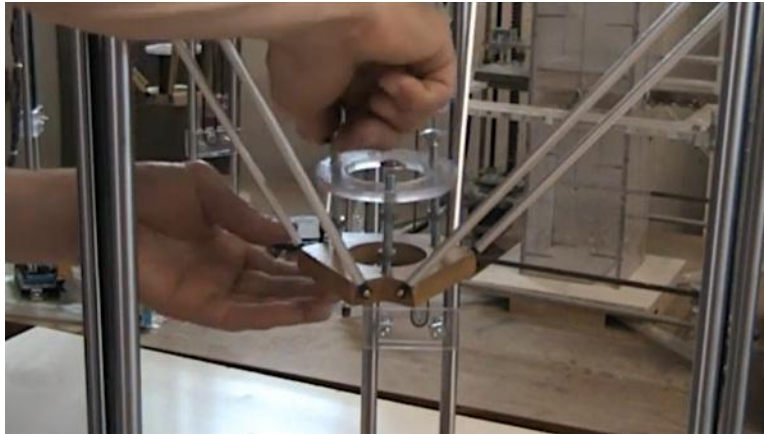


MAKE YOUR OWN 3D DELTA PRINTER FOR CERAMIC

(Original text published in 2013. This is an edited version with additions from 2026)



Make your own Ceramic 3D Printer video - [Link to YouTube](#)

Annoyed and frustrated by 3D Systems buying out and then stopping the production of the RapMan 3D printer in 2013, I decided to develop my own replacement clay 3D printer. At the time there was not a ceramic 3D printer on the market. The RapMan had been developed as a plastic filament printer by British company Bits from Bytes (BfB) and was the original kit printer Belgian design duo Unfold adapted to print with clay in 2010.

I based my design on the delta type of 3D printer as I liked that the base plate or printed object did not move and also the way the delta arms moved. The movement had something of the way a potter moves when coilbuilding. My aim was to use parts that could either be made with basic DIY tools and be easily ordered off the internet. The design is specifically for printing in clay but could be adapted to work with other materials. Many other self-built 3D printers use parts printed in plastic but with this project I did not want to be reliant on already having access to a 3D printer.

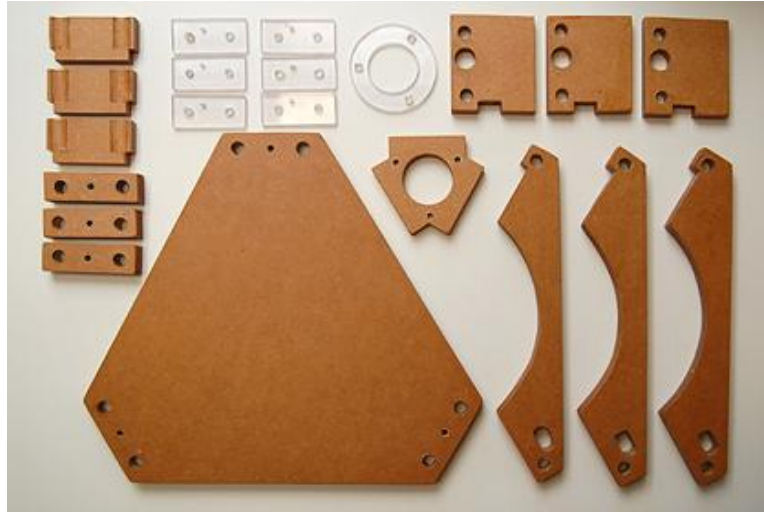
This document is not a blue print for building a 3D printer but more my documentation of what I did. My experience was as an artist and not as an engineer or computer specialist and so I was always aware that there could be improvements to be made. This is what worked for me. I welcomed others to take up the design and develop it further but only in a private or research and education context. I requested that my ethos of sharing and the humanity to be found in generosity be respected. This project was borne out of the disgust of the practices of big business and so asked that the information on offering not be used for personal commercial gain.

