

User Manual  
**FELIX Tec 4**

18 December  
2017

Revision 1



# 1 Introduction

Thank you for choosing FELIXprinters!

It is highly recommended to read this manual. It explains in short how to make your first print and contains essential tips to operate the printer properly.

If you are unable to continue or have any questions, you can check at the support section of our website or you can contact us directly:

Website: [www.felixprinters.com/support](http://www.felixprinters.com/support)

Email: [support@felixprinters.com](mailto:support@felixprinters.com)

Telephone: +31 (0)30 30 31 387

Address: Zeemanlaan 15, 3401MV IJsselstein, The Netherlands

Kind regards,

FELIXprinters

## 2 Safety

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

	<p><b>General safety</b> Keep children under the age of 14 out of reach of the FELIXprinter. FELIXprinters are only suitable for professional use.</p> <p><b>Considerations when printer is in operation.</b> Don't leave the printer unattended, before making sure the first layer is printed properly Don't lean on the printer. Be careful with long hair and wide clothes. Don't transport the printer. Make sure all moving parts can move without any obstructions. Don't remove any objects from the hot plate while printing Caution with any moving parts that move in the X, Y and Z direction. Moving parts can have a pinching hazard.</p> <p><b>Printer placement</b> Place the FELIXprinter on a stable table/desk or something with a similar height. Place the printer on a height where children cannot reach it. Use the FELIXprinter in a dry environment at room temperature</p>
	<p><b>Electronic safety</b> <b>Only use the power supplies and cables supplied by FELIXprinters.</b> Always turn off and unplug the printer before performing maintenance or modifications.</p> <p>The power supply meets all CE mark regulations and is protected against short-circuit, overload, over voltage and over temperature.</p>
	<p><b>Ventilate</b> Good ventilation while printing is advised. When printing ABS, small concentrations of styrene vapor can be released. This can (in some cases) cause headaches, fatigue, dizziness, confusion, drowsiness, malaise, difficulty in concentrating, and a feeling of intoxication.</p> <p>We recommend using filament types shown on the FELIXprinters website. Examples PLA, PETG, ABS, Glassbend etc. Other types may be toxic; please follow instructions from the filament supplier.</p>
	<p><b>Caution with heater elements</b> There is a potential risk of burn, as the print head can reach temperatures of up to 275°C and the heated bed of up to 105°C. Don't place objects on the heated bed, not even when the printer is turned off.</p> <p>Always let the printer cool down for at least 10 minutes before doing maintenance or modifications.</p>

## 3 Contents

1	Introduction.....	1
2	Safety .....	2
3	Contents.....	3
4	Printer specifications.....	4
5	FELIX Tec 4 at a glance.....	5
6	Unboxing, Setup and Prepare.....	5
7	Printer calibration .....	6
7.1	What does the calibration do? .....	6
7.1.1	Physically leveling the build plate. (semi-automatic).....	6
7.1.2	Calibrating the z-probe height offset. (semi-automatic).....	6
7.1.3	The height difference between the two hot-ends. (manual).....	7
7.1.4	Adjusting the x, y distance between two hot-ends. (semi-automatic).....	7
8	Display functions.....	8
8.1	Turn On the printer/General display unit overview .....	8
8.2	The main menu.....	9
8.3	Control Menu .....	9
8.4	Print Menu .....	10
8.5	Settings menu .....	10
8.6	Printing Menu (Only active during print).....	11
9	Maintenance .....	12
9.1	Dust cleaners .....	12
9.2	Motion system .....	12
10	Trouble shooting.....	13
10.1	Z-sensor triggered, improper leveling (G33), homing and printing in the air .....	13
10.2	No filament is coming out of extruder .....	13
10.3	Heater decoupled / DEF / DEC message on screen.....	14
11	Safety .....	15
12	Tips and tricks.....	16
12.1	Flexible Filaments.....	16
13	Material Data Safety Sheet.....	17
13.1	PLA.....	17
13.2	ABS.....	19
14	Appendix: Terms Of Service .....	21

