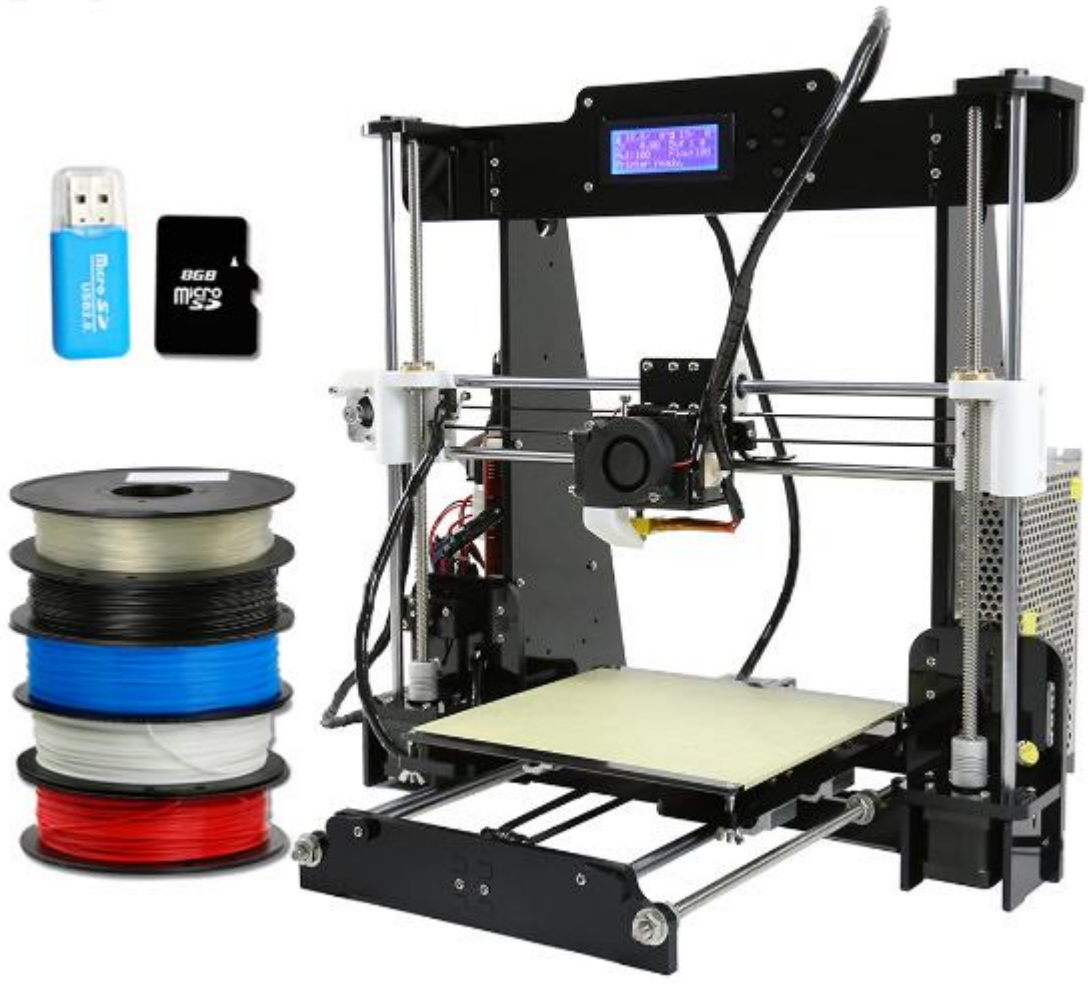
# ANET A8 3D printer

# Additional build & usage guide.




Kevin D Smith “3D printer hobbiest and quite a nice guy”

Anet A8 printer assembly guide for the newbie V0.1

# Introduction.

So, you have just taken delivery of a large cardboard box from China containing multi layered parts to build a 3D printer and your thinking “Where do I start”, “Where are the instructions”, “will it work”.

**DON’T PANIC……**

## What will this guide do for me?

It will provide you with an insight in how a 3D printer works, things to look for when building it which are not covered by the build guides and things to do to ensure the printer and you have a long and productive relationship.

