![FELIX printers logo]

User manual

Felix 2.0, 3d printer

Version 3 – 17-Septembre-2013

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FELIXrobotics BV
Wapendragervlinder 17
3544DL Utrecht
Netherlands

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2   INTRODUCTION

First of all thank you choosing FELIXprinters! To get your Felix printer up and running as fast and painless as possible please follow this manual carefully. Don't compare this product with a television, where a user manual is normally not required to get it working properly.

Please **follow instructions carefully** and take your time to get familiar with the product. Please don't make any shortcuts unless you know what you're doing. It's better to spend a few minutes extra on reading, than to wait a week for new parts.

When things are unclear or if you have any remarks or tips, please contact us at support@FELIXprinters.com. We also recommend looking on our forum and get yourself a forum account. You will benefit from the ability to get downloadable and printable upgrades for your printer. Also it is a great source to obtain more knowledge about your printer and printing in general.

| Printing			Electrical		
Print Technology	Fused Filament Fabrication		AC input:	100-240V, 50-60 Hz	
Build Volume	25.5 x 20.5 x 23.5 cm		Power Requirements	12V DC, 15 Amps	
Print Quality	Extreme	50 microns	Connectivity	USB	
	High	100 microns			
	Medium	250 microns			
	Low	320 microns			
Postioning Precision	XY: 13 microns Z: 0.4 microns				
Filament Diameter	1.75 mm		**Mechanical**		
Nozzle Diameter	0.35 mm		Chassis	Aluminum profiles	
			Build platform	Aluminum plate	
Software			XY Bearings	Linear ball bearings	
Software Bundle:	RepetierHost + Skeinforge/SFACT		Z bearing	Linear ball bearings	
File Types:	.STL		Stepper Motors	1.8 deg angle 1/16 micro-stepping	
Supports:	Windows, XP and newer				
	Linux (Ubuntu 12.04+)				
	Mac OS X [10.6/10.7/10.8]				
Physical Dimensions					
Weight	7.5kg				
Shipping Weight	11 kg				
Shipping Box	50x30x30 cm, DIY kit 50x50x60 cm, Assembled unit				
Temperature					
Ambient operating temperature	15-32 ˚C [60 – 90 ˚F]				
Storage temperature	0 – 32 ˚C				
Warmup time					
Heated bed (60 degC)	3 min				
Nozzle (200degC)	1 min				

4.1   CALIBRATION OF TABLE

For a successful print it is important that the table is properly calibrated. The distance between the nozzle and table should be the same at every x,y position. The table can be leveled by turning the 3 M4 nuts underneath the heated bed. For the assembled units the calibration should be good, but due to shipment it could be that the calibration is slightly off.

!!The calibration should be done by moving the axes by hand, not via interface of computer!!
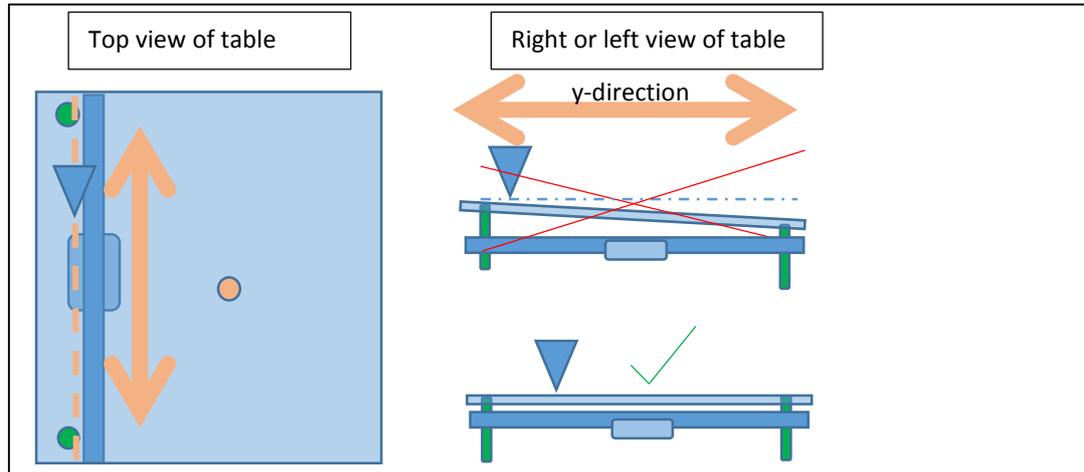
Step 1:
Calibrate the table in y-direction.
1.   Move the X-axis carriage(extruder) to the homing sensor
2.   Move the Y-axis (heated bed) to the homing sensor
3.   Move the table up until approximately 1mm from the hot-end.
4.   Goal is to move the y-axis and to get the distance between the tip of hot-end and the heated bed the same over the whole movement.
5.   Move the bed over the whole movement range and while moving adjust the 2 adjustment nuts underneath the plastic parts under the table along the rail to level out the table in y-direction.
6.   Move the table a little closer to the hot-end and repeat the previous step until the distance is the same over the whole length.
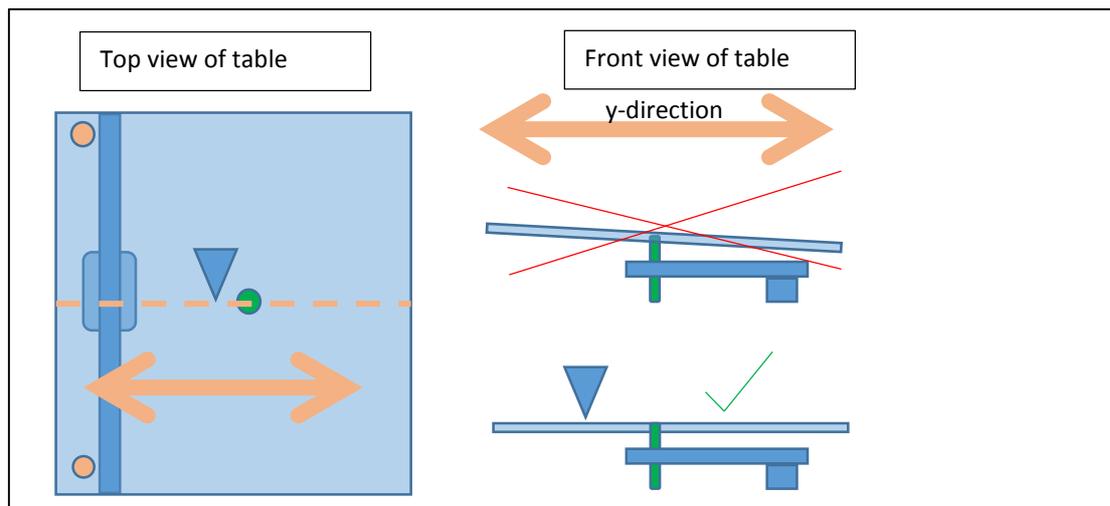
Step 2:
Calibration in x-direction
7.   Move the table to the middle of its movement range
8.   Move the X-axis carriage over its movement range. While moving check the distance between the hot-end and bed. If the distance is not even, adjust it with the nut which supports the middle of the table.
You are done-calibrating the table.

4.2 SOFTWARE INSTALLATION –MICROSOFT WINDOWS

For mac users goto chapter 4.3

4.2.1 DRIVER INSTALLATION

The following steps are necessary to make your printer and the computer able to communicate to each other.

1. Plug in the power supply cable.
   NOTE: without the power cable the electronics doesn't work. It needs the voltage of the purple wire to drive the logic of the board. The power to the rest of the board is controlled by the CPU when needed.
2. Plug in the USB cable into the computer
3. Your operating system should find the correct drivers automatically
   a. if the drivers are not found automatically then download drivers from here: http://www.ftdichip.com/Drivers/VCP.htm.

4. Go to start->right-click on "Computer"-> click properties -> in left pane click ''Device Manager''
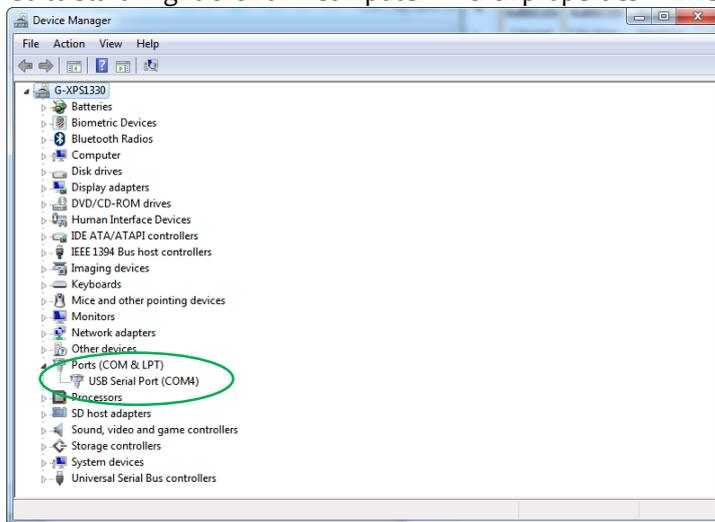
Note what COM-port is present. If there are more than one COM ports available unplug the RAMPS USB cable, and re-plug it again. Check what port number is appearing and disappearing. This port number will be used for the next step.

