

# BLACKBELT

## Installation & User Manual

### Bowden & varioDrive

Original document  
Version 2020- 5.0



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## Preface

This user manual has been composed for those persons assigned to work with the Blackbelt 3D Printer.  
Prior to operating the Blackbelt 3D Printer, it is highly recommended to thoroughly read and understand this user manual.

The user manual consists of important instructions and information how to proceed with the printer on a safe and skilled manner.

**! Please make sure a copy of this manual is available at any time near the printer !**

We advise that the user manual can / shall be completed with directions and legislations with respect to national compliances concerning :  
Safety / Health / Environment (SHE)

**! Please read and understand the contents of this installation and user manual carefully !**

Failure to read the manual may lead to personal injury, inferior results or damage to the BlackBelt 3D Printer. Always make sure that anyone who uses the Blackbelt knows and understand the contents of the manual and makes the most out of Blackbelt 3D Printer.

The conditions or methods used for assembling, handling, storage, use or disposal of the device are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, injuries, damage, or expense arising out of or in any way connected with the assembly, handling, storage, use or disposal of the product. The information in this document was obtained from sources which we believe are reliable. However, the information is provided without any warranty, express or implied, regarding its correctness.

The Blackbelt 3D Printer is intended for use as described in Chapter 1.1: Technical specifications and tolerances. Any other use of the printer is not allowed by BlackBelt 3D BV and will expose the user and its surroundings to significant danger.

Blackbelt 3D BV will assume no responsibility for direct / indirect damage resulting from improper operation / lack of maintenance and any other use of the machine as intended is this manual. Any modification on the Blackbelt 3D Printer without proper written consult and permission by BlackBelt 3D BV will automatically void any right to warranty.

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## 1.1 Technical specifications and tolerances

The sole intention of this machine is 3D Printing of models / parts. The Blackbelt 3D Printer is only intended to produce products and use materials as described in this user manual. A detailed description of the functionality of this machine is described in Chapter 2 : "Introduction".



*This machine shall only be used within the specifications and tolerances as described in this manual. Blackbelt 3D BV will assume no responsibility for direct / indirect damage resulting from improper operation / lack of maintenance and any other use of the machine as intended is this manual.*



*The sole use of the machine is only intended for the production of products as described in the general terms and conditions. These terms and conditions are provided prior to shipment and need to be countersigned for acceptance. A copy can be acquired through e-mail ([info@blackbelt-3d.com](mailto:info@blackbelt-3d.com)) or download a copy on our website ([www.blackbelt-3d.com](http://www.blackbelt-3d.com))*



*Do not use of the machine for any other purposes then intended by BlackBelt 3D BV. Not doing so can lead to serious damage to the machine or the machine-operator and its surroundings.*



*The Blackbelt 3D printer generates high temperatures and has hot moving parts that can cause injury. Never reach inside of Blackbelt 3D Printer while it is in operation. Always control the printer with the jog button at the front or the power switch at the back of the electrical cabinet. Allow the Blackbelt 3D Printer to cool down for 5 minutes before reaching inside the stationary gantry.*



*Only use this machine inside a building. Ensure the machine is positioned in a well ventilated and clean environment. Ensure a room temperature of 15C – 30C for optimal operating conditions.*

Specifications	
Voltage / Frequency	115 - 240Volt; 50 - 60Hz
Wiring machine	IEC connector
Installed Power	600W
Consumables	1.75 mm Filament / open material platform
Year of production	2018
Type of product	As agreed in order confirmation

## 1.2 Identification plate

The identification plate is positioned on the bottom of the electrical cabinet, showing the serial number.

## 1.3 Safety messages








*The Blackbelt 3D Printer has been designed and build using modern techniques and using appropriate safety precautions. Improper use may cause severe danger / injury to body and surroundings, as well as damage to the printer itself and peripheral appliances.*

Service and maintenance of the Blackbelt 3D Printer shall only be carried out by qualified personal, taking into account the safety warnings displayed on the machine and full awareness of the user manual. Keep children and / or unqualified staff away from the machine.

1. This machine is only intended to be used for processes and ambient conditions as described in the chapter 1.1: "Technical specifications and tolerances" of this user manual. Any other use is prohibited and not allowed by BlackBelt 3D BV. Any other use will create direct and present danger to the user and its surroundings.
2. It is prohibited at all times, to modify the machine without prior written consent of Blackbelt 3D BV.
3. The machine shall be positioned in such as manner, that at any time there will be enough free moving space around the machine for demonstrations/ service trainings and carrying out maintenance and inspections.
4. Keep the printer location clean and well illuminated. A messy or poorly illuminated printer location can cause safety hazards and injury.
5. Keep hands, hair, loose clothing and jewelry away from the moving parts of the machine. Wear appropriate clothing. We strongly advise to wear safety glasses and gloves when working with the BlackBelt 3D Printer.
6. As long as the machine is in use and switched on, no connector or safety precautions shall be removed. Only use the machine if all safety precautions are installed and ready for use.
7. Prescribed service intervals and maintenance instructions as mentioned in this user manual must be maintained at all times.
8. Only allow qualified personnel to replace spare parts and carry out maintenance and repairs.
9. As addendum to this manual, general and local regulations with respect to Safety / Health and Environment (SHE) shall be maintained at all times, including the use of personal protection equipment.
10. Always inform the users of the Blackbelt 3D Printer in time prior to starting maintenance or repairs. Completely switch of the main power switch and remove the connector from the wall socket.
11. If a part or sub-assembly of the Blackbelt 3D Printer has been damaged or is not functioning properly, please cease all activities or print jobs immediately. Only resume activities if the part has been repaired or replaced by a spare part. Please contact or your supplier or consult with Blackbelt 3D BV, if the machine is not functioning properly.
12. Machine parts shall be disposed in accordance with local laws / regulations.

### 1.3.1 Explanation of pictograms and symbols

Pictogram	Explanation:
	Please read and understand the contents of this installation and user manual carefully. It contains important information about commissioning and maintenance of the machine.
	<b>Warning!</b> Important attention points / instructions concerning safety or damage prevention are highlighted with this warning sign.
	<b>Electrical Safety</b> E-Cabinet 110 / 230V voltage inside.
	<b>Entrapment hazard / Mechanical safety</b> Caution: moving parts
	<b>Hot Surface.</b> Burn Risk by touching the hot surface (up to 120C).

## 1.3.2 Definition of users.

**Operator:** Low-skilled technical staff who read this user manual. An operator can work with the Blackbelt 3D Printer, except calibration, fine-tuning and maintenance of the machine.

**Maintenance:** Secondary skilled technical staff who read this manual. A maintenance engineer can work and calibrate the machine, except modifying the fixed machine parameters.

**Specialist:** Highly educated technical staff who read this manual. A specialist can work with the machine, calibrate and fine-tune the machine and modify fixed parameters.

No users may change or temporarily overrule or disengage safety features

## 1.4 Transportation



*Please follow all prescriptions as described in this manual. In particular chapter 1.3 : Safety messages.*

The transportation box of the Blackbelt 3D Printer must be carried out horizontally. The humidity in the cardboard packaging must not be allowed to reach critical levels, causing condensation of moisture in the machine.

In case of eventual damage caused by transportation, please report this damage immediately to your shipping agent or transporter and to Blackbelt 3D BV at all times. Take all necessary steps to prevent further damage to the machine.

## 1.5 EG-declaration of compliance

EG-declaration of compliance for machinery (directive 2006/42/EG, Addendum II, section A.)



Blackbelt 3D BV  
Bremweg 7  
5951 DK Belfeld  
Netherlands

Declares that:

**Machine:** **BLACKBELT 3D-Printer**  
**Type:** **BLACKBELT 3D-Printer Desktop version**

complies with **Machinery directive 2006/42/EG** and complies to the provisions of the **EMC-directive 2014/30/EG**

complies with harmonized European standards:

Harmonised European standard	Description	Harmonised European standard	Description
NEN-EN-ISO 12100:2010	Safety of machinery - General principles for design – part 1: Basic principles, methodology	NPR-ISO/TR 14121-2:2010	Safety of machinery – Risk assessment – Part 2: Practical guidance and examples of methods
NEN-EN-IEC 60204-1	Safety of machinery - Electrical equipment of machines – part 1: General requirements		

Belfeld, The Netherlands  
April 2020

Stephan Schürmann  
CEO

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## 2.1 Description of the BlackBelt 3D print platform

### 2.1.1 Versions explained

In the FDM 3D Print market there is a wide range of filaments to choose from which all have their own applications and advantages. We can separate them into two big groups: Flexibles (< 95 A) and Rigids (> 95 A). These terms are no standard and other suppliers might use different values.

For the BlackBelt 3D printer platform we have developed two print systems that are dedicated to print optimal for one of the two groups.

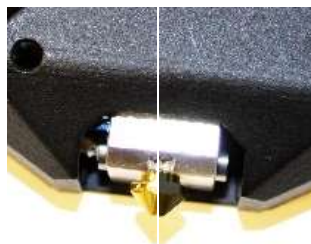
### 2.1.2 Bowden

This is the so called “standard setup” and works good with all the recommended rigid materials. You can recognize this setup at the printhead. In the images below You see an example of the standard 0.4 printhead [1] and hardened steel 0.4 printhead [2] for fiber filled materials. Or materials that are very abrasive due to added particles as steel, bronze, ceramics etc.

1



2



### 2.1.3 varioDrive

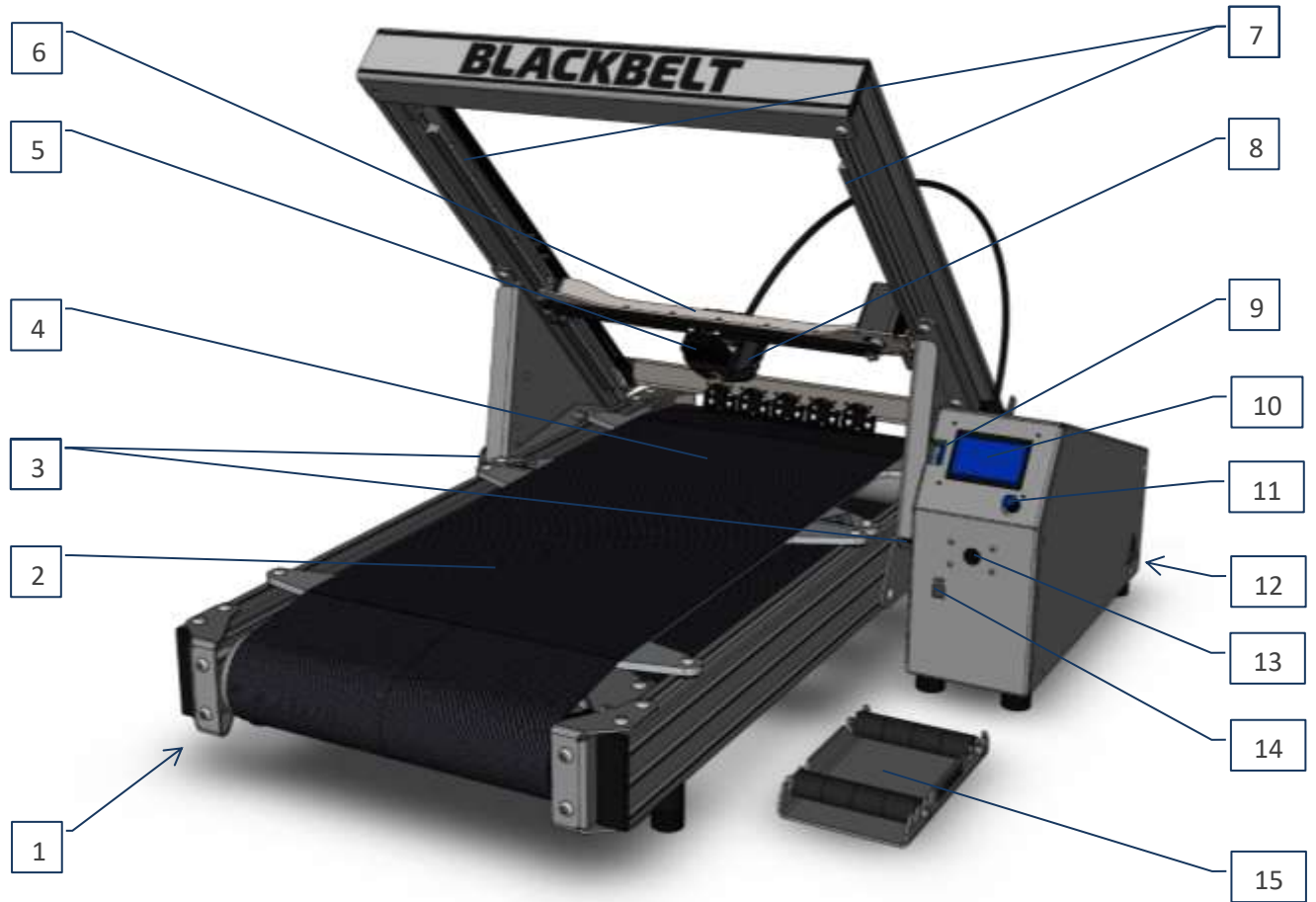
The varioDrive setup is developed for flexible materials and performs very well with Nylon carbon filled materials (no different nozzle needed). In combination with the varioShore material developed with colorFabb a wide range of flexibilities can be printed. The setup can be recognized at the following printhead setup:





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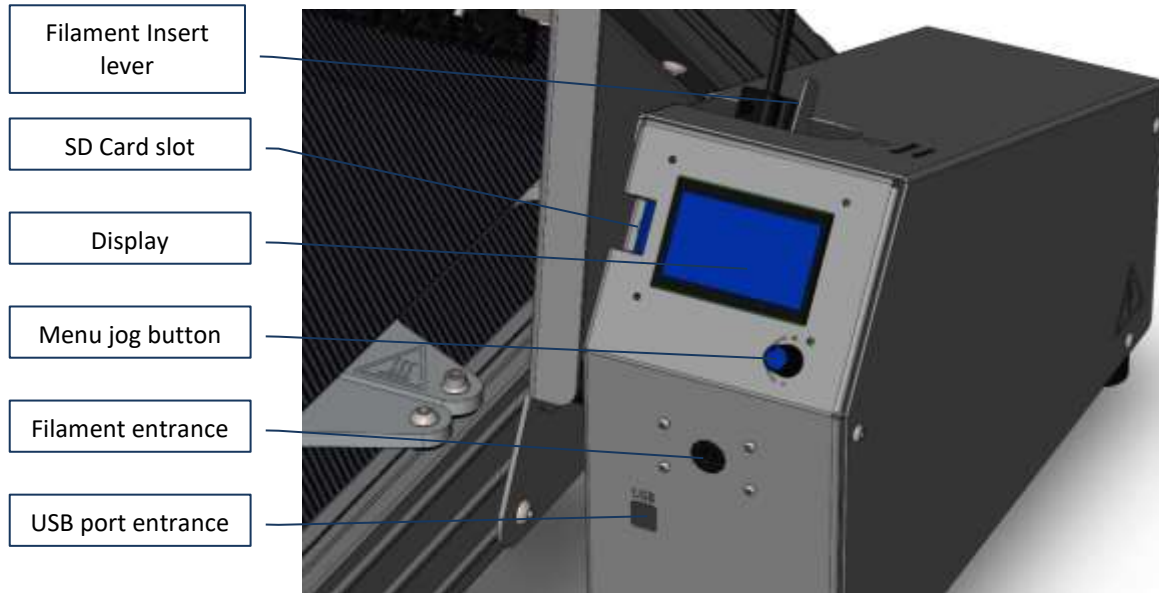
## 2.1.4 Machine overview



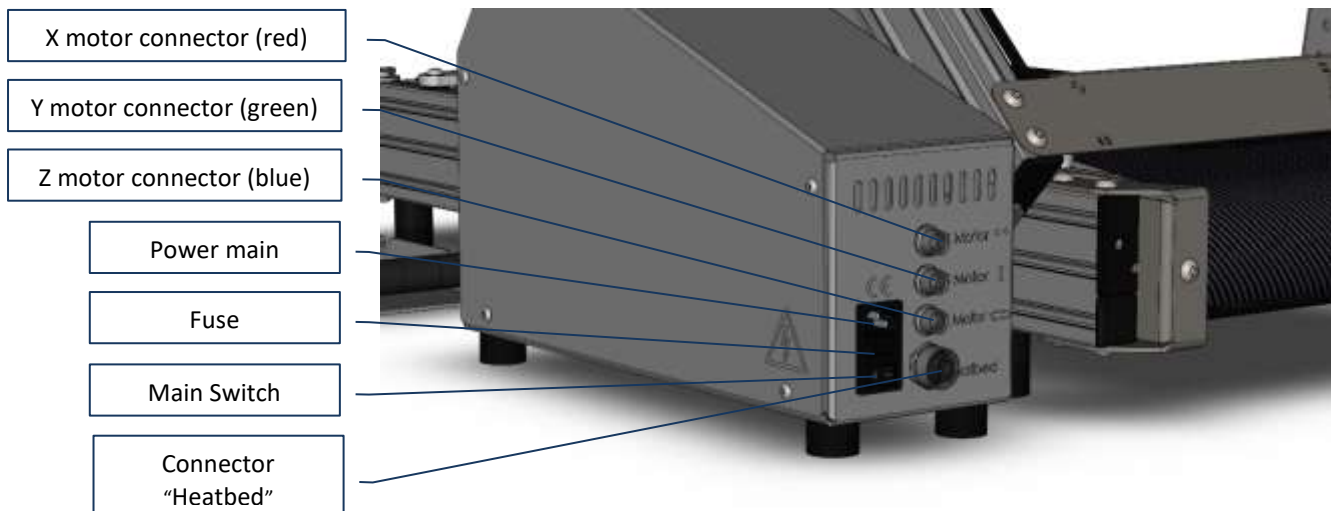
Number:	Machine part:
1	BLACKBELT 3D Printer (assembled)
2	Conveyor belt (Z Axis) cold segment
3	Angle Adjusting knob
4	Conveyor belt (Z Axis) heated segment
5	Cooling fan
6	X Axis
7	Y Axis (2x)
8	Printhead assembly
9	SD Card Slot
10	Display
11	Menu jog wheel
12	Electrical control cabinet
13	Filament inlet / entry
14	USB Port
15	Filament spool / holder

## 2.1.5 Control panel & electrical cabinet

Control panel / front side:



Electrical cabinet backside:





## 3.1 Unboxing

Standard practice:

1. Unbox / Unpack the machine and set-up on a table, wire the components
2. Install software on the PC, generate gcode, write the gcode to the SD card
3. Insert SD card into the SD card slot of the control cabinet
4. Switch on main power and select the gcode on the display
5. Pre-heat the Printer and start up a print-job
6. After the printed part has been completed, allow the machine to cool down.
7. Remove the printed part from the belt.

## 3.2 What's in the box

Please ensure that all parts below are present, prior to commissioning the Blackbelt 3D Printer:

### Hardware

1. 1x Printer
2. 1x Electrical control cabinet
3. 1x Spool holder
4. 1x SD card
5. 2x Printhead screws

### Bowden specific

6. 1x Printhead fan
7. 3x Printhead

### varioDrive specific

8. 1x varioDrive

### Consumables

9. 2x Filament spool
10. Grease syringe  
[Klüber ISOFLEX TOPAS NB 52]

### Tools

11. 1x Hexagon key 3 mm
12. 1x Hexagon key 5 mm

In order to operate the BLACKBELT 3D Printer, you'll also need a computer (using Windows or Mac/iOS operating system)

## 3.3 Surroundings/Environment

Set-up the printer on a stable table in a dry and clean room with a temperature between 15-35°C.

The minimal dimensions of the table should be: 80cm x 80cm.

## 3.4 Assembly, installation and commissioning the machine



*Please follow all prescriptions as described in this manual. In particular chapter 1.3 : Safety messages.*

### 3.4.1 Positioning

The machine shall be placed on robust flat surface, rigid enough to hold the machine. The machine shall be positioned in such a manner, that at any time there will be enough free moving space around the machine for demonstrations/ service trainings and carrying out maintenance, cleaning and inspections.

### 3.4.2 Assembly / wiring

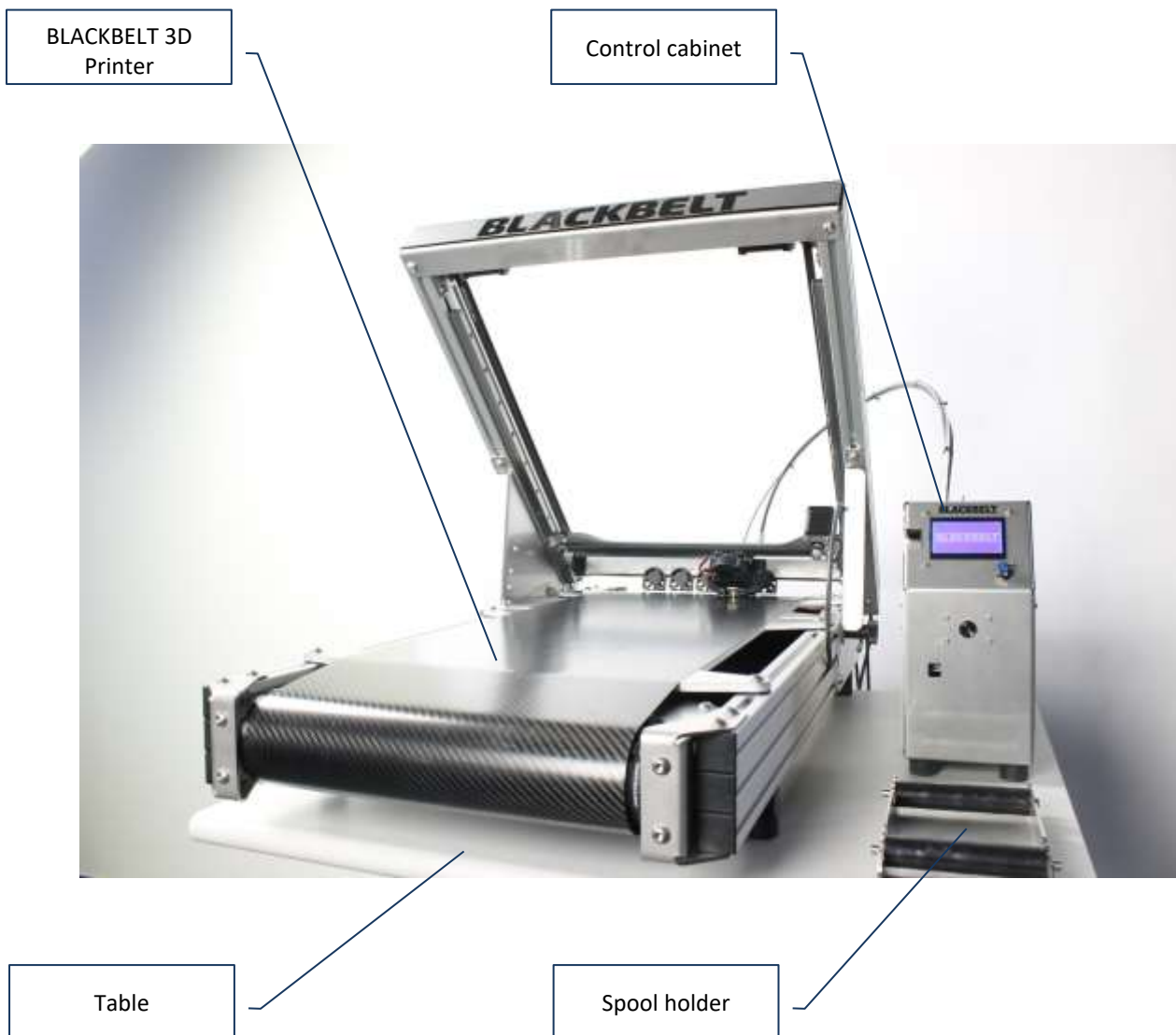
All supplied parts shall be connected onto the machine by the user as described in this manual. Once the machine assembly is completed, it can be wired and switched on by an authorized person by connecting the main power and switching on the main power.



*As long as the machine is active and / or switched on, no connector or safety feature shall be removed. Only use the machine if all safety features are in place and functional.*

## 3.4.3 Setting up the 3D printer

1. Lift the printer from the packaging with 2 persons and place the machine on a table.
2. Remove the angle adjusting knobs (left and right), while holding the XY gantry.
3. Elevate the XY gantry to 35° (preset) and screw the adjusting knobs back in.
4. Position the control cabinet left or right beside the 3D printer.
5. Connect the cables / wires of the 3D printer with the connectors on the control cabinet:
  1. The connector with the red indicator connects with the contact labeled "X Motor".
  2. The connector with the green indicator connects with the contact labeled "Y Motor".
  3. The connector with the blue indicator connects with the contact labeled "Z Motor".
  4. The bigger connector without an indicator connects with the contact labeled "Heatbed".
  5. The main power connector connects with the supplied power adapter to the wall socket.



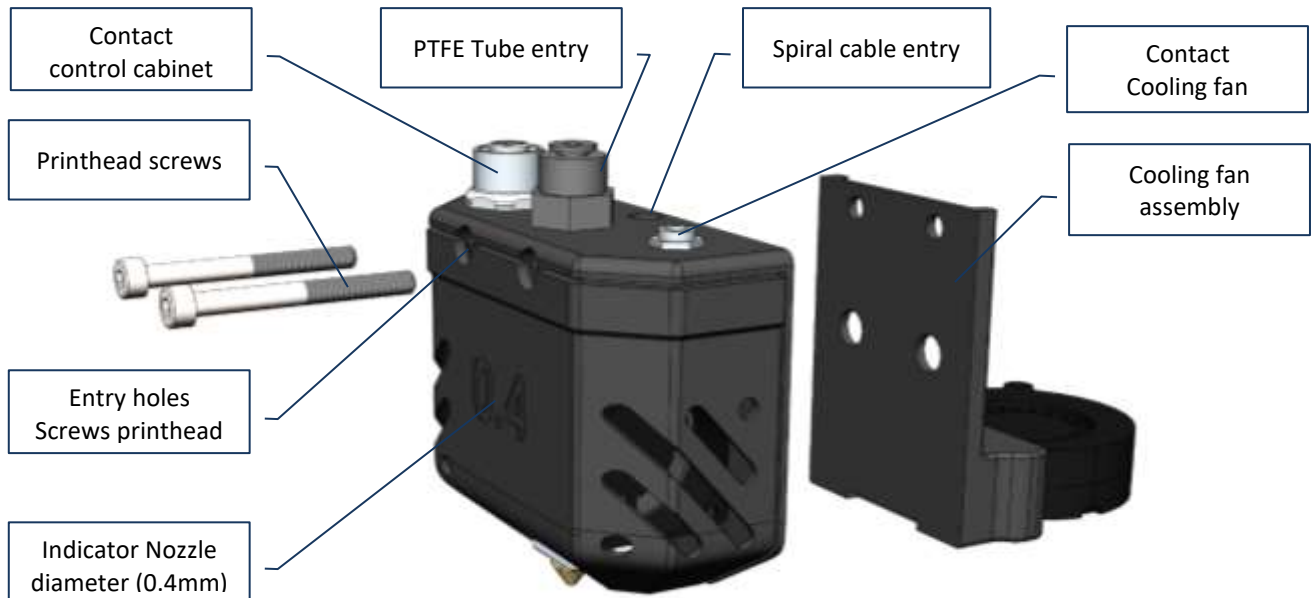
## 3.4.4 Installation of the printhead [BOWDEN]



Ensure the machine is switched "Off".



Ensure the machine is setup secure on a robust table and can be accessed from all sides.



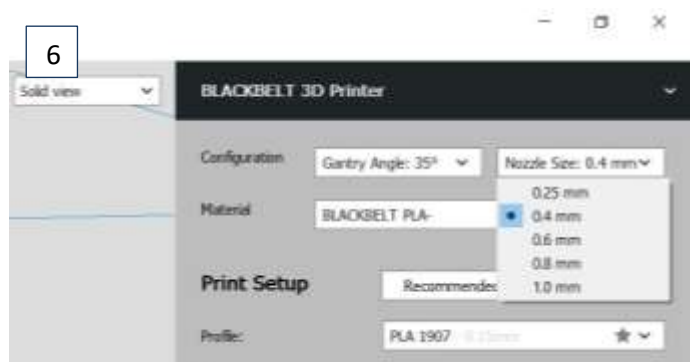
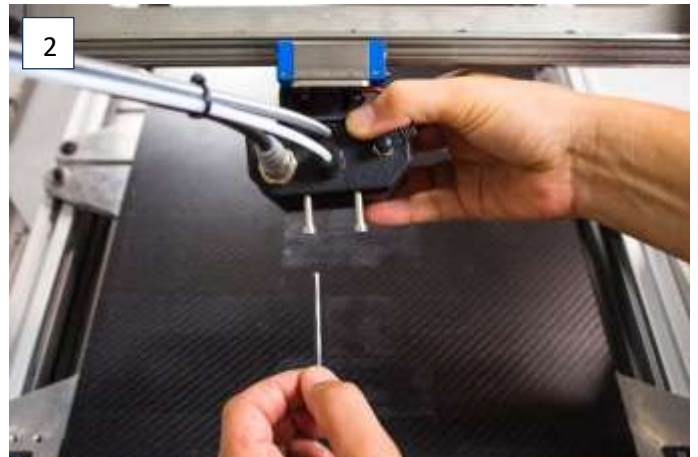
Parts needed to install the printhead:

- 3D printer, assembled as described in chapter 2:
  - Printhead with Printhead screws
  - Hexagon key 3mm.
1. Choose the printhead you wish to use.  
Printheads are available in 0.25, 0.4, 0.6, 0.8 and 1.0mm Nozzle Diameter.  
The smaller nozzle diameter you choose the more detailed prints will result. However, small nozzle diameters will also increase printing time for a big object.
  2. Position the 2 printhead screws in the printhead assembly and position the printhead in front of the cooling fan assembly.
  3. Move the X and Y axis of the printer to the middle of the XY gantry, providing access to the backside of the X axis.
  4. Assemble the printhead on the X axis. The screws can be inserted in the 2 holes of the linear sled of the X axis.
  5. Connect the wires / tubes of the control cabinet with the print head:
    - a. First the spiral cable (spring) into the "spiral cable entry"
    - b. Second the white PTFE Tube, into the "PTFE Tube entry".
    - c. Finally connect the cable plug connector into the "Contact control cabinet".