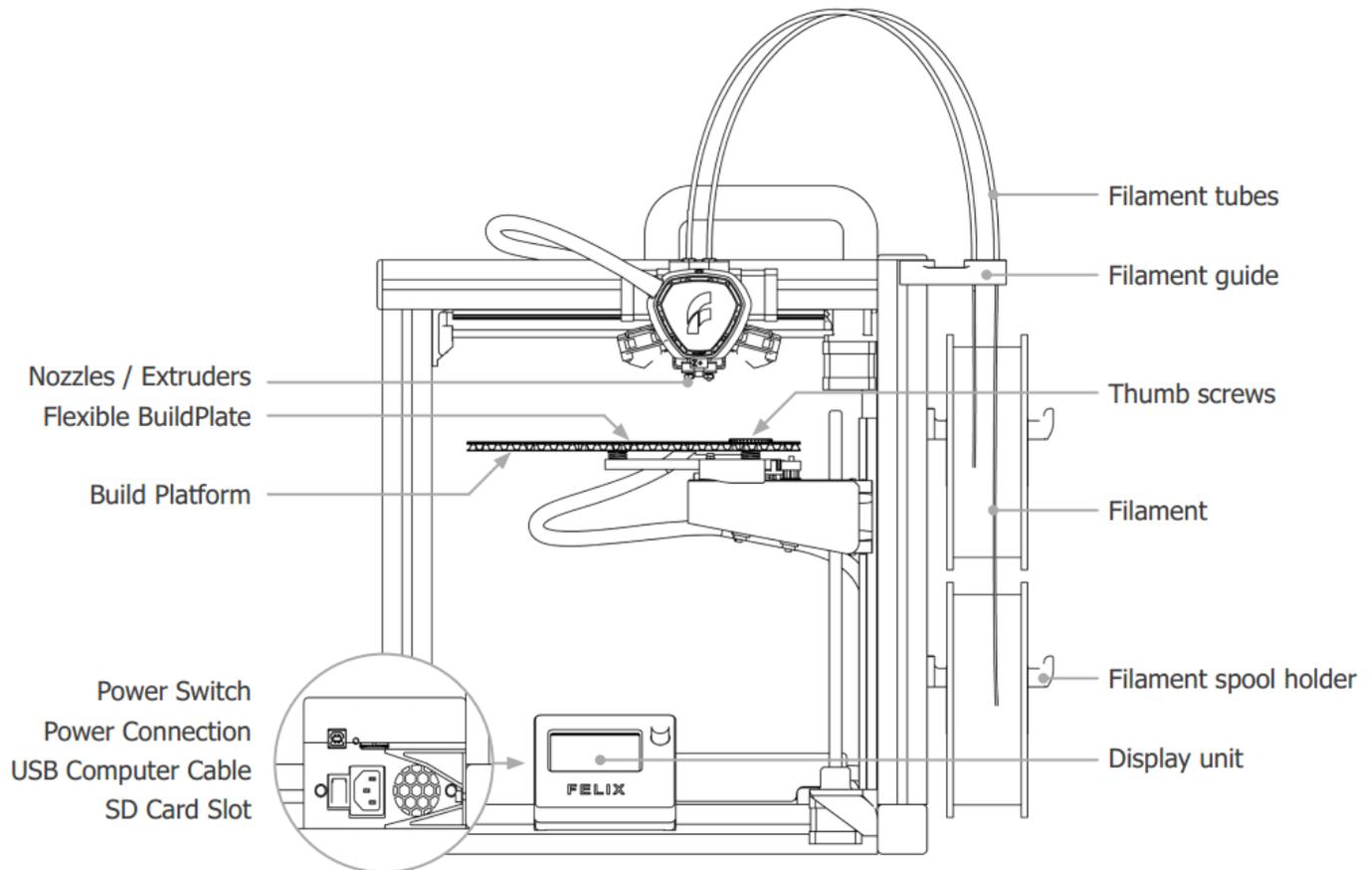
## 4 Printer specifications

Printing		Electrical											
Print Technology	Fused Filament Fabrication	AC input:	100-240V, 50-60 Hz										
Build Volume	255(240 dual head) x 205 x 220 cm	Power Requirements	12V DC, 20 Amps										
Print Quality	<table border="1"> <tr> <td>Low</td> <td>250 microns</td> </tr> <tr> <td>Normal</td> <td>200 microns</td> </tr> <tr> <td>High</td> <td>150 microns</td> </tr> <tr> <td>Very High</td> <td>100 microns</td> </tr> <tr> <td>Extreme</td> <td>50 microns</td> </tr> </table>	Low	250 microns	Normal	200 microns	High	150 microns	Very High	100 microns	Extreme	50 microns	Connectivity	USB Optional WIFI
Low	250 microns												
Normal	200 microns												
High	150 microns												
Very High	100 microns												
Extreme	50 microns												
Positioning Resolution	XY: 13 microns Z: 0.4 microns	Power Usage	Max 250W										
Filament Diameter	1.75 mm	Chipset	Arduino Atmega										
Nozzle Diameter	0.35 mm	Internal Voltage	12V										
Amount of Nozzles	1 or 2												

Software		Mechanical	
Software Bundle:	Repetier-Host for FELIXprinters Optional: - Simplify3D	Chassis	Aluminum profiles
File Types:	.STL .gcode	Build platform	Detachable flexplate Heated platform
Supports:	Windows, XP and newer	XY Bearings	Linear ball bearings
	Linux (Ubuntu 12.04+)	Z bearing	Linear ball bearings
	Mac OS X [10.6/10.7/10.8]	Stepper Motors	1.8 deg angle 1/16 micro-stepping

Physical Dimensions		Temperature	
Printer dimensions	45 x 41 x 52 cm	Ambient operating temperature	15-32 °C [60 – 90 °F]
Weight	10 kg	Storage temperature	0 – 32 °C
Shipping Weight	11 kg		
Shipping Box	58.4x50.8x55.5.0 cm	Warmup time	
		Heated bed (60 °C)	2.5 min
		Nozzle (200 °C)	1.5 min

## 5 FELIX Tec 4 at a glance



## 6 Unboxing, Setup and Prepare

For further instructions please consult the quick start manual, where the following topics are covered.

- Unboxing
- Setup of printer
- Preparation for microSD printing

## 7 Printer calibration

For 3d printing, the first layer is the most important layer. It is the basis of a print job (which can take more than 70 hours in some cases). An improperly printed first layer is mostly the cause of a failed print. With the semi-automatic calibration features properly executed, the chance of failure will be minimized.

