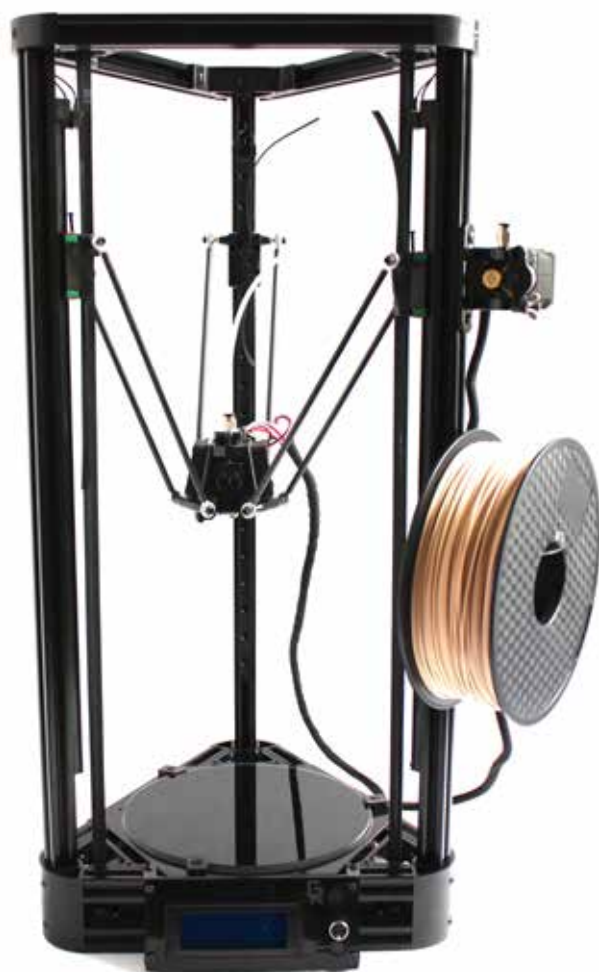




**KINEMATICS 3D PRINTER**  
MANUAL





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# TOOLS NEEDED FOR ASSEMBLY



## Materials

2.5mm allen key

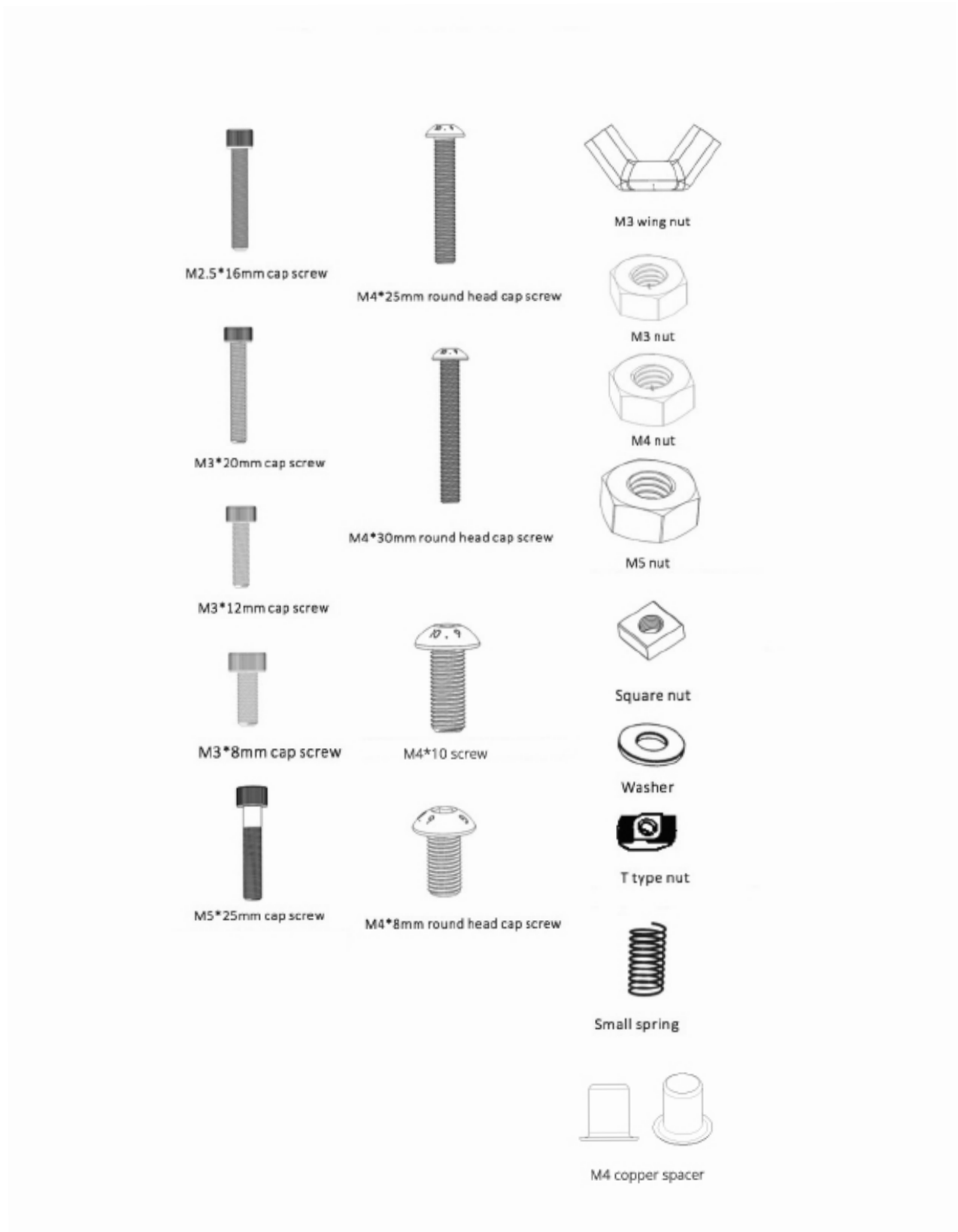
2mm allen key

1.5mm allen key

Mini flathead screwdriver

Phillips head screwdriver (*not included*)

# REFERENCE PAGE FOR PARTS



# ASSEMBLY OF THE TOP VORTEX

## Materials needed for assembly

Short V rails (3)

Top vertex (3)

M4 Square nut (12)

M4\*10 screw (12)

## Step 1

Take a top vertex. The side having the hexagonal groove in the center is on the bottom. (See figure 1.1).

Then attach M4\*10 screws into the 4 holes in the flank from the inside, As well as the back hole of the Vertex .

After that, put on the M4 square nuts from the outside (attention: only turning nut approximately 3 times, they should be loose.) (As figure 1.2)

Repeat this step for the remaining vertexes.

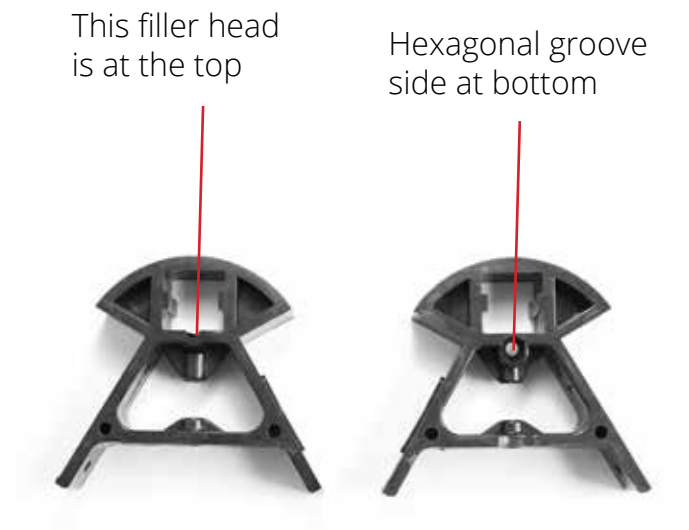


Figure 1.1

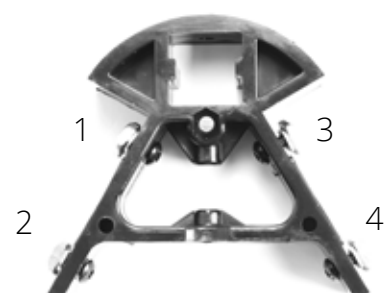


Figure 1.2

## Step 2

Lay the top vertex on a flat surface. The side with the hexagonal groove being on bottom. Slide short short V rail in the flank of the vertex. (These should easily slide on due to the screws being loose).

