# UP BOX

*Congratulations, you and your UP BOX will make great things together*

*"The UP BOX is an exemplary printer*
*that sets new standards*
*in safety and HD print quality"*

# USER'S MANUAL

## Table of Contents

# 1 Say hello to the UP BOX

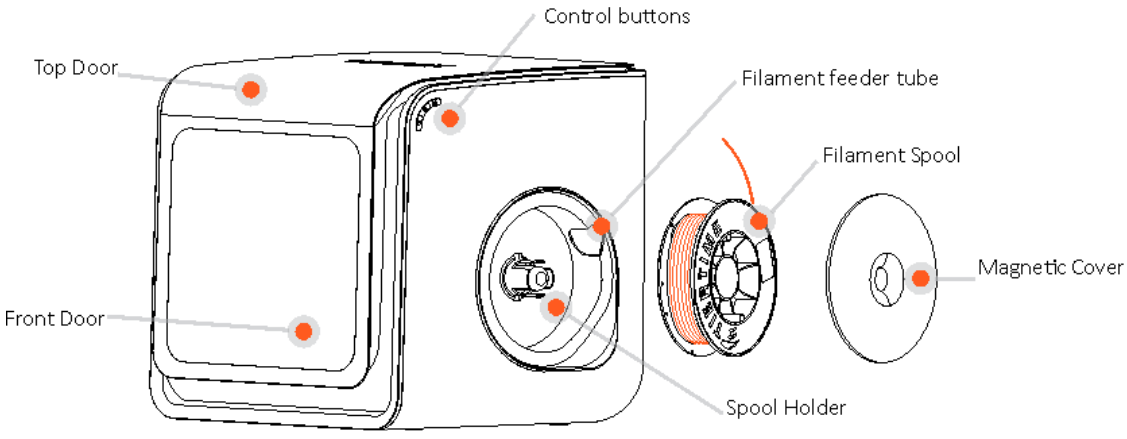
Take a look around.

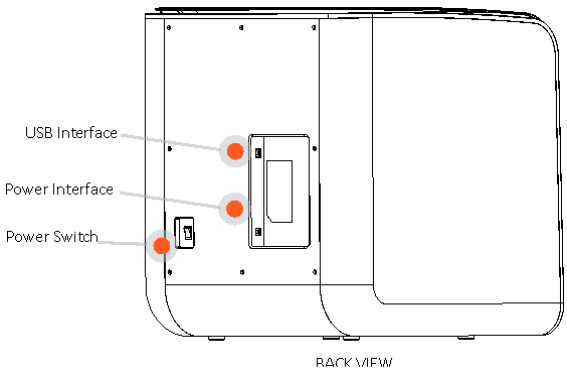
The UP BOX was designed specifically for educators and professionals looking for fast, hassle-free 3D printing with exceptional quality. The UP BOX boasts a host of features, from Smart Support, user-friendly software and automatic leveling, to paper-thin layer HD resolution with a heated build platform. Everything about this printer is geared towards creating high standard professional 3D models.

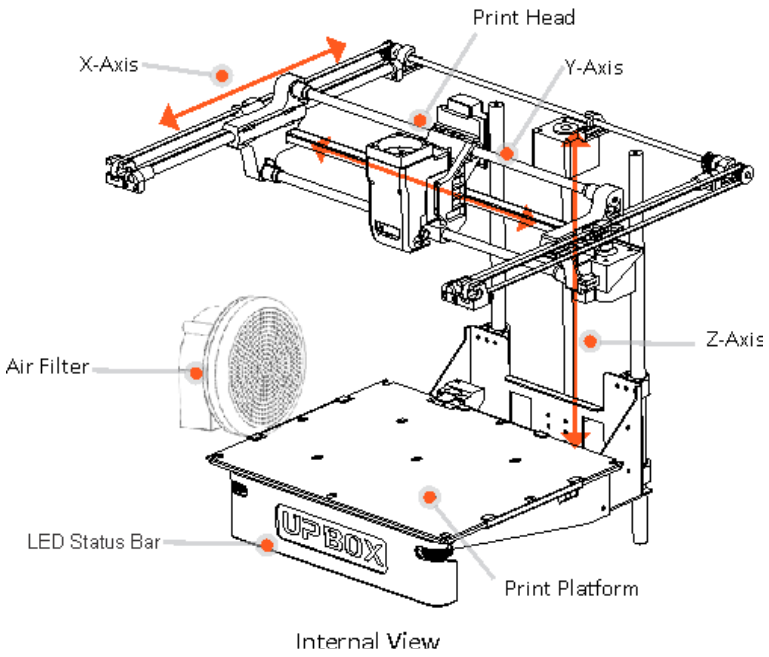
Print a working bearing in one hit, make a part for a dishwasher or just unleash your creativity and bring your designs to life with your new UP BOX.

## 1.1 UP BOX at a glance

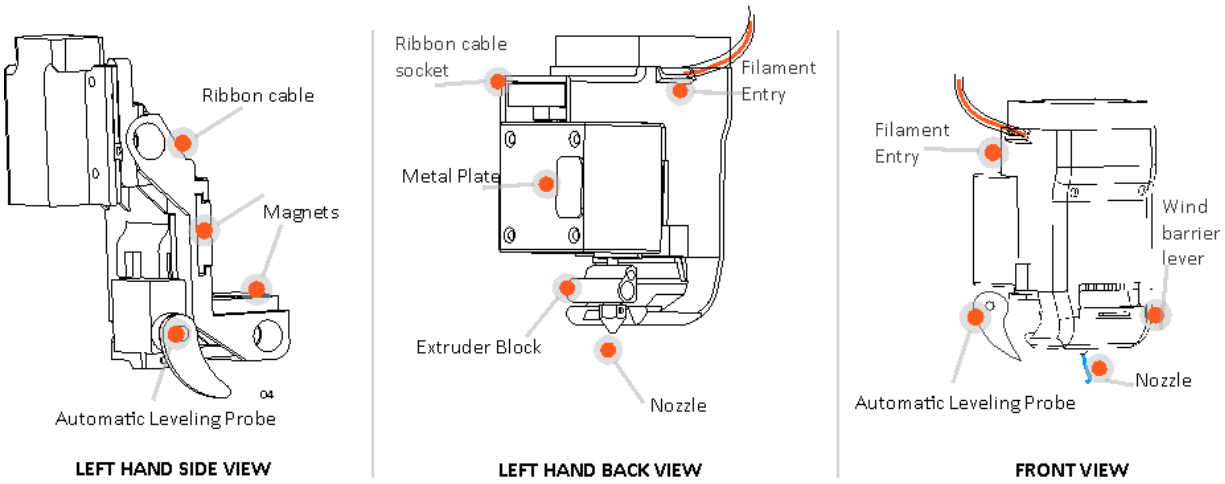
The UP BOX with HEPA filter is packed with advanced technologies in a remarkably stylish and robust design.



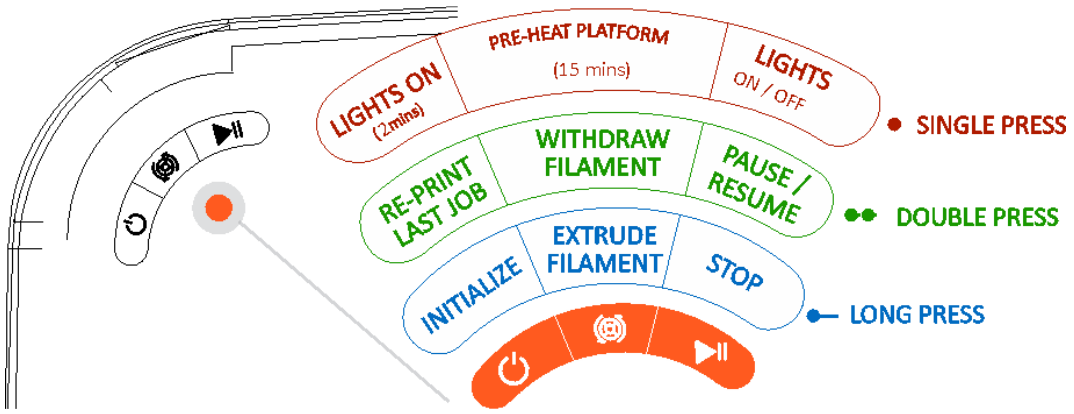



## 1.2 Print Head and mounting



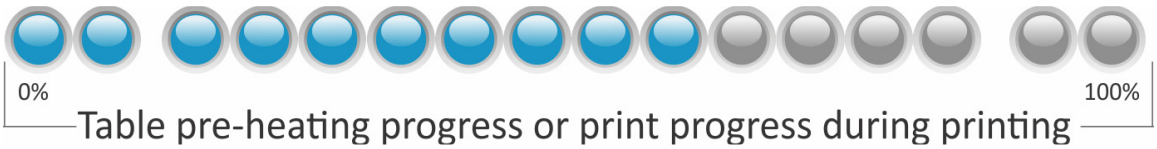

## 1.3 Touch Panel

You can do a lot with your UP BOX by using the Touch Panel, so it follows your every command. You also use the UP software to control the UP BOX.