Being more interested in what might be creatively produced with 3D printers, I am happy to contribute openly to the growing knowledge based around clay and computerisation but it comes with a warning. As difficult as it is to pull all the technology and computerisation together I suggest it is even more difficult to do something creative, fresh and meaningful with this technology. I look forward to seeing what others can do with it. By 3D printer standards this is a rather primitive tool set, but it does offer an accessible way into a very exciting new way of working with clay.

PARTS

MDF and Plastic -

Where more strength is needed I have used 15mm MDF but some parts are 12mm. The plastic parts are 10mm. My cutting templates were originally sketched out in Microsoft Word and were not very accurate but were kindly improved by John Nicholson (update March 2014) and all are as PDF documents below.

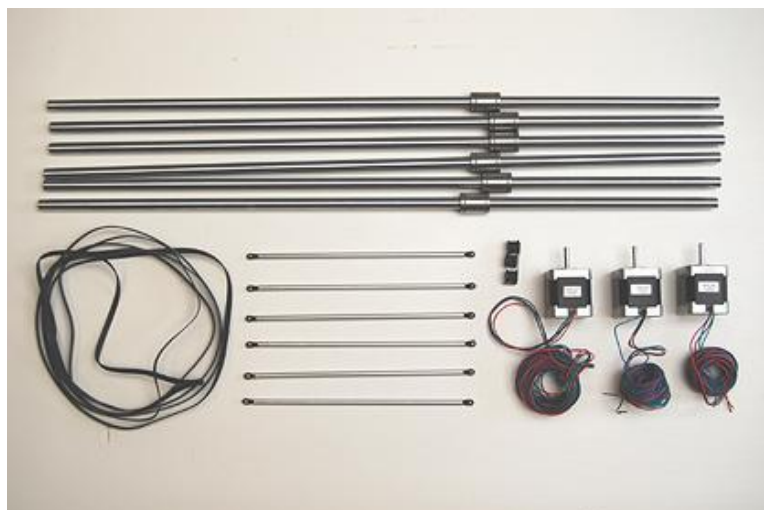


PDF All parts
PDF Frame parts A4
PDF Base
PDF Top Assembly

PDF Base A4
PDF Moving parts A4
PDF Components

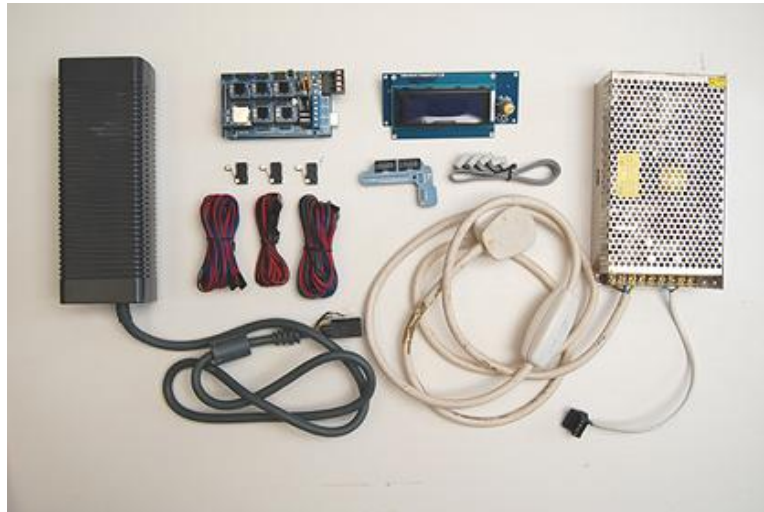
Mechanics -

- *6 x 70cm 12mm steel rods
- *6 x linear bearings to fit steel rods
- *3 x High Torque Hybrid Stepper Motors SY42STH47_1684A (Holding Torque 4.4 Kg-cm)
- *6 x arm rods with ball joints (These I made up with aluminium rod and model car Traxxas Rod Ends)
- *3 x 1200 mm length 6mm wide GT2 pitch (2mm) belts
- *3 x Aluminium GT2 Pulleys for the stepper motors.