Using the M2.5 Allen Key fasten the screws tightly from the inside. (As figure 1.4).

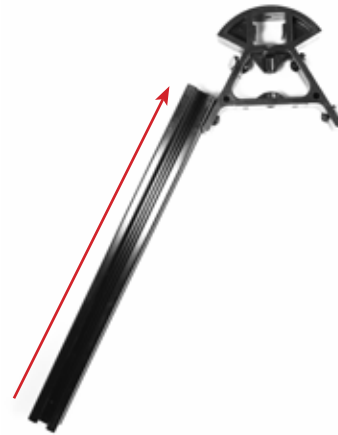


Figure 1.3

## Step 3

Next, assemble the remaining top Vertexes with the short V rail, similar to steps 1 & 2. Attention: the bottom of the vertex is the side with hexagonal grooves. (As figure 1.4)



Figure 1.4

## Step 4

Sequence 3 assembled top Vertexes like Figure 1.5, then put them together slowly. Finally, tighten the remaining screws.

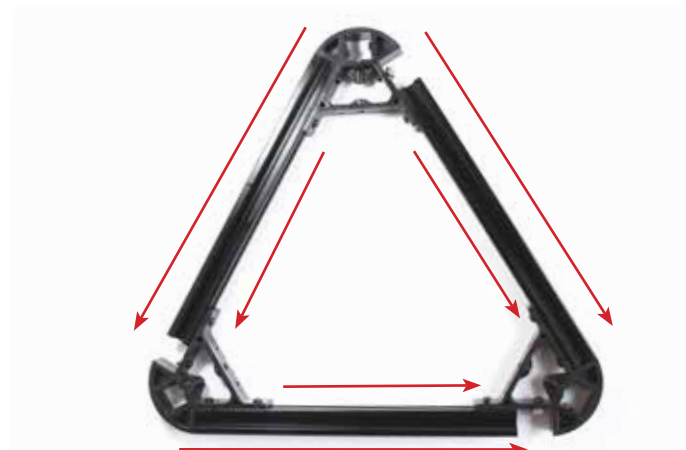


Figure 1.5



## Step 5

### Materials needed for assembly

M3 nut (3)

M3\*20 screw (3)

608 Bearing (3)

Install the 608 bearing as per Figure 1.6. Hold the vertex upright to assist alignment of the M3 nut on top of the 608 Bearing. Next, place the M3\*20 screw under the 608 Bearing using the Allen key to tighten.

Repeat step for the remaining 2 sides to complete. (Figure 1.7)



Figure 1.6



Figure 1.7

# ASSEMBLY OF THE BOTTOM VERTEX

## Materials needed for assembly

M4\*10 screws (30)

M4 square nuts (32)

M4\*8 screws (2)

Short V rail (6)

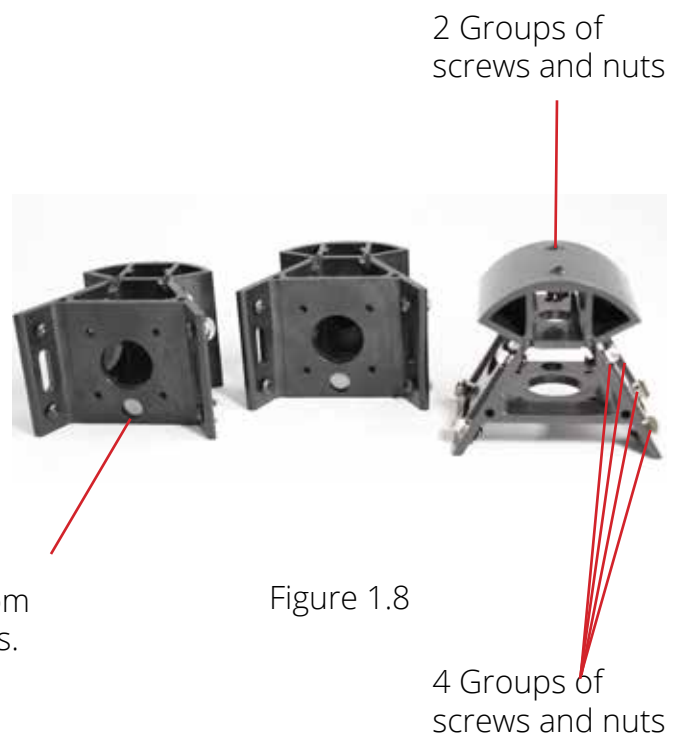
Makeboard (1)

Bottom vertex (3)

## Step 1

The bottom Vertex is assembled similar as the top Vertex.

Attach 10 pairs of M4\*10 screws and M4 square nuts on all 3 Vertexes. 8 pairs on the flank and 2 pairs on the back. (Fig 1.8)



## Step 2

Before sliding together the short V rails, attach the Makeboard to one of the short V rails using 2 M4\*8 round head cap screws and M4 square nuts.

Make sure the mounting holes on the side of the USB input are used to mount the Makeboard (See Figure 1.9).



Figure 1.9

## Step 3

Assemble the short V rails to the 3 bottom Vertexes just like the top Vertex. Be sure the Makeboard connection holes are facing outwards (i.e away from the center of the vertexes), and tighten the screws to secure. (Figure 1.10)

The Makeboard should sit between the v rails.



Figure 1.10



Figure 1.11

# ASSEMBLY OF AXIS MOTORS

## Materials needed for assembly

Timing wheel (3)

Axis stepper motor (3)

M3\*8 screws (12)

## Step 1

Take a stepper motor and place a timing wheel on the shaft of the motor.

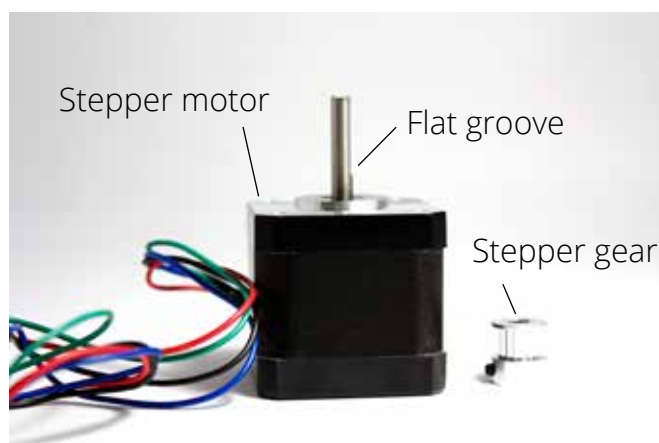


Figure 2.0

## Step 2

The set screw of the stepper gear should correspond with the flat groove on the motor shaft (see figure 2.1)

The set screw is already included in the timing wheel.



Figure 2.1

## Step 3

Tighten the set screw of the timing wheel using a 1.5mm allen key so it is secured at the base of the groove in the shaft (i.e there should be a 3mm distance between the top of the stepper motor shaft and the stepper gear).

Ensure that the set screw is tight. GearRev recommends the application of thread lock on the set screws.

## Step 4

Repeat steps for the 2 remaining axis stepper motors.

## Step 5

Attach stepper motor to the bottom vertex with the wires facing down.

To start, position the stepper motor in the vertex as seen in figure 2.2.



Figure 2.2

## **Step 6**

Position 4 M3\*8 screws in the coordinating holes and begin to screw manually first to avoid damage to motor.

## **Step 7**

Use a 2.5 allen key against the grooves in vertex to tighten the M3\*8 screws to secure the stepper motor in place.