## What will this guide not do for me?

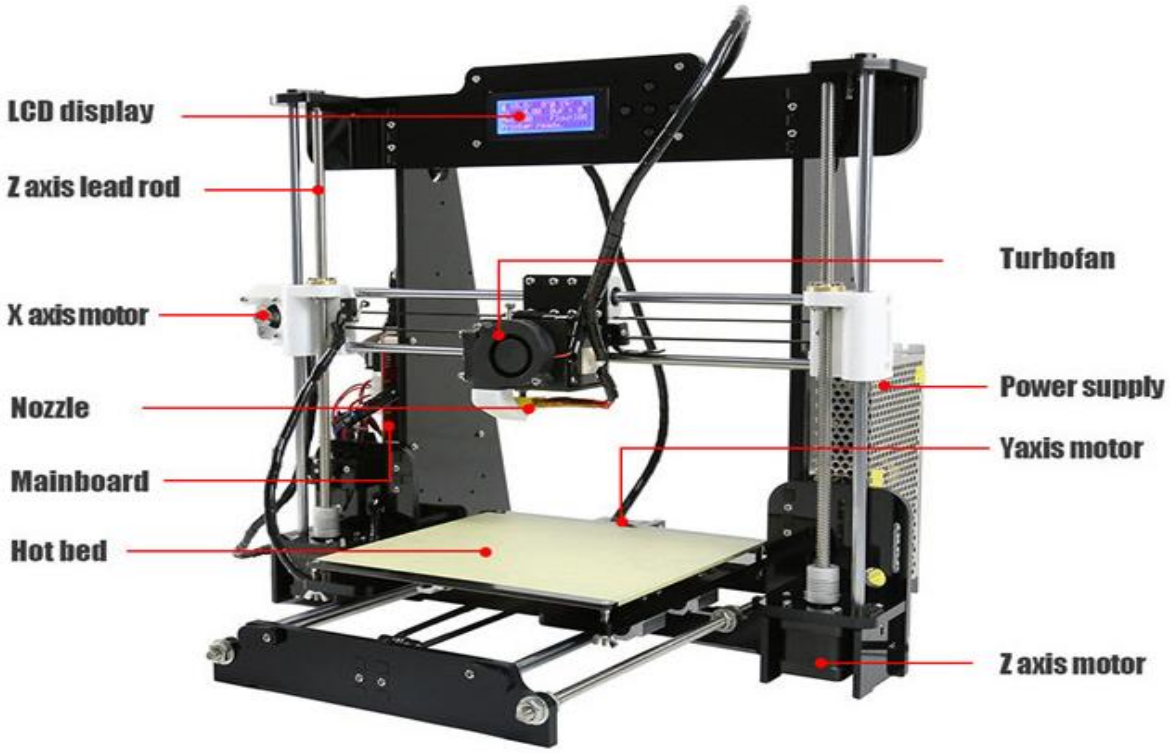
It won’t give you that Perfect printed object. The Anet series of printers like many things are massed produced and no two printers operate the same. However with time, learning how to tweak the printer and the associated 3D printing software you can work towards that perfect printed object

## About me.

I have been involved in IT / Electronic engineering for the last 20+ years. After spending time in the Armed forces, I re-trained for a career in computer systems design but with Electronics still playing a role. I came across my first 3D printer around 6 months ago and after many hours of using Google (Other search engines are available) I opted for a semi built kit. It was great, 2 hours of self-assembly and I was up and running. I then thought how about building one from scratch, so I bought a Anet A8 clone and the rest is history as they say.

So enough of these ramblings, let’s get into the nuts and bolts and strange looking parts of your 3D printer.

## Section 1 - Anatomy of the A8 3D printer




The diagram above shows the key parts of a typical 3D printer, lets understand better what these things do.

1. LCD Display – This is where key information about you printer is shown, this included things like Tempature settings for the Printer head and Bed, access to files stored on the SD card, fine tuning of settings for the X, Y and Z axis motors etc.

2. Z axis lead rod – These are use to lead or drive a component  such as the Z-Axis assembly on a printer.

3. X-Axis motor – This motor/belt controls the X-axis travel and the head movement from left to right.

4. Nozzel – This is where your filament appears once it has been heated upto the required tempature, most printers are fittem with a 0.4mm nozzel as standard

5. Mainboard – This is the brains of the operation base on a Ardunio processor it also contains the electronics for the motors, heater elements, USB port for connections to a computer etc.

6. Hotbed – This is where the filament and your printer object is printed onto, typical operation temparatures are in the region of 40-60c

7. Turbo Fan – this provides a controlled airflow to the object being printed ensuring it cools down correctly avoid you having a large pool of PLA or ABS sitting on the heatbed.