The calibration mechanism is dependent upon the inductive sensor. Located in front of the print-heads.

### 7.1 What does the calibration do?

For the FELIX Tec 4 to properly operate, the calibrations described in this chapter need to be performed when commissioning the machine.

#### 7.1.1 Physically leveling the build plate. (semi-automatic)

To ensure the distance between the bed and the nozzles is the same over the whole build plate. The bed needs to be adjusted with the two thumbscrews. Please run the calibration routine via the display interface according to the quick start manual.

When to do this calibration?

- When changing to a new bed plate.
- When you see that the lines on the first layer, significantly differ in thickness from one side to the other side of the build plate.
- After transporting the printer.

When the auto bed leveling routine is started. The following steps are performed.

1. The bed will heat up to 55 °C.
2. The probe sensor will probe 3 positions, to determine how level the bed is. Depending on how level the bed is, the screen will display how much you need to turn the 2 leveling wheels.
3. When level-ness is within a certain tolerance, the calibration routine goes to the next step.
4. The hot-ends heat up to 120 °C, and the probe sensor will probe the bed in a grid of 5x5 measurement points. This will determine the curvature of the surface and is required to ensure good first layer adhesion, the printer will compensate for bed curvature deviations for the first 3mm. The compensation gradually goes to 0 when the z-height is at 3mm.

#### 7.1.2 Calibrating the z-probe height offset. (semi-automatic)

After doing the bed calibration it is important to do the z-probe height calibration. This will determine the distance between the nozzle and the bed surface for the first layer. Use the supplied calibration card with the printer. (the thickness is 0.4mm)

If the height calibration is not done correctly, the printed object will be either squashed and might potentially clog the nozzle or the distance is too far away and the object will not stick to the bed surface.

### 7.1.3 The height difference between the two hot-ends. (manual)

The extruders must operate at the same height. Due to production tolerances this has to be calibrated. Please consult the quick start manual how to do this.

When should you calibrate?

- After changing/servicing one of the two hot-ends or nozzles.
- When you see the first purge lines are significantly different in thickness.

### 7.1.4 Adjusting the x, y distance between two hot-ends. (semi-automatic)

The distance between two extruders need to be calibrated properly in order for a dual head print to successfully finish. If this is not done properly printed lines from both extruders might overlap too much and cause a printed failure.

When to do this?

- After exchanging/servicing a hot-end
- When adjacent features printed with both extruders do not properly aligning.



## 8.2 The main menu

Press the rotary button to enter the main menu:



This is the main menu.

**Control**, contains most commonly used functions

**Print**, will display the print files on the microSD card

**Settings**, you can adjust printer settings.

## 8.3 Control Menu

Back ←	Return to previous menu.
Dual Preheat/Cool	Toggles heaters On or OFF to preset temperatures
Remove Build PLT	Disables heaters and moves platform forward for convenient bed removal
Change Filament	Shows a routine to change filament.
Level Build PLT	Performs a bed leveling calibration routine
Calibrate Z-Probe	Level build plate and measure bump map
Calibrate Extruders	Calibrate Z-probe height, for first layer
Calibrate XY	Calibrate XY distance between extruders
Move	
Home X	Home X axis of the printer.
Home Y	Home Y axis of the printer.
Home Z	Home Z axis of the printer.(Nozzles will heat up first to 120 °C
X pos fast       »	Enter the X axis normal movement menu. Click again to exit.
X: 0.00 mm	
Min endstop: Off	This indicates if the zero position sensor is activated.
Max endstop: N/A	This indicates if the maximum position sensor is activated.
X position       » ...	Enter the X axis fine movement menu. Click again to exit.
Y pos fast       » ...	Enter the Y axis normal movement menu. Click again to exit.
Y position       » ...	Enter the Y axis fine movement menu. Click again to exit.
Z pos fast       » ...	Enter the Z axis normal movement menu. Click again to exit.
Z position       » ...	Enter the Z axis fine movement menu. Click again to exit.
Extr. Position   »	Enter the extruder movement menu. Click again to exit.
E: 0.00 mm	Turn blue knob to feed in or out filament of the active extruder.
1 click = 1 mm	
E: 0.0/ 0°C -> 0%	The percentage shows how much power is sent to the heater,
176.7 m printed	
Manual Positioning	Disables all motor power, enabling manual movement of axes by hand.
E1: 22/ 0°C	Left Extruder temperature (actual temp / setpoint temp)
E2: 22/ 0°C	Right Extruder temperature
B: 22/ 0°C	Bed temperature

## 8.4 Print Menu

Back ← Folder 1 Printfile.gcode	Return to previous menu. Folder Printfile. Only *.gcode files can be printed.
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## 8.5 Settings menu

