JANUARY 25, 2014

User Manual
FELIX 3.0, 3d printer
VERSION 4

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Contents

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1 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 and share knowledge about your 3d printer and 3d printing in general.

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2 Specifications

Printing			Electrical	
Print Technology	Fused Filament Fabrication		AC input:	100-240V, 50-60 Hz
Build Volume	25.5 x 20.5 x 22 cm		Power Requirements	12V DC, 15 Amps
Print Quality	Low Normal High Very High Extreme	250 microns 200 microns 150 microns 100 microns 50 microns	Connectivity	USB
Postioning Resolution	XY: 13 microns Z: 0.4 microns		Power Usage	Max 250W
Filament Diameter	1.75 mm			
Nozzle Diameter	0.35 mm		Mechanical	
			Chassis	Aluminum profiles
Software			Build platform	Aluminum sandwich plate
Software Bundle:	RepetierHost + Skeinforge/SFACT		XY Bearings	Linear ball bearings
File Types:	.STL		Z bearing	Linear ball bearings
Supports:	Windows, XP and newer		Stepper Motors	1.8 deg angle 1/16 micro-stepping
	Linux (Ubuntu 12.04+)			
	Mac OS X [10.6/10.7/10.8]			
Physical Dimensions				
Weight	8.7kg single, 9kg dual head			
Shipping Weight	11 kg			
Shipping Box	50x30x30 cm, DIY kit 58.4x50.8x55.5 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			

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3 Mechanical Setup

3.1 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 leveling mechanism of the table can be adjusted by turning the 3 M4 nuts underneath the heated bed. For the assembled units the calibration should be good right of the box, but due to shipment it could be that the calibration is slightly off. Therefor it is important to check it first.

> **ℹ IMPORTANT NOTES:**
>
> !!The leveling should be done by moving the axes by hand, not via computer interface!!
>
> !!Never move the axis at a high rate by hand, because the motors could act like a generator (similar to your bicycle and potentially damage the electronics of the board.)!!

3.1.1 Step 1

Calibrate the table in y-direction.

1. Move the X-axis carriage (extruder) close to the homing sensor as shown above, and move the table up until approximately 1 mm from the hot-end.

Start with approx. 1mm distance
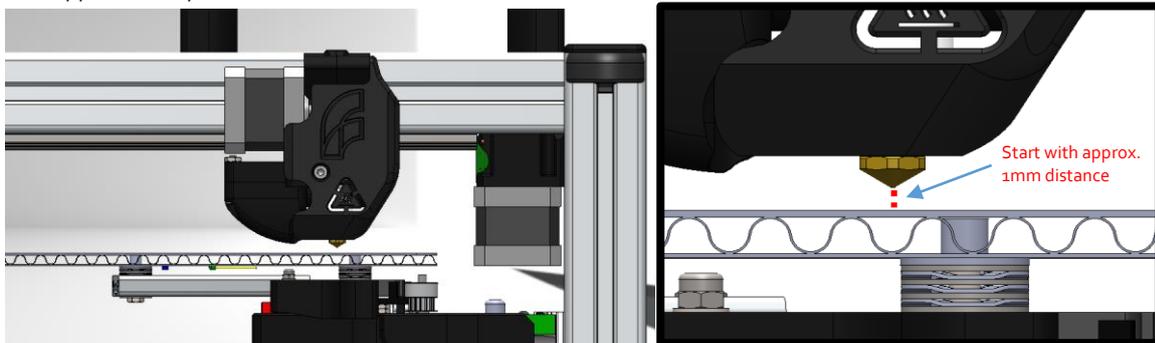
2. Move the Y-axis (heated bed) back and forth slowly. While doing this check the distance between the tip and bed while. It should be the same over the whole movement.
   If it is not turn the 2 screws underneath the bed as indicated in the picture below.
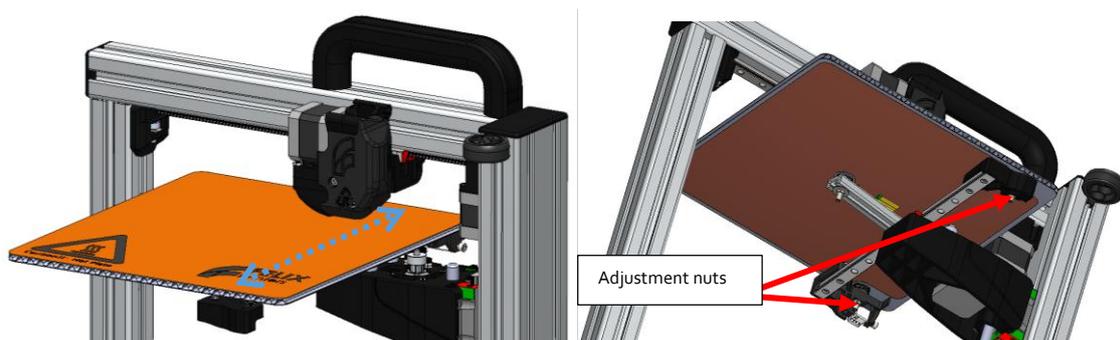
Adjustment nuts

3. Move the table a little closer to the hot-end and repeat the previous step to more precisely determine the distance between the hot-end and the table over the whole length.

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3.1.2   Step 2

Calibration in x-direction

4.   Move the table to the middle of its movement range slowly.

Adjustment nut
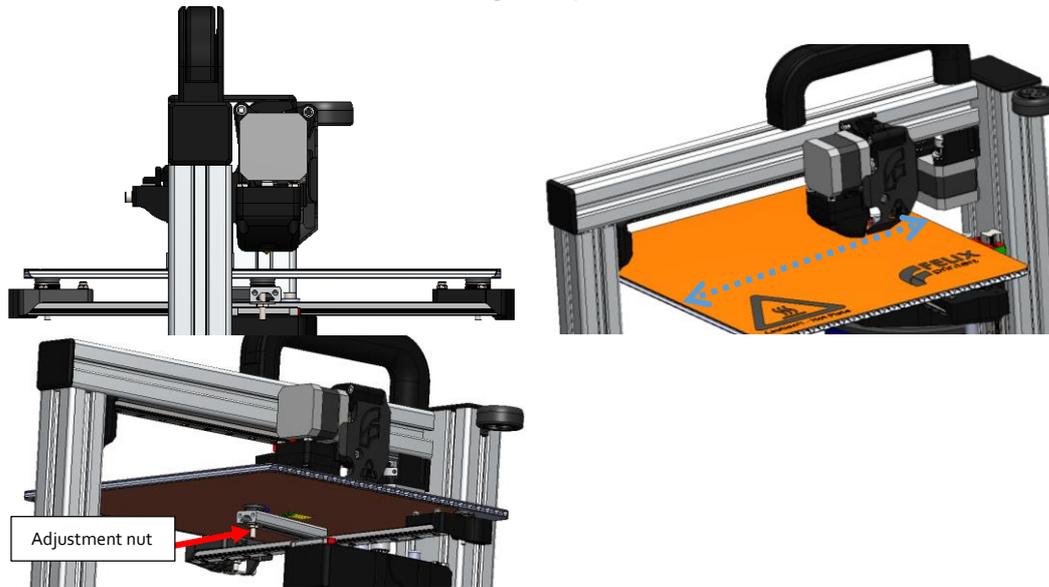
5.   Move the X-axis carriage over its movement range slowly. While moving check the distance between the hot-end and bed. If the distance is not even, adjust it with the nut which supports the middle of the table.
6.   Move the table a little closer to the hot-end and repeat the previous step to more precisely determine the distance between the hot-end and the table over the whole length.

You have successfully calibrated the table.

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3.2   Extra calibration for dual extrusion printers

> ℹ **NOTE:**
>
> **This step is only intended for people who bought a dual head DIY kit. Otherwise skip to next subchapter.**

This subchapter guides you to mechanically calibrate your DUAL head setup. The following checks make sure the hot-ends will have the same height with respect to the just leveled heated bed.

1. Make sure the heated bed is leveled correctly.
2. Make sure hot-ends are from the same version. Otherwise mechanical adjustment might be required.
3. Make sure bottom bolts are gently fastened with an equal amount of torque?
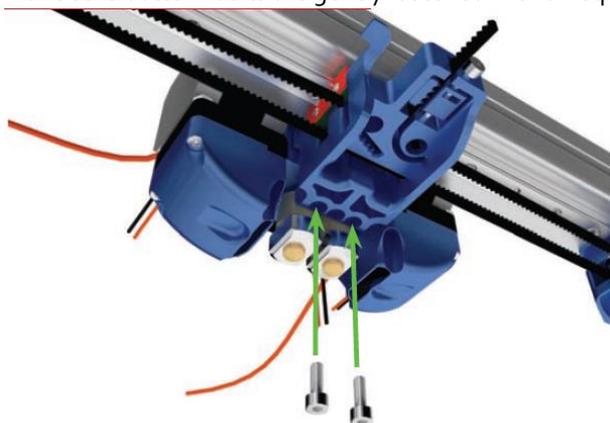
4. Is the height of both hot-ends equal? If not, do the following checks to see what could be the cause.

1.	Check if edge of top hot-end part touches the bottom
2.	Check of peek part is equally as high
3.	Check if heater barrels have the same height
4.	Check of tips have the same height.
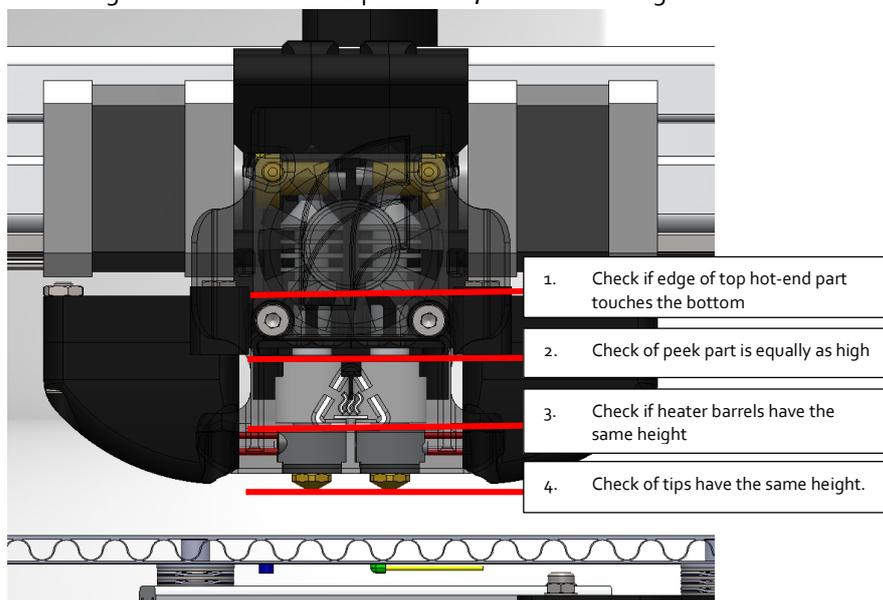
If there is a difference, it could be that the hot-end parts are not fastened equally between the hot-ends.