Electronics -

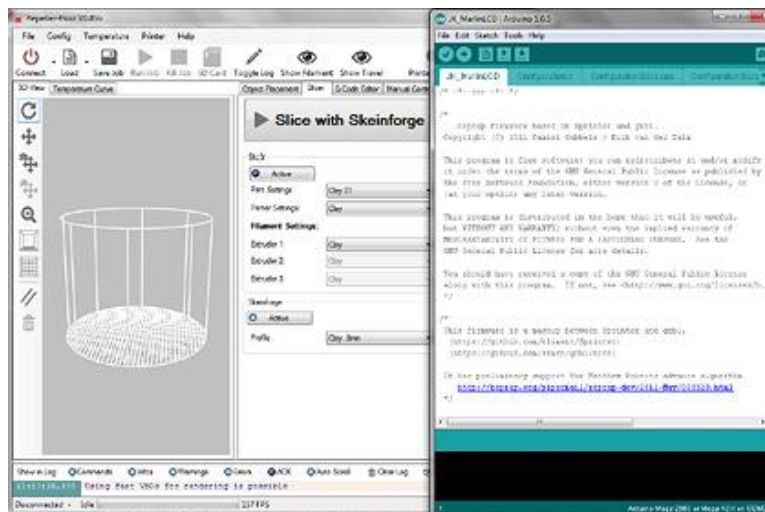
- *1 x Arduino Mega 2560 microcontroller board
- *1 x RAMPS 1.4 set that is complete.
- *1 x LCD and SD card panel that plugs into the RAMPS
- *3 x Mechanical Endstops
- *100k thermistor (Not needed for clay but needed to keep the firmware happy)
- *A good selection of cables
- *Power supply options. Left - X Box. Right - General purpose power bricks 12V 220W



There is a pictorial bill of parts based on suppliers convenient to the UK in 2013 and was considered as a helpful guide and no responsibility is taken for this information so please check all items before ordering.

[Link to Delta Ceramic 3D Printer Bill of Parts](#)

Firmware and Software – At the time I used Johann Rocholl’s modified [Marlin](#) firmware. I looked at the [Repetier](#) firmware but got the Marlin going first so have stuck with it. Here is a copy of the [CeramicPrinter_MarlinLCD](#) firmware that I set up for my original build. To create and edit 3D files I use the open source 3D modeling program called [Blender](#). To slice .stl files to gcode ready for the SD card that carries the information to the printer I use [Repetier Host](#). (I have since gone over to using [CURA](#))



Printhead -

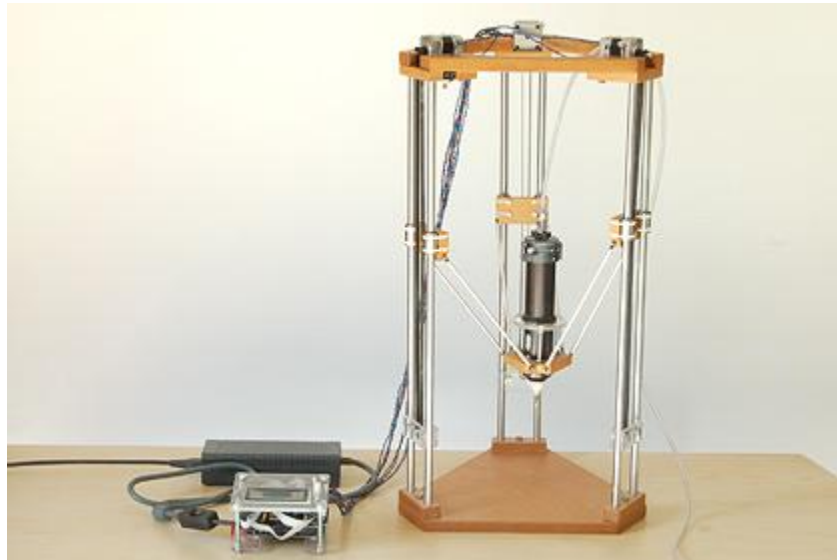
The clay extruder was simply parts adapted from the adhesives industry . I use parts from the Techcon Systems TS Series dispensing gun, using the cartridges, retainer body and cap but not the gun grip - right.