Back ← Info Tot. Time: ...H Tot. Filament.: ...m Language English Deutsch Espanol ...	Return to previous menu. General info Total printed time in hours Total extruded filament in meters. Choose your language
<div style="border: 1px solid red; background-color: #fff9e6; display: inline-block; padding: 2px 10px; color: red; font-weight: bold;">                     ONLY CHANGE BELOW SETTINGS IF YOU KNOW WHAT YOU ARE DOING                 </div>	
Extruder <input type="checkbox"/> Select Extr. 1 <input type="checkbox"/> Select Extr. 2 X-Offset: 0.00 Y-Offset: 0.00 Steps/MM: 147 Start FR: 5 Max FR: 30 Accel: 10000 Stab.time: 1 Wait Retr.: 0mm Wait Temp. 150C Advance Lin: 0 Advance quad: 0 Control: PID PID P: 20.00 PID I: 0.60 PID D: 65.00 Drive Min: 40 Drive Max:220 PID Max::255	Extruder settings Currently active extruder (see white square in front)  X-offset of extruder (this is only used for extruder 2) Y-offset of extruder (this is only used for extruder 2) Motor steps to extruder 1mm of filament Start feedrate of extrusion Maximum feedrate of extrusion Acceleration of extrusion Temperature stabilization time. Filament retraction amount when printer is waiting to reach temperature Waiting temperature during pause Extruder linear advance parameter. Extruder quadratic advance parameter. Heating strategy, standard PID control Proportional control value Integral control value Derivative control value Minimum PID control value Maximum PID control value Maximum PID value
Build Platform Build PLT Coating BuildTak Kapton Custom: 0.10mm  Control: PID PID P: 100.00 PID I: 0.50 PID D: 150.00 Drive Min: 0 Drive Max: 255 PID Max:255	Build platform control Build platform coating setting, used to add offset between nozzle and bed after homing.  Heating strategy, standard PID control Proportional control value Integral control value Derivative control value Minimum PID control value Maximum PID control value Maximum PID value
Baudrate:115200 Save Settings	Set communication baudrate between printer, must reboot printer to activate. Save changed settings.

Reset Settings	Reset settings to default parameters.
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## 8.6 Printing Menu (Only active during print)

Back ← Stop Print Pause Print Change Filament Z-Offset: 0.00mm Speed Mul.:100% Flow Mul. : 100% E1: 190/190°C E2: 190/190°C B: 45/55°C Fan Speed: 0%	Return to previous menu. Stop and cancel the print Pause the print Change filament during print. Printer will move to side where user. Change offset of printer. Speed override. You can change print speed on the fly. Filament Flow override. You can override the rate of extrusion.  Fan speed override, changes rate of cooling of extruded filament.
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## 9 Maintenance

### 9.1 Dust cleaners

Filament attracts a lot of dust and small particles. Make sure the filament enters the filament holder through the dust cleaner. After a few months of printing it is recommended to replace the dust cleaners.

### 9.2 Motion system

The linear bearings require almost no maintenance. Recommended is that you put a little some grease on them every 3-4 months.

The belt tension of the x and y axis can also be checked in intervals of 3 months. Check this small movie to see how to tension the belts.

<https://www.youtube.com/watch?v=dpS6nWn5rE8>

## 10 Trouble shooting

### 10.1 Z-sensor triggered, improper leveling (G33), homing and printing in the air.

The calibration features rely on a proper functioning of the z-probe, if it does not work, you can get the error messages below.

#### **Z-sensor triggered.**

This message can show up when the printer is idle message can show up when the printer is idle and one of the two z-sensors is active, while the nozzle tip is not actually touching the bed.

This does not have to be an issue. It becomes an issue if at the start of the print this issue is not cleared.

#### **G33 leveling failed.**

This is related to the z-sensor. It shows up , when a bed leveling routine is started and the z-sensor is either triggered at the start of this routine, or it unexpectedly triggers during this routine.

#### **Printing in the air**

The z-probe sensor is not properly calibrated. In some occasions, you need to do this twice, as the maximum change is only 1mm per calibration run for safety reasons.

### 10.2 No filament is coming out of extruder

The most common causes to get a clogged hot-end are (ordered from most common to least common):

#### **Wrong slicing profiles.**

Don't use slicing settings of the FELIX 3 for the Tec 4. This will most likely result in clogs especially when there is a series of retractions happening in a short time.

#### **Chosen print temperature too hot.**

Try printing at the recommended temperatures for the chosen filament. For instance, printing PLA at 210 degrees might work in some cases, but it is critical. The top part of the hot-end will become near the critical 60°C where the filament becomes too soft, too soon and causing a clog.

#### **Fan in front not working**

The front fan cap should be flipped closed all the time when the extruder heaters are active. Failure to do so can cause the cooled part of the extruder to become hot, and the filament will soften or melt too early, causing jamming.

#### **Hot end not really clogged**

Sometimes the extrusion is partly blocked because the nozzle is too close to the bed or to the printed object. Please check if the z-homing of the printer is correct. Check if the printed object is deforming in such a way that it moves too close to the nozzle.

#### **Bad quality filament.**

Make sure to get good quality filament. Dimensional tolerances and also bad consistency of the material itself can cause trouble during printing.

Dust collector not applied around the filament.

Filament attracts a lot of dust, which can potentially all come into the hot-end. In some dusty environments this could cause a clogged hot-end within a few hours.

**Fragment of previously printed material still in extruder.**

If you print a material with a high melting temperature and next a material with a low melting temperature, it may be that a residue of the high melting temperature plastic causes issues inside the extruder. Try extruding some (20 cm) PLA filament manually at high temperature (220 °C). Make sure to turn back the temperature to normal while slowly extruding some more material to prevent it to coal inside the extruder.

**Clog from the inside of the hot-end.**

It could be that a big dust particle or debris buildup inside the hot-end tip causes clogging from the inside.

