Nitrile O-ring 2.5mm x 1.6mm

1 Extruder connection PCB

4 No2 pan wood screw x 13mm

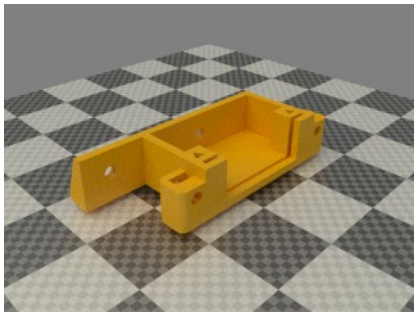
4 3 way terminal block

4 Washer M2.5 x 5.9mm x 0.5mm

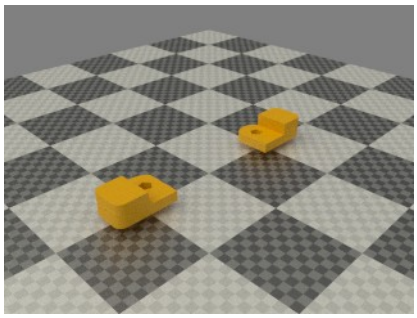
6 Washer M3 x 7mm x 0.5mm

Printed parts

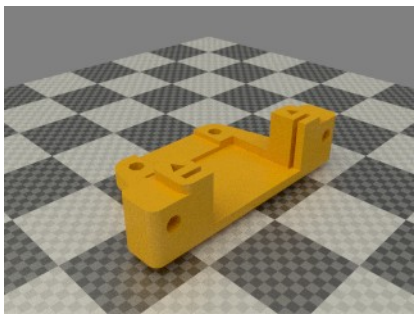
1 d_motor_bracket.stl



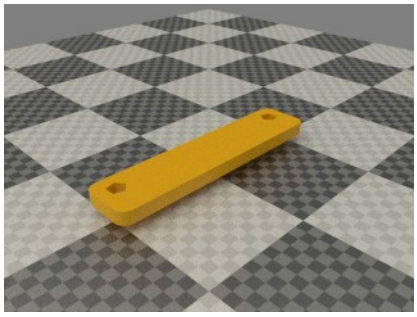
1 d_motor_bracket_lid.stl



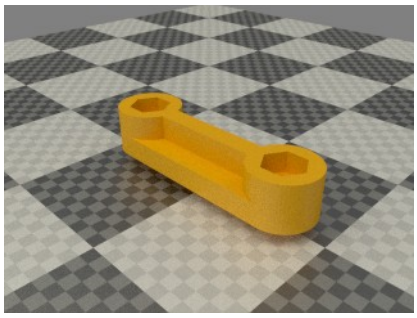
1 d_shell.stl



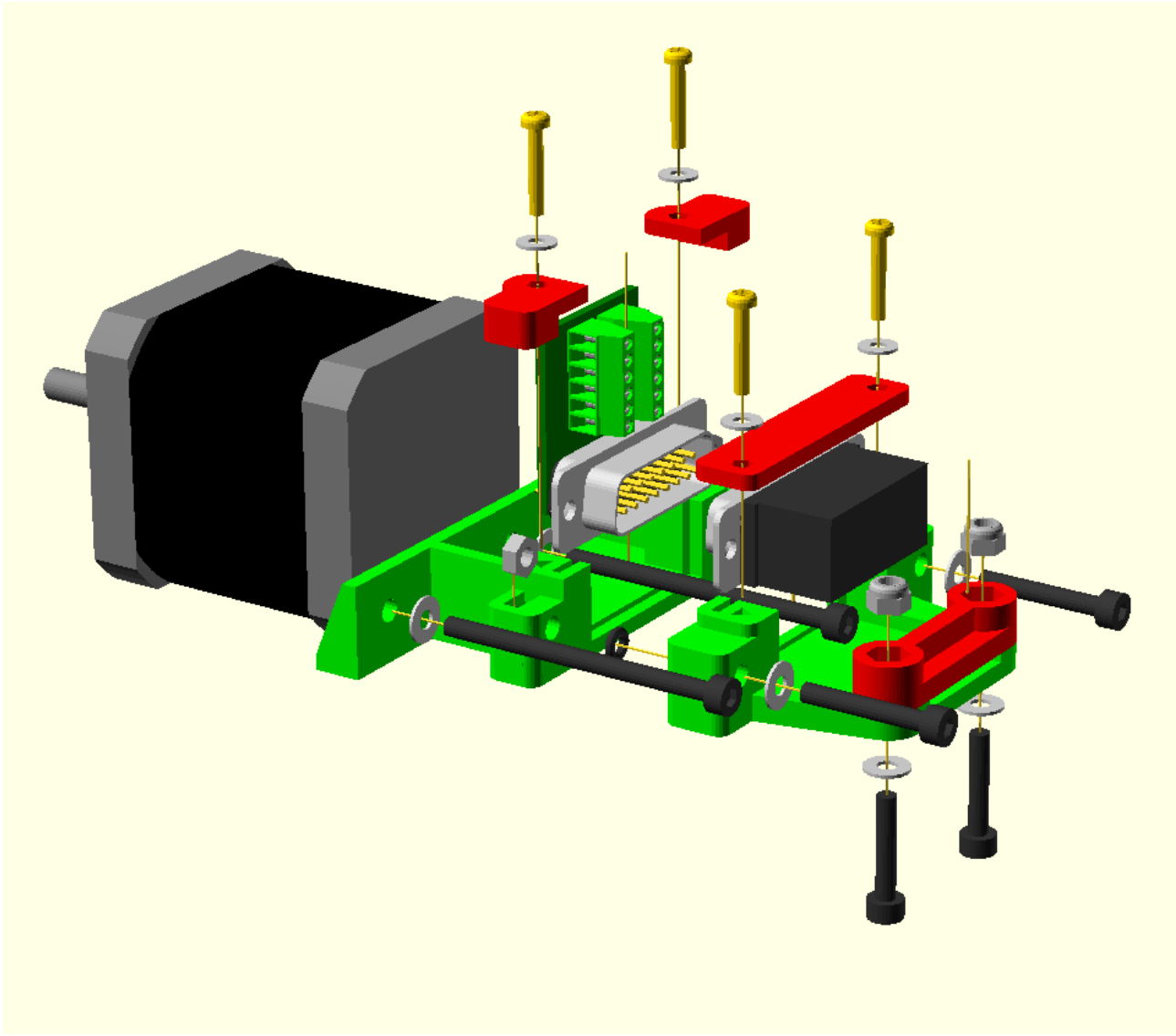
1 d_shell_lid.stl



1 ribbon_clamp_14_33NB.stl



Assembly



The extruder motor is the one with the short wires.

Note that the wires exit the motor on the front most edge.
Start by removing two of the motor's screws and replacing them with the longer M3 x 45mm screws that fasten the d_motor_bracket to the motor. Insert the PCB and the two M3 nuts in the nut traps and then screw down the lid pieces which hold connector and the nuts in place.
The female connector is supplied already attached to the ribbon cable which is soldered to the X motor. It is passed up through the hole in the X motor bracket before the motor is attached. It can then inserted in to the shell and secured with the shell lid.