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Bigger objects with less details can easily be printed with a bigger nozzle. Just changing the nozzle size will decrease printing time by a factor two if you double the size. Follow these instructions to change the nozzle size.

1. Make sure the material is removed according the steps in chapter 3.5.1 (Scenario 1: steps 1 + 2).
2. Unscrew the two bolts that attach the printhead tot the gantry. [1]
3. When both are loose pull the assembly back, the fan will come loose together with the printhead. Pull the cable and release the fan from the assembly. [2]
4. Detach the spring, tube and cables. [3]
5. Move the X and Y axis of the printer to the middle of the XY gantry, providing access to the backside of the X axis. [4]
6. Assemble the printhead on the X axis. The screws can be inserted in the 2 holes of the linear sled of the X axis. [5]
7. Connect the wires / tubes onto the printhead assembly:
  - a. First the spiral cable (spring) into the spiral cable entry
  - b. Second the PTFE Tube, into the PTFE Tube entry.
  - c. Finally connect the last connector into the control cabinet.
8. Make sure you use the correct angle and nozzle size when generating the machine code [6]



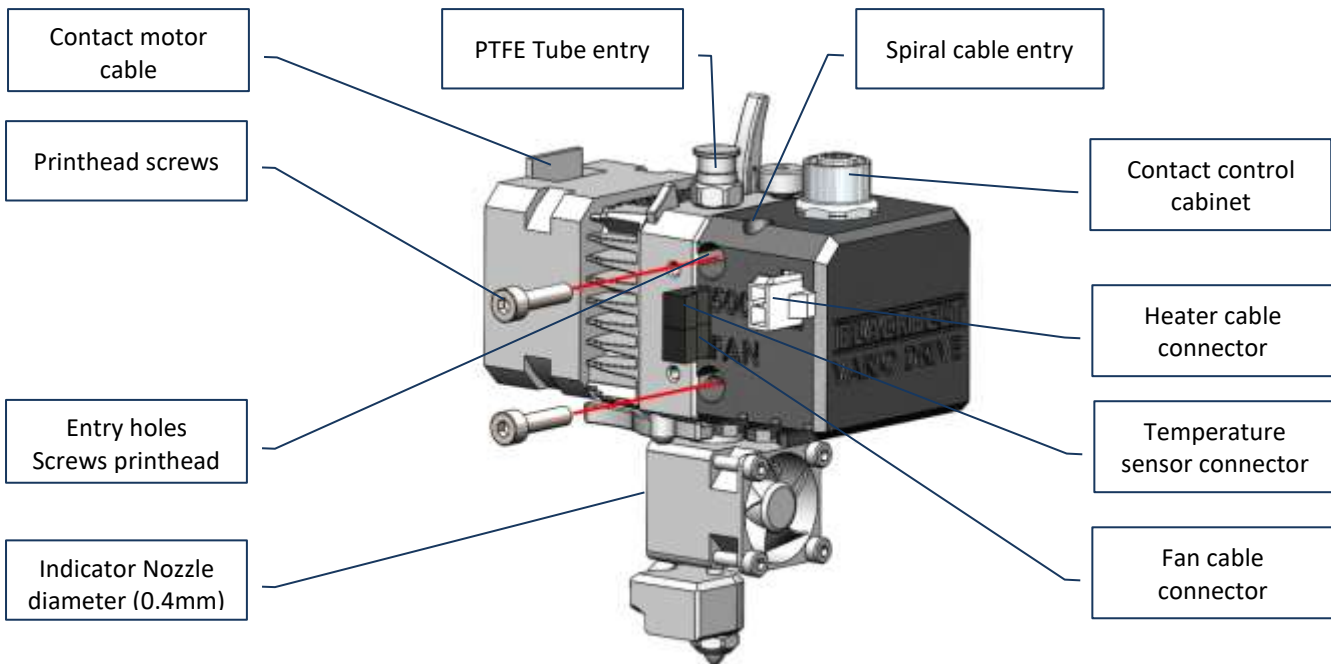
## 3.4.5 Installation of the printhead [varioDrive]



Ensure the machine is switched "Off".



Ensure the machine is setup secure on a robust table and can be accessed from all sides.



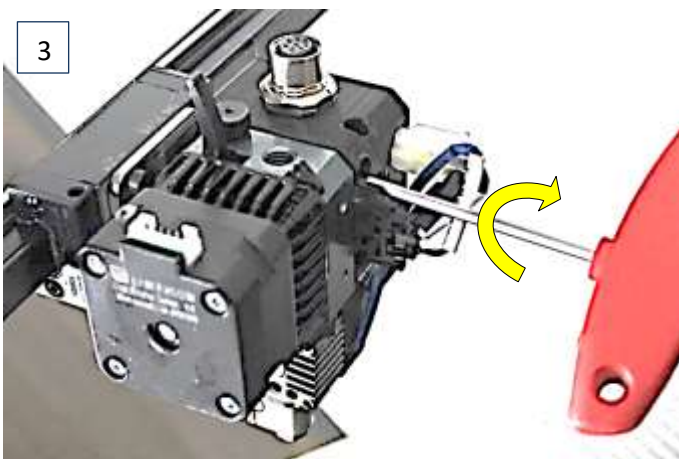
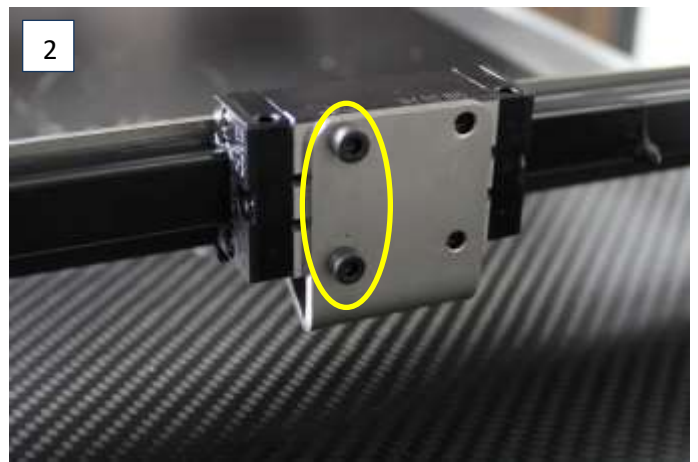
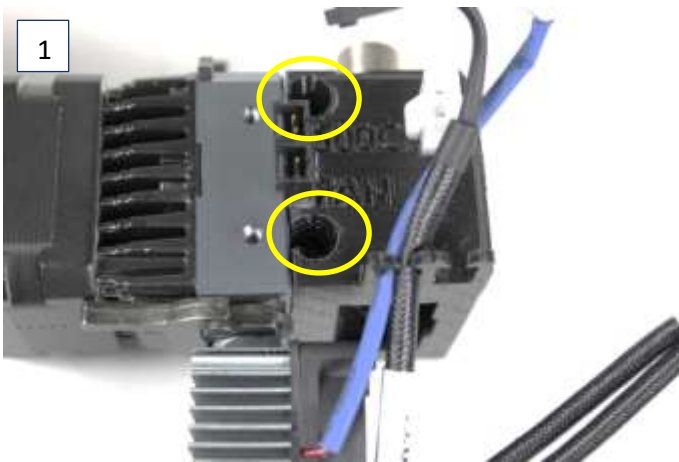
Parts needed to install the printhead:

- 3D printer, assembled as described in chapter 2:
- varioDrive Printhead with Printhead screws
- Hexagon key 3mm.



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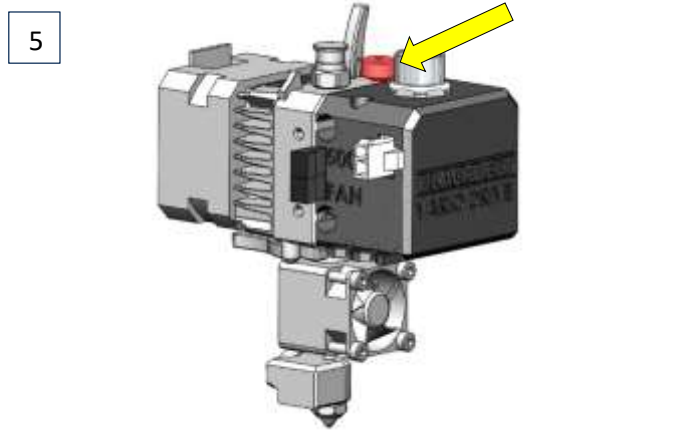
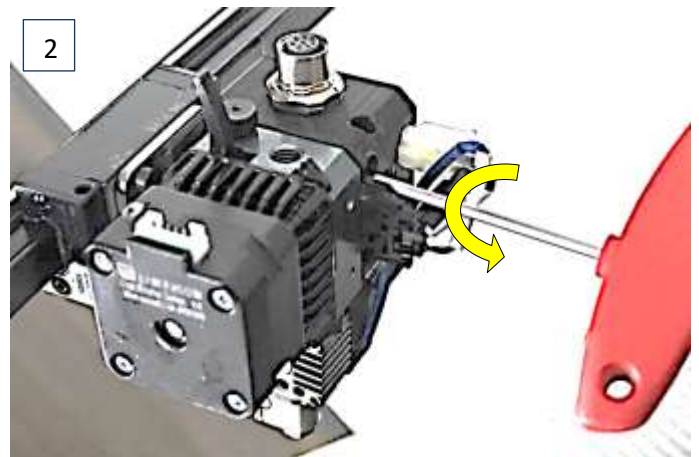
1. Unbox the printhead assembly.  
On request other nozzle diameters are available in 0.25, 0.4, 0.6, 0.8 and 1.0mm Nozzle Diameter.  
The smaller nozzle diameter you choose the more detailed prints will result. However, small nozzle diameters will also increase printing time for a big object.
2. Position the 2 printhead screws in the printhead assembly and position the printhead. [1]
3. Move the X and Y axis of the printer to the middle of the XY gantry, providing access to the backside of the X axis. Make sure the current bolts are configured as shown above each other. [2]
4. Assemble the printhead on the X axis. The screws can be inserted in the 2 holes of the linear sled of the X axis. [3]
5. Connect the wires / tubes of the control cabinet with the print head: [4]
  - a. First the spiral cable (spring) into the "spiral cable entry"
  - b. Second the white PTFE Tube, into the "PTFE Tube entry".
  - c. Finally connect the cable plug connector into the "Contact control cabinet".
  - d. Connect the motor plug in the "Motor control cable".



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Bigger objects with less details can easily be printed with a bigger nozzle. Just changing the nozzle size will decrease printing time by a factor two if you double the size. Follow these instructions to change the nozzle size.

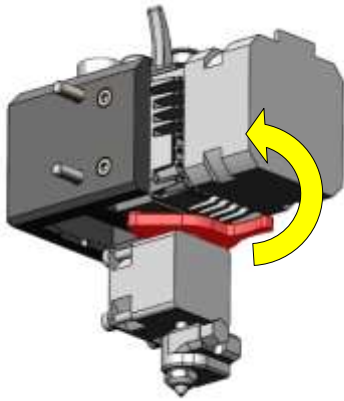
9. Make sure the material is removed according the steps in chapter 3.5.3 (Scenario 1: steps 1 + 2).
10. Move the X and Y axis of the printer to the middle of the XY gantry, providing access to the backside of the X axis. Disconnect all the cables and Bowden. [1]
11. Unscrew the two bolts that attach the printhead to the gantry. [2]
12. When both are loose pull the assembly back. [3]
- 13. MAKE SURE TO ONLY DO THIS WHEN THE PRINthead IS REMOVED FROM THE PRINTER** [3]
14. Disconnect all the cables from the fan, extruder and sensor. [4]
15. Use the quick release screw to loosen the printhead, just a few strokes (keep close distance to a table) [5-6]



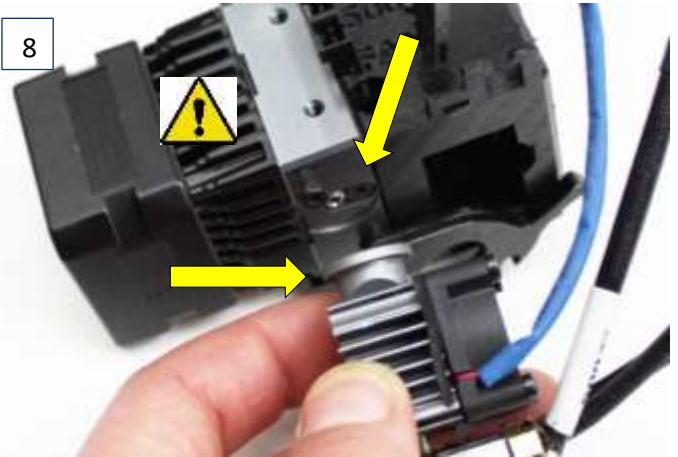
# BLACKBELT

16. Release the lever and the nozzle together with the cooling unit. Don't unscrew the rest. [7-8]
17. Installing the new nozzle please make double shore the two rings align properly before securing the lever back in position. **WATCH THE POSITIONING UNDER THE BOLT** [9-10]
18. Rotate the quick release screw clockwise to secure everything in place. This can be tight but do not use any tools just your hands. A good hand-tight fixing is best. [11]
19. Make sure you use the correct nozzle size when generating the machine code [12]

7



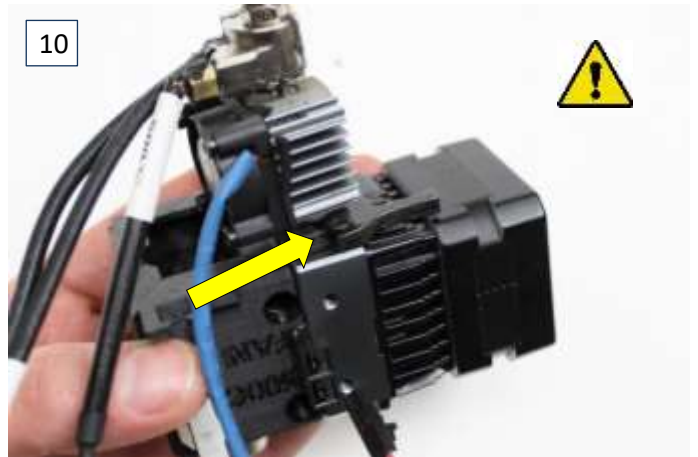
8



9



10



11



12



## 3.5 Operating the BlackBelt 3D platform



*Please follow all prescriptions as described in this manual. In particular chapter 1.3 : Safety messages.*



*As long as the machine is active and / or switched on, no connector or safety feature shall be removed. Only use the machine if all safety features are in place and functional.*



*If a machine part has been damaged or is not functioning in the prescribed way, the machine operation must be stopped immediately and can only be resumed if the damaged part has been replaced or repaired. Please inform or consult Blackbelt 3D BV if the machine is not functioning properly.*

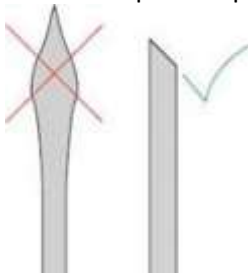
### 3.5.1 Loading filament

*The Bowden and varioDrive system have a slightly different approach to material change. The next chapters will explain the differences. For both situations, the preparations are the same and if this is the first time, the unloading is done with filament in the machine. For the Bowden you can skip the unload steps.*



*Please assure that the 3D Printer is fully assembled and wired correctly and that the printhead has been installed.*

1. Place the filament spool onto the spool holder in front of the control cabinet.
2. Take the end of the filament of the spool and assure the filament end is straight and has no thickening at its end. If not please apply a straight cut with a pair of scissors or a pair of pliers:



3. Please assure, the end of the filament is guided from the lower side of the spool into the control cabinet.
4. Position the filament into the filament entry and carefully push the filament up until it hits the *feeder motor*.
5. Continue with chapter 3.5.2 Material change [Bowden] or 3.5.3 Material change [varioDrive]

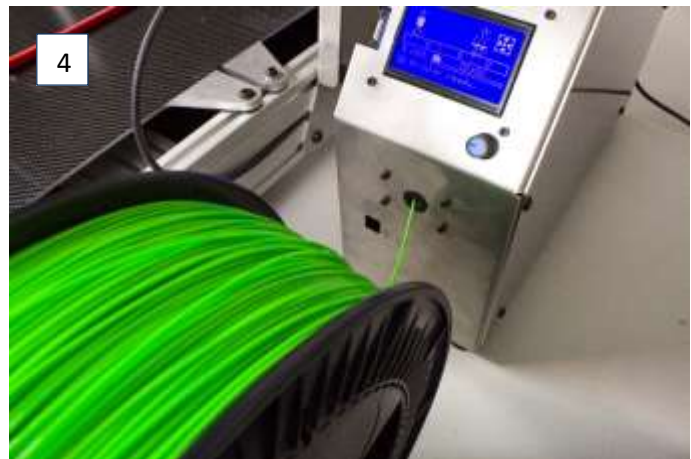
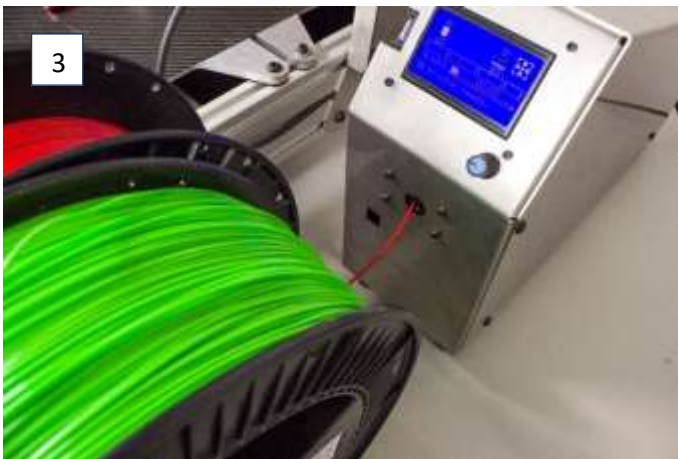
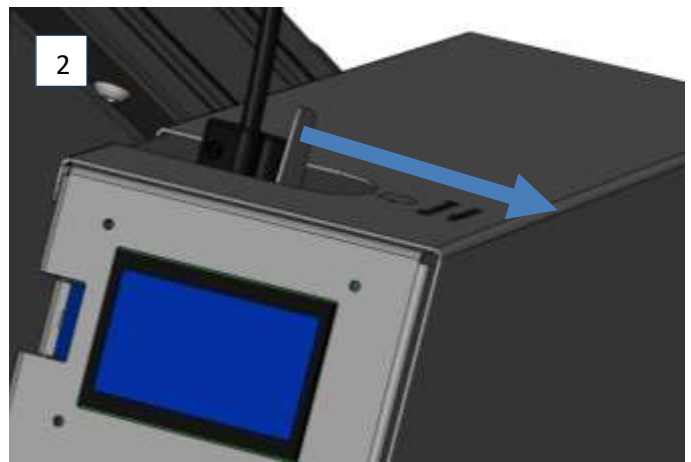
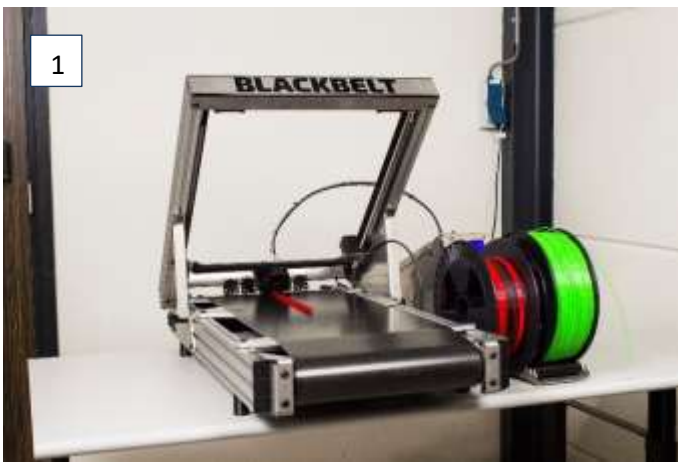
## 3.5.2 Material change [BOWDEN]



Please assure that the 3D Printer is fully assembled and wired correctly and that the printhead has been installed.

### Scenario 1: NOT during a print job and when the heater is cold.

1. Preheat the nozzle with the presets:
  - Push the button → “scroll down and select “Prepare” → scroll down and select “Preheat Ngen” or “Preheat PETG”. For PLA choose “Preheat Ngen”, for ABS choose “Preheat PETG”
2. Press the material lever to the right with one hand while manually retracting the filament the filament with the other hand.
3. Push in the new material and press the lever to the outside again. The material should be push through all the way until you see a little bit of the material leaving the nozzle.



### Scenario 2: DURING a print job when the heater is hot

If you notice that the spool is running towards its end you can take the following steps

1. Reduce the feed rate all the way down by rotating the jog button to the left.
2. Position the new filament on the spool roller and place the old next to it. [1]
3. Press the material lever to the right with one hand while manually retracting the filament the filament with the other. Place the old filament spool aside. [2]
4. Push in the new material and press the lever to the outside again. The material should be push through all the way until you see a little bit of the material leaving the nozzle.
5. Set the speed back up to 100%

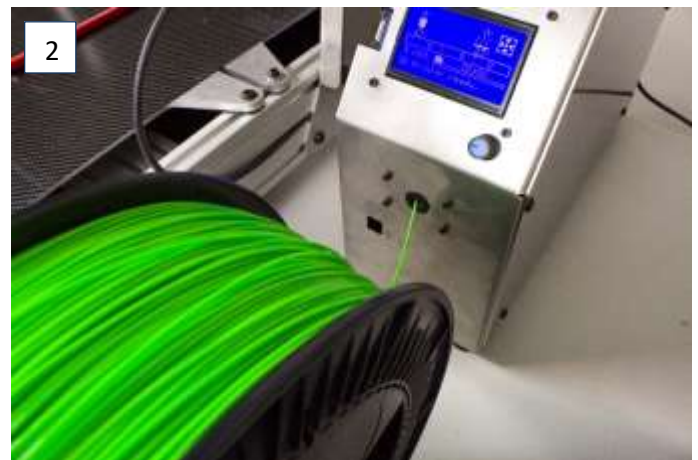
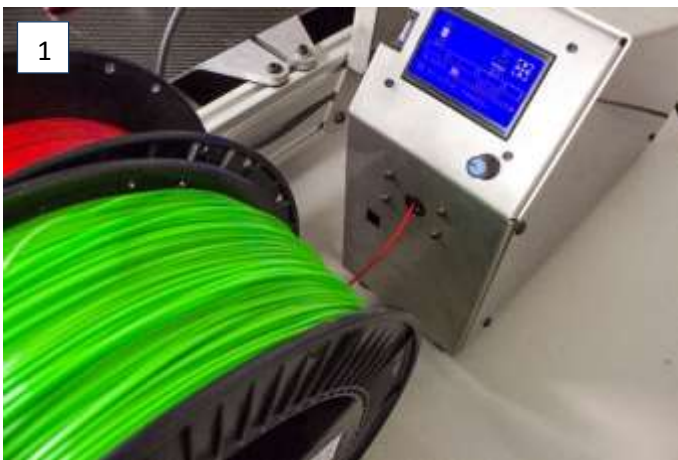
## 3.5.3 Material change [varioDRIVE]



Please assure that the 3D Printer is fully assembled and wired correctly and that the printhead has been installed.

### Scenario 1: NOT during a print job and when the heater is cold.

1. Preheat the nozzle with the presets:
  - Push the button → “scroll down and select “Prepare” → scroll down and select “Change Filament” → scroll down and select “Preheat Ngen” or “Preheat PETG”. For NinjaFlex choose “Preheat Ngen”, for varioShore choose “Preheat PETG”
2. Wait for the printer to heat up and remove the installed filament. Follow the instructions on the screen to load new filament.
3. When the nozzle purges the filament, you can start printing. You will see a good amount of filament coming out of the nozzle.



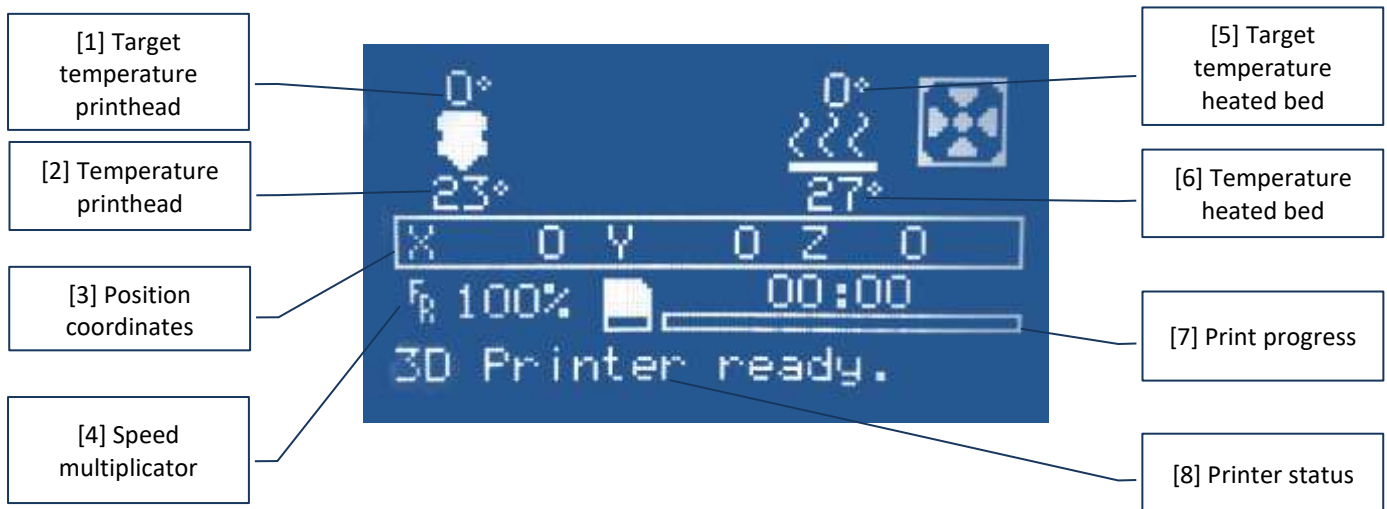
### Scenario 2: DURING a print job when the heater is hot

If you notice that the spool is running towards its end you can take the following steps

1. Position the new filament on the spool roller and place the old next to it. [1]
2. Push the button → “scroll down and select “Tune” → scroll down and select “Change Filament”
3. Wait for the printer to heat up and remove the installed filament. Follow the instructions on the screen to load new filament.
4. When the nozzle purges the filament, the print will automatically start again and continue

## 3.5.4 Explanation Menu 3D Printer

When starting the BlackBelt 3D Printer, the following start screen will appear.



1. Target temperature printhead: Displays the set target temperature value of the printhead. When displayed "0", the heating element is switched off.
2. Temperature printhead: displays the actual temperature of the printhead. In the screen above the display shows the room temperature of 23°C.
3. Position coordinates: displays the X, Y and Z coordinates of the printhead.
4. Speed multiplier: By turning the jog button it is possible to increase or decrease the print speed during the printing process.
5. Target temperature heated bed: Displays the set temperature value of the heated bed (belt). When displayed "0", the heating element is switched off.
6. Temperature heated bed (belt): displays the actual temperature of the heated bed (belt). In this case : 27°C
7. Print progress: displays the progress of the part in percentage finished.

Printer status: displays the status of the printer or possible failure indications.

## 3.5.5 Starting up a Print



Assure that all previous steps have been executed completely and correctly.

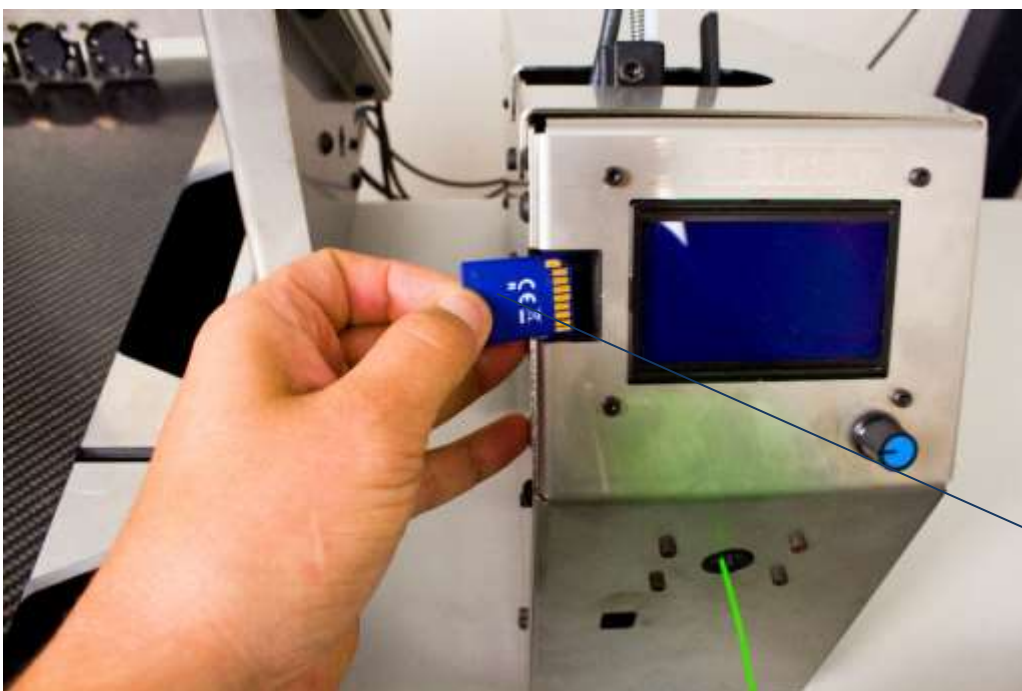


Hot Surface!  
Burn hazard when touching the hot surface.