NOTE: If the port is not displayed follow this tutorial: Sometimes windows is still not able to find the port. To fix this follow this tutorial: http://forum.arduino.cc/index.php/topic,107098.0.html

4.2.2 PRINTER SOFTWARE – REPETIER-HOST

The function of Repetier-Host software is to control the printer and processes your CAD files (STL-format) to be printable.

1. Download latest version of Repetier-Host from www.FELIXprinters.com/downloads
   Navigate to software folder and download **setupRepetierHostFELIXprinters*.exe**
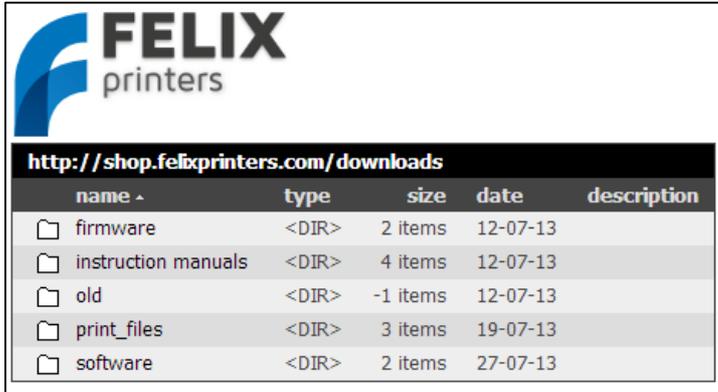
2. Run the **setupRepetierHostFELIXprinters*.exe** file and follow the installation instructions.
3. Make sure the power cable and USB cable of the printer are connected.
4. Start Repetier-host.
5. Go to Config -> Printer settings.
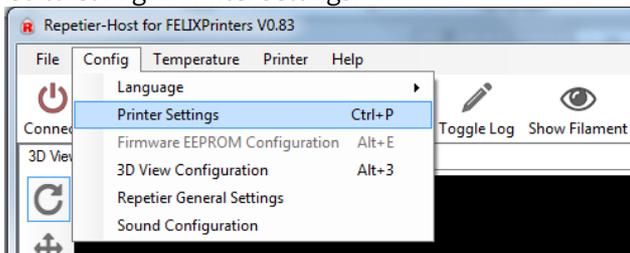
In the configuration window press the **Refresh Ports** button.
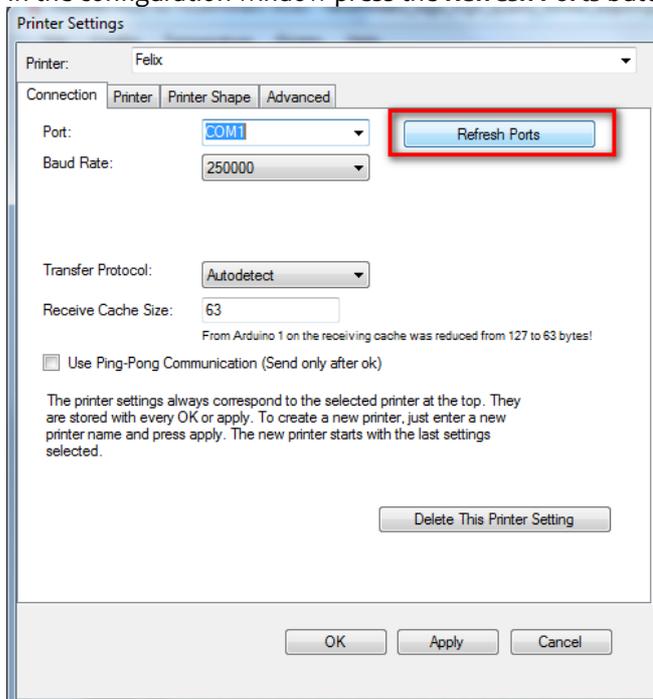
Choose the COM-port which belongs to your printer. This is the same COM-port obtained from previous chapter. The COM1 in the pictures is probably different for your situation.

4.3 SOFTWARE INSTALLATION –MAC OS

1. Plug in the power supply cable.
   NOTE: without the power cable the electronics doesn't work. It needs the voltage of the purple wire to drive the logic of the board. The power to the rest of the board is controlled by the CPU when needed.
2. Plug in the USB cable into the computer
3. Download Mac-drivers from: http://www.ftdichip.com/Drivers/VCP.htm.
4. Download repetier software (.dmg file) from: http://www.repetier.com/download/ or from http://shop.felixprinters.com/downloads/index.php?path=software/

5. Open .dmg file and copy Repetierhost.app to your Application folder
6. Download latest printer profiles from http://shop.felixprinters.com/downloads/index.php?path=software%2Fsfact+slicing+profiles/

7. Extract sfact.zip file (containing 1 folder with 2 subfolders: "sfact" and "sfact_profiles"
8. Copy sub-folder "sfact_profiles" to Macintosh HD
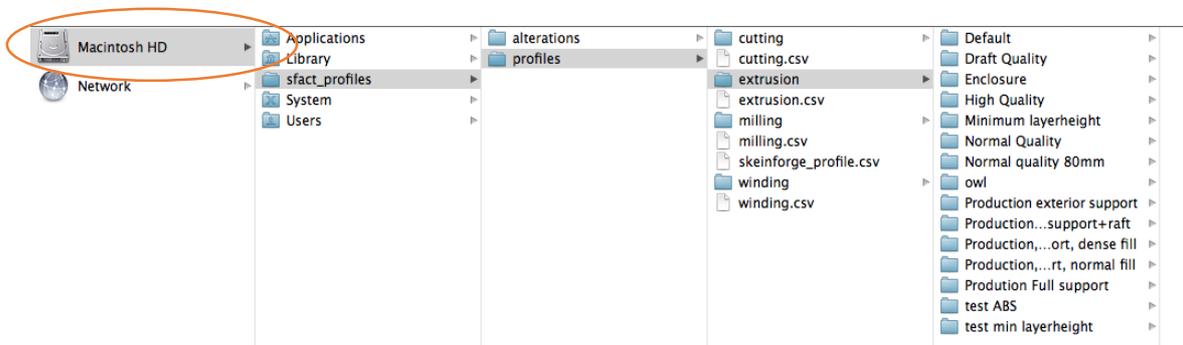
9. Copy the "sfact" **sub**-folder to Applications folder (where the Repetierhost.app is as well)
10. Open the Repetier-Host Mac Application and go to Printer Settings
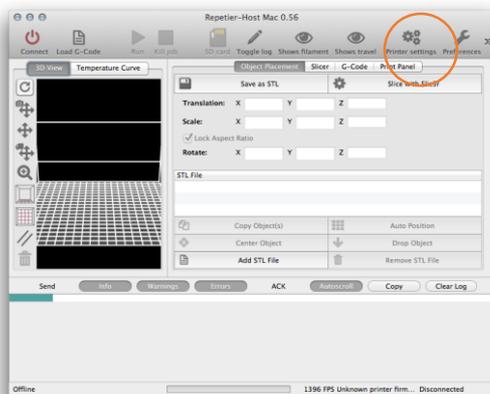
11. Configure printer settings:

Printer settings

Configuration: Default | Add | Delete

Connection | Behaviour | Dimension | Advanced

Port: usbserial-AM026O7K

Baud Rate: 250000

Stop Bits: 1

Parity: None

Transfer Protocol: Force ASCII protocol

Receive cache size: 127

Most firmwares have a buffer of 127 bytes. The official boards supported by Arduino 1.xx only have 63 bytes.

☐ Use Ping-Pong Communication (Send only after ok)

The host can speed up communication, if it sends as many commands as fit into the receiving buffer. In Ping-Pong mode, only one command is send at a time. Only after the printer send an ok signal, the next command is send. Use only if you have problems without Ping-Pong mode.

☑ Firmware sends OK after error

Normally a printer sends ok even if needs a command resend. Uncheck if your printer doesn't do this.