8. Power supply – All the electronics need power, so this is what this unit does, typical designs provide either 12 or 24V DC at around 20A

9. Y – Axis motor – this controls the hot bed movement during a print using a single motor and belt.

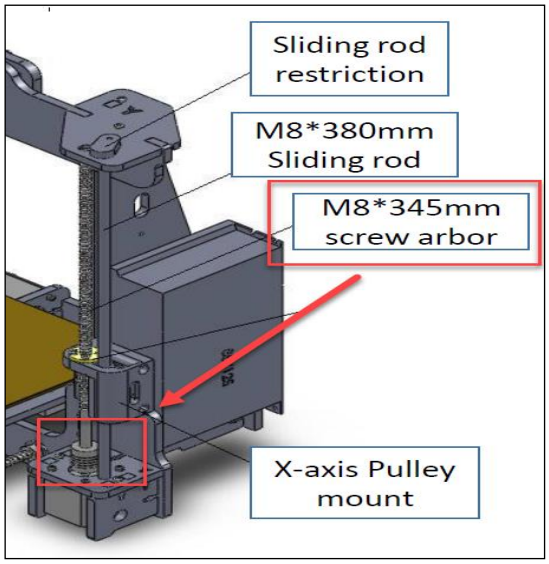
10. Z – Axis motor – This controls the up and down movement of the Head using two motors connected to the Z-Axis linear rods which in turn are connected to the X-axis left and right drive assembly.

In the next section, we will start getting into the build areas which are not covered by the instructions.

# Section 2 - Part 1. – Mechanical

Z-Axis Linear rods and Couplers.

The Z-Axis consists of a number of components which need to assembled correctly. The picture below shows the parts we need to focus on (highlighted in the red boxes).




Z-Axis Motors and Linear Rod.

When you remove the Z-Axis motors from the packaging, the Z-couplers will either be installed on the motors or in a small packet. The first thing to do is ensure the Z-couplers are installed a distance of 5mm onto the Z-Axis motor shafts and then during the assemply of the Z-Axis motors and the X-Axsis mounts ensure the Linear rods (Screw arbor) are inserted 5mm into the top of the Couplers. The Z-Coupler has 4 small grub screws which need to be tighted once installed onto the motor and Linear rods (see photo below).


***Next Section - Electrical checks***

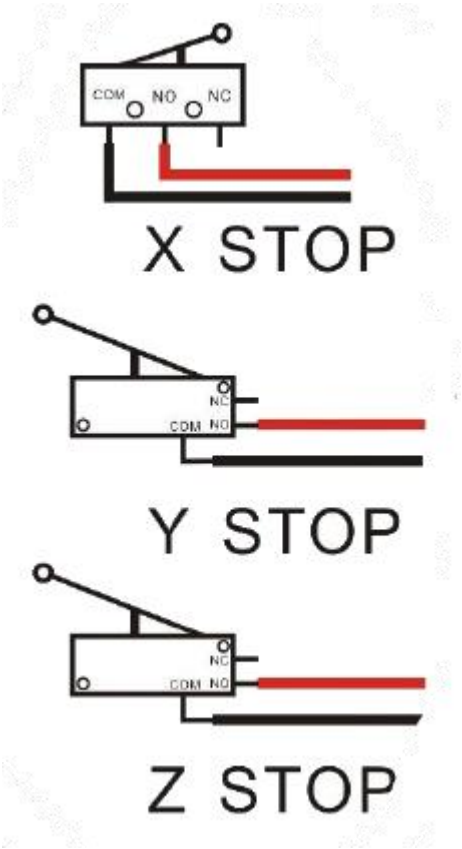
## Section 2 – Part 2 – Electrical

This section is broken down into the following areas

- Micro-switches
- Power supply
- Cable management

Micro-Switches

There are a number of micro switches fitted to the printer which control the home positions for the X, Y and Z Axis. Each switch has to be wired correctly during the assembly of the printer. The picture below shows the correct wiring of these switches.