Entrapment hazard  
Danger / moving parts.

1. Insert the SD Card with the G-code into SD the slot (8)
2. Double check if the printhead, filament material and the printing angle are set the same as in the software as in hardware.
3. Move the printhead manually to the middle position and close to the conveyor belt.
4. Switch on the machine.
5. Insert the SD card.
6. Press in the Jog Wheel and select the option "Print from SD".
7. Select the machine code (G-code), which you wish to execute.
  - The G-code has automatically generated identifications for Gantry angle, Print head and material.  
Double-check that all parameters are right.
8. The printer will now automatically heat up and start the print after heating up.



Correct  
installation of the  
SD Card



## 3.5.6 Stop the print

In this chapter we will explain the most common manual ways to stop the printer.

### 3.5.6.1 Stop the print using the menu

- Push the jog button.
- Turn the button to the left and select "Stop Print" .
- Push the button again to stop printing immediately.

### 3.5.6.2 Stop the print switching of the main switch

On the rear side of the control cabinet the main switch is positioned on the left down corner. If the main switch is set to "0" the machine will stop printing immediately .



## 3.5.7 Unloading the filament [BOWDEN]

1. Pull the "Filament lever" on the control cabinet and hold this in position.
2. Gently pull the filament out.
  - If the filament does not release, follow the following steps.
    1. push back the filament and release the filament lever.
    2. Switch on the machine, and wait for the main screen to start.
    3. Push the jog button in
    4. Select "Preheat"
    5. Select "Preheat nGen"
    6. Select "Preheat nGen End"
3. The printhead will now heat up to 230C. The progress will be shown on the main display.
4. The set temperature value is 230C, the real temperature is shown below the set value and will reach the set value after a short time.
5. If the real temperature has reached the set temperature, it is possible to extract the filament.
6. Switch off the printer or switch off using the menu: "Prepare" → "Cooldown"  
Or: "control" → "Temperature" → "Nozzle" → Turn the Jog Wheel to set: "0"

## 3.6 Using BlackBelt Cura



Software installation shall only be carried out by qualified staff.



Only use software as made available by Blackbelt 3D BV on its website ([www.blackbelt-3d.com](http://www.blackbelt-3d.com))  
Any other software may damage the machine.



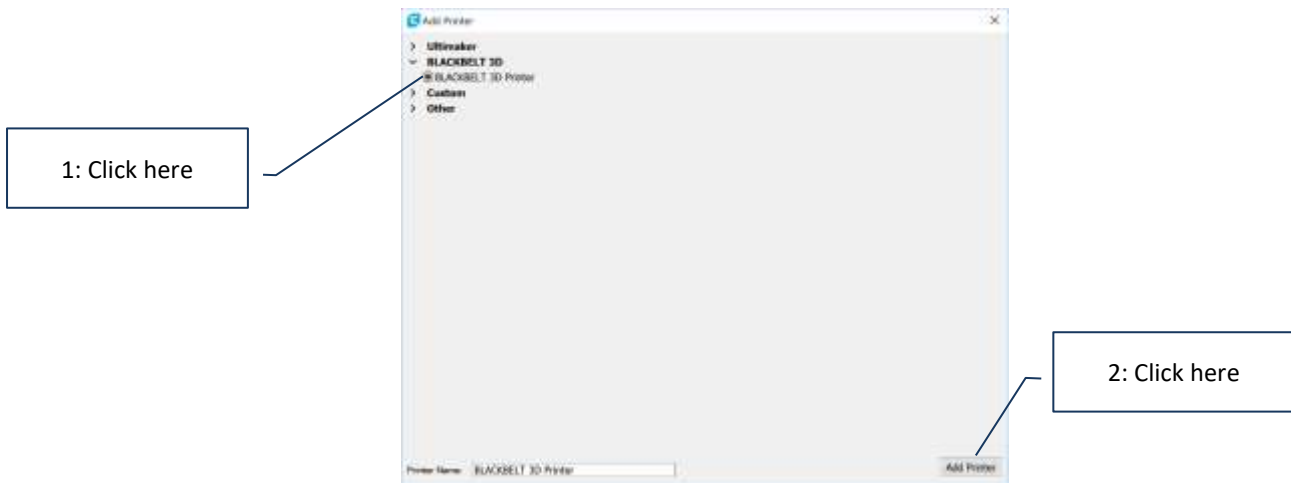
Accepted operating systems:  
Windows Vista or later version, Mac OSX 10.7 or later versions  
Linux Ubuntu 15.04, Fedora 23, OpenSuse 13.2, ArchLinux or later versions



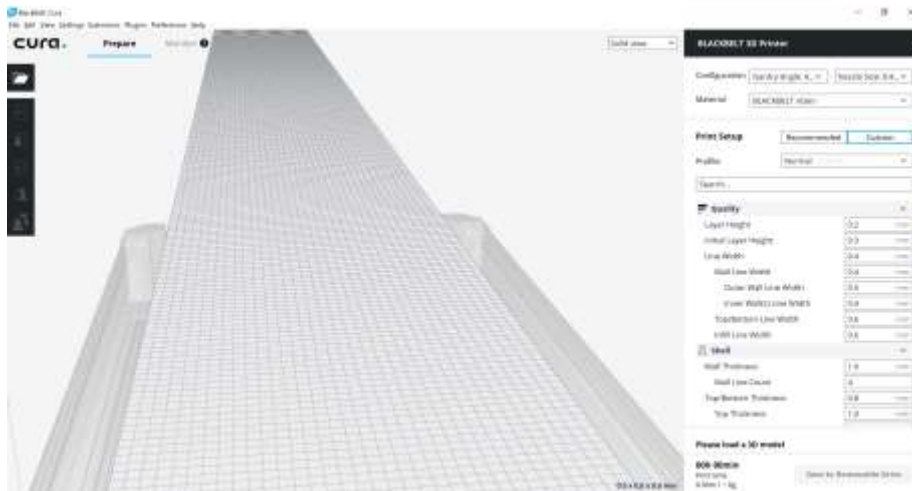
Accepted hardware:  
OpenGL 2 compatible graphical chip  
Intel Core 2 or AMD Athlon 64 or later versions

### Installing software:

1. Browse to: <https://blackbelt-3d.com/download-area/> and download the our software “BLACKBELT Cura”  
Select your operating system (Windows, Linux or OSX) to download the latest version of BLACKBELT Cura.
2. DoubleClick on the .exe file and follow the steps in the installation wizard.
3. Open “BLACKBELT Cura”, if this does not start automatically.
4. If the next dialog window does not start automatically, then go to “Settings” – “Printer” – “Add Printer...”
5. Select “BLACKBELT 3D Printer”, secondly in the submenu “BLACKBELT 3D” and click on: “Add Printer”



6. The Cura software for Blackbelt will now open automatically.



## 3.6.1 Generating Machine code / G-code



Compatible design CAD languages are: STL, OBJ or 3MF



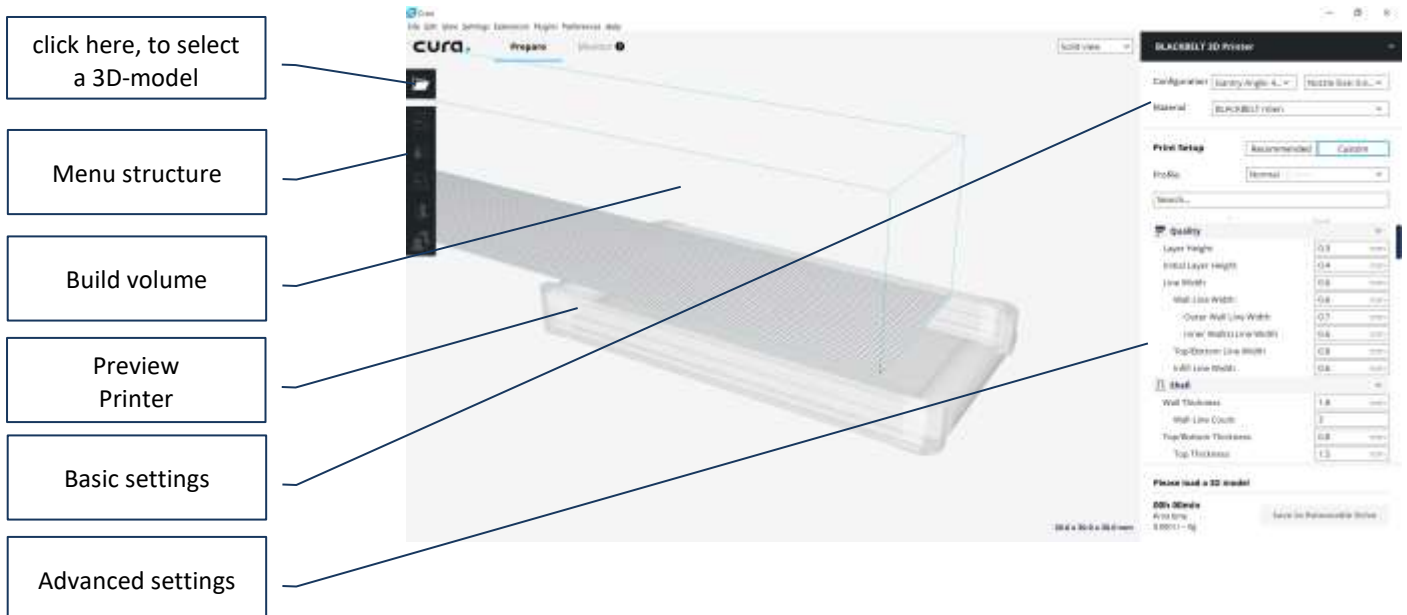
Your hardware (PC / Laptop) must be configured to write data onto an SD card.

In order to generate the machine code (G-code) the following requirements are necessary:

- A Mac or PC equipped with a SD card reader. The BLACKBELT Cura software needs to be installed onto the hard drive as described in chapter 3.6
- The SD-card
- A 3D CAD model in STL, OBJ or 3MF format
  - o A test model can be downloaded here: <https://blackbelt-3d.com/downloads/cube.stl>
  - o More test models can be downloaded from our website to ensure your first print successes, we advise to start printing with these models and learn by doing.  
<https://blackbelt-3d.com/downloads/test-models.zip>

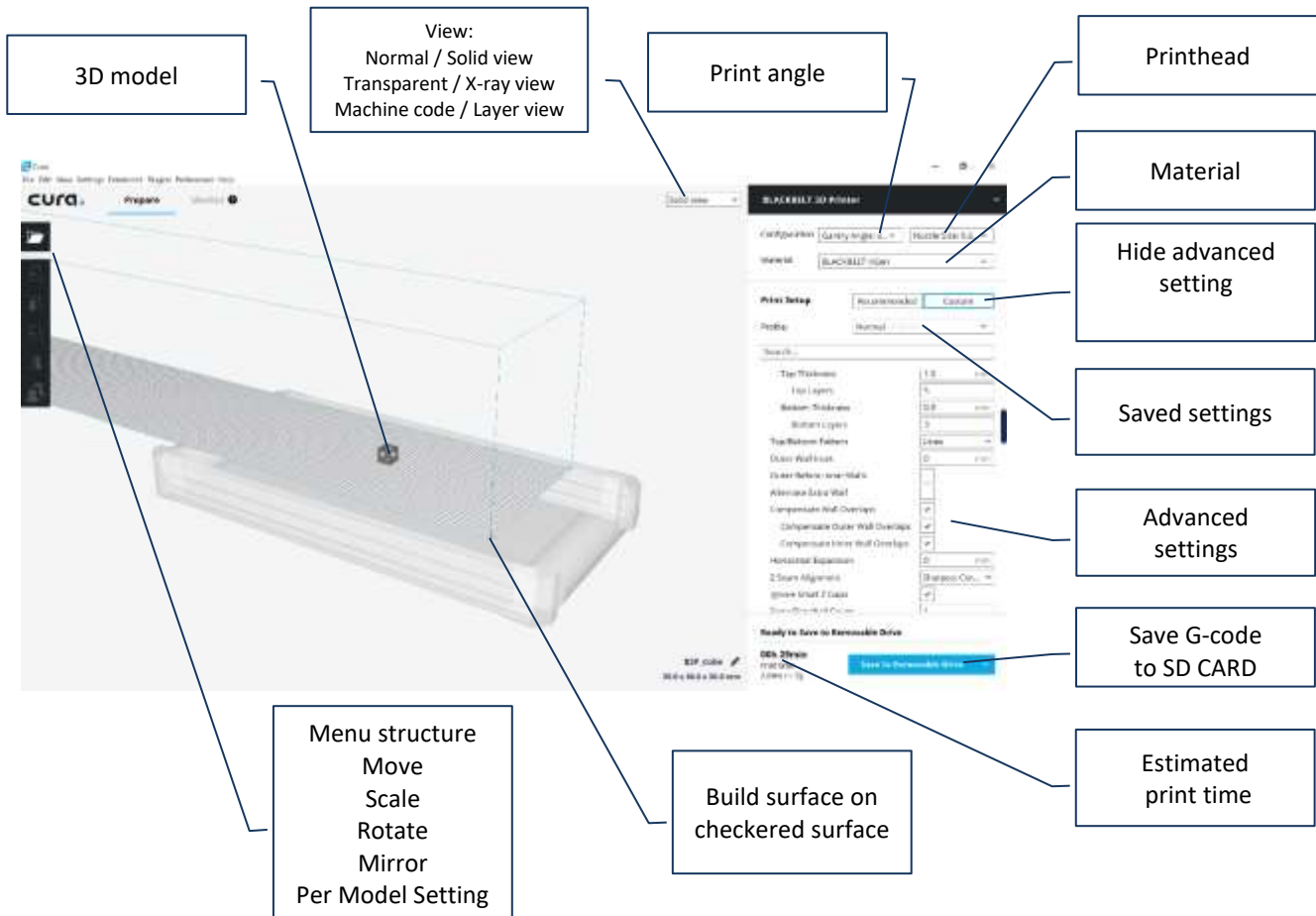
1. Insert the SD card into the SD card reader of your PC
  - Pay attention to using the right direction of the SD card, as specified by your computer manufacturer.
2. Open BLACKBELT Cura (version 3.4.2 or higher)
3. After loading the start screen you'll see this:

Overview BLACKBELT Cura Software:

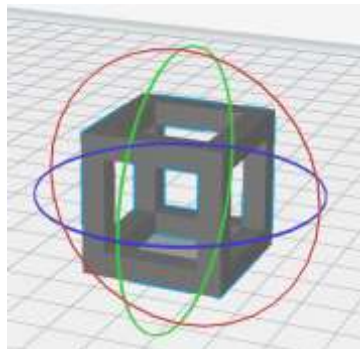


4. Import the 3D-CAD model you would like to print using the software BLACKBELT Cura.
  - Importing the model can be done in 3 ways:
    - Using "Drag & Drop"
    - Using the Menu (top left): File --> Open File(s)... Ctrl+O
    - Using the Icon on top of the left menu structure.
5. View the model from all sides.
  - Turn your scrolling wheel on your mouse to zoom.
  - Click and hold the right mouse button, move the mouse to turn the view of the part.
  - Click and hold the scrolling wheel, move the mouse to move the viewing (eye) point.

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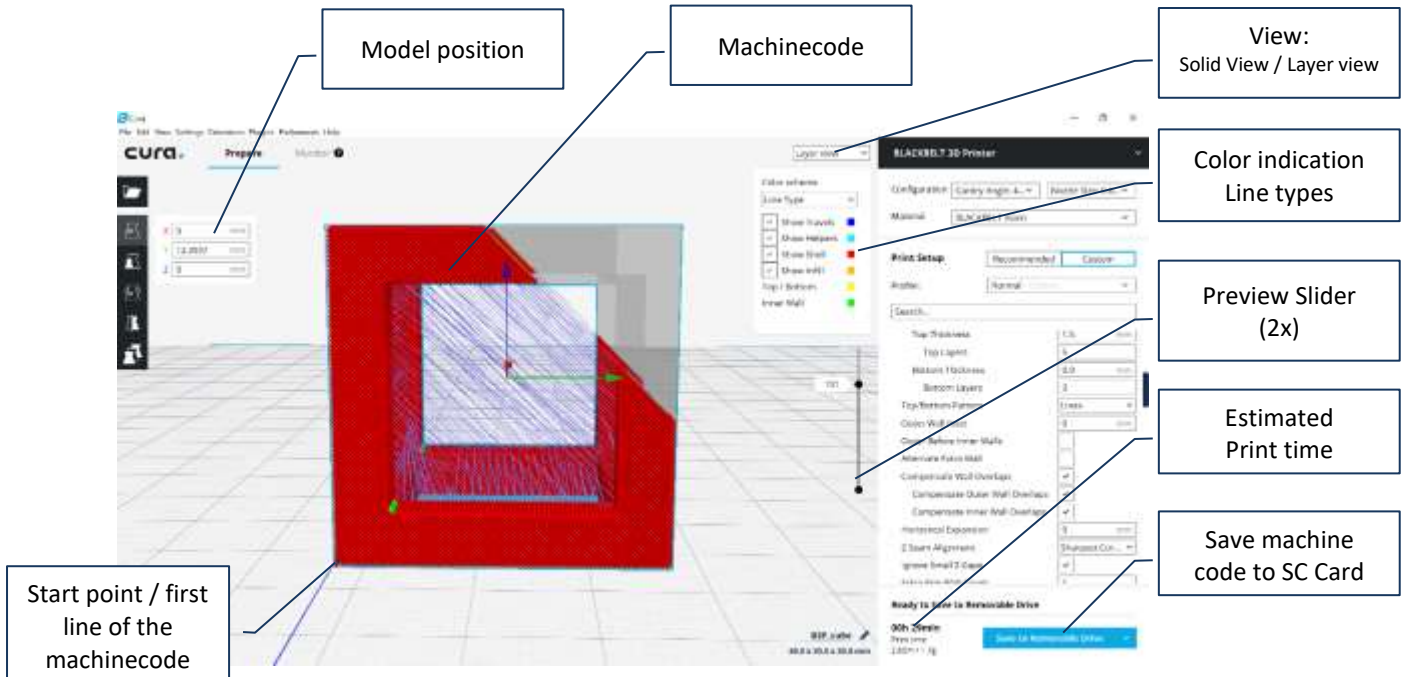


6. First select the desired printing angle, printhead and material in the upper right corner of the program. Your selection needs to correspond with your machine set-up.
  - Print angle, using “Gantry angle” – we advise 35° (35 degrees)
  - Printhead, using “Nozzle diameter” – we advise to use a 0.4 or 0.6mm printhead, to obtain detailed results
  - Material, using “Material:” – we advise “BLACKBELT nGen” to be used for your first prints.
7. Move the model into the desired position:
  - Select the model, click on “Rotate” in the left menu structure.

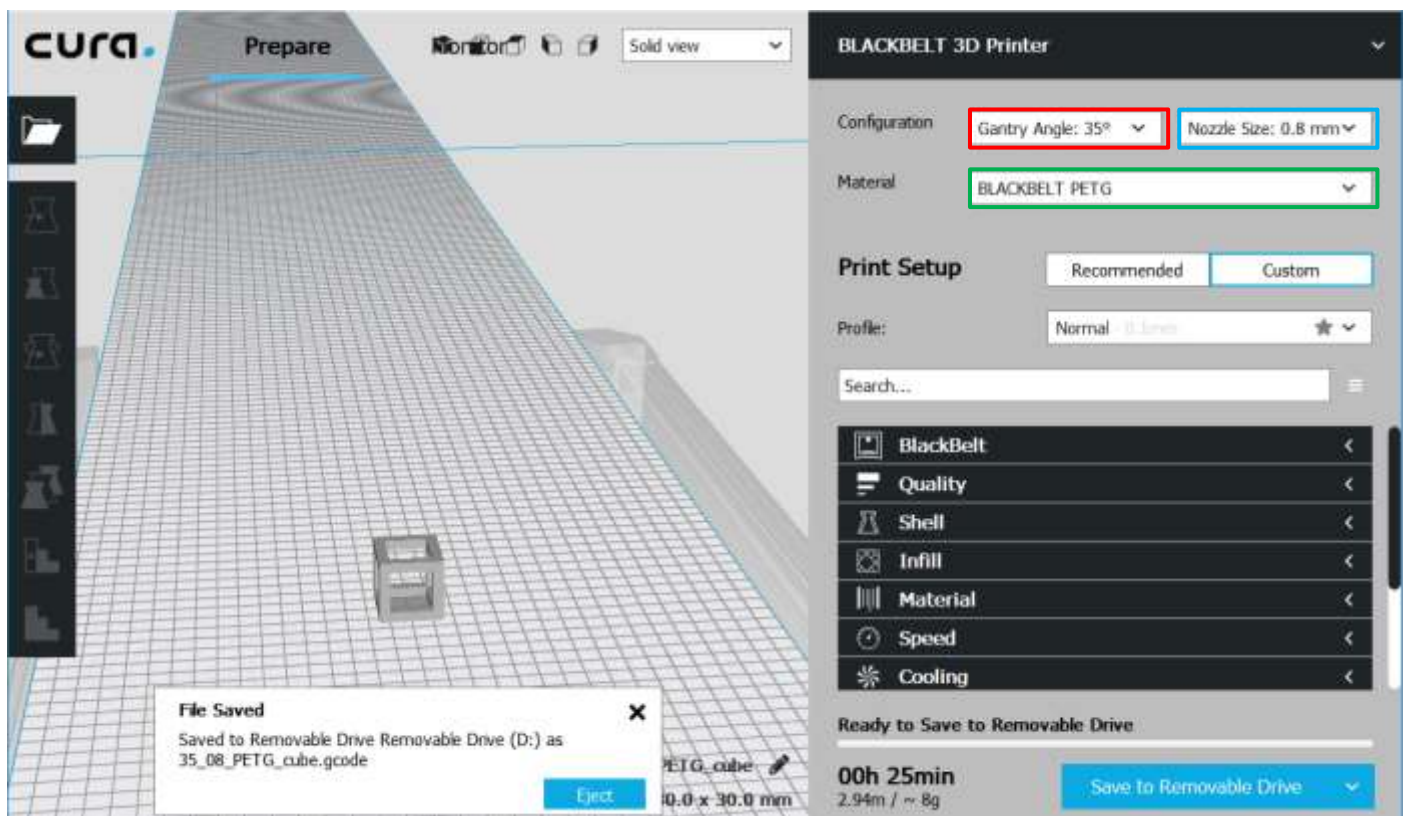


- Click one of the circles that appear around the model, to rotate the part in steps.
  - Rotate the model to position it with a flat surface onto the checkered surface.
  - Make sure that it does not start printing in the air. Take Chapter 4 “Design Guide” into account if you are not sure.
8. The most important rule for a successful print is to ensure that the first line of machine code, is a flat line on the machine belt surface.
    - To verify the first line, switch the view from “Solid” to “Layer view”.

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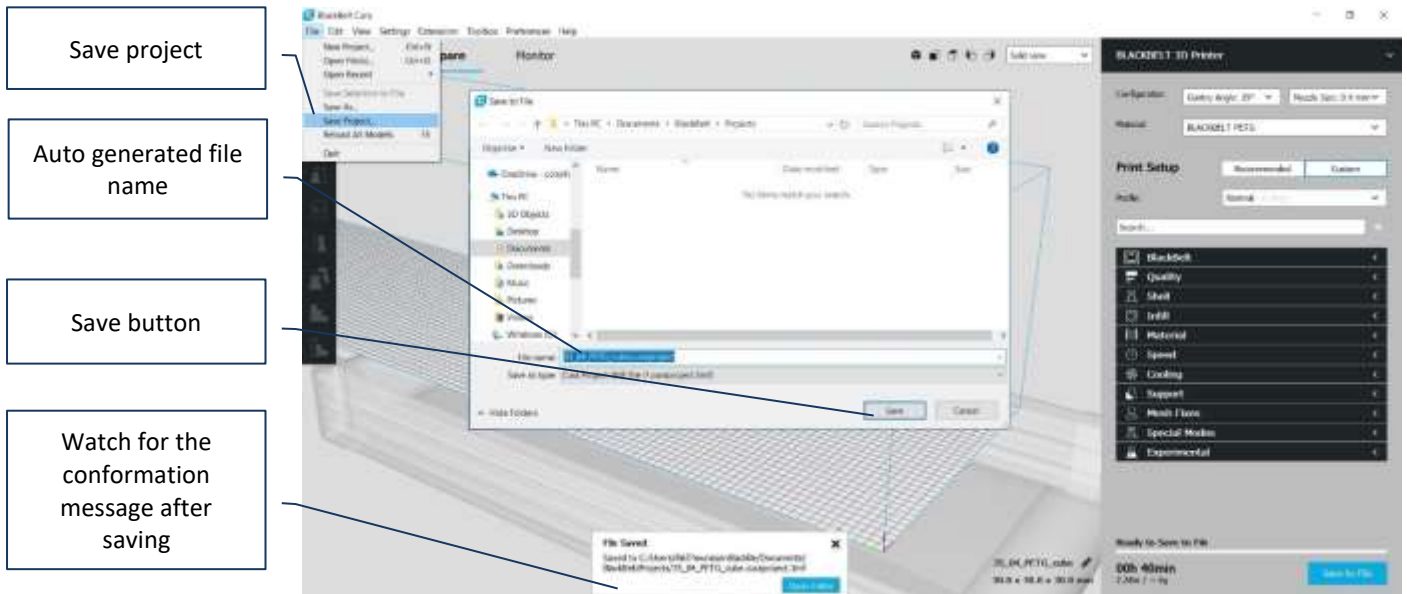
9. Have a look at the G-code / machine code and evaluate your model.
  - You can see the nozzle movements (track) the print nozzle will be following, to build the product.
  - Move the upper “Proview Slider” down, to scroll through the G-code / machine code.
  - Please check :
    - The starting point of the first line is positioned directly onto the checkered surface.
    - A flat surface of the model is positioned onto the checkered surface.
    - Each new layer is built upon a previous layer, ensuring the print layer does not start or commence in unsupported “air”
10. Place the SD-card in your SD-card reader slot or plug the external reader in the USB (or similar) port of your PC / Mac. The filename will automatically refer to the important machine settings according to the following rule:
  - **[Gantry angle]\_[Nozzle size]\_[Material]\_[Project name].gcode**
  - Example: **35\_08\_PETG\_cube.gcode**



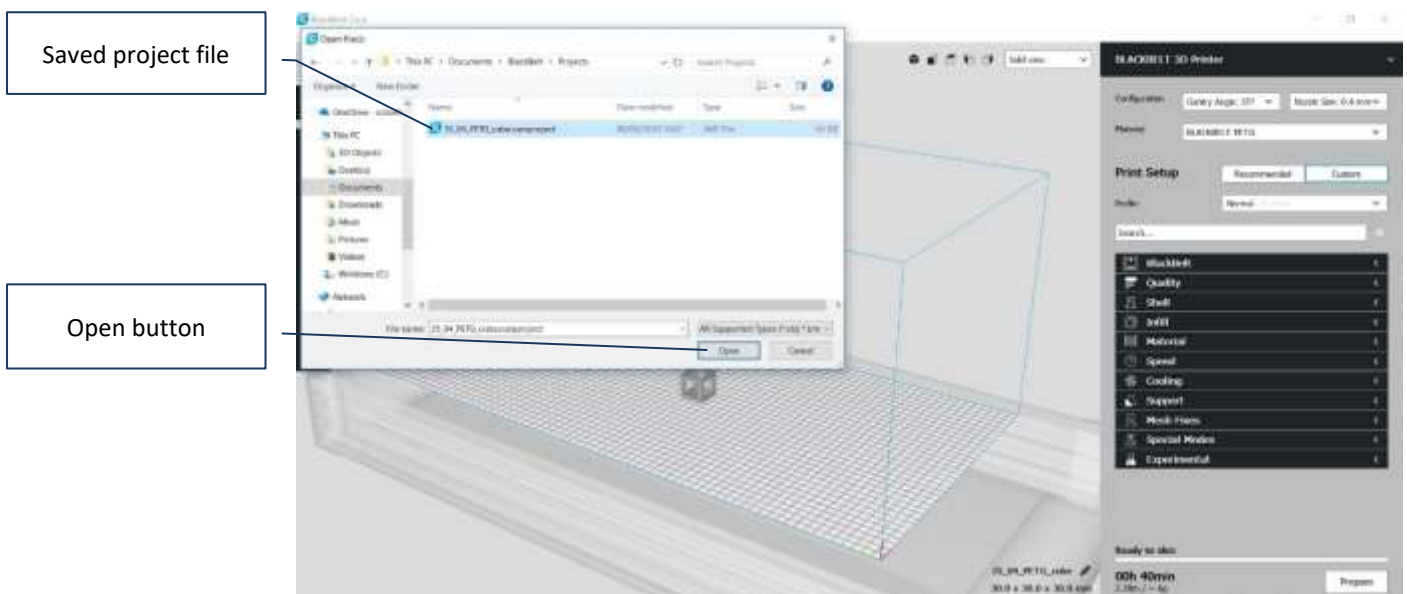
## 3.6.2 Saving a project

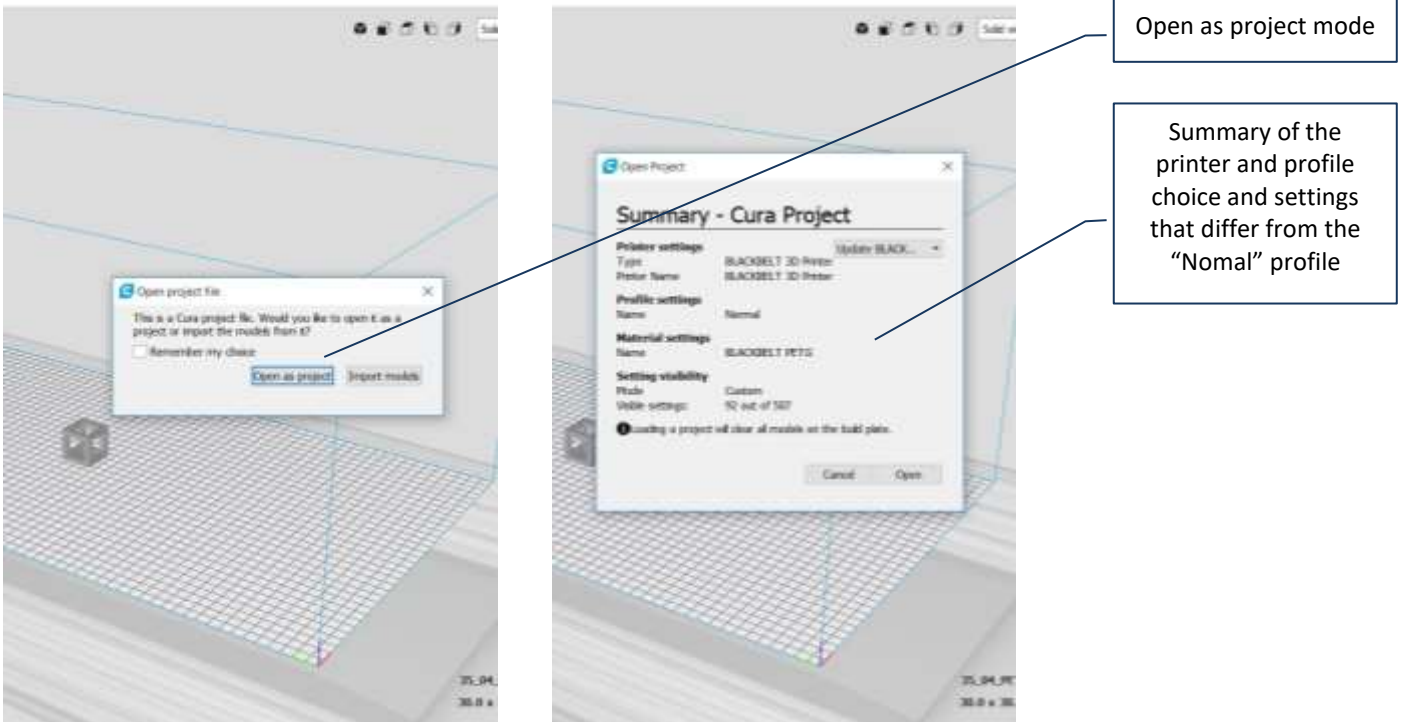
If you are happy with the settings and you want to keep these for later, you can save the entire project in Cura as a \*.curaproject.3mf file. This can also be convenient when you want to continue a later time or share your work with others. The save project function will export the link to the models and keep all the settings. Unique profiles will be included in the workspace of a second user when accepted (see figure by step 4). You need to use the following steps to save and load a project file:

1. Choose the “File” menu in the upper left corner and select “Save Project..”
2. A general save window of your operating system will appear. The file name is auto generated based on the settings, you can choose to change this, or press “Save”. Make sure you choose a location where you can find the files again.