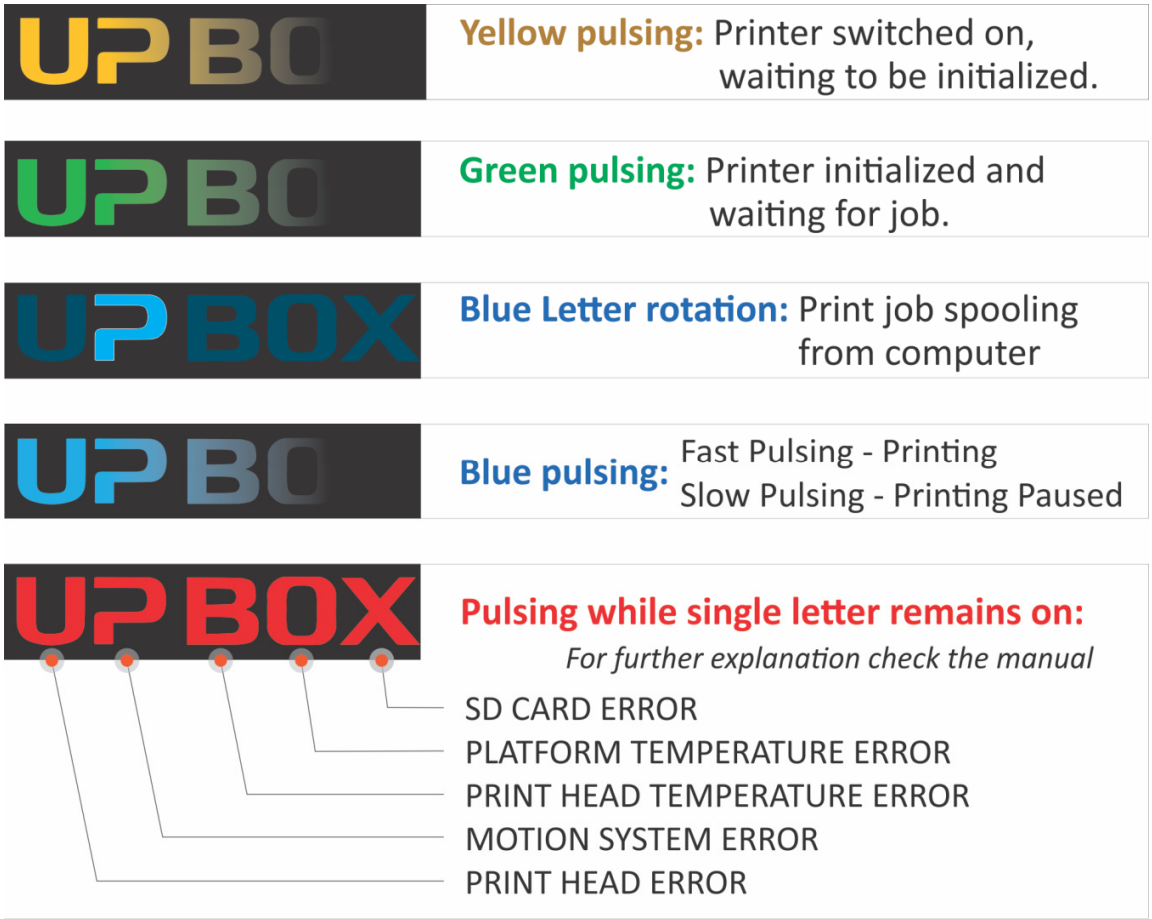


## 1.4 Status Display


On the front of the platform sit a row of blue LEDs above the words UP BOX indicating either progress of: a.) When you are preheating the Platform, this indicates progress on reaching its target temperature or b.) During printing, this is the overall print progress.

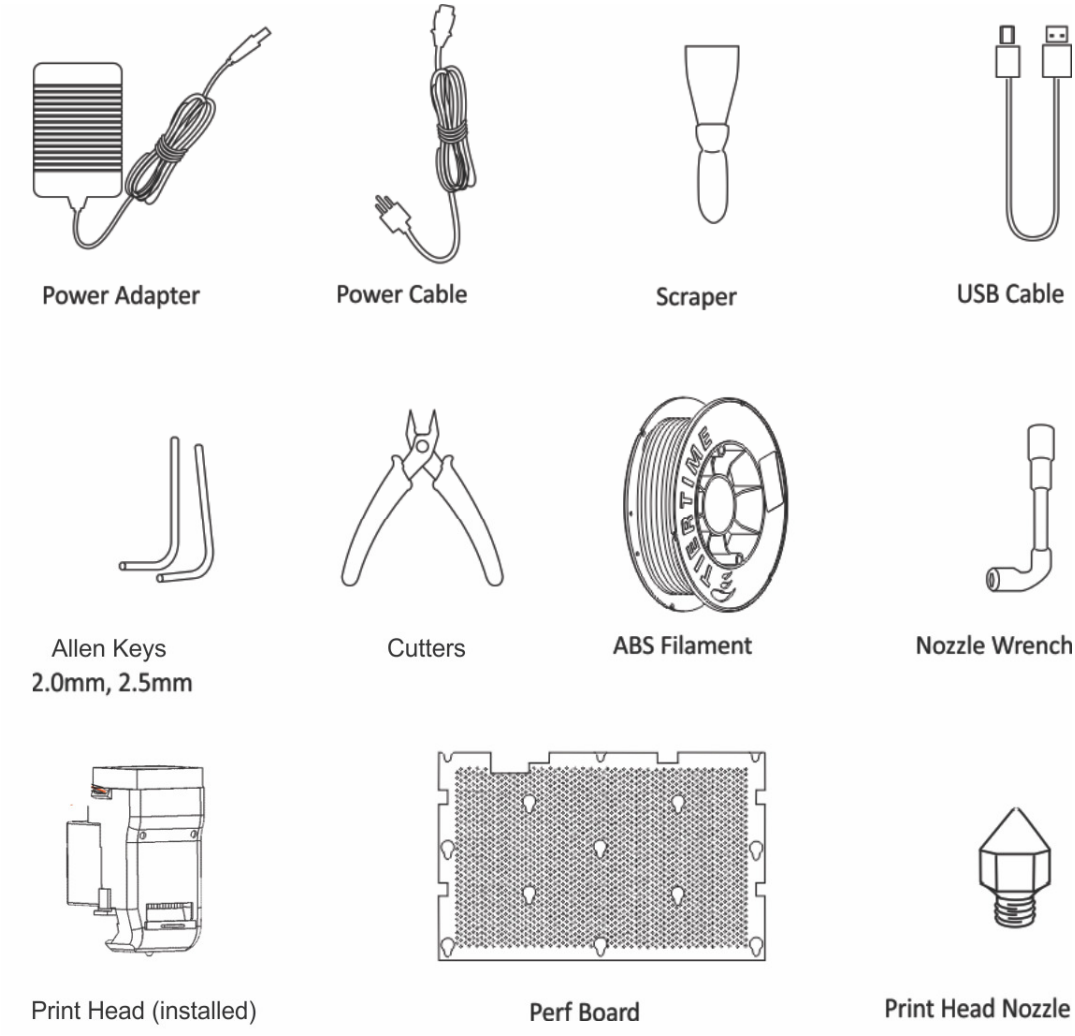



Located on the front of the platform is the heart beat of the UP BOX, it pulsates telling you what state it is in.



## 1.5 What's included

The UP BOX comes in an even bigger box filled with everything you need to kick start your desktop factory into action.



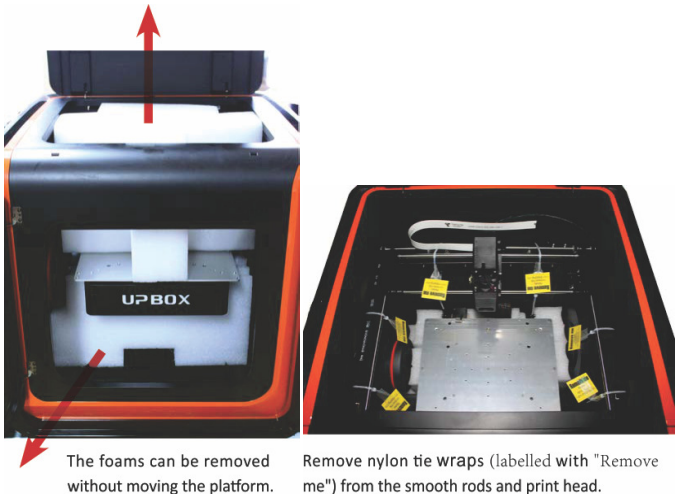
# 2 Acronyms and abbreviations

| | |
|---|---|
| STL | STereoLithography is the common file format used for sharing and printing 3d files |
| Additive Fabrication | The technical term used for the more user-friendly term of 3D printing. |
| ABS | Acrylonitrile Butadiene Styrene. This is a lightweight thermoplastic with resistance to high heat and is the most common plastic used in 3d printing and Lego. A strong and easy material to print with, but printing large parts can warp. |
| PLA | Polylactic Acid is a biodegradable material derived from corn. Unlike ABS it warps less but support removal can be harder. A great material to obtain low cost steel parts by sending the PLA printed part to a foundry to use investment casting / lost wax casting. |
| Raft | The printer lays down a foundation before it starts print the model. The raft is used to anchor the model down onto and into the perfboard. During the printing of the raft, any unevenness in the leveling of the platform is correct during the raft. |
| Perfboard | A reusable and removal build platform that the model is printed onto. (included) |
| Shell | The external layers of the printed part, much like an egg shell. |
| Infill | The internal honeycomb structure that gives the part strength |
| Smart Support | The UP software automatically generates the required supports / scaffold to support any overhangs of the model during printing. Much like building a bridge over water and having scaffolding to support it. |
| MEM | Melted Extrusion Melting, the process of melting plastic and 3d printing. Much like a hot glue gun on steroids. |
| Air flow lever | A small flap at the bottom of the print head that controls the air flow onto or away from the nozzle. Cool air blowing over the nozzle, cools the molten plastic quickly and can causes: weaker parts, better print quality and warping |
| Warping | When a part lifts away from the platform. Caused by the uneven cooling of the part during printing as the material shrinks back to its normal state. All materials expand when heated and shrink when cooled. Molten plastic as it is printed is in an expanded state, as the part cools it contracts. The larger the part the worse the effect and ABS is more prone to warping where PLA does not warp as much. |
| Air Printing | When the printer is moving and acting as if it is printing, but nothing is being extruded out of the nozzle. Check the trouble shooting section for help. |
| Extruder Block | Part of the print head that heats up to 260c, to turn the filament into a molten state and gets pushed out of the nozzle. Requires back pressure to be extruded in order to be squeezed out the 0.4mm hole of the nozzle. |

# 3 Quick start

This step by step guide might seem long and drawn out, but we highly suggest you follow it to get started. The touch panel can be used to carry out many of the below functions, but if you are unfamiliar with the printer we highly recommend following the below guide to have a better understanding of the process.