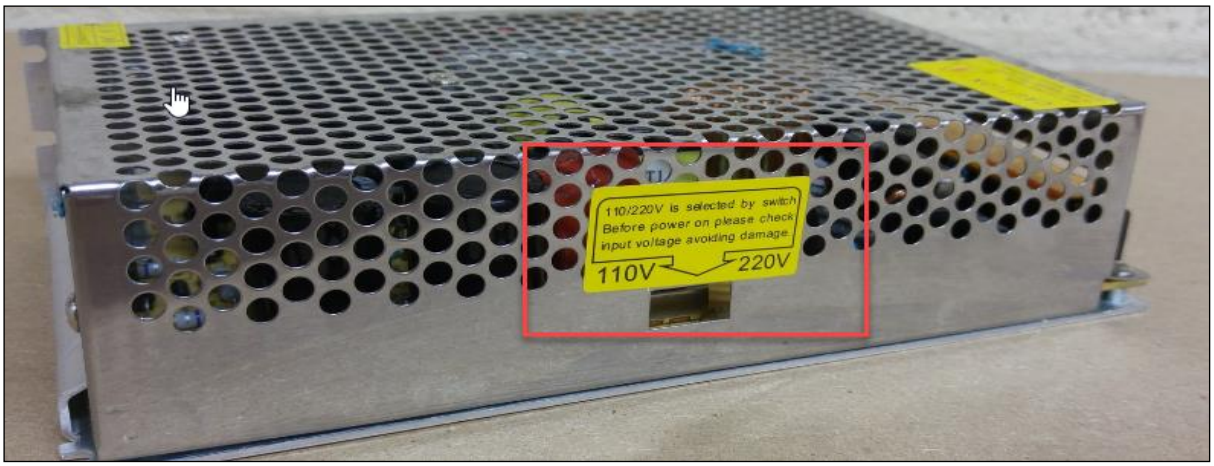



It is very important that you make sure the wiring to the switches is fully secure and the connectors going back to the motherboard are connected to the right sockets on the board. I have seen a number of people have problems with the Heat bed not homing correctly for example and it was down to the cabling not fitted correctly on the switch or the connector not fully homed on the motherboard.

Power supply.

This is one of my favourites and at the time of writing this document one of the most popular parts to fail, either wired incorrectly or great confusion in terms of installation.

The supplied unit is a 12V 20A switch mode PSU module. It have a number of electrical wiring connectors which are required during installation and more importantly a Voltage selector switch. (shown below)




Before you do anything with the electrical wiring on the printer, check the voltage selector switch as shown above. A lot of these PSU's are being sent out with the selector switch set to 220V 50Hz (Slider switch set to the right). This is fine for those country which operate on this voltage. However the USA operates on 110V 60Hz. Now believe it or not, if you plug the PSU into a 110V supply on the 220V setting, I know what your thinking "Well its half the voltage here, no problem" – Wrong due to difference in the frequency of the AC Voltage (I won't bore you with the science) you can still damanged components expecting to operating at 50Hz and not 60Hz. Now if it was set to 110V and plugged into a 240V sockets the effects can be a bit more lounder and colourful and you will kill it ☹.

**So please make sure the Switch is set correctly according to your country.**

**AC Mains Wiring colours**

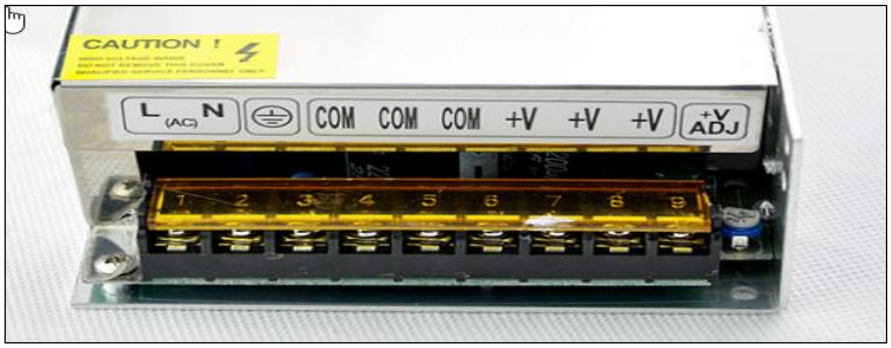
The mains colouring wire varies from country to country, so please make sure you wire the PSU correctly according to your country via this link or refer to the table below

| USA | Phase | UK (Europe) |
|---|---|---|
| Red/Black | Live | Brown |
| White | Neutral | Blue |
| Green | Earth | Green |

**DC voltage wiring**

The power supply comes with a total of 3 pairs of connections each delivering 12V DC

The connections are either marked +V and Com or +V and -V as shown below





In both cases V+ = 12V positive and in the case of -V / Com this is the negative (ground)

Please make sure you wire up the power cable provided correctly and if possible secure into the connectors with suitable crimp connectors such as these. (Spade connectors)

In terms of the power cable it can be provided in two flavours

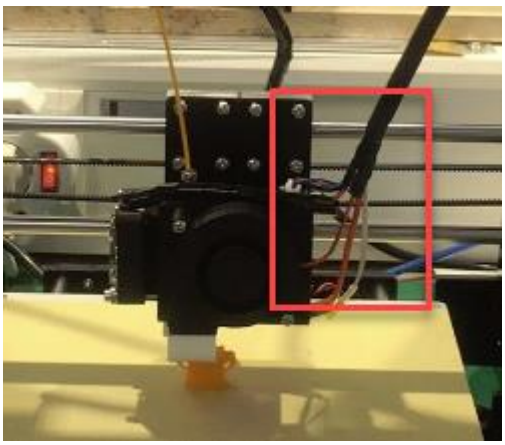
Solid Red and Solid Black  = Red = +V and Black = -V / Com.