3. Open project file by choosing “File” menu and browse to location where you saved the file.





4. After pressing the "open" button you will be asked how to load the file. Make sure you choose "Open as a project" here. Otherwise the 3D object(s) will be loaded without settings.
5. BLACKBELT Cura shows an overview of the printer, profile and material that is saved to this project. It will also overwrite the visibility settings. If you agree to overwrite the current models and settings press "open" and continue with the project.

**This offers the opportunity to share your settings and files with a third party. Make sure the model files used in the project are stored in the same folder.**

Intentionally left blank





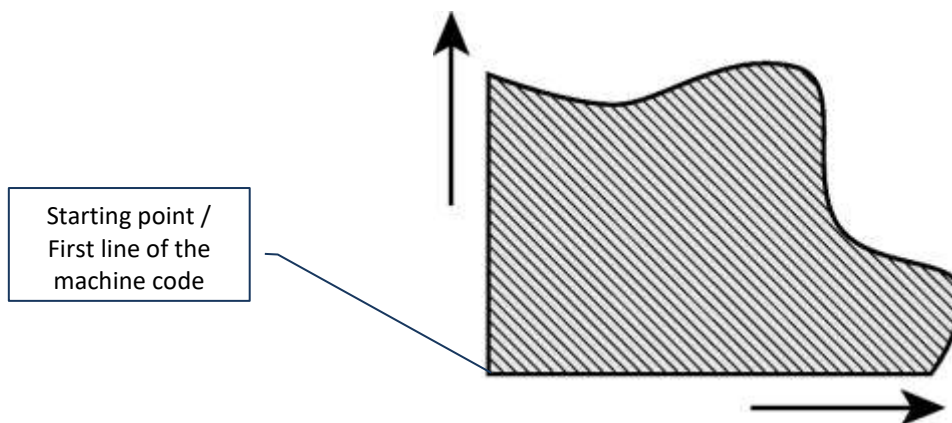
Printing on a belt has a lot of opportunities if the design is correct. In this chapter we show the specific design rules that apply to the BlackBelt 3D printer. Not every product is directly suitable for FDM printing and some digital preparation is in order.

## 4.1 Design guidelines



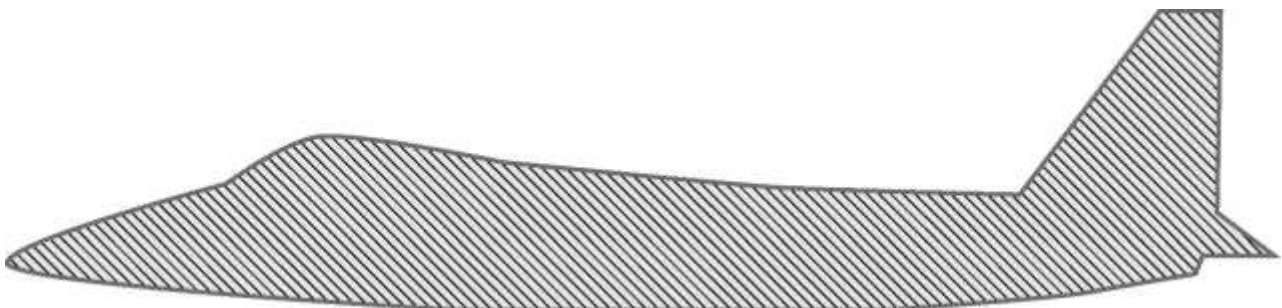
In order to produce successful printed parts on the BlackBelt 3D Printers, it is critical to use the correct machine parameters, but even more important is to apply to correct design rules for parts suited to be printed on the BlackBelt 3D Belt printer. If the geometry to be printed does not comply with very specific design rules the part will not print correctly and there will be a risk of damaging the machine.

The BLACKBELT 3D Printer print layers of molten polymer, in other words a viscous plastic. This polymer needs to adhere on the belt composite material or onto an existing polymer layer. In the pictures below those layers are visualized using diagonal lines.



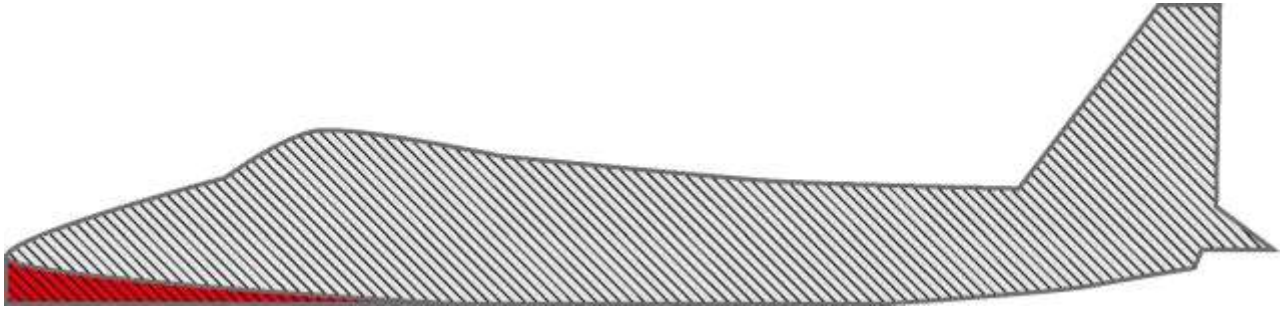
If a new product is being printed, there is no previous layer. This means that the first layer needs to start onto the conveyor belt.

Not every geometry is equally suited to be printed on the BLACKBELT 3D Printer. The model below is a cross section of a plane which does not start onto the composite belt:



If the model starts above the belt, it is necessary to apply a support or starting geometry to the part, that can be modelled in using CAD software. Applying an offset of 0.2 mm between start geometry and the actual product will ensure easy removal of the support structure (red lines). The current version of BLACKBELT Cura (3.4) does not create support structures automatically. This needs to be done by the user in a manual design process.

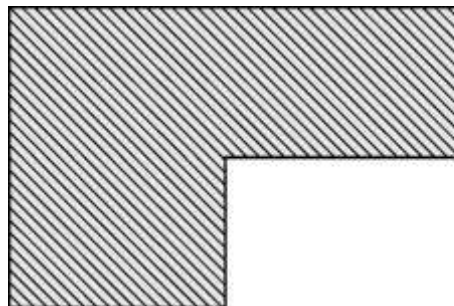
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Products that are designed properly can be printed using a minimal or no support structure.

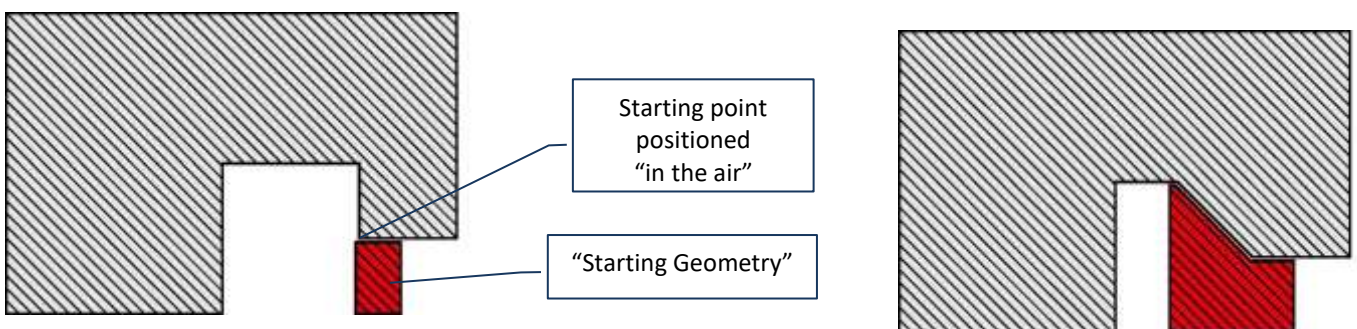
The printhead can only print onto the composite belt or on a previous layer. It is not possible to print into the air. Because of these facts, the design of the part needs to be considered carefully.

While designing products for the BlackBelt 3D Printer it is important to consider the direction the product will be printed. The cross section below can easily be printed from left to right.



Designs and parts that need no or only little supports are very suitable for series. Printing time, material use and post processing can be reduced by applying these design rules into clever and smart designed products.

If a geometry needs to have a starting point in the air, it is possible to apply a starting / support geometry (left image).

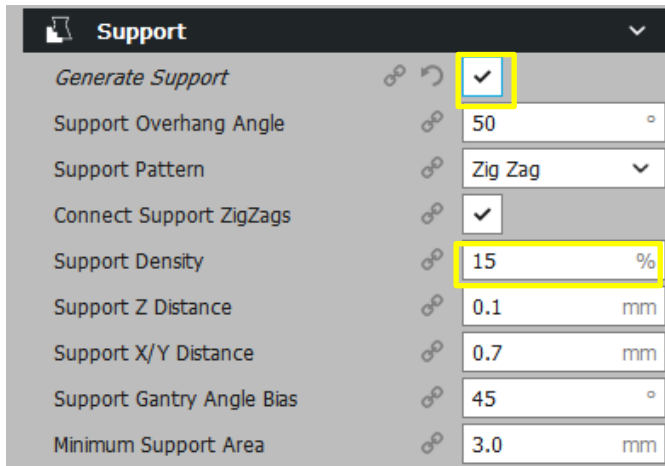


Overhangs parallel to the XY angle (printing angle) need additional support, to prevent sagging of the printed layers. (right image)

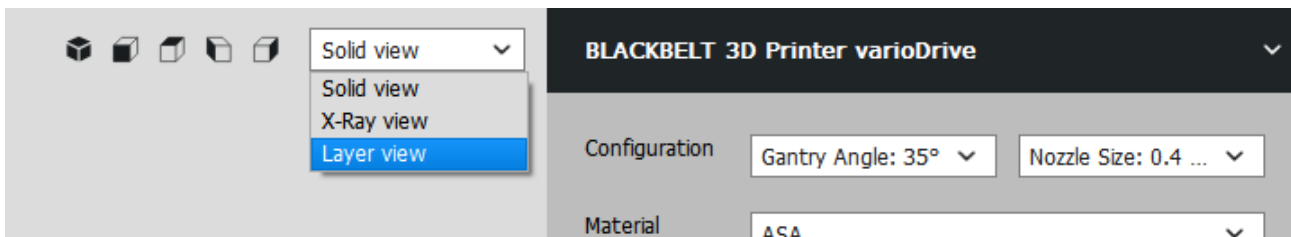
Creating those custom support geometries in CAD, Please consider creating a new volume body and using no offset to the main part. And follow the steps in the following chapter.

## 4.2 Using auto generated support

1. Make sure the Auto generate support is on and check if the *Support Pattern* and *Support Density* is according specifications.

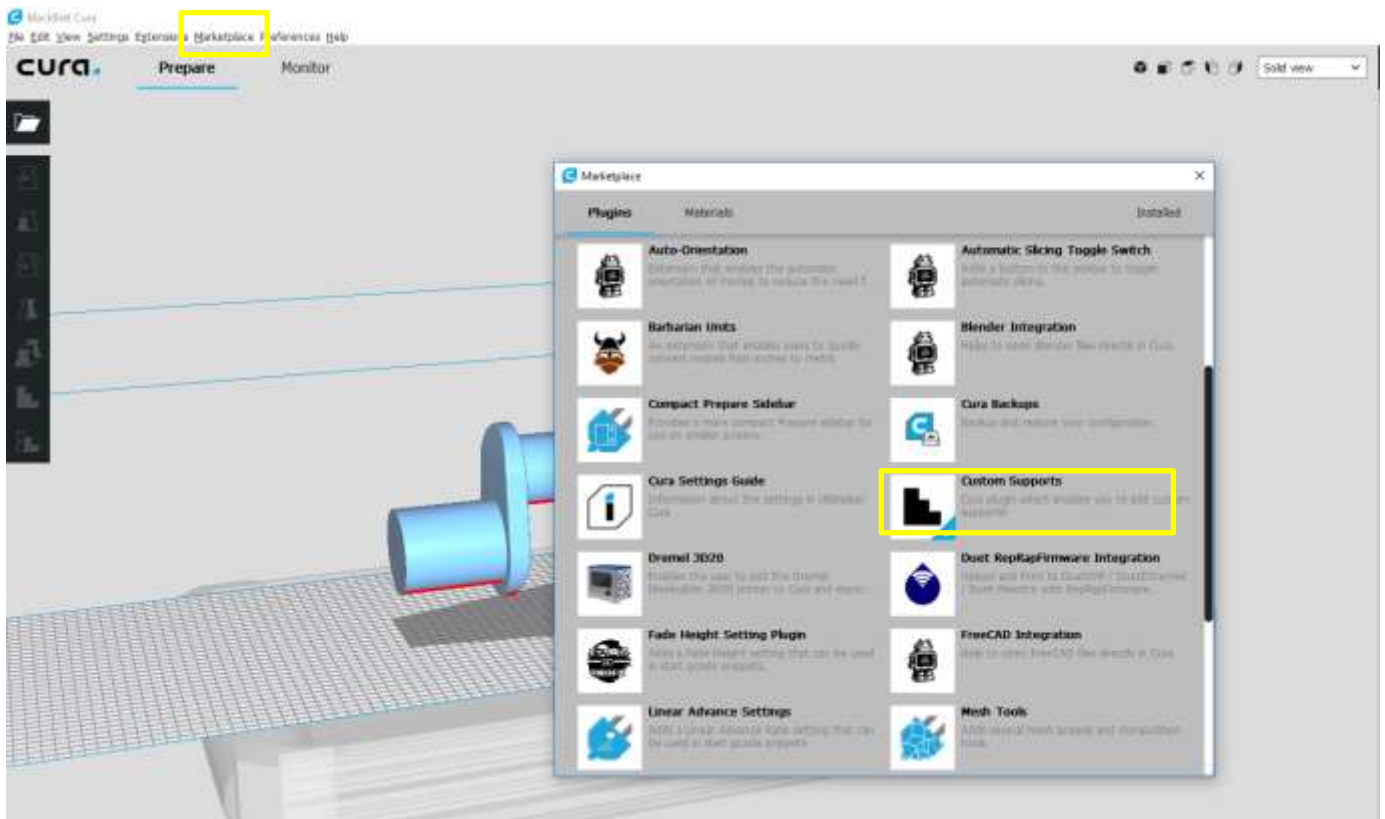


2. Check all the other parameters like material settings and Prepare your GCODE for printing. If auto slicing is on this will happen automatically.
3. As a final check use the Layer View to see if all the support is placed as expected. If the support does not show, make sure Show helpers is enabled.

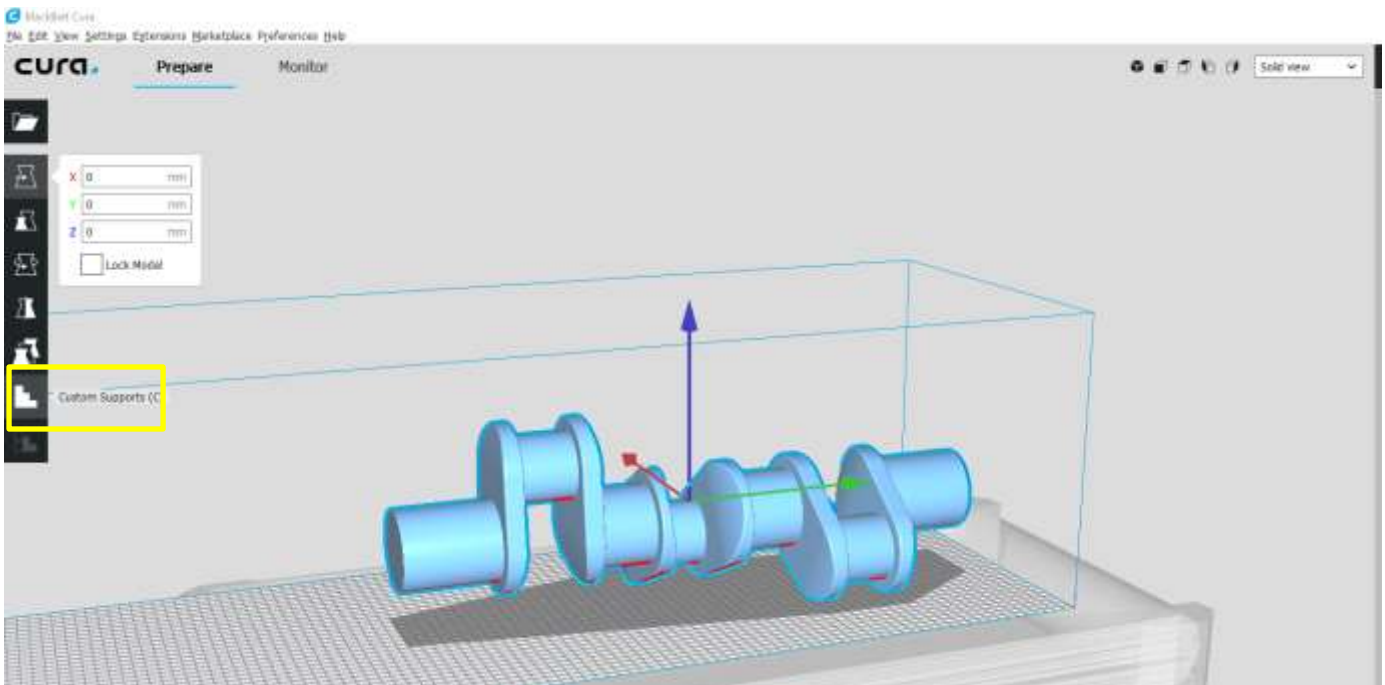


## 4.3 Manual support in BlackBelt Cura

1. Open the Marketplace and install Custom Supports

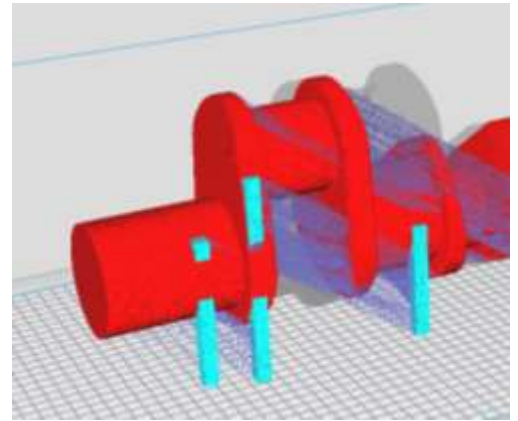
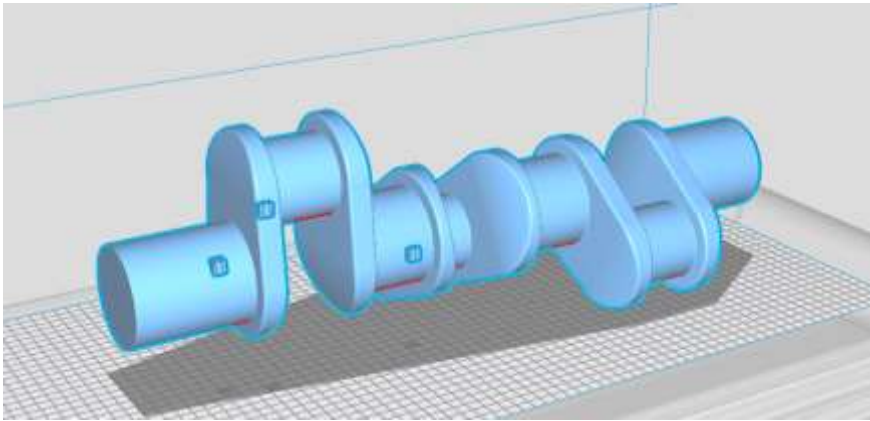


2. Selected the model you want to support and click on the new icon in the menu on the left.



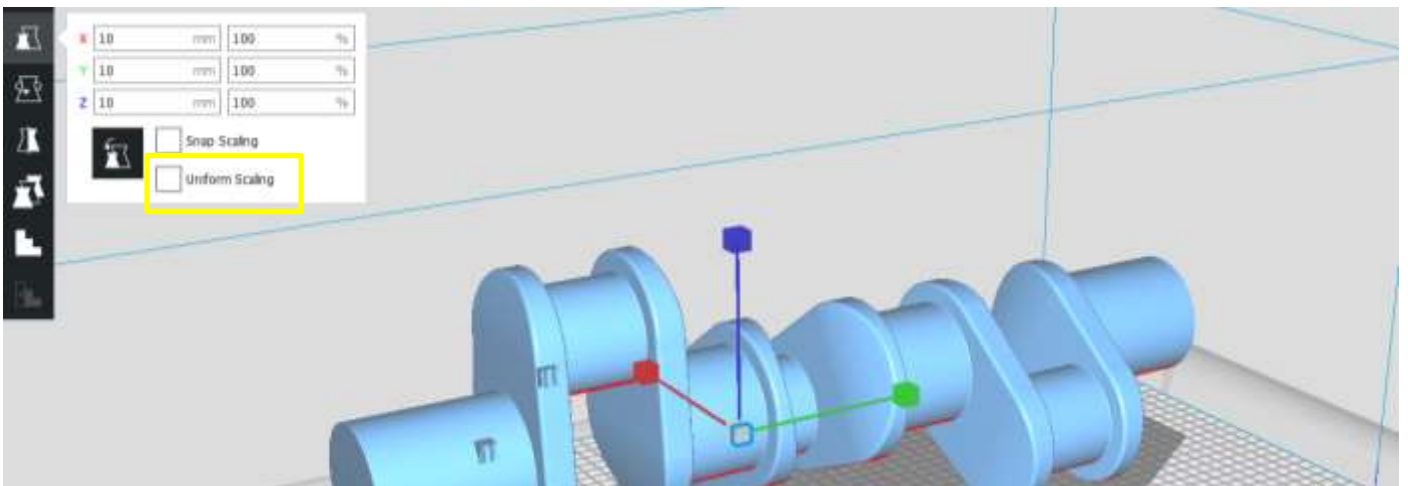
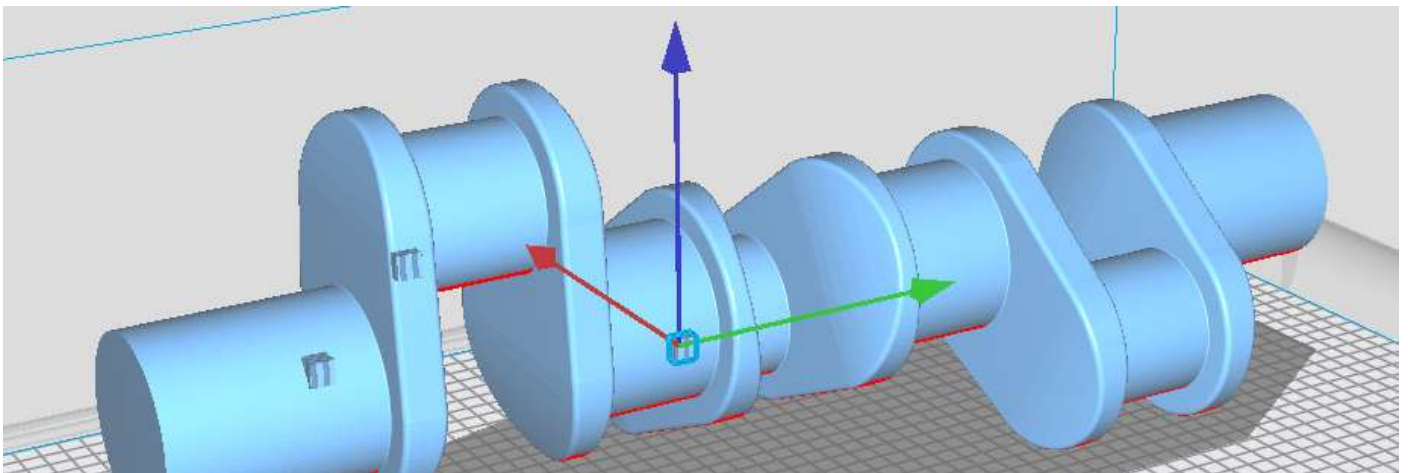
3. Click **ON** the model near the location and a cube 5x5x5 appears, place as many as you need. By deselecting the option in the menu to the left you will lock the amount of support blocks. This is important for the next steps, otherwise you keep adding and removing basis cubes.

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Keep in mind that support is generated full height and in between the object all the way to the platform if it touches the object.

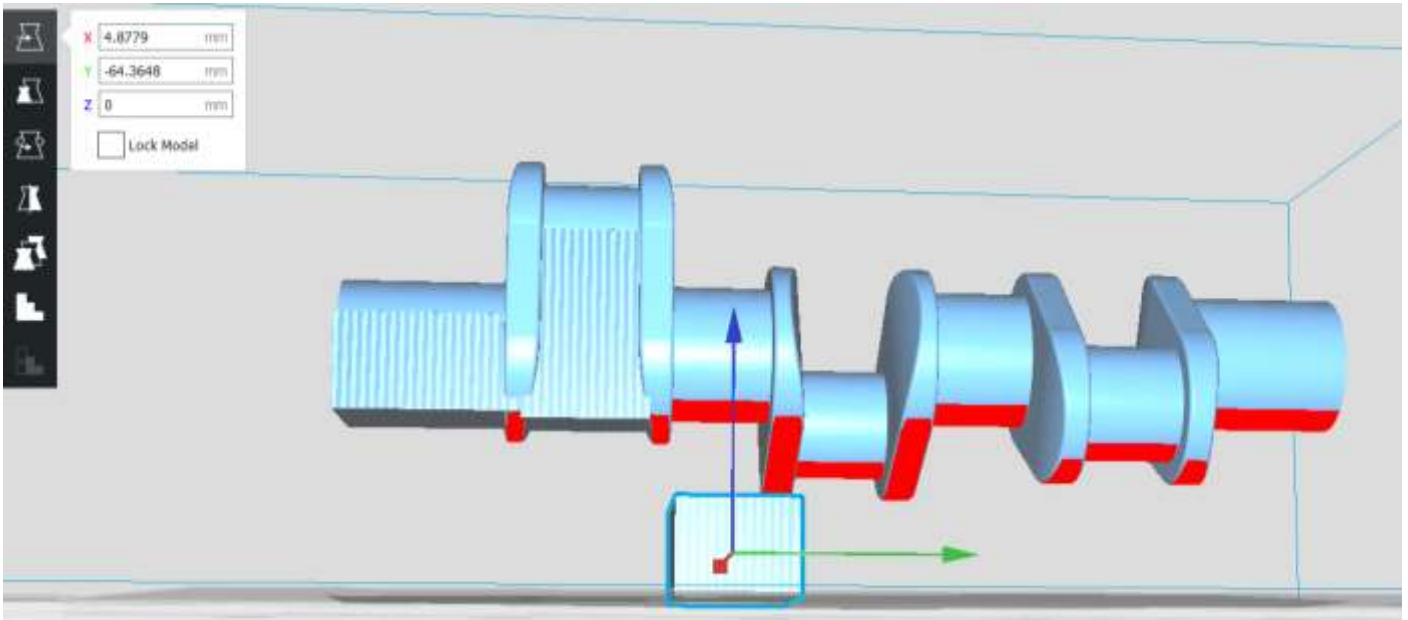
4. After deselecting the adding custom support tool you can move and scale the support. For a better control deselect uniform calling and work with individual scales.



