# RepRapPro Huxley

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# Introduction

These pages are the complete instructions for building, commissioning and using the RepRapPro Ltd (http://reprappro.com/) version of RepRap Huxley.

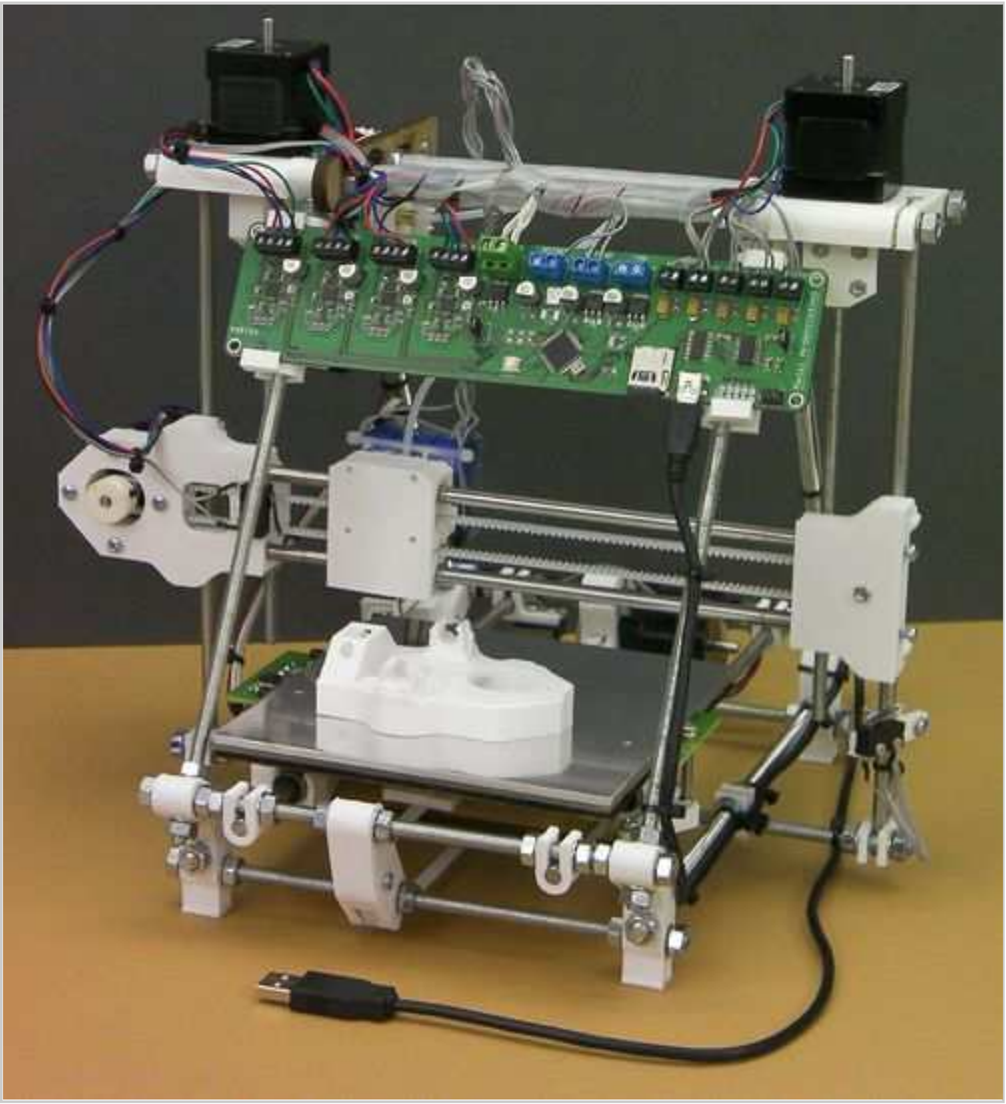
Like all RepRap machines, RepRapPro Huxley (http://reprappro.com/Huxley) is fully open-source. It is licenced under the GPL. All the design files and software are available from the RepRapPro Ltd Github (https://github.com/reprappro) repository; the electronics are here: https://github.com/mosfet/melzi. And it is here in the Thingiverse (http://www.thingiverse.com/thing:16625) .

If you want to print the plastic parts for a RepRapPro Huxley, see this wiki page.

# General notes

Give yourself plenty of space and ensure your work area is clean. Dust and dirt are a 3D printer's worst enemy. All printed parts have been printed on various RepRap machines from suppliers within the RepRap community. Despite the fact that these machines are highly tuned RepRap 3D printers, some holes and features may need a little fettling to get the best performance from the RepRapPro Huxley. This is especially true for the Igus bushings used for the Z axis. There is a video how-to on fettling 3D printed parts here on Vimeo (http://vimeo.com/14492980) . Don't fettle the 3mm holes on the huxley-x-carriage (http://reprap.org/mediawiki/images/thumb/5/5a/Reprappro-huxley-x-carriage.jpg/150px-Reprappro-huxley-x-carriage.jpg) though (we changed the assembly screws without changing the drawing)!

Before you start the build, please ensure you have all the components as listed on the packing list included in the kit. If anything is missing, please contact us via email: support@reprappro.com


RepRapPro Huxley fitted with Melzi electronics

We understand that people may want to change aspects of the machine's design, and in fact we encourage this as it is one of the benefits of open source development. Before changing anything, please be aware that the RepRapPro Huxley has been designed to maximise the build volume relative to the the machine's footprint, and as such many of its components fit closely to others. So consider your changes carefully before you try to implement them. And when you find improvements, please tell us so that we can include them in future kits, and so that existing owners can upgrade their own machines.

BEFORE YOU ATTEMPT TO ASSEMBLE ANY PART OF THE RepRapPro HUXLEY 3D PRINTER, PLEASE READ THESE BUILD INSTRUCTIONS FULLY AND ENSURE YOU UNDERSTAND THEM. Although all parts are covered by warranty, this will be invalidated by your not following these build instructions.

The RepRapPro Huxley is a robust RepRap machine once assembled; however it does require a certain amount of care during assembly. If in doubt, force is usually not the answer! There are many ways to get support and advice, see the Get Support section below.

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# Get support

If you find you need help or advice with assembling, commissioning or using your RepRapPro Huxley 3d printer, you can use the following channels:

- Our Forum (http://www.emakershop.com/forum?vasthtmlaction=vforum&g=1.0) . This is shared with the eMaker Huxley forum, as the machines are so similar.
- RepRapPro/eMaker channel on freenode irc (http://irc.netsplit.de/channels/?net=freenode&chat=emaker)
- Email support@reprappro.com

# Tool List

## Mechanical

Tools required for the mechanical build of the RepRapPro Huxley 3D printer:

- Drill bits
- Precision screwdriver set
- Allen keys, 1.5mm and 2.5mm
- 10mm spanner (M6 nut)
- 15cm adjustable spanner
- File
- Half round needle file

- Craft knife
- Fine tweezers
- 300mm rule
- Vernier or digital callipers
- Square
- Fine nosed pliers
- Pliers
- Bench vice
- For the Hot End Assembly you will also need some PTFE plumber's tape

# Electrical

Tools required for the electrical build of the RepRapPro Huxley 3D printer:

- Digital Multimeter
- A fine-tipped soldering iron
- Precision screwdrivers
- Solder (flux is also useful)
- Hair dryer (or other heat source for heating heatshrink wire sleeving; the barrel of a soldering iron works OK)
- Wire strippers/cutters
- Ratchet crimp tool Such as this one (http://www.rapidonline.com/Tools-Equipment/Crimping-tool-for-PCB-connectors-30535)
- Molex crimp tool (such as the 63811-1000, you may also want the extraction tool 11-03-0044, Molexkits.com)
- Scissors

# Next step

Frame assembly


Categories: Build Instructions | RepRapPro | Huxley | Huxley Development

# RepRapPro Huxley frame assembly

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# Goal

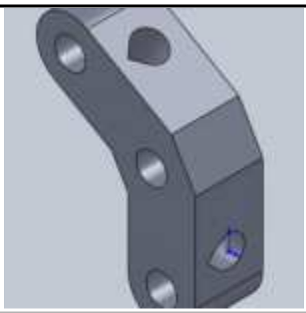
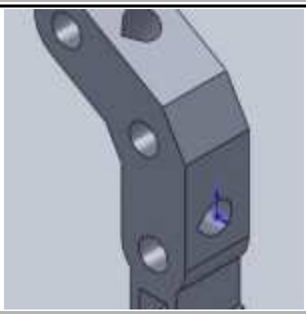
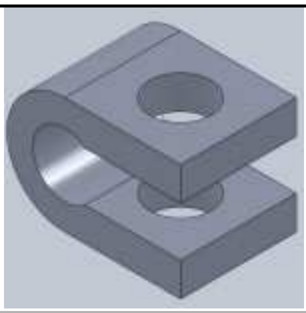
By the end of this stage, your machine should look like this:

# Tools

You will need the following tools

- M6 (10mm) spanner
- Adjustable spanner
- 300mm Rule
- (optional) Spirit level, cotton and Blu-tack

# Step 1: Frame triangles

| RP parts | Quantity |
|---|---|
|  | 2 |
|  | 4 |
|  | 2 |
| **Hardware** | **Quantity** |
| M6 threaded bar x 250mm | 6 |
| M6 nuts | 28 |
| M6 serrated washers | 28 |

Split the above components into two equal sets, then loosely screw them together into each frame triangle. Make sure you slide a belt clamp along the bottom M6 threaded bars, with a serrated washer and nut either side.

Place a serrated washer between the RP parts and each M6 nut. You frame triangles should now look like this:

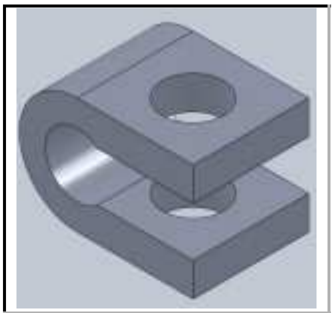
Before moving on to the next step, we need to tighten the nuts on both frame triangles. For each frame, measure the distance between the vertices on all three sides. The distance you should be aiming for is 207mm. But more important is to make them all the same. The better aligned your frame is, the better your prints will be when printing large and/or tall objects.

Tighten all the M6 nuts ensuring the distance between vertices of 207mm is maintained.

A useful trick once you have one triangle accurately tightened is to use other 6mm rods from the kit to align the other one:

Use the smooth rods rather than the threaded ones for better accuracy.

# Step2: Cross bars

| RP parts | Quantity |
|---|---|
|  | 3 |
|  | 1 |
| **Hardware** | **Quantity** |
| M6 threaded bar x 185mm | 4 |
| M6 nuts | 24 |
| M6 serrated washer | 24 |
| 626 Bearing | 2 |

The bars aren't bent - that's the wide-angle lens... The U clip top right should be the one with the tab with the tab pointing towards the middle.

Again split the above components into two equal sets, but with two U-shaped RP bar-clamps in one set, and one U-shaped RP bar-clamp plus the one with the extra tab in the other. (The tab is for the Y axis limit switch.) You will assemble two top bars (identical but for the U/U+extra-tab), and two bottom bars (identical).

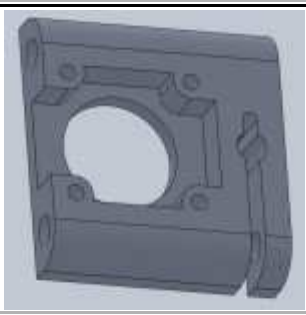
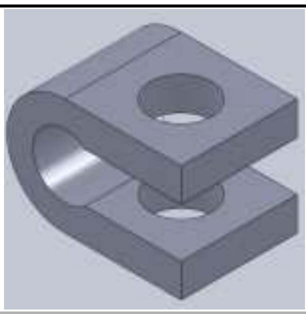
So for one top bar, you will need (starting from the middle of the M6 threaded bar): serrated washer, two M6 nuts, serrated washer, bar-clamp, serrated washer, two M6 nuts, serrated washer. Then, in the other direction: serrated washer, two M6 nuts, serrated washer, bar-clamp+tab (with the tab facing towards the centre of the bar), serrated washer, two M6 nuts, serrated washer.

For the other top bar, you will need (starting from the middle of the M6 threaded bar): serrated washer, two M6 nuts, serrated washer, bar-clamp, serrated washer, two M6 nuts, serrated washer. Then do exactly the same in the other direction.

And for the bottom bars: 1 x 626 bearing, serrated washer, 2 x M6 nuts, serrated washer, (and repeat in the other direction, except for the bearing).

Your cross bars will now look like this:

# Step3: Put them all together

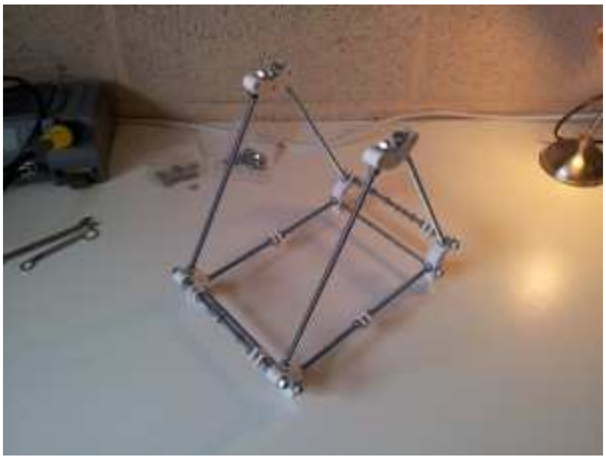
| RP parts | Quantity |
|---|---|
|  | 2 |
|  | 2 |

| Hardware | Quantity |
|---|---|
| M6 threaded bar x 285mm | 3 |
| M6 smooth rods x 235mm | 2 |
| M6 nuts | 20 |
| M6 serrated washer | 20 |
| Lasercut filament drive bracket | 1 |

Again, bars aren't really bent...

Firstly screw the cross bars into one of the triangles. The cross bar with the bar clamp with the extra tab should go at the back, with the bar clamp with the extra tab on the left.

Then screw the second triangle to the other end of the cross bars:



Now we need to slide the two top bars through the top frame vertices. Slide each bar through one vertex, then fit one serrated washer, two M6 nuts and another serrated washer before sliding the bar through the opposite vertex.

Next, slide a Z motor mount onto each ends of the top bars. This may need a little force as the holes through the z motor mounts tend to be quite a tight fit on the M6 threaded bars (it's usually a good idea to make sure you can push a spare length of M6 threaded bar into each of the z motor mount holes before trying to fit them to your frame).

Add the lasercut filament drive bracket so it is inside the left Z motor mount and frame-vertex, and is held against it by the inner nuts and washers. The front slot next to the rounded end goes upwards, the middle slot goes at the back and downwards. Imagine hanging a weight on the projecting end - the slots need to go in the way that makes the weight tend to pull things into place, not to release them.

Before tightening the M6 nuts on the top bars, slide the bottom cross bar through the two bottom bar clamps. You do not need M6 nuts or washers either side of these bar clamps. At each end of this bottom cross bar, fit an M6 nut, a serrated washer, a bar clamp, a serrated washer, and another M6 nut.

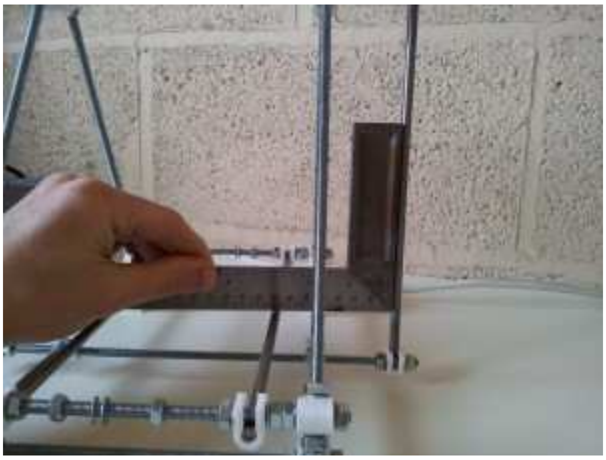
At this stage, the frame should be quite loose, so just jiggle everything around until it all the angles look about right. Once you are happy with this step, you can tighten the nuts on the cross bars. The distance between the frame vertices along the cross bars should be 146mm. When tightening the M6 nuts on the top cross bars, please note that you do not need to tighten the nuts which clamp against the Z smooth rods too much, only enough to stop the smooth rod from sliding down. If you slip two washers into the groove on the Z-motor mount (with the threaded rod run through their holes) you will be able to clamp your frame solidly and grip the Z-rods without over-stressing the plastic. Your kit doesn't come with these washers. 1/4" washers work well for this.

Before tightening the bar clamps on the bottom cross bar, slide the Y axis smooth rods (270mm) into place. (These are easily confused with the X axis rods, which are 265mm - get the right ones.)

# Aligning the Z Rods

You can now slide the two Z smooth rods (length 235mm) into place.

Use a set-square to get the angle of the Z smooth rods correct. Make sure you get the right smooth rod for the Y-axis; if you swap them you will have to go back and take things apart again.



You can now tighten the M6 nuts along the bottom cross bar.

# Alternative alignment method

Some people swear by this method, others hate it...

For this you will need the spirit level, two pieces of cotton, and a small blob of Blu-tack.

Build the frame as above, as far as "Aligning the Z Rods".

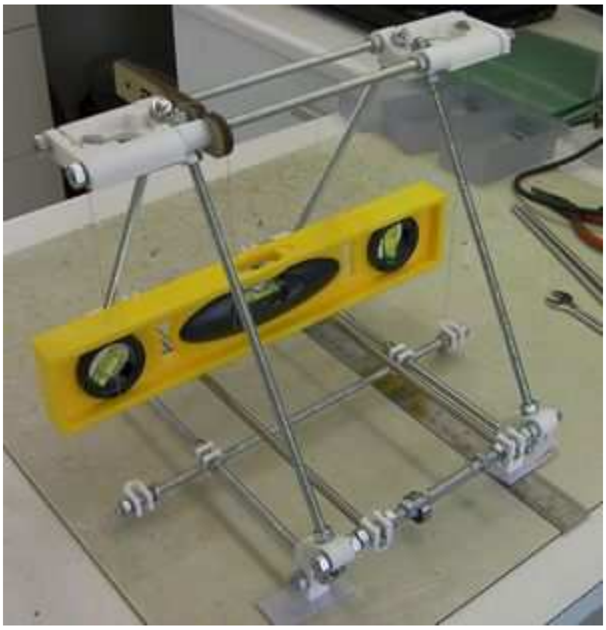
Place the frame on a **flat** surface (40mm-thick Formica-covered kitchen worktops are remarkably flat). You will almost certainly find that the feet aren't quite level and that the frame rocks a little about a diagonal. Tightening the frame has distorted it slightly.

Put an object about 10mm high under a foot on that diagonal, and **very gently** push the other two diagonal corners down. Try the feet on the flat surface again. Repeat this until the frame does not rock, but instead sits four-square on the surface. You can carry out this process at any future stage in the build to re-square the frame.

Put the spirit level across the Y smooth bars, and place folded paper shims under the left or right feet until the frame is level left-right. You will discover that a spirit level is an exquisitely sensitive instrument, and that it can easily detect a couple thicknesses of paper.

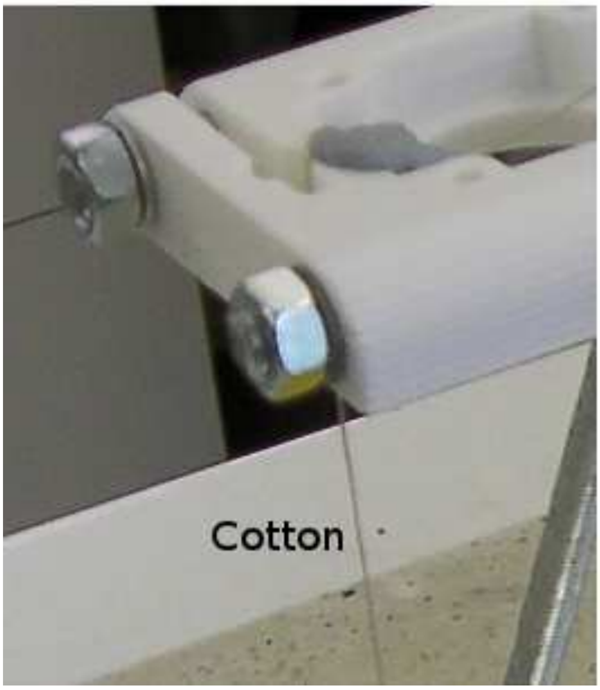
Rotate the spirit level through a right angle so it rests between the front and back cross bars, and get the frame level front-back too.

Check the frame is level in both directions.



Now thread two lengths of cotton down through the top bracket and the U clamp on the bottom where the Z axis smooth rods will be. Attach it to the Z-axis-smooth-rod holes at the top with Blu-tack such that it is half-way round the inside of the clamp arc.

Put a small blob of Blu-tack on the bottom of each piece of cotton to act as a plumb weight.




Now adjust the positions of the threaded rod at the bottom and the Z-axis-smooth-rod U clamps so that the cotton falls freely in the middle of the U-clamp holes.

Tighten the nuts on the main frame holding the threaded rod, making sure that the cotton stays in the middle of the holes where it was.

Now tighten the inner nuts to move the U clamps outwards so that the cotton just kisses the edge of the U holes in exactly the same relative position as it is falling through the clamps at the top of the frame.

Slide the Z-axis rods in, tighten the clamps from the outside, and check with a square as in the section above. If you've done everything carefully there should be little or no discrepancy, but it is more important to have a right angle than to have the Z-rods plumb.

# Frame finished

You will now have an assembled RepRapPro Huxley frame:

# Next stage

assemble the Y axis.