## STEP 1 - unpack



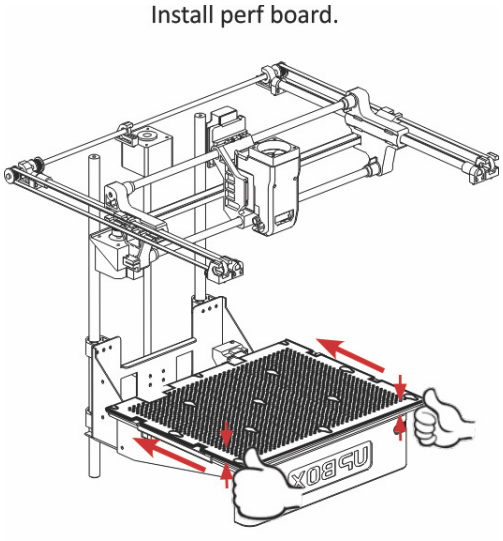

You'll need a friend in this step to help you remove the UP BOX from its box.

It's BIG!

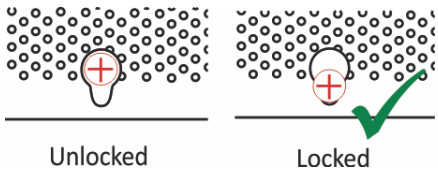
Lift it onto a table and then pull out the foam packaging and remove the cable ties that hold each axis in place.

**TIP:** Ensure you have removed all the shipping cable ties and packaging material from the inside of the printer. Move the print head manually around to ensure it has free motion. The platform cannot be manually moved.

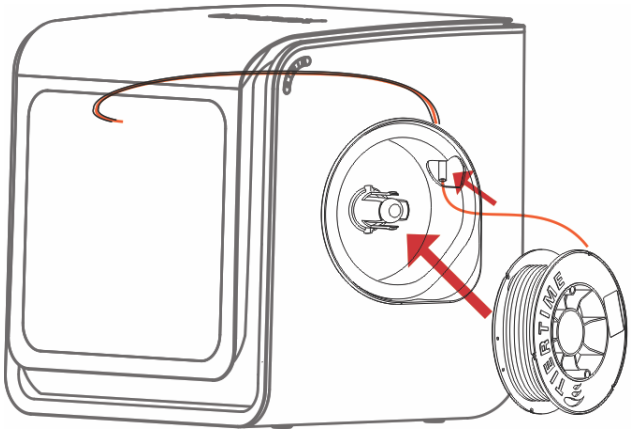
## STEP 2 - perfboard




Place the Perfboard onto the build plate and **lock** it into place with the locating holes, so the perfboard is completely flat against the metal plate.



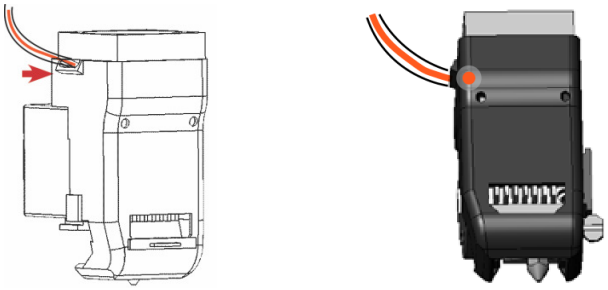
## STEP 4 - load filament



Remove the magnetic spool cover, then remove the spool of UP Premium ABS from its packaging.

**TIP:** Always keep tension on the filament. Never let the end of the filament go, or it will coil under itself and you'll then spend hours untangling it.

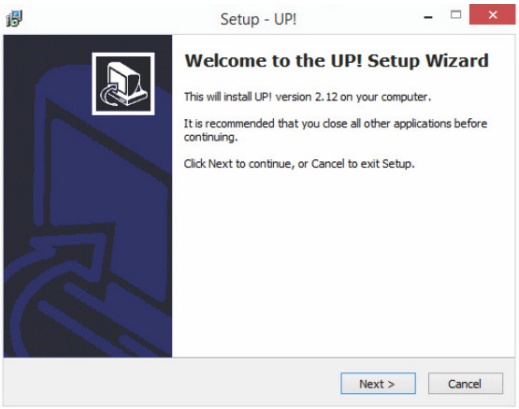
Feed the end of the filament from the back of the spool into the feeder tube until the end of the filament appears out the other end.



Cut the end of the filament off, so it has a nice clean flat end.

Insert the end of the filament into the left hand side of the print head and push it in all the way until it can't go in any further.

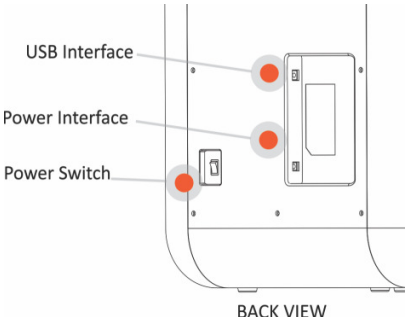
## STEP 5 - installing software




Download and install the latest UP software and included drivers from:
http://www.3dprintingsystems.com/support

**TIP:** For detailed installation or help, refer to Software Installation in this manual.

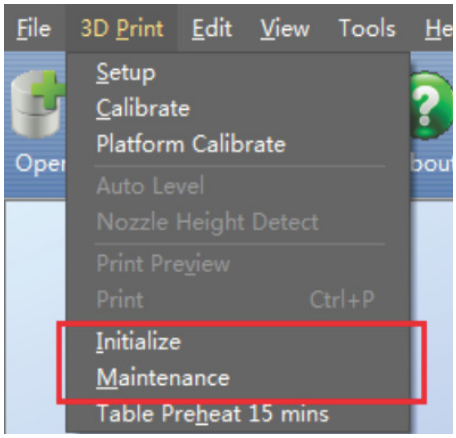
## STEP 6 - power up




At the back of the printer:
a) Plug in the supplied USB cable to both printer and your computer.
b) Plug in the supplied power supply
c) Switch on!

The front will be pulsing an orange light. Meaning, waiting to be initialized.

## STEP 7 - UP software

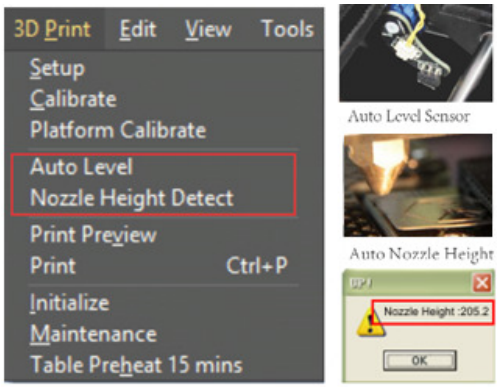



**CUATION: Double** check you have removed all the shipping cable ties and packaging material from the inside of the printer before you initialize the printer!

Start the UP! software, then click "3D Print". If the "Initialize" option is available, go ahead and click initialize.
If "Initialize" is unavailable, then check that the UP drivers are correctly installed.

During initialization the printer finds its home position on each X,Y & Z axis. Initialization is required every time the printer is switched on.

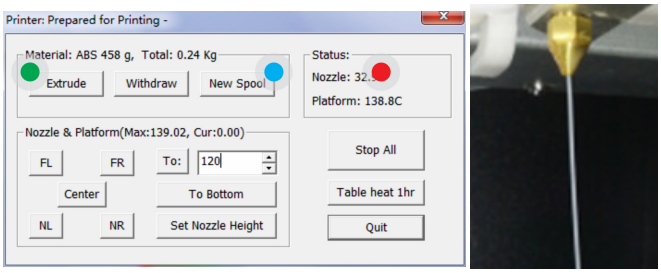
## STEP 8 - automatic calibration




The most important part of 3D printing is having a level platform and the correct distance between the nozzle and the platform. Click "**Auto Level**", the head will check 9 points around the platform are level, then it will set the platform/nozzle height.
You don't need to auto calibrate every time, only if you are having issues.

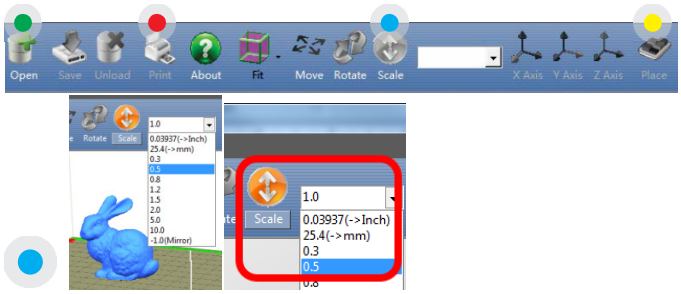
**TIP:** Ensure the end of the nozzle is clean and has no bit sticking out, otherwise this will give your auto-height a false reading. Auto calibration can only be done when the temperature of the nozzle is below 80c

## STEP 9 - extrusion!




Click "3D Print" and "Maintenance" then
- Click "New Spool", select ABS, OK
- Click "Extrude" (*beep*)
- You'll start to notice the Nozzle temperature starts raising. Once it gets to 260c (*beep*) **push** the filament into the print head and you should start to see a thin string come out of the nozzle. Repeat from extrude if it doesn't.

## STEP 10 - my first print




Download the "My first print" Bunny from here
http://www.3dprintingsystems.com/support

- Open the Bunny.STL file
- Click "Scale", select 0.5 and click "Scale"
- Click "Place" to centre the object
- Click "Print" and click "OK"

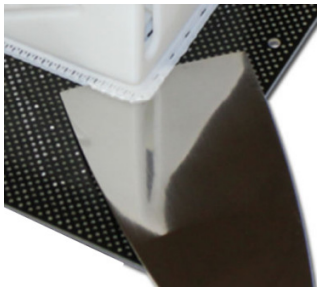
*Once spooled you can remove the USB cable from the computer.*

## STEP 11 - printing starts


It is very important to ensure that your first layer is squished out flat for good adhesion to the perfbord. If the nozzle is too far away then you'll just get a bunch of squiggles. Too close and you'll hear the print head clicking.

**TIP:** Any problems STOP the print job. Refer to troubleshooting section if you are having problems at this stage.

## STEP 11 - print complete - tada!



The printer will (*beep*) when it is complete.

CAUTION HOT, USE GLOVES
Unlock and remove the perfboard from the printer.