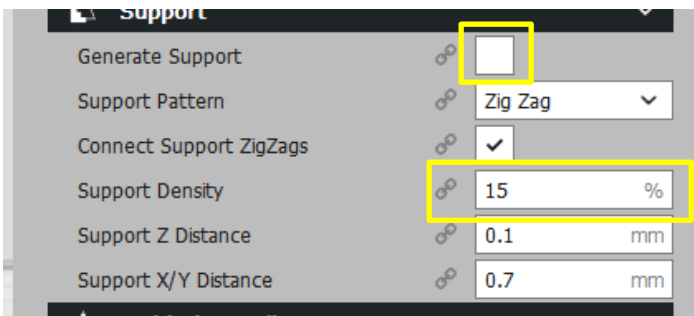
5. Scale and position the rectangles to position you like to support. The areas highlighted in red are suggested support areas by the software.

**Tip:** the bottom face of the lowest object is set as reference for Z=0. This can be used to lift the object from the belt end fully support it. A ball for instance is better placed 5 mm from the belt fully supporting the bottom half. Manually setting the Z position of other support blocks to 0 will level them on the belt.

# BLACKBELT



6. Make sure the Auto generate support is off and check if the *Support Pattern* and *Support Density* is according specifications.

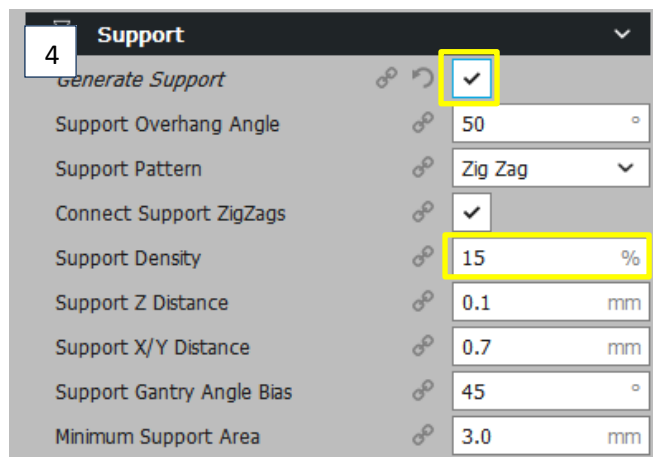
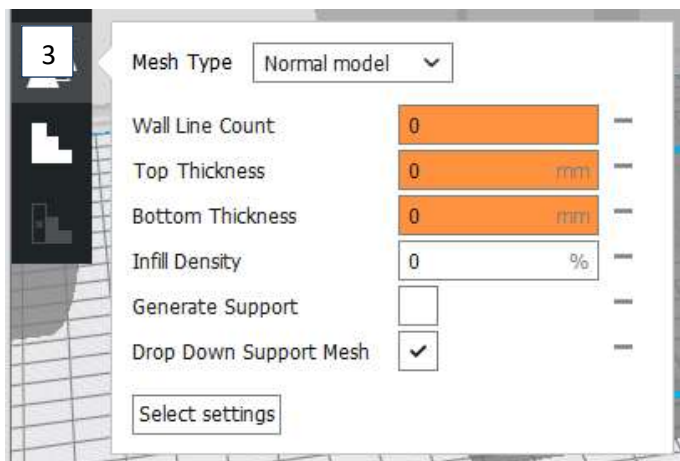
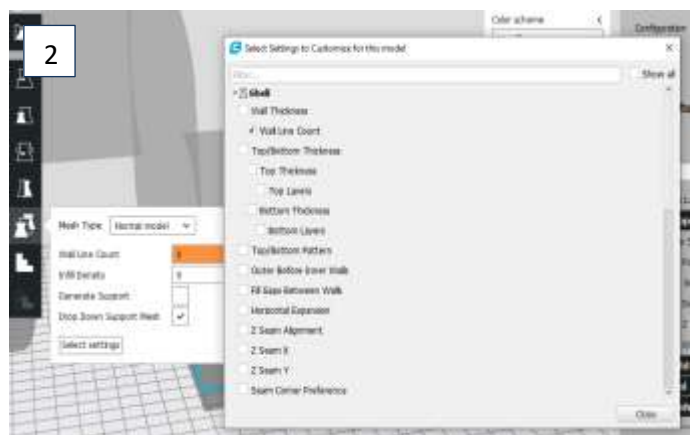
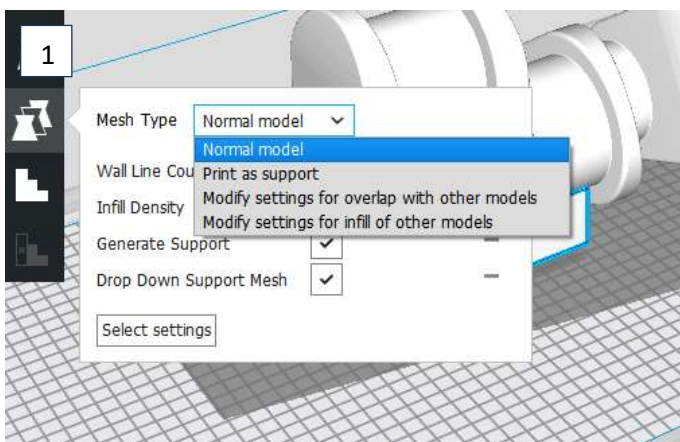


7. Check all the other parameters like material settings and Prepare your GCODE for printing. If auto slicing is on this will happen automatically.
8. As a final check use the Layer View to see if all the support is placed as expected. If the support does not show, make sure Show helpers is enabled.

## 4.4 Auto support in BlackBelt Cura with custom support blocker

Follow steps 1-5 from the previous chapter 4.3, the only difference is that you position the blocks where no support is needed. You can also do this with custom generated support in CAD after you import them and merged the files. Continue with the following steps:

6. Select the block or custom support you want to use as support blocker and use per model settings to set the *Mesh Type* to *Normal Model*. Select the following settings to change: [1-2]
  - a. Wall line count
  - b. Top Thickness
  - c. Bottom Thickness
  - d. Infill Density
  - e. Generate support
7. Set all the settings to zero or none. [3]
8. Make sure the Auto generate support is on and check if the *Support Pattern* and *Support Density* is according specifications. [4]



9. Check all the other parameters like material settings and Prepare your GCODE for printing. If auto slicing is on this will happen automatically.
10. As a final check use the Layer View to see if all the support is placed as expected. If the support does not show, make sure Show helpers is enabled.

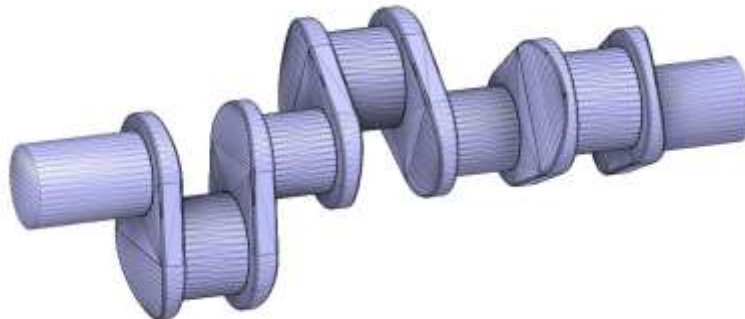


## 4.5 Using custom support

The custom support mentioned in the previous chapter can be designed in your CAD program [1-2]. Make sure that the support geometry is a separate volume body that has no offset to the product geometry. It is possible to overlap the geometries.

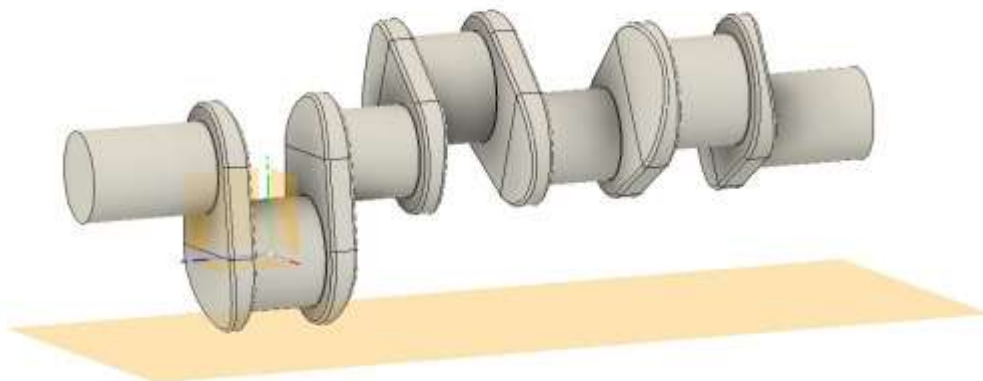


1. **Use the original design or STEP/IGES file (goto step 3).** This is highly recommended because not all STL files can be converted back. If you only have a STL file goto step 2.



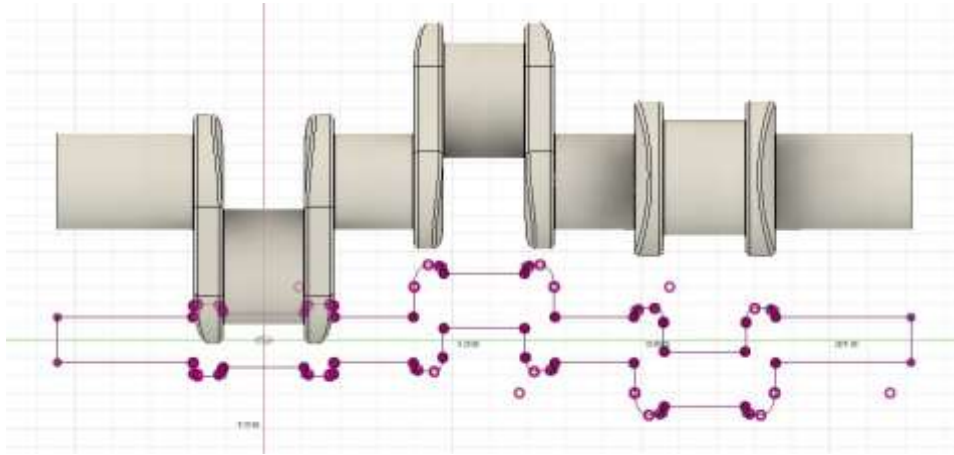
2. Insert the STL file using the IMPORT function of your CAD software. Make sure you match the dimension (mm / inches etc.). Convert this file to BREP / SOLID / MODEL (options differ per software)

tip: If you do not move the file or auto relocate it the origin stay the same as the source file. This makes merging possible in Cura. Otherwise export the source geometry as well in step 10.

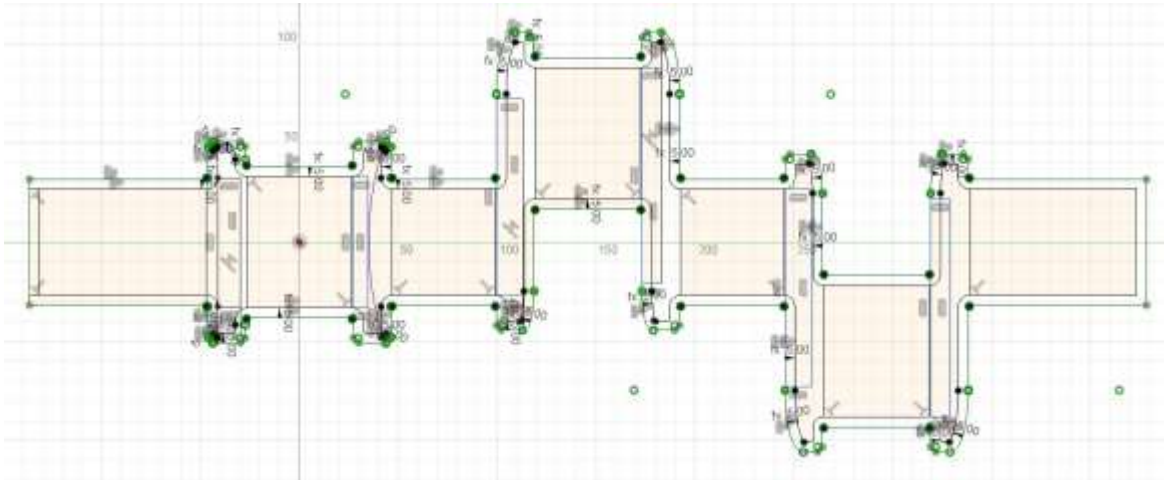


3. Place a convenient plane (in this case the flat surface of the nut was used). Most often you can use an offset plane from one of the origin planes (XY / YZ / XZ).

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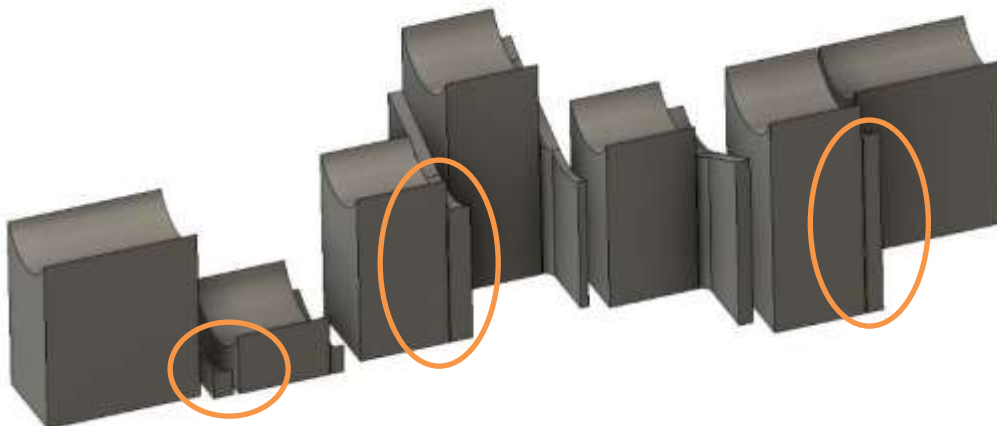
4. Open a sketch and project the **BODY** on the surface. Most CAD software include a function to project the “shadow” of the object onto a surface. This is the easiest solution. You can also get this result by projecting single lines and curves.



5. Check for small gabs between the lines. Most times indicated by a point in a different color. In this case it is shown as a whit point. Fill these gabs and try to create a closed area. IF done right the area should highlight or become active to use for extrusion.

Tip: Remove small lines and replace them with lines or curves to speed up the following steps. Lesser data points is lower calculation time.

6. Create an offset line towards the **INSIDE** of the area. Usealy 1 mm works, but values from 0.2 to 5 mm are possible and can work on the printer (this is an indication we can never state this as a fact for all the geometries).

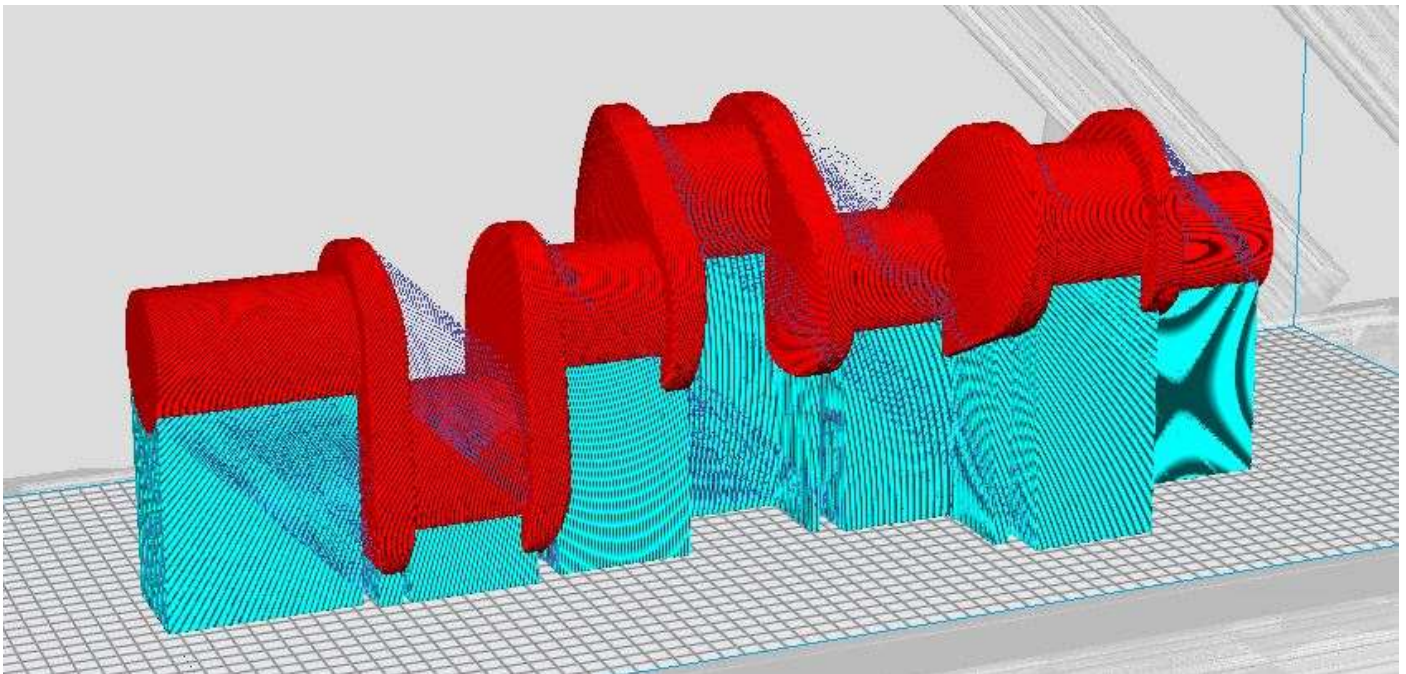


7. If you are satisfied with the offset and the area is active for extrusion. Use the EXTRUSION UP TO BODY to make a NEW BODY. This feature takes some getting used to since it sometimes does not perform as expected. This can be due to undercutting or if a surface is equal to the extrusion surface. When a fillet is used on the original body it's an indication that there might be a difficult area (orange circle). In this example we avoid these areas by keeping a gap. Make sure the extrusion profile is only a profile that can be projected to the surface of the body.

Tip: Vary the offset (step 6) or simplify the extrusion profile to get



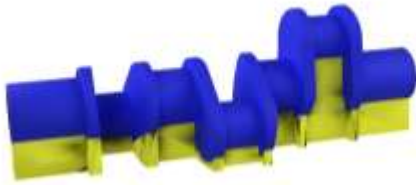
8. Extrude the surfaces that are going to be printed first (start side). If the overhang is too big, the part will not print very well. On the back side, this is not an issue, because previous layers support the next one. In the example, we have two of these spots, extrude the amount of the offset used in step 6.
9. Export the body / bodies as STL. Most software will require you to create a component or group in order to export more than one body into one single STL. Using one STL object is the easiest way to merge and apply support features in Cura.



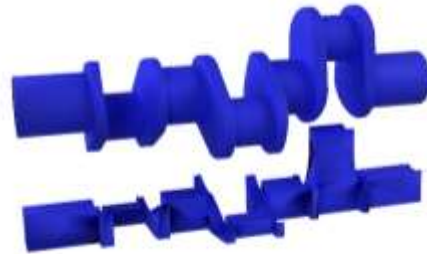
# BLACKBELT

10. Save both files to a folder on your system on which BlackBelt Cura is installed. Make sure both files share a common origin. If the models do not align in the next steps this is the most common issue.
11. Open both models in the same BlackBelt Cura window.
12. Before further positioning, Merge the models by selecting both via `ctrl + "A"` or holding *Shift* key down and clicking on the models [3]. Then right click and select "Merge Models" in the pop-up screen [4].

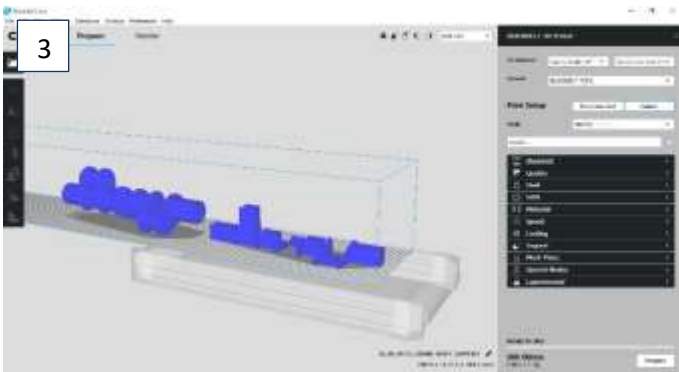
1



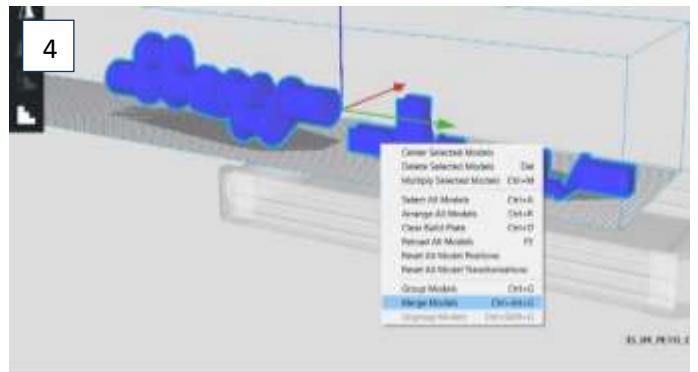
2



3

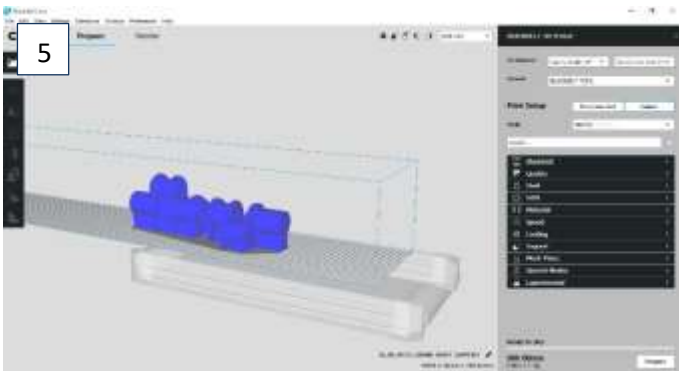


4

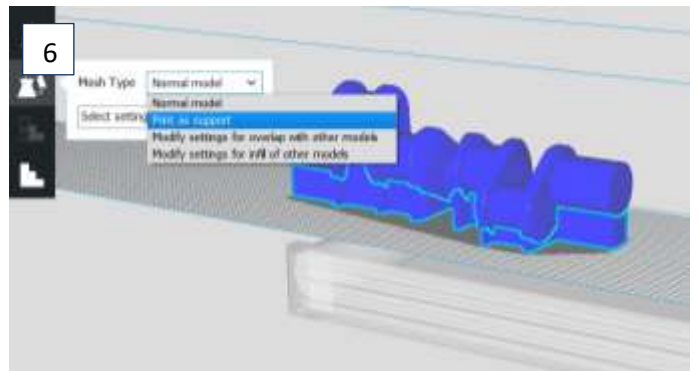


13. When both files are merged they should be aligned and positioned as drawn in your CAD software [5].
14. Select the support structure by holding *Ctrl* and clicking on the model. The "Per model Settings" are now available. Choose in this menu to "Print as Support". When applied correctly the model get a chequered texture. [6]
15. Slice the model and use the "layer view" to see if the support is generated as imagined [7-8].

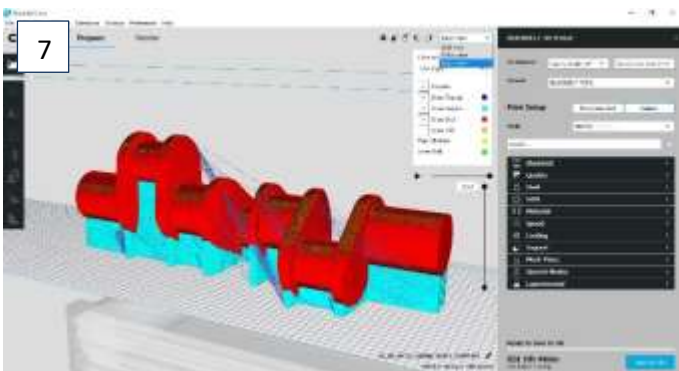
5



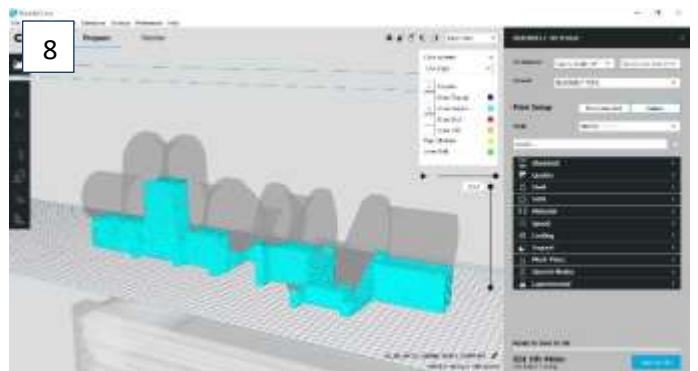
6



7



8



## 4.6 Support for long profiles

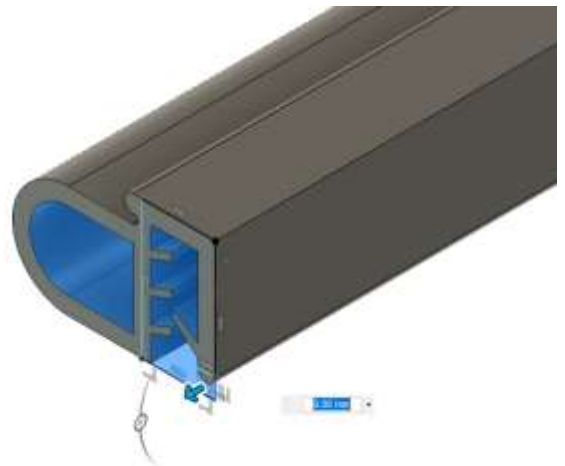
For printing longer profiles the only support structure needed. This part you can later remove or cut off. Especially flex materials are best to just print 10 mm extra in front and in the back and remove these parts later.

1. Open the CAD file or import the STL into your CAD/Design program. [1]
2. Draw sketch filling the enclosed areas form the profile. You do not always need to fill the entire object. Always make sure the parallel areas to the belt are support. Extrude this 5 mm. [2]
3. In the end the support will result in a short support. This makes you do not need to get rid of support all the way to the end. Here some additional structure is drawn to support the floating area. [3]
4. Follow the custom support guide for the next steps and this will be the result. [4]

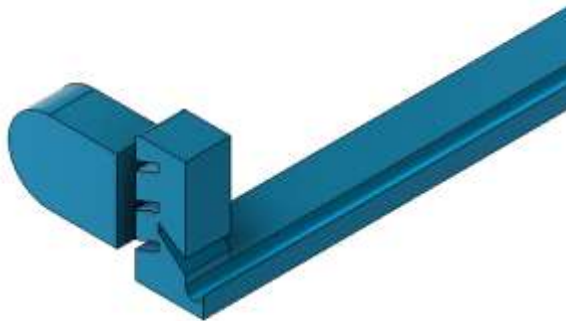
1



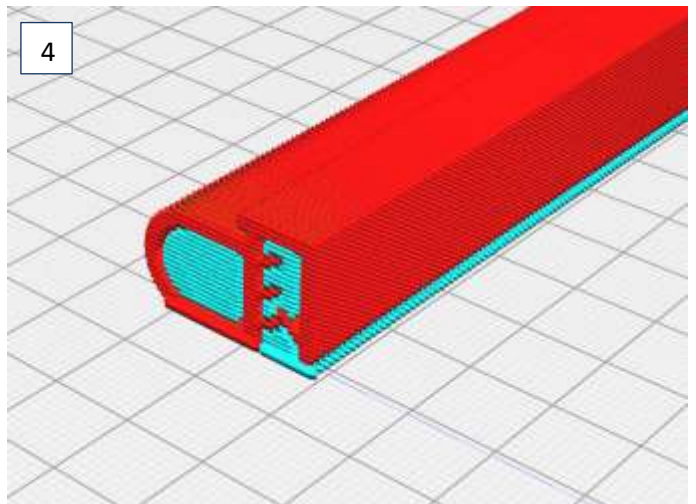
2



3



4



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Please follow all prescriptions as described in this manual. In particular chapter 1.3 : Safety messages.



Maintenance of this machine shall only be carried out by qualified staff following the warning signs on the machine and taking into account the recommendations in this user manual. To re-assure the functionality of the machine we advise in case of accidents to consult Blackbelt 3D BV immediately. Please double check if the instructions in this manual have been executed properly. If the machine is still not functioning properly, please consult the Blackbelt 3D BV service desk. (mail : [support@blackbelt-3d.com](mailto:support@blackbelt-3d.com))



Keep hands / hairs / loose clothing / jewelry away from moving parts in the machine. Wear appropriate clothes preventing loose hanging clothing parts.