## **Step 8**

Repeat steps for the two remaining 2 stepper motors.

# ASSEMBLY OF LONG LONG V RAILS

## Materials needed for assembly

Long V rails (3)

Terminal block (3)

limit switches (3)

M4 square nut (3)

M4\*10 screw (3)

M2.5\*16 screw (6)

## Step 1

### Assembly of Limit switches

Tighten the M4 square nut with the M4\*10 screw in the groove of the terminal block (3.1)

Attach the limit switch to the terminal block by screwing 2 M2.5\*16 screws in their corresponding holes (3.2) (attention, not too tightly to damage spring inside).

Repeat step for remaining 2 limit switches.

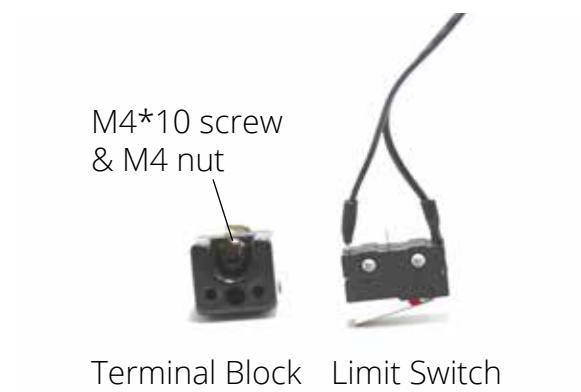


Figure 3.1



Figure 3.2

## Step 2

### Long V rails

Insert three 2020\*680mm long V rails to their corresponding slots in the bottom vertex.

Once in place, tighten the M4 screws to secure long V rails. (Figure 3.3)



Figure 3.3

## Step 3

### Wiring

Next, slide the wire attached to the limit switch down the hole of the open beam and guide the wire through the hole in the vertex (Figure 3.4 & 3.5)

Repeat for remaining long V rails.



Figure 3.4

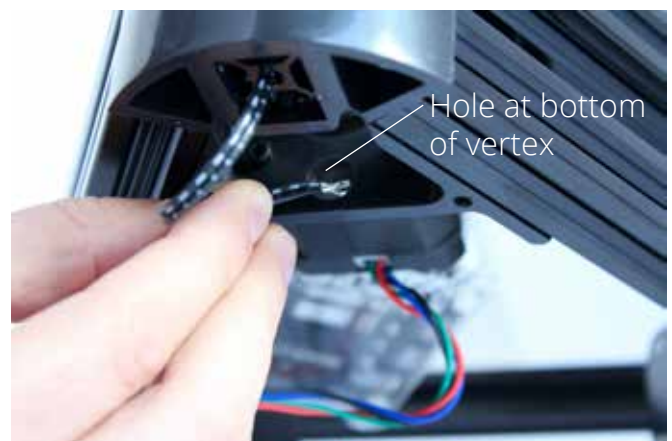


Figure 3.5



## Step 4

### Linear rails

Assemble the three linear rails with sliders by attaching 4 M3\*8 screws and 4 M3 nuts to each rail (Figure 3.6).

Place screws on holes 1, 7, 12, & 18 of the linear rail. (See Figure 3.7)

Be sure to leave the screws and nuts loose for easy attachment to the long V rail.



Figure 3.6

Insert screws  
into holes  
# 1, 7, 12, 17

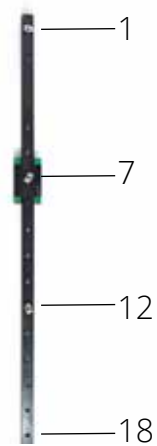


Figure 3.7

## Step 5

### Secure

Slide the linear rails onto the long V rail grooves, securing them temporarily while we attach the limit switch in place.

Secure the limit switch 5cm below the top of the open beam groove using a M4 nut if the original M4T nut is not fully securing the limit switch in place. (see figure 3.8)

Slide the linear rails up, securing them right below the limit switch (See figure 3.9).



Figure 3.8



Figure 3.9

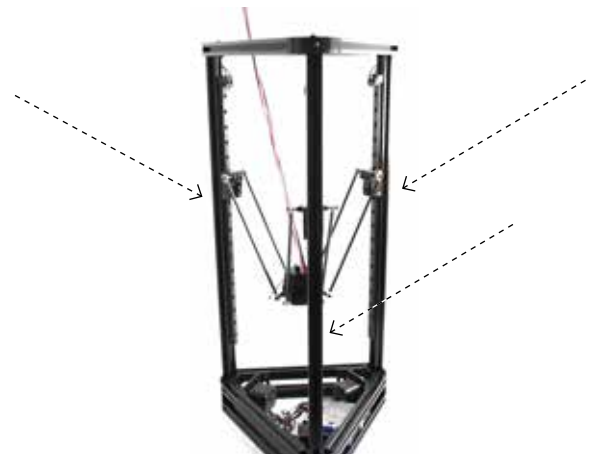


Figure 3.10

# ASSEMBLY OF THE EFFECTOR

## Materials needed for assembly

The auto-alignment effector user materials	M4*30 screw (1)	Assembled nozzle (1)
M2.5*16 screw (2)	Spring (1)	Heating wire (1)
M3*12 screw (9)	M3 nut (2)	2 pin connector (1)
M3*8 screw (2)	M4 nut (1)	
M3*20 screw (1)	endstop (1)	

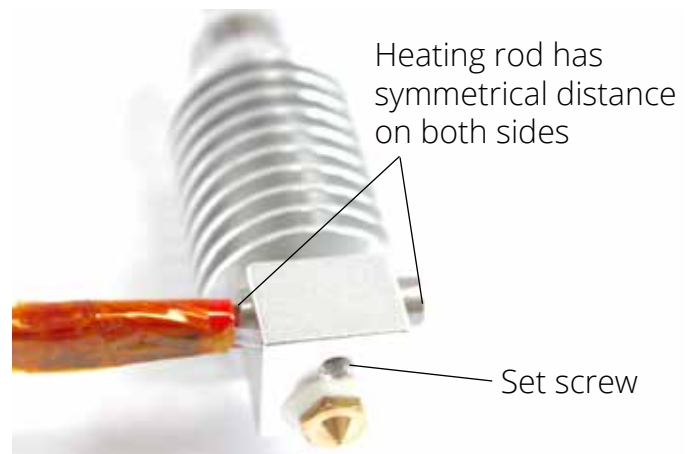
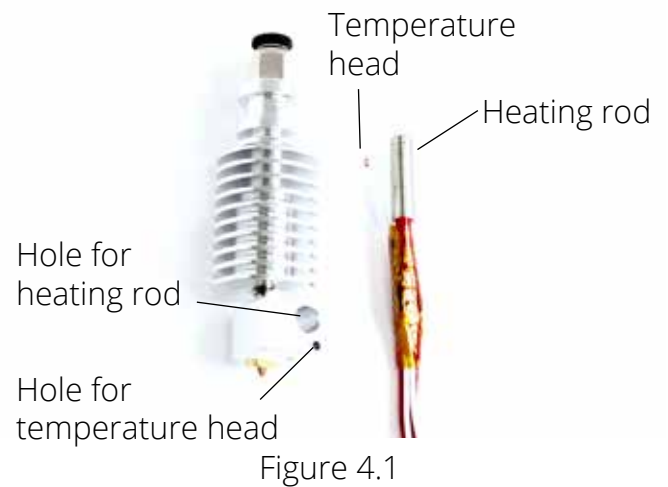
## Step 1

### Print Head

Assemble the print head with the heating rod by inserting the heating rod and temperature head into the two corresponding holes of the heating aluminum block (See figure 4.1). The set screw under the heating block may need to be loosened in order to insert the heating rod and the thermistor.

The ends of the heating rod should be symmetrical on either side of the hole. Make sure the thermistor is inserted well into its designated hole.

Secure in place by tightening the set screw with a 1.5mm allen key. Be gentle to not damage the wire inside.