CAUTION: USE GLOVES & GLASSES.
Use the scraper to remove the entire printed object from the perfboard. Then break away the support material. Scrape both sides of the perfboard smooth (don't worry about bits of plastic stuck in the holes)

# 4 UP software installation

Visit http://www.3DPrintingSystems.com/support to download and install the latest UP software for Mac and Windows.

## 4.1 Windows

Start the "**UPx.xx setup.exe**" file and install it to the specified directory (Default is "Program files/UP" or for 64bit computers "Program files x86/UP"). Refer to the trouble shooting section for further help.

**Note:** This install includes the UP software, the UP drivers, spare part files and firmware into your Program files/UP folder.

## 4.2 MAC

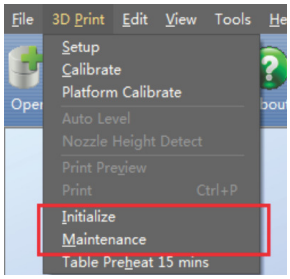
Run the BETA version "**UPx.xx.pkg**" file to install the software. Refer to the trouble shooting section for further help.

If you have any problems with the MAC software try:

1. Navigate to */Applications/Utilities/* and open **Disk Utility.**
2. Select the hard drive the game is installed on.
3. Click on the **Repair Disk Permissions** button.

# 5 Initialize

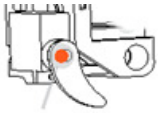
Every time you switch on the printer or perform an emergency stop on a print you'll need to initialize the printer. Doing an initialization zeros each axis to the printers starting point. For example if the print head crashed into a model, the head would slip on the belt and you would then need to stop the print and initialize. This can be done using either the touch panel or UP software.

| TOUCH PANEL | SOFTWARE |
|---|---|
|  |  Click "3D Print" then "Inialise |

# 6 Auto calibration


When a building is constructed, you must always have a level foundation. The same goes for 3d printing. Without a level platform to print onto or the distance between the nozzle and platform are incorrect will lead to all kinds of problems during the print like warping. Auto calibration does not need to be done every time you print, only when you start to have problems.

## 6.1 Auto Leveling

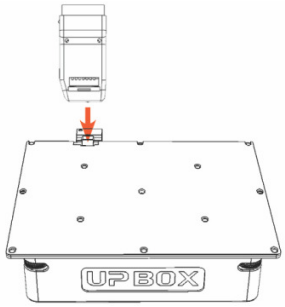



Before you perform the auto level procedure, ensure the perfboard is scrapped clean both sides and mounted flat and clipped onto the platform.
To level the platform click "3D Print" then "**Auto Level**". The leveling probe will drop down (*located on the back left of the print head*) and will measure the difference at 9 points around the platform. These differences are recorded in "*Platform Calibrate*" menu.

An extra test to check that your platform is level before printing, we recommend printing the "box_boarder.stl", with this you'll be able to see if the very first layer is squished out flat equally all the way round the platform. http://3dprintingsystems.com/download/box_border.stl
Without correct leveling you will get all kinds of problems later on, always start with a good foundation! Check the troubleshooting section if you are having any problems.

## 6.2 Auto Height

The Auto height only works with the supplied perfboard. If you are using any other surface you will need to manually set the height. With the correct height, the first layer of plastic should be squished out flat to ensure good adhesion to the perfboard.





EXPERT TIP : There is an easy way to tweak the platform/nozzle height by increasing or decreasing the gap between the nozzle & platform.
Load a model, then click "3D Print" and "**Print**" then simply either add or decrease 0.2 to the current value displayed **Nozzle Height:** and click OK.

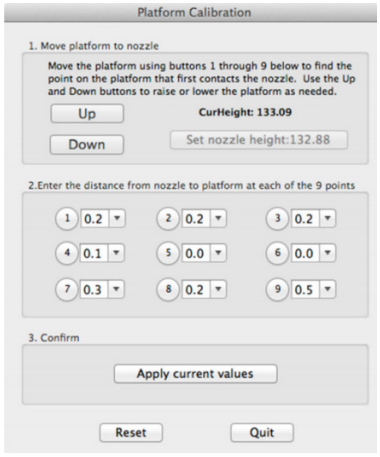
# 7 Platform leveling

There are three different way to level the build platform

## 7.1 Automatic Leveling

This is the easiest method and if using this then you don't need to use the other two methods below. This stores the nine point calibration in the "Platform Calibrate" window. The platform doesn't physically level, the variance is measured in software (platform calibrate) and when printing the raft this variance is accounted for. You might notice your raft is thicker on one side to the other.

## 7.2 Platform Calibrate (software)




The values in the image above indicate that the print surface is warped, with the center higher than both the front and back edges.

If you don't want to use the automatic leveling, you can also level the platform using the software.
Select "**Platform Calibrate**" from the 3D Print menu to open the manual utility. Click "**Reset**" as this will reset all the previous values store from the automatic calibration.
Move the platform up using "**UP** or **up arrow**" until the platform is quite close to the nozzle. Then click buttons **1** through **9** to find the closest point to the nozzle. Once you find the number 1-9 that is closest to the nozzle, move the platform until it just touches the nozzle and then click "**Set nozzle height**"

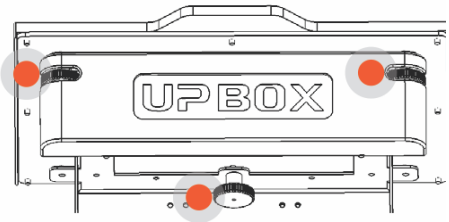
Next, click button **1** and select an option from the **drop down** menu to select how much the platform should move up. Do this until the platform just touches the nozzle.
Repeat for buttons **2-9**
Then double check that the gap distance between platform and nozzle is equal at each of the 9 points.
Once you are satisfied, then click "**Apply current values**" and quit.
If you need to perform this again, then click "Reset" to zero the current values.

## 7.3 Manual Leveling


Usually you don't need to physically level the platform, but if your platform is unlevel by more than 1mm, you'll need to level it. An expert tip is to always have a physically level platform (gap between platform and nozzle is equal at all corners).

First select "**Platform Calibrate**" and "**Reset**" and then "**Apply current values**" and quit. This zeros all the values.

Click "**maintenance**", enter **200** in the "**To:**" box and click "**To:**" then increase the value get the platform about 1mm away from the nozzle. The platform should touch the nozzle at around 205 but this is different from machine to machine.




VIEW FROM UNDER THE PLATFORM

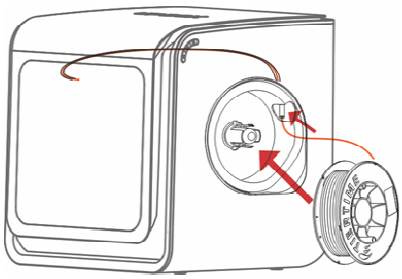
There are three thumb wheel screws, one on either side at the front of the platform and one underneath the platform. Start with the two front thumb wheels to adjust the front left and right height. Click "**NL**" to move the nozzle to the near left and compare it to the right by clicking "**NR**" near right and get the front left and right equally level.

Click "**FL**" & "**FR**" to check the back and under the underneath thumbwheel to align the back height.

Then use click "**Nozzle Height Detect**"

Leveling your actual printer on a table is not required, your printer can even print on its side and even upside down!

# 8 Loading & undloading filament

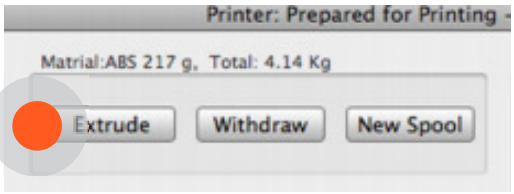


You can either use the touch panel buttons or software to extrude or withdraw the filament from the print head.

**TIPS:** Always keep tension on your spool, otherwise your filament will become tangled.
Always **withdraw** your previous filament before loading new filament.
Click "New Spool" if changing between ABS or PLA

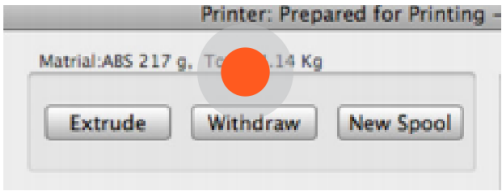
## 8.1 Loading / extrude filament

Cut the end of the new filament off so the filament has a clean edge to enter the print head.
Feed the filament through the feed tube until it comes out the other end.
There are two ways to extrude filament. Either "**Long press the centre button"** on the touch panel OR using the software click "**Maintenance**" and click "**Extrude**"
The nozzle will take a couple of minutes to reach the temperature (PLA = 200) & (ABS =260), once at temperature (*beep*) then gently feed the filament into the print head, you should feel the gear pulling the filament.
Refer to the trouble shooting guide if you have any problems.

| TOUCH PANEL | SOFTWARE |
|---|---|
|  To extrude the filament |  |

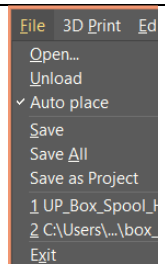
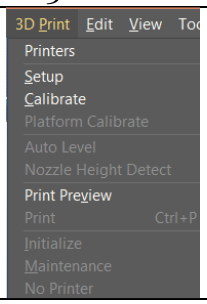
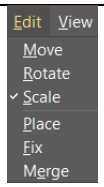
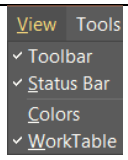
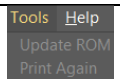
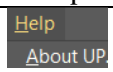
## 8.2 Ejecting / withdraw filament

To withdraw the filament either "**double press the centre button**" or via the maintenance screen and click "**withdraw**". It will take a couple of minutes to reach temperature and you can watch progress in the maintenance window. Once ready you'll hear a "*beep*"

| TOUCH PANEL | SOFTWARE |
|---|---|
|  To withdraw / remove the filament |  |

# 9 UP software

## 9.1 Menu Structure

| FILE | 3D Print | Edit | View | Tools | Help |
|---|---|---|---|---|---|
|  |  |  |  |  |  |













### 9.1.1 File

1. Open — Open STL files
2. Unload — Remove selected model
3. Autoplace — Enable auto placement of models on build platform
4. Save — Save selected model as UP3 file format
5. Save All — Save all models as UP3 file format
6. Save Project — Save models and print settings
7. Recent — Recently opened files
8. Exit

### 9.1.2 3D Print

1. Printers — Choose if you have multiple UP Printers
2. Setup — Choose default print parameters
3. Calibrate — Vertical calibration - refer to maintenance
4. Platform Calibrate — Software leveling - refer to maintenance
5. Auto level — Automatic leveling of the platform
6. Nozzle height — Automatic nozzle/platform height setup
7. Print preview — To view how long and how much material a model will take to print
8. Print — Spool the displayed models to the printer (*you can unplug the USB after spooling*)
9. Initialize — When you switch on the printer you need to initialize / zeros in all axis.
10. Maintenance — Extrude, withdraw, New Spool, Height, Pause - Refer below.