As long as the machine is active and / or switched on, no connector or safety feature shall be removed. Only use the machine if all safety features are in place and functional.



Inform your staff or users prior to starting maintenance or repairs. Switch of the main power switch.

## 5.1 Customer service and support

Our technical and support department will answer all your questions about repair and maintenance of your machine and spare parts. Team BLACKBELT 3D is happy to advise you regarding your purchase, use of the machine and setting up the products, as well as applying the correct design guidelines. Please contact us at [support@blackbelt-3d.com](mailto:support@blackbelt-3d.com).

### Support procedure:

1. Create a few clear pictures of the situation
2. If available save a project file as described in chapter 3.6.2
3. Send all this info to [support@blackbelt-3d.com](mailto:support@blackbelt-3d.com)
4. We will respond within 3 working days. If not please call us on the following number **+31 77 3333 790** to check in on the progress.

## 5.2 Preventive maintenance

For regular use of the machine the maintenance schedule below can be used in regular intervals. In case of intensified use or use in extreme circumstances the maintenance schedule intervals need to be doubled.

Item	Frequency	Remarks
Machine	Continuously	Keep the conveyor belt clean. Remove materials that can disrupt the functionality of the machine
Machine	Continuously	Assure there is enough filament on the spool to print a part
Machine	Daily	Double check if all moving parts do not jam and move correctly. Broken or damaged parts shall be removed and replaced upon repair. Printing using damaged parts will shorten the lifetime of other components.
Bearings / linear bearings	Every 6 months	Apply grease type Klüber ISOFLEX TOPAS NB 52 (bearing grease) Use a grease syringe.



## 5.3 Calibration Y axis

You'll need a 5mm and 3mm Hexagon key and a sheet of paper

5. Set the gantry to 45° and mount a printhead.
6. Take a piece of paper, put it on the conveyor belt and place the printhead onto it:



7. Turn the printer on, press the jog wheel, select by rotating and pressing  
Prepare → Move axis → Move Y → Move 0.1mm

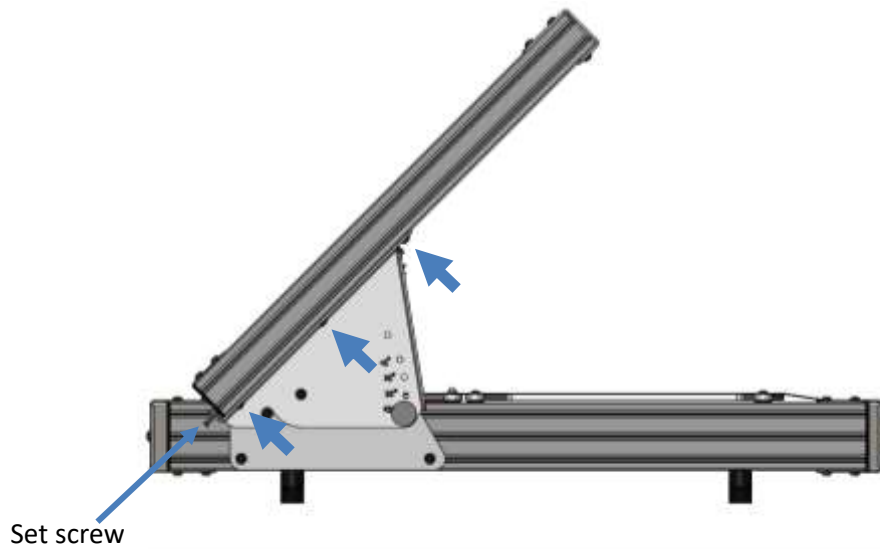


8. Turn the jog wheel to the right until you can move the paper freely
9. Now carefully move the printhead by hand to the left and right side, while constantly checking with the piece of paper if you can still move it freely. Do not move any further when you notice a resistance. [3]



10. If you start noticing a resistant at one side, move the printhead to the opposite side.
11. Loosen the following 3 screws for ½ rotation at one side of your choice, using the 5mm Hexagon key:

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12. Adjust the set screw to level the gantry - clockwise if the printhead is now at the same side, or counterclockwise, if the printhead is now at the other side.

[5-6]

13. Tighten the 3 screws again

14. Check calibration as described in step 5 and 6

15. Repeat step 5-9, until both sides have the same distance to the belt on both sides.



## 5.4 Belt adhesion maintenance

To increase the adhesion between the 3D printed part and the conveyor belt, the belt surface can be cleaned by detergent. Especially when 3D Lac or any other adhesion agency is used we strongly advice to clean the belt at least every month.



*In order to prevent permanent damage to the conveyor belt or the machine. Please follow all steps as described.*



*Turn the machine off!! Do not throw under any circumstances water on the belt or the machine.*

In order to correctly roughen the belt, the following requirements are necessary:

- Isopropyl Alcohol or similar cleaning agency without additives
- Paper tissue or clean cloth
- Moist cleaning cloth with a drop of detergent

1. Make sure that the conveyor belt is free from objects or material residue. Move the belt once around by hand to check that all spots are clean.
2. Clean the belt with the detergent and moist cloth over the entire surface. Move in several directions to get rid of all the particles. [1]
3. After cleaning the entire belt surface, apply the Isopropyl alcohol directly to a second cloth and wipe the belt clean of soap residue. [2]
4. When the alcohol vaporizes, and the belt looks clean you can start you prints again.



## 5.5 Heated bed modification

When printing long parts or parts that need additional heating for a longer period, the machine can be adjusted for a longer hot zone. This is often used when printing with filament that requires a heated bed above 80 degrees Celsius and is bigger than 100 x 100 mm in length and height. Printing in ABS or colorFabb HT often requires this modification.



*Before taking these steps make sure the printer is turned off, the power cable is unplugged, and the bed is cooled down to room temperature < 30 °C*

For parts that extend the heated area during printing, we recommend doing a onetime modification to the printer. This will not affect the printing performance for the other materials. To extend the heated zone for long adhesion to the belt.

1. Take a number 5 Hexagon key
2. Loosen the 4 bolts indicated with the arrows in [1].
3. Push the front plate backward until it's aligned with the hot plate. This will increase the hot zone of the printer.
4. Fix the bolts before plugging the power cable back in and turning the printer back on.

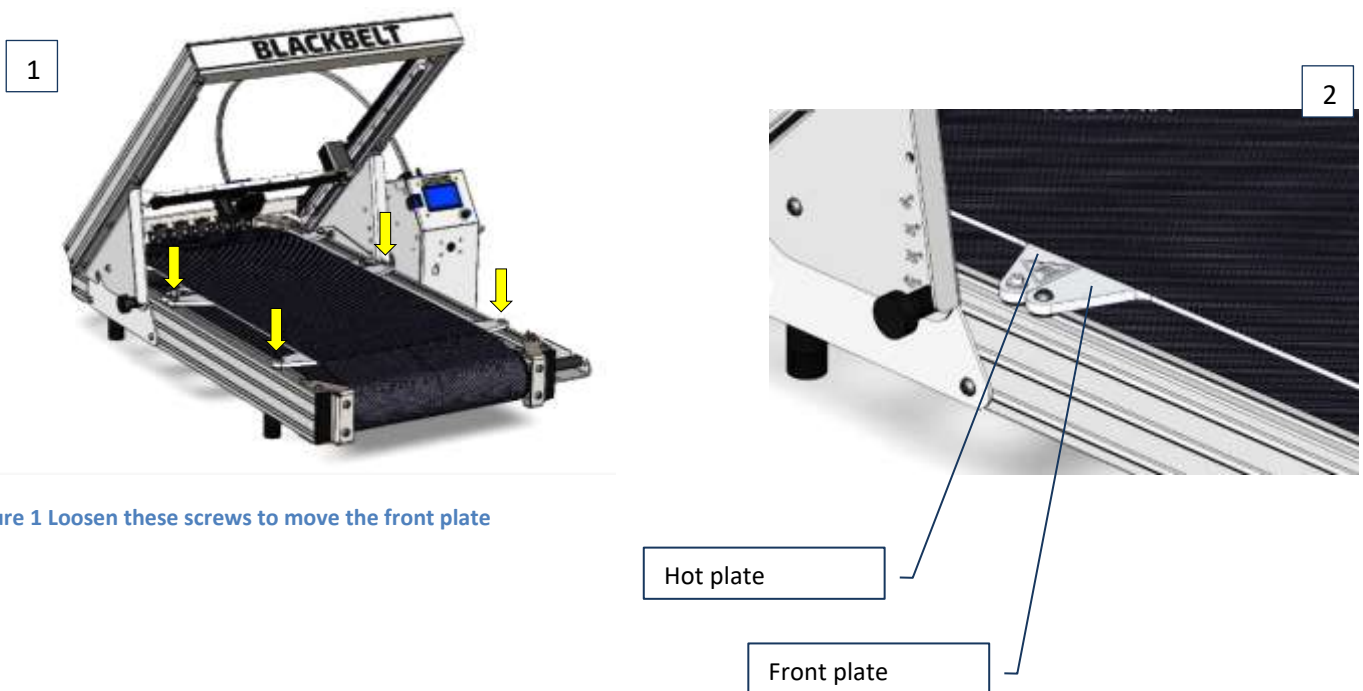


Figure 1 Loosen these screws to move the front plate

## 5.6 Spare parts

Only original spare parts and machine parts of BlackBelt 3D BV can be used in the machine.

All consumer and spare parts can be found in the web shop of [Blackbelt-3d.com](http://Blackbelt-3d.com) or by direct inquiries at [sales@blackbelt-3d.com](mailto:sales@blackbelt-3d.com). When sending inquiries always remark the number of parts and specifications.

Spare Parts list with numbers

Category	Part	Partnumber	Version	
Consumables	Printhead bowden 0.25	BB-PH-250-B BB-PH-250-H	1. Brass 2. Hardend steel	
	Printhead bowden 0.4	BB-PH-400-B BB-PH-400-H	1. Brass 2. Hardend steel	
	Printhead bowden 0.6	BB-PH-600-B BB-PH-600-H	1. Brass 2. Hardend steel	
	Printhead bowden 0.8	BB-PH-800-B BB-PH-800-H	1. Brass 2. Hardend steel	
	Printhead bowden 1.0	BB-PH-100-B BB-PH-100-H	1. Brass 2. Hardend steel	
	Nozzlekit varioDrive 0.4	BB-VDPH-400	1. Thungsten carbide	
	Nozzlekit varioDrive 0.6	BB-VDPH-600	1. Thungsten carbide	
	Nozzlekit varioDrive 0.9	BB-VDPH-900	1. Thungsten carbide	
	Nozzlekit varioDrive 1.2	BB-VDPH-120	1. Thungsten carbide	
	Spare Belt	BB-CB-001	1. Carbon belt	
Printer	Y-axis Motor	BB-P0014		
	X-axis Motor	BB-P0013		
	Linear guide rail with runner Y-axis	BB-P0180-L BB-P0180-R	1. left 2. right	
	Linear guide rail with runner X-axis	BB-P0181		
	Roller front	BB-P0068	with bearings / geared	
	Roller back	BB-P0069	with bearings	
	Bowden tube (860 mm)	BB-P0179-860	with tie wraps	
	Printhead blower fan	BB-P0029		
	Printhead cooling fan shroud	BB-P0045		
Electronics box	Rambo motherboard	BB-P0093	v1.4	
	Rambo Fuse 5A	use description		
	USB cable	BB-P0135	1. USB A - USB B	
Others	Allen key 3mm	BB-P0097		
	Allen key 5mm	BB-P0098		
	Wooden packaging crate	BB-P0092		

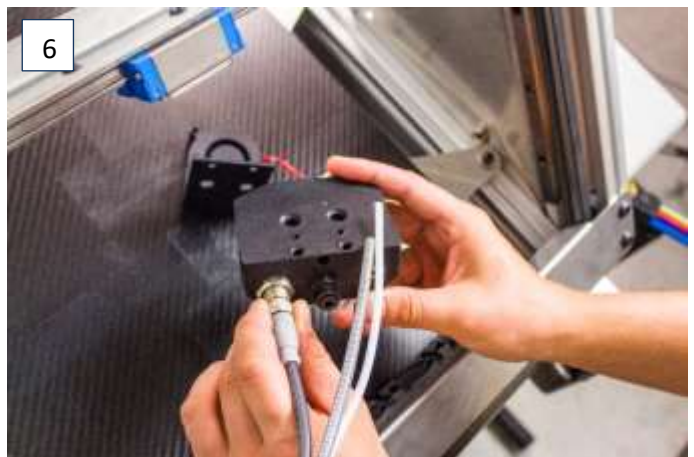
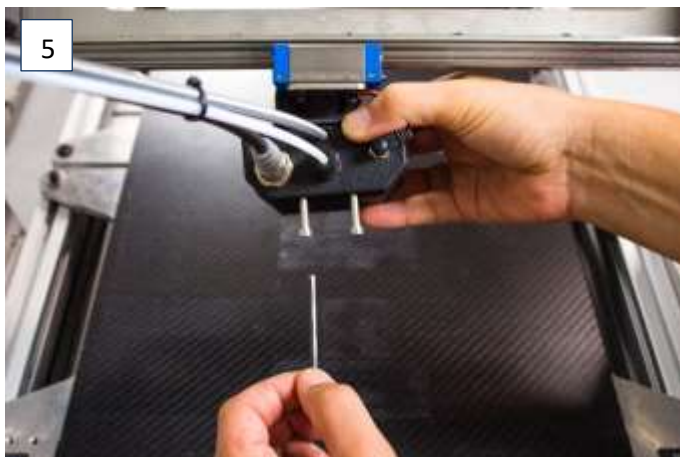
In the following chapters we will explain some of the handling steps of replacing the most common spare parts.

## 5.7 Changing the belt

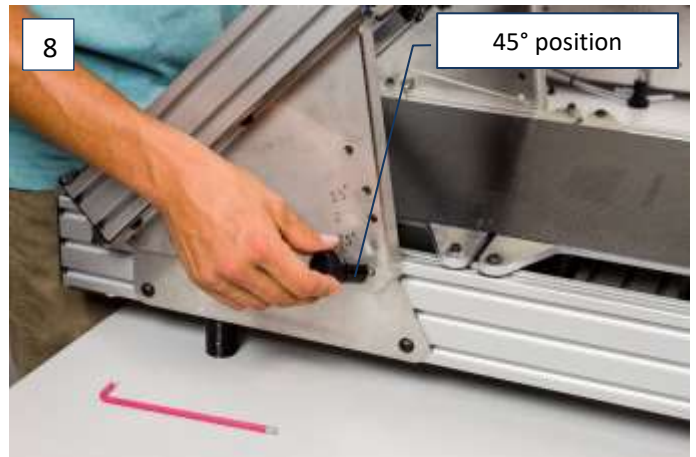


Please make sure all the material is removed from the printer. The material removal steps are explained in chapter 3.5.

1. Turn off the machine and disconnect the controller box [1-3]
2. Remove the printhead, please make sure all the cables are removed [4-6]



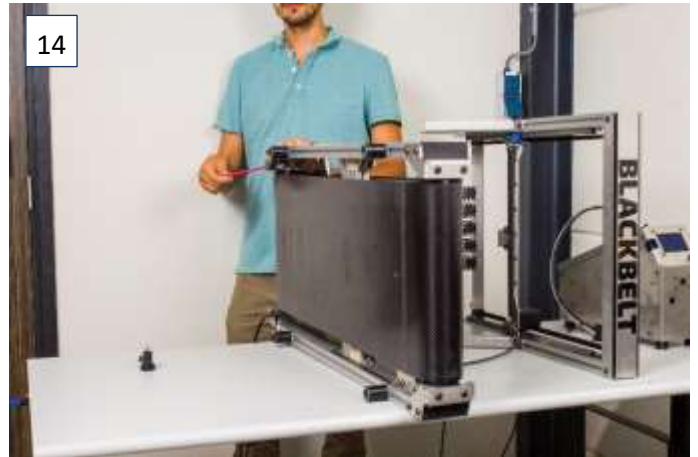
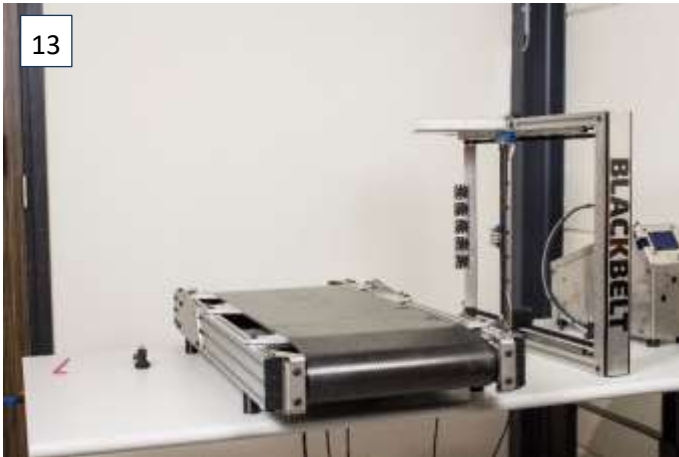
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3. Remove the controller box, make sure that there is enough space to the right of the machine [7]
4. Set the machine to 45° [8]
5. Remove the 2 screws at the hinge – the gantry will now hold its position [9-10]
6. **Detach the rear fan cable!** [11]
7. Remove the 2 angle adjusting knobs (3) while holding the gantry up with one hand [12]



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8. Take off the gantry and put it to the left besides the printer [13]
9. Set the base unit upright [14]
10. Loosen the rear roller with the rear 2 screws [14]
11. Unmount the rear roller while **holding it with the other hand** [15]
12. Remove the rear roller [16]
13. Remove the conveyor belt [17-18]
  - a. Move it carefully to the front, between the limitations
  - b. Now lift the front side of the belt above the mount of the front roller



14. Mount the new belt [19-20]
  - c. Check the belt direction
  - d. **Carefully position the belt to the rear of the printer**
  - e. Then put it over the front roller
15. Put back the rear roller inside the conveyor belt [20-21]
16. Mount the rear roller with the 2 rear screws. Turn at the short side of the Hexagon key to not overtighten the belt. [22-23]



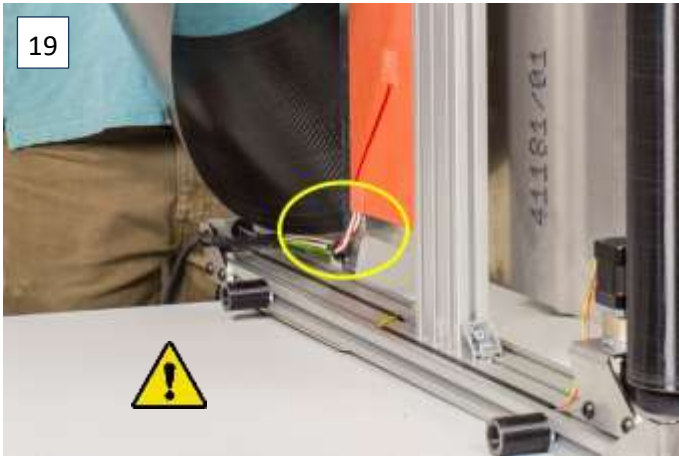
17. Turn the base unit back on its feet

[24]

- f. **Make sure the belt is between the guiders!** In the latest models the guiders have been removed from the design. **In that case make sure it is in the middle, with even space left and right.**



*Follow instructions in Chapter 5.8 for the belt calibration before continuing this guide.*



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18. Put the gantry back on the base unit and mount it in 45° position with the 2 angle adjusting knobs [25]
19. Mount the 2 screws at the hinge back again. [26]
20. After a belt-change you will need to calibrate the Y axis as explained in chapter 5.8.

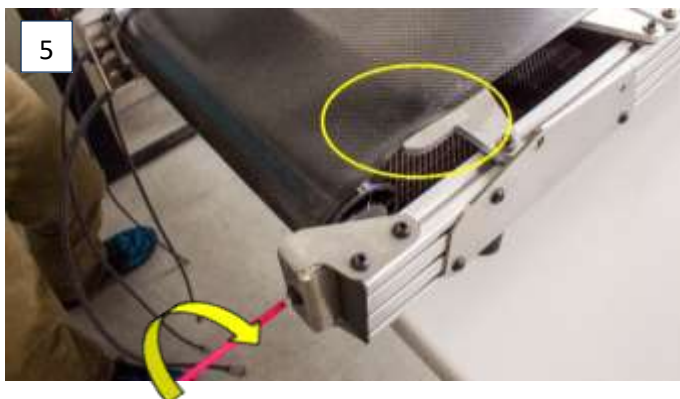
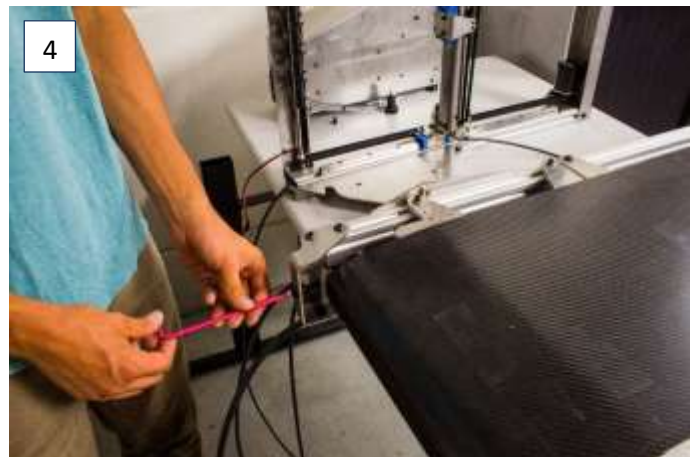


## 5.8 Calibrate the belt



*In this procedure we need to touch the belt with the hands. Make sure that you have clean hands with no grease on them to keep the conveyor belt clean.*

1. Make sure that the conveyor belt is in between the limitations. [1-2]
  - a. Check the tension of the belt. Pull up the belt mid between the front roller and the front build plate.
  - b. With a decent pull of your index finger you should not be able to pull it higher than the build plate. If you can pull it higher, tighten the rear screws a bit more, so its levels with the build plate.
2. Turn the belt manually by hand in the printing direction. [3-6]
  - a. If you notice the belt going towards one of the limitations, tighten that side for half a rotation and loosen the opposite side for half a rotation
3. Repeat step 2 until the belt does not move to one of the sides
4. Check the belt tension once again, make sure that you cannot lift the belt above the build plate [2]

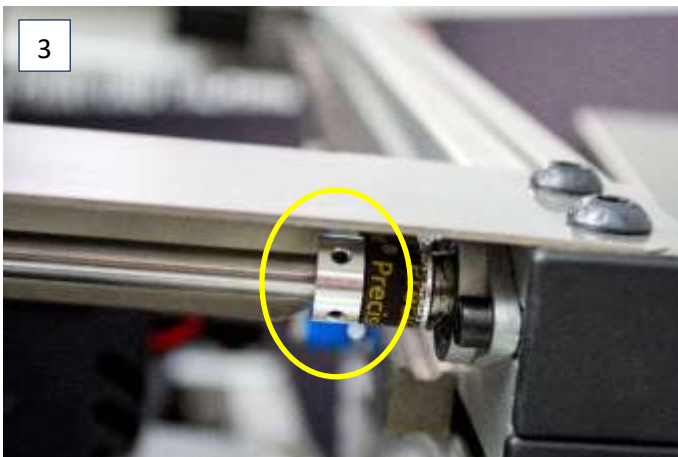
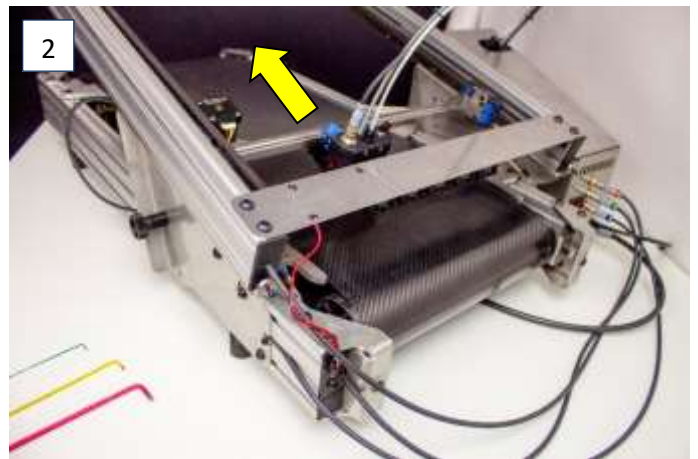


## 5.9 Synchronize the Y-motors

You'll need a 1,5mm Hexagon key

When you encounter misalignments during printing or small level shifts, a likely cause can be non-synchronized y-motors. Please follow these steps to make sure the Y motors are synchronized again.

1. Turn on the machine. [1]
2. Position the x-gantry up a bit, leave room to move up with the controller. [2]
3. Use the jog wheel to go to *Prepare / Move axis / Move Y / 10mm*. [3]
4. Loosen the set screws using the hexagon 1.5 key. You might need to move the Y-axis to reach the other screw. [3]
5. Move the X-gantry up and down using the controller.
6. The motors are now synchronized again.
7. Tighten the screws again.
8. Always check the Y-alignment and recalibrate when needed before printing [4]



## 5.10 Upgrade machine Firmware



*This does not apply to the varioDrive, use Manual upgrade firmware for varioDrive instead.*

In order to correctly update the firmware, the following requirements are necessary:

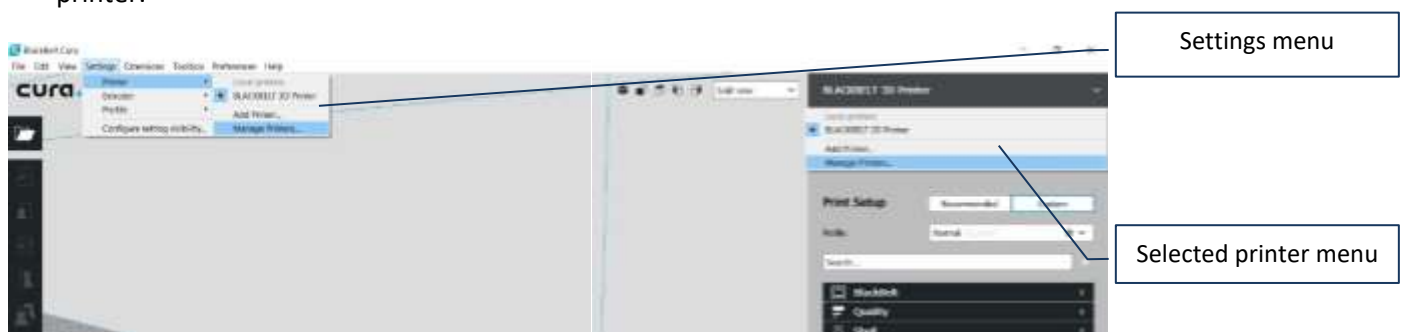
- A Mac or PC equipped with an SD card reader. The newest version of BLACKBELT Cura software needs to be installed onto the hard drive as described in chapter 3.6  
<https://blackbelt-3d.com/download-area>
- The USB cable supplied with the BlackBelt 3D printer.



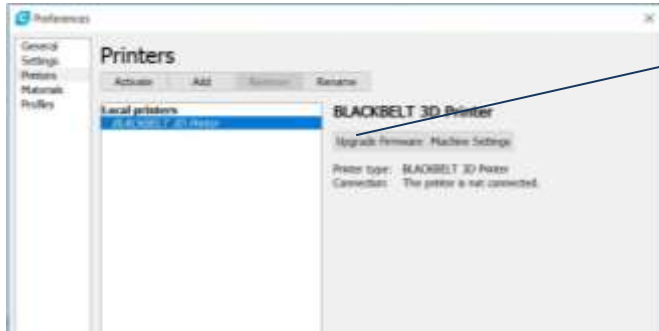
1. First turn on the BlackBelt 3d controller by flipping the main switch and make sure it powers up.
2. Hook-up the machine to the MAC or PC using the USB cable. The USB port of the printer can be found in the front side of the controller console marked USB (figure 1+2). Make sure that the orientation of the USB plug is as indicated below – the flat side pointing left:



3. Open BLACKBELT Cura on the device that is just connected to the printer.
4. Open the “manage printer” menu (figure 2) under “settings / printer” or in top right corner under the selected printer.