**You could try the dip-and-pull method:**

Insert PLA in the hot end. Heat the hot end to about 220°C. Try to extrude some material. Set the hot end temperature to 80°C. Disable stepper motors (can be done via the Quick settings menu on the printer itself). Wait for the extruder to reach the set temperature. Pull out the filament in one smooth and steady movement. Most times the clogging material is attached to the solidified end of the filament.

If that fails, you can try hand-drilling the nozzle opening with a drill that matches your nozzle diameter. The best is to do this when the extruder is warm, but be careful! We sell some small diameter drills in our web shop.

**Hot-end parts are not fixed together properly.**

This could cause buildup of filament in some internal cavities/edges.

## 10.3 Heater decoupled / DEF / DEC message on screen

This error presents itself when a part of the heater circuit is not working.

**DEF:** The thermistor circuit is broken.

- If you see this after turning on the printer. It is most likely the thermistor element itself which is defect and needs to be replaced.
- If you see this while the axis are moving, it is most likely that the wire itself is broken.
- Worst case it could be the control board connections which are not properly fixed.

**DEC:** This means the printer is not able to heat up 1 degC within the 20 seconds of heating for the extruders or 60 seconds for the heated bed. Another issue which could trigger it is if the temperature could not be held within 20 degC of the setpoint value.

- If you turn on the heater, it should warm up. Please inspect the heater element itself. Only way to do this is by measuring the resistance with a multimeter. The value should be 4.7Ohm +/- 1 Ohm.
- Then inspect the wiring. If you see it heating, but the temperature stagnates with increasing, while moving one of the axis, it is most likely there is a wire breakage.
- If above two things are ok, inspect the connections on the control board. Are the terminals and/or connectors ok for the respective heater which is giving issues.
- In a rare occasion there could be static electricity involved which is influencing the temperature measurement. Please check if you see very big fluctuations.

## 11 Safety

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

1. FELIXprinters are only suitable for professional use.
2. Keep children under the age of 14 out of reach of the FELIXprinter
3. Only use the materials polylactic acid (PLA), Acrylonitrile butadiene styrene (ABS) or Arnitel as printing material. Consult FELIXprinters if you want to use a different material.
4. Do not use a different power supply than the provided power supply, it can be dangerous and cause electronical malfunctions.
5. Always make sure the first layer of the printer is successfully printed, before leaving the printer unattended.
6. When removing or feeding material to the hot end, wearing heat-resistant gloves is recommended.
7. When operating the FELIXprinter, be carefull with long hair and loose clothes.
8. Don't put objects on the heated bed, not even when the printer is turned off.
9. Don't remove any objects from the hot plate while the printer is still printing objects.
10. Turn off the FELIXprinter when errors occur.
11. When unattended, turn off the FELIXprinter.
12. Make sure all moving parts can move without any obstructions.
13. 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.
14. Watch out for any other non-protected sharp edges of the printer.
15. Don't lean on the FELIXprinter when it is operating.
16. Don't transport the FELIXprinter when it is in operation.
17. Only operate the FELIXprinter in a sufficiently ventilated environment (fumes from ABS and PLA can cause respiratory irritation).
18. Use the FELIXprinter in a dry environment.
19. Use the FELIXprinter on a stable and leveled surface.
20. Place the FELIXprinter on a table/desk/something with a similar height in order to keep small children at a safe distance.

## 12 Tips and tricks

### 12.1 Flexible Filaments

Our 3d printers can in general handle flexible filaments well. Depending on the amount of flexibility, you might need to take some extra precautions to print it without trouble.

This is a best practice:

Precautions.

1. Ensure you **use the correct slicing profiles** for flexible filaments from our supported softwares.
2. Ensure the **extruders are cleared** from non-flexible filaments. It is essential that the filament does not experience any obstructions in the hot-end barrel, before reaching the hot parts of the hot-end. Otherwise chances of buckling filament inside the extruder are very high. Obstructions can occur if there has been printed with some hard filament before, make sure it is removed from the barrel of the hot-end. This can be done by extruding some hard filament and then fully retract it again. Easy way is to do it via the display unit. Then slowly extrude the filaflex into the hot-end.
3. **Adjust filament clamping range.** The extruder arm pushes filament onto the extruder drivewheel. When using flexible filaments it might be that the filament is squashed too much causing a lot of friction and eventually it buckles and clogs the extrusion.

<http://www.felixprinters.com/downloads/1.%20Pro%20Series/2.%20FELIX%20Pro%202/2.%20Tips%20%26%20Tricks/How%20to%20-%20Adjust%20filament%20clamping%20range.pdf>

Loading filament.

It is recommended to load filament via the interface at the printer. Goto *Control* => *Change filament* => Choose the correct filament and/or temperature.

1. **Cut the end of the filament in a skew manner.** The extruder gears might find it difficult to get grip onto the first part of the flexible filament which is fed into the extruder.
2. **Extrude filament until the first drip comes out.** Then slowly extrude more piece by piece. Do not extrude in a continuous feed at high speed as that will increase chances of buckling.
3. **Optional: Lower the overall print speed.** Via the display unit take the following steps after starting the print. Press the rotary button. Then scroll down to Speed Mul. And lower it to 50%. Then by trial and error increase the speed.