Retrieved from "http://reprap.org/wiki/RepRapPro_Huxley_frame_assembly"
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- This page was last modified on 22 May 2012, at 15:26.
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# RepRapPro Huxley y axis assembly

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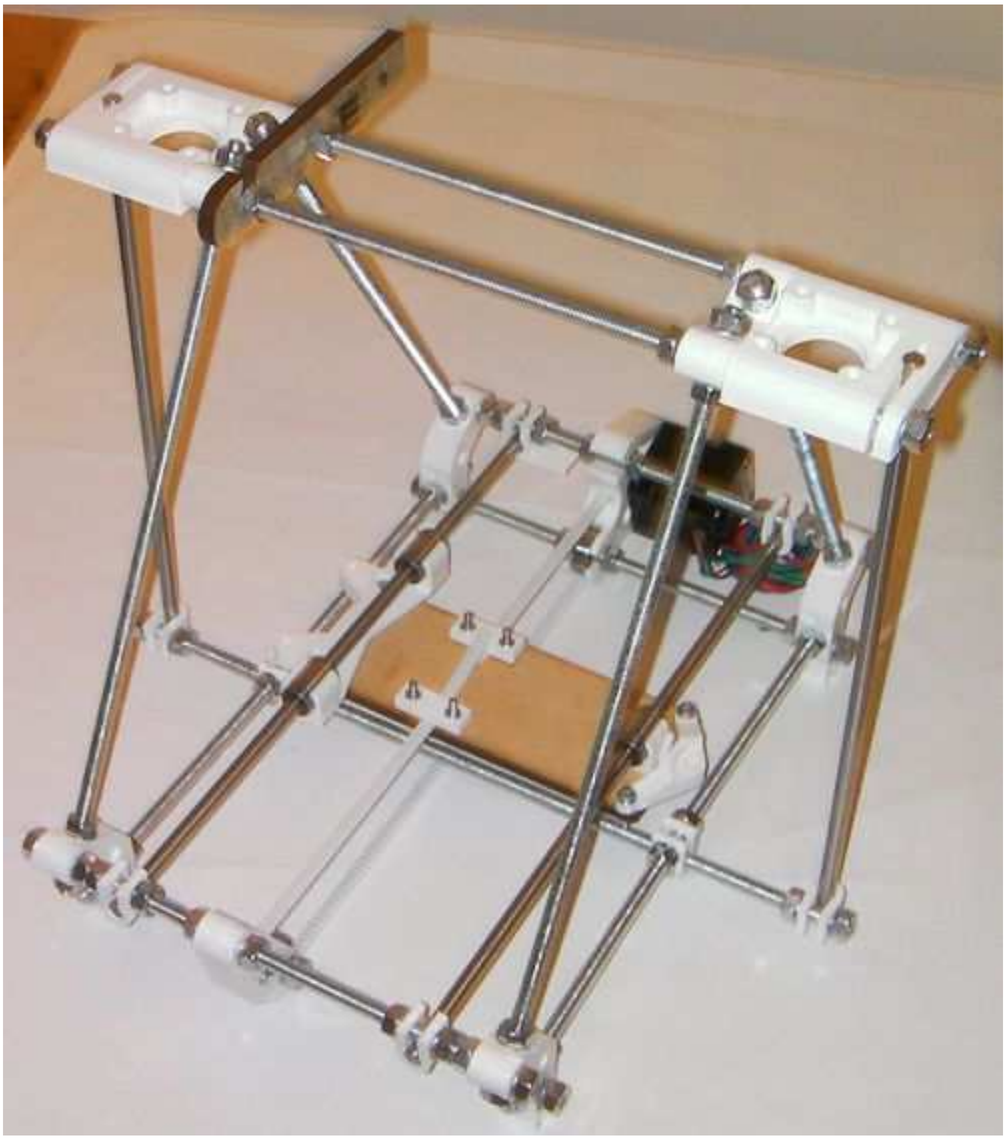
# Goal

By the end of this stage, your machine will look like this:



# Tools

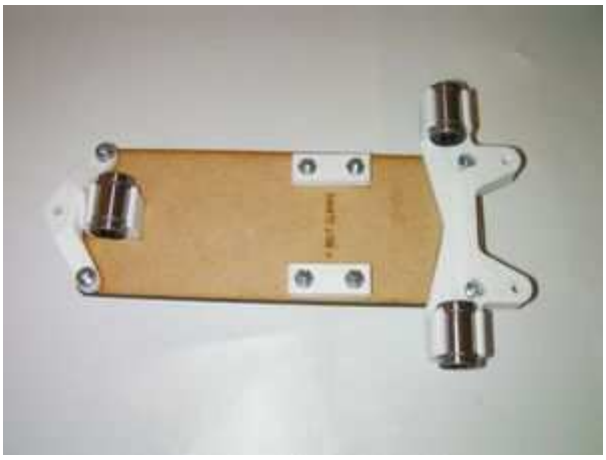
You will need the following tools:

- Phillips screwdriver
- Adjustable spanner
- 1.5mm hex key (Allen) for M3 socket set screw (grub)

# Step 1: Sled assembly

| RP parts | Quantity |
|---|---|
|  | 1 |
|  | 1 |
|  | 2 |
| **Hardware** | **Quantity** |
| Lasercut frog | 1 |
| LM6UU Linear bearings | 3 |
| M3 x 12 screw | 4 |
| M3 x 16 screw | 4 |
| M3 washers | 8 |
| M3 nuts | 8 |

Assemble the parts of the Y sled as shown:



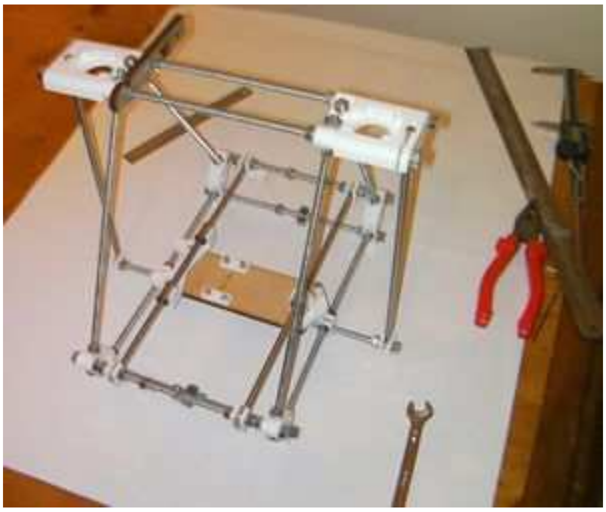
Push the bearings in from the side. Don't try to clip them in from the top. They should be an interference fit and should stay where they are put.

When correctly fitted, the linear bearing should protrude by the same amount from each end of the bearing holders.

Use the 16mm M3 screws for the Y Belt Clamps. The screws should be inserted from the bottom with a washer between the screw head and the wood. For the bearing holders use the 12mm screws inserted from the top with a washer between the wood and the nut.

Adjust the gap between the 270mm Y rods at both ends so they are parallel and their inner edges are 103mm apart. Don't tighten their clamps yet.

Slide the 270mm Y rods partly out of the machine, put the sled onto them, and refit their free ends into the frame:



Ensure the linear bearings slide freely along the smooth rods. If the bearings are a little tight, insert the smooth rod into a power drill, then spin the rod for a few seconds whilst holding a scouring pad over it. Clean the rod with a cloth, then try the bearing fit again.

Slide the Y sled back and forth. It should run completely freely. If it doesn't, that means that the rods are not quite parallel - move their ends a little bit using the nuts either side.

Gradually tighten the ends of the rods, checking for free running right from end to end all the while as you do so.

# Step 2: Y motor and idler brackets

| RP parts | Quantity |
|---|---|
|  | 1 |
|  | 1 |
|  | 1 |
|  | 1 |
| **Hardware** | **Quantity** |
| 623 bearing | 1 |
| M3 x 16mm screw | 4 |
| M3 washer | 5 |
| M3 nut | 1 |
| NEMA 14 stepper motor | 1 |
| M3x10mm socket set screw (grub) | 1 |
| 14 Tooth moulded pulley | 1 |

The next stage is to fit the Y axis idler and motor assemblies. Each end is made up of two printed parts and some hardware. Each end is in two parts to enable printing these components without the need for support material.

# Motor end

The pulley has an encapsulated nut. Insert the set screw and tighten it all the way until it breaks out into the centre hole. Clear out the plastic.

The hub of the motor has a slight swelling to accommodate the encapsulated nut and make it stronger - it is deliberately not concentric.

Fit the 14-tooth pulley to the Y axis stepper motor. This should slide over the front shaft (the one with a flat), and is fixed to the shaft by tightening the M3x10mm socket set screw. Don't tighten the screw too much with the pulley mounted otherwise you could break the pulley apart.

Ensure the teeth face in towards the motor (the Y axis belt will not fit with the pulley the other way around). Screw the motor to the Y motor bracket using the three M3x16mm screws with washers under their heads.

The Y motor goes at the back of the machine, with the motor to the right looking from the front and the wires pointing in towards the 626 bearing slot.

Fit the the Y motor bracket either side of the 626 bearing, and between the serrated washers on the top cross bar.

Move the Y sled to be at the same end, and make sure that the motor is positioned so that the bearings line up with the centre of the two holes in the sled that will hold the toothed-belt clamp.

The Y axis motor end will now look like this:

Note the orientation of the stepper motor, with the wires pointing in towards the machine and the motor on the left of the bracket when looking at the machine from this end.

# Idler end

The Y axis idler end is also constructed from two printed parts. Screw them together with the bearing inside as shown. If the 16mm screw is a little short for the idler part, leave the washers off.

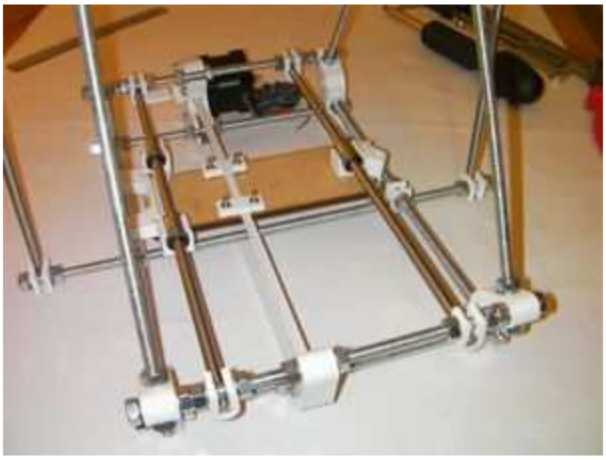
Move the Y sled to the front of the machine (i.e. the opposite end to the Y motor you just fitted) and use the Y belt holes to get the idler bracket in roughly the right place.

Measure the gap from one of nuts holding the motor bracket to the nut along from it that holds one of the smooth Y bar clamps.

Adjust the idler bracket so that the gap between its corresponding nut and its Y-bar-clamp nut is the same. Tighten the nuts to hold the Y idler bracket.

# Step 3: Y axis belt

For this step you just need one 600mm T2.5 PU toothed belt.



Slide the belt under the belt clamp at the Y motor end and tighten the clamp ensuring the belt in centred. Don't do it up too tight, or you will bend the clamp excessively.

Route the belt through the Y axis motor end, around the 14-tooth pulley, under the bearing, along to the idler end, under its 626 bearing, around its 623 bearing and back under the other belt clamp. Do not pull the belt too tightly at this stage, but nip up the belt clamp enough to enable you to slide the sled to either end of the smooth rods without the belt escaping.

Line the belt up by eye. The top should be in line with the bottom and the belt should be square where it sits under the clamps.

Pull the belt tight (gently - it needs to be taught, but you don't need to be able to play it like a harp...).

While holding the belt tight, tighten the idler-end clamp. Don't do it too tight, or you will bend the clamp excessively. Your T2.5 belt may have been supplied as a single piece used for both the Y axis and X axis assemblies, so when you cut off the excess belt you'll want to retain as much as possible of the remainder.

Hand-turn the Y motor by holding the hub of the 14-tooth pulley between your fingers. You will be able to feel the clicks as the motor's rotor magnets run past the ends of its stator coils. Make sure everything on the Y axis stays in line and runs freely right from one end to the other and back.

# Next step

X axis assembly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# RepRapPro Huxley x axis assembly

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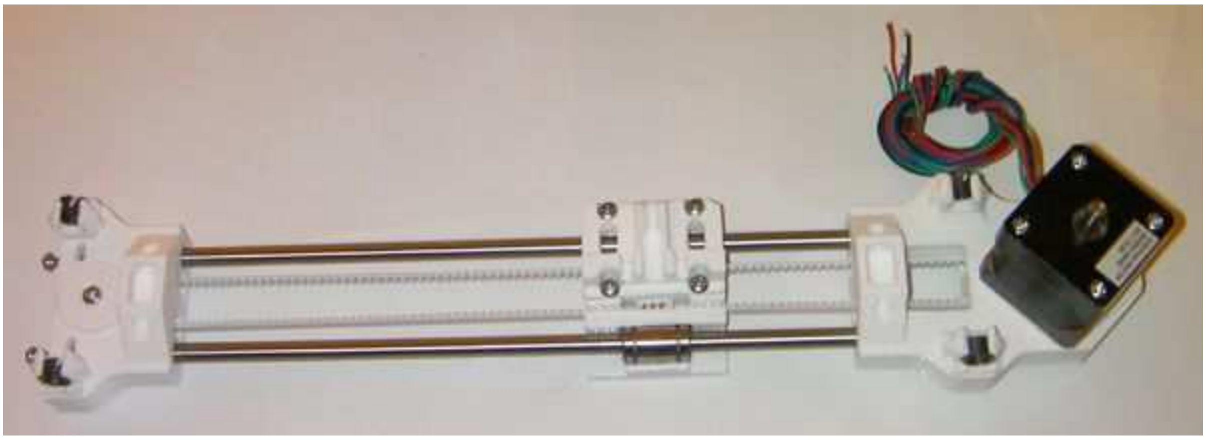
# Goal

By the end of this stage, your X axis will look like this:



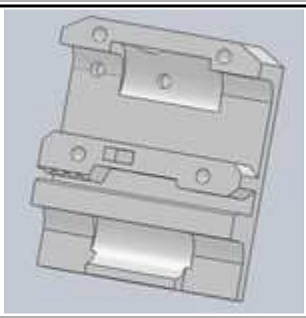
# Tools

You will need the following tools:

- Phillips screwdriver
- Long-nosed pliers
- 5.5mm drill bit

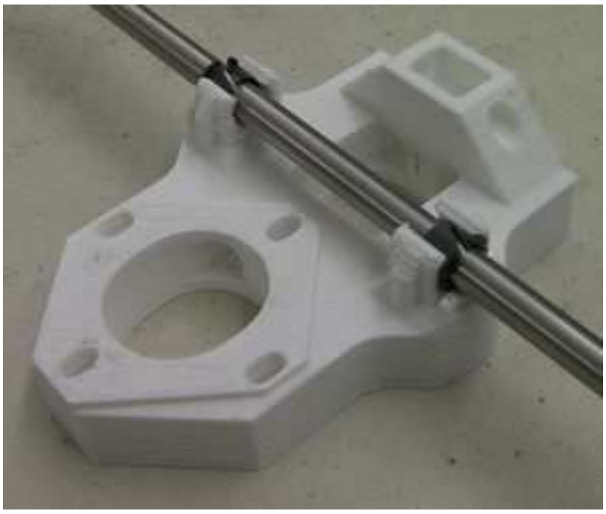
- 6mm drill bit
- Half round needle file or 7mm drill bit
- Knife

# Step 1: X axis rails

| RP parts | Quantity |
|---|---|
|  | 1 |
|  | 1 |
|  | 1 |
| **Hardware** | **Quantity** |
| 265mm Smooth Rod | 2 |
| LM6UU Linear bearings | 2 |
| Igus bushings | 4 |

We will start by fitting the Igus bushings into the x ends. These bushings need to allow the Z smooth rods to slide easily and without much slack. In order to achieve this, you will need to fit an Igus bushing into position and slide a smooth rod through it.

The bushings can be curled up slightly to fit in downwards. The rims are retained by slots in the 3D-printed parts. **Do not attempt to put the bushing in with the smooth rod running through them** - this will break the printed part. Put the bushing in on their own, then run the rod through afterwards to check them when they are in place.



If the fit is too tight, remove the igus bushing, then remove a small amount of material from the X end.

Either use the half-round file to remove material, or clamp a 7mm drill in a vice and run the X end up and down it by hand. Take care - it's better to remove too little and to have to repeat the procedure, than to remove too much irrecoverably.

Try the smooth rod through the bushing again. Repeat this procedure for all four bushing positions.

The holes for the smooth rods in the two ends of the X axis are very deep and tend to be very tight fitting; you should ream these out before assembly. Clamp a 6mm drill in a vice and run the holes up and down over it by hand. Again take care not to remove too much - you want a snug fit.

Run a 5.5 mm drill through both Z-axis threaded rod holes (top right in the picture above); these holes must allow the threaded rod to pass through with clearance.

Also check that an M5 nut will fit comfortably into the slot between these holes. If it is too tight, fettle the hole edges with a blade (cut away from your fingers...).

Clip a linear bearing into the bottom of the X carriage. Push more horizontally (towards the top left of the picture), rather than downwards, otherwise you will break the clip.

You can now insert the smooth rods into the X motor end, and slide the other linear bearing onto the top rod (you may need to de-burr the end of the rods with a file to get the bearings on). The smooth rods go a LONG way into the motor mount; make sure they are both fully inserted before you go further.

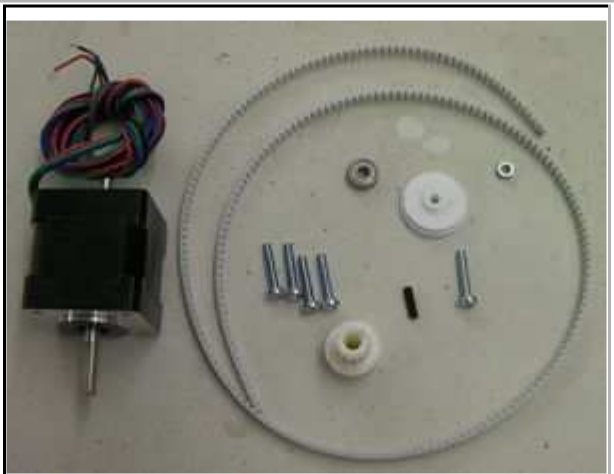
As with the Y axis smooth rods, if the linear bearings are a little tight, place the smooth rod into an electric drill, then spin the rod whilst rubbing it with a scouring pad. The linear bearing should slide freely along the rod, but without too much play.

Put the X carriage onto the rods.

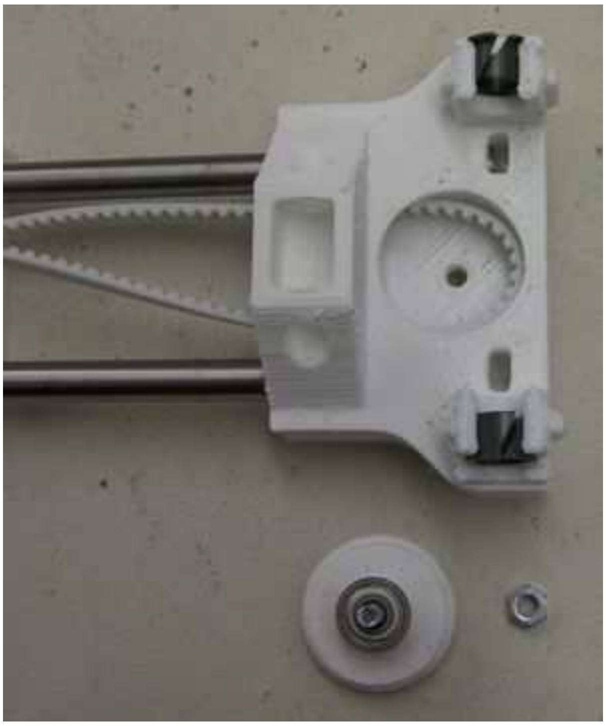
Add the X idler end, at which point your X axis assembly will look like this:

# Step 2: X belt

| RP parts | Quantity |
|---|---|
|  | 1 |
| **Hardware** | **Quantity** |
| T2.5 toothed belt | 1 |
| NEMA14 stepper motor | 1 |
| M3x16mm screw | 7 |
| 14 tooth T2.5 pulley | 1 |
| 623 bearing | 1 |
| M3x10 socket set screw | 1 |
| M3 nut | 3 |



(There should be two more screws and nuts in the picture...)



Loop the belt through the idler end as shown. Put a screw through the cover, put the bearing on it, and push the result into the hole in the idler end. Tighten a nut on the back.

Put one end of the belt into the X carriage, gripping it with the little teeth printed in it (see below for a picture).

Loop the other end of the belt through the motor end in a similar manner.

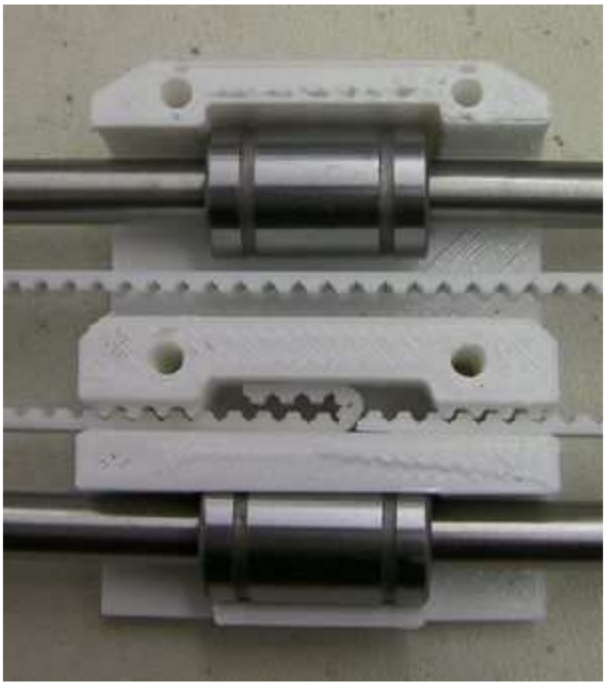
The toothed pulley has an encapsulated nut. Insert the set screw and tighten it all the way until it breaks out into the centre hole. Clear out the plastic.

The hub of the pulley has a slight swelling to accommodate the encapsulated nut and to make it stronger - it is deliberately not concentric.

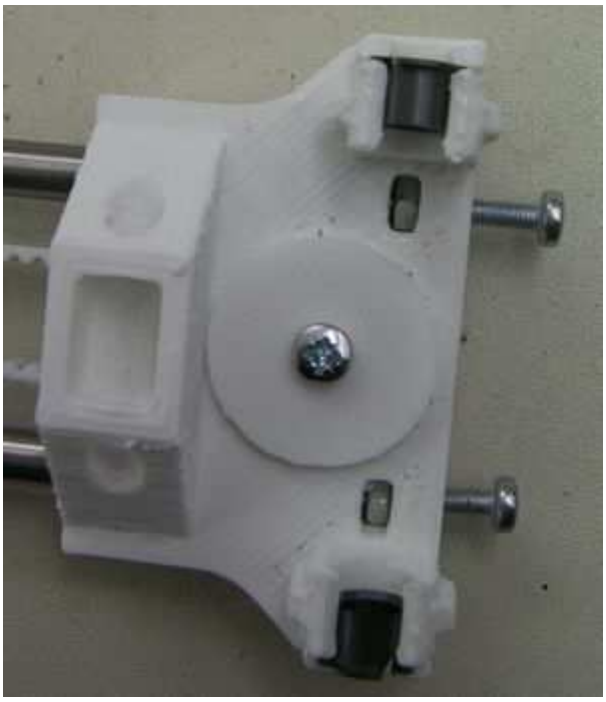
Fit the 14-tooth pulley to the X axis stepper motor. This should slide over the front shaft (the one with a flat), and is fixed to the shaft by tightening the M3x10mm socket set screw. Don't tighten the screw too much with the pulley mounted otherwise you could break the pulley apart.

Ensure the teeth face in towards the motor (the X axis belt will not fit with the pulley the other way around).

Attach the motor to its bracket with four screws. Put the motor at the inside end of the screw slots (i.e. as close to the idler end as possible).



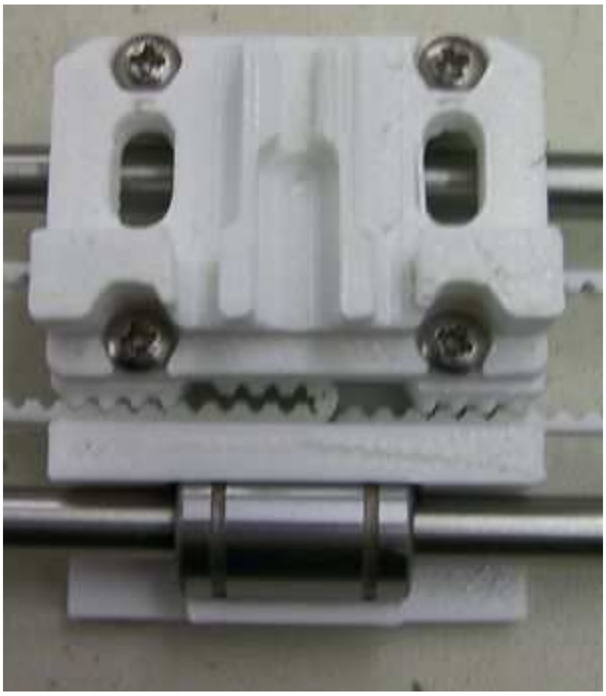
Put the free end of the belt into the carriage as shown. The belt should be slack, but only just.



Drop two nuts into the slots in the idler, and put two screws into them. Leave them loose. These are used to adjust the gap between the Igus bearings to match the gap between the Z axis by pushing on the ends of the rods.

# Nozzle mount

You will need the nozzle mount RP part and four 12mm self-tapping screws.



Attach the mount to the X carriage with the screws. This will not only hold the hot end, it also retains the top linear bearing in the carriage.

# Next step

Z axis assembly

# RepRapPro Huxley z axis assembly

## From RepRapWiki

| Introduction | Frame assembly | Y axis assembly | X axis assembly | **Z axis assembly** | Heated bed assembly | Extruder drive assembly |

| Hot end assembly | Wiring | Commissioning | Printing | Maintenance | Troubleshooting | Improvements |

## Contents


- 1 Goal
- 2 Tools
- 3 Before starting the Z axis assembly
- 4 Z axis assembly
  - 4.1 Fitting the X axis
  - 4.2 Fitting the Z drive
- 5 Next step


# Goal

By the end of this stage, your machine will look like this:

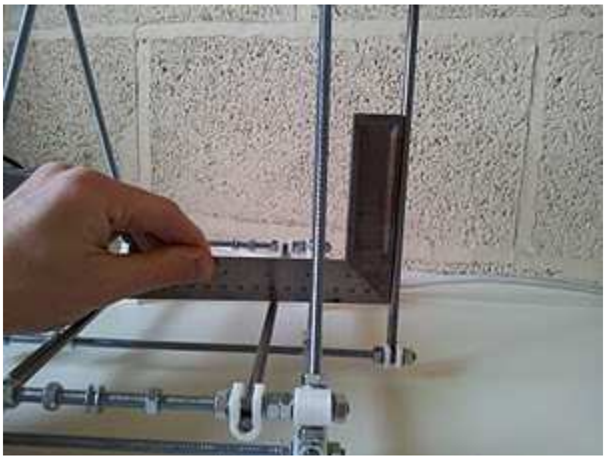
# Tools

You will need the following tools

- Knife
- Phillips screwdriver
- Digital callipers

# Before starting the Z axis assembly

Now is a good time to double-check that the Z smooth rods are square to the Y axis smooth rods. Place a set-square on the Y axis smooth rods and adjust the bar clamps at the bottom of each Z smooth bar in turn to get it square. On machine #248, the distance from the Z-axis bottom threaded rod clamp surface to the Y-axis motor mount corner block was 91.6 mm; this will get you close to square if your machine has the specified corner block to corner block dimensions. Side to side the gap between the Z-axis rod clamp surface and the Z-axis bottom threaded rod clamp was 38.9 mm.