## Step 2

### Limit switch

Insert the limit switch wires into the big hole of the external part

to secure, install 2 M2.5\*16 screws in the remaining holes of the external part (see figure 4.4)

Cover the end of the limit switch wire into the 2 pin connector. Ensure that the wire is locked into place. There should be a subtle click once the wire is locked into place (See figure 4.5).

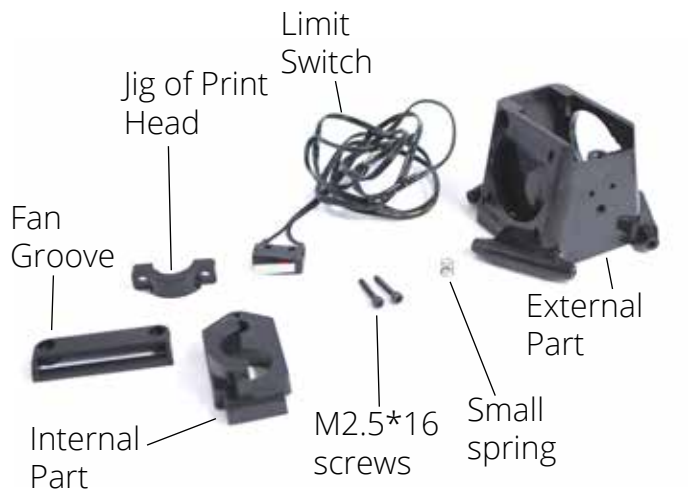


Figure 4.3



Figure 4.4



Figure 4.4



Figure 4.5

## Step 3

### External part

Cover the assembled nozzle with the internal part and place it inside the external part with the wires coming out of the back end, opposite to the limit switch. (Figure 4.7).

Cover the assembled nozzle with the with the internal part (Figure 4.6)

Secure this assembly by attaching with the jig of the print head to the internal part with 2 M3\*12 screws and 2 M3 nuts (Figure 4.8)

In addition, add the M4\*30 screw and the M4 nut into the corresponding grooves in the external part and turn approximately 4 times. (Note: the screw goes in the circular groove, and the nut in the hexagonal groove, see Figure 4.9 & 5.1)

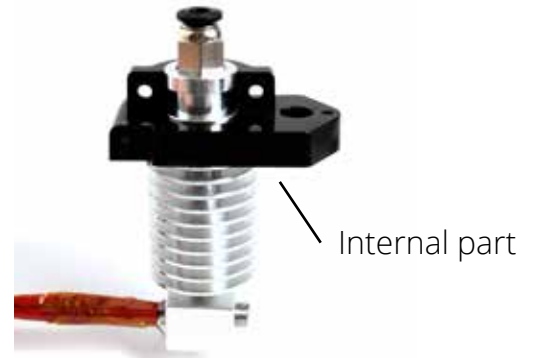


Figure 4.6

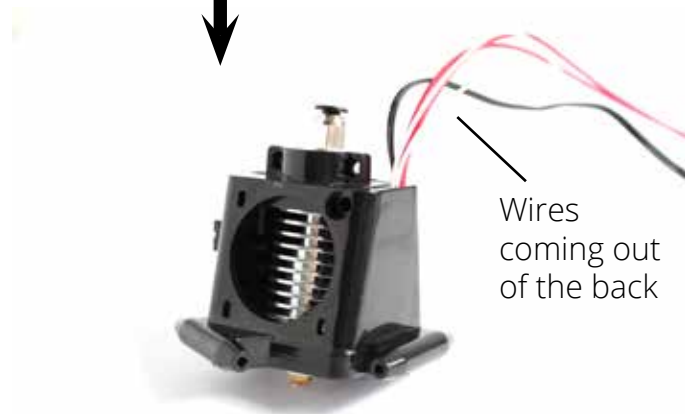


Figure 4.7



Figure 4.8



Figure 4.9



Figure 5.1

## Step 4

### Fan groove

Add the fan groove to the bottom of the external part using 2 M3\*8 screws in the corresponding holes (Figure 5.2)



Figure 5.2

## Step 5

### Small spring

Next, add the small spring to the shaft of a M3\*12 socket head screw and screw into the big hole of the external part above the limit switch. And the M3\*20 screw into the smaller hole. NOTE: screw the M3\*20 screw just enough that the limit switch is triggered. (See figure 5.3)



Figure 5.3

When assembled properly, the limit switch should be depressed by pushing up on the assembled nozzle and triggered when released. (See figure 5.4)

Adjust both screws until the auto alignment effector is working properly.



Figure 5.4

## Step 6

### Fans

Finally, add on two fans on either side of the external effector, with the fan labels facing inside.

Be sure to arrange the fans so the wires are on the same side as the other wires (see figure 5.5)

Mount the fans using 3 M3\*12 screws to their corresponding holes.

The fan above the fan groove will be the “cooling fan”, opposite to the “radiating” fan.



Figure 5.5



Figure 5.6

# ASSEMBLY OF THE BELT CONNECTOR PIECES

## Materials needed for assembly

Carbon fiber rods (6)

M3\*25 screws (12)

M4 copper spacer (12)

M3 nuts (12)

## Step 1

### Carbon fiber rods

On the bottom of the effector, insert the M3 nuts into their corresponding holes.

Slide a carbon fiber rod on the M3\*25 screws.

Place M4 copper spacer on the M3\*25 screws after the carbon fiber rod and tighten the screws until secured into the nuts.

NOTE: Ensure that the copper spacers are not sitting loosely in between the rod and the effector as it can be the cause of unwanted noises upon printer activation (see figure 5.7).

Repeat step for remaining sides.

Figure 5.8 shows the end result of this step.

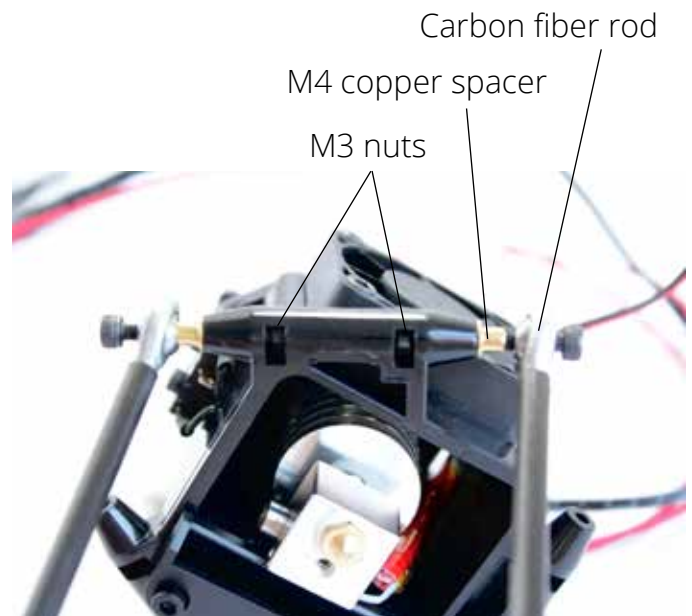


Figure 5.7

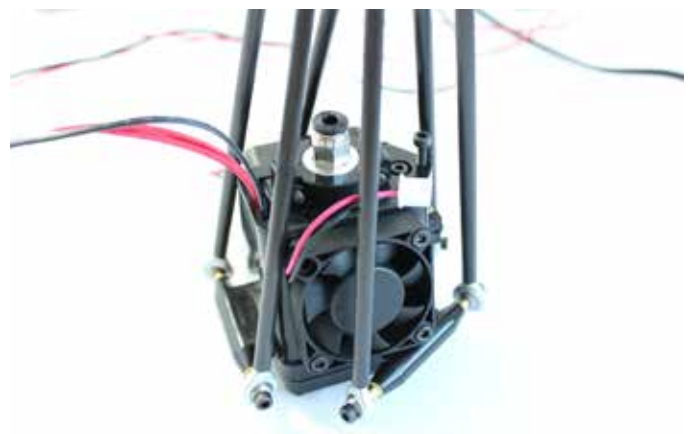


Figure 5.8



## Step 2

### Belt tensioner

Secure the belt tensioner on the opposite end to the carbon fiber rods similar to the effector.