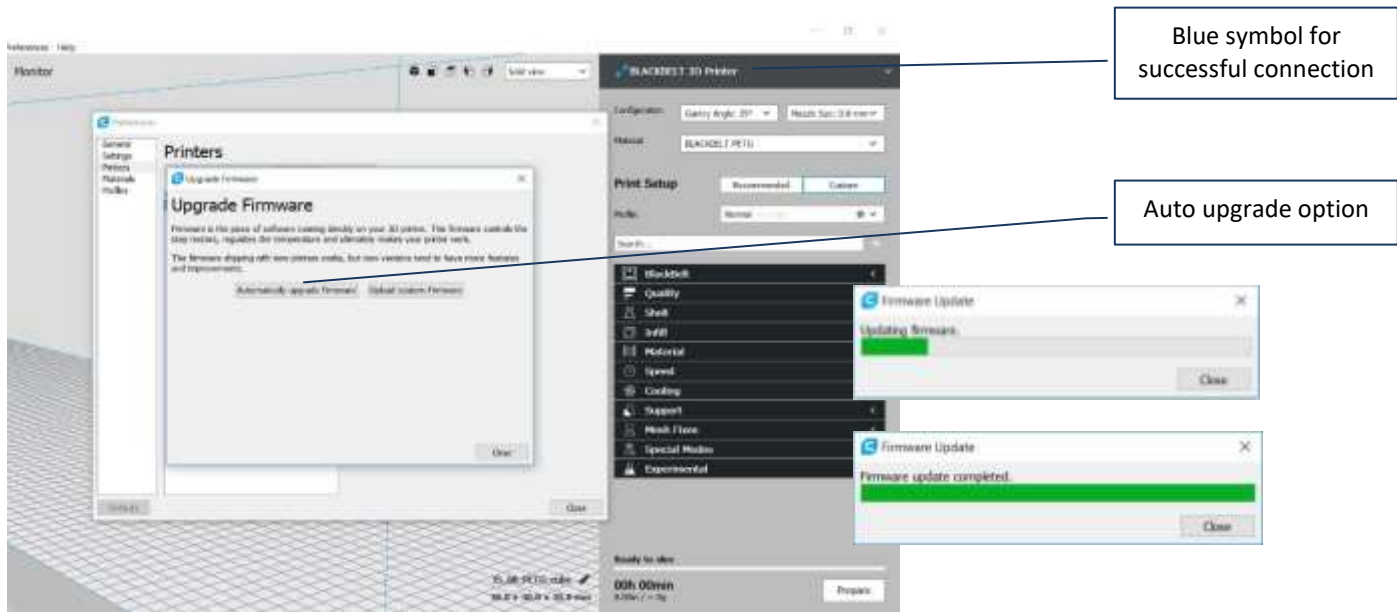


5. Now select the BlackBelt printer if this is not already the case and press “Upgrade Firmware” (figure 3).



Upgrade firmware menu

6. The upgrade menu should open where you choose “Automatically upgrade Firmware”. Wait for the process to complete and close all the windows until your back in the main program. Your 3D printer is now up to date with the newest version of the BlackBelt Firmware



Blue symbol for successful connection

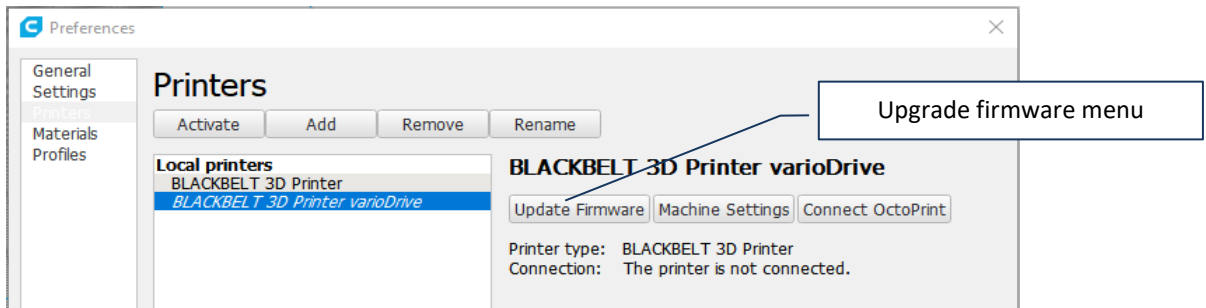
Auto upgrade option

7. If it is not possible to start the update process,
- Make sure that the 3D Printer is turned on.
  - Use a different USB port on your MAC or PC.
  - Check next to the printer name if there is a connection symbol.  
Possible solution: reconnect the USB to the device or wait for the drivers to be installed.
  - Replace the USB cable.
  - Contact [support@blackbelt-3d.com](mailto:support@blackbelt-3d.com)

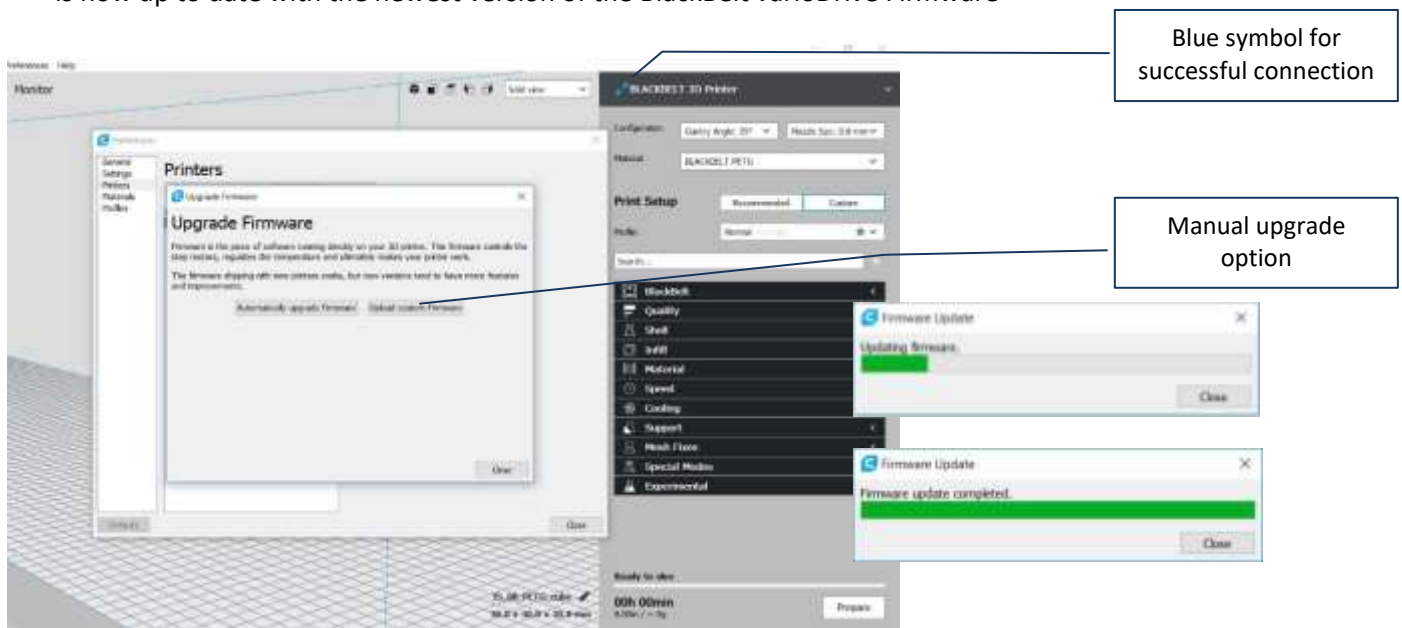
## 5.11 Manual upgrade firmware [varioDRIVE]

Follow steps 1-4 from the previous chapter 5.10 and continue with the following steps:

- Now select the **BlackBelt 3D printer varioDrive** if this is not already the case and press “Upgrade Firmware” (figure 3).



- The upgrade menu should open where you choose “Upload custom Firmware” and browse to the downloaded file **BB\_varioDrive\_Firmware-vX.X.hex**. Select the file as custom firmware.
- Wait for the process to complete and close all the windows until your back in the main program. Your 3D printer is now up to date with the newest version of the BlackBelt varioDrive Firmware



- If it is not possible to start the update process,
  - Make sure that the 3D Printer is turned on.
  - Use a different USB port on your MAC or PC.
  - Check next to the printer name if there is a connection symbol.  
Possible solution: reconnect the USB to the device or wait for the drivers to be installed.
  - Replace the USB cable.
  - Contact [support@blackbelt-3d.com](mailto:support@blackbelt-3d.com)

Intentionally left blank



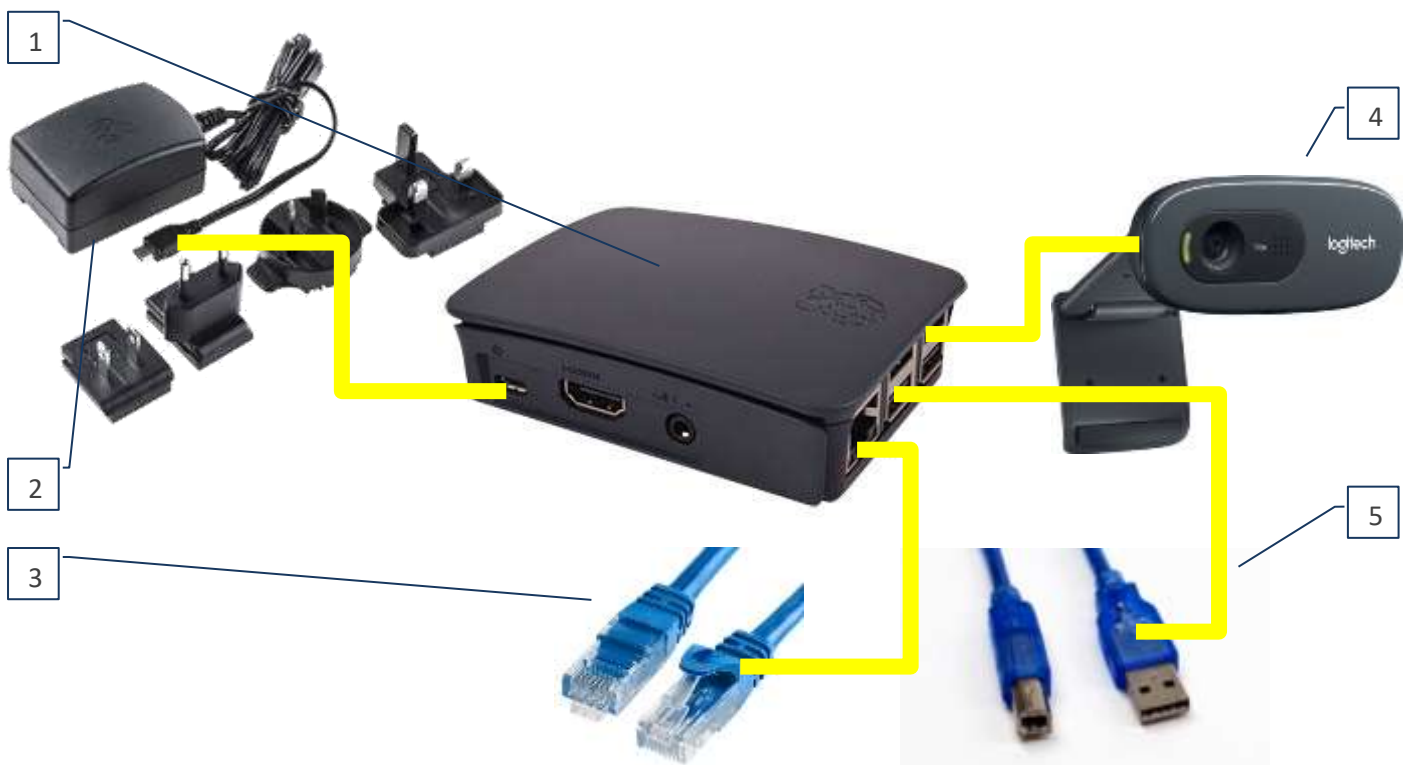


## 6.1 BlackBelt Server

Packing list BlackBelt server			
nr.	Amount	Description	order number
1	1	Raspberry Pi board	BB-P0167-RBPi
1	1	SD-card with installation	BB-P0167-SD
1	1	Power adapter (universal)	BB-P0167-PA
4	1	Webcam Logitech HD720	BB-P0168
	1	Webcam mount	BB-P0169
	2	Cable cover (100 mm)	BB-P0081-100

In order to correctly update the firmware, the following requirements are necessary:

- A Mac or PC equipped with an SD card reader. The newest version of BLACKBELT Cura software needs to be installed onto the hard drive as described in Installation manual chapter 3.6  
<http://www.blackbelt-3d.com/download-area>
- BlackBelt Server box. [ 1 ]
- Server power plug with your local adapter plug. [ 2 ]
- Ethernet cable to connect the server to your local network (not included, if present always contact your ICT department for connection to the network). [ 3 ]
- Compatible webcam (supplied with the server). [ 4 ]
- The USB cable supplied with the BlackBelt 3D printer. [ 5 ]

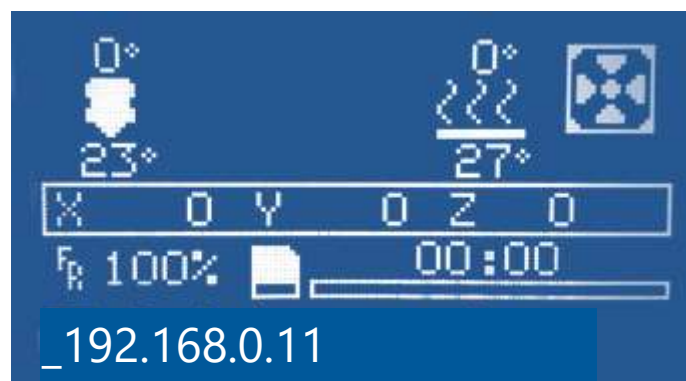


# BLACKBELT

8. First turn on the BlackBelt 3d controller by flipping the main switch and make sure it powers up.
9. Hook-up the machine to the server box with the USB cable. The USB port of the printer can be found in the front side of the controller console marked USB (figures 1+2). Make sure that the orientation of the USB plug is as indicated below – the flat side pointing left:



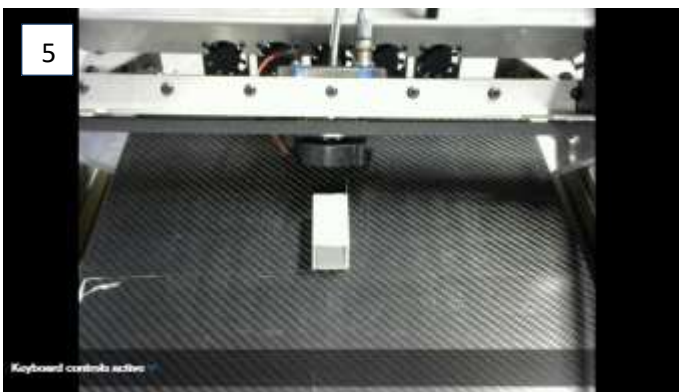
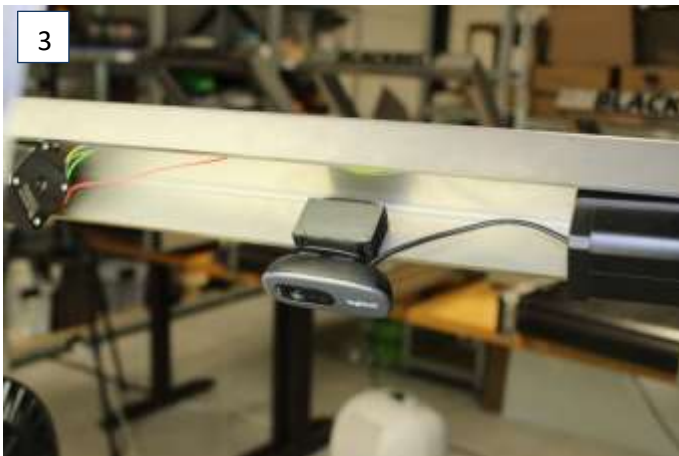
10. Connect the webcam and the Ethernet cable to the correct ports.
11. Plug in the power adapter and plug the micro Sd plug in the correct port in the server box
12. When the server boots up the printer will reset and boot up again automatically.
13. When the correct connection is established the LCD screen will show you the IP-address of the server.



## 6.1.1 Webcam mount

The package is supplied with a 3d printed webcam mount. Follow the instructions below to correctly install the webcam for optimal use.

1. Move the clip over the webcam with the rubber dots towards the lip. [1-2]
2. Place the webcam on the inside of the frame with BlackBelt logo on it. Make sur the lip is on the outside. [3-4]
3. Afterwards you can tune the angle and position if it's not fully aimed at the center. [5-6]



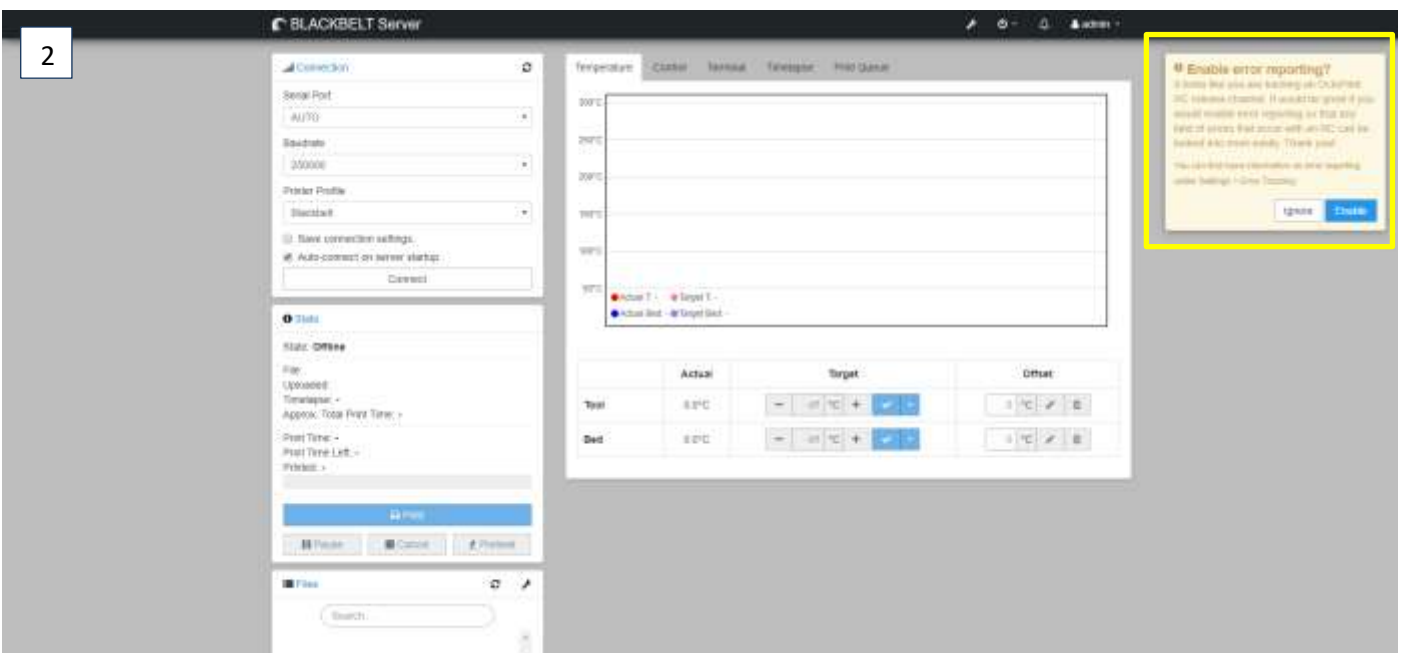
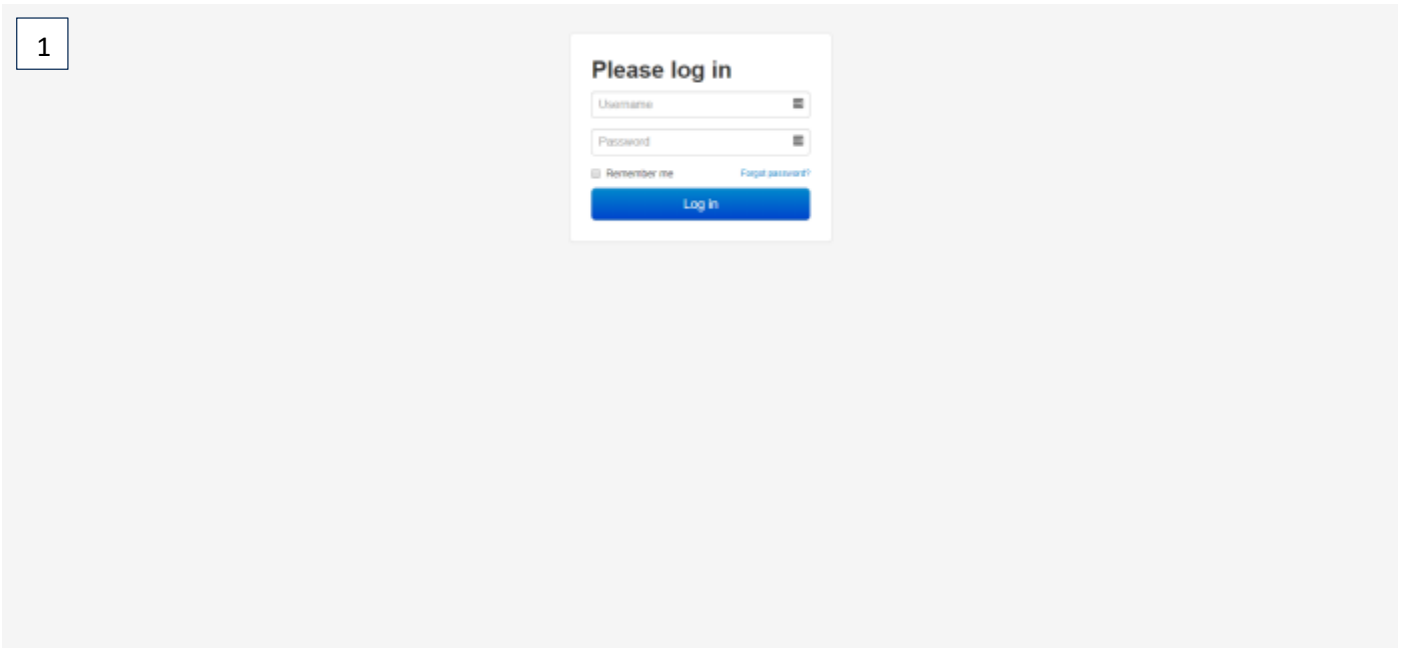
## 6.1.2 Software setup

To make sure the BlackBelt server runs optimal in your local network run the following steps to setup all the software.

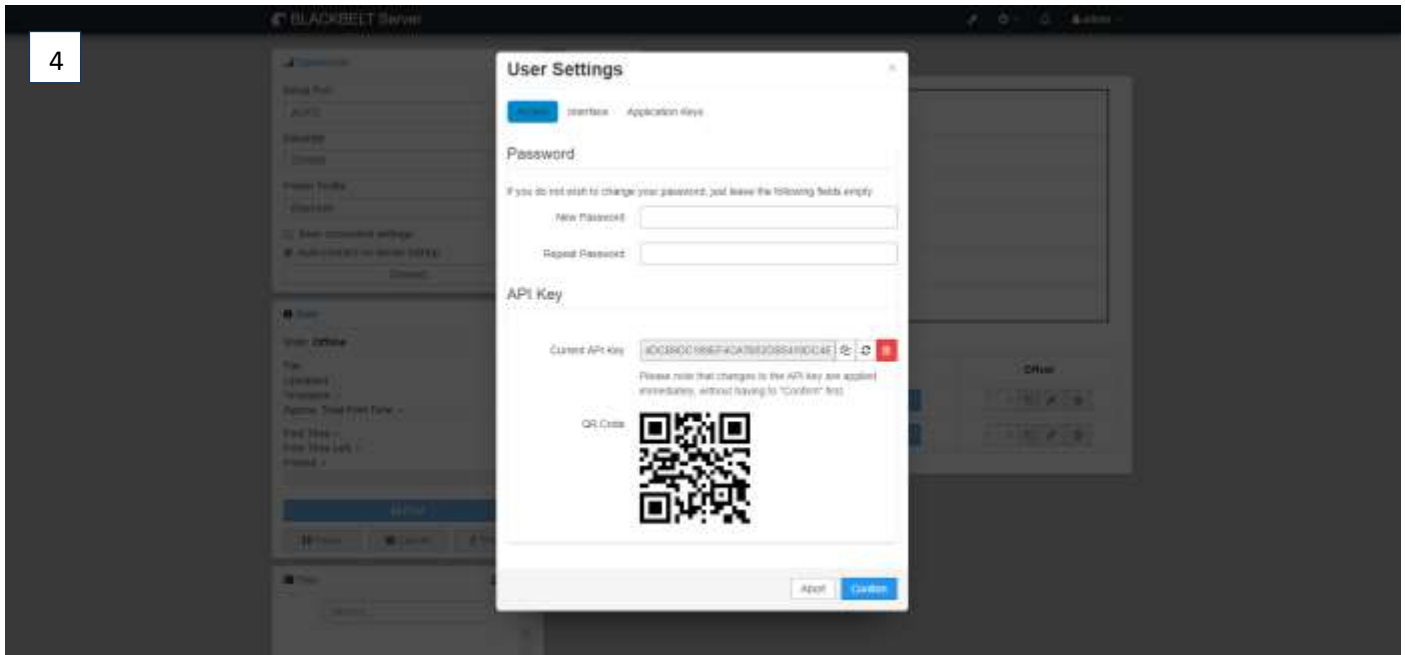
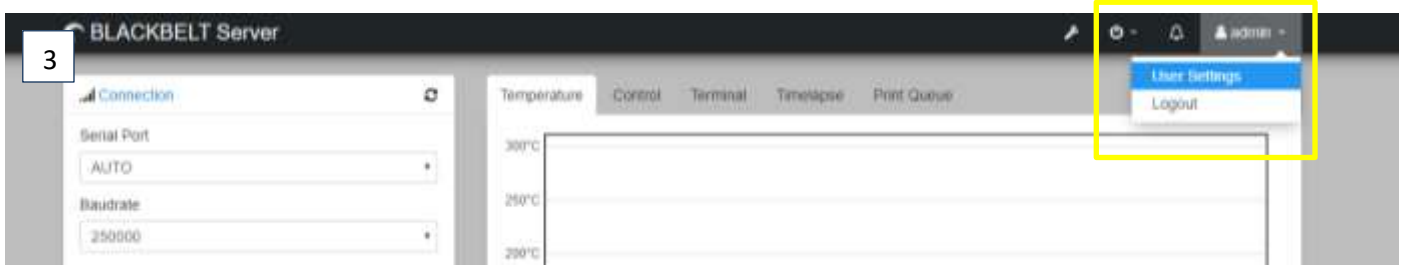
1. Open your browser and surf to the IP-address that is shown on the LCD screen and a login screen will pop-up. To enter the server for the first time please use the following info: [1]

Username	<b>BLACKBELT</b>
Password	<b>Server</b>
Admin	<b>admin</b>
Password	<b>BB#server</b>

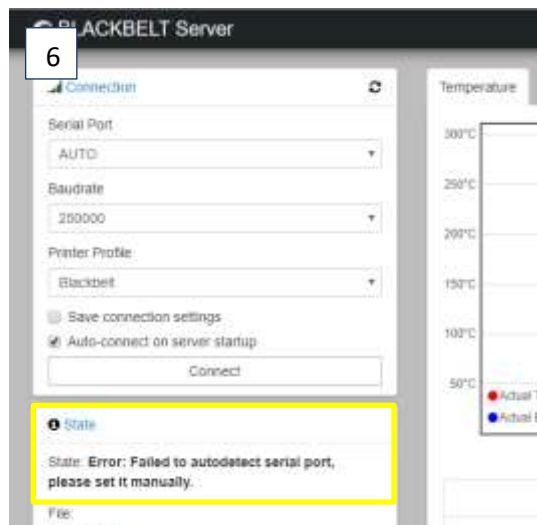
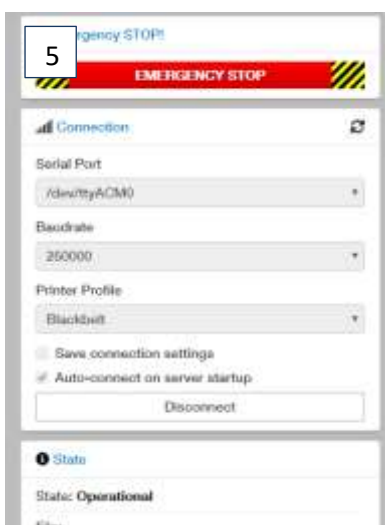
2. After login in you will see some pop-up to the right you can choose to enable error reporting and it will ask for updating the plugins that are not up to date. We recommend applying all the updates and enable error reporting.



3. Feel free to change to standard password to one of your choosing to increase security. Go to admin user menu and click on user settings. A screen will pop-up that allows you to change the password. [ 3-4 ]



4. If your all setup updated and rebooted, you can check the connection to the machine by checking the connection screen and state. If it is not auto connected press the connect button. If an error state is shown the following things are most likely:
  - a. The power to the printer is down and the printer is offline (power on the machine)
  - b. The USB-cable to the printer is not connected (connect it)
  - c. The printer itself is busy or in error state (finish the print or restart the printer).
  - d. If it none of the above, contact [support@blackbelt-3d.com](mailto:support@blackbelt-3d.com) for further assistance.



5. If everything is ok and the printer is connected. You should see an *Operational* state and a temperature read out [ 7 ].