# Z axis assembly

| RP parts | Quantity | |
|---|---|---|
|  | 2 x 2pcs |  |
| **Hardware** | **Quantity** | |
| NEMA 14 stepper motor | 2 | |
| Poly tubing 15mm | 2 | |
| M3x16mm screw | 12 | |
| Z anti-backlash springs (inner Ø greater than 5mm) | 2 | |
| M3 nut | 8 | |
| M3 washer | 4 | |
| M5 nut | 2 | |
| M5x165mm Threaded rod | 2 | |

## Fitting the X axis

Now undo the U-clips that hold the bottom of the Z-axis rods. **Only undo the outside nuts** - the inside ones need to stay positioned to relocate the rods when you do things up again.

Undo the M6 nuts that retain to tops of the rods and slide the rods upwards so they are sticking out the top by about 100 mm.

Disconnect one end of the X belt from the X carriage. This will allow you to pull the two ends of the X carriage apart freely.

Push the Z-axis rods down through the Igus bearings in the ends of the X carriage.

Put one Z rod back in its retaining bottom U clip:

The above picture is from the back of the machine (where the Y motor is).

You will almost certainly find that the ends of the X carriage are not quite the right distance apart. Slide them back and forth on the X rods until everything fits, then put the other Z rod back in its U clip.

Slide the X axis to the top of its travel, and get the gaps between its ends right there. (This will be a distance that cannot be adjusted.) Gently tighten the two screws projecting from the X-axis idler end until they touch the ends of their rods. Don't over-tighten them, as that will bend the Z rods.

Now slide the X axis back down again, checking that it moves completely smoothly. It may bind for two reasons:

1. It is tilted (like trying to put a drawer in a chest-of-drawers at a slight angle). This doesn't matter - simply get things straight and try again.
2. The gap at the bottom of the Z rods is not quite the same as that at the top. This does matter, and needs to be fixed:

To get the bottom Z-rod gap right, carefully move the U clips by undoing and doing up the nuts either side of them. **Do this symmetrically.** That is to say, if you move the inner nut on the right three-quarters of a turn inwards, do exactly the same with the corresponding nut on the left. It helps to mark one flat on the nuts with a felt-tipped pen so you can keep track of turns.

Keep sliding the X axis up and down the rods, and make small symmetrical adjustments as above until it runs completely smoothly.

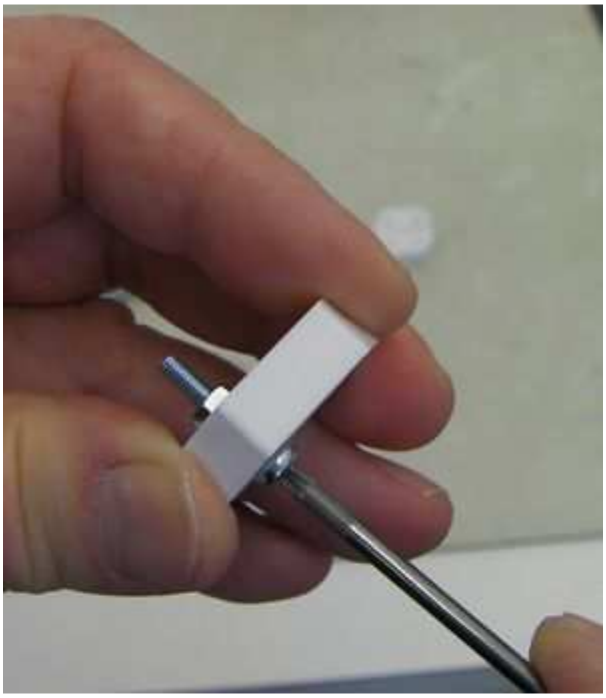
Re-fit the X belt. Pull it tight, then slot it in one notch looser.

Slacken the screws on the X motor, slide them in their slots to take up the slack on the X belt, and re-tighten them.

# Fitting the Z drive

Begin by cutting the poly tubing into two equal lengths, each of which should measure approximately 15mm, and slide each onto a stepper motor shaft with a flat on it.

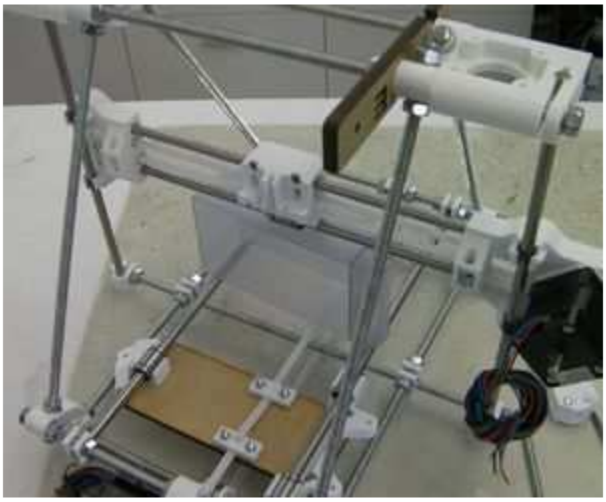
Next put the couplings together. You may find that the M3 nuts are a little tight in the hexagonal holes that accommodate them. This is good because it retains them, but it makes them hard to put together. But it's easy if you use a screw to pull them through from the other side:



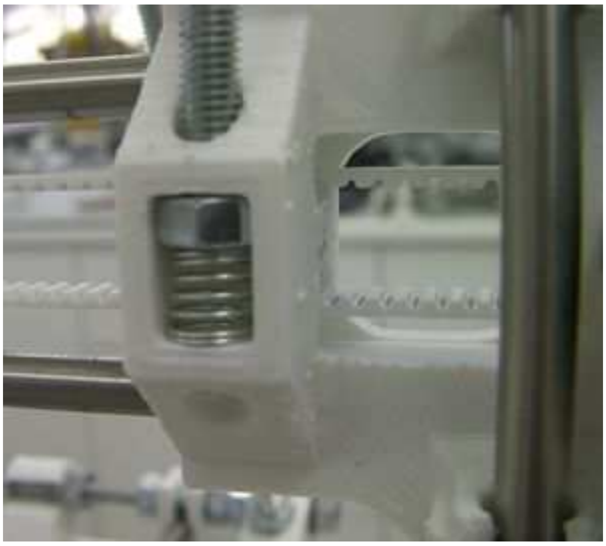
Put the couplings and motors:

to one side for use in a minute.

Place an object on the Y bars to hold the X axis about half-way up its travel:



Insert an M5 nuts into its slot in an end of the X axis. Put an M5 threaded rod on top of it and screw it in a couple of turns. Use the rod to hold the nut at the top of the slot and push an anti-backlash spring in under the nut:

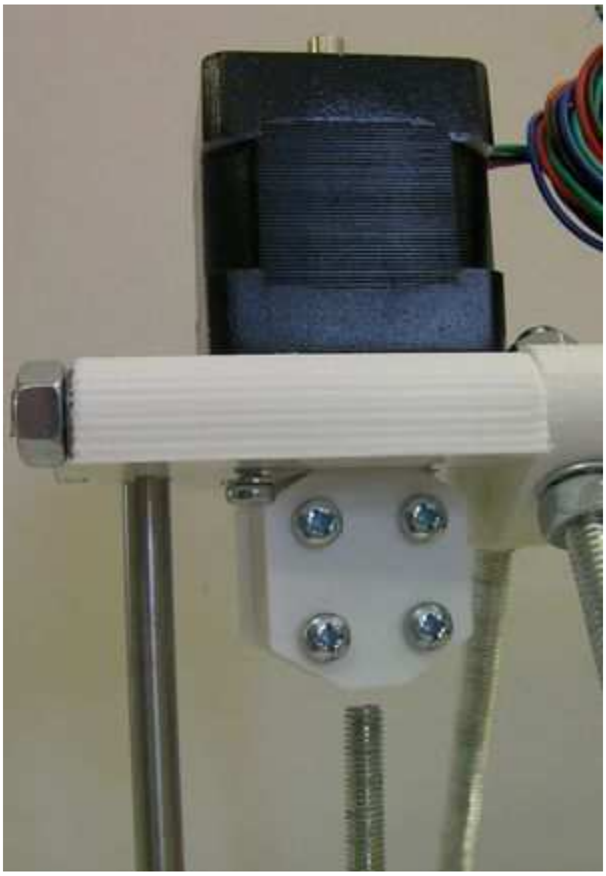


Screw the M5 rod down through the nut and spring until its top is about 30mm below the Z-motor brackets at the top of the machine.

Repeat this for the other end of the X axis.

Put the Z motors with their poly tubes in place on top of their brackets and loosely attach them from underneath with two M3 screws with washers under their heads on the motor's diagonals. Have the Z motor wires pointing towards the middle of the machine.

Make sure the screws on the Z couplings are loose. Put the large holes in the couplings over the poly tubes. Move the couplings up till they touch the Z motor brackets, then back them down by two millimetres or so:



Lift the X axis to push the M5 rods into the bottoms of the couplings. Position them so there are about two millimetres clear between the tops of the M5 rods and the bottoms of the motor shafts. You can see this by looking in at gap at the sides of the couplings.

Tighten the couplings.

Tighten the diagonal pairs of screws holding the Z motors.

Measure the gap between the Y rods and the bottom X rod with digital callipers. Turn the Z motors by hand to make the gap each side equal.

# Next step

Heatbed assembly


Categories: Build Instructions | RepRapPro

# RepRapPro Huxley heatbed assembly

### From RepRapWiki

| Introduction | Frame assembly | Y axis assembly | X axis assembly | Z axis assembly | **Heated bed assembly** | Extruder drive assembly |

| Hot end assembly | Wiring | Commissioning | Printing | Maintenance | Troubleshooting | Improvements |

## Contents

- 1 Goal
- 2 Tools
- 3 Heated bed assembly
- 4 Next step

# Goal

By the end of this stage, your machine will look like this:

See also this wiki page.

# Tools

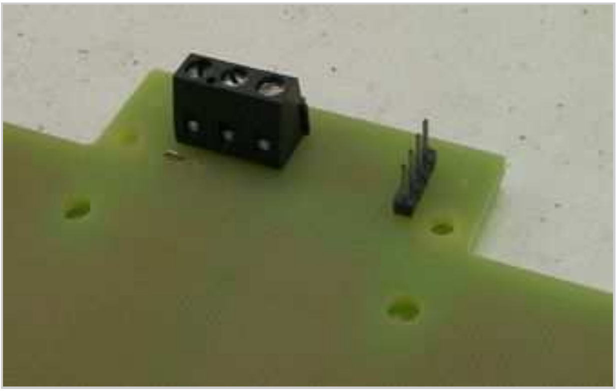
- Wire cutters
- Soldering iron
- Allen key

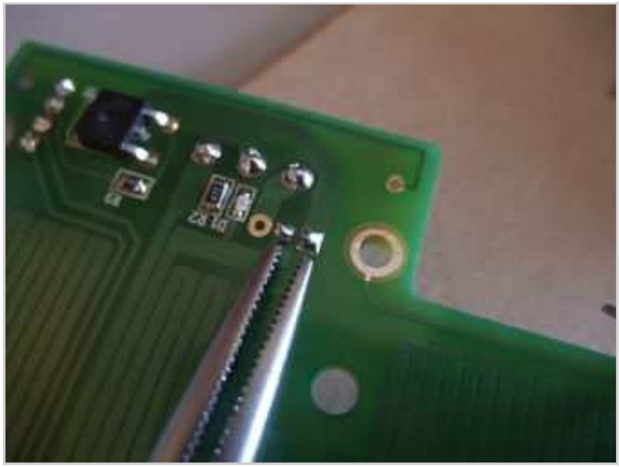
# Heated bed assembly

| Hardware | Quantity |
|---|---|
| Heated bed PCB | 1 |
| Aluminium plate | 1 |
| Balsa ply insulator | 1 |
| Bed springs | 3 |
| 3-way screw connector | 1 |
| 4-way pin header | 1 |
| short wire (e.g. clipped resistor lead) | 20mm |
| M3x35mm screw | 3 |
| M3x8mm screw | 4 |
| M3 nylock nut | 3 |
| M3 nut | 3 |
| M3 washer | 10 |

There should be 6 more washers in this picture [The white splodges are heatsink grease (see below);

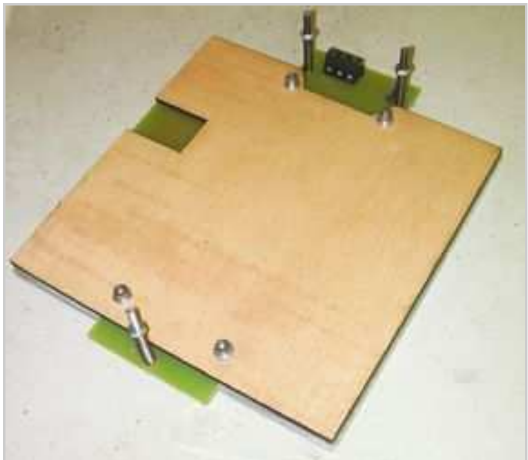
we took an assembled bed apart for the picture.]



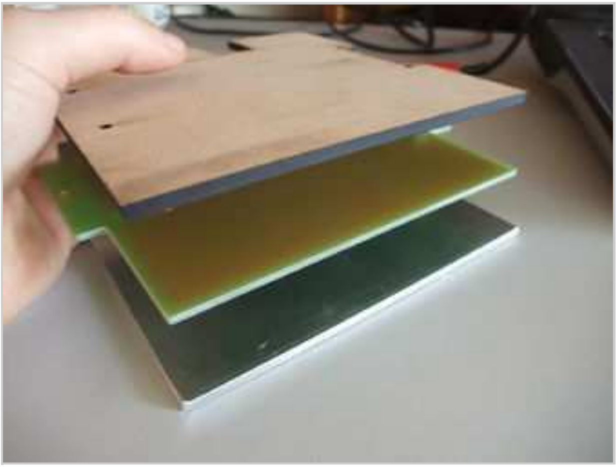


Start by soldering the connectors in place. The wire holes on the screw connector face outwards. Also use a length of wire to make a jumper between the left two holes beside the 3-way screw connector.

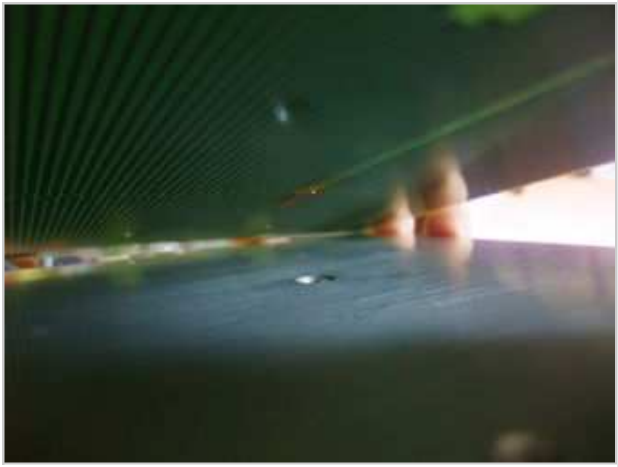
Use one of the short screws with a washer under its head to pull the nylock nuts into the three hexagonal recesses under the printed parts of the Y sled.



Sandwich the flat components together. This shows them upside down to the way they will be when fitted to the machine.

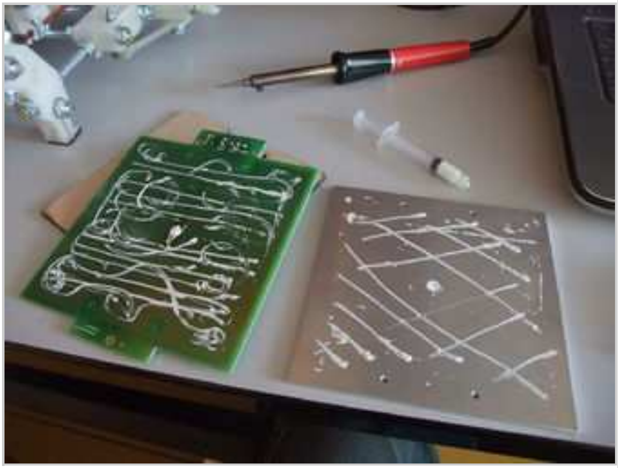


From the top down in the picture they go: Balsa ply insulator (lasercut lettering downwards, towards PCB), PCB (circuit side down, towards aluminum bed-plate), Aluminium plate.

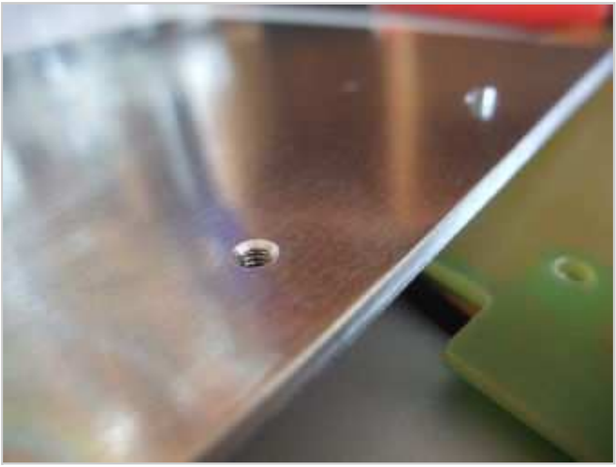


Take care when sandwiching the parts together that the edge of the recess does not hit the thermistor - you don't want to knock it off... **NOTE : The thermistor should be electrically insulated from the Aluminium plate**. This can be achieved using a small piece of Kapton tape, or even a short length of PTFE plumber's tape over the thermistor.

The aluminium plate has a recess in the centre to accommodate the tiny surface mount thermistor in the middle of the PCB. You can put heat-sink grease in that recess to improve the thermal contact between the thermistor and the aluminium plate if you like.



If you have plenty of heatsink grease, you can also put some on the rest of the pcb.



Put washers under the heads of the four short M3 screws and screw them through the stack to hold it together. **Don't do the screws up so tight that they project through the aluminium plate.** The ends of the screws need to be just below the plane of the top of the plate. If they project, put extra washers under their heads.

Put the long screws through the holes in the PCB, put on washers, drop the springs onto them, put on three more washers (one per screw), and put the M3 nuts on by about 10mm to hold the springs.

Use the screws to attach the heated bed to the machine. Screw the screws into the nylock nuts until the bed is secure and roughly level. Then loosely run the nuts down the screws (relaxing the springs) until they meet the printed parts of the Y sled. Tighten them gently against the sled.

(To level the bed accurately later, you will slacken those nuts, adjust the screws in the nylocks, then tighten the nuts again.)

If you find that the springs are a bit weak (and so do not hold the PCB firmly up against the heads of the screws), simply add three extra nuts under the washers on the ends of the springs. Use the top nuts to set the spring compression, and the bottom ones independently to secure the bed.

You should be able to push the bed down easily with a finger, and it should spring smartly back up again to rest under the screw heads.

Carefully run the Y-axis back and forth by turning the toothed pulley on the Y motor by hand. Make sure that nothing hits anything.

# Next step

Extruder drive assembly

# RepRapPro Huxley extruder drive assembly

### From RepRapWiki

| Introduction | Frame assembly | Y axis assembly | X axis assembly | Z axis assembly | Heated bed assembly | **Extruder drive assembly** |

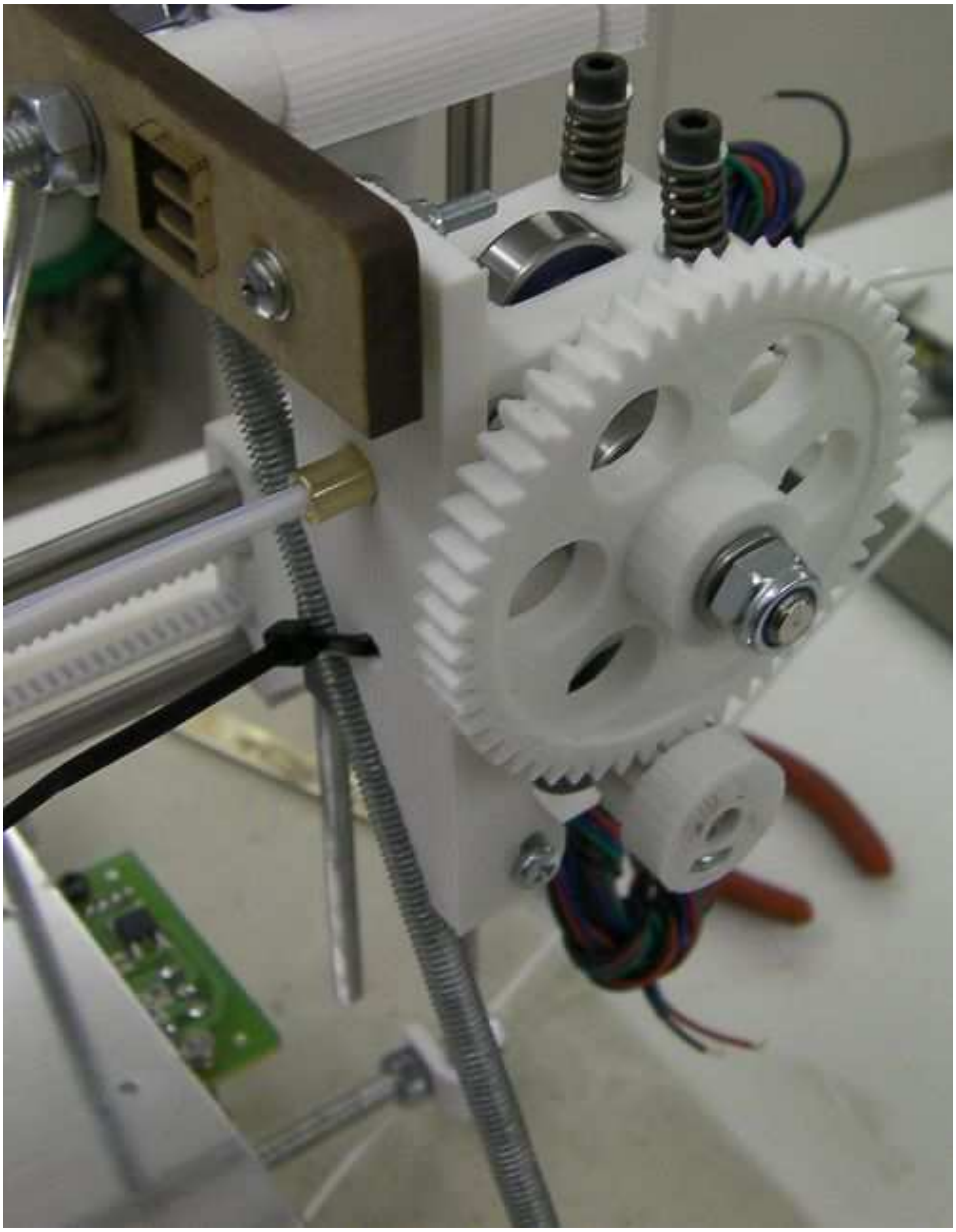
| Hot end assembly | Wiring | Commissioning | Printing | Maintenance | Troubleshooting | Improvements |

## Contents


- 1 Goal
- 2 Tools
- 3 Step 1: Motor and hobbed stud assembly
- 4 Step 2: Idler
- 5 Step 3: The Bowden tube
- 6 Step 4: Fitting the drive
- 7 Next step


# Goal

By the end of this stage your extruder drive will be mounted on the back of your Huxley like this:



# Tools

- 10mm (M6) spanner
- Adjustable spanner
- Allen key
- Phillips screwdriver
- Tweezers
- 2mm drill

# Step 1: Motor and hobbed stud assembly

| RP parts | Quantity |
|---|---|
|  | 1 |
|  | 1 |
|  | 1 |
| **Hardware** | **Quantity** |
| M6 hobbed stud | 1 |
| M6 full nut | 1 |
| M6 nyloc nut | 2 |
| M6 split washer | 1 |
| M6 plain washer | 2 |
| 626 Bearing | 2 |
| NEMA 14 stepper motor | 1 |
| M3x10mm socket set screw (Grub) | 1 |
| M3 nut | 1 |
| M3x8mm screws | 3 |
| M3x25mm countersunk screw | 1 (Mendel only - not Huxley) |

If you are building a Mendel drop the countersunk screw through the mounting hole in angled section on the printed block under where the motor will go - head towards the motor. (Huxley does not need this screw.) You won't be able to fit the screw after you have attached the motor.