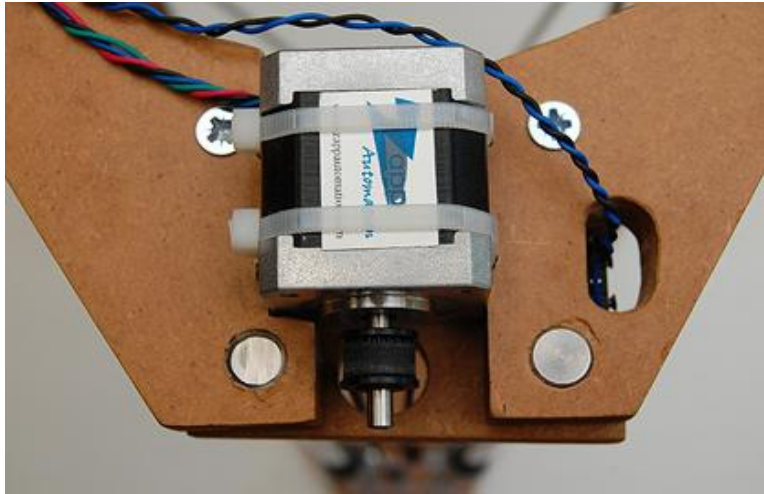
Left - syringes originally used. The clay is extruded with compressed air.

BUILD

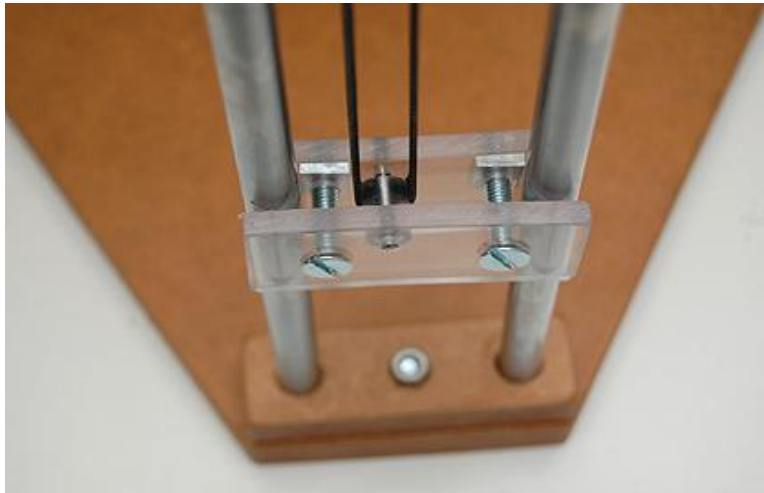
Basic Frame – The steel rods offer vertical rigidity while also being the runners for the plates to which the print head arms are attached. To ensure the whole structure is rigid the rods are a tight fit top and bottom where I have doubled up on the thickness of the MDF to help.



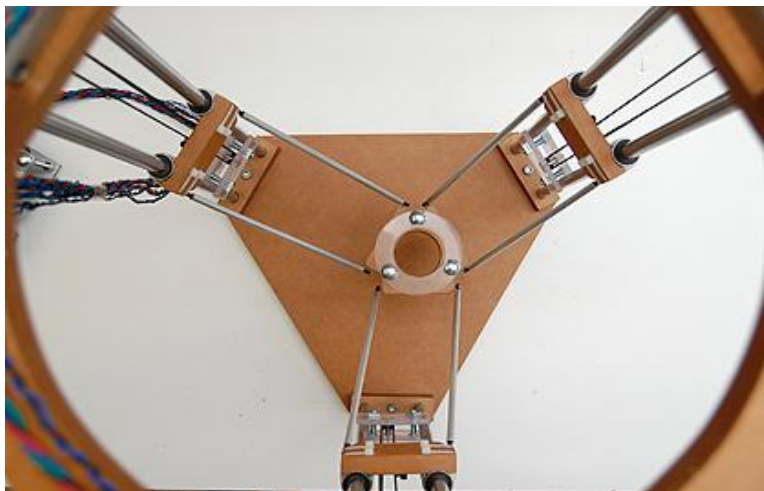
Motors – the motors are mounted at the top to keep out of the mess from clay and clay dust. For the same reason the controller is separated from the main print unit. The motors are held in place by the MDF top elements and secured down with plastic pull ties. The pulleys are supplied in the ULTRA SET from fabster3D, including allen key that is a nice touch.