OK | Apply | Cancel

Printer settings

Configuration: Default | Add | Delete

Connection | **Behaviour** | Dimension | Advanced

Travel Feedrate: 4800 [mm/min]

Z Axis Travel Feedrate: 600 [mm/min]

Default Extruder Temperature: 195 [°C]

Default heated bed temperature: 55 [°C]

Number of Extruder: 1

☑ Check extruder & heated bed every 3 seconds

☑ Don't log temperature requests (M105)

Dump area position: X= 125 Y= 0 Z-Min= 20

☐ Go to dispose after job/job kill

☑ Disable extruder after job/job kill

☑ Disable heated bed after job/job kill

☑ Disable motors after job/job kill

Add to comp. printing time: 8 [%]

OK | Apply | Cancel

12. Configure Skeinforge settings under Preferences -> Slicer -> Skeinforge

13. Click "Browse" to direct to the correct files

Application: /Applications/sfact/sfact**.**py

Craft Utility: /Applications/sfact/skeinforge_application/skeinforge_utilities/skeinforge_craft.py

Python Interpreter: /usr/bin/pythonw

Python Interpreter: /Applications/Repetier-Host Mac.app/Contents/Resources/pypy.app/bin/pypy

Profiles Directory: /sfact_profiles/profiles
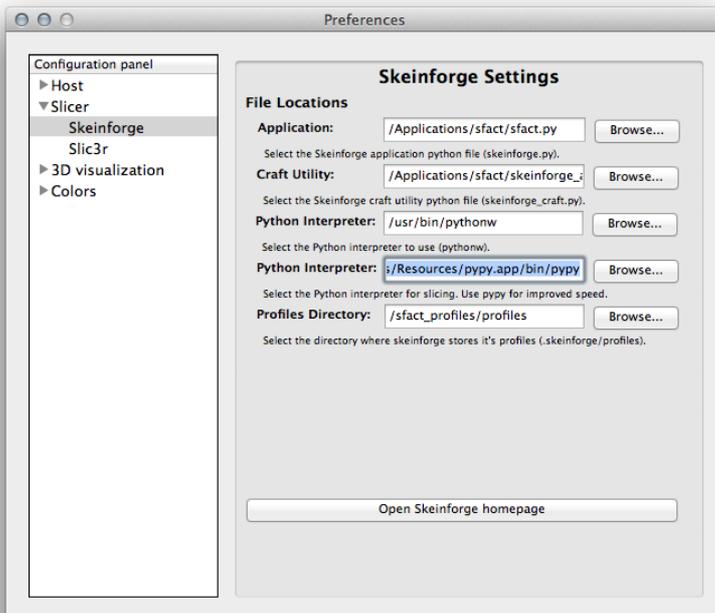
4.4 CALIBRATE THE Z-DIRECTION/ CONNECT TO PRINTER

To obtain good quality prints it is **essential** that the heated bed is **level** and that the distance between the hot-end and the bed is close enough.

The leveling was done prior to the software installation. So now it is time to calibrate the z-axis height with the z-axis limit switch vane. (If you assembled the printer yourself: Make sure if you have a shining through color printed parts for the printer to apply the tape, tipexx to the limit switch vanes.)

1. Connect to the printer. (The connect button should turn green)
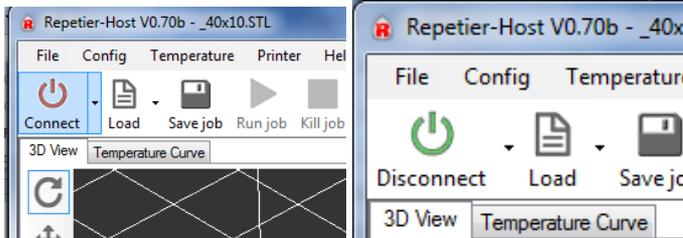
Other checks to see if the printer is connected properly:
On the bottom of the repetier host program the following should be displayed
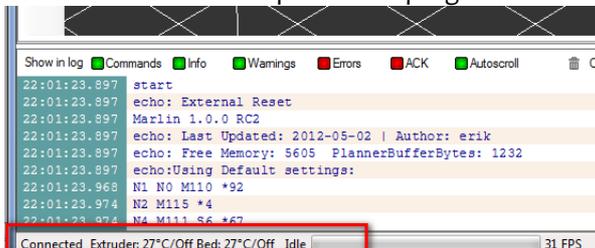
If you see **... commands waiting**, press the reset button on the side of the electronics board. Next to the SD card and USB connector.
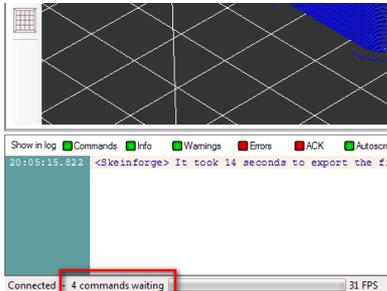
2. Go to the *manual control* tab
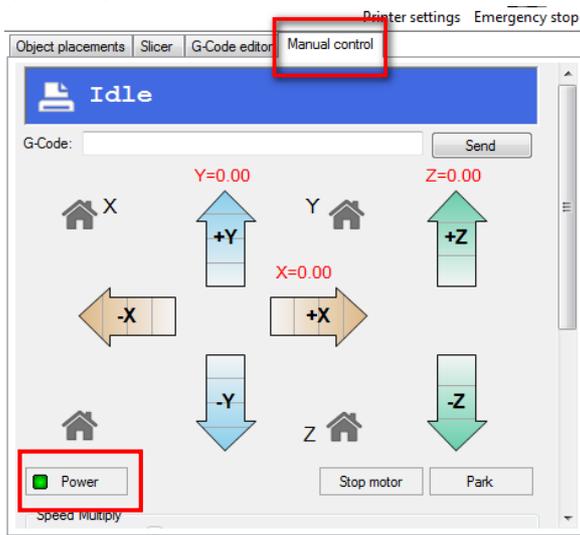
Now it is time to calibrate the z-height:
When doing the following steps, hold your hands on the powercable. Plug it out if something goes wrong.
- Press the Power button. This will turn on the power circuit of the electronics board. Do the following checks to ensure you have connected the wires correctly.
    o Make sure the fan which blows air on top of the hot-end is spinning
    o Make sure the leds of the opto-sensors on the electronics board and on the opto sensors are burning. Make sure the lights of these opto-sensors goes out when they are triggered. So if the the flanges go into the limit-switch the light should turn off.
- Make sure the bed is at least 5 cm from the hot-end.
- Press Home X, then move the x axis back and forth. The axis will only move in positive direction if the Home X button is not pressed.
- Press Home Y, move the y axis back and forth.
- Press Home Z
- The distance between the table and hot-end is probably too large.

1. Rough adjustment

2. Fine adjustment
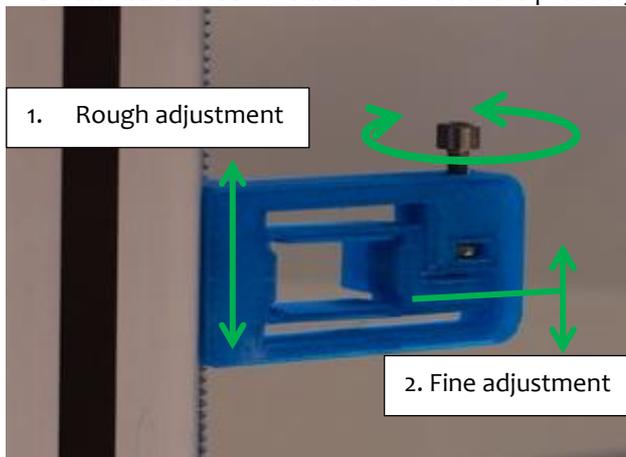
- Turn the screw in such a way that the flexible vane mechanism goes downwards. Do this approx. till ¾ of the possible stroke. Move the complete part a little bit up and press Home Z again.
- Repeat this until the table is approx. 3 mm from the nozzle. Now fix the bracket to the frame and start homing again. Now repeat this procedure to get the nozzle closer and closer by turning the little screw as shown in the picture above.
- Do this a couple of times until the distance is less than the thickness of a piece of normal paper.

Scroll down the manual control window.
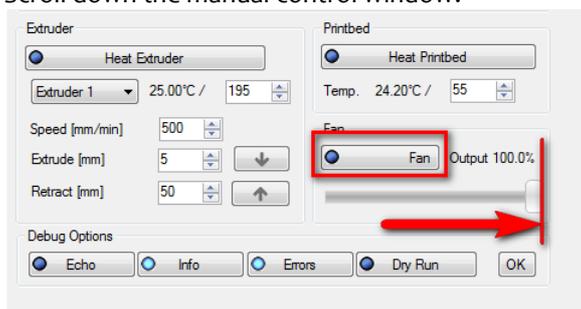
- Check if the switchable fan mounted to the airduct is working.

    Move the slider to 100% and press the fan button

You are almost ready to do your first print, please proceed to the next section.
14. The software is configured for printing and it is now time to slice and print your first object. Get your test file from here:
http://shop.FELIXprinters.com/downloads/index.php?path=print_files%2Ftest_print_files/ .
In this tutorial the smallest file is used. _40x10.STL.