Use the 8mm M3 screws to attach the motor to the block. Put it as far from the centre as it will go in its slots. Don't do the screws up tight. The motor wires come out towards the bottom of the picture:

Push the M6 nut (plain, not one of the nylocks) into the hexagonal recess in the big gear.

Put a bearing on the hobbed 6mm stud (note the relative positions of the short and long threads), followed by two plain M6 washers, followed by the gear with its nut. The nut should face away from the bearing.

You are going to adjust things so the gears mesh.

Put the M3 nut into the slot in the small gear and run the M3 set screw through it.The small gear may need reaming out by hand with a 5mm bit.

Some motors have a flat on the shaft that runs all the way to the motor case. If yours is one of these, put the small gear on the shaft with its hub towards the motor. Then put the bearing in its hole so the big gear meshes with the small one.

If the flat stops short of the case, put the bearing and the big gear on first, then put the small gear on the other way round (as in the picture below).

Take things apart and put them together again, adjusting the motor's position in its slots, until the gears mesh nicely.

When you are happy tighten all the motor screws, reassemble everything else, and tighten the small-gear set screw. Make sure that the small gear hub is not rubbing on the big gear - there should be about half a millimetre clearance between them.

Put the other bearing in on the other side of the block.

Put the split M6 washer on the side with the big gear so it bears on the gear's nut, then put M6 nylock nuts on both ends.

Tighten the nylocks, while checking the hobbing against the 2mm hole down through the block where the filament will run. The hobbing should be centred on this. Undo or do up the big gear with its nut, and the two nylocks until this is so.

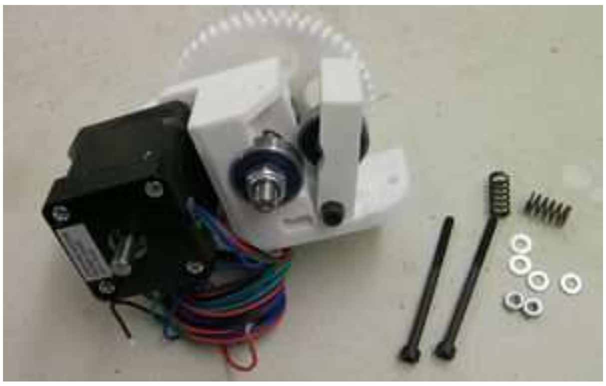
Don't tighten the nylocks so far that the gears, stud, and motor can't rotate freely.

# Step 2: Idler

| **RP parts** | **Quantity** |
|---|---|
|  | 1 |
| Hardware | Quantity |
| M3x30mm screw | 1 |
| 626 bearing | 1 |
| M3x45 screws | 2 |
| M6x20mm socket set screw | 1 |
| M3 washers | 6 |
| M3 full nuts | 2 |
| M3 nylock nut | 1 |
| Springs | 2 |

Put the bearing on the M6 set screw and drop it into the slot on the printed part. Check that it rotates freely. If it does not, use a blade to remove a little material where it is binding.

Fit the idler to the drive with the 30mm M3 screw, two washers - one each side - and the nylock nut. Don't over-tighten it - it must move freely. The photo below is wrong - you want the head of the screw on the gear side and the nut facing you in the picture. You will find that if you rotate the gear you can get the screw through the holes in it. This makes the idler much easier to remove when it is mounted on the RepRap machine.

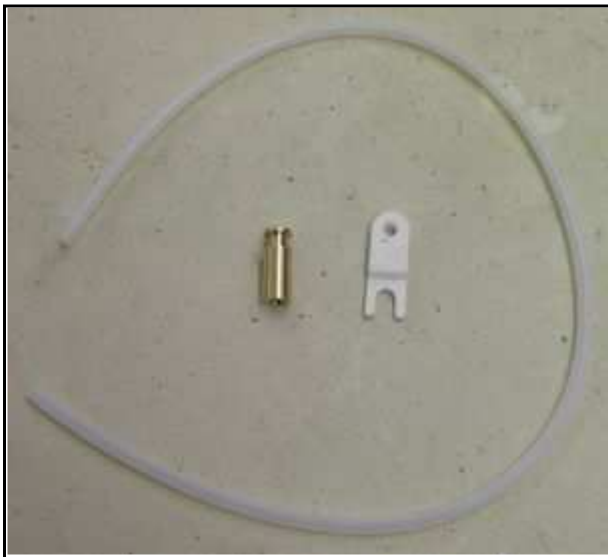


Put the springs on the long screws. Sandwich each spring between a pair of washers.

Put the screws through as shown. If you drop the nuts into their holes with tweezers first, then hold a screwdriver blade over them while you tighten the screws this is less fiddly.

# Step 3: The Bowden tube

| RP parts | Quantity |
|---|---|
|  | 1 |
| **Hardware** | **Quantity** |
| slotted brass retainer | 1 |
| PTFE tube | 1 |



Don't confuse the PTFE tube (shown) with the shorter
translucent heatshrink also supplied with the kit.

Use a sharp blade to trim a few millimetres off the end of the tube at right angles to get a clean square end.

If your kit has a 4mm diameter PTFE tube supplied (as opposed to 3mm) then make a small cone on the end with a pencil sharpener. Don't cut too far - PTFE is very soft. The cone makes it easier to start the thread.

Screw the tube into the brass retainer. Look in the other end to see when it gets to the end of the internal thread, then stop.

Screwing the tube in will have reduced its internal diameter slightly. Gently twist a 2mm drill by hand in the end of the brass to thin the tube where it is inside the screw thread. If you have a small hand-chuck this is made easier. The picture shows this being done for the other brass connector that you will install on the next page. The method is the same:

Push a short length of 1.75mm build filament down the tube from its free end to clear out any PTFE swarf.

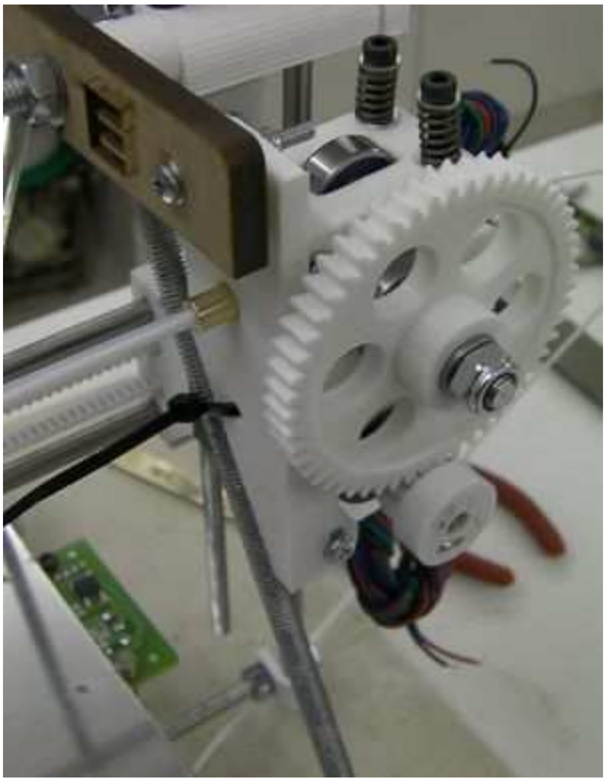
Push the brass retainer into the drive, and secure it with the printed tongue. The thin end of the tongue goes to the right in this picture:

Feed in the short length of 1.75mm filament. The compression screws should be done up just tight enough that when the filament is trapped in the drive you cannot pull it out by hand - no tighter. (Hold the big gear still when you tug to test this.) Turn the device by hand. The filament should feed slowly and smoothly down the tube.

# Step 4: Fitting the drive

| Hardware | Quantity |
|---|---|
| M3x20mm screw | 1 |
| M3 washers | 6 |
| M3 nylock nut | 1 |
| small cable tie | 1 |

Attach the drive to the bracket on the machine. Put four washers as spacers between the drive and its bracket. Use the cable tie in the bottom hole to secure the lower end:



Clip the excess off the cable tie.

Finally, take a pair of long-nosed pliers and use them gently to remove the tongue. Take out the PTFE tube and its brass fitting. You will need these separate for the next step...

# Next step

Hot end assembly

# RepRapPro Huxley hot end assembly

### From RepRapWiki

| Introduction | Frame assembly | Y axis assembly | X axis assembly | Z axis assembly | Heated bed assembly | Extruder drive assembly |

| **Hot end assembly** | Wiring | Commissioning | Printing | Maintenance | Troubleshooting | Improvements |

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- 1 Goal
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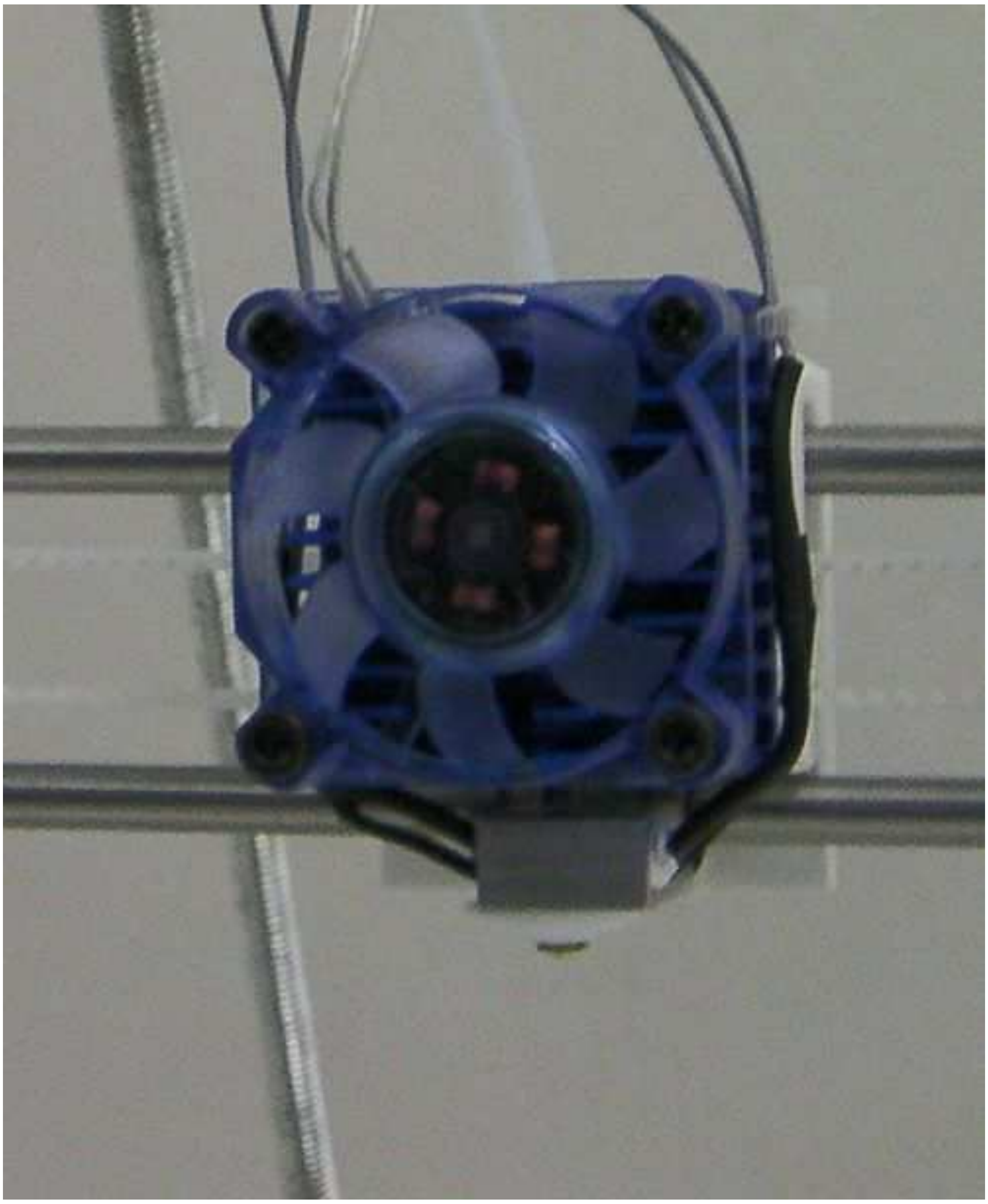
- 4 Step 1: The hot part of the hot end
- 5 Step 2: The cooling system
- 6 Step 3: The heater resistor and temperature-measuring thermistor
- 7 Step 4: Fan wires and nozzle insulator
- 8 Step 5: Installation
- 9 Next step

# Goal

By the end of this stage you will have finished all the mechanical construction! Your hot end will be fitted to your Huxley like this:



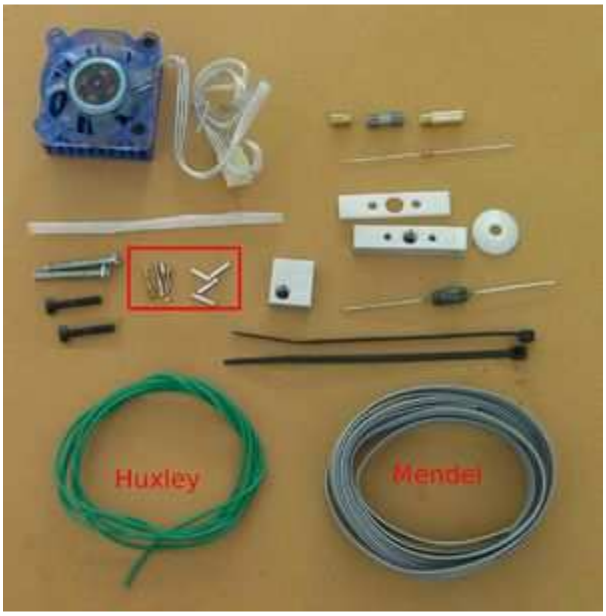
# Tools

You will need the following tools:

- Allen key
- Small screwdriver
- Pliers
- Adjustable spanner
- Heat sources (small blowtorch plus hairdryer/soldering-iron)
- Bench vice

# Parts

| Hardware | Quantity |
|---|---|
| Fan and heatsink | 1 |
| Aluminium heater block | 1 |
| M3x25 screws | 2 |
| M3x16 screws | 2 |
| Cable ties | 2 |
| Stainless steel barrel | 1 |
| Brass union | 1 |
| Brass nozzle | 1 |
| 100K thermistor | 1 |
| Heater resistor | 1 |
| PTFE insulating cone | 1 |
| PTFE spacer | 1 |
| Aluminium cooling block | 1 |
| Huxley connecting wire | 4x300mm lengths |
| Mendel connecting wire | 8-way ribbon cable |
| crimps | 4 |
| PTFE Heatshrink sleeve | 1 |




The heatshrink is easy to confuse with the PTFE

for the extruder Bowden tube. The heatshrink
is the shorter one made from thinner material.

You will see that Mendel and Huxley have different connecting wires. Also the Huxley heating resistor is a 6R8, whereas the Mendel one is 2R7.

There are also alternative crimps for attaching the wiring to the resistor and thermistor (red rectangle). See below.

There are several stages in this construction where you have to trim pieces of PTFE. It is essential to clear any swarf created away and not to let it get into the extruder. PTFE swarf will travel to the nozzle and block it if it is allowed to contaminate the device.

# Step 1: The hot part of the hot end

Check that the 6R8 heater resistor fits in the larger hole in the heater block. The resistors can be a little variable in their diameter. The thermistor should fit in its hole - they are manufactured to a tighter tolerance.

If the resistor is too big, clamp the heater block firmly in a vice and run a 5mm drill down it. Be careful to run it square on. Running the drill up and down will shave a little off the sides of the hole. Repeat this until the resistor fits.

Set the resistor aside for use in a minute.

Take the PTFE tube from the extruder drive that you just made. If you have the 3mm diameter version, cut a short length (about 15mm) from its free end using a sharp blade, taking care to make the cut square on to the axis of the tube. Put the short length aside for use later.

If you have the 4mm diameter version you will also have a short length of 3mm diameter in your kit. In the 4mm diameter tube case, use a pencil sharpener to make a small cone on about 2mm of the free end of the tube. Take care not to cut too far - PTFE is very soft.

Screw the brass union onto the end of the PTFE tube that you have just cut. By looking down the other end of the brass you will be able to see when the PTFE reaches the end of the thread.

Screwing the tube in will have reduced its internal diameter slightly. Gently twist a 2mm drill by hand in the end of the brass to thin the tube where it is inside the screw thread. If you have a small hand-chuck this is made easier:

Push a length of 1.75mm build filament down the tube from the other end to clear out any PTFE swarf (see the warning above about leaving any behind). Make sure the filament runs freely down the tube and comes out of the far end without impediment.

Wrap plumber's PTFE tape round the shorter thread of the stainless steel barrel **BUT NOT** the nozzle:

Take care that the tape does not cover the holes, and leave the smooth part of the barrel free (or trim the tape away from that with a blade after wrapping). The barrel has a big temperature drop in operation from one end to the other (around $200^{o}C$), so it is important that you leave the middle surface free to radiate heat.

Don't put PTFE tape on the nozzle.

Screw the barrel and the nozzle into the heater block so they meet in the middle. The nozzle goes in the side of the aluminium block with the small 2mm through-hole (that will later accommodate the temperature-measuring thermistor).

Offer up the PTFE insulating cone beside the nozzle. The nozzle should stick out of the block a bigger distance than the depth of the cone. The cone will be screwed onto the nozzle later, and the nozzle needs to project out the bottom.

Place the assembly in the corner of a vice, gripping as little of it as is compatible with its being secure. Adjust the adjustable spanner to the flats on the nozzle and have the long-nosed pliers to hand.

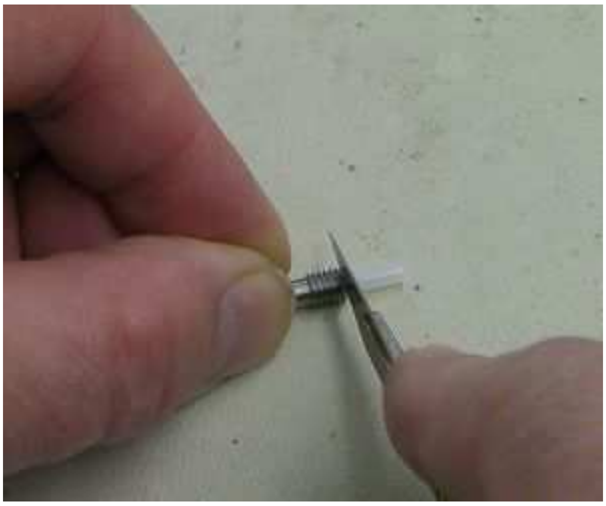
Use the blowtorch to heat the block:

You need to heat the block enough for it to expand by at least the amount it will expand during printing. Neither the brass nozzle nor the stainless steel barrel will expand as much as the aluminium heater block. So, whilst hot, hold the steel coupling with the pliers and tighten the nozzle with the spanner. This will normally take only a very small amount of rotation (say 1 or 2 degress) but will be enough to ensure the nozzle assembly does not leak during printing.

Leave the block in the vice to cool.

# Step 2: The cooling system

Take the short length of PTFE tube you saved and put it in the counterbored hole in the stainless steel barrel. Trim it flush with a sharp blade:



Take a 5mm drill and gently twist it against the end of the PTFE that you have just created to dish it slightly. Make sure you clear all swarf away.

Now screw the brass bowden end piece (with the PTFE bowden tube screwed into it), into the Aluminium heatsink block (the long thin one with five holes in it). Once fully screwed in, screw the free end of the barrel into the M5 hole in the Aluminium heatsink block until it meets the brass piece. Now unscrew the brass piece by 1/4 turn, screw the barrel in to meet it, and finally tighten the brass piece with some pliers. This will result in the barrel and bowden end pieces being locked together inside the heatsink block.

The heater block should be parallel with the heatsink block (and with the power resistor).

Peel the sticky backing off the fan and heatsink. This is quite tough - you may need to pull with pliers. Take care not to put stress on the delicate plastic fan. The easiest way once you have a corner off is to hold that with long-nosed pliers and to roll them over the back face of the heatsink like peeling the lid off a tin of sardines.

If you are building a Huxley, keep the sticky backing - you will need it on the next page. Cover the side that was against the fan with polythene (such as the zip bags that the components come in are made from) and keep the plastic covering on the other side.

You can put a little heatsink grease on the aluminium cooling block if you like. Attach it to the fan with the two longer screws. Put the two shorter screws through the PTFE spacer and screw them a few turns into the block.

You will see that there are slots in the heatsink attached to the fan that blow down on the heater block. Put a piece of sticky tape over those slots.

# Step 3: The heater resistor and temperature-measuring thermistor

For Mendel the heater resistor is 2R7; for Huxley it is 6R8.

Try the heater resistor in the hole in the heater block. The resistors can be a little variable in their diameter. If the resistor is too big, clamp the heater block firmly in a vice and run a 5mm drill down it. Be careful to run it square on. Running the drill up and down will shave a little off the sides of the hole. Repeat this until the resistor just fits.

Alternatively, if the resistor is too lose, wrap it in a little PTFE tape.

For Mendel use two adjacent wires from the ribbon cable for each end of the heater resistor - four in all. This is to increase the current capacity. For Huxley, simply connect one wire to each end.

For Mendel the wires across the ribbon cable in order go like this:

1. Wire with the colour stripe: Thermistor
2. Thermistor
3. Fan + volts
4. Fan Ground

5. Heater resistor Wire 1
6. Heater resistor Wire 1
7. Heater resistor Wire 2
8. Heater resistor Wire 2

Resistor wires 1 and 2 are arbitrary - the resistor has no polarity.

You can either use the ferrule crimps (right in the red box in the parts picture) or the connector crimps (left). The connector crimps just plug onto the resistor wires, which is simple. If you crimp them onto the ends of the thermistor and then tin the connector wires for that, the wires will plug in. The ferrule crimps are a bit more fiddly, and they make a permanent connection.

The advantage of the connector crimps is that you can plug and unplug the wires. The advantage of the ferrules is that they give a better quality (i.e. lower resistance) connection.

The pictures show the ferrule crimps and the Huxley single wires.

Bare about 10mm on the end of the resistor connector wires and crimp them onto the ends of the resistor's leads. Put heatshrink on and use a soldering iron or hairdryer to shrink it.

The picture shows the left-hand side complete, and the right hand side waiting for the crimp to be slid over the join followed by crimping. It also shows conventional heatshrink. To shrink the PTFE heatshrink you will have to hit it with a flame - a mere soldering iron won't touch it.

The thermistor should fit in its hole - they are manufactured to a tighter tolerance. It will be a little undersized. But the crimps on the thermistor wires won't fit through the hole, so you have to crimp one wire after the thermistor has been pushed through the block.

Put about 20mm of PTFE heatshrink over the thermistor and shrink it on with a flame (try not to scorch things). Put the thermistor in the block - the PTFE should make it a snug fit. Crimp and then heatshrink over the connections to either end.

With the ribbon cable for the second thermistor connection, don't forget to slide the heatshrink onto it and away from the join before you make the join - you won't be able to get it on afterwards.

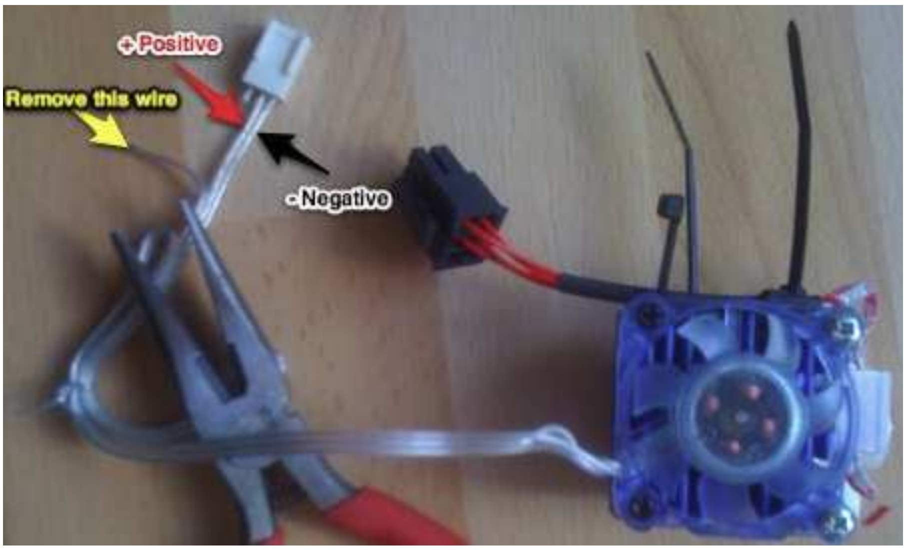
Bend the wires up the side of the heat sink. Do not pull them tight - they need a little slack to accommodate movement and expansion. Attach them at the top of the heatsink with two cable ties chained together, one of them running through the top slot in the heatsink.