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4 Software Installation – Microsoft Windows

4.1 Microsoft Windows

> ℹ **NOTE: Mac users goto chapter 4.2**

This chapter describes the steps how to make the printer communicate with your PC.

- Driver installation
- Firmware installation
- Repetier-host

4.1.1 Driver Installation

1. Plug in the power supply cable.

> ℹ **NOTE:** The electronics board is NOT USB powered, so 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, or download them automatically with windows update.
    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''
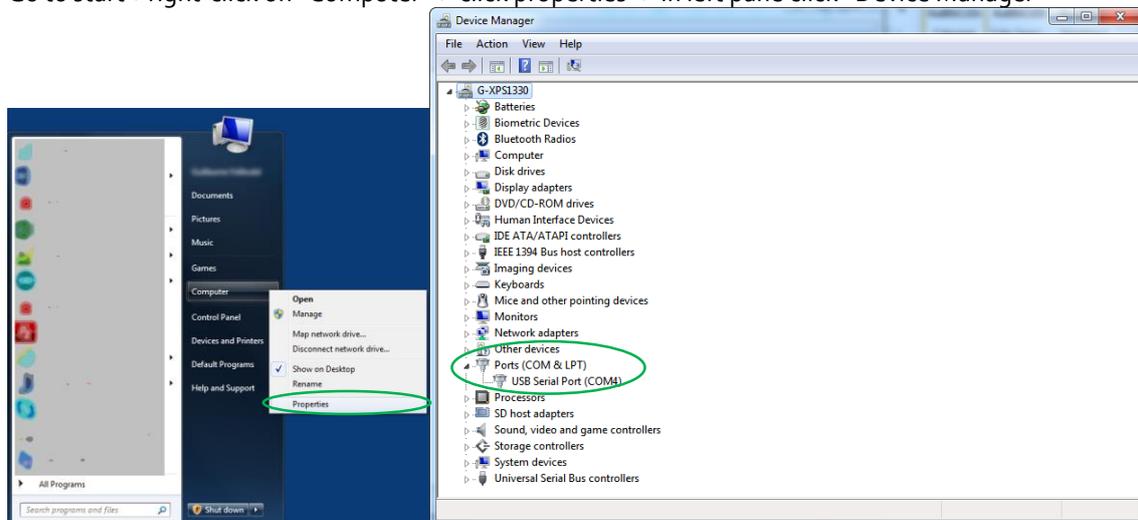
Note what COM-port is present. If there are more than one COM ports available unplug the USB cable of the printer, and re-plug it again. Check what port number is appearing and disappearing. This port number will be used for the next step.

> ℹ **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

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4.1.2 Firmware installation – Arduino

> ℹ️ **NOTE: Only continue with this subchapter if:**
> 1. **You have just assembled your DIY kit DUAL extruder 3d printer**
> 2. **You want to update the firmware of your printer because there is new firmware available.**

This chapter explains how to update the firmware on the electronics board of your printer.
This step requires the following software:
- Arduino, http://arduino.cc/en/Main/Software platform to upload firmware to the printer.
- FELIXprinter firmware (check the revision of the printer). Contains printer settings for correct operation of your FELIXprinter.

Steps to upload new firmware to the control board

1. Download, the latest firmware here.
   http://www.felixprinters.com/downloads/index.php?path=firmware/
   Be sure to download the printer firmware that matches your printer version.
   Extract the firmware .zip file.
2. Install the Arduino software, and run it.
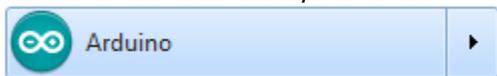
3. Open the firmware file from the extracted firmware folder.
   In this case it is Repetier.**ino**, it could also be Marlin.**ino**.
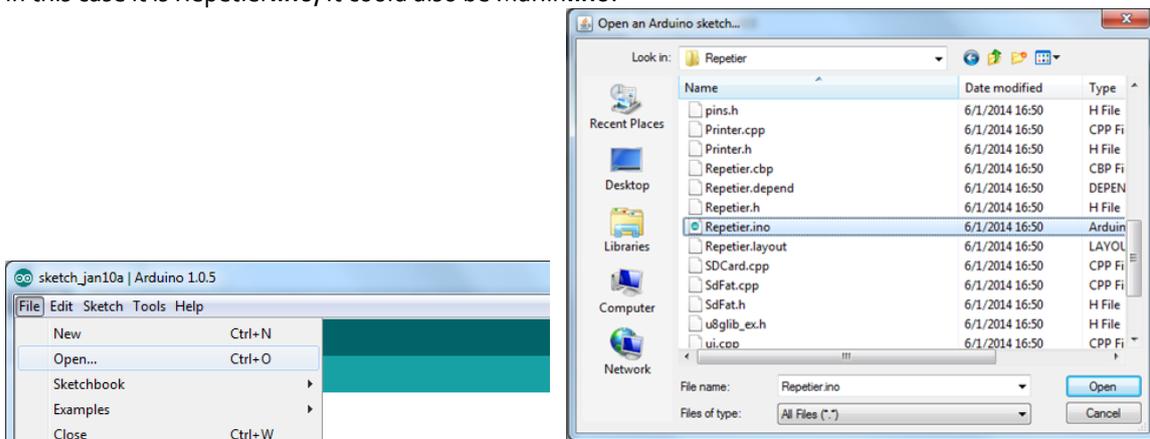
4. Select the correct platform:
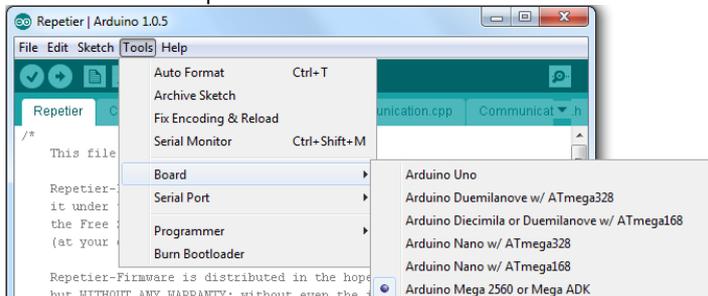
5. Select the correct Serial Port which you've noted earlier

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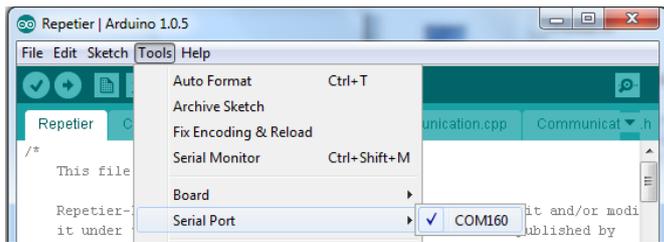
6. Press the upload button and wait till the upload is complete. This normally takes between 1 to 2 minutes.

The new firmware is now on your printer.

4.1.3   Printer Software – Repetier-Host

With repetier host provides the following functions.
- Control your printer, move axes and set temperatures, monitoring etc.
- Process your CAD files (STL files) and make them printable.

To install Repetier-Host on your PC take the following steps:
1. Download latest version of Repetier-Host from www.FELIXprinters.com/downloads
   Navigate to software folder and download **setupRepetierHostFELIXprinters*.exe**

name ▲	type	size	date	description
firmware	<DIR>	2 items	12-07-13	
instruction manuals	<DIR>	4 items	12-07-13	
old	<DIR>	-1 items	12-07-13	
print_files	<DIR>	3 items	19-07-13	
software	<DIR>	2 items	27-07-13	
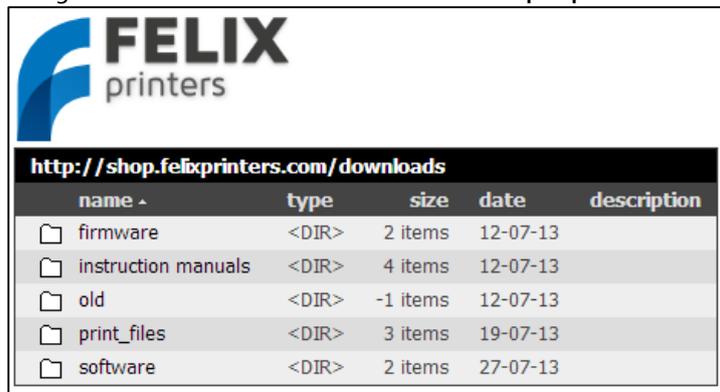
2. Run the **setupRepetierHostFELIXprinters*.exe** file and follow the installation instructions.
3. Make sure the power cable and USB cable of the printer are connected.
4. Start Repetier-host.
5. Go to Config -> Printer settings.

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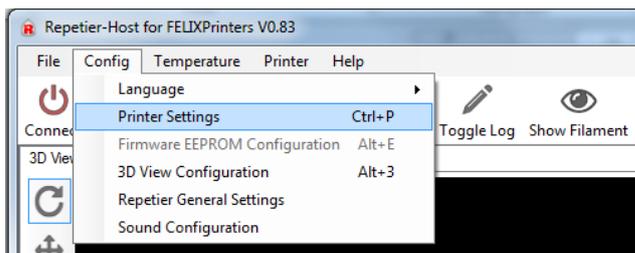
In the configuration window press the **Refresh Ports** button.
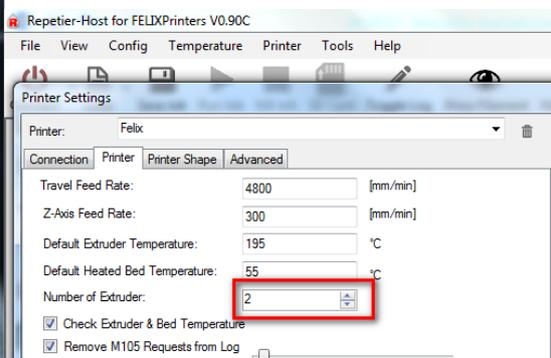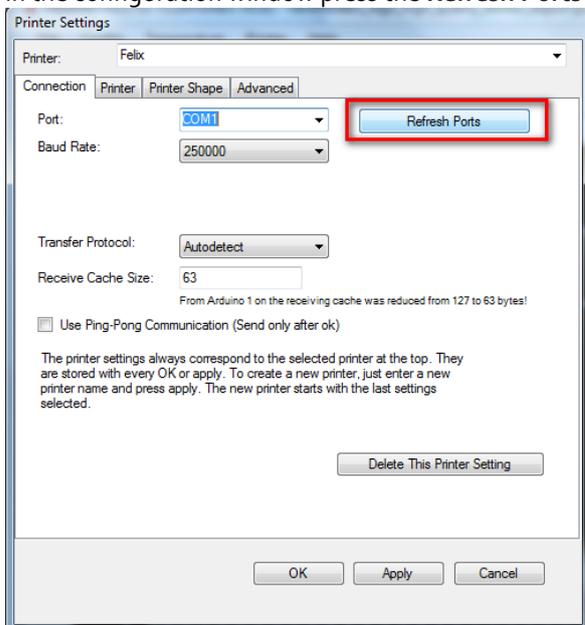
Choose the COM-port which belongs to your printer. This is the same COM-port obtained from previous chapter. The COM1 in the pictures is most probably different for your situation.