Solid Red and Solid Red with a black streak = Red = +V and Red/Black streak = -V/Com.

**Again check the cabling before you wire it up to the main board etc.**

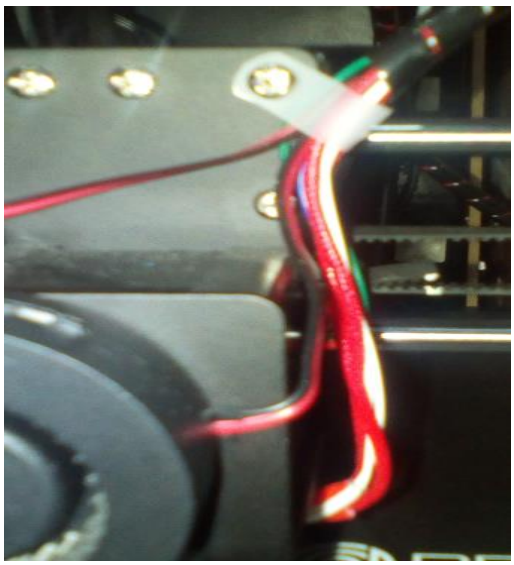
Printer Head Cable Management.

One of the most popular photos on completed printers I see is the one shown below.



The installation guide does not tell you about how these cables should be secured and this can lead a to the printer failing if the heater elements getting snagged. In some cases this may  lead to a complete burn out of the the printer head assembly, if they come out.

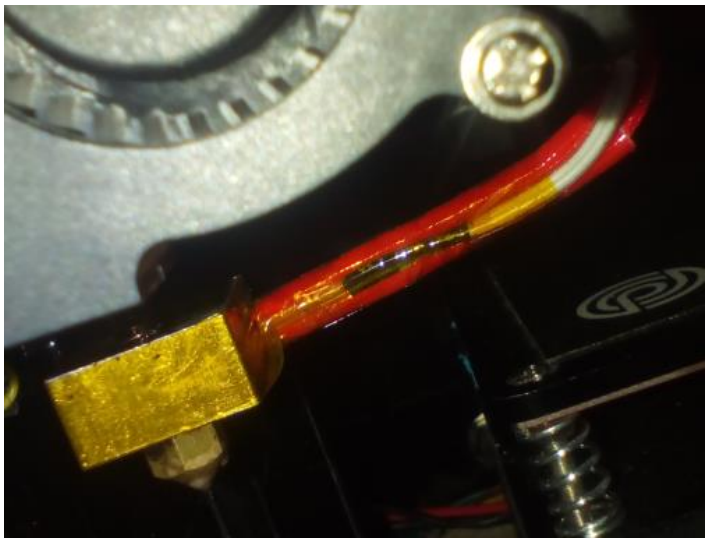
The printer Head cable harness once assembled should look something like this.



The white clips (supplied in the kit) are used to secure the cables going the to Printer head and fans from working loose or getting caught in the print head as it moves.

**PLEASE make sure you carry out this step.**

There is a second part to this sectoin which is the most important bit. However it should be noted some of the printer heads being delivered pre-assembled as shown below so this may not apply to you.



In the photo shown above you will see the cables to the heater blocked sealed with Kapton Tape, this tape is ideal for use in areas of high temparture and in particular on 3D printers.

The cables going into the printer head consist of the heater element and the temparture sensor. These are normally secured with small grub screws so check these are tight and then the head is sealed with kapton tape along with part of the cable harness you secured earlier. If this has not been done, do so to ensure these components don't come out during normal operation of the printer.

The other thing to check here while doing the above is the Printer nozzle, if this is not tight then you risk filament feeding back up the hole which the nozzle screws into and forming a nasty mess on top of the printer block, so check this is secure before fully fitting the head.

***Next Section – Pre-flight checks and maintenance – but first a break***

# BREAK TIME

So, by now you're maybe thinking wow that's a lot of information, I bet. Well believe it or not you have managed to work through almost 90% of the known areas which I didn't know about along with quite a few other people during the assembly of their 3D printer. If you have got this far then you are almost there. So, have a break, Tea or coffee and come back shortly to the final part of this guide.