## 13 Material Data Safety Sheet

### 13.1 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<sub>2</sub>). 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<sub>2</sub>)  
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 conjunctival 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.

## 13.2ABS

### 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 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.

## 14 Appendix: Terms Of Service

### 1. Scope

a) These Terms and Conditions shall apply to all purchases submitted or to be submitted by you for any item, service or subscription offered to you on or via the FELIXprinters website, a FELIXprinters device or other FELIXprinters application (referred to in these Terms and Conditions as the "Products"), including, but not limited to, (i) hardware devices, accompanying items and accessories including devices, items or accessories containing pre-installed software ("Hardware"), (ii) FELIXprinters software, including content and content programs offered by FELIXprinters and all Internet-based downloadable ("Software") and (iii) services offered by FELIXprinters from time to time ("Services"), which may include (separately or bundled) Internet-based services, (third party) functionality or content, whether offered to you on a subscription basis ("Subscription") or on a pre-paid basis and delivered in one or more parts.

### 2. Orders

- a) Any purchase order submitted is subject to acceptance by FELIXprinters. Only upon acceptance by FELIXprinters by way of an order confirmation is the agreement concluded.
- b) FELIXprinters reserves the right to reject any orders in full or in part or to apply a maximum order amount.
- c) All orders for Hardware are subject to stock availability.

### 3. Price and payment

- a) Prices indicated on the website are exclusive of state and local sales and use taxes. You are responsible for any such state and local sales and use taxes, and any other taxes and government levies, if any, associated with your order. Shipping and handling charges (if any) will apply in addition to the sale price indicated on the website and the applicable sales and use taxes. Prices are subject to change at any time but will not affect orders for Hardware, Software, or Services made prior to the date of the change (subject to clause 7c).
- b) All orders must be paid for through the payment service as made available by FELIXprinters ("Payment Service"). In order to submit orders and use the Payment Service you must supply details of your preferred payment method, billing and shipping address (if applicable) and/or any other details necessary to complete the order.

### 4. Delivery and risk of loss

- a) FELIXprinters will endeavor to deliver or activate the Product within thirty (30) days of order acceptance. If multiple Products are ordered, FELIXprinters reserves the right to deliver or activate each Product separately.
- b) Products will be delivered either to your delivery address or possession, or electronically. The risk of loss or damage to the Products will pass to you at the moment the Products are delivered to your delivery address or possession.
- c) If you refuse or neglect to take delivery of the Products, FELIXprinters reserves the right to charge you for the reasonable cost of storing and shipping the Products until delivery can be made.
- d) If delivery to you should fail for any reason outside of FELIXprinters's control, FELIXprinters reserves the right to cancel the purchase agreement and refund any moneys paid
- e) If FELIXprinters delivers a Product or an amount of a Product that you did not order or activates a Product on your device by mistake, you shall immediately inform FELIXprinters of its mistake by email via [info@FELIXprinters.com](mailto:info@FELIXprinters.com) and you shall, at FELIXprinters's request, immediately arrange for the return of the Product (the costs of which shall be met by FELIXprinters), de-install or destruct the Product.
- f) Acceptance of a non-ordered Product or amount of a Product does not relieve you from acceptance and payment of the Product you initially ordered, unless otherwise agreed with FELIXprinters.

## 5. Return Policy

- a) FELIXprinters allows you to return Hardware for any reason provided that it has not yet been used at any time during the fourteen (14) business days following the date of receipt at your delivery address. If the item has not been opened, FELIXprinters will refund the purchase price actually paid minus shipping and handling charges. If the item has been opened, FELIXprinters will charge a 15% restocking fee in addition to shipping and handling charges. FELIXprinters will not issue refunds for products that have been defaced, altered, used, or damaged in any way. All requests for refunds are subject to inspection by FELIXprinters of the returned item. FELIXprinters will issue refunds through a bank transfer or PayPal. If you choose to return any Hardware, you must contact FELIXprinters during the fourteen (14) business days following receipt by email via [info@FELIXprinters.com](mailto:info@FELIXprinters.com) to obtain a Return Materials Authorization number and return the Hardware in its original packaging, free of all interests, liens, or claims otherwise, to the address provided by FELIXprinters. FELIXprinters will not issue any refunds in response to requests made more than fourteen (14) business days following receipt of the item. FELIXprinters will only accept returns on items purchased directly from the FELIXprinters store.
- b) Purchases of Software may be cancelled in accordance with clause 5(a) provided that the seal has not been broken nor tie wraps are cut loose. Downloading, installing or activating Software are all considered as breaking the seal.
- c) You agree that the supply of Services by FELIXprinters will commence immediately on FELIXprinters's acceptance of your purchase order or placed order via the website. You will not be able to cancel the purchase agreement after supply of the Services commences.
- d) All sales of products sold as Refurbished are final.