### 9.1.3 Edit

1. Move — Move model
2. Rotate — Rotate model
3. Scale — Scale model
4. Place — Automatically place the models on the platform
5. Fix — Attempt to do a basic fix on model (*highlighted in red*)
6. Merge — Combine all models into one file, so only one raft is created.

### 9.1.4 View

1. Toolbar — Show/hide toolbar
2. Status — Show/hide status at bottom of screen
3. Colours — Customise display colours
4. Worktable — Show/hide platform

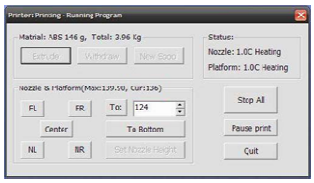
### 9.1.5 Tools

1. Update — Update the ROM file for the motherboard
2. Print again — Reprint the last model using it's platform/nozzle height

### 9.1.6 Help

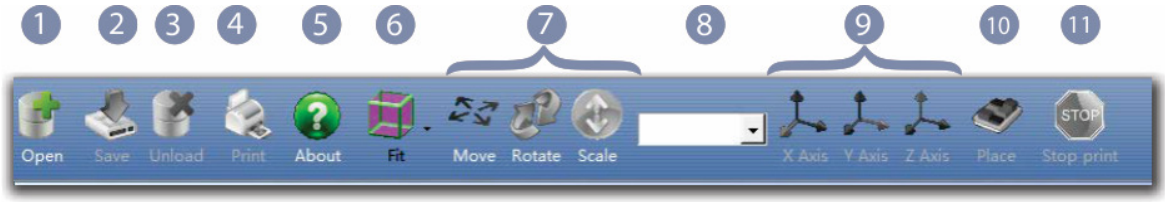
1. About UP — Software version

#### *9.1.6.1 Maintenance Window (from "3D Print" menu)*



1. Extrude — Extrude filament - takes a few minutes to reach temperature
2. Withdraw — Remove filament - takes a few minutes to reach temperature
3. New Spool — Change material between ABS or PLA and weight
4. Status — Displays the current temperature and heating status
5. Nozzle&Platform — Shows the maximum height and current height
6. FL,FR,center, etc — Moves the platform to different locations
7. To: & value — Moves the platform to the desired height.
8. To Bottom — Moves the platform the platform
9. Set Nozzle Height — Sets the current height as the nozzle height
10. Stop all — Abort the print job
11. Pause print — Pause the current print job
12. Quit

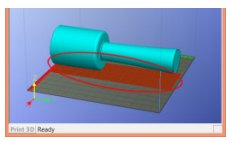
## *9.2 Tool bar*




1. To open a 3D model as an STL file type
2. Save as UP3 file format
3. Click to select the model, then click "*Unload*"
4. 3D Print the models on the screen
5. Software version
6. Choose from top, bottom, left, right etc views
7. First click on the model, then click Move, Rotate or Scale by the amount set in "**8**" and click Move, Rotate or Scale to do this uniform.
8. This is the amount you want to move, rotate or scale the part.
9. To move, rotate or scale by the individual axis
10. Click Place and your models will be laid out on the platform.

## *9.3 Navigation*

- Mouse over the model and a popup window displays information about the model.
- Right click on a model and a popup displays available functions
- Models displayed in red have errors, either attempt to perform a basic fix by clicking Edit / "Fix" or fix using this free service https://modelrepair.azurewebsites.net/
- Base of model highlighted in red, shows a possible "Warping warning" that the model could potentially warp due to its large size.



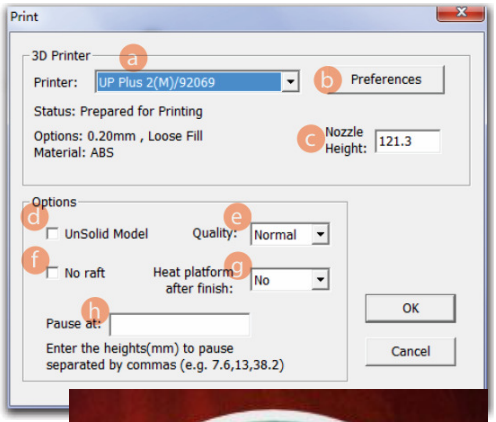
- Holding 'Ctrl' key you can simply drag the model to the position you want on the X & Y axis
- Middle mouse wheel, for zooming in/out of the model
- Holding middle mouse button, free rotation of the build area
- Right mouse button, move the entire build area
- Hold 'Shift' key and hold mouse left button, the model moves up/down on the Z axis.
- Hold 'Alt' and hold mouse left button, selected model is freely rotated.

### *9.4 Display : Status bar*

The status of the printer is displayed on the bottom row of the software.

- Status of the printer displayed on the bottom left
- Current print progress bar
- Current platform and nozzle temperatures
- Any error messages

## 10 Print!



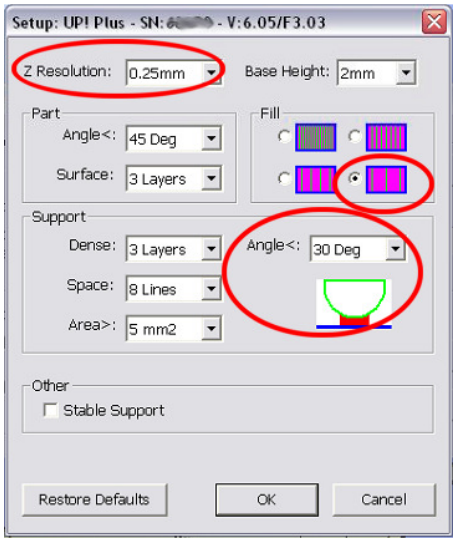

So you've loaded your model and ready to make it real!

Click "Print" and click "OK" if you just want to print it.
There are a few handy options available to you:

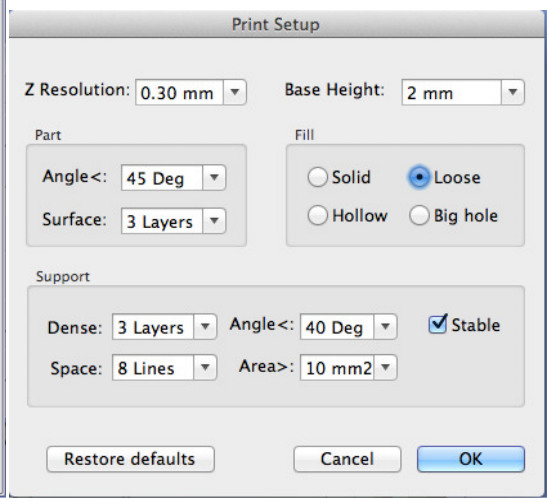
a. Lucky enough to have multiple UP printers, choose from this list of connected UPs.
b. Preferences - refer to section 11.
c. Nozzle height / platform height fine tuning
d. The software automatically detects if you need this on as it tries to fix unsolid models.
e. Quality: This is actually the print speed. Slower = better quality. Turbo=Super fast & draft quality
f. Prints without a raft - requires a manually leveled platform.
g. How long to remain heating the platform after finishing this job
h. Used when changing colours during a print. The image on the right was made raising the height of each coloured element of the logo. e.g. 2.4,3.1,3.6 - Start with white, printer passes at 2.4mm, withdraw white and add red, resume printing, printer passes at 3.1 and so on...


## 11 Print preferences

Click menu “3D Print->Setup” or Click “print” and select “Preferences’ and the following dialog box opens:
*Recommended Settings in red and in most cases are the only values that require changing depending on the model you are printing.*



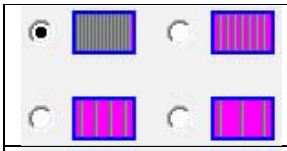
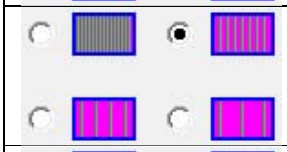
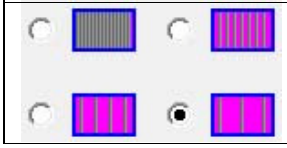

*Windows version*




*Mac version*

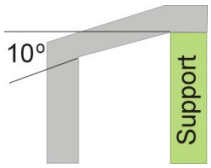
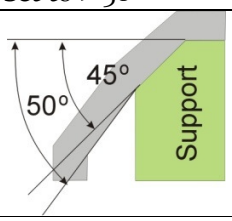
**Z Resolution:**
Sets the print resolution (layer thickness) of the printer. This can be between 0.2mm per layer to 0.4mm per layer. The finer the layer thickness, the better quality, the stronger the printed part and the longer it takes to print.

**Fill:**
There are four types of honeycomb fill that the interior of parts are made of. These cut away images below show the four different internal fill types.

| | | |
|---|---|---|
|  |  | **Solid Honeycomb:** The part is made of nearly solid plastic, which gives you the strongest part with a longer print time. This setting is recommended for strong and functional parts. |
|  |  | **Semi-Solid Honeycomb** |
|  |  | **Semi-Hollow Honeycomb** |
|  |  | **Hollow Honeycomb:** The Part is made mostly hollow, which gives you the weakest part but faster print time. Parts with flat top surfaces can slightly droop with this setting. |

**Support Options (Smart Support)**
The software's Smart Support is where the software will automatically calculate where it requires support material. The Bunny on the left was printed with 80 degree support and then the support material is broken away to reveal the end result on the right. The recommended setting is 30 or 10 degrees.