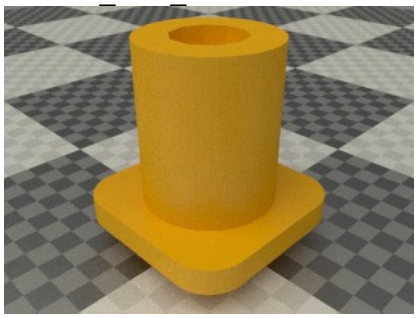
Extruder Assembly

Vitamins

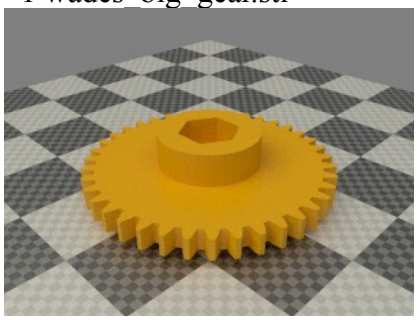
3 Ball bearing 608 8mm x 22mm x 7mm	(pre-fitted)
1 M3 grub screw x 6mm	
1 JHead MK4 hot end	(pre-fitted)
3 M3 hex screw x 10mm	
2 M4 hex screw x 20mm	
2 M4 hex screw x 50mm	
1 M8 hex screw x 60mm	
1 NEMA17 x 47.5mm stepper motor	
1 Nut M3	
2 Nut M4	
2 Nut M8	
1 Smooth rod 8mm x 22mm	(pre-fitted)
1 UB5C 5R6F 5R6 3W vitreous enamel resistor	(pre-fitted)
1 Epcos B57560G104F 100K 1% thermisior	(pre-fitted)
2 Spring 7mm OD, 1mm gauge x 10mm long	
3 Washer M3 x 7mm x 0.5mm	
1 Washer M8 x 17mm x 1.6mm	
3 Star washer M3 x 0.5mm	
1 Star washer M8 x 1.6mm	