Go to the **Slicer** tab. You'll see two type of slicers. The first one is SFACT and the second one is Slice3r. SFACT is the preferred choice and has optimized profiles for the felixprinter. Slice3r is a faster slicer, but is less reliable than SFACT, which means that some models don't get sliced correct.
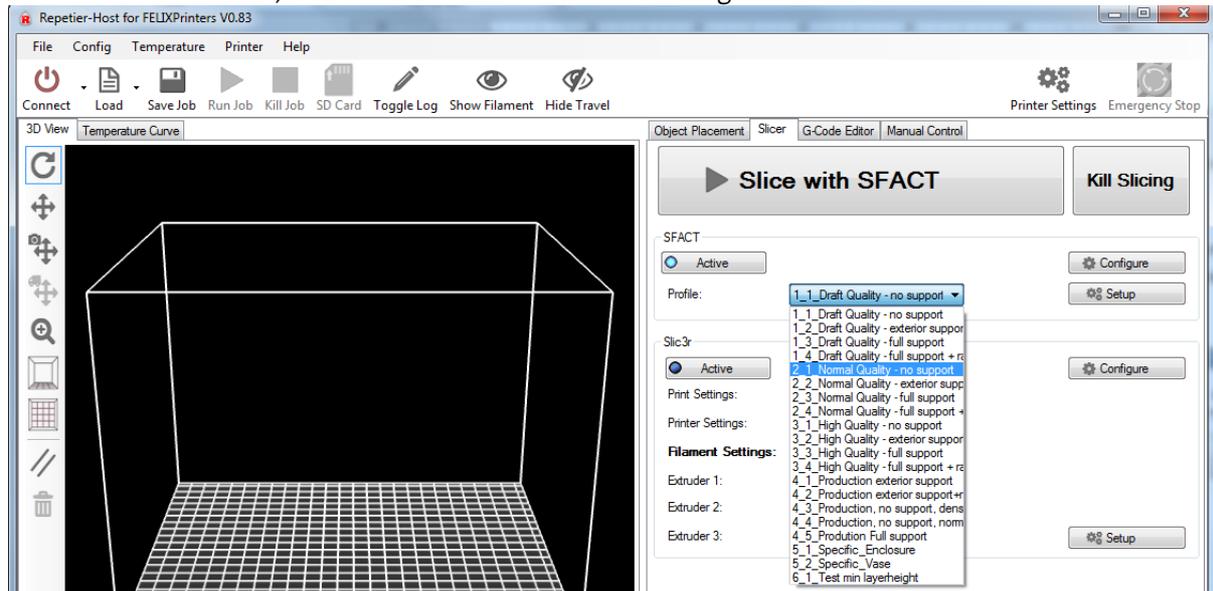
There is a large choice of slicing profiles. For the first test it is recommended to choose the
2_1_Normal_Quality profile.
Short explanation of the slicing profiles:
Profile 1_1 to 3_4: are profiles setup for everyday printing.
Profile 4_1 to 4_5: are profiles optimized for our production parts. These are the profiles used to produce the printed parts of your printer. When printer upgrades are provided, these can be used to slice your parts.
Profile 5_1 to 5_2: are used for specific cases
Profile 6_1 and further: are used for testing purposes.

The structure of the profiles 1 to 4 is done like this:

X_1_No support,
No support material is generated. Part is printed as imported. In this example not recommended.

X_2_Exterior support
Automatic support material generated outside of the object

X_3_Full support
Automatic support material generated outside and inside of the object

X_4_Full support + raft
Automatic support material generated outside and inside of the object + a raft to ensure good contact with the heated bed.

- Printed part
- Support material
- Raft
- Heated bed

The profiles are easy to adjust and tweak yourself for further improvement. To do this just click the configure button

This will show a very elaborate amount of settings to tweak. Don't worry every setting is well documented. If you are interested to know more just click the question mark button as indicated in the figure below.
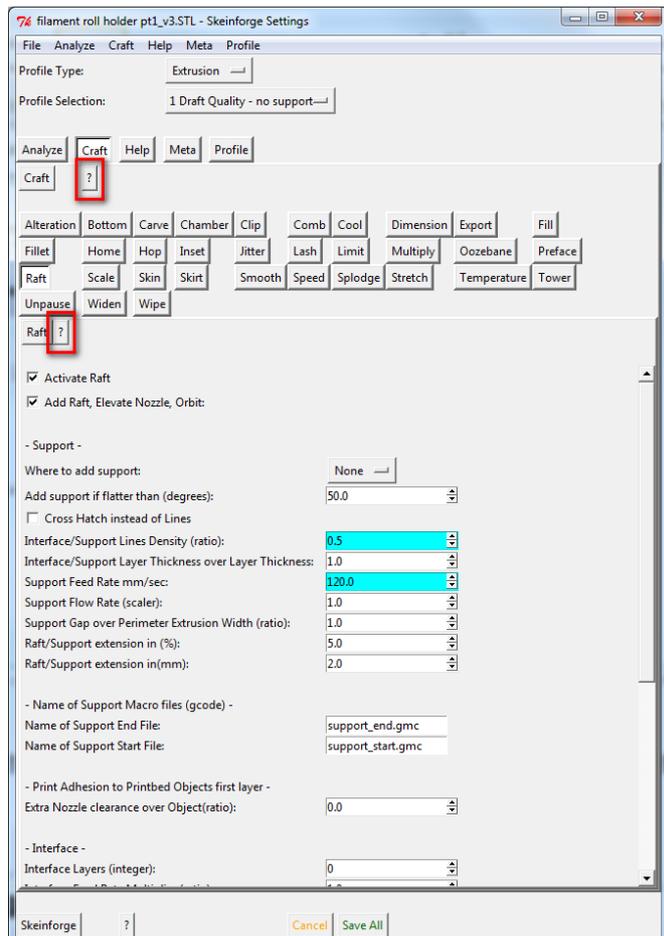
15. Now back in the repetier main interface make sure the SFACT slicer is activated and select one of the profiles.

16. Now it is time to slice our first object.
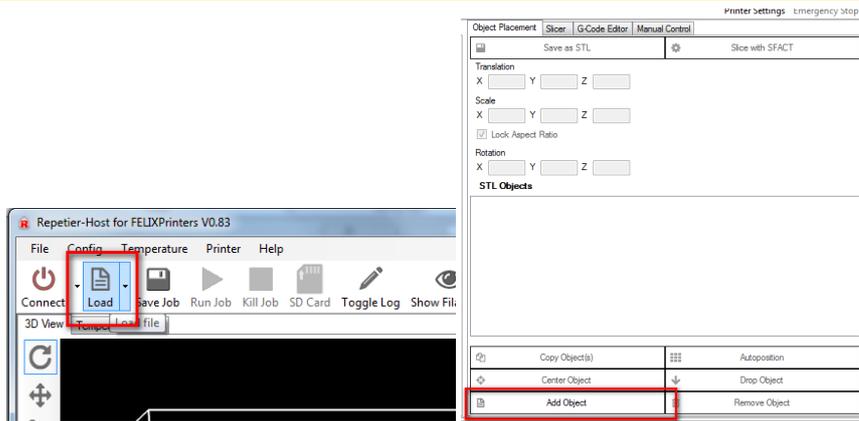
Press the *Load button* or in the Object placement tab, *Add Object button*.
Then navigate to the folder where you downloaded the _40x10.STL file or any other STL file.

17. Slice this file and prepare it to print. Press the *Slice with SFACT* button
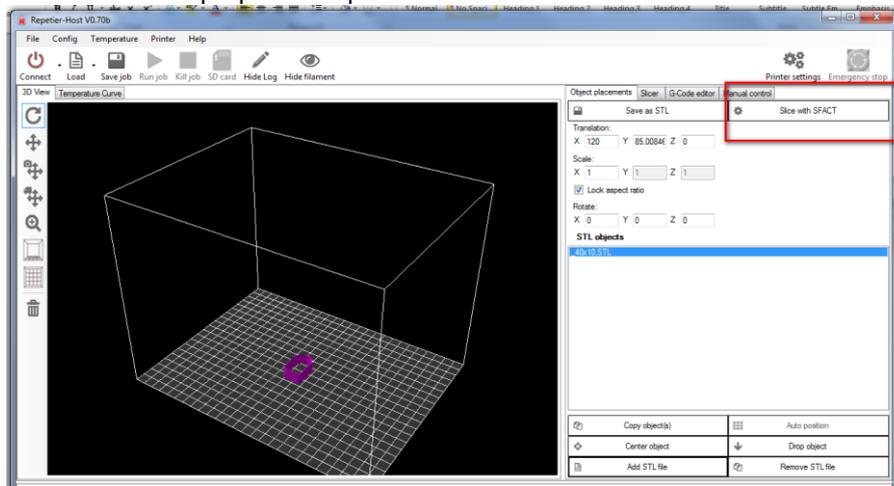
When the program is done after slicing the interface should look like this:
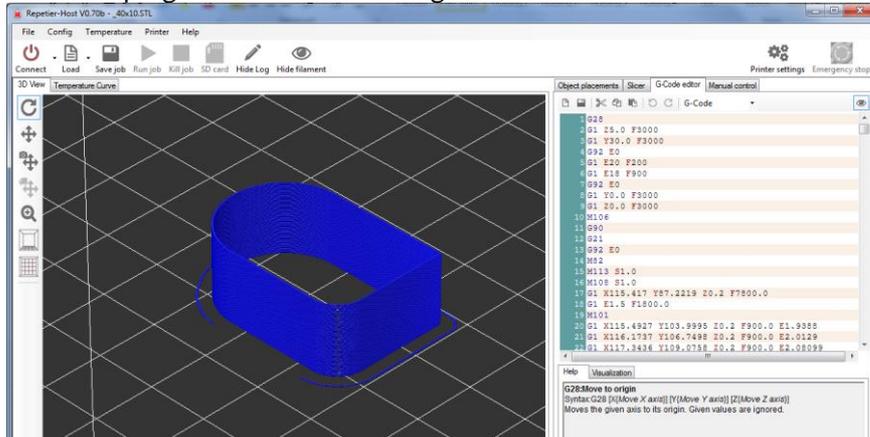
You have now sliced your first object and are ready to go to the next step.