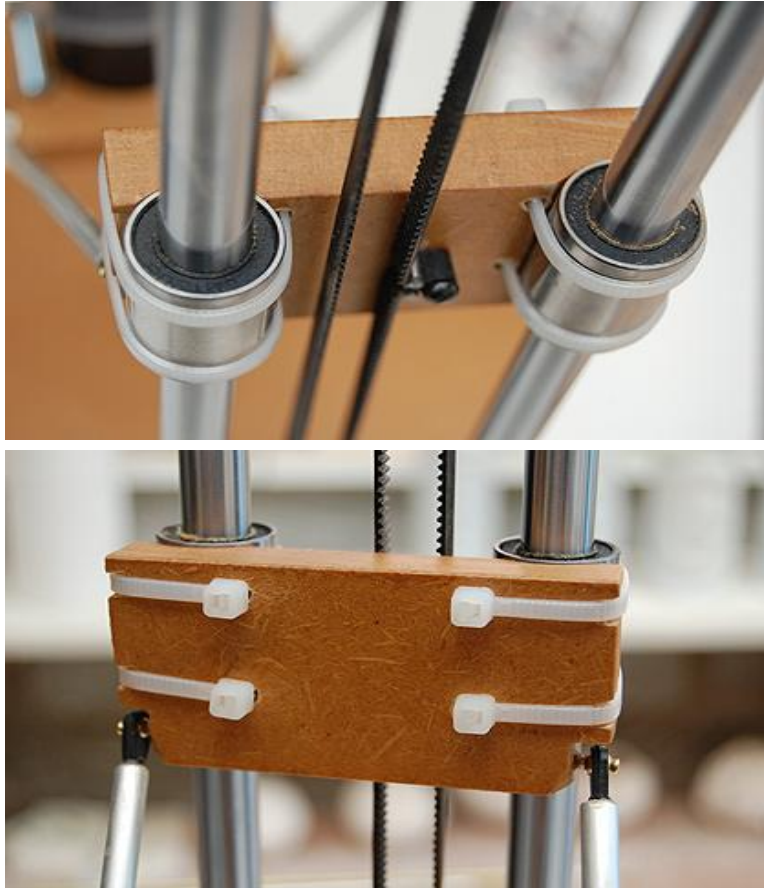
Belts – The belts I use are continuous, so easily tensioned up on a self made pulleys held by the plastic plates attached to the steel rod. Return pulleys made from two tap washers.



Arms and extruder mount – The arms are made up using a jig to ensure they are all the same length. Model car ball joints are glued into aluminum rod from a DIY store. On the jig the nails that the rose bearing at each end of the aluminum rod push onto are 24 cm apart. The arm length to pivot point on each end is 24 cm. The arms are then pinned and glued into the runner mounts and extruder mount. The extruder mount has a simple cradle to hold the clay cartridge.



Runner plates – From experience it is important to have a good and square fit between runner mount plate and bearings. With a self made tool I sand a hollow to bed the plate up against the bearings. The plates are secured with plastic pull ties onto the bearings. The belts can then be secured onto the runner plate.