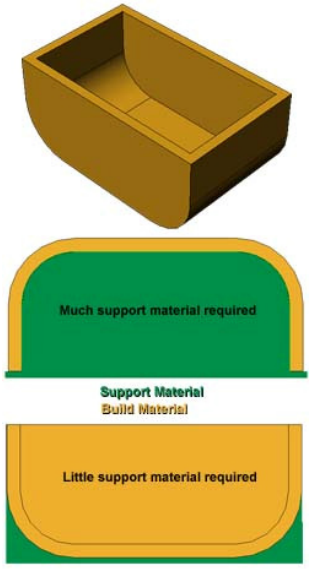
**Support Angle:** *(Recommended Angle:30)*
Angle at which support material gets inserted. For example if 10° is used, support material only gets used if angle of surface is greater than 10° from horizontal (so support material is almost not used unless there is a direct overhang), If set to 50° than support material is used for any surface that is greater than 50° away from horizontal. In the image on the left of a green curve, the red indicates the amount of support material, changing the angle higher will produce more support.

| Set to > 10° | Set to > 50° |
|---|---|
|  |  |

There is always a delicate balance between minimizing the amount of support material, versus the quality of the part, versus the difficulty of removing support material.

The orientation of the part on the print platform is also critical in determining both how much support material gets used, and also how difficult the support material will be to remove.

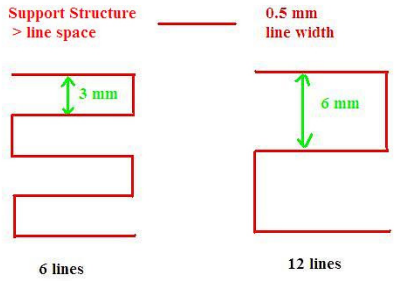
As a general rule, it is easier to remove support material from the outside of a part than from the inside. As can be seen in the picture to the right, the part would use a lot more support material if printed with the opening facing downwards than if it were facing upwards.

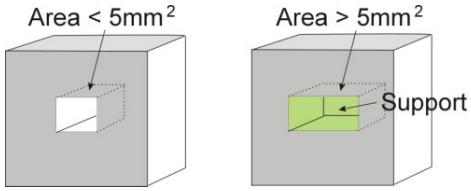



**Support - Dense:** This represents how many layers of 'solid' (dense) material form part of the support structure directly beneath the model. *Default = 3 layers*

**Support - Space:** The distance between the lines of non-solid support material. Changing this parameter requires some experience in balancing the quantity of support material used, ease of support material removal, and part print quality.

**Support - Area:** The surface area above which support material gets used. When you choose 5mm², for example, there will be no support if the overhanging area is less than 5mm².

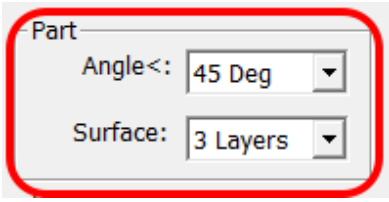



**Base Height:**
This is the thickness of the raft of material before the support layer is printed under the part. When the printer starts printing, it first prints a raft of non-solid material in which all the lines of support material are horizontal (along the Y axis). It keeps building up horizontal rows of support material for as many mm as you have chosen. Then, just before it gets to the bottom surface of the real part, it starts to build support layers perpendicular to the raft layers layer. *The default value is 2mm.*

**Part - Angle:**
The part Angle determines at what point solid (dense) support material gets used. If the angle is small then the printer will add solid fill layers under the part surface. The thickness of this solid (dense) support is determined by the "dense" parameter under the Support options as described below.

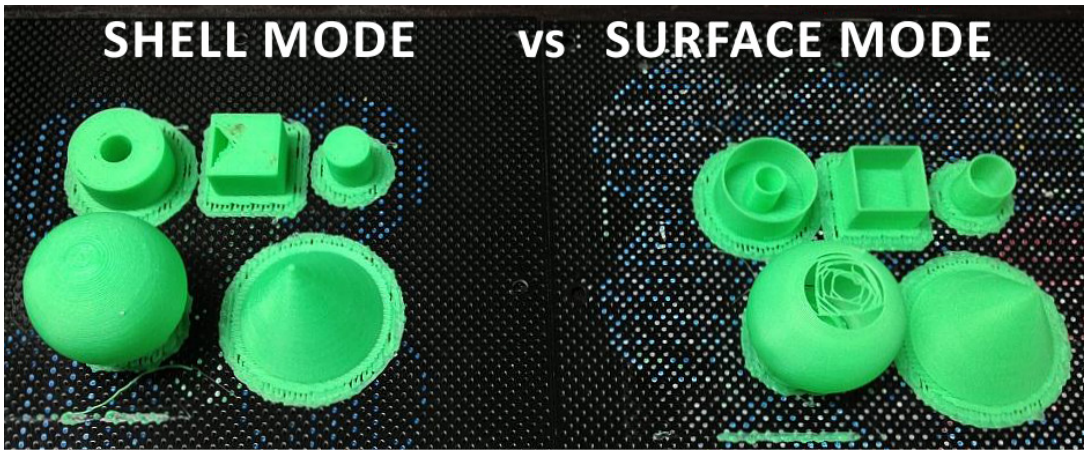
**Part - Surface:**
This parameter determines how many layers form the bottom face of a part when it is not solid. For example, if you set it to 3, the machine will print 3 complete layers before going into non-solid mode. This does not, however, affect the side wall thickness on non-solid parts, which are all the same thickness (approximately 1.5mm) irrespective of the fill mode.




**Stable Support**: Stable support creates support that is more rigid and the model is less likely to distort, but the support material is more difficult to remove.

**Shell**: By selecting this mode, the software will not create the internal honeycomb fill and will only create an external shell. For example printing the bunny with this selected will print a hollow bunny, saving material however making it fragile (2 layers thick). The shell option does not work well for parts with flat surface tops, e.g. a cube as there is nothing to support the top surface.

**Surface:** With surface mode, it will print a model only 1 layer thick with no internal fill. It will also not create a flat bottom surface or the top flat surface. Printing the bunny in this mode will not create a bottom surface and its back will cave in. See the below comparison.



# 12 Annotation of a 3d printed part

Shell is the outside shell of the part.

User selectable internal honeycomb fill of the part. This gives the part strength.

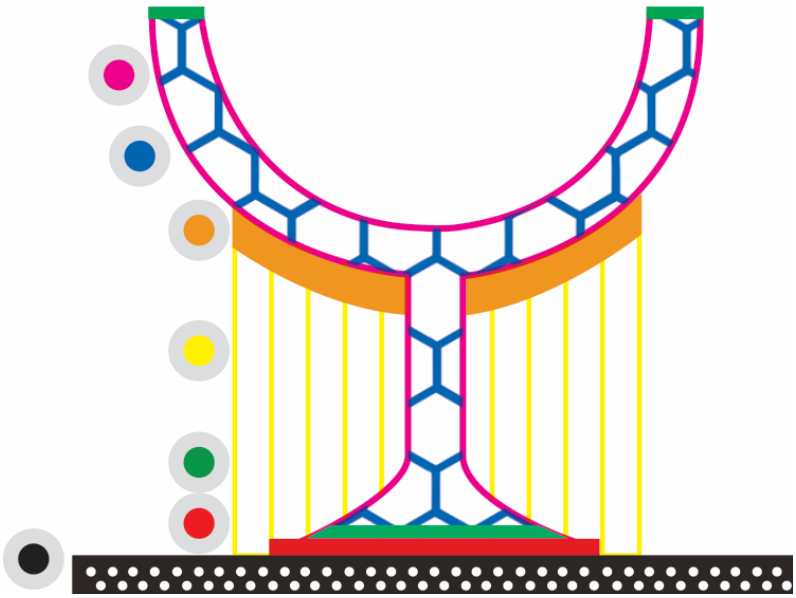
Support material shelf. Example <30°

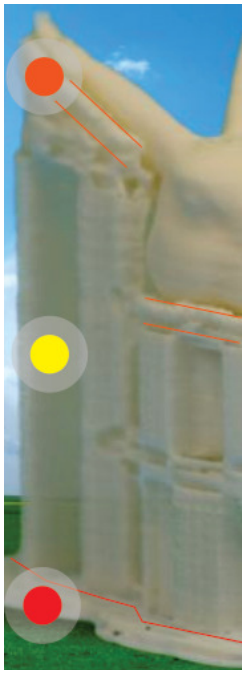
Support material concertina.

Surface is the 100% flat / horizontal bottom or top of the part.

Raft is the foundation of the part.

Perfboard





# 13 Removing finished printed parts

When the model has finished printing, the printer will beep, and the nozzle and platform stop heating. Open the door, using gloves, unlock and remove the Perfboard out from the printer.

Either wait for the perfboard to cool down or use gloves if too hot. Slide the spatula under the model and slowly wiggle it back and forth to pry loose the model.
TIP: Remember to use gloves as the platform and model may still be hot. The spatula is sharp, gloves must be worn.

The easiest way to remove support material is in this order:

- Remove the raft from the model first
- Next remove the concertina part of the support material
- and lastly unclip the support shelf from the part.

## 13.1 Removing the raft

The first few layers that the printer lays down is referred to as the Raft. In order to remove the raft from the model, if the base of the model is flat. Its easiest using the spatula by sliding it between the raft and the model and then sliding left and right in between the model. Pulling the raft off by hand will normally cause ABS fatigue marks (were the ABS plastic goes white from stress).

**TIPS:** You can easily get the original colour of the ABS back by waving a flame over the affected area briefly.

## 13.2 Removing Support Material

Printed models are composed of two parts. One part is the model itself, and the other part is the support material used to support any overhanging parts of the model.

The support material is the same physical material as the model material, but the support material is printed at a lower density. It is very easy to distinguish the model from the support material so it is easy to remove.

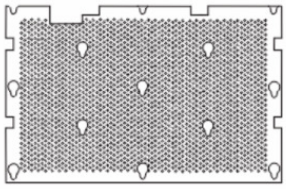
Have a look at the teapot in the pictures. The top picture shows the teapot with its support material still attached and the right picture shows the teapot with support material removed.