5   IT'S TIME FOR PRINTING!

After all the hard work of the assembly and setting up the machine it is time to get some reward by means of your first successful print.

Before pressing the "Print" button make sure of the following

In the manual control window do the following.
- Heat up the extruder to 195 degC
- Heat up the heated bed to 55 degC
- Move the table down 10mm

Warning: extruder and heated bed get hot. Wear gloves when operating the FELIXprinter.

If the extruder and heated bed are warmed up, check or make sure that the following is true:
- Printer axes can move without obstructions
- Remove all plastic residues on the heated bed, preferably with the supplied tweezers
- Degreased heated bed surface.
- When all axes are homed the hot-end is not touching the table.

Move down the table 10mm and insert the supplied **PLA** filament in the extruder.
Run the extruder until a steady flow of plastic comes out.
When there is not a continuous flow coming out of the nozzle, make sure the extruder arm is properly tensioned. Turn the m4 bolt clockwise to put more tension on the filament, so the filament will be pulled into the hot-end better. But watch out, too tight and the motor will have a hard time to turn and the filament might be squashed so wide that it gets clogged into the hot-end.

When these steps are OK, you are ready to press that print button.
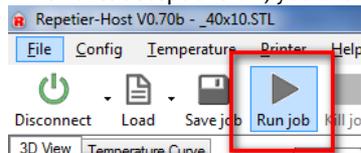
If the calibration was done ok the print should finish without any problem.
The most probable cause of failure could be the wrongly adjusted z-height of the first layer.

Warning!
Surface of hot plate still hot!
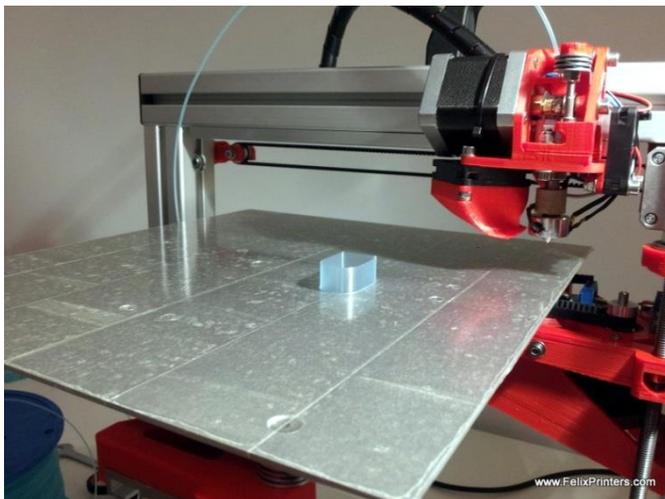
If the print looks like the picture above than congratulations your printer is completed!!

If the print fails, it usually because the distance of the bed and nozzle is too large. Try to adjust the z-axis limit switch vane to get the distance closer.

IMPORTANT info:

To keep the hot-end running as long as possible, let the filament run through a dust collector like a small piece of sponge. The filament picks quite a lot of dust due to static charge or dirt from the factory. This will all enter the hot-end and partially stick in there and finally clog the nozzle. When this happens the hot-end needs to be cleaned out when hot from both sides. A tutorial for this is available on the forum on the website.

6   FAQ

Q: Which hot-end nozzle temperature do you recommend?
A: For small detailed parts we recommend to print as cold as possible 180 to 190 degC , but for our production prints we print with an as high as possible temperature (195-200 degC), because that increases strength of the parts.

The optimal temperature depends on the type of filament used. When using PLA check if the temperatures of the hot-end and the heated bed are between 180-210 and 30-60 degrees C respectively. When using ABS these temperatures should be somewhere around 210-250 and 70 – 100 degrees respectively. The heated bed temperatures can be much lower with painters tape. Try only using PLA or ABS as filament. If you wish to use any other kind of material, consult FELIXprinters first.

Additional note:
Each supplier provides PLA with slightly different properties, even different colors have different properties. To find the optimal temperature for optimal extrusion, start with a low temperature. Then go up slightly. When the temperature is too high, you might hear some pops and sisses coming from the hot-end. When the temperature is too low the extruder motor will have a hard time extruding. When printing at high speed, the temperature of the filament should be a little higher.

Q: How would you recommend changing the filament?
It is possible to change filament in the following ways.
1. Retract/Replace. This is the safest way to change filament.
-    Retract the old filament at a high speed, 1000mm/min for 100mm. The high speed prevents development of a long string which can potentially jam the hot-end.
-    Now extrude the new filament 50mm at a time at low speed 200mm/min, until filament comes out of the nozzle.
2. Feed through. In this method filament is cut off near the extruder.
-    Cut the filament off as straight as possible. The new filament will push it down, and if cut of scew, the new filament will slip of the to be pushed filament resulting in a extruder jam.
-    Extrude the filament long enough at a low speed 200mm/min. When the filament is just cut off above the extruder entrance, 50mm should be sufficient to push the new filament into the hot-end.
-    Again extrude it 50mm to flush out the old filament.

Q: How to elongate the lifetime of the hot-end?
A: The hot-end is robust, seldomely have we experienced a jam or failed operation. But because we print 24/7 we experienced that the hot-end stopped working after 2-3 months. The reason for that is a contaminated hot-end.
Ways to prevent this from happening.
-    Make sure the filament enters the hot-end is clean from dust. Do this by letting it run through a piece of sponge before it enters the hot-end. You will be surprise how much dust there will be there after a 5 hour print. That would of all entered the hot-end and form a layer of contaminants, which isolates that heat. from going into the filament
-    Do not use too high temperatures. This will make the filament decompose and contaminate the inside of the nozzle.
-    Do not leave the hot-end heated for hours. The filament might decompose after leaving it at high temperatures and this will leave a layer of contaminants behind in the hot-end nozzle
-    Use good quality filament.

The FELIXprinter is an easy to product to maintain and clean. To keep enjoying your FELIXprinter and ensure optimal print performance, regular maintenance is very important.

7.1   GENERAL TIPS FOR OPTIMAL OPERATION

- Make sure filament that enters the hot-end is as clean as possible from dust. Do this by letting it run through a piece of sponge before it enters the hot-end. You will be surprise how much dust there will be there after a 5 hour print. That would of all entered the hot-end and form a layer of contaminants, which isolates heat from going into the filament
- Do not use too high temperatures. This will make the filament decompose and contaminate the inside of the nozzle.
- Do not leave the hot-end heated for hours. The filament might decompose after leaving it at high temperatures and this will leave a layer of contaminants behind in the hot-end nozzle
- Use good quality filament.

7.2   CLEANING

- To ensure good bed adhesion of prints we recommend cleaning the heating bed with spirit, alcohol, thinner or nail polish remover. We recommend doing this before or after each print, especially for long prints.
- Be careful with getting any liquids onto the electric board, it can damage the electronics permanently.
- Dust the printer off with a moist piece of cloth.

7.3   REGULAR MAINTAINANCE

- Lubricate the vertical spindle and the lineair railings with a lubricant, we recommend doing this every 3 months.
- After some time the toothbelt might loose a little tension. Tighten the screw in the belt tensioning part until a healthy tension is back on the belt. For an indication of how to tension the belt check out this video: http://www.youtube.com/watch?v=dpS6nWn5rE8
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7.4   PRECAUTIONS

To prevent that you will be unable to print, we recommend printing out the following spare parts.
- Extruder arm
- Airduct

GOTO: http://shop.felixprinters.com/downloads/
then navigate to print_files/spare_parts
Search for *Extru_arm_v6_F_1_5.STL* and *print_assy_5_F1_5_export.gcode*

This chapter helps to troubleshoot common problems with the printer. Each common issue is described in a table. Follow from top to bottom to get to the solution in the most likely way.

PROBLEM: Stopped extrusion after x-layers/Skipped layers/weak strength of parts/Extruder jammed.