6. In case of dual extrusion select the PRINTER tab and change the number of extruders.

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4.2 Software Installation – Mac OS

1. Plug in the power supply cable.

   > **i** **NOTE:** The electronics board is NOT USB powered, so 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/

   http://shop.felixprinters.com/downloads/software

name ▲	type	size	date	description
[back]	<DIR>		12-07-13	
old	<DIR>	6 items	12-07-13	
sfact slicing profiles	<DIR>	1 item	27-07-13	
Repetier-Host-Mac_0_56.dmg.	dmg	12.4 MB	04-09-13	
setupRepetierHostFELIXPrinters_0_90.exe	exe	37.2 MB	08-07-13	

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/

   http://shop.felixprinters.com/downloads/software/sfact slicing profiles

name ▲	type	size	date	description
[back]	<DIR>		04-09-13	
sfact.zip	zip	3.4 MB	10-09-13	

7. Extract sfact.zip file (containing 1 folder with 2 subfolders: "sfact" and "sfact_profiles"
8. Copy sub-folder "sfact_profiles" to Macintosh H
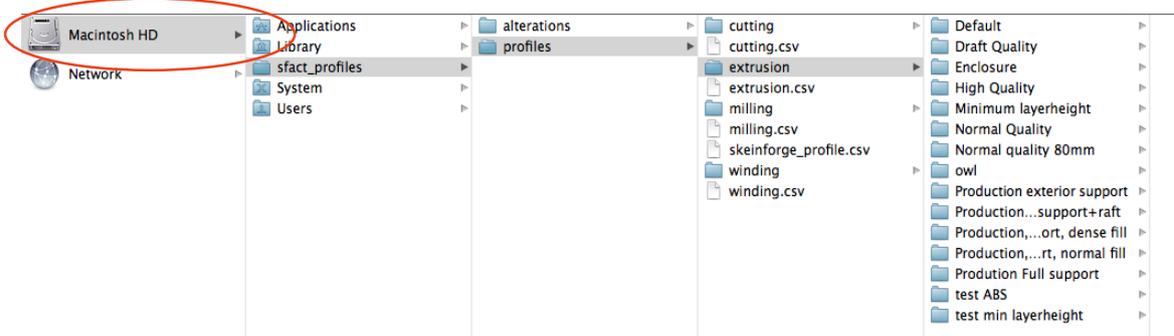
9. Copy the "sfact" **sub**-folder to Applications folder (where the Repetierhost.app is as well)

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10. Open the Repetier-Host Mac Application and go to Printer Settings
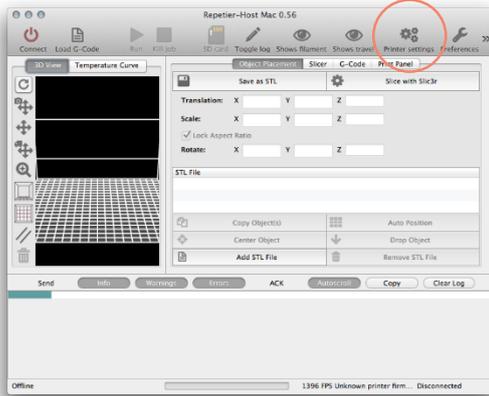
11. Configure printer settings:

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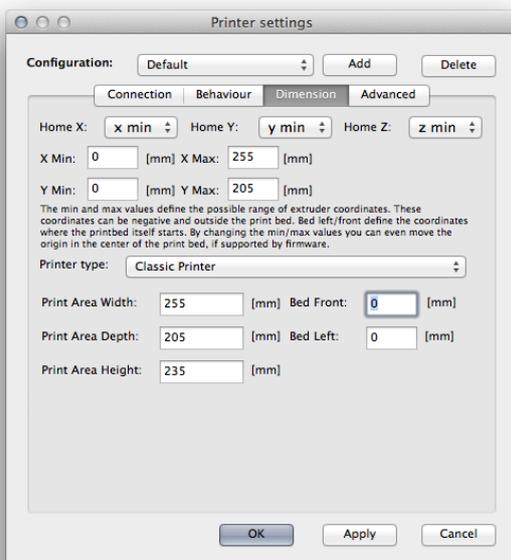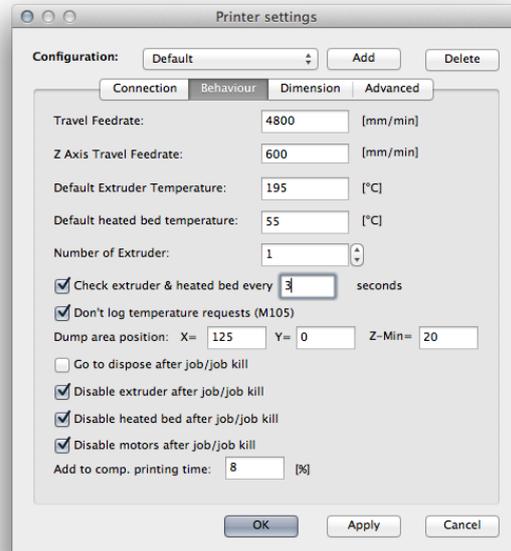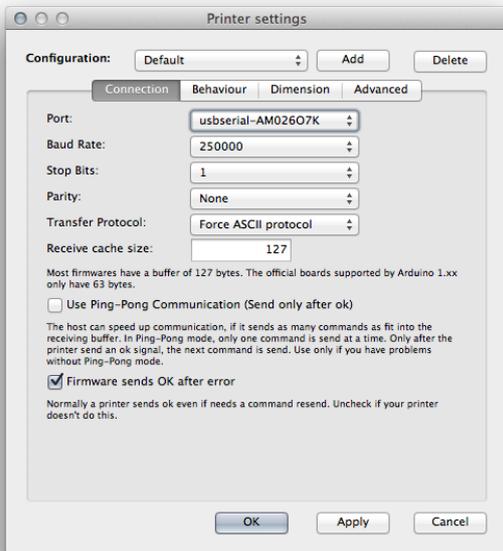
12. Configure Skeinforge settings under Preferences -> Slicer -> Skeinforge
13. Click "Browse" to direct to the correct files

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

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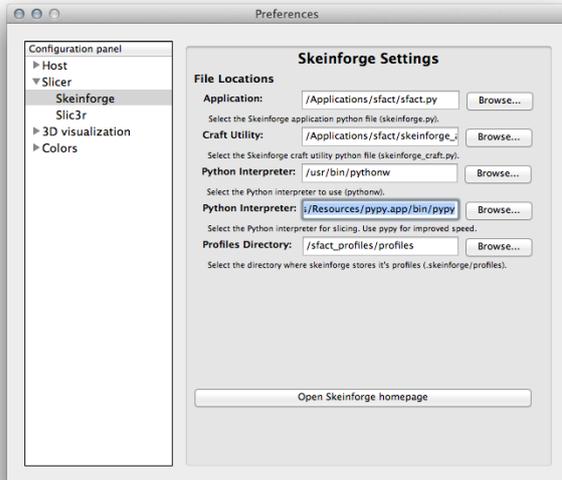
4.3   Calibrate the Z-Direction/Connect to printer

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 when printing the first layer.

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.

1. Connect to the printer. (The connect button should turn green)
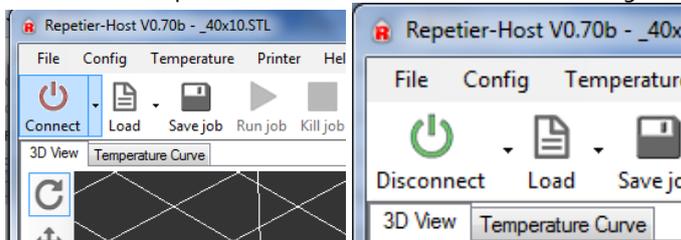
Other checks to see if the printer is connected properly:
On the bottom of the repetier host program the following should be displayed
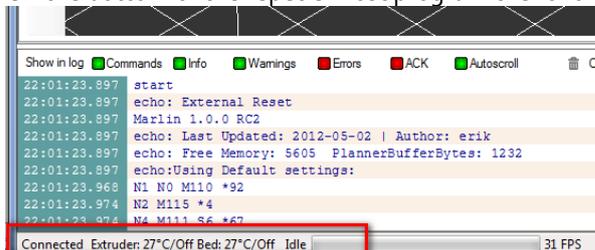
If you see **... commands waiting,** press the reset button on the side of the electronics board. Next to the SD card and USB connector.
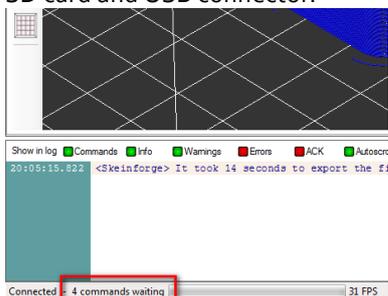
2. Go to the *manual control* tab

Home X, Y and Z

Home All axes
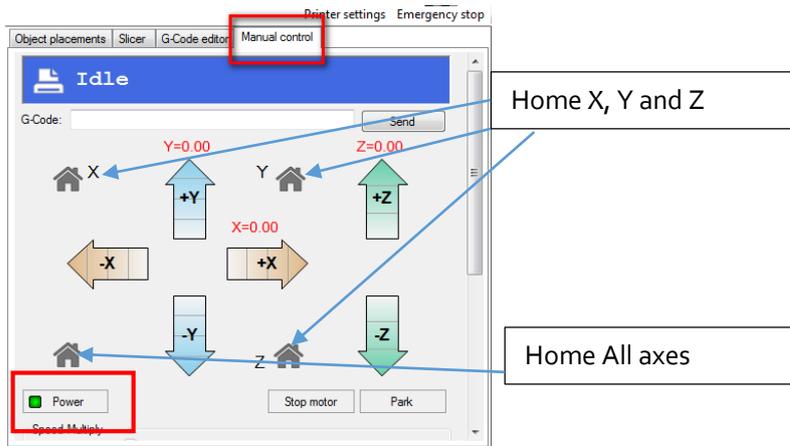
3. Now it is time to calibrate the z-height:
When doing the following steps, hold your hands on powerswitch of the powersupply. Flip the switch if something goes wrong.
- Press the Power button. This will turn on the power circuit of the electronics board.
If you have built a DIY kit: Do the following checks to ensure you have connected the wires correctly.