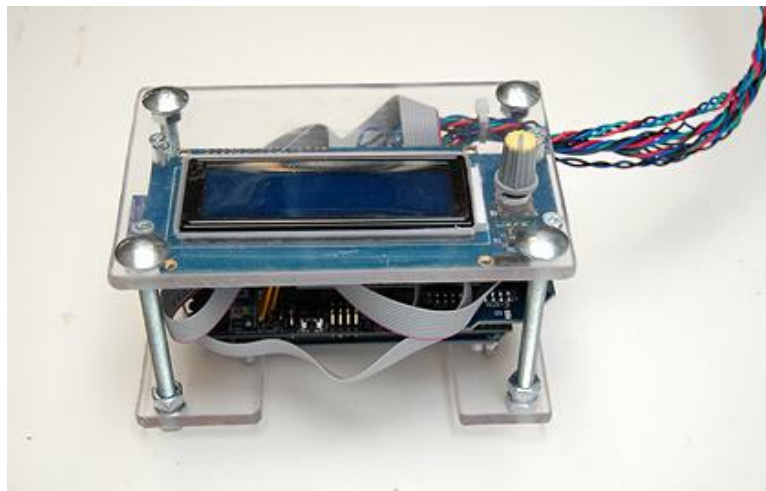
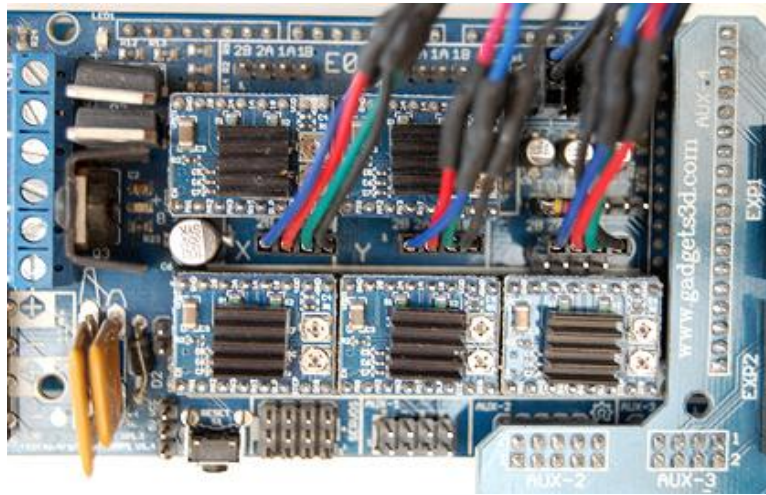
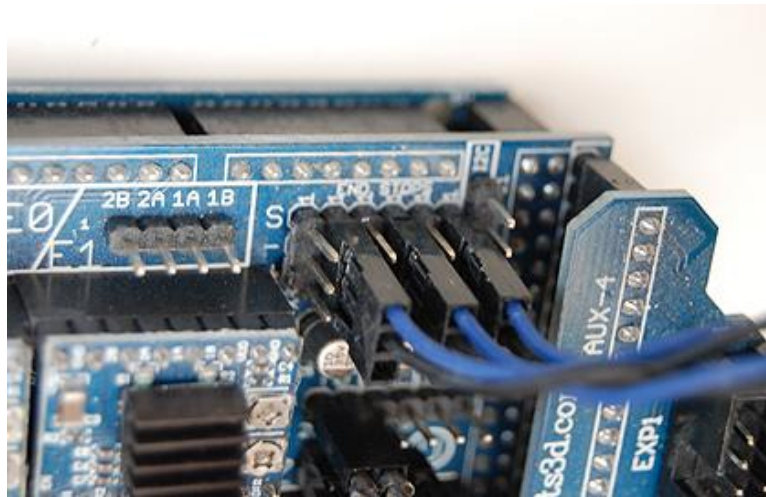


End stops – I only have endstops at the top where the print head zeros before each print. The wiring configuration is tricky but by trial and error. I got it working using two terminals on the mechanical endstops that are provided in the ULTRA SET.