The support material gets removed using a combination of tools. Some material can easily be cracked off by hand. Support material close to the model is easier to remove using tools such as the knife and cutters.

# 14 Maintenance

## 14.1 Caring for the Perfboard

**TIPS:** Never attempt to remove a printed model whilst the perfboard is loaded inside the printer. Doing so will unlevel your build platform.



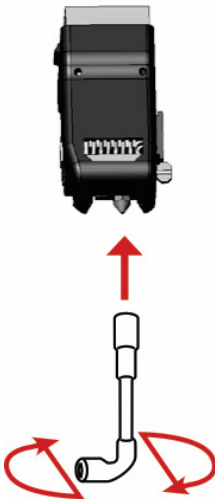
Perf Board

The perfboard is a hard wearing platform and can be used time and time again. You don't need to remove the plastic from the inside holes, as when heated these become sticky and help the model stuck down to the platform to reduce warping. Once a print has completed, using the gloves remove the perfboard and let it cool down. Then you can slightly flex the perfboard to attempt to release the printed model. To clean the perfboard vigorously scrape the left over plastic off, on both sides to prepare for the next print. If you find parts are no longer sticking, brush some acetone over the perfboard. Spare or replacement perfboards are available to purchase.

## 14.2 Cleaning the Nozzle

**STOP!** Always check that the drive gear is clean, before attempting to clean the nozzle.

ALWAYS press "Withdraw" and whilst above 240c then unscrew the nozzle using the safety gloves. Failing to follow this will damaged your extruder and void your extruder block warranty.



It is recommended to replace your nozzle every 300 hours or 6 months. For most people, it is easier to simply purchase replacement nozzles instead of the hassle of cleaning old nozzles.

For best results obtain the "UP Essentials" tool kit.

*What you need:*

- *Small blow torch*
- *0.4mm drill bit (yes it is very small!)*
- *Acetone*
- *Safety gloves, glasses and mask.*
- *Long handled pliers*

**TIP:** To keep your prints looking great it is important to keep the outside of your nozzle clean and free from leaving dark blotches in your prints. Always keep your nozzle clean. Do a withdraw and once at temperature (*beep*) give the nozzle a wipe with a piece of old denim jeans (non synthetic).

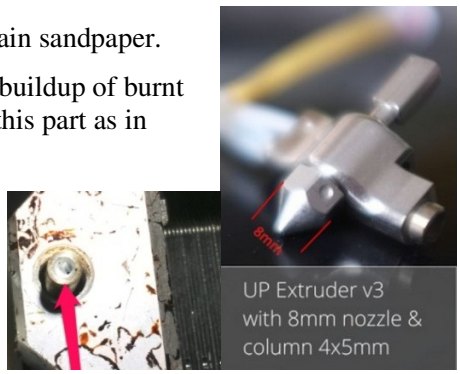
Pay attention to the safety instructions included with Acetone as it is flammable.

-  Do a withdraw and once the nozzle is over 240c, using the 0.4mm drill bit, poke through the hole in the nozzle. Be careful not to break the drill bit inside the nozzle. This alone offers a quick fix.
-  Otherwise soak the nozzle in acetone for 1hr (overnight is better)
-  and if all else fails then, wear a mask as the fumes from burning plastic inside the nozzle are hazardous. Use the blow torch, hold the nozzle with the pliers and burn the nozzle for around 4 minutes, to burnout the residue plastic.
- Cool the nozzle down in water
- Do another withdraw and screw the nozzle back on.

## 14.3 Cleaning the extruder column

The outside of the extruder block can be cleaned, when cold with a fine grain sandpaper.

The silver column that runs from the top through into the nozzle can get a buildup of burnt particles on its inside walls. It is not a very common requirement to clean this part as in order of importance cleaning 1) driver gear 2) nozzle 3) extruder column.




To clean the column:

- Remove the nozzle (*follow the section Cleaning the Nozzle*)
- Remove the print head from the printer
- Put a 1.5mm drill bit through the silver column

It is recommended to have a spare extruder block on hand.

## 14.4 Cleaning the drive gear

The drive gear tends to get a buildup of plastic dust over time as the gear grips into the filament and pushes it down into the extruder block and time to time it slips. You can hear the slippage by a (*click click*) sound coming from the print head, normally on the first layer of printing or when parts are warping. The drive gear is the first place you want to check for problems.

*What you need*

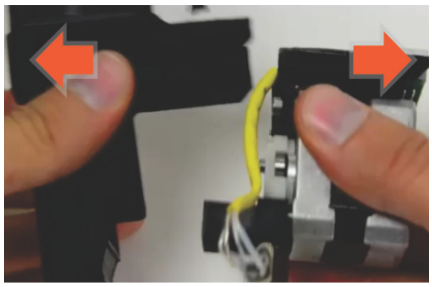
*An old toothbrush / a steel bristle brush is better*

*Small size Alan key*

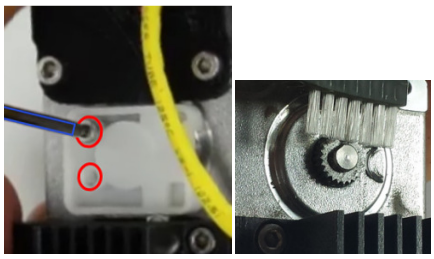
*Safety gloves*

- Withdraw the filament from the print head
- Wait around 20 minutes for the print head to cool down sufficiently before working on it
- On the top back of the print head, remove the rainbow ribbon cable cover.
- Unplug the rainbow ribbon cable from the print head.
- Unplug the black fan cable from the top of the print head
- Pull out the entire print head, held in place by magnets.

Either wait for the print head to cool or using saftey gloves pull apart the black head cover from the main body of the print head. The cover is held in place by small snap lock dimples, so it might require a bit of twisting and pulling action to release it.



Using the Alan key tool, unscrew the white gear cover (*2 screws*). Then pull the gear cover off the motor (*snap lock*). Remove the plastic dust residue from the gear and clean the surrounding area.



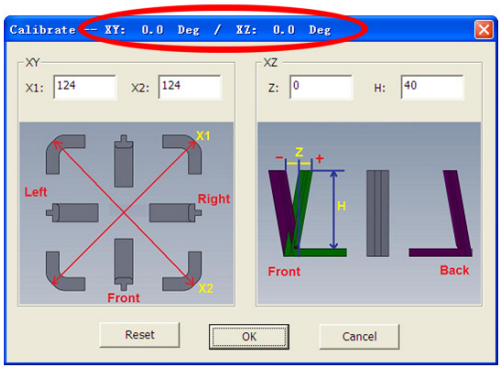
*Be carefull when replacing the gear cover not over tighten the two screws, otherwise you'll break the gear cover.*

Replace the print head in reverse order.

## 14.5 Lubrication

The linear rods on the UP 3D Printer may occasionally require a bit of lubrication to keep it operating smoothly. The recommended to use lithium grease. When lubricating the bearings, first clean off as much old grease as possible from the bearings, and then apply new grease to the bearing and slide each axis in the appropriate direction to spread the grease.

## 14.6 Vertical calibration

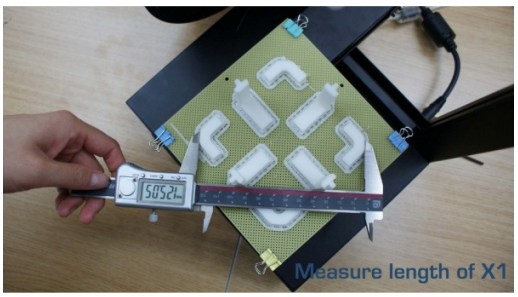


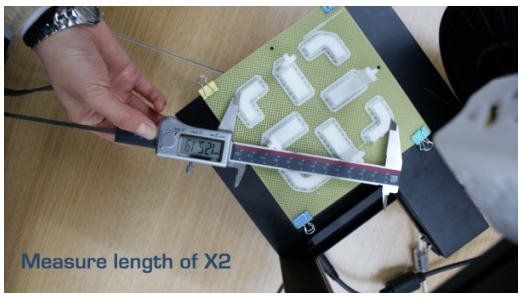

If your models have a lean to them, like the leaning tower of Pisa, only then you'll need to run the vertical calibration.

**IMPORTANT: Ensure your platform is level, at the correct height and you have RESET the calibration values before starting this process!!!**

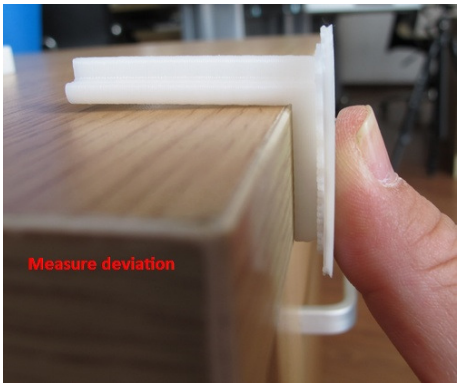
The Vertical calibration procedure allows you to ensure that the printer platform is perfectly horizontal and that the printer prints consistently in the X, Y and Z direction.

1. In the UP software, click "3D Print" menu and click "**Calibrate**"
2. Click "**Reset**" and click **OK**. (the status bar should then show 0 values as per picture)
3. In the UP software open the Calibration model located in "**C:\program files\UP\Example\Calibrate96.UP3**"
4. Open the "Calibrate" box form the "3D Print"
5. 3D Print the calibration model.
6. After the calibration model is printed, measure the X1 and X2 length, as shown in the pictures below.




Then enter the measured X1 and X2 values into the appropriate boxes.




Remove the Front Centre 'L' shaped component, and measure its deviation. Put the exact value into the Z box. If it deviates to the right side, the value to be put into the Z box will be a positive value. If the deviates to the left, the value to put into the Z box will be a negative value.

Finally, measure the height of Front Centre component, which should be 40mm. If the part measures near 40mm, enter 40mm as the value.

Click "OK" to record all these values and exit the calibration window.

# 15 Trouble shooting guide

## 15.1 Air printing

The term air printing comes from when the printer is performing the action of printing but nothing is coming out of the nozzle. The biggest cause of air printing is NOT a blocked nozzle, but rather a buildup of plastic dust around the drive gear.