Possible cause	Possible solution
1. Is temperature setting OK?	Recommended hot-end temperatures are: PLA: 180 – 200 degC ABS: 210 -240 degC **Too hot** extrusion causes two things. Filament in the nozzle tip gets very fluid. When there are fast extrusions, the molted filament could creep up the barrel and causes jams, because it cools down and solidifies. The temperature of the cold zone will get critically hot and the filament starts to melt too fast. **Too cold** extrusion, can cause the filament to slip over the extruder wheel due to the extremely high required force to extrude the filament.
2. Is fan blowing on top of hot-end working?	The fan blowing on top of hot-end is working. When there is loose contact the fan might stop working on some points of the movement. This could cause the top part of the hot-end to get too hot.
3. Ambient temperature OK?	Ambient temperature must be between 15 to 30 degC
4. Filament quality within tolerance?	Check if the filament diameter is within the 1.6 to 1.8mm. Somethimes filament substance is not consistent, try different filament to see if it solves the issue
5. Are all bolts to assemble the extruder assemble tightenend sufficiently?	Make sure bolts are all tightened sufficiently.
6. Extruder arm tension OK?	The extruder arm must be able to exert enough pressure on the filament. Turn the bolt in front of the extruder clockwise for more pressure. Turn it counterclockwise to exert less pressure. When too much pressure on the arm the filament will be squashed too wide and cause a lot of friction inside the hot-end and eventually might get stuck.
7. Extruder arm in good shape?	Check if the extruder arm is not broken. Replace if broken or deformed too much.
8. Contaminents inside the hot-end.	Filament attracts a lot of dust, which without filtering all has to go through the tiny nozzle. In time this could cause, a layer of dirt inside which acts as a thermal barrier, preventing the filament to melt properly. Try to clean nozzle exit with 0.35mm drill. Guitar string, or other thin wire to clean nozzle. If this doesn't work there is a large contamination from the inside. Take the hot-end apart and clean it carefully with a 2mm drill from the inside. This will only work when the hot-end is hot. Please follow the instructions dowloadable here: http://shop.FELIXprinters.com/downloads
9. The hot-end parts are not assembled good enough	When parts are too loosely mounted filament could leak through the components.
10. Fabrication error in hot-end	It could be that due to fabrication tolerances the hot-end parts are not fully up to spec, maybe not aligned perfectly or the holes are not the same. Most issues occur with the PEEK middle isolation part. Try to post drill it with a 2mm drill.

PROBLEM: Objecst don't stick to the heated build platform

Possible cause	Possible solution
1. Is the bed clean?	For good bed adhesion of the object the bed must be clean from dirt, dust and grease. A recommended cleanser is spirit/alcohol/thinner.
2. Is the heated bed on?	The recommende bed temperature for PLA is 55 degC
3. Is the bed level?	Essential for good bed adhesion is that the bed is level. Make sure the bed is leveled properly, the distance between nozzle and bed must be the same everywhere.
4. Distance from head to bed ok?	Make sure the distance between bed and hot-end tip is close enough for first layer. Adjust finetuning mechanism accordingly.
5. Is the printspeed of the first layer low enough?	Try reducing the speed for the first layer
6. Is the bed flat	When the bed is not flat, due to assembly, damage or from the factory, it is impossible to have the same distance from bed to nozzle over the whole surface. If this is the case, try to bend the bed by hand. Make sure you don't introduce forces into the bearing of the y-axis.

PROBLEM: Bad print quality

Symptom	Possible solution
Changing slicing settings in repetier-host don't have effect.	Make sure you have selected/activated the correct slicer settings. SFACT is the slicer of preference. Slic3r is not configured out of the box.
Circles are not round/Dimensions differ	Check belt tension Make sure y-axis bearing is fastened enough to the z-axis carrier and also make sure the 4 bolts are mounted with washers. Are pulley's setscrews fastened?
Parts with sharp corners have large vibrations/waves	Make sure all parts are fastened correctly
The part sags after a few layers; this happens mostly to smaller parts with thin walled features.	The temperature of the filament is way too high. The extrusion is not good enough. Make sure nozzle exit is clean and also extrusion mechanism is working properly. Slow down the printspeed to give part more time to cool down.
Quality of small parts is really bad	Decrease temperature Slow down speed. Print multiple parts in the same print. Use the multiply plugin in SFACT/Skeinforge.

9   SAFETY

To safely operate the FELIXprinter, we advise to keep the following **safety recommendations** in mind:

1. Keep children under the age of 14 out of reach of the FELIXprinter
2. Caution with any moving parts that move in the X, Y and Z direction. At the end of each moving part there is a pinching hazard.
3. Watch out for any other non-protected sharp edges of the printer.
4. Don't lay objects on the heated bed that are not being printed, not even when the printer is turned off.
5. Only use the materials polyactide (PLA), Acrylonitrile butadiene styrene (ABS) or Arnitel as printing material. Consult FELIXprinters if you want to use a different material.
6. FELIXprinters is only suitable for professional use.
7. When removing or feeding material to the hot end, wearing heat resistant gloves is recommended.
8. Only operate the FELIXprinter in a sufficient ventilated environment (fumes from ABS and PLA aren't toxic, but can cause an irritable respiratory).
9. Don't lean on the FELIXprinter when it is operating.
10. Make sure all moving parts can move without any obstructions.
11. Don't remove any objects from the hot plate while the printer is still printing objects.
12. Don't transport the FELIXprinter when it is in operation.
13. Do not use a different power supply than the provided power supply, it can be dangerous and cause electronical malfunctions.
14. Use the FELIXprinter in a dry environment.
15. Use the FELIXprinter on a stable and leveled surface.
16. When moving the FELIXprinter only use the handle on top.
17. Turn off the FELIXprinter when errors occur.
18. When operating the FELIXprinter, be carefull with long hair and loose clothes.
19. When unattended, turn off the FELIXprinter.
20. Place the FELIXprinter on a table/Desk or something with a similar height. This will keep it safe from small children.

11 APPENDIX: MATERIAL DATA SAFETY SHEET
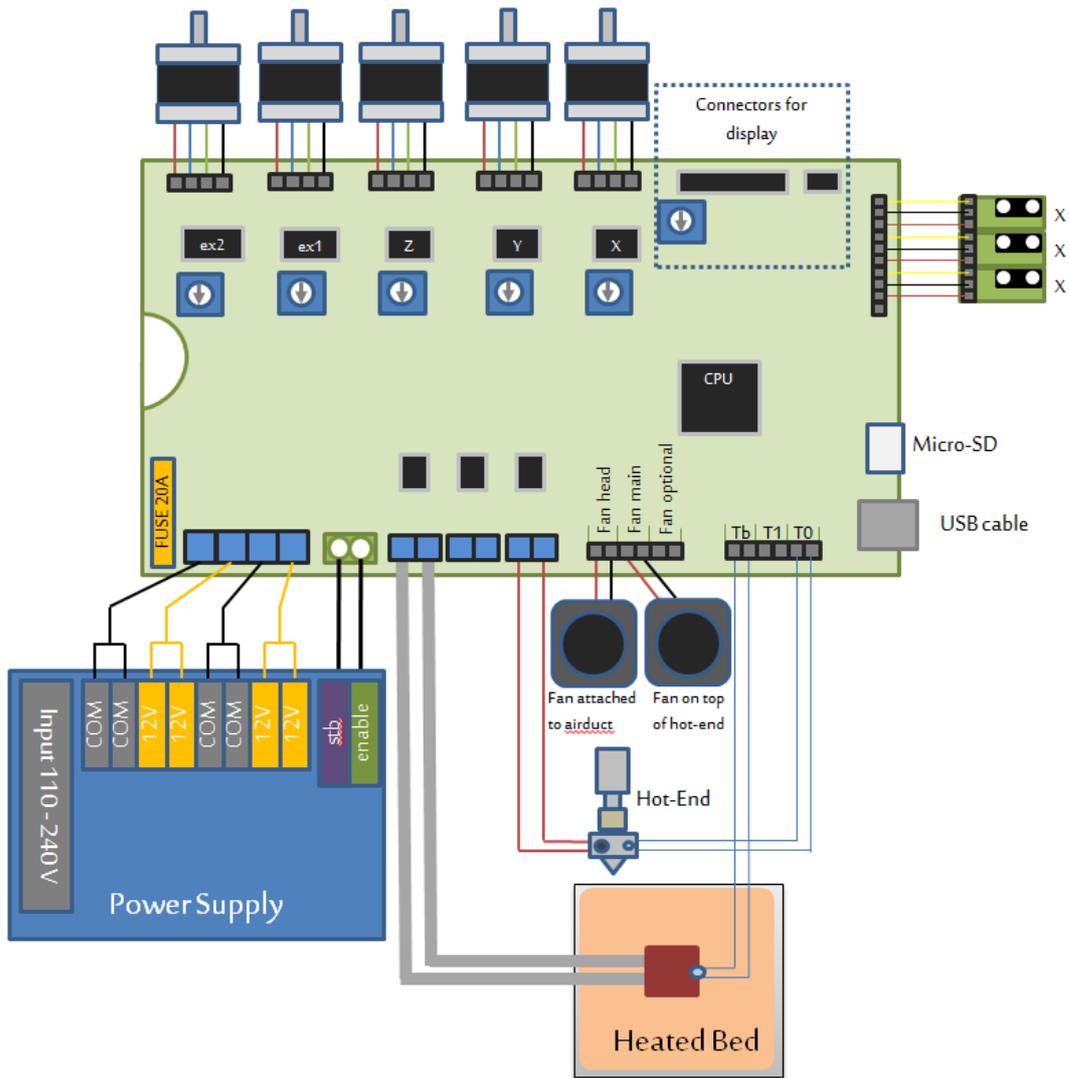
11.1 PLA

Hazards Identification

Appearance: Clear, translucent, opaque, pellets.
Physical state: Solid
Odor: Sweet

Potential health effects:

Eye contact: Contact with eyes may cause irritation.
Skin contact: Substance may cause slight skin irritation.
Ingestion: Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea.
Inhalation: Inhalation of dust may cause shortness of breath, tightness of the chest, a sore throat and cough. Low hazard for usual industrial or commercial handling.
Target organ effects: There were no target organ effects noted following ingestion or dermal exposure in animal studies.
Sensitization: Did not cause sensitisation on laboratory animals
Flammability: Fine dust dispersed in air may ignite.