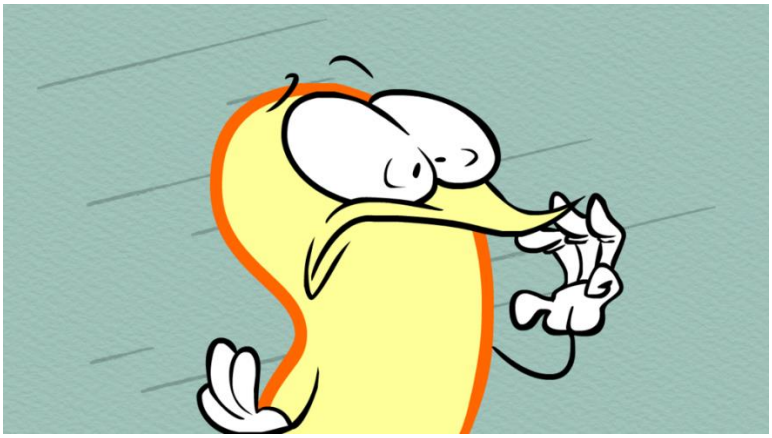
**Section 3 – Pre-flight checks and maintenance.**

So, if you have got this far, your ready stand back and start printing your first 3D object.

Let's double check a few things

1. Power supply voltage selector ✓
2. Power supply cables wired in correctly ✓
3. Printer head secure and Nozzle tight ✓
4. Cables from Printer secure ✓
5. All connectors secure and in the right places ✓
6. Pizza and choice of liquid refreshment ready ✓

# HOLD ON – Heat Bed levelling



Yes, it’s moment every 3D printer owner loves or hates but it has to be done to make that first printed object look pretty good. So here is a basic guide for you to follow. I’m not going to say it’s perfect but it will at least give you a basic understanding of the process.

The process of levelling is fairly straightforward, and does not require any fancy tools. It involves only seven (7) easy steps:

1. Stiffen the print bed support screws.
2. Set adequate tension in the springs.
3. Adjust the Z-Axis.
4. Set the tolerance.
5. Level first diagonals.
6. Level second diagonals.
7. Secure hardware.

Important TIP note:

Ensure the hotbed has been brought up to temperature before proceeding and the stepper motors are disabled.

## Stiffen the Print Bed

To stiffen the print bed, tighten the nuts under the bed so that the support screws are absolutely perpendicular to the print bed surface.

## Set Spring Tension in the Springs

The springs most commonly used on 3D printers. While more than adequate for the job, they provide little resistance when fully extended, so they need to be compressed enough so that they provide sufficient support for the weight of the bed, while still allowing for slight compression during the occasional head crash, or low to the surface print (more on this below). We ultimately want to set the tension in all the springs, but for now, we only want to set them leaving the last spring relatively loose. It is not important that they be level at this point. It is generally easier to slightly over-tension the springs with the intent of loosing them off during the levelling process. This allows you to set the Z-Axis (in the next step) to just above the bed and the you will raise the print bed back up to the hot end during the levelling process.

## Adjusting the Z-Axis Home Position

As mentioned in the prerequisites, the Z-Axis min limit switch (Z-endstop) should be located on the same side as the X-Axis motor. The reason for this is that this side of the X-Axis weighs more, and is less likely to lag behind during downward movements like homing. Through repetition, bring the Z-Axis nozzle down to the surface of the print bed at the centre. t does not have to be perfect, but should be within +/- 0.5 mm (but Ideally just above the bed), I prefer to be a little above the surface. Approx 0.2mm

## Tolerances

In addition to being level the distance between the hotend and the bed is important. If you are using a strongly flat bed, such as glass, you should be able to achieve a gap of 0.2 mm. For less flat surfaces your gap will need to be larger. A common method of setting the tolerance is to place a piece of paper onto the bed, so that you can still move the piece of paper, but there is a slight drag.

As you go around the bed, adjusting the level, you should use a piece of paper to check the tolerance.

## Levelling Diagonal 1

The levelling order is Front-Left, Back-Right, Back-Left, Front-Right. We refer to the first pair as Diagonal 1. With the printer homed, disable the motors and position the head over the Front-Left corner of the print bed, use the tension wheels to adjust the height of the print bed. Using the piece of A4 paper between the bed and the nozzle adjust the height until the nozzle touches the paper but you can still pull the paper out with a little bit of drag. Re-home the Z-Axis and checking that the paper still drags. Adjust as needed until you can achieve drag without movement of the print bed.

Once you have set the front-left corner, repeat the process with the opposite diagonal corner in the back-right. Return to the front-left corner and verify that nothing has changed. On or two repetitions, may be required.