**Causes and Solutions**

| | |
|---|---|
| Filament diameter | Always check the diameter of your filament using a vernier caliper and ensure the filament is 1.75mm and within +/- 0.1. Too thin and the drive gear won't be able to grip onto the filament. Too thick and the filament won't be able to fit inside the silver column. |
| Parts warping | A warping print lifts away from the perfboard and pushes up against the nozzle and blocks the flow of plastic, thus causing the gear to slip on the filament. Creating dust around the drive gear. |
| Platform to close to the nozzle | If the nozzle is scraping on the platform it's too close and will cause the flow of plastic to be blocked. You might hear a clicking sound from the gear slipping on the filament. |
| Broken piece of plastic in the silver column | Open the head up and check for a broken piece, or a piece stuck in the entry of the silver column |
| Carbon build up on inside walls of silver column | Refer to Maintenance section |
| Carbon build up inside nozzle | Refer to Maintenance section |

## 15.2 Increasing the nozzle height

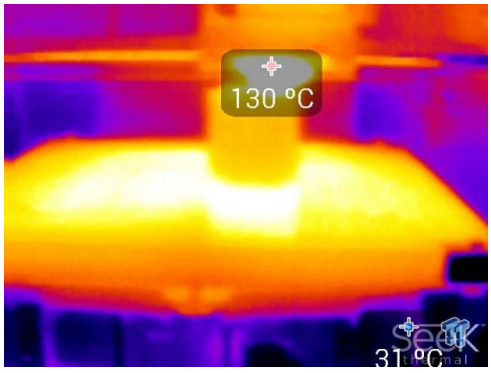
If you find you can't increase the platform/nozzle height any further then do the following:

Load a model and do a print preview, then enter a greater value in the "*Nozzle Height*" box 

and click OK. Now go into "*Maintenance*" and move the platform higher as required.

## 15.3 Warping & splitting parts

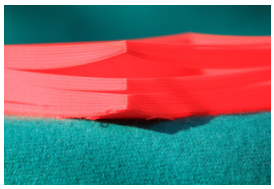
*Warping is a constant battle of the forces of physics!*




Warping of a model is a result of uneven thermal contraction of the ABS during printing. Like most materials when heated they expand and contract as cooled. If you printed a solid cube the inside temperature would be greater than the outer temperature and so the outside cools faster than the inside and you end up with the part warping. So what if we print the cube in a heated environment like the UP BOX. The cube example would still be hotter on the inside than on the outside, so the warping would still happen, just reduced. So why don't we increase the environment temperature, this

would reduce the effect of warping even more, but unfortunately this would also result in several other problems. Even the large industrial plastic extrusion printers suffer from warping. To get around warping it's about learning the best orientation to print a model, or splitting a model into parts.

Warping is caused by a number of different factors:



- The gap between the platform and the nozzle are not equal at all points, i.e. the print platform is not level. e.g. Always warping from one side.
- The nozzle height / distance between nozzle and platform is to great. If the nozzle is too far away from the print platform, then the part will not anchor correctly. As the part cools it will pull free of the perfboard, resulting in warping. e.g. The raft warps away from the perfboard.
- The edge of the bed is cooler than the centre. A bead of ABS deposited at the same temp as it exits the nozzle will cool more rapidly at the edge of the bed, the higher the temperature gradient, the greater the contraction, so the plastic at the cooler edge will contract more and when this occurs repeatedly (layer by layer) as a fresh layer retracts, it pulls the layer underneath up slightly.
- Not sufficient pre-heating of the platform before printing. The larger the model, the more pre-heating is required before starting a large print.

You absolutely must not open the UP BOX doors during printing, as it is as bad for the ABS as it would be for opening the oven when making Soufflé. A sudden rush of cold air can warp or split your model.

Some materials shrink when cooled at a higher rate and unfortunately ABS is one of them. You should try other materials like PLA as it doesn't warp as badly as ABS.

### 15.4 Blocked nozzle

When you perform an extrude, the filament should come out in a straight line. If it curls around the nozzle or comes out at an angle refer the maintenance section. The photo to the right shows a good extrusion.

### 15.5 Blocked extruder column

Check the maintenance section

### 15.6 Burn marks on the printed models

When printing with light coloured plastics like white, you will see brown burn marks. To reduce these always keep your nozzle clean. Check the maintenance section

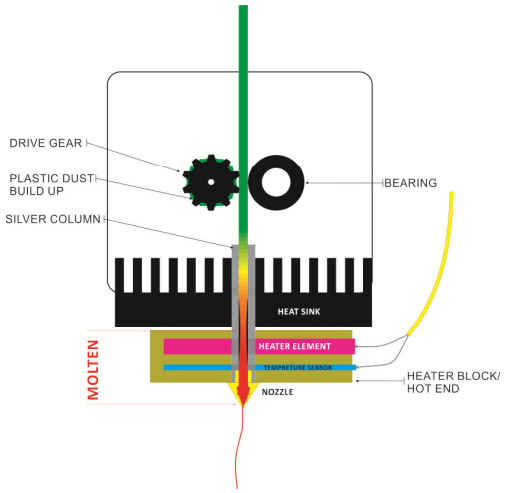
### 15.7 Nozzle too hot/cold error

The yellow cable connection that attaches to the extruder block is very fragile and can easily get damaged from: cleaning the print head, wiggling the connection or a printed part crashing into the connection. When the cable gets a small break in it, the software reports "Nozzle too hot / too cold" error". We strongly suggest having a spare extruder block or print head available as a spare.

# 16 How does the print head work

## 16.1 Extruder components

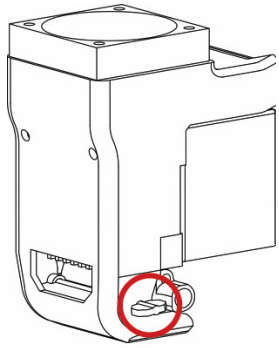
- Stepper Motor: Used to drive the plastic material into the hot end.
- Drive Gear: Bites into the plastic and pushes it down with some force into the hot end / extruder.
- Gear Cover: The bearing is to allow the filament to be passed through easily.
- Heat sink & fan: This keeps the top part of the extruder silver column cool, to ensure the filament remains solid and rigid in order to push down onto the molten filament below.
- Silver Column: Upper part of column dissipates heat through the heatsink.
- Nozzle: Screwed into the Hot End / Extruder Block
- Extruder Block/Hot End: Heated up to 270c and monitored by the temperature sensor.




## 16.2 Theory of plastic extrusion 3D Printing

1. The filament is pushed down by the drive gear, pushing the filament into the hot end.
2. Because the extruder gets very hot, the heat easily travels up the silver column and would soften the filament. However we don't want that to happen.
3. The fan blows cold air onto the heat sink, so the heat sink deflects the heat from the upper part of the silver column and the filament stays rigid.
4. The rigid filament pushes down on the molten filament and also creates a large back pressure on the molten filament below, thus extruding it out of the tiny hole in the nozzle.
5. Without this pressure or force, you would not be able to print. You would be able to extrude as there is no model or platform in the way when you do this. e.g. The model or platform slightly blocks the nozzle during printing, thus a fair amount of force is required to extrude during printing and hence the filament is squished out flat onto the model or platform.
   The concept is like icing a cake, you need to put pressure on the bag to extrude out of a tiny hole.

### 16.3 Extruder air flow


Air Flow Adiustment Knob

On the right hand side of the print head is an air flow adjustment knob.
With air flow blowing over the nozzle, this has the following effect:

- Increases print quality of underside surfaces as the plastic is cooled faster each layer. e.g. Rabbit chest is smoother
- Easier to remove the raft and support material from the model.
- Part strength on the Z axis is weaker as each layer is not melted into the previous layer well.
- Increased warping or splitting of parts as the outside of the shape is cooled too fast.

With the knob is the closed position, the opposite effect will occur.

- Decreased print quality of underside surfaces as the hot plastic droops over the edge of the previous layer.
- Raft and support material is harder to remove from the model.
- Part strength on the Z axis is stronger as each layer is melted into the previous layer.
- Decreased warping or splitting of parts as the outside of the shape is not cooled.

## 17 Safety considerations

**Warning Hot Surfaces!** Never touch the print head, nozzle or print bed during operation, these will be too hot to handle and could result in burns or personal injury. Always use the included safety gloves when handling the head, nozzle, platform or printed parts.

**Warning!** Turn off the printer before a) placing your hands inside the printer b) before removing parts, cables or covers. Ensure to tie back loose hair, loose clothing whilst the printer is in operation.

The Printer must be used in conjunction with the original manufacturer power supply, otherwise the machine could become damaged or even cause a fire hazard. Keep the power supply and printer away from moisture, water and out of high temperature environments. Failure to do so could result in risk of electric shock of fire.

It is recommended that you discharge any static charge from your body before touching the machine to prevent an interruption while printing and any potential damage to the printer. For best performance place an anti static computer mat on the floor in front of the printer.

The printer is designed to work properly at an ambient temperature of between 15°C and 30°C and humidity of between 20% and 50%; Operating outside these limits may result in decreased print quality of your models.

# 18 Appendix a - support

Please take the time to join the UP community forum where are UP users hangout.
forum.3dprintingsystems.com

To get support for your product please contact 3D Printing Systems

| | |
|---|---|
| Australia | New Zealand |
| Phone: +61 (0)3 9099 0225 | Phone: +64 (0)9 281 4206 |
| support@3DPrintingSystems.com | support@3DPrintingSystems.com |

# 19 Appendix b – 3d related printing software

There are many great free or low cost 3D CAD programs that can be used for design, scanning and cleaning up files to 3D print.

For an every growing range of excellent software apps, check this list out:
http://3dprintingsystems.com/education-stem-apps/

Library of 3D files ready to print.

- www.thingiverse.com
- www.grabcad.com

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## Revision Sheet

| Release No. | Date | Revision Description |
|---|---|---|
| Rev. 0 | 10/4/15 | User's Manual Created as draft |
| Rev. 1 | | |
| Rev. 2 | | |
| | | |
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