Printed parts

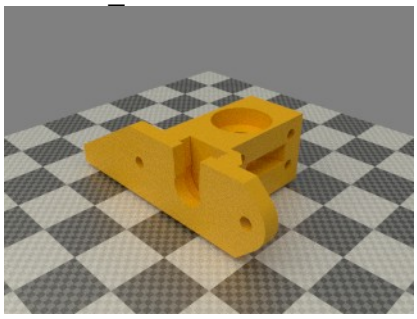
1 feed_tube_connector.stl



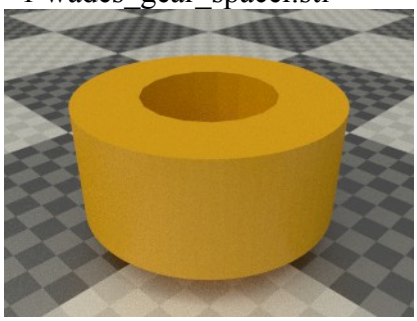
1 wades_big_gear.stl



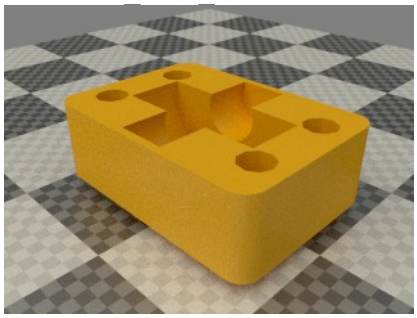
1 wades_block.stl



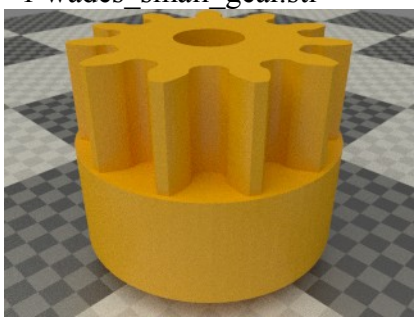
1 wades_gear_spacer.stl



1 wades_idler_block.stl



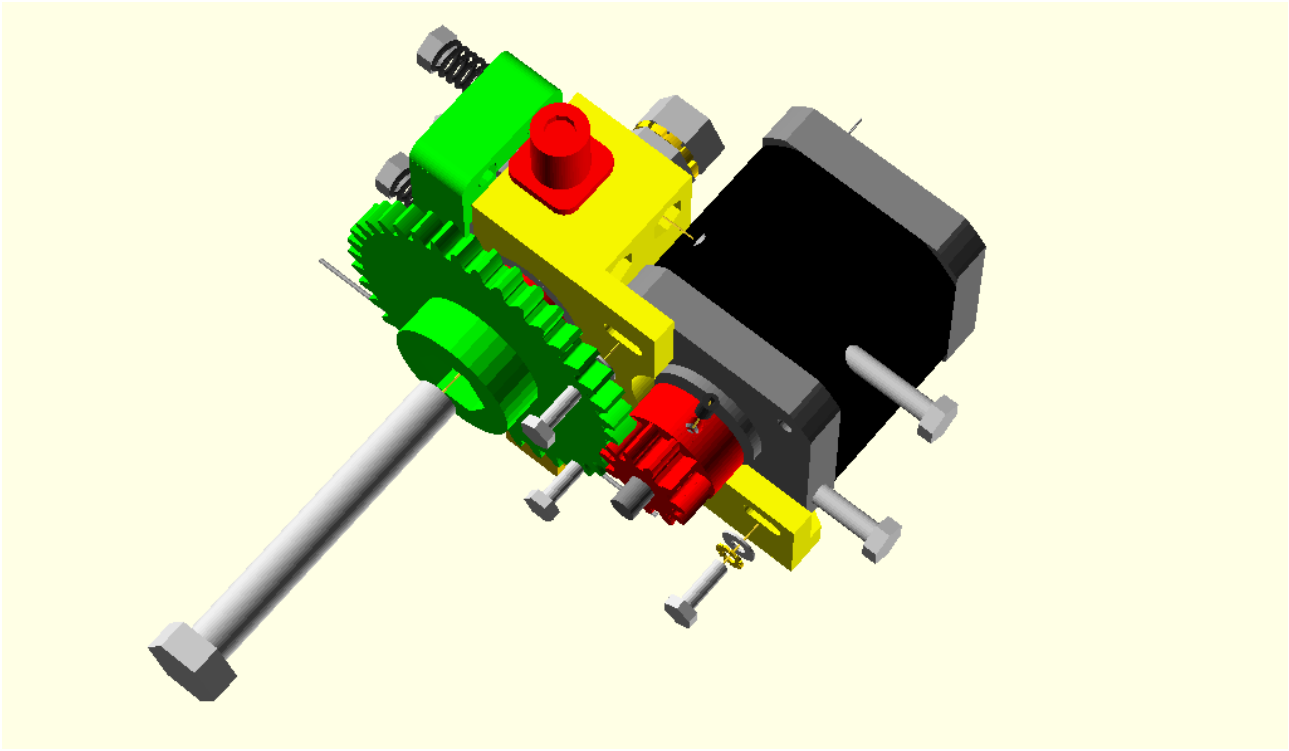
1 wades_small_gear.stl



Sub-assemblies

1 D_connector_assembly

Assembly



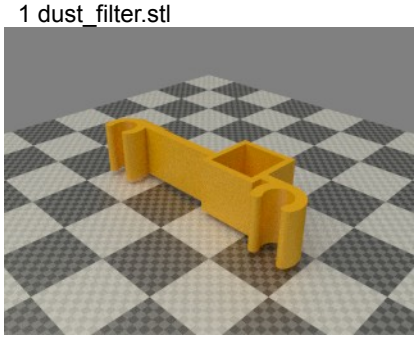
Spool holder assembly

Vitamins

4 Ball bearing 608 8mm x 22mm x 7mm
2 M4 cap screw x 16mm
4 M8 cap screw x 30mm
2 Nyloc nut M4
4 Nyloc nut M8
2 Washer M4 x 9mm x 0.8mm
8 Washer M8 x 17mm x 1.6mm
4 Washer M8 x 30mm x 1.5mm