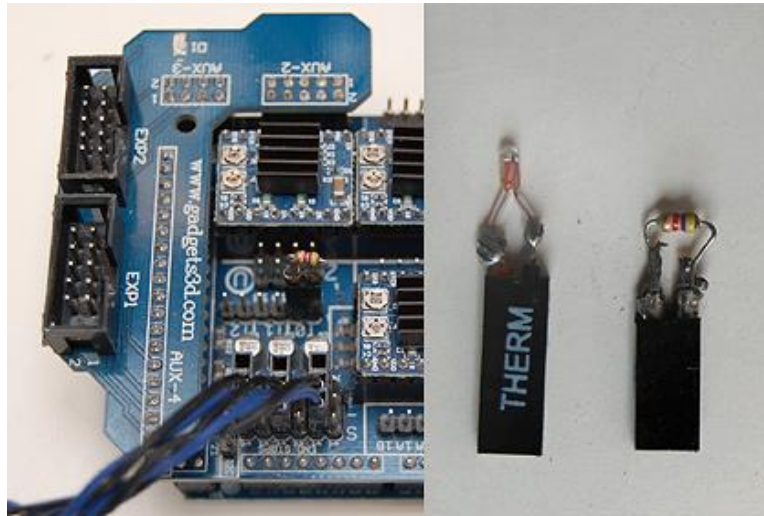


Processor – I got the ULTRA SET from Fabster3D on EBay. They have been very good and delivered to the UK from Hong Kong in three days. The set is sold for plastic printers so includes a MK2a heatbed that is not needed with clay so negotiate a swop for 3 x 1164mm length 6mm wide GT2 belts. In the ULTRA SET the RAMPS board arrives sitting on the Arduino ready to go. The gadgets3d.com

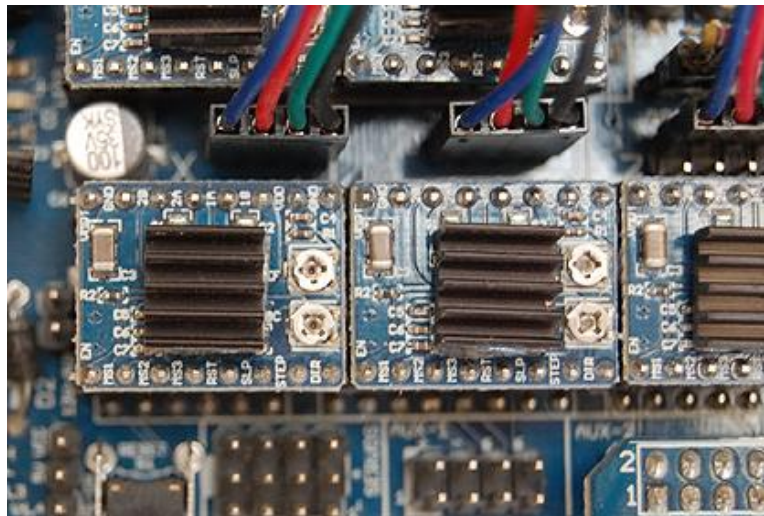
RAMPS board is well marked out for what goes where. There is an extra mini SD card and board attached that needs to be removed first so the main LCD screen and SD card board can be plugged into the RAMPS board. I pair up the motor and endstop to an X a Y and a Z column (although for the movement of a delta printer the x, y and z is not meaningful) so they correlate with how they are marked on the controller board. Wires are twisted together with a drill, cut to length and the relevant end fittings solder on keeping all colour coding. The end stop wires are plugged in ensuring they are in the slot for the top endstops - second slot for each x, y, z mark on the board. The thermostat I cover below but in the video I cover that in next. The X, Y and Z motor drivers are clearly marked on the board, as is the wiring for the LCD screen and SD card. With clay printing I am not using a heat bed so power is only attached to the 5A +/-, see power below. This leaves many slots on the RAMPS board unused.



Thermostat – The program running the printer – firmware, checks for a thermostat as it is programmed for plastic printing. Printing in clay no thermostat is needed but without a thermostat plugged into the RAMPS board it will not run. A small resistor or the 100K thermostat supplied in the ULTRA SET plugged into the first temperature slot seems to keep the firmware happy.



Stepper motor tuning - Each stepper motor driver board has two star headed adjustment screws. When I first started up my printer, although the motors made a hum they would not move. Each screw has one flat side that when fully turned down – anticlockwise, sits at about 10 o'clock. With the power off I gradually turned up – clockwise, the top screw for each motor. Too much and apparently more power goes to the motors but then they heat up. I have found turning the flat side to around three o'clock is strong enough without the motors getting too hot during continuous printing. I am not quite sure what the lower screw is for but on the fabster3D EBay webpage they suggest leaving them turned fully anticlockwise.