Trim the excess off the cable ties.

Use a meter to check that the resistance between the wires and the aluminium block is infinite and that nothing is shorting.

# Step 4: Fan wires and nozzle insulator

You need to cut one wire off the fan. Looking at the picture below, use a red and a black felt-tipped pen to mark the positive and negative fan wires. Trace them right back to the fan and mark them there.




Cut the socket off (leaving your marks on the fan side of the cut...), then remove the extraneous wire.

Screw the PTFE insulating cone onto the nozzle.

# Step 5: Installation

Use the two free screws in the aluminium cooling block to attach the extruder hot end to the X carriage of your Huxley. The PTFE tube clips into the printed vertical channel in the X carriage.

Put the free end of the PTFE tube back in the extruder drive and re-secure it with the tongue that you undid at the end of the previous page.

The tube runs outside the machine. It does not run between the threaded rods.

By hand run the X carriage to X-motor end of its travel and check that the fan does not strike the extruder motor. If it does, wedge a small spacer between the M6 rod of the frame and the extruder motor mounting block. The cable tie that holds the mounting block should be flexible enough to allow this.

# Next step

Wiring


Categories: Build Instructions | RepRapPro

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- This page was last modified on 25 March 2012, at 13:22.
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# RepRapPro Huxley Melzi wiring

### From RepRapWiki

(Redirected from RepRapPro Huxley wiring)

| Introduction | Frame assembly | Y axis assembly | X axis assembly | Z axis assembly | Heated bed assembly | Extruder drive assembly |

| Hot end assembly | Wiring | Commissioning | Printing | Maintenance | Troubleshooting | Improvements |

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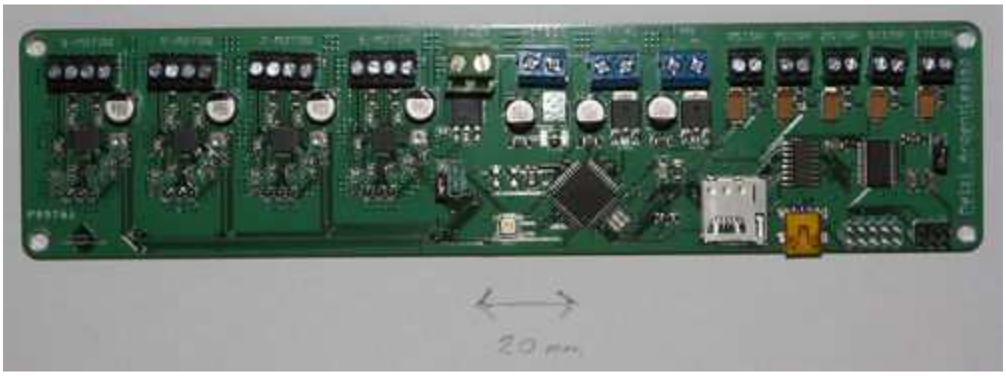
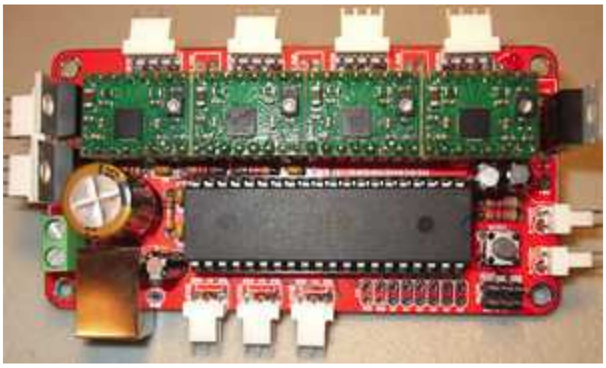
# Alternative

This page describes how to wire up a RepRapPro Huxley that is to be fitted with Melzi Electronics that look like this:



There is a parallel page that describes how to wire up a RepRapPro Huxley that is to be fitted with Sanguinololu Electronics that look like this:



Follow this link for the alternative Sanguinololu wiring page.

# Goal

By the end of this stage your machine will be ready to commission.

The electronics will have been temporarily fitted. This allows wire lengths to be set and the machine to start working. It is deliberately rather messy, as this allows wires to be re-routed over and under each other and similar adjustments. The messiness will, of course, be tidied up over the next few instruction pages.

Your will be guided through the print of the final parts needed for your RepRap Huxley to build itself: the clips for holding the controller PCB and the power socket.

You will then remove the temporary attachments and replace them with permanent ones.

# Important: general rules for wiring up

You will do serious damage to your RepRap electronics if the power is connected backwards. Other damaging mistakes are to short out high-current devices like motors and heaters, and to connect high-voltage devices like stepper drivers to signal inputs like temperature sensors.

So - **in the sections below where it tells you to check things - please check them thoroughly**. It is worth taking the time...

**Also important for the steps below:** when attaching wires to screw connectors, strip about 5mm of insulation off them, twist them between your fingers, and **tin them with solder**. The tinning is needed for good contact, and to ensure that fraying does not cause shorts.

When wires leave a device (like a motor) or arrive at a connection (like the screw connectors on the controller) leave a small slack length (about 20mm long) for strain relief - don't have the wires taut.

Finally, when making any changes to the wiring or any other electrical aspect of the machine, **first disconnect both the power and the USB**.

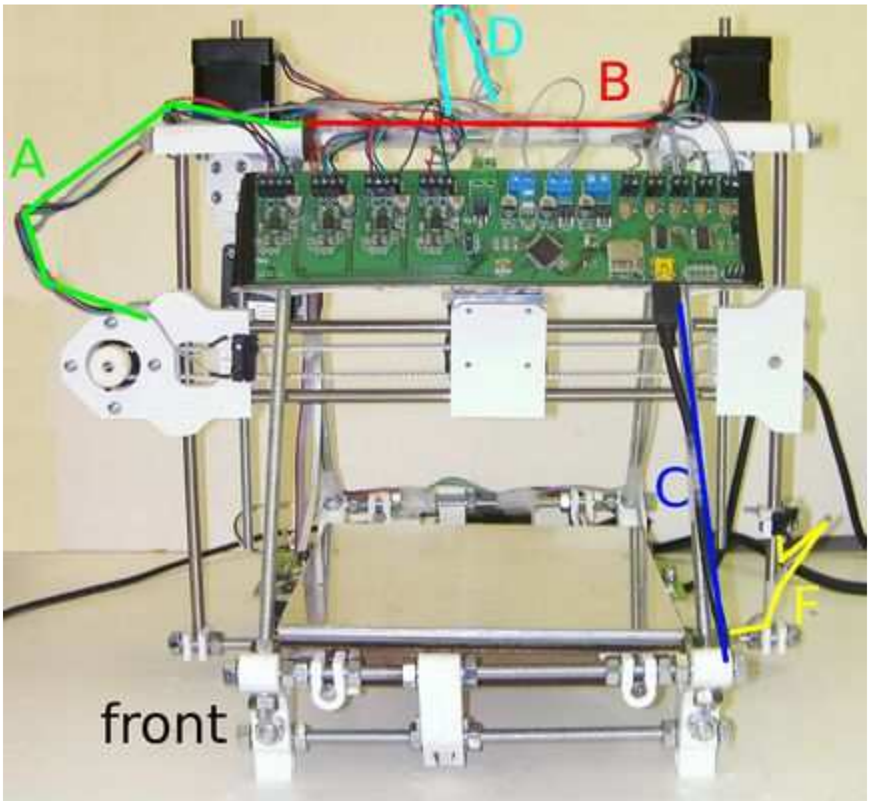
# Tools

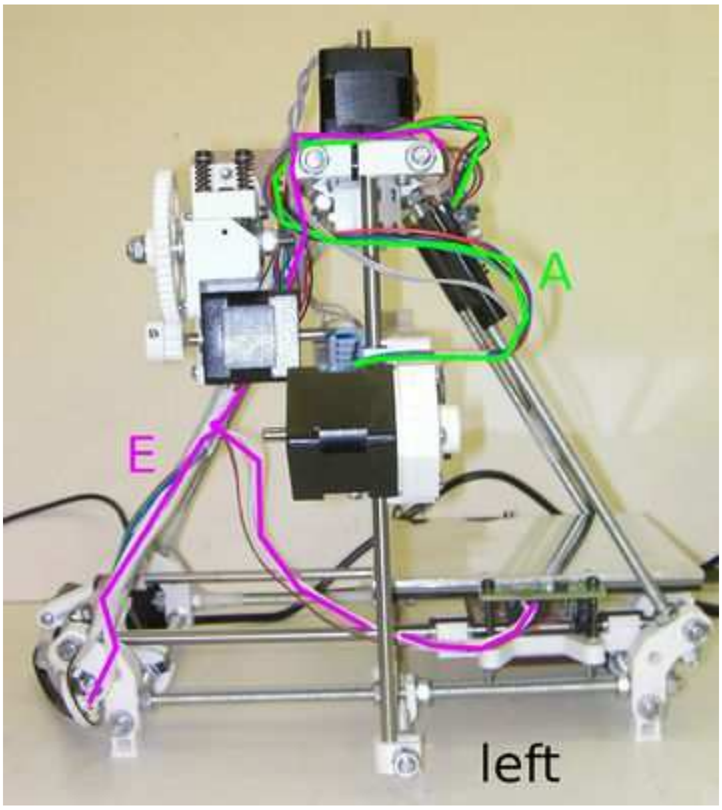
- Wire strippers
- Soldering iron
- Small screwdriver
- Vice

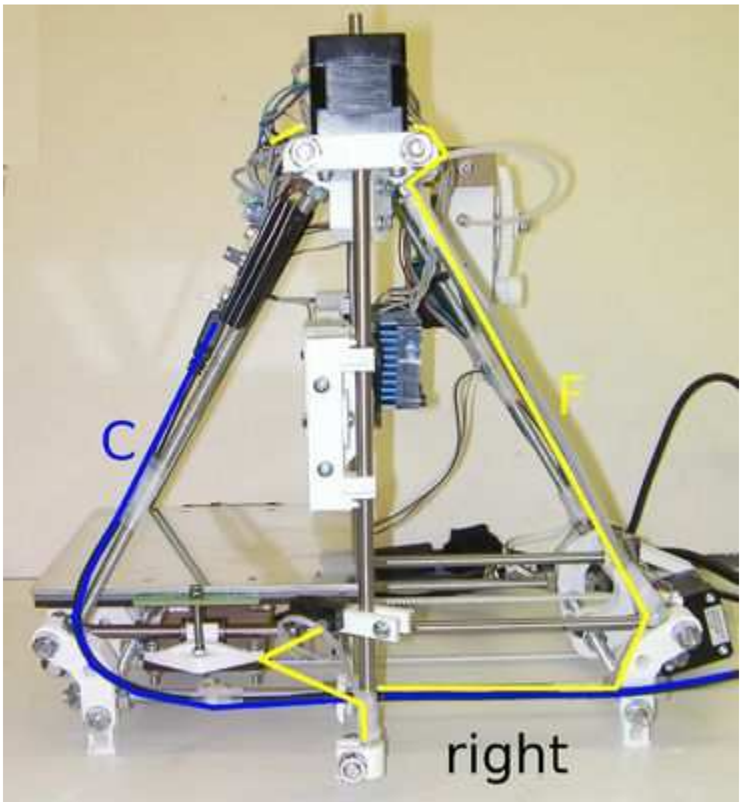
You will also need a reel of sticky tape.

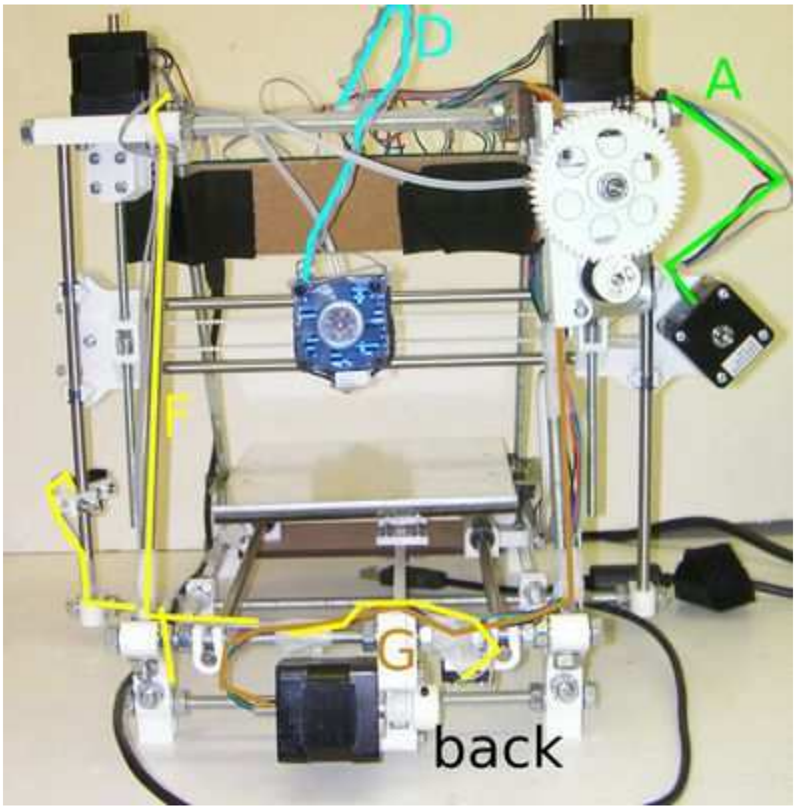
# Wire routes

These elevations show the wire routes round the machine. They are referred to in the individual sections below.



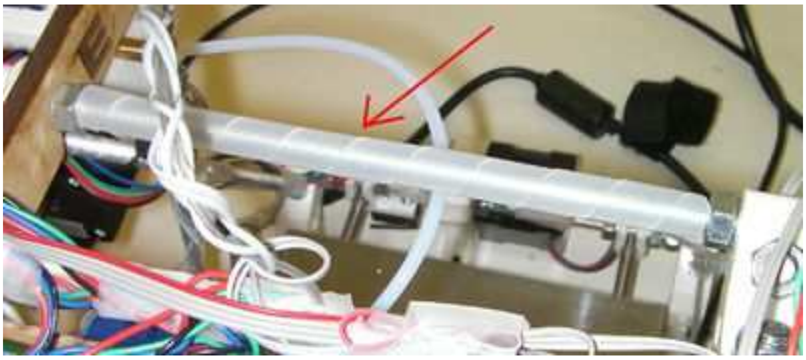

A
E
left


C
F
right




The wires will ultimately be attached using coil strip and cable ties. But at this stage attach then using sticky tape (the tape called "pressure tape" works well). If you do this you can build things up incrementally without sacrificing ties when you need to move a wire.

# Step 1: The PTFE tube shield



Run a length of the curled wire retaining strip along the back M6 threaded bar at the top. This should completely cover the threads. It prevents the extruder's PTFE tube from rubbing on them.

# Step 2: The controller

Take a piece of thick cardboard and draw round the main controller printed circuit on it. Cut out the shape with scissors.

Tape the main contoller PCB and the cardboard to the top of the frame as shown. First tape the card to the frame on its own, then tape the printed circuit to that. (Don't worry: the card is only temporary - you will throw it away later.)

Make sure that the card completely prevents the electrical connections on the back of the printed circuit from touching the metal frame.

Offset the printed circuit so that the USB connector (yellow in the picture) is just to the left of the right-hand angled threaded bar.

All the connectors along the top of the controller are labelled so you can get the right wires in the right connectors. The only exception is the extruder fan - this does not connect to the connector labelled "FAN"; that is for something else. See the extruder wiring section below for more information.

You will see that one power MOSFET has not been soldered to the board - the one for the heated bed. That is deliberate. The bed has its own power transistor.

Finally in this section, use a small screwdriver to turn the four motor-current-setting potentiometers at the left end of the controller board fully anti-clockwise, and then about $30^{o}$ clockwise from that. You want to start with a low current and adjust it upwards if need be, not the other way round.

# Step 3: Power

The power from the 19v power supply comes through the connector with positive in the centre and negative around the outside


You will need two power cables in the machine: one about 500 mm long for the controller board, and one about 400 mm long for the heated bed. Both connect to the socket above.

Strip the insulation from the ends of two power wire pairs. For the +19v ends strip about 5mm. For the 0v ends strip about 15mm.

Twist the +19v ends together and tin them. Put a length of heatshrink over both, then solder them to Pin 3 in the picture:


Run the heatshrink down over the pin and shrink it.

Twist the 0v ends together and push the result through Pin 1 , then across and through Pin 2. Keep it clear of Pin 3.

Solder these wires to both Pins 1 and 2. Trim off any excess.

Tape the power connector to the outside of the frame vertex to the left of the Y motor. Make sure no bare wires short on the frame. (The tape will be replaced with a permanent fixing later.)

The power wire to the controller board follows the upper path of route E.

Trim the wires to the right length (not forgetting the extra for strain relief - see above), strip the ends, and tin them.

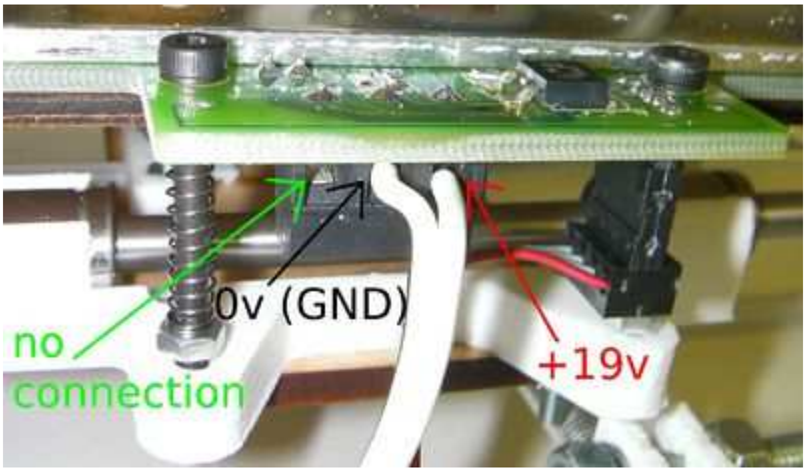
Now plug the power supply into the power connector. Make sure that neither of the free ends of the power leads can short on anything and connect a voltmeter to the ends that you are about to screw into the controller board.

Turn on the power, and make sure that you have +19v and 0v where you expect.

**Turn off the power and unplug the power supply.**


Screw the wires into the power connector of the controller. The 0v (GND) connection is on the **right**. The +19v is on the **left**. Check this again with a meter to the outside of the power connector and then to its middle pin.

The power wire to the heated bed follows the lower path of route E. Leave a generous loop so that the bed can run back and forth along its full travel. But don't make the wire so long that it catches on things. Tape it on and try different lengths by hand. Only cut it when its right.




Strip the ends, tin them, and screw them into the heated bed. The 0v (GND) connection is **in the middle**. The +19v is on the **right**. There is **no connection on the left**.

Check that 0v (GND) and +19v on the heated bed are connected to the corresponding points on the controller board with the meter.

# Step 4: The stepper motors

### Y

Start with the Y stepper wires. These follow route G on the pictures above. Gently twist the wires (not tight) so that they lie neatly together. Tape the wires to the frame every 60/70 mm.

From left to right the colour sequence of the Y-motor wires connecting to the controller is: Red, Blue, Green, Black.

Trim the wires to the right length (not forgetting the extra for strain relief - see above), strip the ends, tin them, and screw them into the "Y-MOTOR" controller connector.

## X

Next do the X wires. These follow route A. Again gently twist them. Allow a loop as shown - remember that this will have to accommodate the Z axis as it moves up and down.

From left to right the colour sequence of the X-motor wires connecting to the controller is: Red, Blue, Green, Black.

Trim the wires to the right length (not forgetting the extra for strain relief - see above), strip the ends, tin them, and screw them into the "X-MOTOR" controller connector.

## Extruder

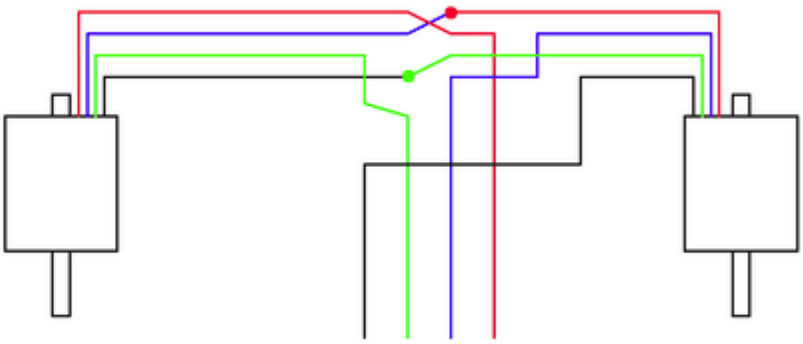
Next do the extruder motor wires. These follow the top of route E. Take care that the wires run clear of the extruder shaft attached to the big gear.

From left to right the colour sequence of the extruder-motor wires connecting to the controller is: Black, Green, Blue, Red (that is, the opposite sequence to X and Y).

Trim the wires to the right length (not forgetting the extra for strain relief - see above), strip the ends, tin them, and screw them into the "E-MOTOR" controller connector.

## Z

Finally in this section do the Z wires.



The Z-motor wires run along route B.

The two Z motors are connected in series as shown above. Cut two 20mm lengths of heat-shrink sleeving and put it on one of each pair of wires that will be connected together. Then twist the ends and solder them, then shrink the sleeving over the join.

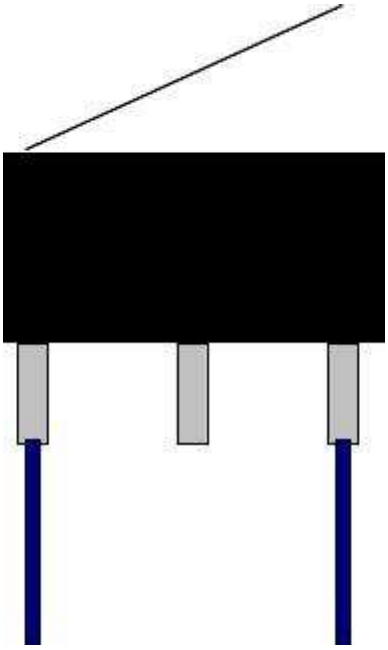
From left to right the colour sequence of the Z-motor wires connecting to the controller is: Black, Green, Blue, Red (that is the same as the extruder).

Trim the wires to the right length (not forgetting the extra for strain relief - see above), strip the ends, tin them, and screw them into the "Z-MOTOR" controller connector.

# Step 5: Endstops

Connect your endstops using two wires each. It is a good idea to use a different colour for each axis as this will make it easier to get the endstops connected to the correct input. The wires you cut from the stepper motors are different colours...

For the limit switch end, crimp or solder a terminal onto the end of the wires, then cover with some heatshrink to insulate the terminal. Connect to the outer pins of the limit switches (the NC = Normally Closed connections; RepRap expects the switch to open when the endstop is hit.)



The endstop switch holes should be drilled out to 3mm diameter so they can be mounted using #4x1/2" self tapping screws (alternatively, #2-56 and M2.2 screws will fit the switch, but are not included).

### Y

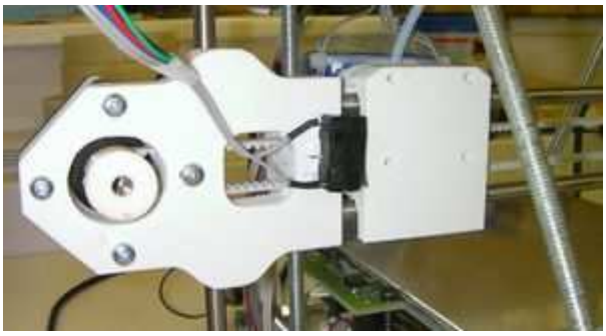
The Y endstop is mounted beside the Y motor:

Its wires follows route F.