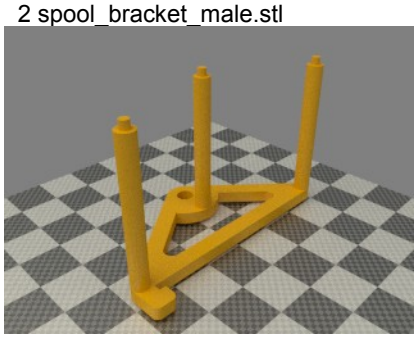
Printed parts

1 dust_filter.stl

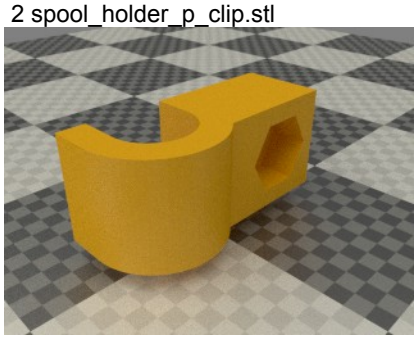


2 spool_bracket_female.stl

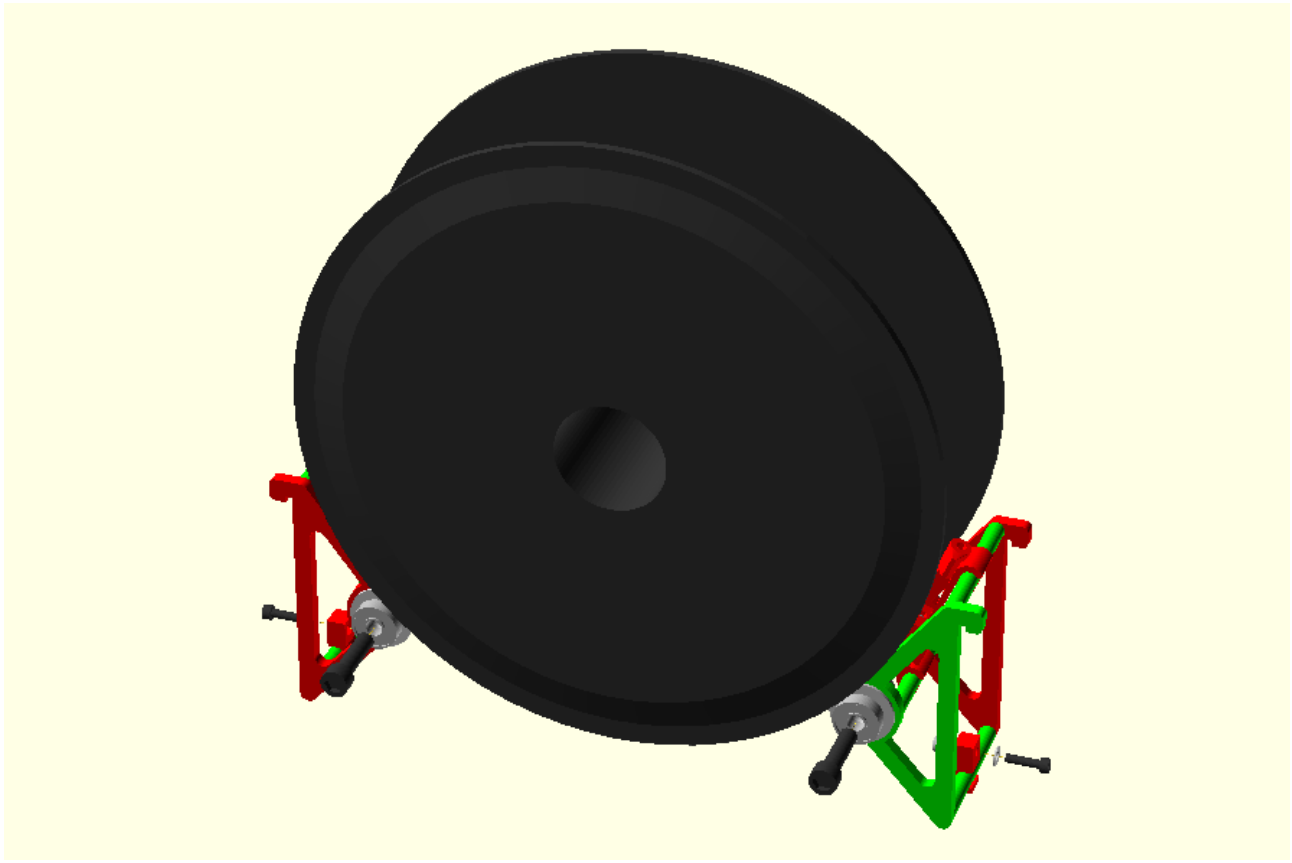
2 spool_bracket_male.stl



2 spool_holder_p_clip.stl



Assembly



Note that the dust filter goes on the left hand side of the machine. Place a cube of foam with a slit down the length of it for the filament to wipe past in the square box. Attach the PTFE feed tube by wrapping Selotape around the end to make the diameter big enough to catch on the step in the plastic parts.