First-aid measures

Eye contact: Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Call a physician immediately.

Skin contact: Rinse immediately with plenty of water for at least 15 minutes. If skin irritation persists, call a physician. Cool skin rapidly with cold water after contact with hot polymer.
Inhalation: Move to fresh air. Call a physician immediately.
Ingestion: Drink water as a precaution. Never give anything by mouth to an unconscious person. Do not induce vomiting without medical advice. Call a physician immediately.

Notes to physician: Treat symptomatically.

Fire Fighting Measures
Flammability:
Autoignition temperature: 388°C
Flammability Limits in Air
Flammable limits in air - lower (%): Not determined
Flammable limits in air - upper (%): Not determined

Suitable extinguishing media: Foam. Water. Carbon dioxide (CO_2). Dry chemical. Alcohol resistant foams are preferred if available. General-purpose synthetic foams (including AFFF) or protein foams may function, but much less effectively.
Extinguishing media which must not be used for safety reasons: No information available
Hazardous decomposition products: Burning produces obnoxious and toxic fumes Aldehydes Carbon monoxide (CO) carbon dioxide (CO_2)
Special protective equipment for firefighters: As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.
Under fire conditions: Cool containers / tanks with spray water. Water mist may be used to cool closed containers.
Other information: Fine dust dispersed in air may ignite. Risks of ignition followed by flame propagation or secondary explosions shall be prevented by avoiding accumulation of dust, e.g. on floors and ledges.

Handling and Storage
Safe handling advice: Avoid contact with skin and eyes. Avoid dust formation. Workers should be protected from the possibility of contact with molten material during fabrication. Low hazard for usual industrial or commercial handling. Use personal protective equipment.
Storage:
Store in cool place. Keep at temperatures below 122F (50 °C). No special restrictions on storage with other products.

Toxicological Information
Principle Routes of Exposure: Eye contact. Skin contact. Inhalation. Ingestion.
Acute toxicity: There were no target organ effects noted following ingestion or dermal exposure in animal studies.

Local effects: May cause eye/skin irritation. Product dust may be irritating to eyes, skin and respiratory system. Caused mild to moderate conjuctival irritation in eye irritation studies using rabbits. Caused very mild redness in dermal irritation studies using rabbits (slightly irritating). Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea.

Long term toxicity: Did not cause skin allergic reactions in skin sensitization studies using guinea pigs.

Specific effects: May cause skin irritation and/or dermatitis. Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea. Inhalation of dust may cause shortness of breath, tightness of the chest, a sore throat and cough. Burning produces irritant fumes.

Target organ effects: There were no target organ effects noted following ingestion or dermal exposure in animal studies.

Skin: LD50/dermal/rabbit > 2000 mg/kg

Ingestion: LD50/oral/rat > 5000 mg/kg.

Ecological Information

Bioaccumulation: Does not bioaccumulate. Inherently biodegradable.

Ecotoxicity effects: EC50/72h/algae > 1100 mg/L

Disposal Considerations

Waste from residues / unused products: In accordance with local and national regulations. Do not contaminate ponds, waterways or ditches with chemical or used container. Contact manufacturer.

THE COMPANY HAS NO CONTROL OVER THE MANAGEMENT PRACTICES OR MANUFACTURING PROCESSES OF PARTIES HANDLING OR USING THIS MATERIAL. THE INFORMATION PRESENTED HERE PERTAINS ONLY TO THE PRODUCT AS SHIPPED IN ITS INTENDED CONDITION.

(Composition/Information On Ingredients).

Contaminated packaging: Empty remaining contents. Do not re-use empty containers. Empty containers should be transported/delivered using a registered waste carrier to local recyclers for disposal.

Hazards Identification

This product is not classified as dangerous according to EC criteria.

First-aid measures

Eye Contact: Flush eyes with plenty of water; remove contact lenses after the first 1-2 minutes then continue flushing for several minutes. Only mechanical effects expected. If effects occur, consult a physician, preferably an ophthalmologist.
Skin Contact: If molten material comes in contact with the skin, do not apply ice but cool under ice water or running stream of water. DO NOT attempt to remove the material from skin. Removal could result in severe tissue damage. Seek medical attention immediately.
Inhalation: Move person to fresh air; if effects occur, consult a physician.
Ingestion: If swallowed, seek medical attention. May cause gastrointestinal blockage. Do not give laxatives. Do not induce vomiting unless directed to do so by medical personnel.
Notes to Physician: If burn is present, treat as any thermal burn, after decontamination. No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

Fire Fighting Measures

Extinguishing Media: Water fog or fine spray. Dry chemical fire extinguishers. Carbon dioxide fire extinguishers. Foam.
Fire Fighting Procedures: Keep people away. Isolate fire and deny unnecessary entry. Soak thoroughly with water to cool and prevent re-ignition. If material is molten, do not apply direct water stream. Use fine water spray or foam. Cool surroundings with water to localize fire zone. Hand held
dry chemical or carbon dioxide extinguishers may be used for small fires
Special Protective Equipment for Firefighters: Wear positive-pressure self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire fighting helmet, coat, trousers, boots, and gloves). If protective equipment is not available or not used, fight fire from a protected
location or safe distance.
Unusual Fire and Explosion Hazards: Pneumatic conveying and other mechanical handling operations can generate combustible dust. To reduce the potential for dust explosions, do not permit dust to accumulate. Dense smoke is produced when product burns.
Hazardous Combustion Products: During a fire, smoke may contain the original material in addition to combustion products of varying composition which may be toxic and/or irritating. Combustion products may include and are not limited to: Nitrogen oxides. Carbon monoxide. Carbon dioxide.
Combustion products may include trace amounts of: Styrene. Hydrogen cyanide

Handling and Storage

Handling
General Handling: No smoking, open flames or sources of ignition in handling and storage area. Good housekeeping and controlling of dusts are necessary for safe handling of product. Avoid breathing process fumes. Use with adequate ventilation. When appropriate, unique handling
information for containers can be found on the product label. Workers should be protected from the possibility of contact with molten resin. Do not get molten material in eyes, on skin or clothing. Pneumatic conveying and other mechanical handling operations can generate combustible dust. To
reduce the potential for dust explosions, electrically bond and ground equipment and do not permit dust to accumulate. Dust can be ignited by static discharge.

Storage
Store in accordance with good manufacturing practices

Personal Protection
Eye/Face Protection: Use safety glasses. If there is a potential for exposure to particles which could cause eye discomfort, wear chemical goggles. If exposure causes eye discomfort, use a full-face respirator. Use safety glasses. Safety glasses should be consistent with Directive 89/686/EEC
Category 2. If there is a potential for exposure to particles which could cause eye discomfort, wear chemical goggles. Chemical goggles should be consistent with EN 166 or equivalent. If exposure causes eye discomfort, use a full-face respirator.
Skin Protection: No precautions other than clean body-covering clothing should be needed.
Hand protection: Chemical protective gloves should not be needed when handling this material. Consistent with

general hygienic practice for any material, skin contact should be minimized. Use gloves with insulation for thermal protection (EN 407), when needed. Use gloves to protect from mechanical injury. Selection of gloves will depend on the task.

Respiratory Protection: In dusty or misty atmospheres, use an approved particulate respirator. Use an approved air-purifying respirator when vapors are generated at increased temperatures or when dust or mist is present. Use the following CE approved air-purifying respirator: When dust/mist are

present use a/an Particulate filter, type P2. When combinations of vapors, acids, or dusts/mists are present use a/an Organic vapor cartridge with a particulate pre-filter, type AP2.

Ingestion: Use good personal hygiene. Do not consume or store food in the work area. Wash hands before smoking or eating.

Engineering Controls

Ventilation: Good general ventilation should be sufficient for most conditions. Local exhaust ventilation may be necessary for some operations

Toxicological Information

Acute Toxicity

Ingestion

Very low toxicity if swallowed. Harmful effects not anticipated from swallowing small amounts. May cause choking if swallowed.

Estimated LD50, Rat > 5,000 mg/kg

Eye Contact

Solid or dust may cause irritation or corneal injury due to mechanical action. Elevated temperatures may generate vapor levels sufficient to cause eye irritation. Effects may include discomfort and redness.

Skin Contact

Essentially nonirritating to skin. Mechanical injury only. Under normal processing conditions, material is heated to elevated temperatures; contact with the material may cause thermal burns.