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- 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 are reacting. 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, to give you enough reaction time to respond if something goes wrong.
- 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
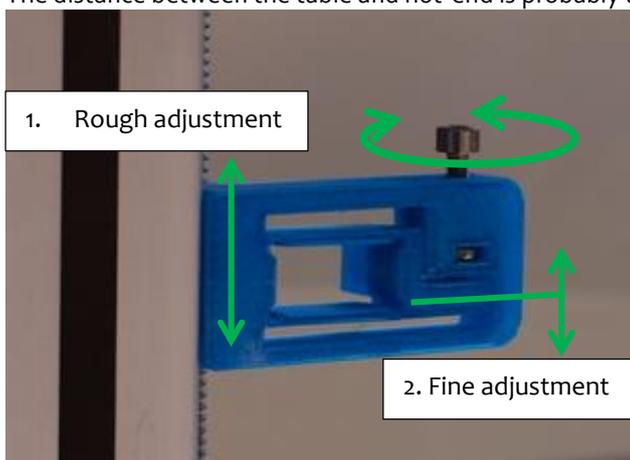
- Turn the screw in such a way that the flexible vane mechanism goes downwards. Do this approx. till ¾ of the possible stroke. Move the complete part a little bit up and press Home Z again.
- Repeat this until the table is approx. 3 mm from the nozzle. Now fix the bracket to the frame and start homing 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.
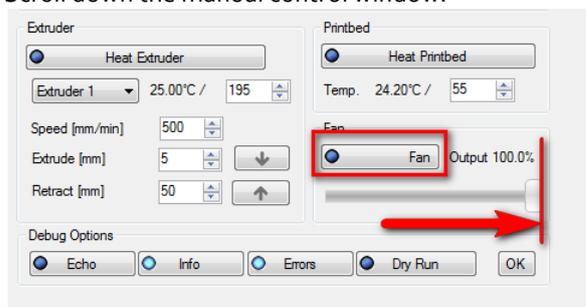
- Check if the switchable fan mounted to the airduct is working.

Move the slider to 100% and press the fan button

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5 Prepare CAD file for printing - Slicing

This chapter will prepare a CAD file for printing. It basically converts a STL file to a gcode file. This process is called slicing.

To keep things simple for your first print we recommend to get the test file from here:
http://shop.FELIXprinters.com/downloads/index.php?path=print_files%2Ftest_print_files/ .
Choose the file. **_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 at the time of writing less reliable than SFACT, which means that some models don't get sliced correct.
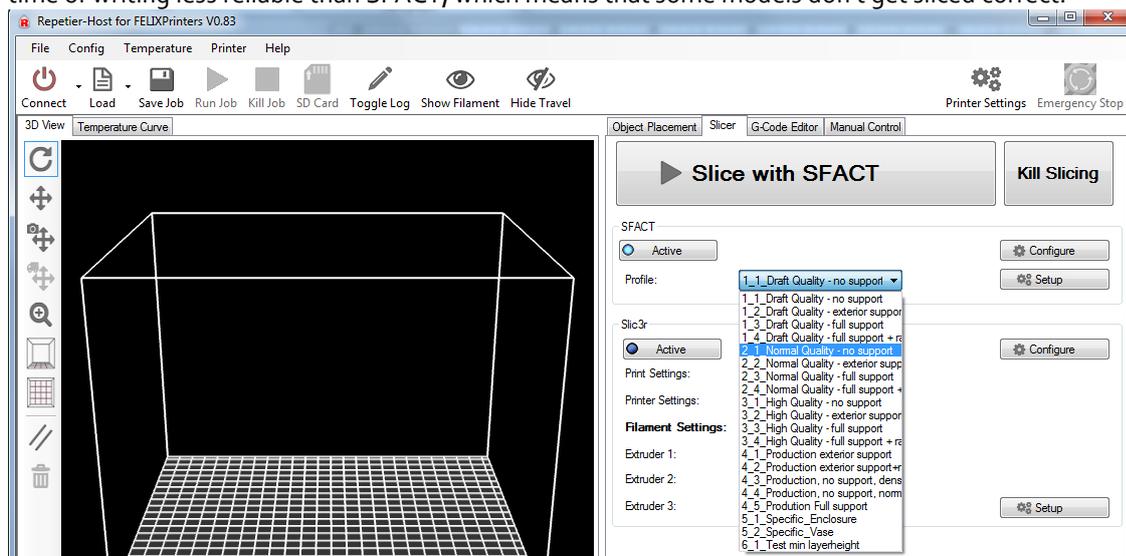
There is a large choice of slicing profiles. For the first test it is recommended to choose the **2_1_Normal_Quality** profile.
Short explanation of the slicing profiles:

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 are recommended to use for slicing the 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

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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.
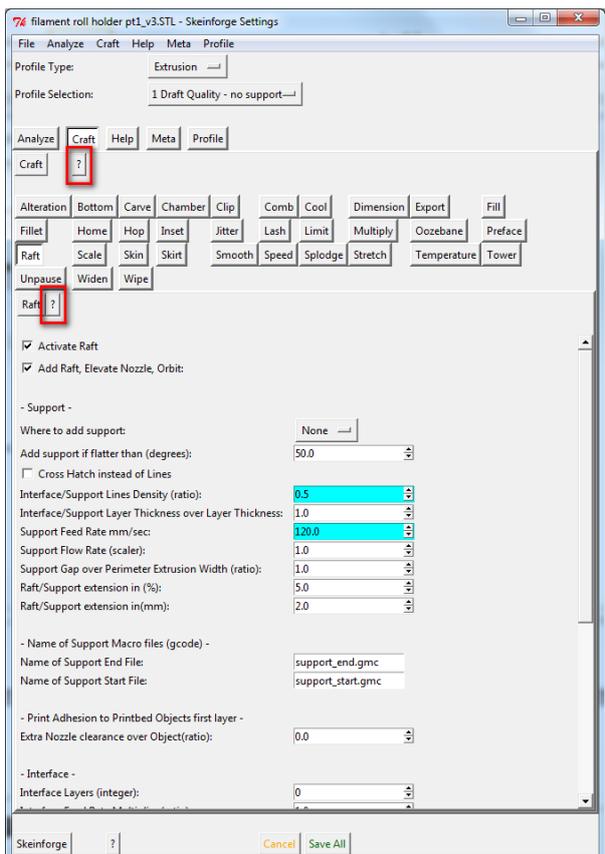
1. Now back in the repetier main interface make sure the SFACT slicer is activated and select one of the profiles.

2. Now it is time to slice our first object.

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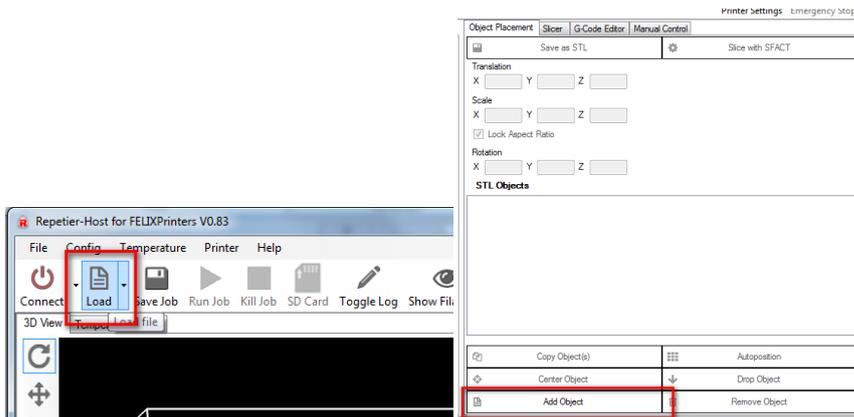
Press the *Load button* or in the Object placement tab, *Add Object button*.
Then navigate to the folder where you downloaded the _40x10.STL file or any other STL file.

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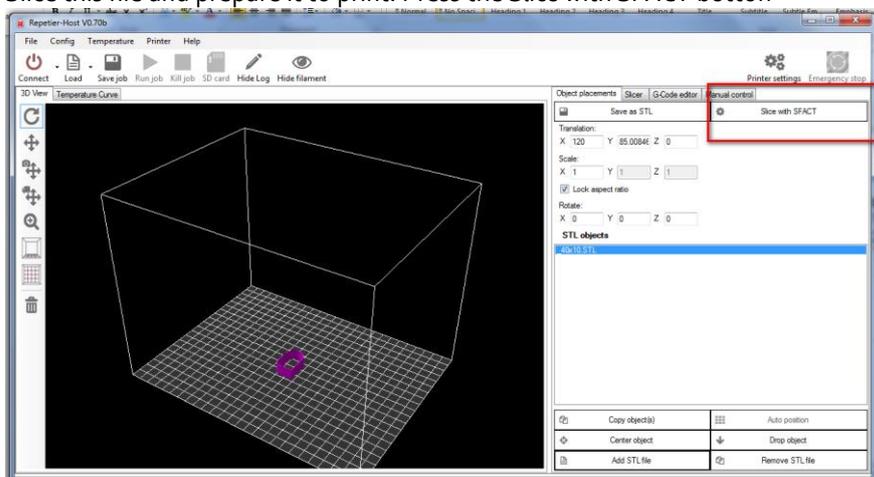
When the program is done after slicing the interface should look like this:
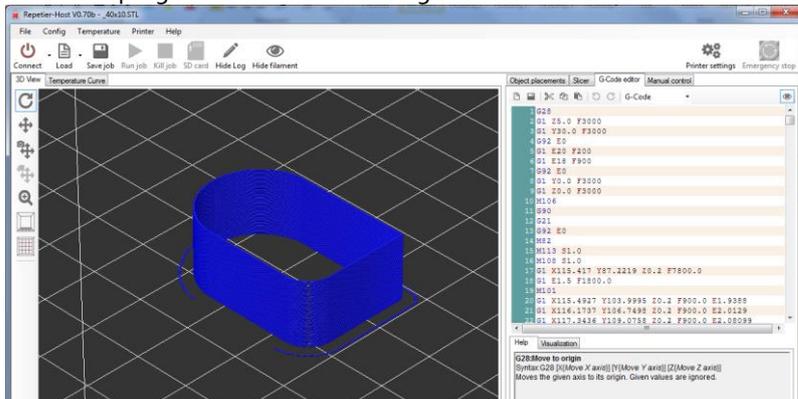
You have now sliced your first object and are ready to go to the next step.