Trim the wires to the right length (not forgetting the extra for strain relief - see above), strip the ends, tin them, and screw them into the "YSTOP" controller connector. They can be connected either way - they have no polarity.

## X

For the X endstop you will need the sticky pad from the extruder fan that you peeled off and saved. Cut a rectangle from it the size of the face of the switch and stick it on so that...



...it will be between the switch and the X-motor end of the X axis. Make sure that the sticky pad does not stick out and so foul the movement of the switch's lever.

Make a small hole in the sticky pad so that you can put a screw through the lower switch hole, then screw the switch to the X-motor end of the X axis.

The wires follow route A. Wind them loosely round the X motor wires.

Trim the wires to the right length (not forgetting the extra for strain relief - see above), strip the ends, tin them, and screw them into the "XSTOP" controller connector. They can be connected either way - they have no polarity.

## Z

The Z endstop switch is mounted using the "h" shaped printed clip on the right-hand smooth Z bar:

Leave a generous loop of wire between the switch and where you first attach it to the frame. You need to be able to move the "h" clip up and down to set the Z zero position.

The Z switch wires follow route F.

Trim the wires to the right length (not forgetting the extra for strain relief - see above), strip the ends, tin them, and screw them into the "ZSTOP" connector. They can be connected either way - they have no polarity.

# Step 6: Hot end

Separate the wires from the heater resistor and those from the thermistor.

Straighten the fan wire (it is quite stiff, and can get kinked). Wrap the heater resistor wires round the fan wire. It is neatest to do these together, one going clockwise and the other anti-clockwise.

Loop the heater and fan wires behind and over the top of the threaded bars across the top of the machine (the wires don't run between the bars). Give a generous loop - remember that the X axis has to run from end to end when the Z axis is at the bottom of its travel. Tape the wires to the middle of the front bar.

You marked the fan wires positive and negative when you cut the connector off them. Trim them to the right length (not forgetting the extra for strain relief - see above, and not forgetting which is positive and which is negative), strip the ends, and tin them. Loosen the power wires and and screw them and the fan wires back into the main power connector. **Make sure you get the polarity right.**

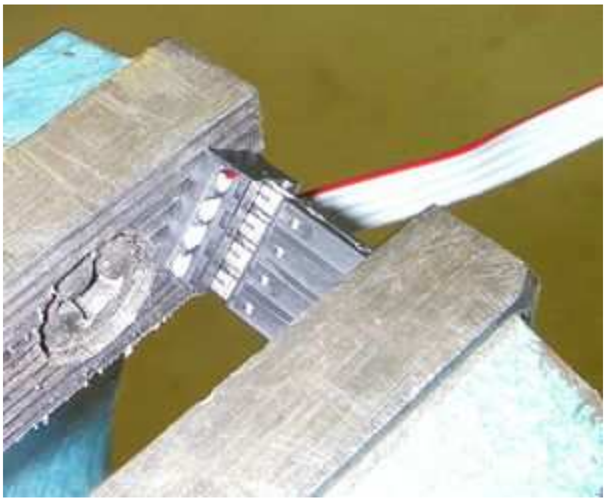
**The fan wires do not connect to the connector marked "FAN"**. That is for a different optional fan for cooling prints as they are being built from materials that require that.

Run the heater resistor wires to the "HOTEND" connector. Trim the wires to the right length (not forgetting the extra for strain relief - see above), strip the ends, tin them, and screw them into the "HOTEND" connector. They can be connected either way - they have no polarity.

Wind the thermistor wires round the fan wires in the same way as you did the heater wires. Run them to the "ETEMP" connector. Trim the wires to the right length (not forgetting the extra for strain relief - see above), strip the ends, tin them, and screw them into the "ETEMP" connector. They can be connected either way - they have no polarity.

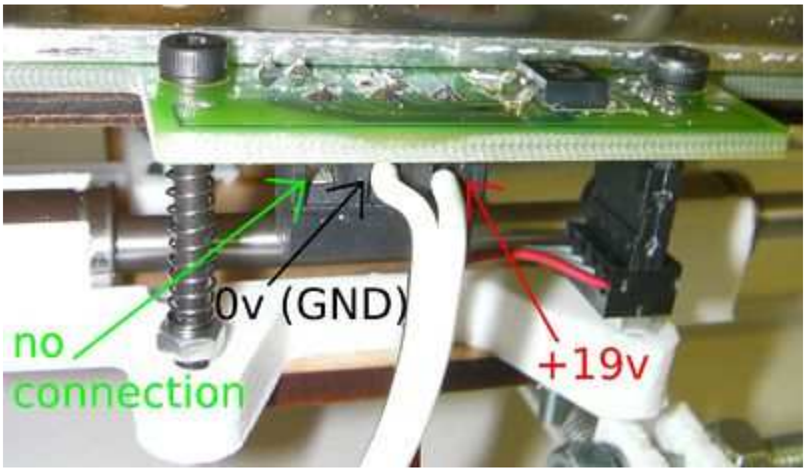
# Step 7: Heated bed signal wires

Take the 4-way ribbon cable. Separate the wires at one end for about 15mm.



Push the separated wires into the 4-way insulation displacement connector (IDC). There is no need to strip the wires. Use the jaws of the vice to push the connector together. Be gentle - don't damage the connector by pushing too far.

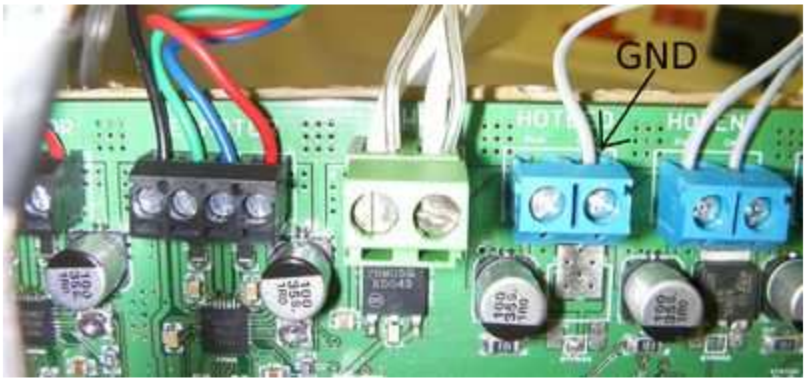
Plug the connector onto the 4-way pin header on the heated bed at the right in this picture:




The ribbon cable follows route E.

Only three of the four wires are used (the fourth is for a future enhancement for bed levelling for which your machine is already pre-configured). The unused wire is the nearest to you in the picture.

The next wire in is the signal that turns the heated bed MOSFET on and off. That needs to be connected to the the controller connector labelled "HOTBED". It needs to go to the side of the "HOTBED" screw connector labelled "GND":



As you can see, the side of the "HOTBED" connector labelled "PWR" is not connected to anything.

The final two wires (the two furthest away in the first picture) go to the connector labelled "BTEMP". The wire connected to the innermost pin on the heatbed PCB is GND. This should be screwed into the BTEMP connector, in the side nearest the ETEMP connector. The next wire in the ribbon cable connects to the other side of the BTEMP connector.

# Step 8: USB cable

The USB cable plugs into the mini-USB connector beside the SD card socket on the controller. The cable follows route C.

# Step 9: Double check

Use your meter to double-check the power connections.

Make sure that 0v (GND) - the outside of the power connector - runs to the places in the circuitry that you would expect (for example the case of the SD card socket).

Check that the +19v wires run from the central pin on the connector to the right places on the circuit boards.

Check the continuity of the connections to the heated bed with a meter from the screw connections on the controller board to the little blobs of solder on top of the 4-way connector. If you have open-circuit problems, it may be the IDC. A neat trick with this to rectify an open circuit (thanks to Alan Ryder) is gently to pull the IDC apart, take the wires out, strip them, and tin them. Then reassemble - the tinning ensures good contact with the IDC blades. This is only worth doing if you have problems with the simple method, though.

# Next step

Commissioning

# RepRapPro Huxley Sanguinololu wiring

## From RepRapWiki



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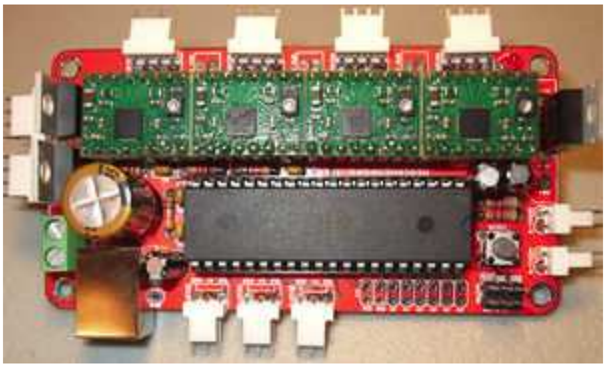
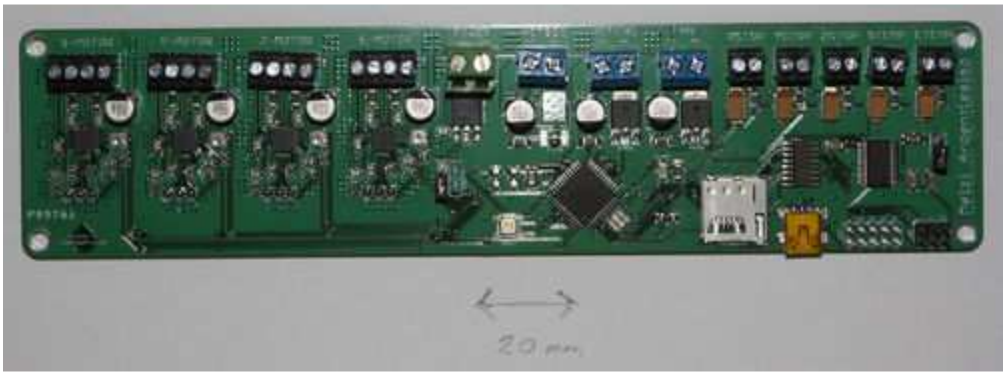
# Alternative

This page describes how to wire up a RepRapPro Huxley that is to be fitted with Sanguinololu Electronics that look like this:



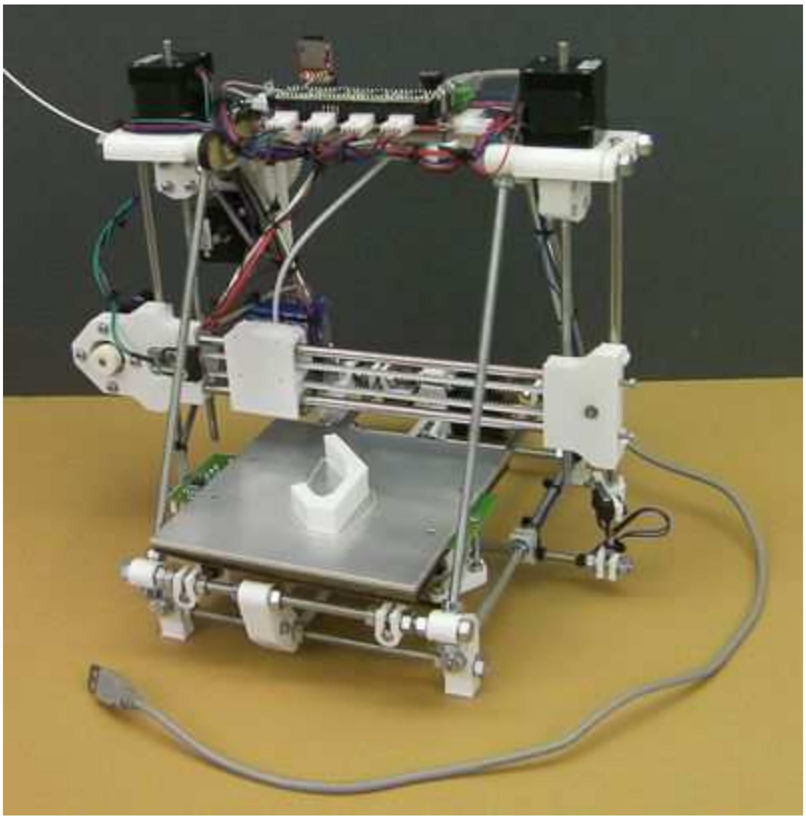
There is a parallel page that describes how to wire up a RepRapPro Huxley that is to be fitted with Melzi Electronics that look like this:



Follow this link for the alternative Melzi wiring page.

# Goal

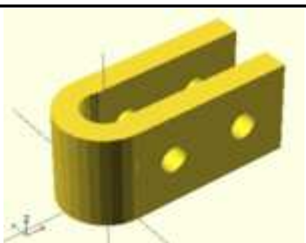
By the end of this stage your machine will look like this (except for the printed part on the bed...) and it will be ready to commission.



# Tools

- Wire strippers
- Soldering iron
- Ratchet crimp tool (Rapid Online (http://www.rapidonline.com/Tools-Equipment/Ratchet-Action-Crimp-Tool-Ht225d-85-0262) )
- Small screwdriver
- Multimeter
- Vice

# Parts

| RP parts | Quantity | |
|---|---|---|
|  | 4 |  |
|  | 1 | |
| **Hardware** | **Quantity** | |
| M3 x 20mm screws | 4 | |
| M3 x 25mm screw | 1 | |
| M3 nuts | 5 | |
| M3 washers | 10 | |
| 5mm lengths cut from 3mm i.d. PVC tube | 4 | |
| Power connector (not shown - see below) | 1 | |
| Cable ties | About 50 | |

You will also need the Sanguinololu PCB, wire (the leads for the motors are long and will be cut - use the spare lengths) and a reel of sticky tape.

# Important: general rules for wiring up

You will do serious damage to your RepRap electronics if the power is connected backwards. Other damaging mistakes are to short out high-current devices like motors and heaters, and to connect high-voltage devices like stepper drivers to signal inputs like temperature sensors.

So - **in the sections below where it tells you to check things - please check them thoroughly**. It is worth taking the time...

The connections to the RepRapPro Huxley Sanguinololu controller are made using crimp connectors. These require no soldering. If you don't have a crimp tool, there's a video from Nophead here that shows how to manage without:

When wires leave a device (like a motor) or arrive at a connection (like the screw connectors on the controller) leave a small slack length (about 20mm long) for strain relief - don't have the wires taut.

There are two strategies for attaching wires to the frame:

1. Run the wires along their routes and attach them with sticky tape. Then when everything is finished go round the machine removing the sticky tape and replacing it with cable ties.
2. Use cable ties from the start, and forget the sticky tape.

The first option takes longer, but allows you easily to correct mistakes without wasting cable ties. The second is quicker, but you will find you have to cut the odd tie and throw it away to edit what you have done.

**Neatness is everything.** Organising and attaching the wires tidily to the machine will produce a reliable result. A kitten's ball of wool will not.

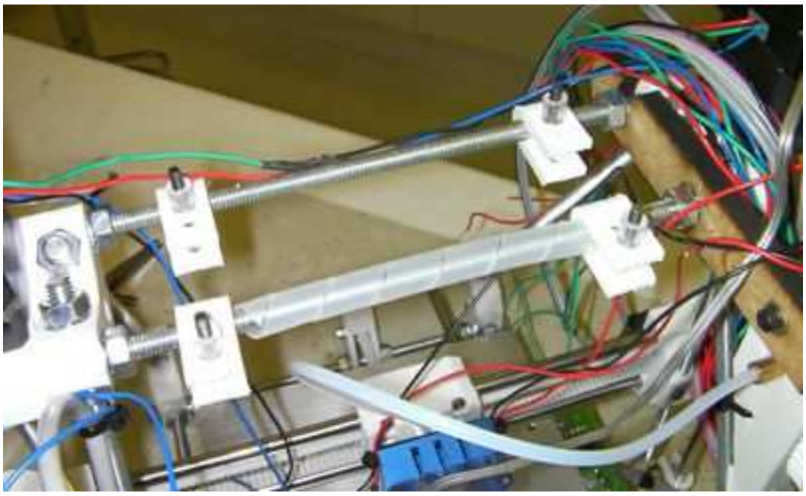
Finally, when making any changes to the wiring or any other electrical aspect of the machine, **first disconnect both the power and the USB**.

# Overview

What you are going to do is:

1. Fit the Sangiuinololu PCB to the top of the RepRapPro Huxley
2. Run the wires from all the electrical devices in the machine up to that PCB
3. Trim the end of the wires to the right lengths, fit connectors on them, and connect them to the PCB

# Step 1: Mounting the Sanguinololu PCB



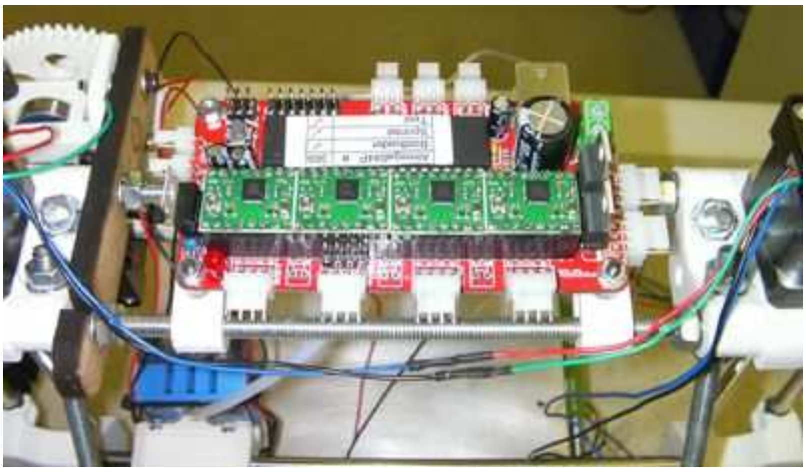
This view is looking from the **back** of the machine where the Y motor is.

Clip the four printed PCB mounts to the top of the frame. Offer up the PCB and look through its mounting holes to get the gap between them right.

Put the M3 screws through from underneath with washers between the heads and the printed parts. At the front of the machine the screws go through the holes nearest the M6 bar. At the back they go through the holes that are away from the M6 Bar.

Slip the 3mm PVC tubes over the screw threads - friction should hold the screws up, but if it doesn't use a little sticky tape.

Cut a length of coiled cable retainer and fit it between the back mounts as shown. This stops the PTFE filament tube to the extruder hot end rubbing on the threads.



This view is looking from the **front** of the machine - the other way from the view above.

Put the PCB over the ends of the screws as shown with the four big connectors facing the front, put four washers on, and then four nuts.

When doing up the nuts, take great care that the M3 spanner that you use does not hit and damage any of the electronic components on the PCB. Don't do the nuts up too tight. They want to compress the PVC a little to give a firm fit, that is all.

# Step 2: Power

The power from the 19v power supply comes through the connector with positive in the centre and negative around the outside


You will need two power cables in the machine: one about 500 mm long for the controller board, and one about 400 mm long for the heated bed. Both connect to the socket above.

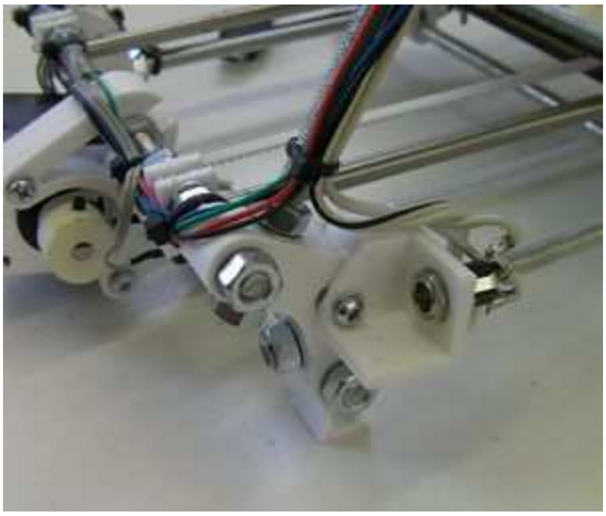
Strip the insulation from the ends of two power wire pairs. For the +19v ends strip about 5mm. For the 0v ends strip about 15mm.

Twist the +19v ends together and tin them. Put a length of heatshrink over both, then solder them to Pin 3 in the picture:


Run the heatshrink down over the pin and shrink it.

Twist the 0v ends together and push the result through Pin 1 , then across and through Pin 2. Keep it clear of Pin 3.

Solder these wires to both Pins 1 and 2. Trim off any excess.



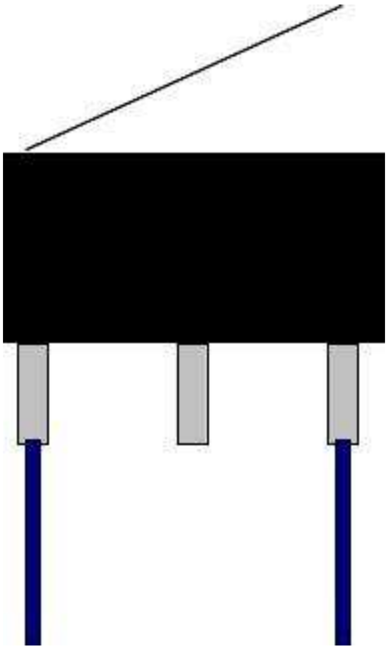
Attach the power socket to the power connector clip then use the 25mm M3 screw to attach this to the back left bottom frame vertex as shown. You can see the Y motor in the picture to give the location. Use washers under both the head and nut of the screw.

The picture shows the wires clipped to the frame - that is done in the next section but one.

# Step 3: Endstops

Connect your endstops using two wires each. It is a good idea to use a different colour for each axis as this will make it easier to get the endstops connected to the correct input. The wires you cut from the stepper motors are different colours...

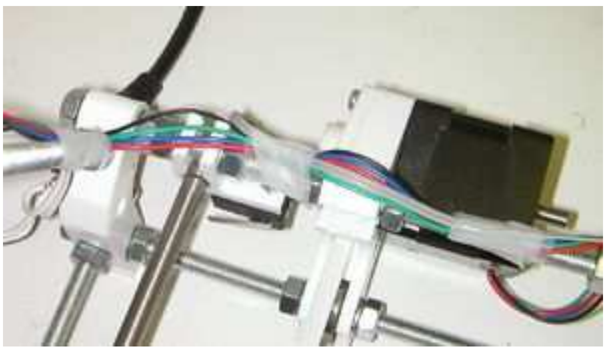
For the limit switch end, crimp or solder a terminal onto the end of the wires, then cover with some heatshrink to insulate the terminal. Connect to the outer pins of the limit switches (the NC = Normally Closed connections; RepRap expects the switch to open when the endstop is hit.)



The endstop switch holes should be drilled out to 3mm diameter so they can be mounted using #4x1/2" self tapping screws (alternatively, #2-56 and M2.5 screws will fit the switch, but are not included).

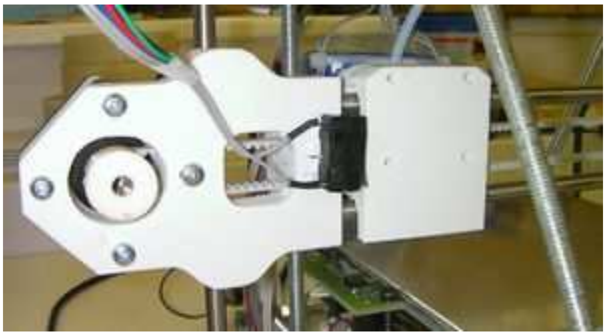
### Y

The Y endstop is mounted beside the Y motor:



### X

For the X endstop you will need the sticky pad from the extruder fan that you peeled off and saved. Cut a rectangle from it the size of the face of the switch and stick it on so that...



...it will be between the switch and the X-motor end of the X axis. Make sure that the sticky pad does not stick out and so foul the movement of the switch's lever.

Make a small hole in the sticky pad so that you can put a screw through the lower switch hole, then screw the switch to the X-motor end of the X axis.

### Z

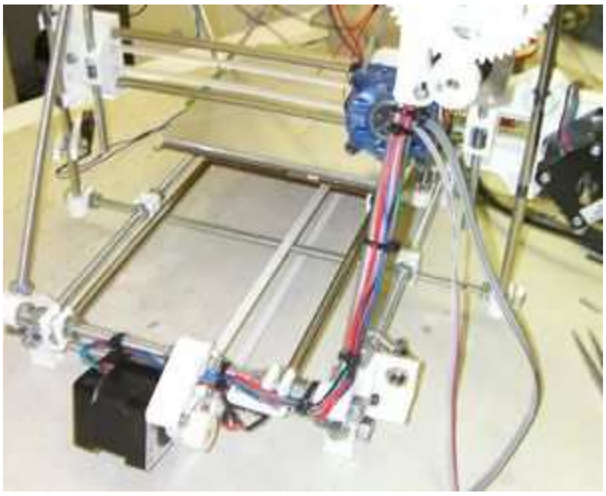
The Z endstop switch is mounted using the "h" shaped printed clip on the right-hand smooth Z bar:

Leave a generous loop of wire between the switch and where you first attach it to the frame. You need to be able to move the "h" clip up and down to set the Z zero position.