Place the M3 nuts in the corresponding grooves on the back of the tensioner, securing the copper rods with the M4 copper spacer and M3\*25 screws (see figure 5.9). NOTE: Ensure that the copper spacers are not sitting loosely in between the rod and the tensioner as it can be the cause of unwanted noises upon printer activation.

Note the belt tensioner side with indentation should be facing opposite to the effector, and placed on parallel carbon fibre rods.

Repeat steps for remaining belt tensioners.

See figure 5.10 for how the final assembly should look like.

Make sure to have belt tensioners on parallel carbon fibre rods for proper assembly. (See figure 5.11)

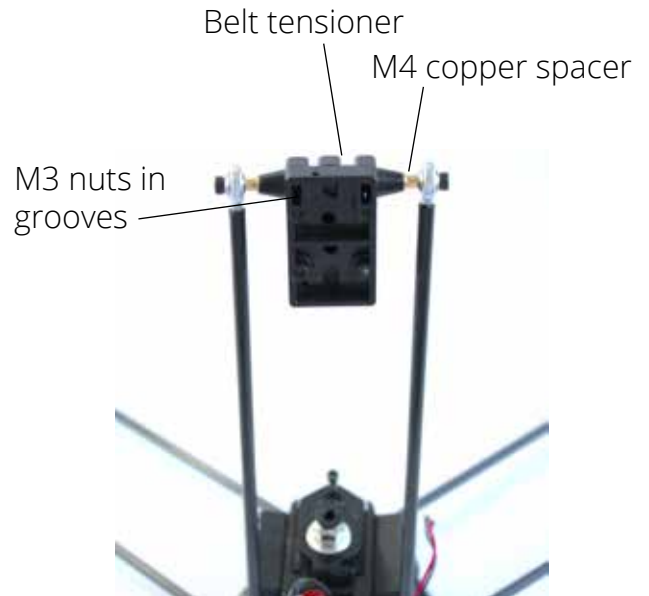


Figure 5.9

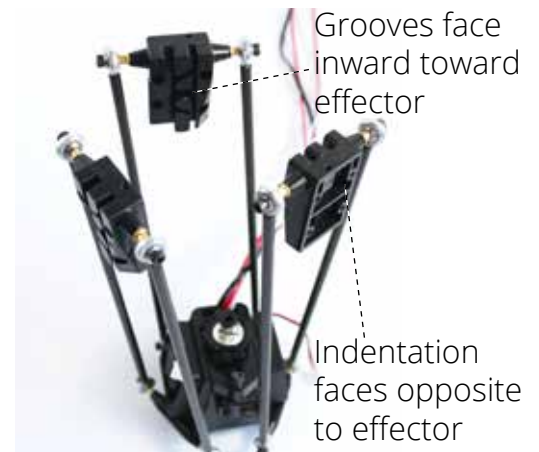


Figure 5.10

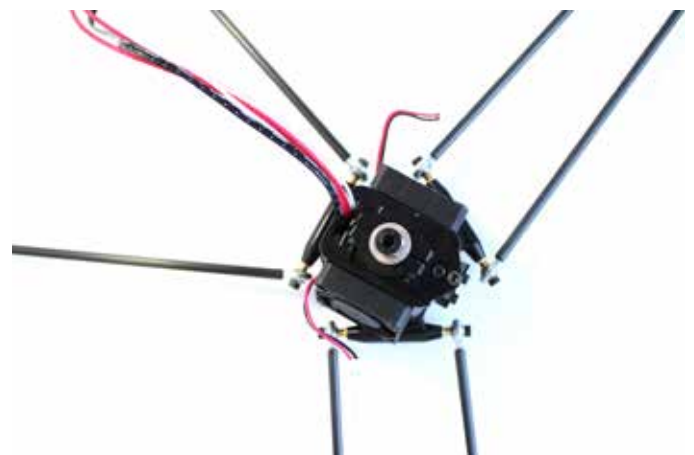


Figure 5.11

## Step 3

Attach tensioner to linear rail

Mount belt tensioner to the linear rail slider by securing 4 M3\*12 screws in their corresponding holes (see figure 5.12)

Repeat steps for remaining belt tensioners.



Figure 5.12

# ASSEMBLY OF TOP VERTEX ON THE FRAME

## Materials needed for assembly

M4\*25 screw (3)

M4 nut (3)

Washer (3)

M4\*10 screw (3)

M4 T nut (3)

## Step 1

Take the frame of the top vertex and loosely attach a M4\*10 screw and M4 nut on the corner of all 3 vertexes (see figure 6.1)

Slide frame onto the long V rails, aligning the M4 nuts with the long V rail grooves and tighten screws to secure.

The hexagonal groove on the top vertex should be pointing downwards.

Insert a M4\*25 screw with a washer in the top groove through to a M4 nut below and tighten.

Do not overtighten the screw as to damage the endstop wires.

Repeat for remaining sides of the vertex.



Figure 6.1

M4 nut and  
M4\*10 screw



Figure 6.2



Figure 6.3

# ASSEMBLY OF THE BELT

## Materials needed for assembly

450cm Belt (1)

### Step 1

Divide the belt into 3 equal parts (Approximately 150 cm each)

Make a loop at one end of the belt

Loop it around the third chamber on the belt tensioner as seen in Figure 7.1.

Next loop the other end around the timing wheel (which is connected to the stepper motor) (figure 7.2), and guide the belt up through the other side of the belt tensioner and around the 608 bearing of the top vertex (figure 7.3).

Ensure that the belt is routed from the inside the carbon fiber rods.

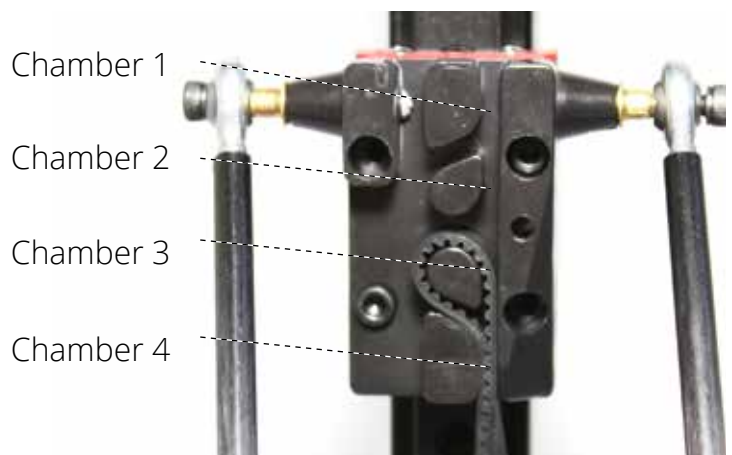


Figure 7.1

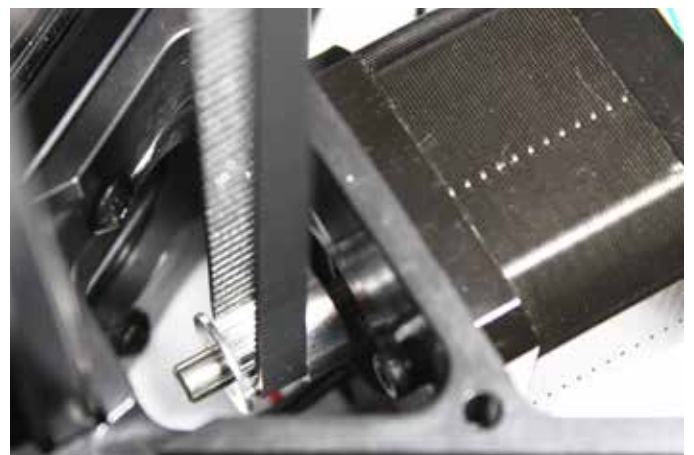


Figure 7.2



Figure 7.3

The other end of the belt will wrap around the second chamber. Make sure the belt is tight when securing it in. (See figure 7.4)

Finally install the belt spring to the belt to ensure optimal tension. The belt springs will need to be installed around 5 cm below the 4th chamber of the belt tensioner. Use pliers for this step if you have difficulty installing the belt spring.