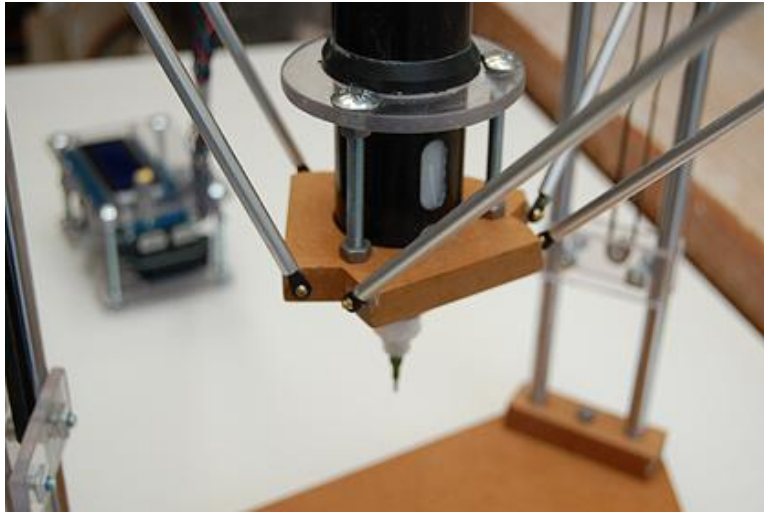
Power supply – I have tried both a LED Strip light power supply, 12V 20A 240W (left) and an Xbox 360 175W power supply (right) and both do the job. I am not qualified in the finer details with regards electricity so would not like to pass on any incorrect information but as with all the information in this documentation it can easily be found on the internet. I have put an inline switch just before the plug that goes into the control board so the printer can quickly be turned off if there is a problem.



Printhead – The clay extruder is simply parts adapted from the adhesives industry. The soft clay is extruded out of the cartridge with the use of compressed air, around 60 psi (pounds per square inch) or 4 bar. The air pressure set against the consistency of the clay controls the rate of flow of the printing material. The extrusion rate is around 1mm per second. Excuse being vague with this information but I am not methodical about each setting as there are so many variables. I rely on my tacit knowledge of working with clay and the general feel to get it right – not helpful I know. I use different settings for different scales of work and different clays and different shapes. Small work will be extruded with a 1mm nozzle while larger works will use a 2 mm nozzle. Small work is sliced at .5 to .6 mm per layer while I scale up to .9, 1mm for larger prints. Most work is printed with a single wall but forms that flare out such as bowls it can be useful to print a double wall.

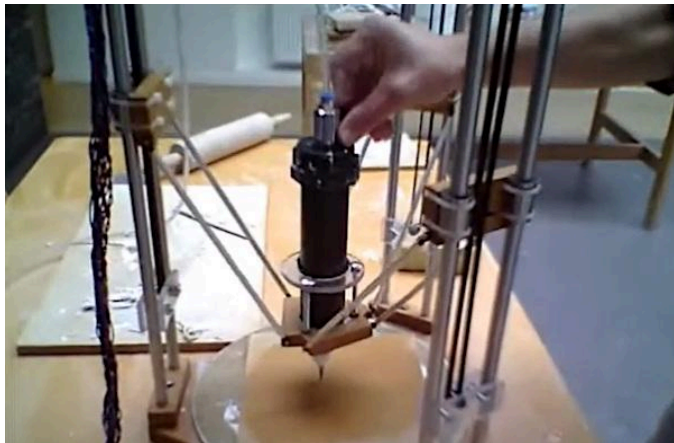
I use the Techcon Systems TS Series dispensing gun cartridges to hold the clay along with the retainer body and cap but not the gun grip. I attach a standard ¼ inch ball valve on/off switch onto the cap where the air pressure hose attaches to the cap. Manually the pressure is switched on at the start of a print and off at the end. During the print the flow of material continues. A technical point that could be improved for shapes where you want the build material to stop and then begin again at another point as the print head keeps moving.





HOW TO USE YOUR PRINTER

(Filmed for the International Ceramic Research Center, Guldagergaard, Denmark)



Using the Delta Ceramic 3D Printer - [Link to YouTube video](#)