# Step 4: Clipping wires to the frame

**Important: don't trim any wires shorter until you come to connect them all to the Sanguinololy PCB in the next section.**

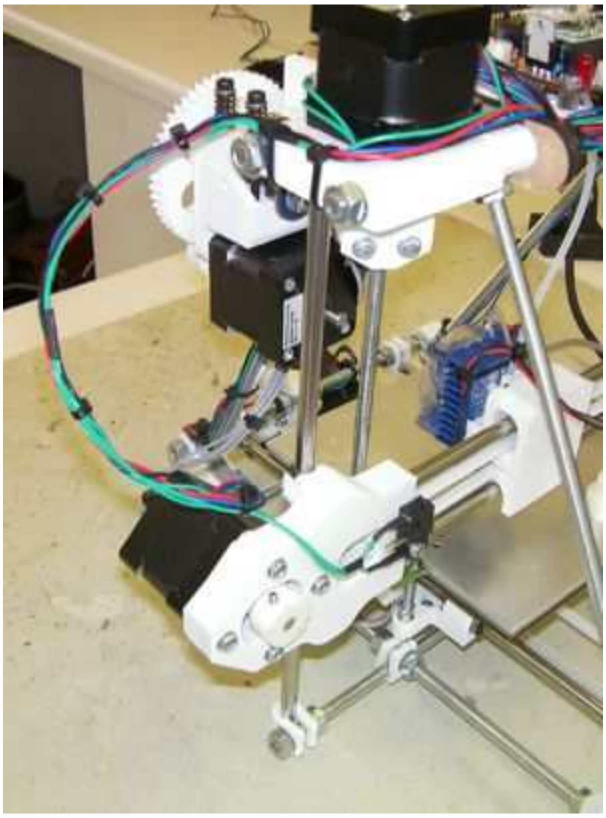
## Y axis and power



Run the Y stepper motor wires, the Y end-stop wires and both power wires as shown in the picture. Use cable ties to clip them to the rods up as far as just under the extruder drive.

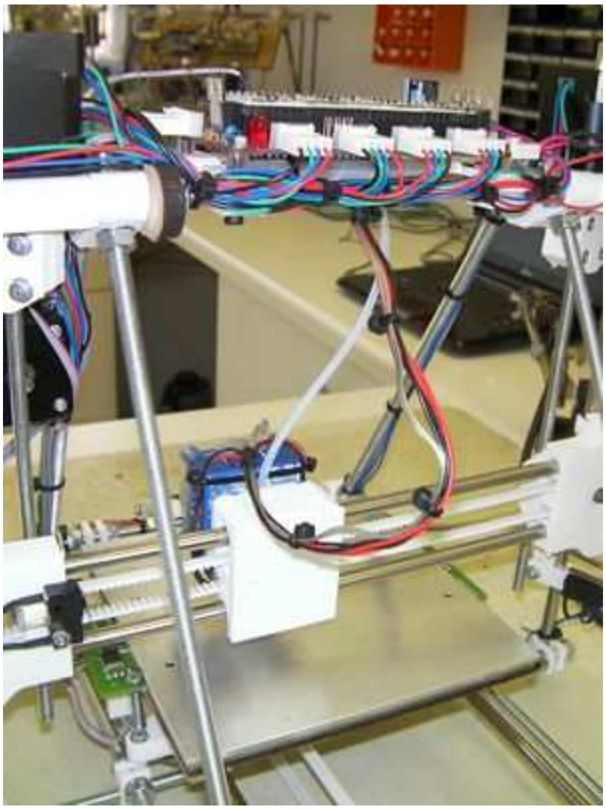
Run all those wires **except the bed power wire** up beside the extruder drive motor and up just behind the left-hand Z motor. Take care that the wires run clear of the extruder shaft attached to the big gear. Don't put any ties on them yet.

## X axis



Next do the X motor and endstop wires as shown. Allow a generous loop so that the full range of Z movement can be accommodated.

## Extruder



This picture is looking from the front of the machine.

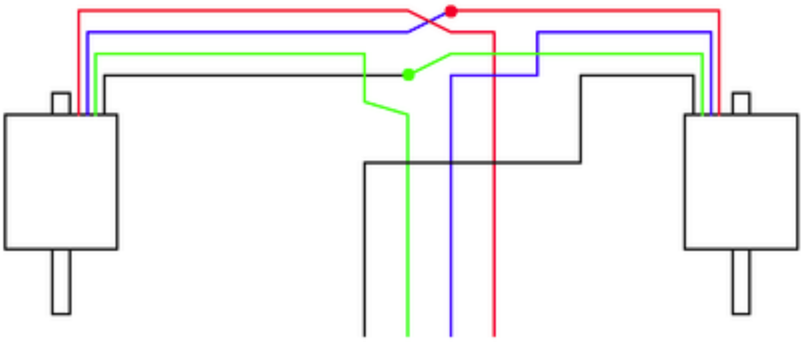
Next do the extruder motor wires. Again allow a generous loop to permit full X movement at the bottom of the Z travel. Also make sure that the wires are clear of the PTFE tube down which the filament moves. **Under no circumstances attach the wires to the tube anywhere along its length.**

## USB cable and Z end-stop switch

Run the USB cable and Z end-stop wires as shown.

## Z motors

Next in this section do the Z wires.

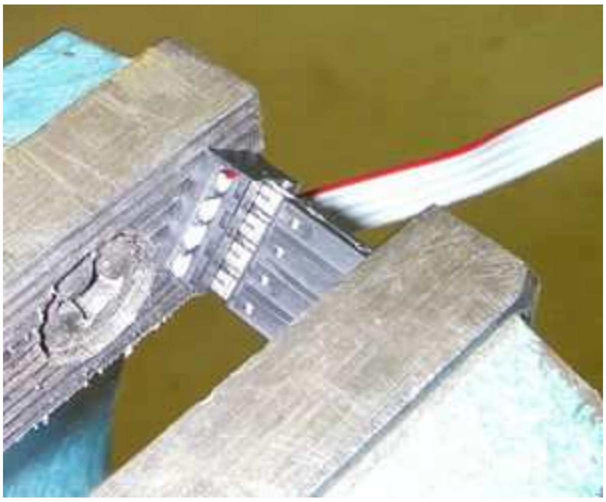


The two Z motors are connected in series as shown above. Cut two 20mm lengths of heat-shrink sleeving and put it on one of each pair of wires that will be connected together. Then twist the ends and solder them keep the heat shrink well away), then shrink the sleeving over the join.

Run the Z wires along the front under the 4-way connectors (see the picture for the extruder connection above). Have the four wires emerge by the Z connector.

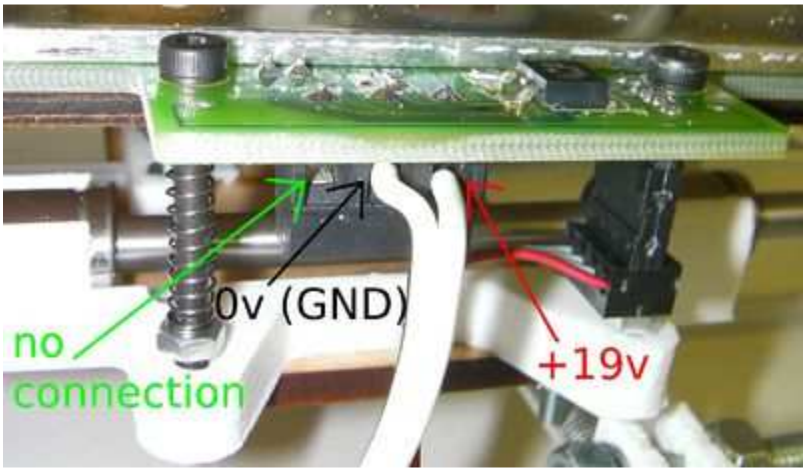
## Heated bed signal and power wires

Take the 4-way ribbon cable. Separate the wires at one end for about 15mm.



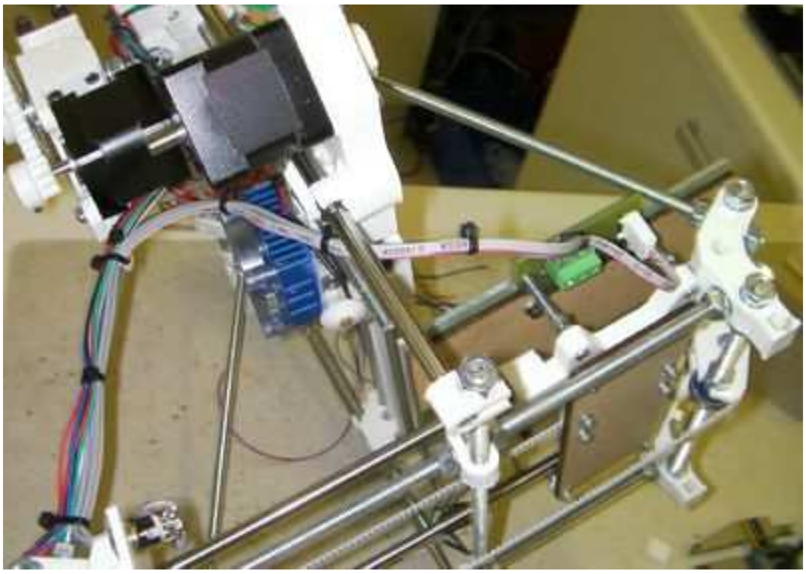
Push the separated wires into the 4-way insulation displacement connector (IDC). There is no need to strip the wires. Use the jaws of the vice to push the connector together. Be gentle - don't damage the connector by pushing too far.

Plug the connector onto the 4-way pin header on the heated bed at the right in this picture:




Only three of the four wires are used (the forth is for a future enhancement for bed levelling for which your machine is already pre-configured). The unused wire is the nearest to you in the picture.

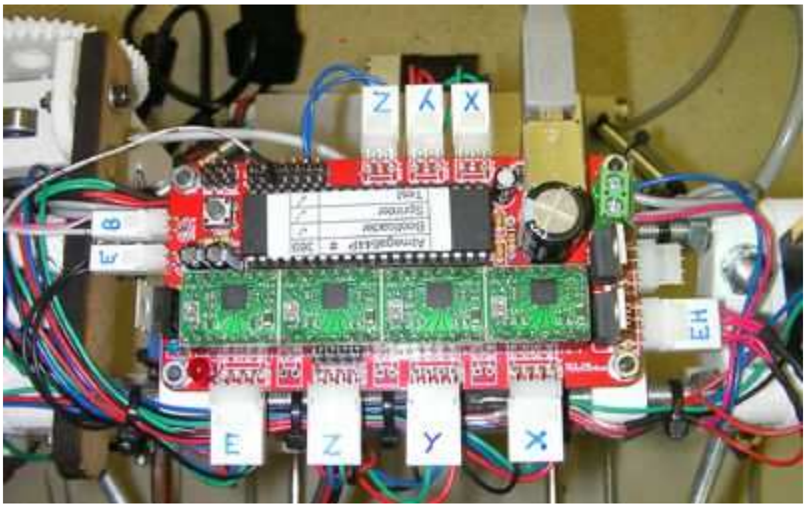
Connect the power wires as shown to the three-way connector. Only two of the connections are used.



Run the ribbon cable and the bed power wire as shown. Pass the ribbon cable up through past the extruder motor. You can now clip this to the frame beside the extruder motor along with the other wires already running there.

# Step 5: Connecting all the wires to the Sanguinololu controller

**Don't have any wires pulled taut - allow a loop for strain relief.**




This is a plan view of the Sanguinololu controller. The front of the RepRapPro Huxley is at the bottom of the picture. Click on the image for a blown-up version.

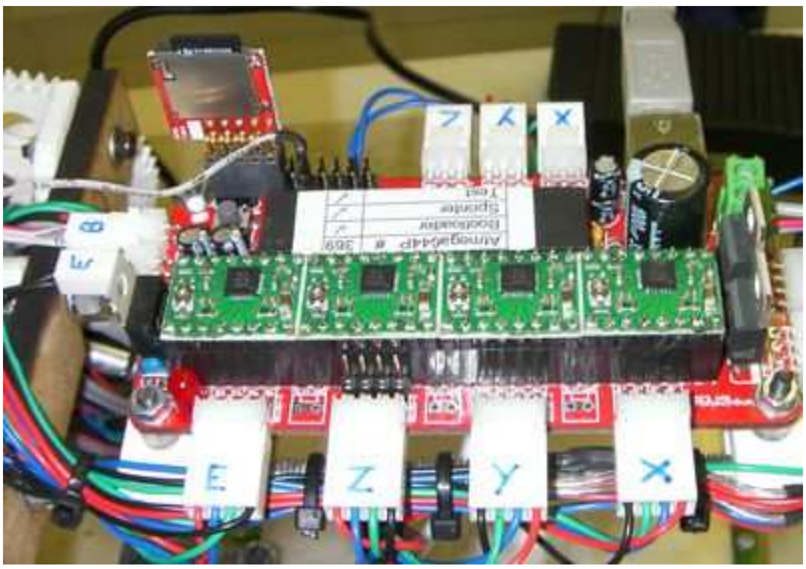
Start with the power wires. These go to the screw connector next to the USB socket. The fan wires also screw into this connector. **Make sure you get the polarity right.** The red wire in the picture is going to +, the blue to -. You marked the fan polarity when you built the hot end. Double check with a meter that the + connection goes to the middle pin of the power connector. Then plug the power supply in **but don't turn it on**. Now check that the - connection on the Sanguinololu controller goes the the cylindrical outer shell of the plug on the power supply, a few mm of which will be projecting to allow you to prod it with a meter probe.

The four wire ribbon cable from the hotbed needs to be split. The four wires are (from the outermost edge of the bed): Probe Sensor, Heater, Thermistor, Ground. The sensor isn't supported for now and isn't connected anywhere. See below for the other three.

Next trim wires to length, fit connectors onto them and plug them in as follows (labels from the photograph) anticlockwise round the PCB:

1. X, Y, Z at the top of the picture: the end-stops. The connectors are 3-way; just use the outer two connections. There is no polarity - you can wire the end-stops either way round.
2. Grey wire going to the third pin on the bottom row (inner row, next to Atmega) of the long connector at the top (to the left of the end-stop connectors): the bed heater control. (There is a 5V signal when the hot bed needs to heat up, otherwise 0V).
3. Connectors B and E: the bed thermistor and the hot-end thermistor respectively. There is no polarity on the hot end thermistor (you can wire this either way round), **HOWEVER** the bed thermistor wires need to go in the correct orientation. The wire from the ribbon cable connected to the innermost pin on the heatbed is GND. Make sure this is connected to the GND pin of the bed thermistor input on the Sanguinololu PCB (the pin nearest the other thermistor connection).
4. Connector E at the bottom of the picture: the extruder motor. Wire sequence left to right: red, blue, green, black.
5. Connector Z at the bottom of the picture: the Z motor. Wire sequence left to right: red, blue, green, black.
6. Connector Y at the bottom of the picture: the Y motor. Wire sequence left to right: black, green, blue, red.
7. Connector X at the bottom of the picture: the X motor. Wire sequence left to right: black, green, blue, red.
8. Connector EH on the right: the hot-end heater resistor. For a pro job, solder a Y on the end of each wire and insulate it with heat-shrink as shown, then put all four connections in, one Y in the bottom two, one in the top two. There is no polarity - you can wire each pair either way round. (The double connections reduce current concentrations in the PCB.)

Finally, plug in the SD-card reader:



# Step 6: Double check

Use your meter to double-check the power connections.

Make sure that 0v (GND) - the outside of the power connector - runs to the places in the circuitry that you would expect (for example the case of the SD card socket).

Check that the +19v wires run from the central pin on the connector to the right places on the circuit boards.

Check the continuity of the three active bed control wires with a meter from the connections on the controller board to the little blobs of solder on top of the 4-way connector on the heated bed. If you have open-circuit problems, it may be the insulation-displacement connector (IDC). A neat trick with this to rectify an open circuit (thanks to Alan Ryder) is gently to pull the IDC apart, take the wires out, strip them, and tin them. Then reassemble - the tinning ensures good contact with the IDC blades. This is only worth doing if you have problems with the simple method, though.

# Step 7: Final tidy

Go round adding extra cable ties (and clipping the tails off the ones you've missed) to get the wiring as neat and tidy as you possibly can.

# Next step

Commissioning


Categories: Build Instructions | RepRapPro

- This page was last modified on 8 May 2012, at 15:37.
- 

# RepRapPro Huxley commissioning

### From RepRapWiki

| Introduction | Frame assembly | Y axis assembly | X axis assembly | Z axis assembly | Heated bed assembly | Extruder drive assembly |

| Hot end assembly | Wiring | **Commissioning** | Printing | Maintenance | Troubleshooting | Improvements |

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# Goal

By the end of this stage, your machine will be ready for its first print.

# Tools

- An object with a measured height (we use a length of 6mm diameter silver steel - the shank of a drill bit works well too).

# Step 1: Communication

Before you start trying to talk to your machine, you need Python and the dependencies. Windows users please note that you install the 32-bit versions of all the Python software even if you have a 64-bit machine (that is to say, do exactly what it says on the following link). Go here for instructions:

https://github.com/kliment/Printrun/blob/master/README.md

## USB Driver

For Windows, without the main power supply plugged in, set the PWR-SEL jumper on your controller board to USB and plug the controller into a USB port on your computer. Does the computer complain that it has no driver for the USB device? If so, unplug the USB, then install this driver (http://www.ftdichip.com/Drivers/CDM/CDM20814_Setup.exe) . Then, when you plug the controller in, it should register as a COM port on your computer.

Linux systems should recognize the controller straight away with no need for driver installation. The controller will automatically appear as something like `/dev/ttyUSB0` when you plug it in.

Mac users should select a driver appropriate to their machine from: http://www.ftdichip.com/Drivers/VCP.htm.

## Start talking

The first thing to establish is that you can communicate with your machine. You will need to install and run the RepRappro Pronterface software, which you will find in our github repo here (https://github.com/reprappro/Software) . The button to download a ZIP file is near the upper left.

Connect your RepRap to a USB port on your computer, then run pronterface.py.

The very first time you run Pronterface, select the correct print profile by navigating to the Settings menu, and selecting Slicing Settings. Then select the relevant profile for the material with which you plan to print. For the PLA supplied with RepRap this is **Huxley-PLA-05-03**. Select "Save all" then close the window and return to the printer interface software.

Now select the active serial port in the upper left, choose 250000 for the baud rate. Click Connect, wait a moment, and the software will confirm when the printer is online.

Press the GET POS button, and if the machine returns a position of X0.00 Y0.00 Z0.00 your serial communication is functioning correctly.

NOTE: If your pronterface window does not display the custom buttons (GET TEMP, GET POS, ... ), you most likely have another copy of .pronsolerc in your home folder. Delete this file and reload the software. You should now see the extra buttons.

# Step 2: Axes

## Motor movement

Begin by turning the current-limit potentiometers on the stepper drivers fully counter-clockwise.

DO NOT CONTINUE WITHOUT CHECKING CURRENT LIMITS!

If limits are not set, the driver boards will most likely be destroyed.

Plug in your power supply. Watch for smoke in case something has gone horribly wrong! Also, make sure that the motors aren't getting hot. With the current limit all the way down, they should be cold to the touch.

### Melzi adjustment

The current to each motor is controlled by the miniature potentiometer (or trimpots, circled below) beside the stepper-driver chips on the left of the controller board. Use a small screwdriver to turn each one fully anticlockwise (don't force them - they should turn freely). Then turn them clockwise by about $30^{o}$.

The rightmost circle at the green

terminal block is GND (not a trimpot).

Connect power to your electronics, then using a multimeter, tune the trimpots to provide 1 Amp to each of the stepper motors. The trimpot dial is connected to the REF pin on the A4988 stepper driver ic. The RepRap's stepper motors are rated to 1 Amp, which equates to 0.4v on the REF pin of the A4988 stepper drivers. You can connect the ground probe (usually black) of your multimeter to the GND pin of the power input screw terminal (green, with the GND screw circled in red), and connect the positive probe (usually red) to each of the trimpot dials in turn.

**Sanguinololu adjustment**

The adjustment of the Pololu stepper drivers that go on the Sanguinololu board is described here on the Pololu site (http://www.pololu.com/catalog/product/1182) . See the section called *Current Limiting*. But ignore the bit on that page about the reference voltage being measured at a via - the easiest place to measure it is on the rotating metal part of the trimpot itself.

Adjust the trimpots to 0.4v by slowing turning clockwise while checking the voltage reading with a multimeter.

**Then for both Melzi and Sanguinololu**

Now type:

G1 X5 F500

in the field below the log window and click Send. The X-motor should move to 5mm in the positive direction (X5) at 500mm/min (F500).

Now type:

G1 X0 F500

and send. The X-motor should move back to its starting location (X0). If you find that your machine will not move in the negative direction, your endstops are probably not wired correctly. Refer to the Huxley wiring page or the Mendel wiring page to check your wiring.

Repeat the above test for the other three axes. For each axis test, replace the X in the above command with the relevant axis letter (Y,Z,E), but for Z make the feedrate 200 mm/minute:

G1 Z5 F200

You may find that some axes judder, or whine but don't move. This means that their current is set a little too low.

**Turn off the power**, then rotate the appropriate potentiometer **just a little** clockwise. Put the power back on and repeat the tests above.

# Motors going backwards

RepRap works with right-handed Cartesian coordinates. That is to say that looking down on the bed from the front of the machine X runs from left to right, and Y runs from front to back (like a graph). Z runs up towards the top of the machine.

Remember that it is the movement of the printing head that counts: when Y increases, the bed will move towards you.

If you find that an axis is backwards, it is simple to reverse its motor: just power down and then reverse the order of its wires into the controller, so, for example, [black, green, blue, red] goes to [red, blue, green, black]. **Don't forget to turn the power off before disconnecting and connecting wires.**

## Endstops

To test the endstops, repeat the above test for the X, Y and Z axes in turn, this time with a much slower feed and a larger negative distance, for example

G1 X-20 F100

As soon as you press Send and the axis begins to move, activate the relevant limit switch to halt movement of the axis. If activating the switch does not halt your axis, check your wiring (Huxley here or Mendel here).

## Homing

You are almost ready to home your machine. Before doing so, ensure the Z endstop is high enough on the Z smooth rod to trigger the switch without the head ploughing into your heatbed.

Press the HOME ALL button and your machine will find its reference position at X0 Y0 Z0.

# Step 3: Alignment

## Level the X axis

Use digital callipers to measure the height of the X rods above the Y rods (move the carriages out of the way if needs be). Turn the Z motors until the X axis is level.

## Level the bed

One of the major differences between the standard pronterface and the eMAKER version is the way the machine is manually controlled. You have five buttons which enable you to position the head above the four corners of the bed and over the centre. The Z axis can be moved in increments of 0.1mm, 1mm and 10mm. The E axis can be moved by the amount specified in the distance spin control. The speed of manual moves can be specified in the spin controls above the manual move buttons.

To level the bed, move the head up such that you have at least the height of your measured object between the head and the bed. Then position the head in the centre and bring it down gradually until it is almost touching the object. Moving the head to each corner, adjust the three M3x30mm cap head screws by which the heatbed is mounted in order to level the bed. The nuts on the M3 screws need to be tight against the spring mounts.

After you have leveled the bed you should add a drop of superglue to the outside of each of the levelling nuts to minimize the shaking as the bed moves. Its actually good if some gets into the threads; you can still adjust be bed height, but it won't creep around by itself.

## Set your Z height

With the head at Z0, the tip of the nozzle should be within a paper thickness away from the surface of the bed. To achieve this, follow the sequence:

- HOME ALL
- Send the following command: G1 Zz F200, where z=the height of your measured object.
- CENTRE
- Check that the head is within 0.3mm of your object.
- For Huxley, adjust the height of the Z axis endstop, or for Mendel rotate the adjustment screw, and repeat until your height is set.

# Step 4: Heaters

Tick the monitor check box to report the temperatures of your heatbed and nozzle. Ensure that the readings are similar to the ambient temperature of the room.

## Heatbed

Command the heatbed to 45C (warm), tick the monitor checkbox and verify that the heatbed temperature reading rises and stabilises around 45C, and that the heatbed is actually warm.