6 Your first print

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.

In the manual control window do the following.
-   In Case of dual extrusion, select the extruder of choice.

WARNING: EXTRUDER AND HEATED BED GET HOT. WEAR GLOVES WHEN OPERATING YOUR FELIXPRINTER.
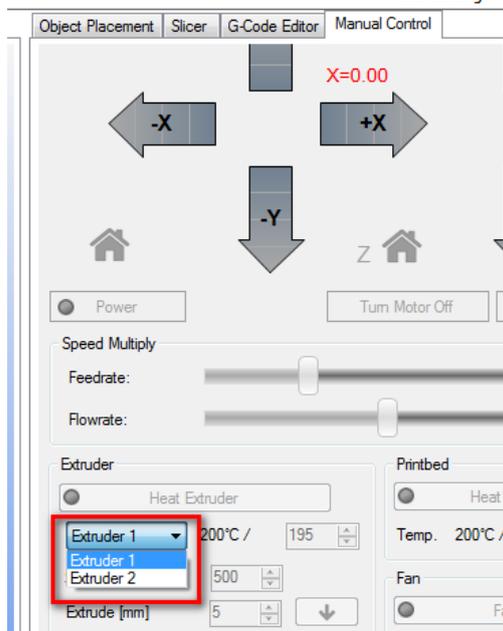
-   Heat up the extruder to 195 degC
-   Heat up the heated bed to 55 degC
-   Move the table down 10mm

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.

> ℹ️ **NOTE:** When there is not a continuous flow coming out of the nozzle, make sure the extruder arm is properly tensioned. Turn the m4 bolt counter 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 in the worst case..

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Tensioning bolt, turn counter clockwise for more tension on filament.
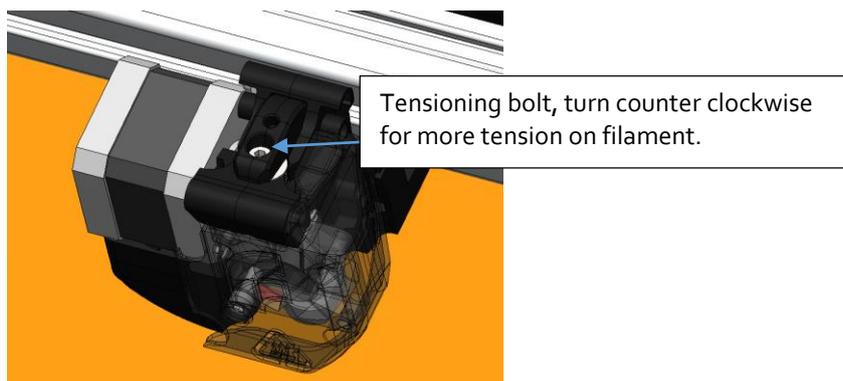
When these steps above are OK, you are ready to press that print button.
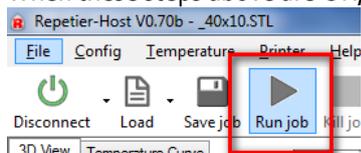
If the calibration was done ok the print should finish without any problem.

WARNING! SURFACE OF HOT PLATE STILL HOT!
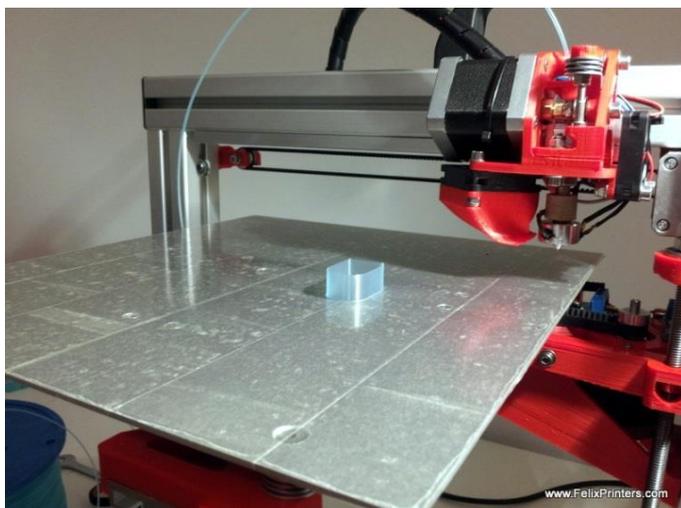
If the print looks like the picture above than congratulations your printer is completed!!

If the print fails, it is 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: 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.

NOTE: If you have a dual extruder, continue to chapter 7

NOTE: For owners who assembled the printer theirselves it is **strongly recommended** to follow assembly checks in **14 appendix.**

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7 Dual head printing

This chapter describes how to calibrate your dual extrusion printer and describes additional steps to make a dual extrusion print.

Assumed in the following steps is that repetier-host is already installed, that the hot-ends are calibrated correctly to have the same height and that you just finished assembling your DIY kit.

1. Make sure you have the latest dual extrusion firmware loaded.

2. Prepare the repetier-host interface for dual extrusion.
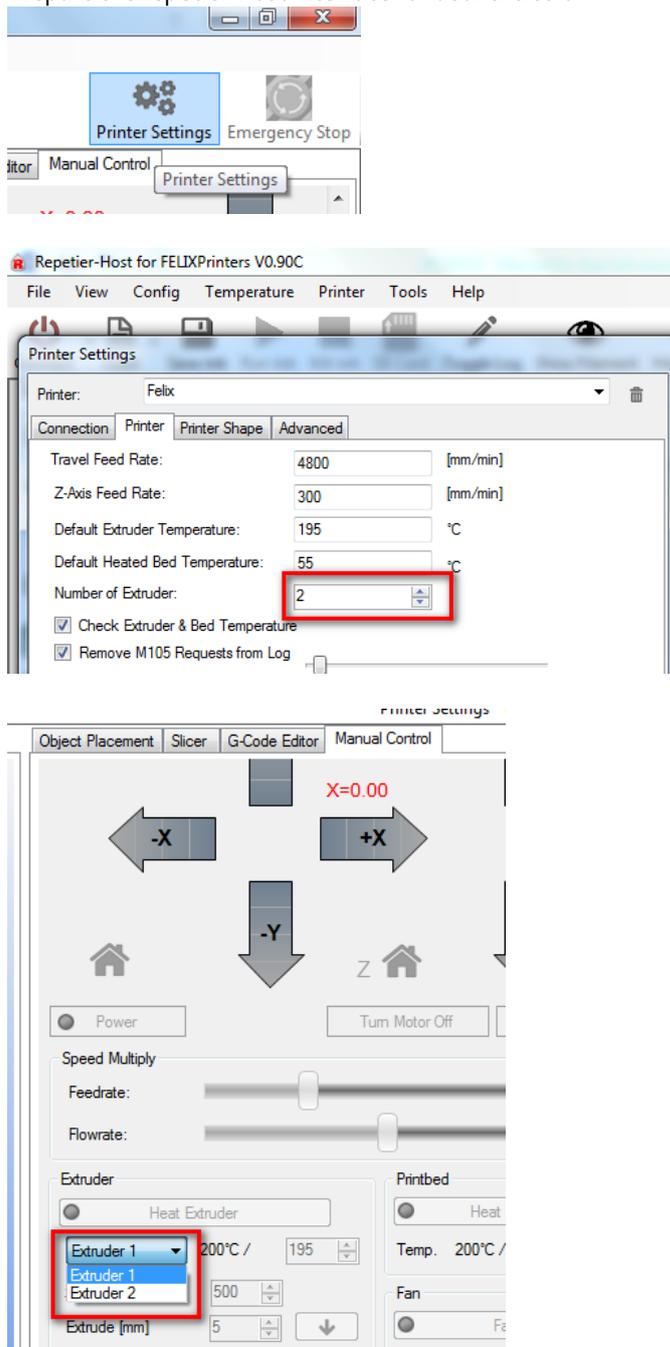
3. Print test_thinwall_v3.gcode with extruder 1.
    a. Go to repetier interface and select extruder 1. Heat up extruder and heated bed.
    b. Printed output must show a smooth straight wall. Possible issues

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- Wall is not straight. Check if hot-end is correctly fastened. Check if pulley is fixed correctly on motor axis
- Gaps in part. Make sure the extruder arm exerts enough tension on filament. When extruding manually, it should be very hard to hold back the filament by hand.

4. Repeat now with extruder 2.
   a. Select extruder number 2. Heat it up similar to extruder 1 and print it out.
5. If both separate extruders have proven to print well, it is time to calibrate the distances between them. Print out the *calibration_dual_extruder.gcode* file as shown below.
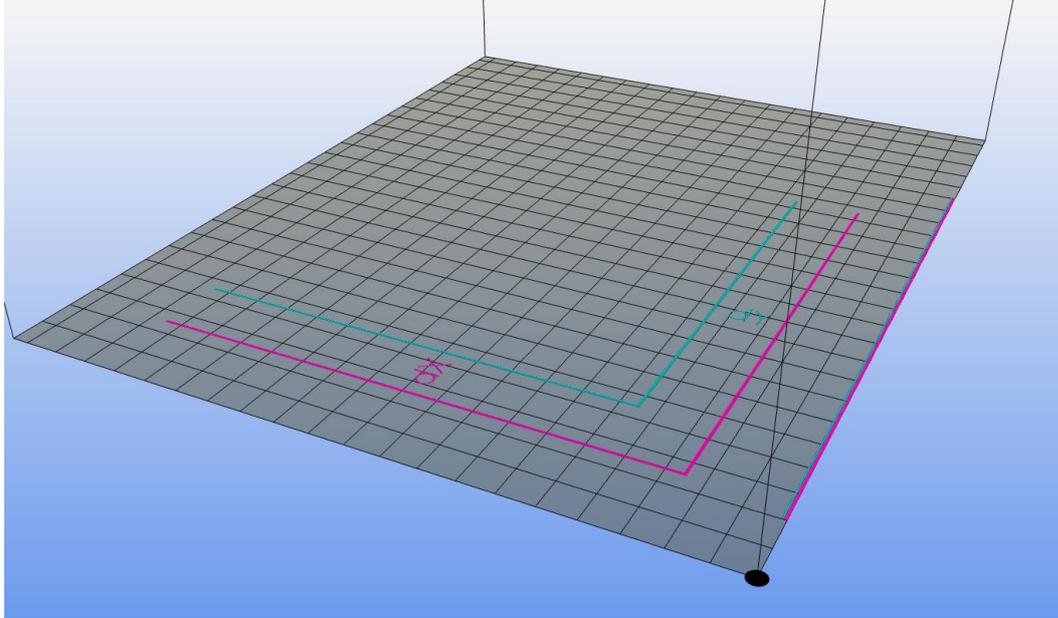
   a. The two lines should be 20mm apart from each other. Start by measuring the distance in X direction with a caliper (lines besides dX). If the distance is different than 20mm this needs compensation.