## 6. License, Copyright & Confidentiality

- a) Subject to these Terms and Conditions, you are granted a license to reproduce in order to install and execute the Software, Services and/or the data, information, functionality or other content ("Content") provided to you as part of the Hardware or via for personal and private use only on the terms set out in this article 6 ("License"). You may install and use the Software, Services and Content on only one computer device at any time and in combination with only one Product. You may not provide the Software, Services or Content to others, directly or indirectly for their or anyone else's use. This License is non-exclusive and non-transferable which means that FELIXprinters is free to license the Software, Services and Content to other customers and that your right to use the Software, Services and Content cannot be transferred by you to someone else or to another piece of Hardware. This License does not include any right to obtain future upgrades, updates or supplements to the Software, Services or Content. If upgrades, updates or supplements to the Software, Services or Content are obtained, however, the use of such upgrades, updates or supplements will be governed by these Terms and Conditions or such other terms and conditions as you shall be asked to accept prior to FELIXprinters supplying you with the relevant upgrade, update or supplement.
- b) FELIXprinters reserves the right, with or without notice, to discontinue update, upgrade and supplement services provided to you or made available to you through the use of the Software, Services or Content, unless the provision of such updates, upgrades or supplements forms an integral part of the Product, as indicated by FELIXprinters at the time of sale.
- c) Without prejudice to any other rights, FELIXprinters may immediately terminate the License without notice of default being required if you fail to comply with any material term of these Terms and Conditions which shall be understood to include clauses 6 and 9. In such event, you must destroy all copies of the Software and all of its component parts as well as any Content.
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- e) You acknowledge and agree that the Products were developed at considerable time and expense by FELIXprinters and are confidential to, and a trade secret of, FELIXprinters and/or other third parties. You undertake to maintain the Products in strict confidence and not to disclose or provide access to the Product to any third party.

## 7. Third Party Software Materials

FELIXprinters Products may make use of third party software codes, data, information functionality, other content and algorithms ("Third Party Materials"). The use of Third Party Materials included in the Products may be subject to other terms and conditions. The official copyright notices and specific license conditions of these Third Party Materials are to be found in or via our website. You hereby agree that the submission of any order implies that you have read and accepted the terms and conditions for any Third Party Materials included in the Products ordered.

## 8. Other Restrictions

Renting, lending, public presentation, performance or broadcasting or any other kind of distribution of the Products is prohibited. Other than as permitted by applicable legislation, you will not, and will not allow any person to, modify the Products or any part thereof, to analyze it by means of reverse engineering, to decompile or disassemble the Products, or to break or circumvent encryption or to allow or enable third parties to do so.

## 9. Limited Warranty

a) FELIXprinters does not and cannot warrant that the Products operate in a manner that is completely error-free nor that any information provided is always accurate. Calculation errors may occur when using systems such as those caused by local environmental conditions and/or incomplete or incorrect data.

b) FELIXprinters offers a limited warranty that the Hardware will be free from defects in workmanship and materials under normal use ("Defects") for a period of one (1) year from the date the Hardware was purchased ("Warranty Period"). Any warranty obligation of FELIXprinters under this Section is expressly conditioned on your compliance with this Agreement. During the Warranty Period, the Hardware will be repaired or replaced by FELIXprinters ("Limited Warranty") without charge for either parts or labor. If the Hardware is repaired after the Warranty Period has expired, the Warranty Period for the repair will expire six (6) months after the date of repair. This warranty does not cover Software or Services.

c) This Limited Warranty does not cover damage caused by normal wear and tear or as a result of the Hardware being opened or repaired by someone not authorized by FELIXprinters, and does not cover damage caused by: misuse, moisture, liquids, proximity or exposure to heat and accident, abuse, non-compliance with the instructions supplied with the Hardware, neglect or misapplication. The Limited Warranty does not cover physical damage to the surface of the Hardware.

d) EXCEPT FOR THIS LIMITED WARRANTY, AND TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, FELIXprinters AND ITS SUPPLIERS PROVIDE THE PRODUCTS "AS IS AND WITH ALL FAULTS", AND HEREBY DISCLAIM ALL OTHER WARRANTIES AND CONDITIONS, WHETHER EXPRESS, IMPLIED OR STATUTORY, INCLUDING, BUT NOT LIMITED TO, ANY (IF ANY) IMPLIED WARRANTIES, DUTIES OR CONDITIONS OF MERCHANTABILITY, NON-INFRINGEMENT, QUIET ENJOYMENT, SYSTEM INTEGRATION, TITLE, SATISFACTORY QUALITY, OF FITNESS FOR A PARTICULAR PURPOSE, OF RELIABILITY OR AVAILABILITY, OF ACCURACY OR COMPLETENESS OF RESPONSES, OF RESULTS, OF WORKMANLIKE EFFORT, OF LACK OF VIRUSES, AND OF REASONABLE CARE AND SKILL, ALL WITH REGARD TO THE PRODUCTS; AS WELL AS THE PROVISION OF OR FAILURE TO PROVIDE SUPPORT OR OTHER SERVICES, INFORMATION, SOFTWARE, AND RELATED CONTENT THROUGH THE PRODUCTS OR OTHERWISE ARISING OUT OF THE USE OF THE PRODUCTS. ALSO, THERE IS NO WARRANTY OR CONDITION OF QUIET ENJOYMENT, QUIET POSSESSION, OR NON-INFRINGEMENT WITH REGARD TO THE PRODUCTS.

e) In order to make a claim under the Limited Warranty of a Defect, you must contact FELIXprinters by email during the Warranty Period via to explain the Defect and to obtain a Return Materials Authorization number if necessary. The Hardware must be returned to FELIXprinters as soon as possible following your notification of the Defect, along with an explanation of the Defect, to the address provided by FELIXprinters. You must comply with any other return procedures stipulated by FELIXprinters, if any.

f) This Limited Warranty is the only express warranty made to you and is provided in place of any other express warranties or similar obligations (if any) created by any advertising, documentation, packaging, or other communications.

g) If applicable law requires any implied warranties with respect to the Hardware, all such warranties are limited in duration to one (1) years. Some states and/or jurisdictions do not allow limitations on how long an implied warranty lasts, so the above may not apply to you. The provisions of this clause 9 do not affect any of your legal rights under applicable national legislation governing the sale of consumer goods.

h) This Limited Warranty is not transferable.

i) This clause 9 sets forth your sole and exclusive remedy in connection with any warranties granted by FELIXprinters hereunder.