## Levelling Diagonal 2

The second diagonal is levelled in the same manner as the first, but starting in the back-left corner, and ending with the front-right. It may be that after completing the procedure to this point, you find that Diagonal 1 is no longer set. It will most likely be a small adjustment, and a second repetition of the levelling process will correct this in most cases.

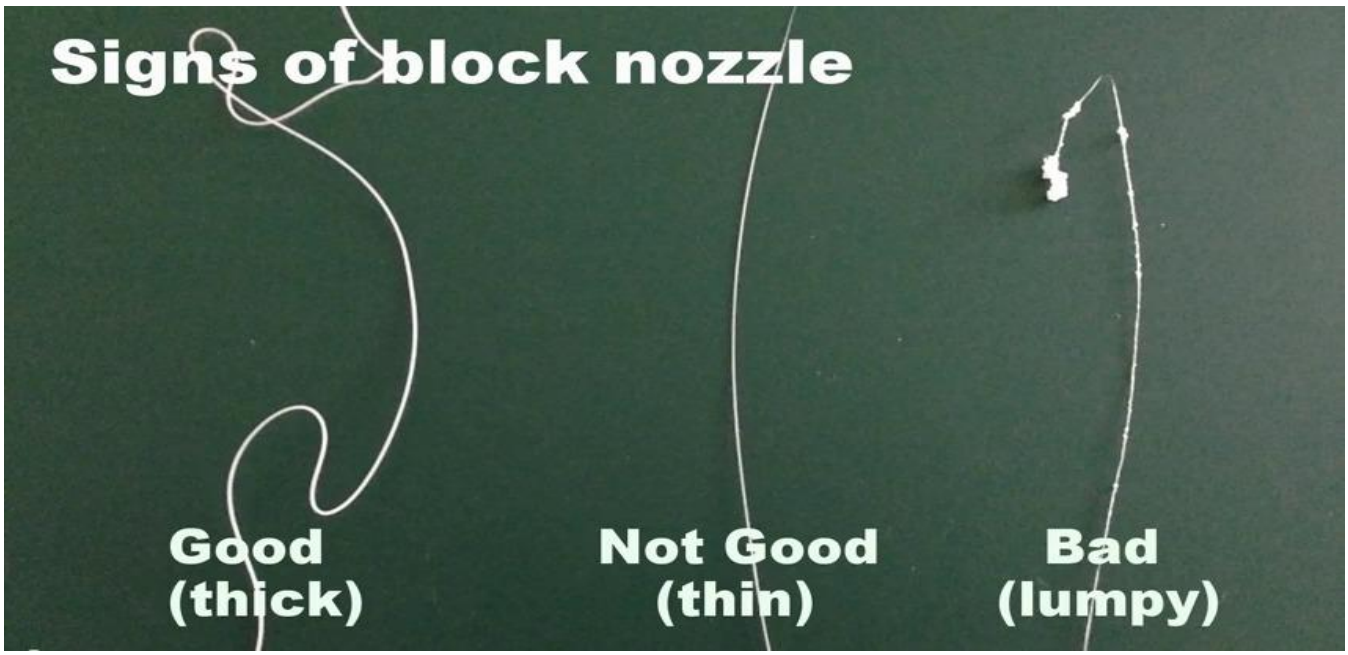
## Securing the hardware

One thing I cannot recommend enough, is that you secure the hardware. 3D printers are subject to high and low frequency vibrations, which will loosen any part, given sufficient time. A quick dab of hobby paint at the base of each nut will insure that your levelling effort pays off for the duration. You could use a second nut to lock each of the tensioning nuts, and then add a drop of red paint. It gets the job done, and is easy enough to remove with a hobby knife, if you need to take something apart.

## 3D Printer Maintenance

Like a Car, you printer consists of a number of precession made moving parts and parts that can get stressed under high temperature and wear and tear over time, here are just a few things to keep an eye on.

Many of you don't like the nozzle clogs and blocks. Even the smallest contamination can block the 0.4mm nozzle, you can use a 0.4mm or smaller drill bits to clean up the aperture while the hotend is hot. But sometime (many time) the contamination would come back and block the nozzle. That’s very bad especially when you are in the mid of big prints.



Nozzle block or clogs can be identified via below symptoms,

- filament is not extruding uniformly
- extrude very thin filament than usual
- Or the filament is not at all coming out from nozzle.

From the above symptoms, we are sure that the nozzle needs clean up, here are some methods known to work

# Cold Pull-out Method

PLA filament can be used to remove hard to remove contamination completely out of your nozzle. PLA has a useful property that you can heat it to a temperature between its glass transition and its melting point where it becomes a rubbery solid. When you pull it backwards it stretches and becomes thinner, so it peels away from the walls of the melt chamber and comes out in one piece. Anything in the melt chamber is pulled out with it leaving it completely empty and clean.