   b. Use the following formulas to calculate the compensation value:
      i. offsetX = 76.20 * (-16+ (dX-20))
         1. Example: Measured distance dX = 20.22mm. fill in this formula:
         2. offsetX = 76.20 * (-16+ (20.22-20)) = -1202.436
      ii. offsetY = 76.20*((dY-20))
   c. Fill in these values here:

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Description	Value
Extr.1 extruder cooler speed [0-255]	255
Extr.1 advance K [0=off]	0.000
Extr.1 advance L [0=off]	0.000
Extr.2 steps per mm	169.000
Extr.2 max. feedrate [mm/s]	30.000
Extr.2 start feedrate [mm/s]	10.000
Extr.2 acceleration [mm/s^2]	10000.000
Extr.2 heat manager [0-3]	1
Extr.2 PID drive max	255
Extr.2 PID drive min	40
Extr.2 PID P-gain/dead-time	41.0000
Extr.2 PID I-gain	0.1000
Extr.2 PID D-gain	270.0000
Extr.2 PID max value [0-255]	255
Extr.2 X-offset [steps]	-1219
Extr.2 Y-offset [steps]	0
Extr.2 temp. stabilize time [s]	1
Extr.2 temp. for retraction when heating [C]	150
Extr.2 distance to retract when heating [mm]	40
Extr.2 extruder cooler speed [0-255]	255
Extr.2 advance K [0=off]	0.000
Extr.2 advance L [0=off]	0.000

6. Press the OK button to save the new calibration values and print out the calibration part again to verify if calibration values give the desired result.
7. If this is successful, you are done with the calibration and you can now successfully print with your dual head printer.
8. On our webpage a pre-sliced dual head print-file is available which will print a part of the accessories set of the printer.
   http://shop.felixprinters.com/downloads/print_files/accessoires/F3_0/04_print_assy_felix_accessoires_dual_extruder.gcode

Currently there are two methods we support to print with dual extrusion. Kisslicer external program and Slice3r, integrated program in repetier-host. See further chapters.

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7.1   Kisslicer

Kisslicer is a separate program to generate gcode. It is an extremely fast slicer and generates impressive g-codes. The program can be downloaded here.

There is a free version and a payed version, it is important to know that the payed version is only able to generate gcode for dual extrusion.

http://shop.felixprinters.com/downloads/index.php?path=software/

Then download the "…..- kisslicer profiles.zip" file. This includes the slicing program and the configuration files specifically made for your FELIXprinter.

The software is able to generate single and dual extrusion gcode. The program is able to create support material with the second extruder. This can be beneficial, because it can print the support material with different material and also the same material with a different temperature.

The following steps will guide you through the program.

1.   Open kisslicer.exe and a STL file

2.   Configure your slicing settings.

Choose quality:
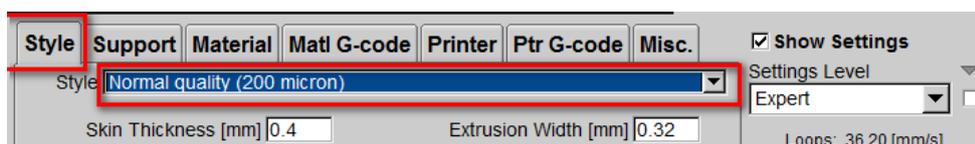
Choose support type:
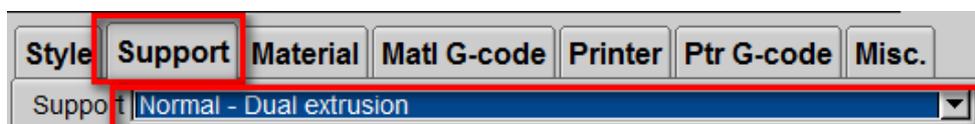
Choose printer type (single or dual extrusion)

Choose what material the extruders are printing

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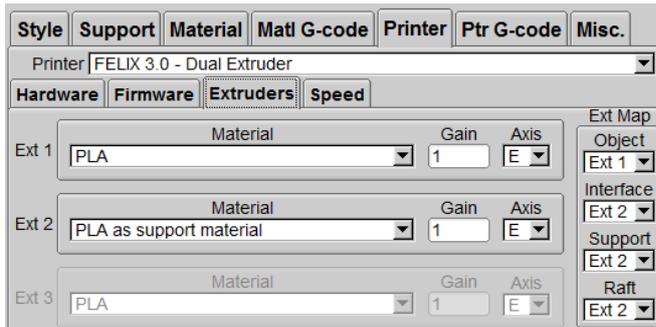
Press slice
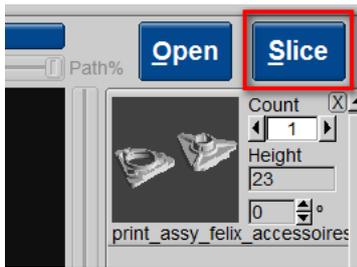
Check results
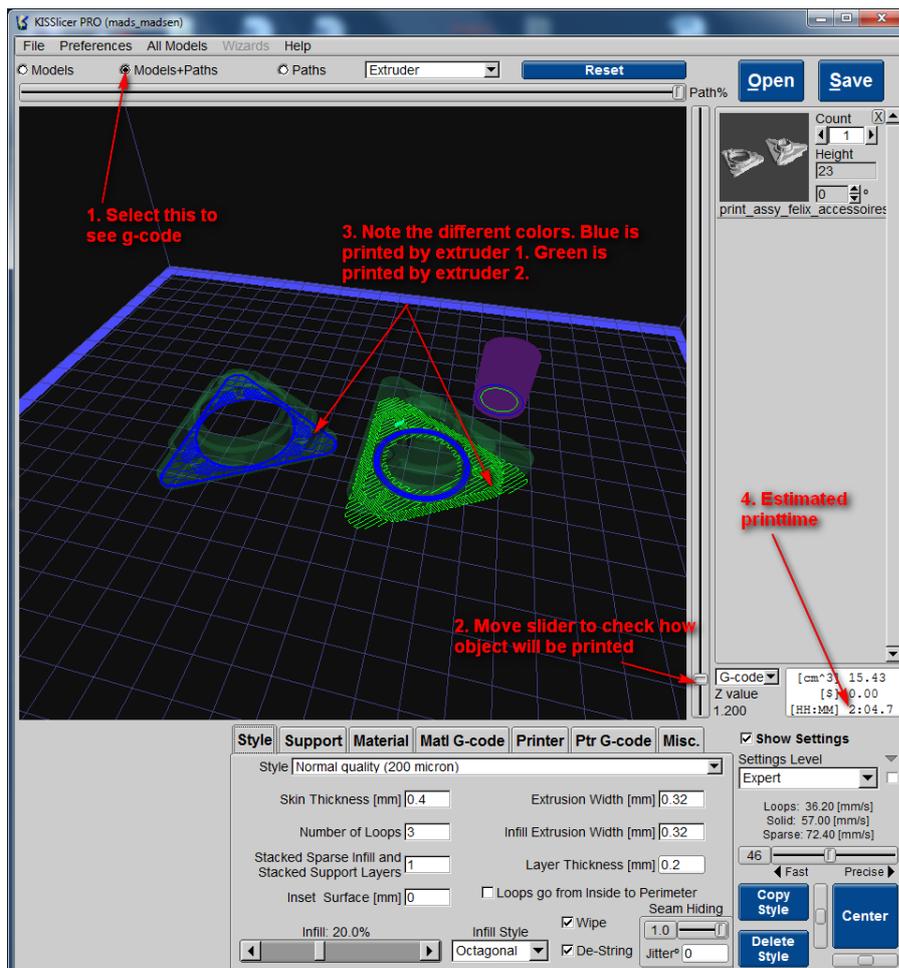
If satisfied, press save:

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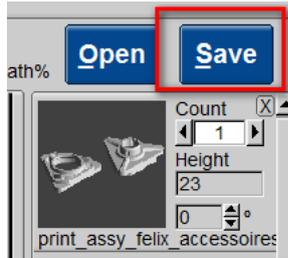
Load the just saved .gcode file in repetier-host to print it on your FELIXprinter.

7.2   SLIC3R – Coming soon

At the time of writing the slic3r slicer profiles are not available yet. This software alternative is free, however the support material generation is under development and does not result in great results yet. Feel free to create a slicing profile yourself for testing.

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8 Printer control with optional display unit

The printer can be fully controlled by the display unit. Below the menu structure is displayed. We will describe each block and show some workflows for the most used functions.

When in a menu in front of each line there will be a cursor, you can go down a line by rotating the rotary button. When you are at the line you want to be you can press the rotary button.