Cut the remaining belt.

Repeat steps for remaining belts.



Figure 7.4



Figure 7.5

# ASSEMBLY OF THE FILAMENT EXTRUDER

## Materials needed for assembly

- |                                    |                       |
|------------------------------------|-----------------------|
| Frame of the filament extruder (1) | Quick acting plug (1) |
| Jig of the filament extruder (1)   | Extruder motor (1)    |
| Wing nut (1)                       | M3*20 screws (3)      |
| Bearing (1)                        | M3 nut (1)            |
| Extruder wheel (1)                 | M3*8 screws (3)       |
| Filament extruder (1)              | PTFE tube (1)         |

## Step 1

### Extruder wheel

Place extruder wheel on the shaft of the extruder motor, secure the wheel just at the beginning of the groove on the shaft. Note: the set screw securing the roll should be in line with the groove (flat part) on the shaft (Figure 8.2).

Next, mount the frame on the Filament extruder using 3 M3\*8 screws.

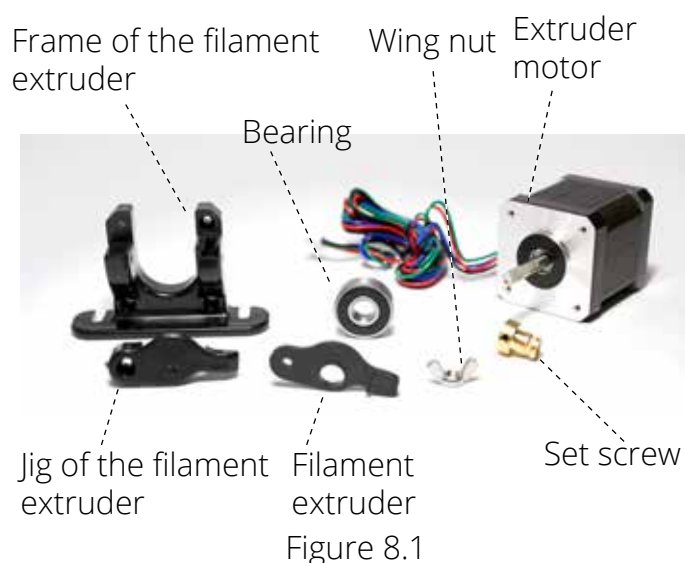


Figure 8.2

## Step 2

### Jig of the filament feeder

Assemble the jig of the filament extruder with the bearing located in the middle. Secure the bearing in place using an M3\*20 screw, washer and an M3 nut (see figure 8.3).

Secure the assembly to the frame using an M3\*20 screw (see figure 8.4)

Then place a M3 nut in the frame of the Filament extruder and insert a M3\*20 screw into the jig to secure it closed with the wing nut (Figure 8.5)

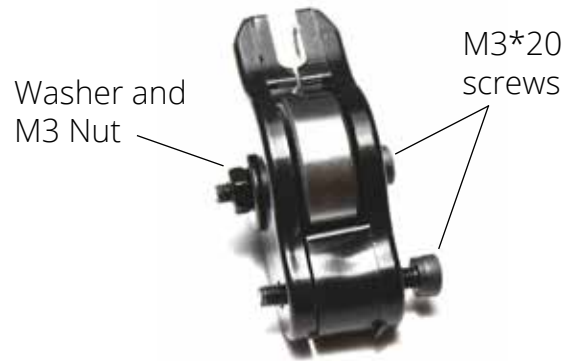


Figure 8.3



Figure 8.4

## Step 3

### Quick acting plug

To complete assembly, install a quick acting plug on the left side corresponding hole (figure 8.5)

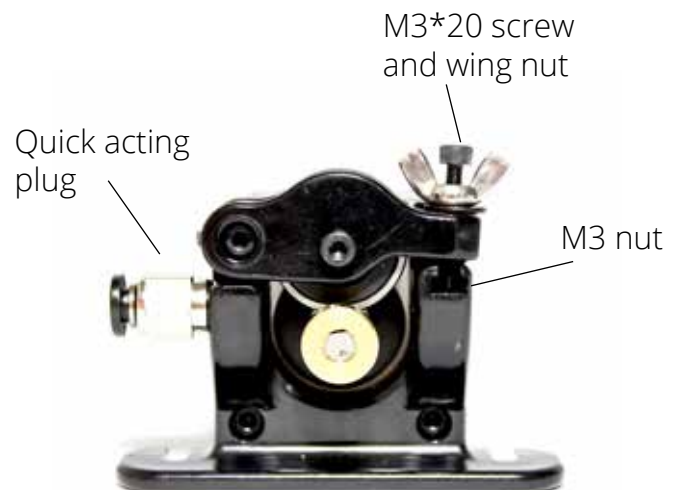


Figure 8.5

## Step 4

### Mounting and PTFE tube

Assemble 2 groups of M4\*10 screws and M4 square nuts to the holes of the flank.

Mount the Filament extruder assembly to one of the long V rail grooves approximately 10cm below the top (See figure 8.6)

Attach the PTFE tube to the quick acting plug hole, and the other end to hole on the top the effector.

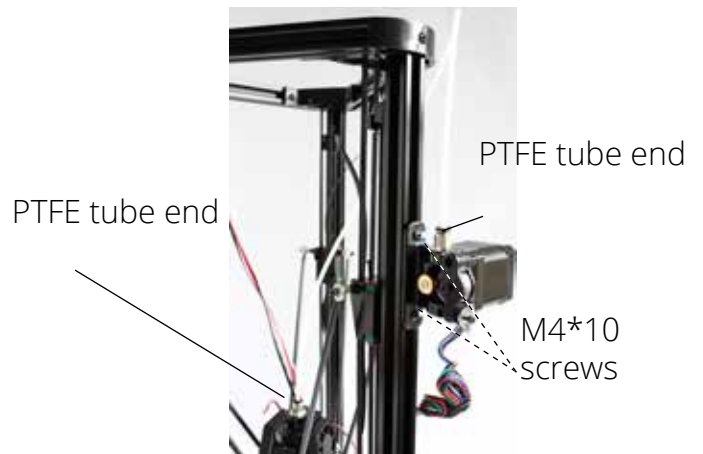


Figure 8.6

## Step 5

### Wrapping wires

Use the fan wire to wire connectors included in the fan bag to attach the fans to their respective cables.

Use the wrap around harness seen in figure 8.7, to cover all wires extending from the effector. Covering the length of the wires.

Feed the group of wires (including the auto level endstop wire) between the bottom vertexes, from the outside of the frame opposite of the Makeboard. The LCD screen will be placed on the remaining side, and be considered the "front" of your printer.

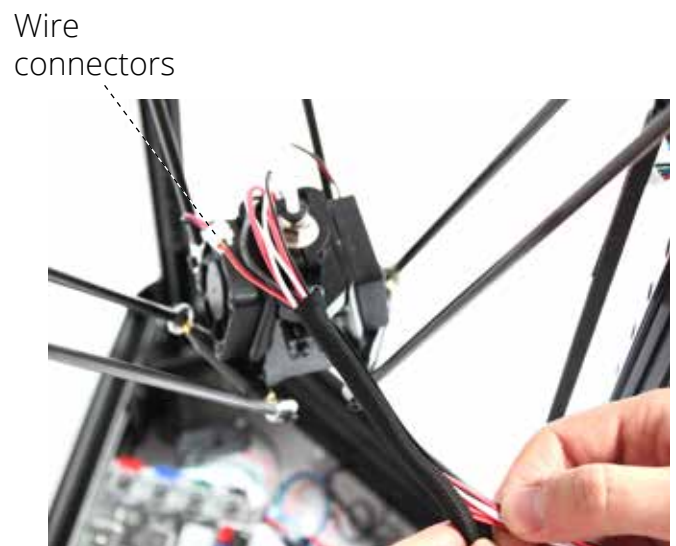


Figure 8.7



# ASSEMBLY OF THE LCD SCREEN

## Materials needed for assembly

LCD screen (1)

LCD housing (1)

LCD clamps (2)

Knob toggle

M3\*8 screw (4)

M4\*10 screw (2)

M4 square nut (2)



Figure 9.1

## Step 1

Slide the two clamps on either side of the LCD screen.