Skin Absorption

No adverse effects anticipated by skin absorption. Estimated LD50, Rabbit > 2,000 mg/kg

Inhalation

No adverse effects are anticipated from single exposure to dust. Vapors/fumes released during thermal processing may cause respiratory irritation.

Repeated Dose Toxicity

Additives are encapsulated in the product and are not expected to be released under normal processing conditions or foreseeable emergency.

Ecological Information

CHEMICAL FATE

Movement & Partitioning

No bioconcentration of the polymeric component is expected because of its high molecular weight. In the terrestrial environment, material is expected to remain in the soil. In the aquatic environment, material will sink and remain in the sediment.

Persistence and Degradability

This water-insoluble polymeric solid is expected to be inert in the environment. Surface photodegradation is expected with exposure to sunlight. No appreciable biodegradation is expected.

ECOTOXICITY

Not expected to be acutely toxic, but material in pellet or bead form may mechanically cause adverse effects if ingested by waterfowl or aquatic life.

Disposal Considerations

For uncontaminated material the disposal options include mechanical and chemical recycling or energy recovery. In some countries landfill is also allowed. For contaminated material the options remain the same, although additional evaluation is required. For all countries the disposal methods

must be in compliance with national and provincial laws and any municipal or local by-laws. All disposal methods must be in compliance with the EU framework Directives 91/156/EEC, 91/689/EEC and their subsequent adaptations, as implemented in National Laws and Regulations, as well as EU Directives dealing with priority waste streams. Transboundary shipment of wastes must be in compliance with EU Regulation 259/93 and subsequent modifications.

12   APPENDIX: FIRMWARE INSTALLATION

Sometimes the firmware of the electronics board can get updated; this chapter explains how to do it. For your first print this chapter is not necessary.

Go to the FELIXprinters http://www.FELIXprinters.com/downloads/ and follow the download links to get all the required software.

This step requires the following software:
- Arduino, www.arduino.cc platform to upload firmware to the printer.
- FELIXprinter firmware (check the revision of the printer). Contains printer settings for correct operation of your Felix printer.

Steps to upload new firmware to the FelixPrinter
1.   Start Arduino software
     It should look like this:
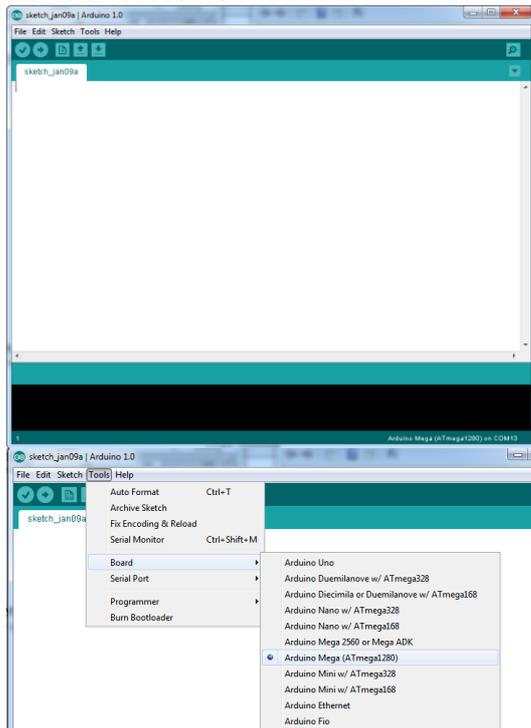
     Select the correct platform:
     Tools -> Board-> Arduino Mega(ATmega2560 or MEGA ADK) for FELIXprinters electronics board. The old arduino ramps board required the ATmega1280 sometimes.
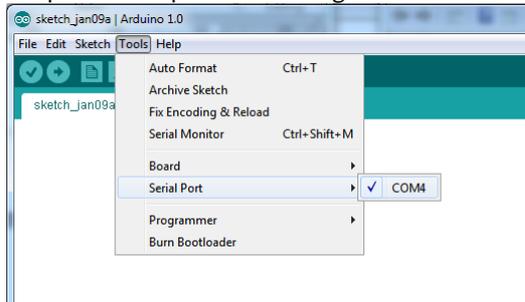
     Select the correct Serial Port which you've noted earlier
     Tools -> Serial Port -> COM...
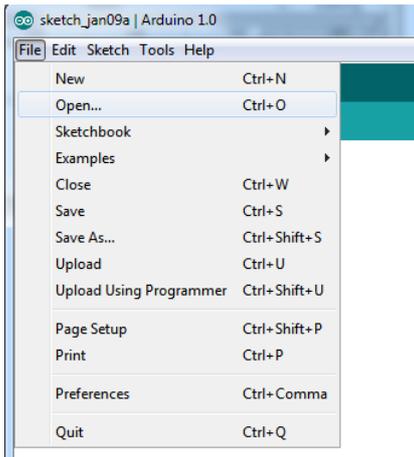
Extract the downloaded FelixPrinter firmware to some folder.

Open this folder through the Arduino interface and click on the *Marlin.INO* file.
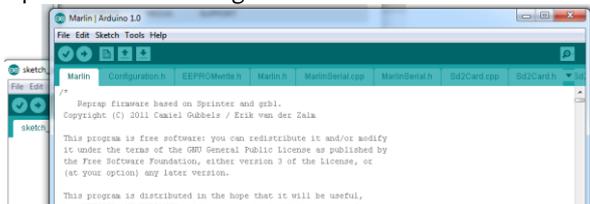
A new window will pop-up, with all the source firmware files. All the settings for the FelixPrinter to work correctly are configured. Feel free to browse around the files to get a better understanding of how it all works.
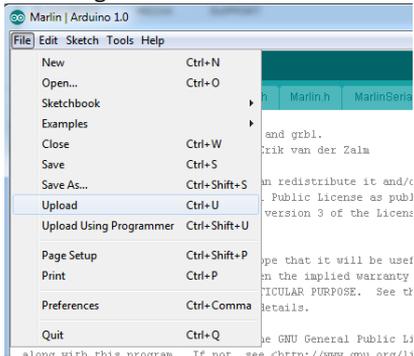
It is time to upload.
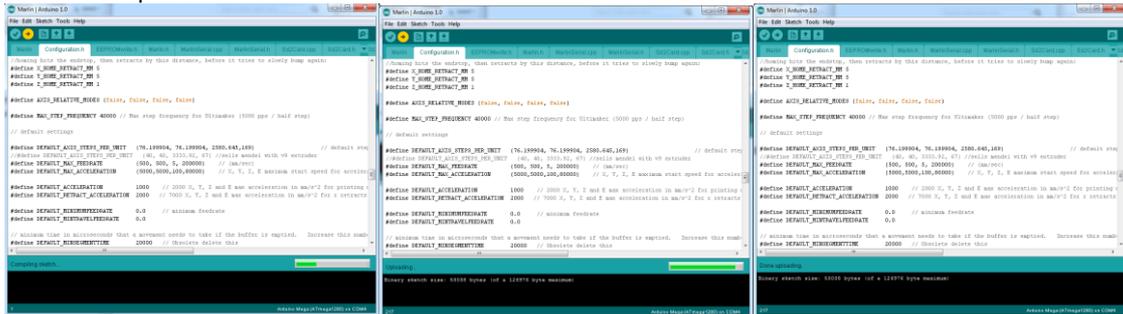
Now you are ready to get started and set it up for printing. Grab the User Manual to get started!

Symbol/indicator	Explanation
	Warning: High temperatures
	Pinch hazard.
Foto temperatuurlampje	Temperature indicator. When LED is on, temperature of ...

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circumstance.

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Please Note - Before you begin any electronics project...

Technology, the laws, and limitations imposed by manufacturers and content owners are constantly changing. Thus, some of the projects described may not work, may be inconsistent with current laws or user agreements, or may damage or adversely affect some equipment.

Your safety is your own responsibility, including proper use of equipment and safety gear, and determining whether you have adequate skill and experience. Power tools, electricity, and other resources used for these projects are dangerous, unless used properly and with adequate precautions, including safety gear. Some illustrative photos do not depict safety precautions or equipment, in order to show the project steps more clearly. These projects are not intended for use by children.

Use of the instructions, kits, projects and suggestions on www.FELIXprinters.com is at your own risk. FELIXrobotics, disclaims all responsibility for any resulting damage, injury, or expense. It is your responsibility to make sure that your activities comply with applicable laws, including copyright.

Always check the webpage associated with each project before you get started. There may be important updates or corrections!

The United States Fire Administration (USFA) has a guide and many simple steps you can take to prevent the loss of life and property resulting from electrical fires. Click here to read them!

You can contact us by e-mail at: support@FELIXprinters.com. You are kindly asked to contact us before returning an item, for the following reasons:

- We may be able to provide revised instructions on how to use the product or circumvent the problem you may be having
- You may not need to send it back to us, sending us a photo of the defective item might be enough

So we can select a logistics partner of our choice that will handle the package. In this case we can choose to pay for shipping the return