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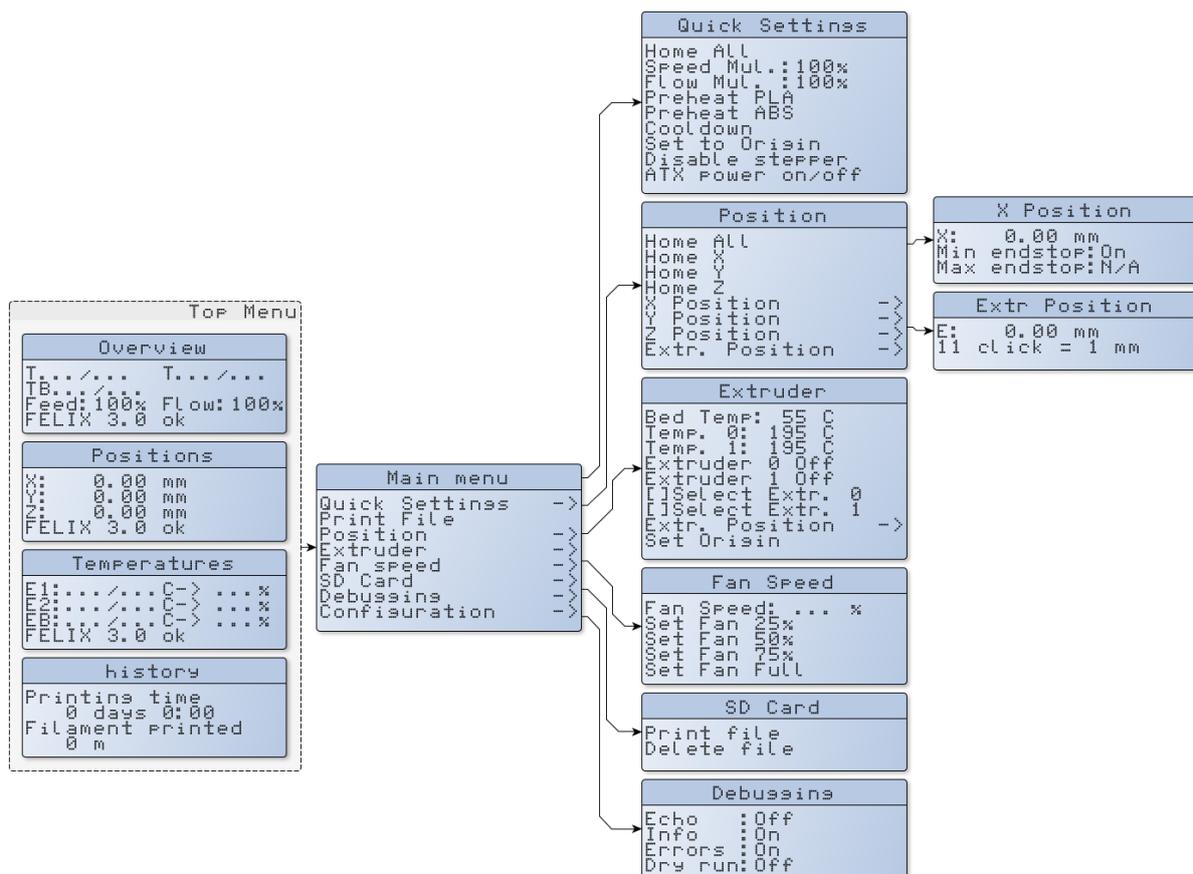
8.1   Workflow to start a print.

This subchapter shows how to start a print from the control interface. Before a print can be started it is mandatory to have a microSD card inserted in the SDcard slot of the electronics board of the printer. On that card also at least one correctly sliced .gcode file must be on it. To generate a gcode file please follow steps in chapter 5. The following steps basically set the temperatures and then load the file to print.

Single extruder printer:
Quick settings -> Preheat PLA -> go back -> Print File (wait till desired temperatures are reached) -> select the file to print.

Dual extruder printer:
This is more elaborate, because you might want to print with one of the two extruders. So these are the possibilities:
Print with one of the two extruders
Quick settings -> Preheat PLA -> go back -> Extruder -> [ ]Select Extr. 0 or 1 -> go back 2x -> Print File -> select the file to print.

Print with two extruders
Quick settings -> Preheat PLA -> go back -> Print File (wait till desired temperatures are reached) -> select the file to print.

8.2   Switch filament.

This step explains how to change filament. Assumed is that the temperature of the nozzle is above 165 degC. Otherwise the extruder motors are not able to move. This is a safety setting.

If temp is not above 165 degC, set the temperature first by doing:
> Main menu -> Extruder -> [ ]Select Extr. 0 or 1 -> in the same menu select Temp. 0 or 1 and turn the wheel till required temp is reached.-> go back to Top menu and wait till temp has reaced target temp

Single extruder printer:
> Quick settings -> Extruder -> [ ]Select Extr. 0 or 1 -> go back 2x -> Print File -> select the file to print.

Dual extruder printer:
This is more elaborate, because you might want to print with one of the two extruders. So these are the possibilities:

1. *Print with one of the two extruders*
   Quick settings -> Preheat PLA -> go back -> Extruder -> [ ]Select Extr. 0 or 1 -> go back 2x -> Print File -> select the file to print.

2. *Print with two extruders*
   Quick settings -> Preheat PLA -> go back -> Print File (wait till desired temperatures are reached) -> select the file to print.

8.3   Menu description

This section describes the existing menu's in more detail.
Top Menu
By scrolling at the overmenu with the rotary button, you will get several views.
The top menu

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```
        Overview
T.../...    T.../...
TB.../...
Feed:100%  Flow:100%
FELIX 3.0 ok
```

Line 1, describes the temperatures of the hot-ends in this format   T (actual)/(desired)

Line 2, describes the bed temperature

Line 3,Feed: …%, is the printing speed override. By changing the feed you can override the current printing speed. To finish your prints more quickly, but at the cost of print quality

Flow …%: This alters the amount of filament extruder compared to the calculated values.

Line 4, Status information.

Main menu