## Hot end

Command the nozzle to 100C and watch the temperature rise, overshoot and eventually settle around 100C. Keep an eye on the nozzle during this test. If you see lots of smoke come out of the hot end, turn off the heater. Repeat the test with a target temperature of 200C. The nozzle should reach the target temperature in about 1 minute or less and settle within a couple of degrees of 200C.

The nozzle heater resistor has a lot more power than is necessary, so the the control parameters are set to limit the available power. For the nozzle to reach a target temperature quickly, with minimal overshoot and fast settling time, the integral windup must be tuned for the target temperature. By default, this is set to 80 by the firmware, but the start_PLA.gcode and start_ABS.gcode files should set the appropriate value for that material. This is achieved by the following line:

M301 Ww, where w = 0-255. A higher value means more power available to the nozzle heater.

So, if your nozzle does not reach the target temperature, gradually increase W until the desired performance is reached. W=120 is not uncommon for PLA, and W=180 for ABS.

Once you have tuned this value to your print material, enter it into the relevant start.gcode file. These files are in the directory:

**skeinforge/skeinforge_application/alterations/**

beneath wherever you have installed **pronterface**.

# Step 5: Extruder

Once you have verified the nozzle behaves as expected, you can carry out a test extrusion by hand. Remove the brass bowden start piece from the extruder block and feed some PLA into the tube until it reaches the nozzle (beware of the filament snagging on the short piece of PTFE tube inside the barrel). Command the nozzle to 205C, and once it has reached and settled there, push the filament through and watch it extrude. The extrusion should be maintained with a steady but not excessive force.

Pull out the filament and reassemble the bowden tube for a test of the extruder drive mechanism. This time, click on IDLE or send an M84 command, and rotate the gears whilst feeding some PLA filament in through the extruder drive mechanism. Repeat the extrusion test, this time by manually rotating the large gear.

Finally, try extruding material by commanding the E axis. 200mm/min is a good speed.

# Next step

PRINT!


Categories: Build Instructions | RepRapPro | Huxley | Huxley Development

# RepRapPro Huxley printing

### From RepRapWiki

| Introduction | Frame assembly | Y axis assembly | X axis assembly | Z axis assembly | Heated bed assembly | Extruder drive assembly |

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- 2 Warming up
- 3 Preparing a file to print
- 4 Starting a print
- 5 Your first print
- 6 Tuning your printer
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- 8 Profiles
- 9 Changing Filament


# Introduction

RepRapPro 3D printers are being sold as a complete printing solution, as such the RepRapPro host software comes with pre-tuned print settings for PLA and ABS filament. We encourage people to play with and put forward improvements to the print settings, but would advise starting with the provided print profiles and working from there.

# Warming up

The provided print profiles include a startup routine which will prepare the printer before the print starts. This routine does not include a command to wait for the heatbed to reach the desired temperature, (this is because the heating of the bed can take up to 20mins for ABS printing, and it would be quite disconcerting for the printer to sit there for ages apparently not doing anything and for it to suddenly start after all this time).

So before starting a print, you will need to heat the bed to a suitable temperature for printing:

Huxley: 95C for PLA and 140C for ABS, (bed temperatures are not calibrated on the top surface of the bed, so these values may appear rather high to some people).

Mendel: 65C for PLA and 110C for ABS.

# Preparing a file to print

Your 3D model will need to be processed into a format which the printer understands. This is known as a GCode file (print commands are GCodes, see this reference).

Before you can process a 3D model, you may need to tell Pronterface where to find the slicing tool. Click on Settings | Options and check that slicecommand and sliceoptscommand point to the location of your slicing tool. These will normally be:

```
python ./skeinforge/skeinforge_application/skeinforge_utilities/skeinforge_craft.py $s
```

```
python ./skeinforge/skeinforge_application/skeinforge.py
```

respectively. The pronterface software includes a customised copy of skeinforge in the subdirectory called ./skeinforge .


The 3D model will need to be in the STL file format. The software will load either a pre-processed GCode file or an STL 3D model. Click on Load file and select an STL file to process it. You will see progress of this process in the log window.

Once complete, the log will indicate how much filament will be used to print the model. You can then either print direct form USB or copy the file to the MicroSD card in the machine.

If printing from USB, your .gcode file will have been automatically loaded.

It is recommended, however, to print from the MicroSD for a number of reasons. When printing from USB, the print can be adversely affected by the host PC giving the printer a low priority over other running applications, slowing down the stream of commands. Also, the USB connection appears to be quite sensitive to AC noise on the power cable to the host PC.

To print from the SD card, copy the file to the card (which can be done through the printer interface with the SD card still in the machine, but it is much quicker to insert the card into the host PC and copy the file. Just make sure you INIT SD once the card is re-inserted).

# Starting a print

To begin a print, you need to select the file you wish to print. Either from the Load file button to print direct from USB, or from the SD Print button.

Once the print starts, the machine will go through the following startup routine:

1. The printer moves all 3 motion axes in a negative direction to find X, Y, and Z zero.

2. The nozzle is heated to the relevant extrusion temperature.

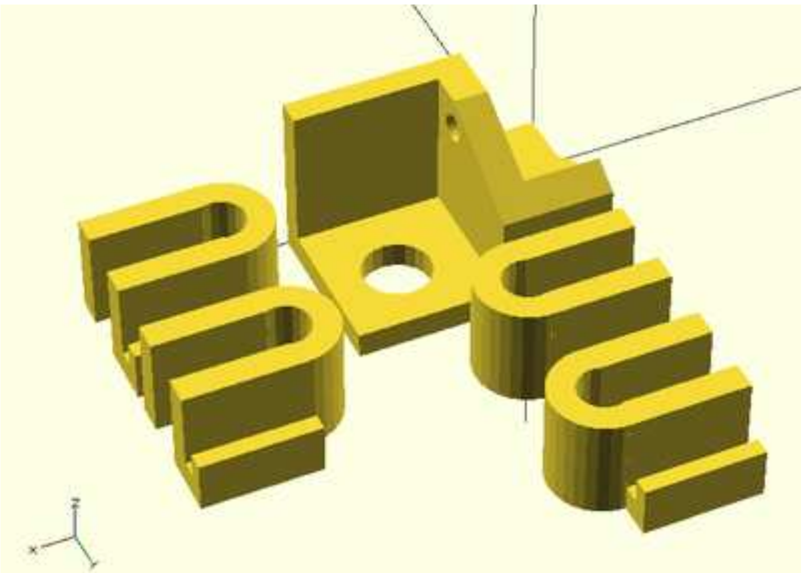
3. Once extrusion temperature has been reached, the machine will print an outline before printing the component(s) to ensure the melt chamber behind the nozzle is primed.

When not required to move, the Z motors are de-activated. This can be a useful feature as it allows the Z height to be tweaked and the X axis to be levelled whilst the outline is being printed. Simply rotate the Z couplings by hand to get a good first layer (filament slightly squished). If you have moved the two couplings in unison to adjust the Z height, you will need to adjust the Z offset in the firmware before the next print, otherwise you will end up having to tweak the Z height manually at the start of each print.

To adjust the Z height in firmware, use the command **M203 Z<value>** where <value> is the amount in millimeters by which you wish to adjust the Z height. If the first layer is too close to the bed, you need to effectively move the bed down, so <value> will be negative. If the nozzle is too far from the bed during the first layer, <value> should be positive to raise the bed. The maximum adjustment is +/-1.27mm. Note that the Z height adjustment is stored in non-volatile memory on the printer so your printer will remember this setting even if you remove power.

# Your first print

The first thing to print is the PCB clips and the power connector clip for your own machine:



The file for this is on the RepRapPro Github repository here (right mouse click and select "Save link as"): https://github.com/reprappro/Huxley/raw/master/Print-Huxley/Individual-STLs/huxley-first-print.stl.

(The source OpenSCAD (http://openscad.org) model is here if you want that: https://github.com/reprappro/Huxley/raw/master/Openscad/huxley-first-print.scad.)

Save the .stl file, load it up and print it!

**Disconnect the power and the USB from your machine before fitting these.**

The power clip attached to the frame vertex just to the left of the Y motor with a single M3 screw:

Put washers under both the head and nut.

Get rid of the tape and cardboard. Then the four PCB clips push over the M6 threaded rods to retain the PCB:


Put the top ones on first. Take care not to damage any components when you push them into place.

Now go round the whole machine replacing the tatty tape with neat retainers. Use the curled one for the top front bar where most of the wires run, and cable ties for the rest. Take care if you use a blade to remove the tape that you don't damage any wires.

# Tuning your printer

The skeinforge print profiles are tuned based on an assumption as to how much plastic is fed into the extruder for a given number of steps of the extruder drive motor. A critical parameter affecting the quality of the prints is how accurately skeinforge knows the volume of plastic it is feeding into the extruder. In practice, this will vary slightly between machines. This is due primarily to the actual filament diameter, and to variations in the effective diameter of the hobbed stud.

The filament diameter should be measured and the value entered in skeinforge's Dimension plugin.

The E steps/mm setting can be adjusted without uploading new firmware, using M92 Ee, where e is the new E steps/mm value. By default the firmware has this set to 980. When this value is tuned, the top surface fill will have virtually no gaps between lines of filament, and no extra plastic at the ends of the lines.

If the E steps/mm is set too low, a gap will separate the fill lines

A good test piece for this exercise is a 3mm high 30x30mm square.

Once you are happy with your E steps/mm value, you can edit your firmware as per these instructions. Please update your firmware even if you don't need to change this setting; new versions come out regularly for fixing bugs (like the bug where an unplugged/failed thermistor means the heater goes to full power)!

# Print another RepRap

So can I print more RepRaps in my RepRap?

Yes!

Your RepRapPro printer has been designed to replicate - that's what the **Rep** stands for. Indeed, RepRaps are humanity's first self-replicating manufacturing machines.

Replicating the plastic parts for another RepRapPro is easy. You can then use them to make a new RepRap (maybe with your own experimental design changes). Or you could make the RepRap plastic parts for a friend. Or you could sell sets of RepRap plastic parts to other reprappers on eMakerShop (http://www.emakershop.com/) or eBay (http://www.ebay.com/sch/i.html?_from=R40&_trksid=p5197.m570.l1313&_nkw=reprap&_sacat=See-All-Categories) .

RepRap's free GPL Licence means that you are completely at liberty to do all of these things.

Go to this wiki page to find out how to print a complete set of RepRapPro Huxley plastic parts.

Go to this wiki page to find out how to print a complete set of RepRapPro Mendel plastic parts.

# Profiles

Printing with different plastic may require modified print profiles. Have a look at this page for details, and if your plastic isn't listed, please add to the table once you have worked out the best settings.

# Changing Filament

1. Heat nozzle to operating temperature.
2. Reverse filament until it comes out of the extruder drive (about 380mm). You can do this at 600mm/min.
3. Command M84 to turn the motors off. Feed the new filament in by hand.
4. Drive/feed the filament to just before the hot end.
5. Command the filament at 200mm/min until it squirts out of the nozzle. You may need to hold the bowden tube straight for the filament to go down into the hot end easily.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# RepRapPro Huxley maintenance

### From RepRapWiki

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| Hot end assembly | Wiring | Commissioning | Printing | **Maintenance** | Troubleshooting | Improvements |

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    - 1.1.1 Downloading from Github
    - 1.1.2 Arduino and Sanguino
  - 1.2 Git repository
  - 1.3 Uploading
- 2 Dismantling the hot end

# Uploading new firmware

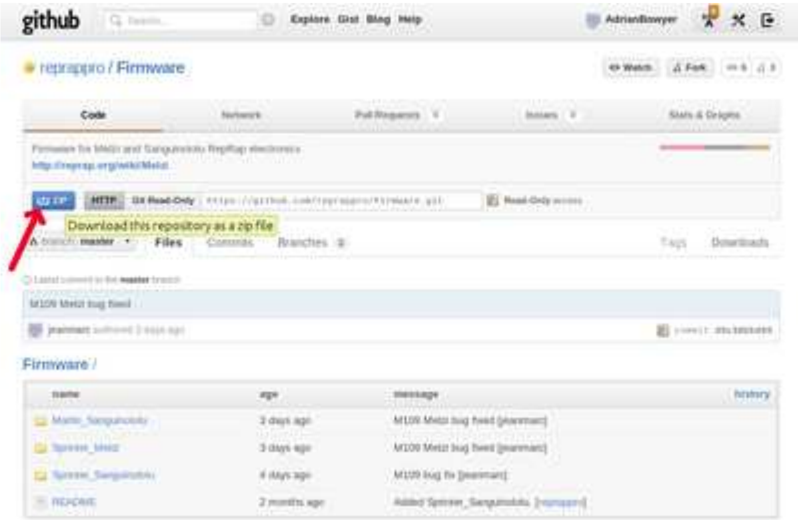
The firmware is the computer program that resides in the microcontroller chip on the controller printed circuit board.

## Required software

### Downloading from Github

Most of the data you need for RepRapPro hardware and software is on Github. Navigate to the appropriate page.

Then download your software with the button on the left to get it as a .ZIP file:




## Arduino and Sanguino

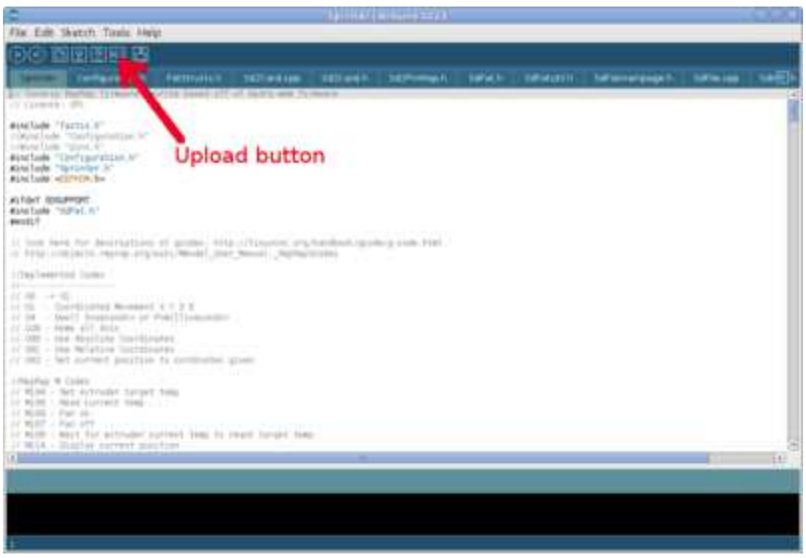
Get the Arduino IDE from the Arduino website here (http://arduino.cc/en/Main/Software) . It's probably best to use Version 0023 until Arduino 1.0 settles down.

Add the Sanguino files (https://github.com/jmgiacalone/sanguino1284p) to your Arduino hardware folder. See the README file in that Github repository for instructions.

# Git repository

Firmware source code is stored in the RepRapPro git repository (https://github.com/reprappro/Firmware) . Download the zip file as shown above and then extract the main folder to your drive. Copy this into your ~/sketchbook folder to make it visible within the Arduino IDE. The Arduino software is much easier to use when it knows where you keep the RepRapPro files, so use File/Preferences to set your preferred location.

# Uploading




Launch the Arduino IDE, and use the File | Sketchbook menu to open one of the two main firmware projects (depending on your electronics board): Sprinter_Melzi or Sprinter_Sanguinololu. (The third option, the Marlin_Sanguinololu project, will only work if your board has the ATmega1284P chip since it requires more memory.)

Select the Sanguino board from the Tools | Board menu. Check your processor type (look at the number on the big chip on the controller board). You will either need to select "Sanguino W/ATmega644P" or

"Sanguino W/ATmega1284p 16 mhz", as appropriate. (If you can't see the Sanguino boards you will need to check that you have downloaded the right files and moved them to the correct folder - see above).

Ensure the serial port is ticked from the Tools | Serial port menu (the RepRap controller board must be physically connected to your computer with the USB cable at this stage, and the auto-reset jumper must be fitted to the board).

Select the tab for the file **Configuration.h**. At the top are the following lines:

```
// Uncomment ONE of the next three lines - the one for your RepRap machine
//#define REPRAPPRO_HUXLEY
//#define REPRAPPRO_MENDEL
//#define REPRAPPRO_WALLACE
```

Uncomment (i.e. remove the two // characters) from the line corresponding to your machine.

About 20 lines further on you will see the following section:

```
//// Calibration variables
// X, Y, Z, E steps per unit - Metric Prusa Mendel with Wade extruder:
float axis_steps_per_unit[] = {91.4286, 91.4286, 4000, 910};
```

These four values allow you to store accurate settings for your printer. Once you have calibrated your printer, particularly the fourth value for Extruder steps, you can edit this line.

To upload your firmware, click the Play button (the first button) to verify that the code compiles correctly, then click Upload (the sixth button) to send the firmware to your processor.

# Dismantling the hot end

With care you can completely to dismantle the hot end:

1. Cut the PLA filament so that you have about 300 mm sticking out of the feed side of the drive.
2. Loosen the spring screws on the drive (or remove them) so that the filament is not being gripped at all.
3. Pull the tongue out of the drive to release the brass coupling. Pull the filament through the drive so the PTFE tube and filament are free.
4. Run the hot end up to temperature, and wait for about 30 seconds.
5. Push the filament through by hand so that it extrudes slowly. Push about 100mm of filament through to get fresh material right through the hot bit.
6. Turn the heat off, and watch the temperature as it cools. Clean any extruded filament away from the end of the nozzle.
7. When it gets down to 100 C, pull the free end of the filament gently but firmly. At that temperature the plastic should be soft enough to come out of the heater assembly, stretching a bit. But it should be coherent enough to hold together; it

should all come out, right down to the nozzle, leaving the filament path completely empty.
8. Disconnect the power and wait for everything to get to room temperature.
9. Disconnect the hot end wires from the controller board, and slacken the two screws that hold the hot end to the X carriage. Take the hot end off the machine.
10. Cut the cable ties on the fan heatsink that retain the wires.
11. Unscrew the fan and heatsink and set them aside.
12. Unscrew the PTFE cone at the bottom of the nozzle, and set that aside. For the next three steps, take care not to damage the wiring as you unscrew things. Take your time and hold the wires out of the way.
13. With long-nosed pliers unscrew the brass end of the PTFE tube from the long block. Set the PTFE tube aside.
14. Unscrew the long block from the short double-threaded stainless steel tube. Set the long block aside.
15. Retrieve the short length of PTFE from within the counterbored recess in the stainless tube. Set it aside.
16. Carefully remove the crimps from one end of the thermistor wire and the heater resistor wires.
17. Pull the heater resistor and the thermistor out from the other end of the aluminium block.
18. Gently hold the aluminium block in a vice, and use an adjustable spanner on the flats of the brass nozzle to unscrew that.
19. Unscrew the stainless steel tube, taking care not to damage its threads if you have to grip it.
20. Clean all residues of PTFE tape from the components.

To reassemble the hot end, follow the instructions on the hot end assembly page for Huxley here and for Mendel here.


Categories: Build Instructions | RepRapPro | Huxley | Huxley Development

# RepRapPro Huxley troubleshooting

### From RepRapWiki

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  - 1.1 Problem
  - 1.2 Solutions
- 2 Machine stops extruding
  - 2.1 Problem
  - 2.2 Solutions
- 3 Stepped layers
  - 3.1 Problem
  - 3.2 Solution

# Parts warp

## Problem

If the first layer does not adhere well enough to the heatbed, there is a chance the component(s) will warp during printing.

## Solutions

1. Cleanliness of build surface

Set the heatbed to atemperature of 45C and wait for it to settle there. Clean the surface with nail polish remover (containing acetone, glycerine, and as few other igredients as possible) using a lint free cloth. Set your heatbed to your print temperature ready for printing.

2. Setting Z zero

Follow the instructions laid out in Huxley commissioning or Mendel commissioning

3. Reduce bed temp

The default 95C maybe too hot, try a lower setting of 50-60C.

# Machine stops extruding

## Problem

This could be due to a number of reasons:

- Bowden tube has popped out of the pneumatic fitting.
- Extruder motor does not move much but makes a squeaking noise.
- Extruder motor rotates. but the gears do not.
- Extruder drive motor and gears rotate, but the filament does not feed.

## Solutions

1. The most likely reason for the bowden tube popping out of its fittings is due to contamination inside the melt chamber. To ensure the melt chamber is free from contamination, follow these steps:

(i) Heat nozzle to around the ABS extrusion temperature and feed (by hand) some filament into the nozzle.

(ii) Set the nozzle temperature to 78C and wait for the temperature to settle there.

(iii) Reverse the extruder, pulling out the filament from the melt chamber, along with any contamination.

(iv) Cut the contaminated end from the filament.

2. If the extruder motor does not move as expected, but makes a squeaking noise, it means it does not have enough torque to drive the extrude3r feed mechanism. Ensure Vref on the stepper driver is set to 0.4v,as described in the Huxley commissioning instructions or the Mendel commissioning instructions.

3. If the gears are not rotating with the motor, tighten the M3x10mm socket set screw which anchors the small gear to the motor shaft.

4. This could be due to a number of reasons. It is possible for the M6 lock nut to come a little loose after much printing, alowing for some play in the hobbed stud. This can result in the filament wandering from the hobbed section of the stud during a print. Once the filament is on the smooth part of the stud, it will no longer feed.

If the filament is still over the hobb, and has stopped feeding, there is most likely a section worn away from the side of the filament. This could be due to a nozzle jam. To resolve this, follow the instructions as per solution 1 above.

# Stepped layers

## Problem

Midway through printing a part the next layer appears to have slipped by a millimetre or two causing a step which should not be there.

A step in the printed object results from a stepper motor skipping steps. This is a result of the motor not having enough torque to move the axis (temporarily, since the print continues at the new position). This can be caused by many things, including:

- Stepper driver overheats and temporarily shuts down
- Motor overheats and therefore loses power
- Print head snags on something, usually a curling print due to the previous layers not having cooled enough when the next is put down. This curling eventually solidifies and creates an obstruction for the head. This failure is usually pretty final though.
- Axis snags on something. This can either be the belt wandering and snagging on the printed parts, or wiring catching/getting in the way of movement.

There are probably other ways a step in the print can happen, but the above are the most common ones.

# Solution

Depending on the cause:

1. Use secondary cooling fan to cool the electronics.

2. Check that the motors are being supplied with sufficient current to meet the demand. The test pads on each stepper motor driver should read 0.4V, relative to ground.

3. Check that the nozzle is not dragging through plastic as it travels.

4. Check all wires, cogs and belts whilst printing and reposition/realign anything impeding the smooth movement on all axes.


Categories: Build Instructions | RepRapPro | Huxley | Huxley Development

# RepRapPro Huxley improvements

### From RepRapWiki

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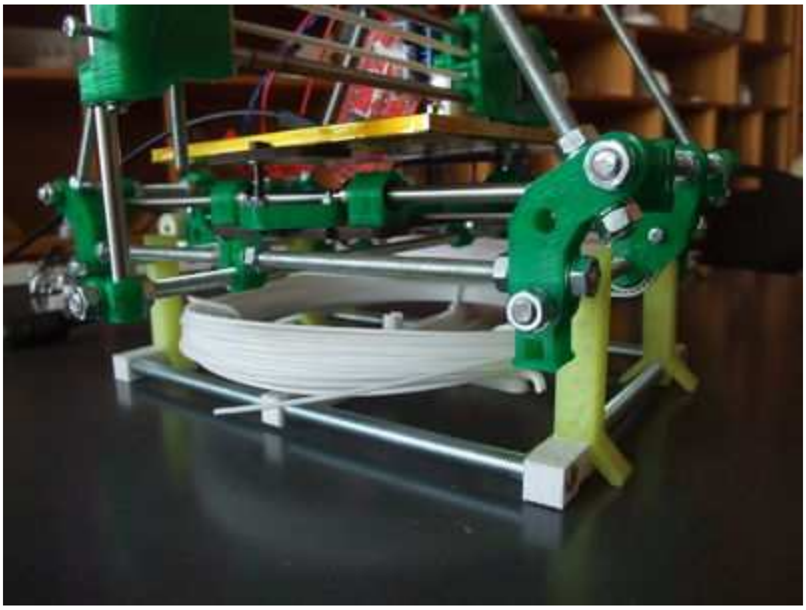
| Hot end assembly | Wiring | Commissioning | Printing | Maintenance | Troubleshooting | **Improvements** |

# This is the place to describe improvements to RepRapPro Huxley

## Huxley Mini-Spool

An horizontal mini-spool, to store a small amount of filament right under your Huxley.




Category: RepRapPro

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