## 10. Limitation of Liability

a) NEITHER FELIXPRINTERS NOR ITS SUPPLIERS SHALL BE LIABLE TO YOU OR TO ANY THIRD PARTY FOR ANY INDIRECT, INCIDENTAL, CONSEQUENTIAL, SPECIAL, PUNITIVE, OR EXEMPLARY DAMAGES (INCLUDING IN EACH CASE, BUT NOT LIMITED TO, DAMAGES FOR THE INABILITY TO USE OR ACCESS THE PRODUCTS, LOSS OF DATA, LOSS OF BUSINESS, LOSS OF PROFITS, BUSINESS INTERRUPTION OR THE LIKE) ARISING OUT OF THE USE OF OR INABILITY TO USE THE PRODUCTS, EVEN IF FELIXPRINTERS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

b) NOTWITHSTANDING ANY DAMAGES THAT YOU MIGHT INCUR FOR ANY REASON WHATSOEVER (INCLUDING, WITHOUT LIMITATION, ALL DAMAGES REFERENCED HEREIN AND ALL DIRECT OR GENERAL DAMAGES IN CONTRACT OR ANYTHING ELSE), THE ENTIRE LIABILITY OF FELIXPRINTERS AND ANY OF ITS SUPPLIERS ARISING FROM OR RELATED TO THE USE OF THE PRODUCTS SHALL BE LIMITED TO THE AMOUNT ACTUALLY PAID BY YOU FOR THE PRODUCTS CONCERNED.

c) Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you. The above limitation of liability does not affect any legal rights under the applicable national legislation.

## 11. Export Controls

You will comply with all applicable laws and regulations, including without limitation the Dutch Administration Act, regarding the export of technology with respect to the Products.

## 12. Force Majeure

Force majeure means circumstances that impede the fulfillment of FELIXprinters's obligations under these Terms and Conditions which are not within FELIXprinters's reasonable control, including late and/or delayed deliveries and incomplete deliveries by FELIXprinters caused by circumstances beyond FELIXprinters's reasonable control. In a force majeure situation all of FELIXprinters's obligations shall be suspended. Should the period in which FELIXprinters cannot fulfill its obligations as a result of force majeure continue for longer than ninety (90) calendar days, both parties shall be entitled to dissolve the purchase agreement in writing without there being an obligation to pay any compensation whatsoever arising out of or in connection with that dissolution.

## 13. Privacy

FELIXprinters will not disclose information regarding your personal details, account or transactions to any third party other than in accordance with the privacy policy from Dutch law.

FELIXprinters holds the right to show your company name and logo in FELIXprinters's promotions, only in the context of you being one of FELIXprinters's customers. ("Our customers include ...[Buyer company name and logo]")

## 14. Links to Third Party Websites

FELIXprinters is not responsible for the content of any third-party websites or services, any links contained in third-party websites or services, or any changes or updates to third-party websites or services. Where FELIXprinters provides links and/or access to third-party websites and/or services it is only as a convenience to you, and the inclusion of any link or access does not imply an endorsement by FELIXprinters of the third-party site or service.

## 15. Third Party Rights

Third parties have no rights under applicable legislation in relation to the rights of third parties to rely upon or to enforce any term of these Terms and Conditions but that does not affect any right or remedy of a third party which exists or is available apart from such applicable legislation.

## 16. Survival

Any provisions in these Terms and Conditions which by their nature extend beyond the termination or expiration of any sale or license of the Products will remain in effect.

### 17. Severability

If any provision of these Terms and Conditions is deemed to be void, invalid, unenforceable or illegal, the other provisions shall continue in full force and effect. You and FELIXprinters are deemed to have agreed to new terms and conditions in substitution for such invalid provisions. These new terms and conditions shall be interpreted, as regards their contents and effect, as closely as possible to the original text as written but in such a way that rights can indeed be derived from them.

### 18. Governing law

These Terms and Conditions and any disputes related to these Terms and Conditions or to the purchase and use of the Products or otherwise are subject to the laws of The Netherlands. The United Nations Convention on Contracts for the International Sales of Goods is hereby excluded from application to these Terms and Conditions. All disputes arising out of these Terms and Conditions shall be settled by courts venued in Amsterdam, which will have exclusive jurisdiction in respect of any such disputes.

### 19. Translations

This English version of these Terms and Conditions is the version that governs your purchase, of Products from FELIXprinters if you are located in the Unites States of America. Should you have any questions, suggestions or complaints concerning your order, your purchase, these Terms and Conditions, or if you desire to contact FELIXprinters for any reason, please do so by email by visiting FELIXprinters's website.