```
       Main menu
 Quick Settings    ->
 Print File
 Position          ->
➤Extruder          ->
 Fan speed         ->
 SD Card           ->
 Debugging         ->
 Configuration     ->
```

Quick Settings: Links to submenu with often used settings

Print File: If SD card is present, you can select and print it. Make sure the temperature of hot-end and bed are at desired values already.

Position: Change the positions of the axes.

Extruder: Move and control the extruder

Fan speed: Change the fan speed of the fan blowing cool air on the bottom of the hot-ends

SD Card: If SDcard is present you can print or delete a file from the SDcard.

Debugging: Here you can change debugging settings, not necessary, more for

Configuration: Change the configuration of the printer. Only do something with it if you know what your are doing.

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9 Printer accessories

To increase the user experience, we provide several accessories to the printer. The accessories basically enable a good filament guiding.

In the kit the basic parts are provided, the plastic parts however have to be printed (only for the DIY kits).

Accessories for the printer can be downloaded and printed out here:
http://shop.felixprinters.com/downloads/index.php?path=print_files%2Faccessoires%2FF3_0/

9.1 Filament cleaner mechanism.

Push the white filament cleaner discs into the black part, and click it into the frame.

Push in the teflon tubes

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9.2 Filament roll off mechanism

Function of the roll off mechanism is to have the filament roll off smoothly from the spool and to prevent knots of during printing. Steps install the filament roll off mechanism

1. Press the large bearing (there are two needed for dual extruder printers) into the printed part first. A pliers could be needed to push it into the printed part.
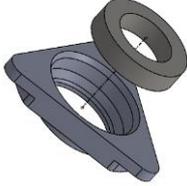
    Break away the thin flange of the part below. (The flange was used to get better adhesion to the heated bed.)
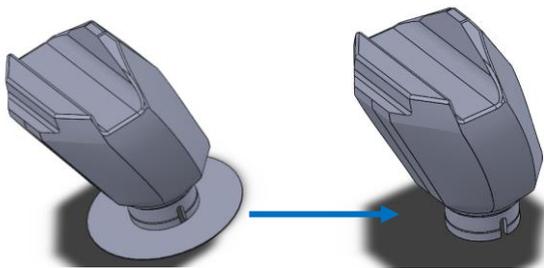
2. The relation of the parts for the filament roll off mechanism.
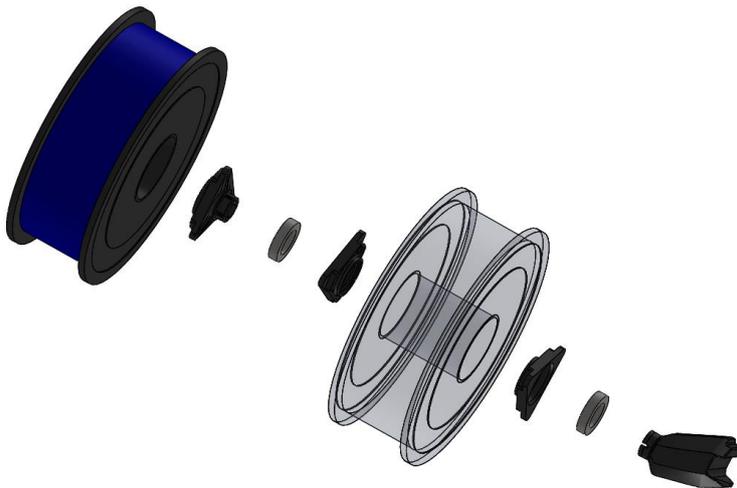
3. Place the parts onto the frame, notice how the filament rolls off before it goes to the dust cleaner

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10 FAQ

Q: Which hot-end nozzle temperature do you recommend?
A: For small detailed parts in PLA 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 180-205 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.

> **i** **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.

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11 Maintenance/Optimal operational tips

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

11.1 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.

11.2 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 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.

11.3 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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12 Troubleshooting

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.

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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 blue spirit/alcohol/thinner.
2. Is the heated bed on?	The recommended 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.

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13 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.

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14 Appendix: Extra checks after assembling DIY kit for optimal operation

The following checks are done by our assembling team. The checks are of great importance and ensure optimal operation of your 3d printer.

No	Mechanical tests	Check
1.	Belt tension for x and y-axis is ok *Tension must be high enough that :* *You don't feel the teeth of the belts when moving the axis by hand* *You don't see sideways movement of the belt when you turn direction.*	
2.	Belt of x-axis is parallel to top beam, when looking from the side. *If not parallel, pulley is probably mounted too high on motor)*	
3.	Pulleys are fixed ok with the setscrews.	
4.	Washers are placed underneath the nuts which hold the y-axis brackets onto the y-axis rail.	
5.	Four screws fixing the linear y-rail onto z-axis carrier, must have rings and must be firmly screwed.	
6.	Stacked guide bearings in z-axis bracket are fixed and perpendicular to bracket.	
7.	Check if washers are present under the 4 m3 bolts to mount y-axis rail. *(Without washers the rail cannot be fixed properly.)*	
8.	Make sure M4x25 bolts are used for tensioning mechanism of x and y axes	
9.	Hot-end must be flat on extruder base	
10.	Hot-ends have the same height (only for dual extrusion)	
11.	Hot-end should be firmly in place, no movement/rocking is allowed after mounting. The bolts that mount the hot-end clamps onto the base must be fixed firmly to ensure.	
12.	Extruder tensioning arm adjustment. *Tension must be strong enough that the filament is very hard to stop by hand. Not too tight that the filament is squashed very wide.*	
13.	Table is aligned properly	
14.	Leveling springs underneath bed are sufficiently compressed, *to prevent loosening during printing*	
15.	Frame bolts are fixed firmly. *It can be disastrous if frame bolts are not tight, during transport*	
16.	Put grease on z-axis spindle	
17.	All cable-ties are neatly cut off	
18.	Finished testprint, belt_guide, filament holder. 3-4hr Must be clean, straight walls, no gaps.	
19.	After test prints do a quick check if all bolts are still properly tightened	

Following checks are endurance tests which are done, before assembled printers are released to our customers. For assembled printers the printed parts generated are supplied with the printer.

No	Printing checks	Check
20.	All I/O are working properly	
21.	00_test_thinwall_v3_export.gcode, *print small test with* **extruder 1**	
22.	02b_print_assy_display_unit_F3_0.gcode, *print display unit with* **extruder 1**	
23.	03_print_assy_felix_single_extruder_V3.gcode, *print accessoire set part 1, with* **extruder 1**	
24.	**NOTE:** *Only print for single extruder printer.* 05_Extruder_cover_single_extruder_V2.gcode, *with* **extruder 1**	
	NOTE: Following prints are only needed for Dual extruder printer	
25.	00_test_thinwall_v3_export.gcode , *print small test with* **extruder 1**	
26.	06_cover_dual_extruder_V7.gcode, *with* **extruder 2**	
27.	NOTE: Before printing this, make sure extruder cover is already mounted. 01_calibration_dual_extruder.gcode, *calibrate distance between nozzles*	
28.	04_print_assy_felix_accessoires_dual_extruder.gcode, *print accessoire set part 2*	

The following checks are required for CE safety.

No	CE safety checks	Check
29.	Heat shield mounted onto extruder.	
30.	Heat warning signs placed according to manual	
31.	Usage of gloves warning signs placed according to manual	
32.	Pinching danger warning signs placed according to manual	
33.	Is handle mounted properly	
34.	Check if damping feet are placed underneath printer	
35.	Are all four bolts mounted for electronics enclosure?	
36.	Is CE label mounted according to instructions?	
37.	Is serial number sticker mounted onto CE sticker?	
38.	Checklist signed by authorized person.	

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15 Appendix: Electronical schematics

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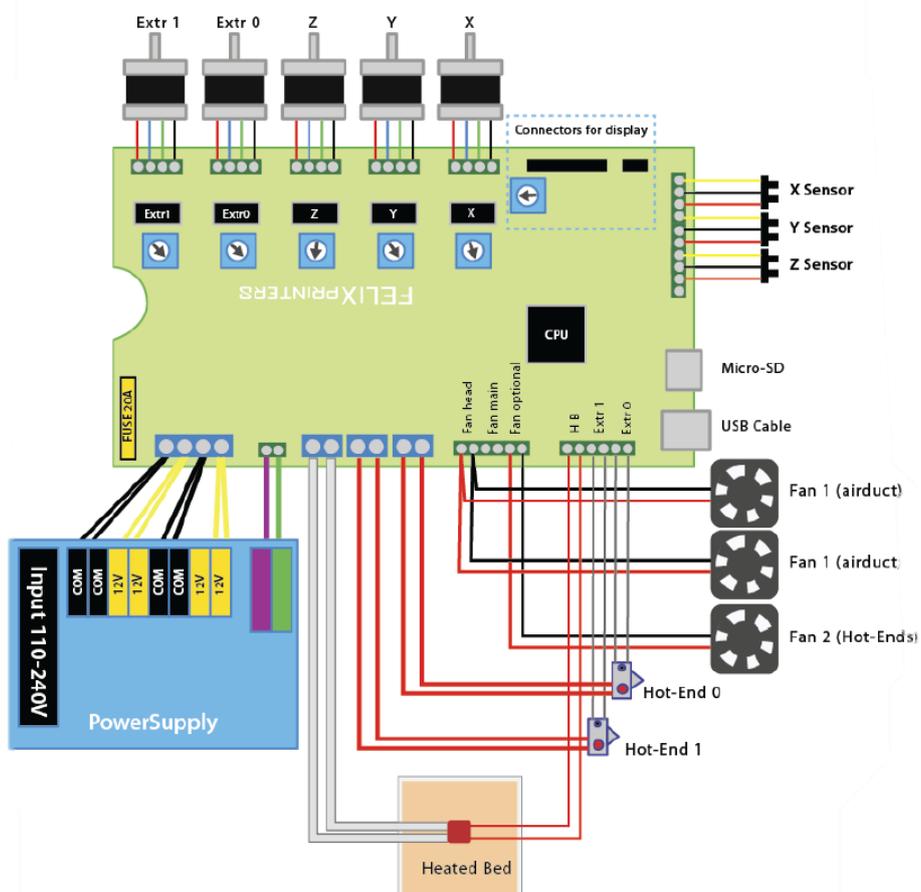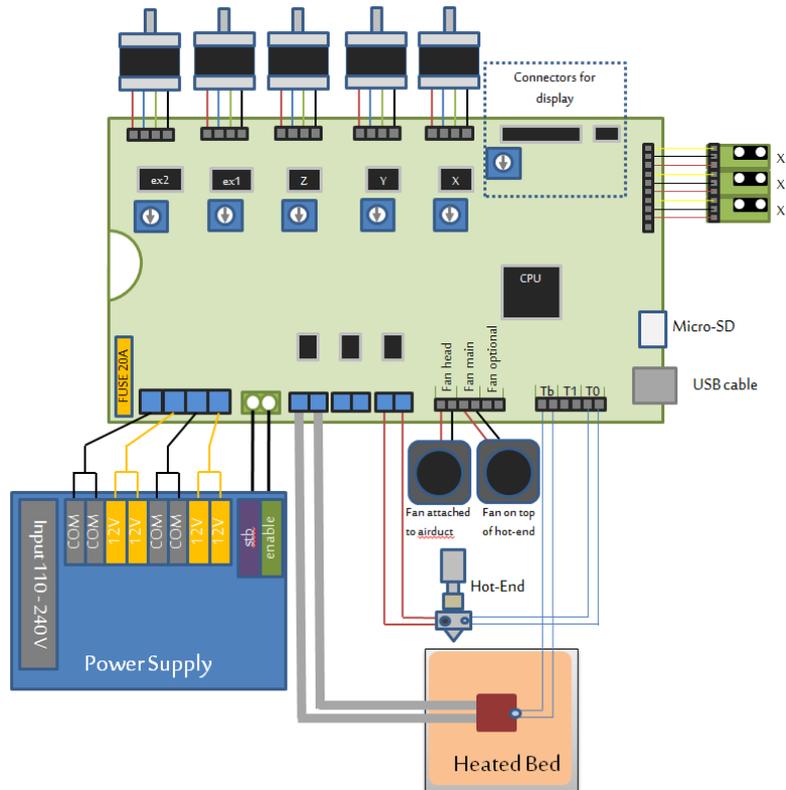
16 Appendix: Material Data Safety Sheet

16.1 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

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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.

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16.2 ABS

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

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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 photo degradation 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.

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17 Appendix: Symbol- and indicatorlights explanation

Symbol/indicator	Explanation
	Warning: High temperatures
	Pinch hazard.

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18 Appendix: Terms Of Service

Please read the entire agreement, you can always contact us if you have any questions. By using and ordering from our website you agree to these terms. If you do not agree, please do not use this product. If you have any questions or concerns, feel free to contact us. Thanks for your patience!

If you have any questions, please contact us.

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- Shipping & Processing Terms
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- Typographical Errors
- Miscellaneous
- Use of Site
- Participation Disclaimer
- Indemnification
- Third-Party Links

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We accept credit card, PayPal and Dutch Wire Transfers as payment for orders. For Wire Transfers payments, the order will not ship until the payment is received and 'clears'. For PayPal eCheck, we will not ship until the payment clears. Due to potential fraud and misuse, we may decide not to ship an order, or request additional verification information for credit card or PayPal payments. Credit cards must clear the authorization process.

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We can't add or remove any item to an order that has already been placed. Orders won't be combined, before or after they're placed; please put all your items in one order. Please check your shopping cart carefully before checking out and paying.

We strive to ship orders as soon as possible, however we do not guarantee specific delivery or shipment dates. Each order takes a minimum of one day. Orders are shipped to the delivery address noted in the customer order. This address is noted in the email sent to the customer upon ordering and is also available in the account order history. For international orders, you are also responsible for any tariffs, taxes, fees, VAT, duties due upon receipt.You are responsible for filing any claims with carriers for damaged and/or lost shipments. A customer may expect that we ship items that were in stock at the moment of purchase to be shipping within 30 days, unless these items are bought as part of a pre-order or are bundled with a pre-ordered item. In the exceptional case that items cannot be shipped in this period, we will contact you beforehand to try to arrive at an agreement on how to process, including the option to cancel the order. In case we send out a substitute product instead of the originally ordered product, we will pay for the costs of returning that product when requested. Such a request has to be sent to us within 14 days, and the product has to be in an undamaged and unused state, and we should be consulted for the courier service that is selected for the return.

We strongly encourage using a traceable shipping method. Use of non-traceable shipping is at customer's own risk and there is no way to retrieve or locate the package once it has been sent. We are not responsible for delays, loss or damage stemming from shipments sent to incorrect, invalid addresses or correct addresses. Orders may end up being returned for various reasons including: non-payment of tariffs, incorrect address, unclaimed at post office, etc. If a package is returned or rejected, the customer will be contacted and will have to pay for re-shipment postage. We are not responsible for damaged or lost packages shipped via untracked parcel services at any time and under any circumstance. Not all packages are insured. For DHL, packages are insured and claims may be filed almost immediately, but its best to

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wait a few days. For other parcel services that are un-tracked, no insurance is offered. Claims for lost or damaged packages must be filed no earlier than 21 days after shipment and before 90 days. For international packages, claims must be filed between 45-90 days except for Italy which is 60-90 days

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Validity of offers

Unless stated otherwise, offers are valid for up to 14 days.

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A customer may return a tangible product within at least 7 days, as long as it is unused, unopened and in the same condition as received. When you want to return a product, please contact us for details or see the last paragraph of this page for our address.

Defective products manufactured in house will be replaced within 10 days of receipt, with the same item. All goods are checked before they are sent out. In the unlikely event that goods are faulty, they must be returned, to the FELIXrobotics store at the address listed on your order invoice. FELIXrobotics will not accept goods that have clearly been used more than the amount needed to evaluate their functionality. If the goods are found to be in working condition, and the lack of functionality is a result of lack of knowledge or assembly error on the customers part, no refund will be made, but the goods will be returned to the user at their expense If there is evidence that the product has been modified or that a fix has been done on it, the FELIXrobotics store will not be made responsible and therefore will not provide an exchange. For other products distributed but not manufactured directly by the FELIXrobotics (i.e. Arduino's, Stepper motors,etc), we will ship a replacement item for the defective part within 14 days of delivery confirmation. The item must be as it was shipped, with no modifications, original packaging and contents. Order cancelations/refunds apply with the following conditions: 1. - When we cannot longer provide one or more items of the actual order (i.e. discontinued parts). 2. - When one or more items of the actual order are not expected to be shipped within 30 days or more. 3. - When one or more items of the actual order is marked as In Stock but was actually Out of Stock. Return shipment is the responsibility of the customer. All returns are credited as store credit upon receipt. RMAs are required for returns.

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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.

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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

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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

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