## Step 2

Place the housing over the LCD screen and insert M3\*8 screws into the 4 corners of the housing to secure assembly (Figure 9.2)



Clamps are placed in-between screen and housing and secured with screws

Figure 9.2

### Step 3

Use the toggle to cover the knob of the LCD screen (figure 9.3)

### Step 4

Clamp assembly on the bottom vertex and secure with M4\*10 screws and M4 square nuts in the corresponding 2 holes.

M4\*10 screws and nuts on  
with end of LCD screen

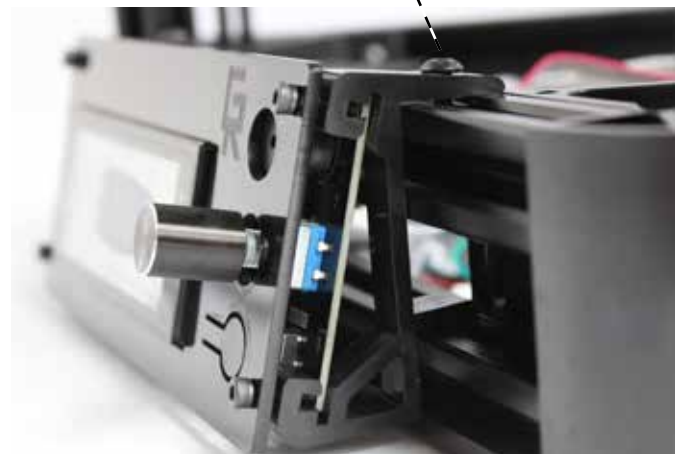


Figure 9.3

# ASSEMBLY AND WIRING OF MAKEBOARD

## Step 1

Take the end wire of each axis limit switch, and insert it into the 2 pin connector (figure 10.1).



Figure 10.1

## Step 2

Start assembly wiring with the effector wires.

Loosen the through hole screws labeled “heater” on the Makeboard and insert the heater wires, securing the screws again once in place (see figure 10.3)

Insert the fan wires into appropriate connectors on the Makeboard. Verify left and right by tugging wires from the effector. FanL corresponds to the cooling fan and fanR corresponds to the radiating fan.

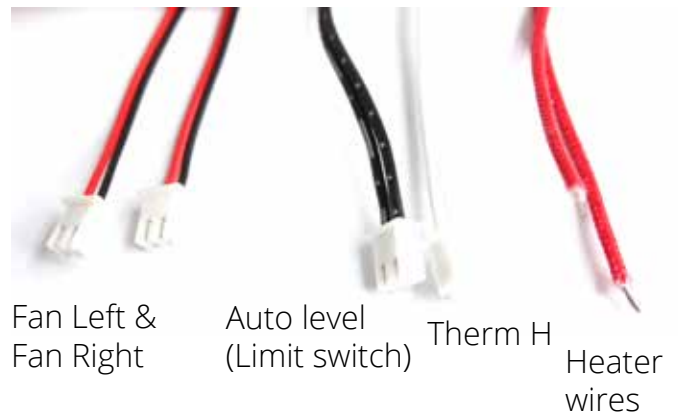


Figure 10.2

Complete the wiring of the effector by inserting the thermH and autolevel limit switch wire into their corresponding connections on the Makeboard.

The auto level limit switch will correspond with the connector labeled “autolevel” on the Makeboard.

Auto level  
limit switch

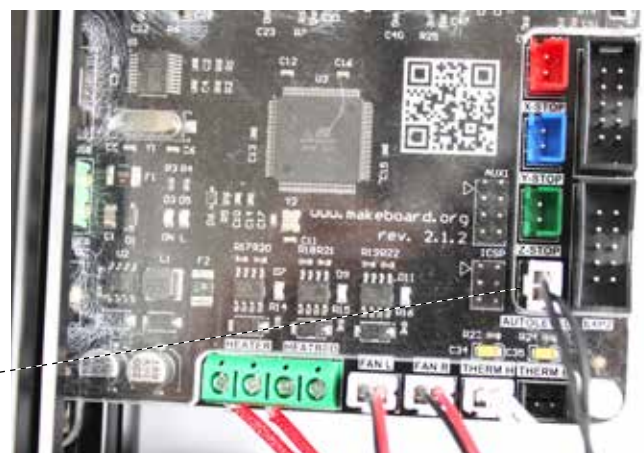


Figure 10.3

# WIRING OF THE AXIS MOTORS & LIMIT SWITCHES

## Step 1

First, we must label the axis.

Having the make board at the base side of the bottom vertex, we label the three axis clockwise, Y axis, X axis, and Z axis. (See figure 11.1)

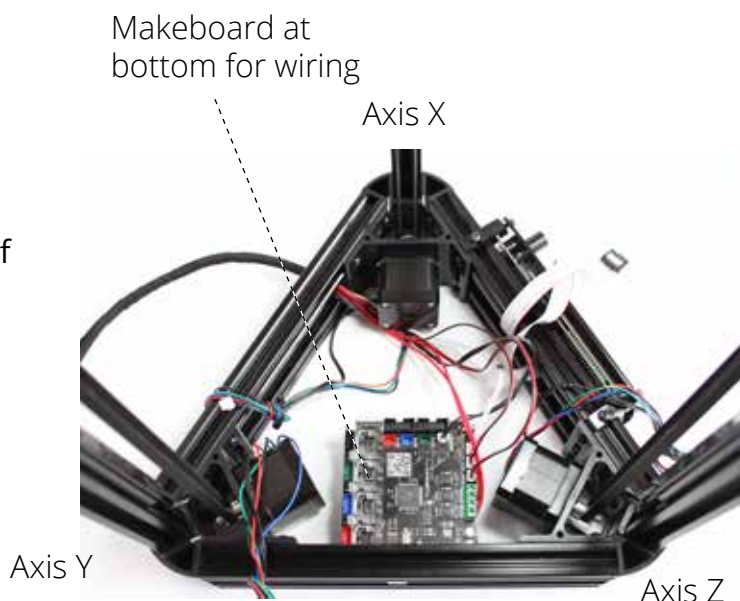


Figure 11.1

## Step 2

### Connect Motor wires

Place the appropriate motor wires from axis Y, X and Z to their corresponding connectors on the Makeboard (see figure 11.2)

Note that the limit switch is labeled as the "stop" on the Makeboard.

Insert appropriate wire from the filament extruder into the connector labeled E-motor on the Makeboard.

Use the remaining wraparound sleeve to protect the extruder motor.

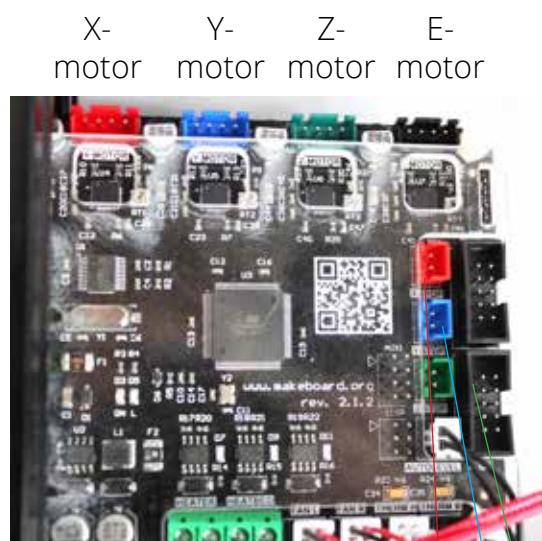


Figure 11.2

X-axis limit switch

Y-axis limit switch

Z-axis limit switch

## Step 3

### Connect LCD wires

Connect LCD wires EXP1 and EXP2 to their corresponding connectors on the Make-board located beside the XYZ-axis stop connectors in figure 11.3 (Confirm EXP wires by looking at the back of the LCD and where they lead to).