Here is one method on how you clean the nozzle

1. Heat to extrusion temperature and pull out the filament being used .
2. Use a 0.4mm drill shank to clear the aperture.
3. Insert PLA filament (preferably natural so you can see the contamination) and flush through the remaining original filament. You may need to keep clearing the aperture with the drill shank.
4. Cool the extruder to 80°C with the drill shank in place to ensure the nozzle is clear.
5. Send M302 command to disable cold extrusion check
6. Remove the drill and then pull out the PLA.
7. Inspect the end that comes out to see the culprit contamination.
8. Send M302 command again to enable cold extrusion check

Of course, if you are using PLA you can just do steps 4 and 5. This method of cleaning with PLA is much better than using solvents or burning out nozzles that I often see recommended as it can be done in easily and doesn’t risk damaging anything.

# Cleaning with flame torch and acetone

What you need:

- Acetone (This chemical don't like your skin, so weare glouse and protection glass)
- Torch (You can use your gas stove - be careful )
- Very thin wire
- Soak the removed nozzle into acetone for about 15 minutes to clean out exterior dirt. Use a tissue paper/cloth wipe clean the nozzle.
- Place a nozzle on a stone and burn it using the torch for about 1 min. Make sure it is extremely hot until you see slight changes in the colour.
- Use a very thin wire to clear the hole in the nozzle. If the wire cannot go through repeat step 2 again until the can go through. You do not want to scratch/damage the internal wall of the nozzle. Do not force through the hole with the wire. I use soft copper wire stripped from an unused phone cable.

- ***Monthly Maintenance***

- Check your belt tension. The belts should be tight enough that they feel tight when pressing down on the midpoint of the belt run. Make sure that the axis movement is smooth and without binding.
- Wipe down the smooth rods. The bearings/bushings (ball bearing ones as standard) may need a little lubrication from time to time. If you upgrade to the IGUS bearings, these are self-lubricating. Wiping with a clean dry cloth is suggested in this case.
- Lightly lubricate and clean the threaded rods. Do not use anything petroleum based. Silicone based or lithium based grease is recommended. Clean the threaded rods by running the axis up and down while wiping the threads.
- Use compressed air to blow out the fans

- ***Quarterly Maintenance***

- Check the set screws on the stepper motor pulleys and the small gear on the extruder, tighten if necessary. Use of a mild thread locking compound is acceptable.
- Examine the threaded rod couplers. Verify that any frame screws are tight.

***Next Section – Hints, tips and conclusion.***

# 3D Hints and Tips.

**Do not print with a badly calibrated printer!** Some printers are even delivered while not properly tuned, and price is not always a safe indicator! Check that everything is square, that the pulleys or belts are not lose, that the bed is level. Keep it clean. Experience and practice are a must, and you will eventually know enough that something goes wrong by the sound it makes!

**When you first get a 3D printer up and running, print out lots of 20mm cubes**. It's quite a boring object, but it can help ensure you have a good setup and calibrated machine. You can print these solid to test for over extrusion and size calibration. You can also print hollow to test for accurate perimeter width settings in your slicing program. This will also ensure better and more accurate hole size, model features and improved strength of parts when you have the perimeter width setting and extruder flow rates correctly defined.

**Get to know your printer**. The beginning is always difficult - test out all the different settings, try printing different shapes with different settings so that you start to understand your printer. At this stage, don't change materials too much as it will blur your results.

**Use the force**. Join online 3D Print communities to learn from others. Stand on the shoulders of giants to reach even further. This will save you a lot of time and will colour your 3D printing journey.

**Get some callipers.** They can be purchased on Ebay or Amazon, and are required to accurately measure filament, calibrate your printer, and to adjust your utility - oriented prints for a perfect fit. They really come in handy for measuring stuff that you are trying to model too!

**Printing with PLA on blue painters tape is a great starting point**. Be sure to wipe down the print bed with an alcohol wipe to remove any grease or grime from the factory before applying the tape.

**Getting the perfect extruder height is critical to great prints**. I prefer the z-level to be set so that there is a very faint impression left on blue painters tape when removing a PLA model.

So as the saying goes


I hope you have found this newbie guide useful and it's given you a better insight into the world of 3D printing and also the fun you can once you have followed a few simple steps.

There is plenty more information out there on the Web and also on the Anet A-series Facebook group page, so if you can't find what you looking here, I'm sure you will find it out there but just remember one thing when playing "If it isn't broke don't fix it"

Thank you.

K D Smith