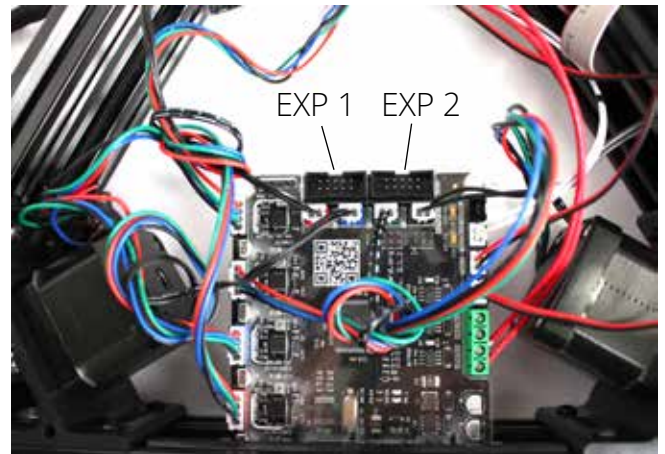


Figure 11.3

# ASSEMBLY OF THE PRINT PLATFORM

## **Materials needed for assembly**

Bed clips (3)

Heated bed (1)

Glass plate (1)

M3\*12 screws (3)

M3T nuts (3)

## **Step 1**

### Connection of the platform wires

Attach the two white power cables to the Makeboard connectors labeled heat bed (loosen the screw, insert wire, then secure by tightening screw again).

Remaining wire (red/black) is to be attached to Makeboard connector labeled thermB, which is beside thermH.

## Step 2

### Print platform

Place the M3T nuts in the vertex grooves in preparation for the platform to be mounted (1 nut on each vertex side) (Figure 12.1).

Cover the circuitry with the print platform and with 2 M3\*12 screws, secure the bed clips to the bottom vertex like figure 12.2.

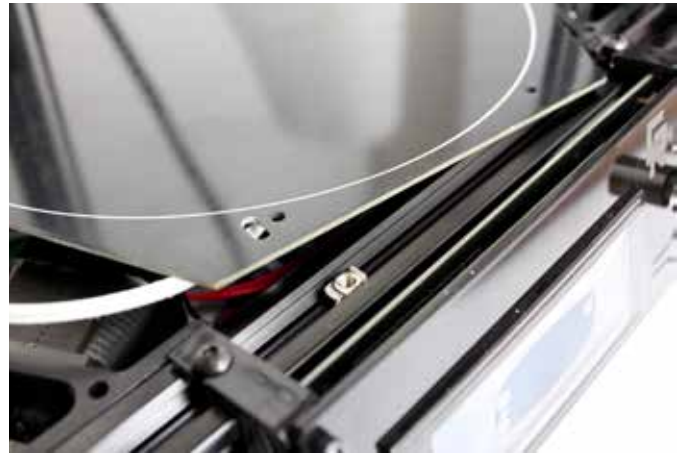


Figure 12.1



Figure 12.2

# POWER SUPPLY

**Warning** Do not power the PSU until wiring is completed.

## Step 1

### L port and N port

Start by loosening screws L and N (AC) on the front of the power box (see figure 13.1)

From your outlet cord (AC cable), insert the RED connector into the L port. and the BLUE connector into the N port.

Tighten the screws to secure wires in place.



Figure 13.1

## Step 2

### COM port and +V port

Next, loosen one COM screw and one +V screw of your choice (see figure 13.2)

Take the DC cable and and insert the BLUE connector into the COM port, and RED connector into the +V port.

Tighten the screws to secure wires in place.

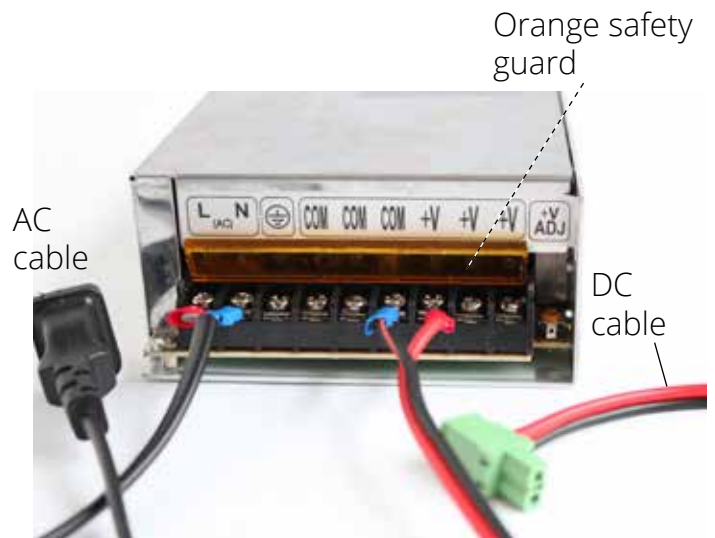


Figure 13.2

## Step 3

### Secure wires and safety guard

After securing all wires, close the orange safety guard to cover the screws.

Before powering, confirm that the voltage switch on the left side of the power box is set to 110V (see figure 13.3)

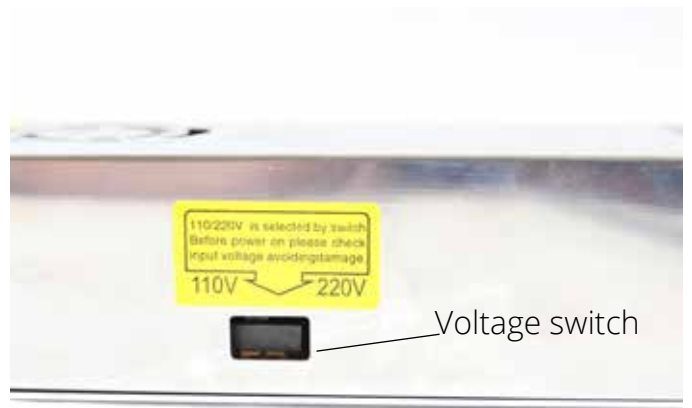


Figure 13.3



# MAKEBOARD OUTLET COVER AND FILAMENT HOLDER

## Materials needed for assembly

M4 square nuts (4)

M4 Tnut (2)

M4\*8 screws (6)

## Step 1

### Outlet cover

Mount the Makeboard outlet cover onto the vertex by using 4 M4 square nuts, and M4\*8 screws (See figure 14.1)



Figure 14.1

## Step 2

### Filament holder

Using 2 M4\*8 screw and 2 M4 T nuts, attach the filament spool holder to the open beam approximately 10cm below the filament extruder (See figure 14.2)

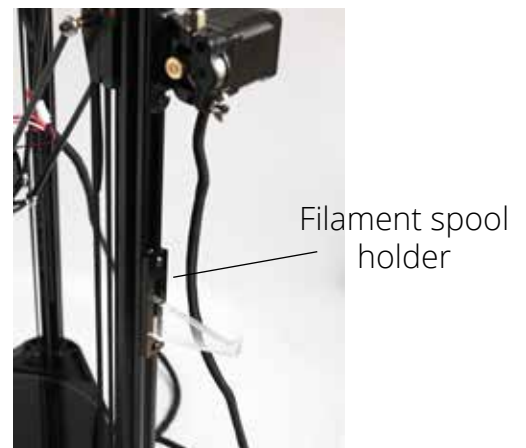


Figure 14.2