The screenshot displays the BLACKBELT Server interface. On the left sidebar, there is a red 'EMERGENCY STOP' button, a 'Connection' status indicator, and a 'State' section showing 'Operational'. Below this are buttons for 'Print', 'Pause', 'Cancel', and 'Cool'. A 'Files' section shows a folder named 'BB test files' with a size of 5.5MB. The main area is divided into tabs: 'Print Queue', 'Control', 'Timelapse', 'Temperature', and 'Terminal'. The 'Temperature' tab is active, showing a graph of temperature over time. The graph has a y-axis from 50°C to 300°C and an x-axis labeled '- 2 mm'. A red line represents the 'Actual T: 41.7°C' and a blue line represents the 'Actual Bed: 40.3°C'. A legend indicates 'Target T: 240.0°C' and 'Target Bed: 70.0°C'. Below the graph is a control table:

	Actual	Target	Offset
Tool	41.7°C	- 240 °C +	0 °C
Bed	40.3°C	- 70 °C +	0 °C

## 6.1.3 File upload

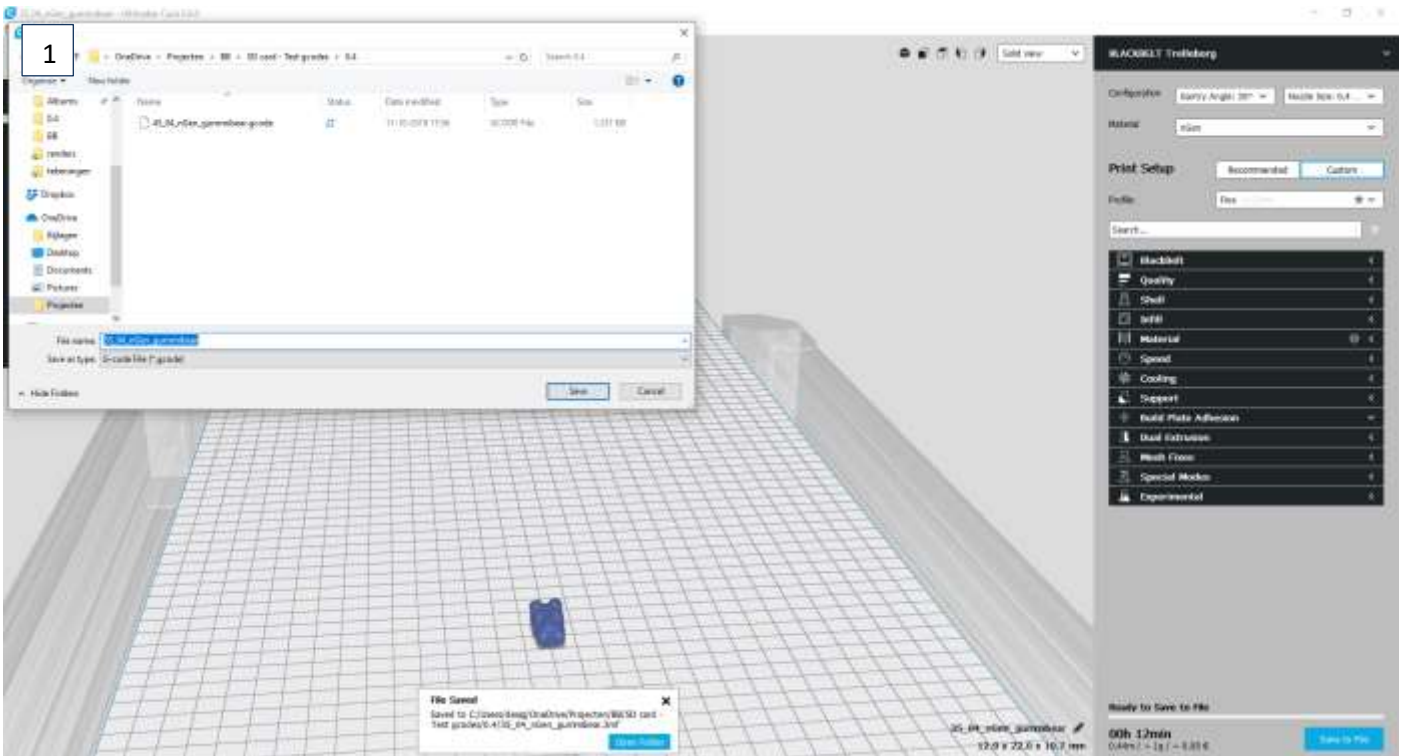
When the server is operational you can start uploading files to the server and start your first print. We already uploaded a few files when you want to test drive the connection.



Always double check the angle and nozzle setup on your printer before starting the print remotely. There is no feedback loop and you will not get a warning. Printing with the wrong physical setup can cause damage to the printer.

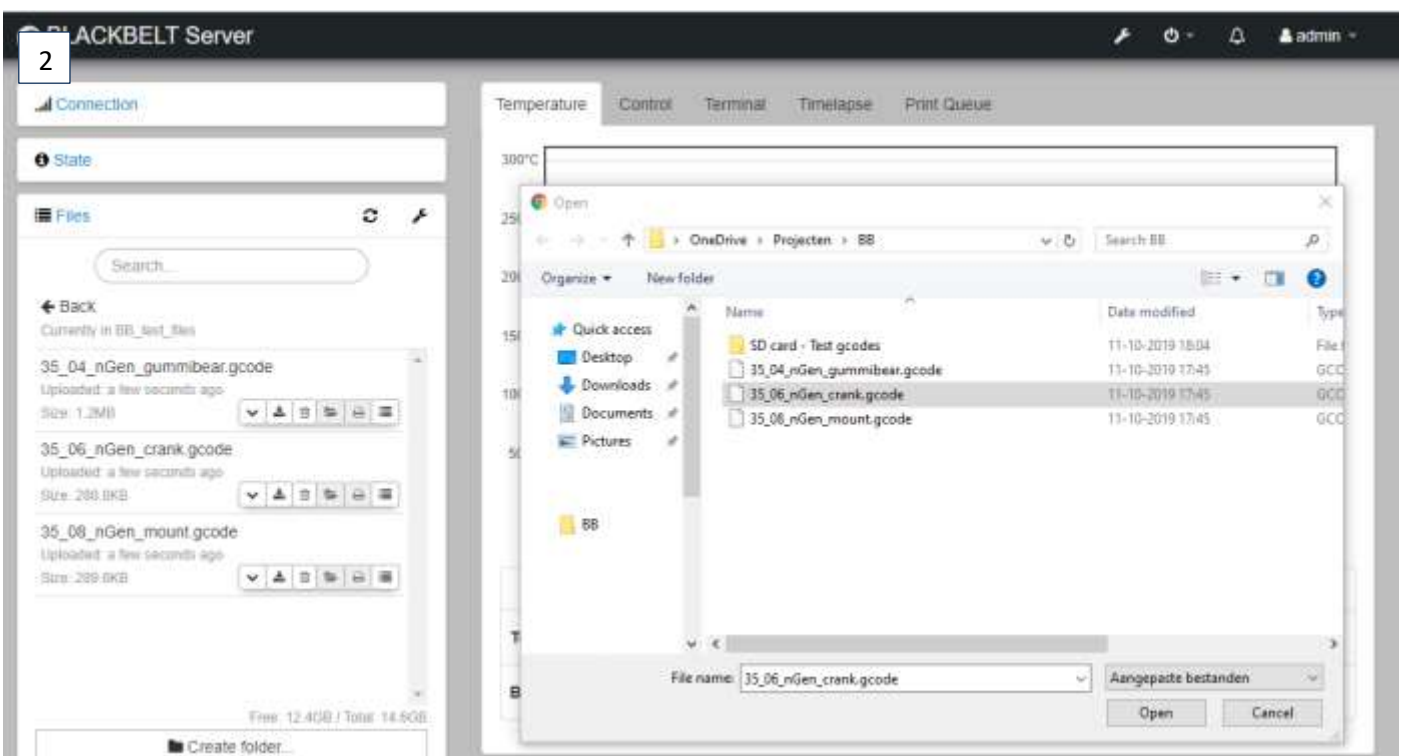
1. Prepare a file in BlackBelt Cura like your used to for SD-card printing.
2. Save the file to a known location on your device as GCODE.

[1]



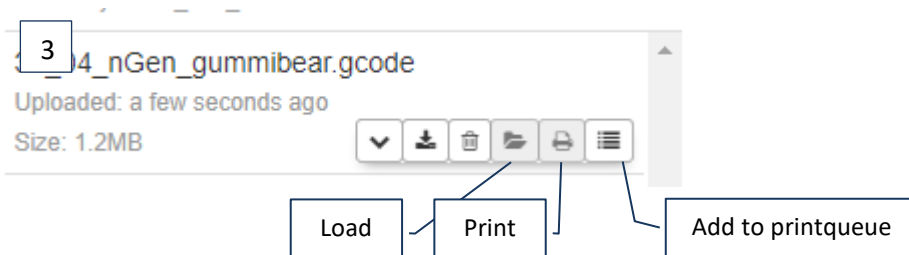
3. Upload the file using file upload button or drag the GCODE into the browser.

[2]



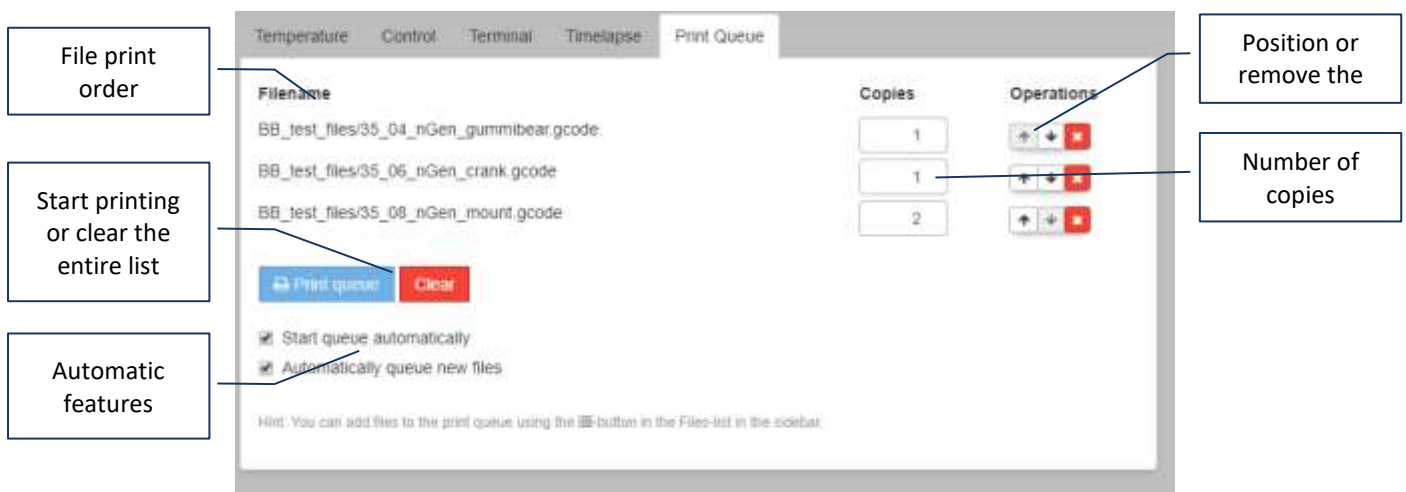


4. The filename will contain the ANGLE and NOZZLE info to keep track of the setup for the printer. Make sure the printer is angled correctly!
5. Start your print by using the following functions [3]
  - a. **Load**: this preloads the file but does not start printing
  - b. **Print**: this will load the file and starts to run the GCODE.
  - c. **Print queue**: this will add the file to the queue and prints it when the rest of the queue is printed (chapter 6.1.4 for more info).
6. If you only preloaded the file you can start the print by pressing print in the *State* section



## 6.1.4 Print queue

The BlackBelt Server is equipped with a special *Print Queue* plugin developed to print 24/7. Especially for series production of custom objects this is a must use feature.



## 6.1.5 Timelapse

Need to promote your work or check up on production flaws or failures the *Timelapse* is a great feature.

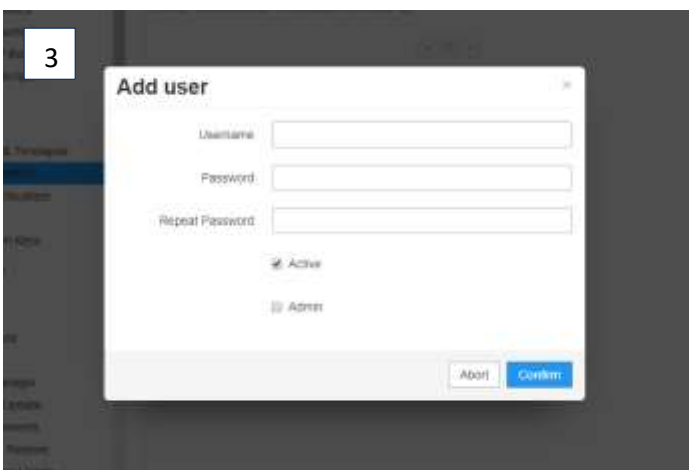
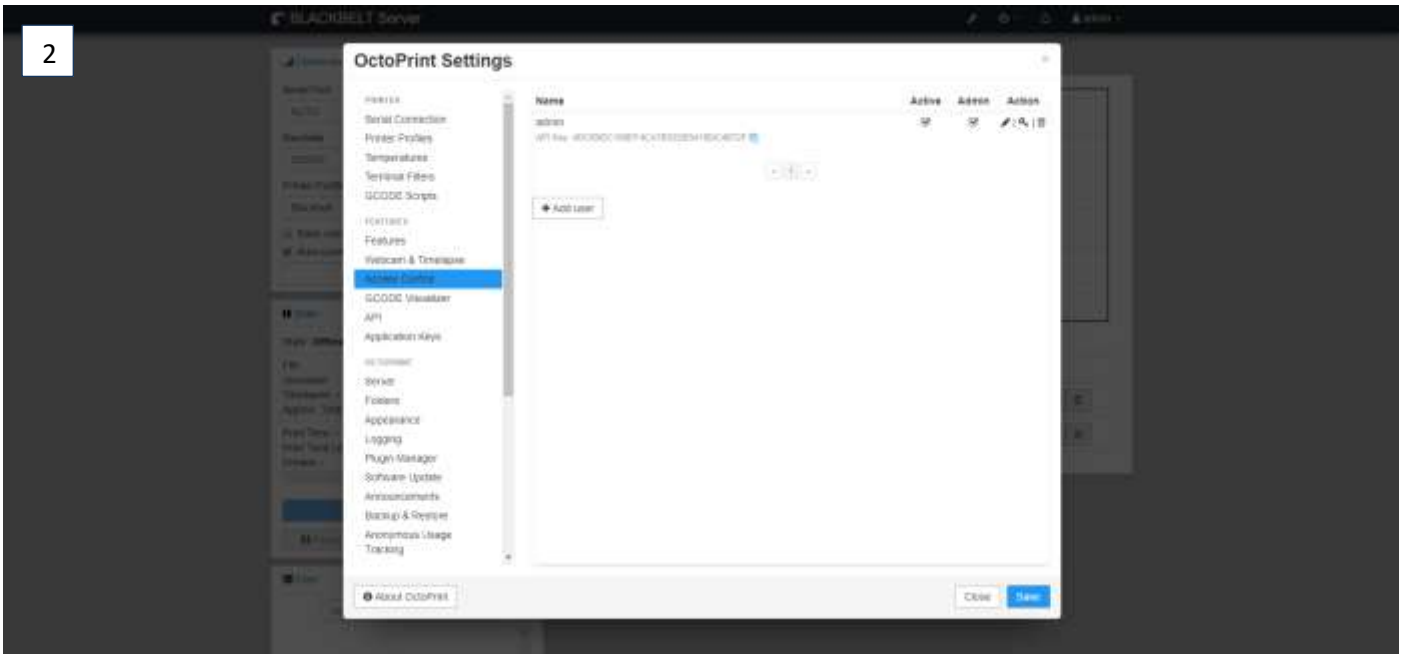
The following modes are available:

1. **Off**: nothing happens
2. **Timed**: take a picture every set interval (standard every 10 seconds). For prints that take up a day or more we recommend 30 seconds interval.
3. **On Z change**: take a picture every z-layer change. We recommend using the standard settings [beta feature]

The screenshot shows the OctoPrint interface with the 'Timelapse' tab selected. The 'Timelapse Configuration' section includes a dropdown for 'Timelapse Mode' (set to 'Off'), a 'Timelapse frame rate' input (25 fps), and a 'Timelapse post roll' input (0 sec). Below these are checkboxes for 'Save as default' and a note about persisting settings. At the bottom of the configuration are 'Save changes' and 'Reset to active configuration' buttons. The 'Finished Timelapses' section shows a table with columns for 'Name', 'Size', and 'Action', and a 'Details selected' button. Callouts point to these elements: 'Mode' points to the dropdown; 'Framerate' points to the frame rate input; 'Extra time at the end of the video' points to the post roll input; 'Apply change or reset to factory defaults' points to the 'Save changes' button; and 'List of previous recorded videos' points to the 'Finished Timelapses' table.

## 6.1.6 Adding multiple users

If you are using the printer with multiple users and want to make use of different privileges, there is an option to add multiple users with different user levels. For this go to the settings menu [1 - wrench symbol] and go to the access control section. Press the *add user* button to add additional users, not checking admin will add a user that is not allowed to change settings and privileges [3].



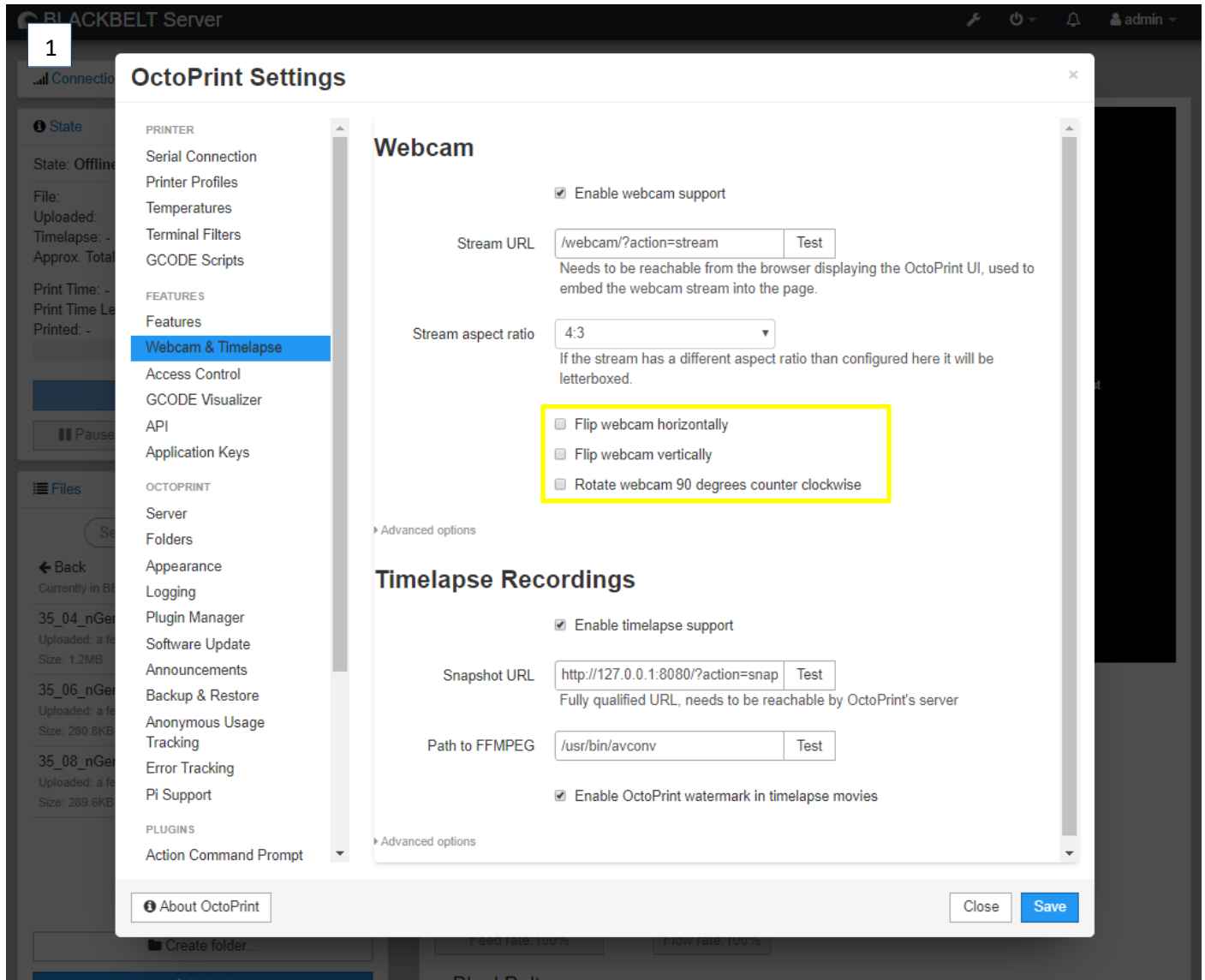
## 6.1.7 Control

Control window for manually controlling the printer. The webcam will install automatically and show up as image here. If the webcam is showing an image that is upside down or mirrored, you can change this in the settings menu [ 1 ].

The screenshot shows the BlackBelt printer control interface. At the top, there are tabs for 'Print Queue', 'Control', 'Timelapse', 'Temperature', and 'Terminal'. The main area is a large webcam image of the printer's nozzle and bed. Below the image are four control panels: 'X/Y' with directional buttons and a feed rate slider; 'Z' with up/down buttons and a flow rate slider; 'Tool (E)' with a tool selection dropdown, '5 mm' display, 'Extrude', and 'Retract' buttons; and 'General' with a fan speed slider, 'Fan speed:100%' display, 'Fan off' button, and 'Motors off' button. A 'Home Y' button is located under the 'BlackBelt' section. Callouts point to the 'Webcam image', 'Controllers' (the X/Y panel), 'Home Y-axis' (the Home Y button), and 'Fan control' (the fan speed slider).

## 6.1.8 Webcam settings

Sometimes the image of the webcam is upside down or mirror. Use the settings below to change the picture orientation.



## 6.1.9 Terminal

The screenshot shows the 'Terminal' tab of the Blackbelt interface. The terminal window displays a series of GCODE commands and responses, including:
 

```

    Recv: Cap:Z_PROBE:0
    Recv: Cap:LEVELING_DATA:0
    Recv: Cap:BUILD_PERCENT:1
    Recv: Cap:SOFTWARE_POWER:0
    Recv: Cap:TOGGLE_LIGHTS:0
    Recv: Cap:CASE_LIGHT_BRIGHTNESS:0
    Recv: Cap:EMERGENCY_PARSER:1
    Recv: Cap:AUTOREPORT_SD_STATUS:0
    Recv: Cap:THERMAL_PROTECTION:1
    Recv: ok
    Send: M155 S2
    Recv: ok
    Recv: T:235.00 /0.00 B:69.19 /0.00 @:0 B@:0
    Send: M117 10.11.4.155_
    Recv: ok
    Recv: T:232.50 /0.00 B:68.91 /0.00 @:0 B@:0
    Recv: T:229.13 /0.00 B:68.61 /0.00 @:0 B@:0
    
```

 Below the terminal window, there are several settings:
 

- Suppress temperature messages
- Suppress SD status messages
- Suppress wait responses
- Advanced options

 On the right side of the settings area, there are buttons for 'Copy all' and 'Clear all'. A 'Send' button is located at the bottom right of the terminal window.

Annotations in the image point to:
 

- Live GCODE view:** Points to the terminal window content.
- Terminal settings and copy text for debugging:** Points to the settings and 'Copy all' button area.

## 6.1.10 Possible failure mode

Problem	Possible cause	Action / solution
Blackbelt server seems to be offline	boot issues	restart / reboot the server 2 times. This so far only occurs the first time on a new network
IP address does not occur on the LCD	false communication	The Ip address is send once to the LCD display. This means you need to make sure the machine is on and standby (not heating or printing etc.) Then restart the server and make sure the internet port is blinking indicating connection. If no network is detected the IP address will also not show up.
The password is not working	Wrong symbol	Make sure the symbol you type in blind is the correct one and all letters are capitalized as n the manual. When in doubt copy the password from the manual to fill in the correct one.

## 6.3 Run-out sensor

For the Blackbelt we use a dedicated run-out sensor that can be retrofitted to all the older models as well as requested as a feature on purchase.

Packing list run-out sensor			
nr.	Amount	Description	order number
1	1	Run-out sensor	BB-FRS-001
2	1	Connector cable	BB-P0172
3	1	Filament guide tube top (60mm)	BB-P0179-60
4	1	Filament guide tube bottom (45 mm)	BB-P0179-45

### 6.3.1 Retrofit installation

Materials needed:

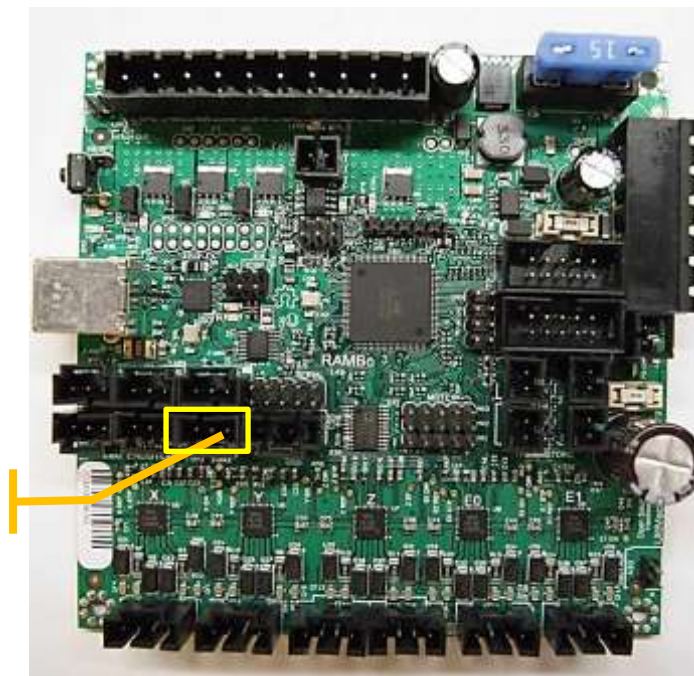
- Hexagon or Ln key 3
- Run-out sensor kit

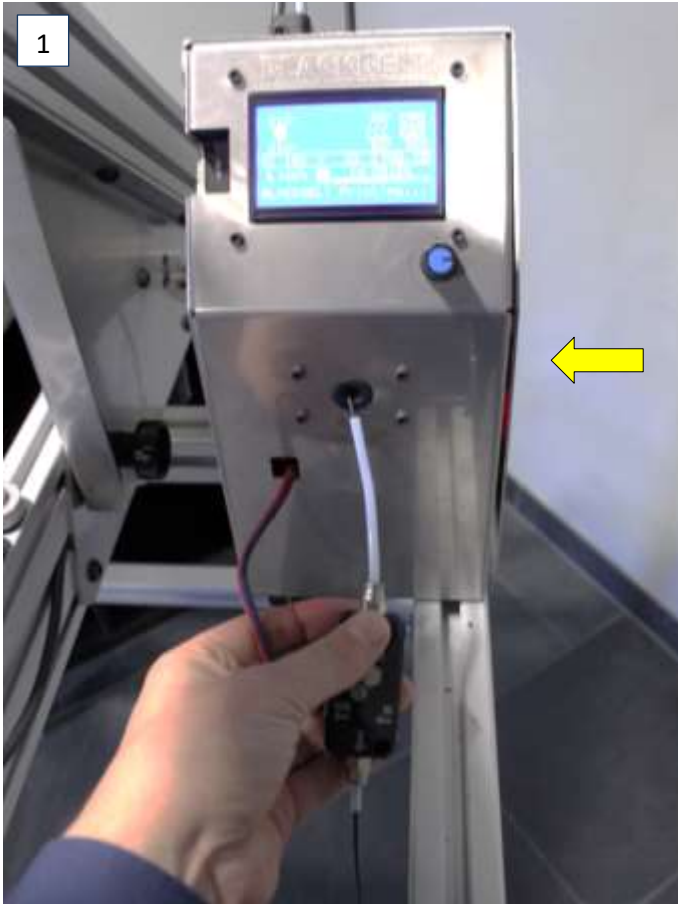


*Make sure to unscrew the installed printhead and disconnect the power from the machine.*

1. Loosen all the 4 bolts from the electrical cabinet on the right side and remove the cover [ 1 ]
2. Feed the wire trough the USB-port opening and place the cable in the correct port. Make sure to use only the supplied cable and that the other side is in the out-port of the sensor. [ 1 ]
3. Place the runout sensor with the long tube in the opening of the current filament guide [ 2 ]
4. When operational the indicator light should be on when filament is detected. [ 2 ]

Run-out sensor position

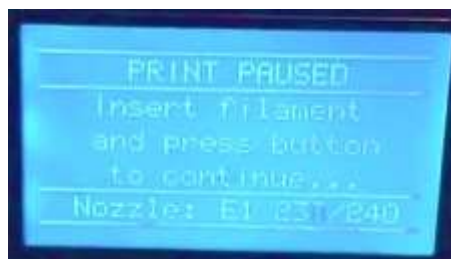




## 6.4 Using the run-out sensor

The run-out sensor is an optional gadget which allows you to change the filament during the print. The run-out sensor detects when the printer is running out of filament and puts the print on pause.

5. Make sure there is no filament left in the printer.
6. Insert the run-out sensor into the printer as far as possible. [2]
7. Insert the filament via the run-out sensor.
8. The sensor detects when there is filament inside and turns green. [2]
9. When the printer is running out of filament the sensor turns red and puts the printer on pause.
10. Add new filament into the sensor and resume printing. [1]





## 6.5 varioDrive retro fit package

If you have purchased a varioDrive update kit and you want to retrofit this on your platform you can use the following guide. For questions and encountered problems contact us through our support channel [support@blackbelt-3d.com](mailto:support@blackbelt-3d.com).

Packing list VD retrofit			
nr.	Amount	Description	order number
1	8	Tie wraps	use description
2	1	Filament guide tube (80 mm)	BB-P0179-735
3	1	Motor cable long	BB-P0156
4	1	Motor cable short	BB-P0157
5	1	Feeder assembly (electrical cabinet)	use description
6	1	Extruder assembly (x-gantry)	
7	1	Printhead assembly (nozzle setup)	
8	1	Filament inlet varioDrive	use description
9	4	M3x25 DIN912 screw	BB-P0160
9	4	M4x12 DIN912 screw	BB-P0159

### 6.5.1 Preparations

Materials needed:

- *Hexagon or Ln key 3, 4, 5*
- *Direct drive printhead module*
- *Direct drive feeder module*

Download the correct files for use:

<https://blackbelt-3d.com/downloads/Marlin%201.1.9.1%20BLACKBELT%20VarioDrive.ino.hex>

<https://blackbelt-3d.com/download-area/varioDrive.zip>

Check the installation manual chapter 5.10 but instead of auto choose custom firmware and upload the hex file to the printer.



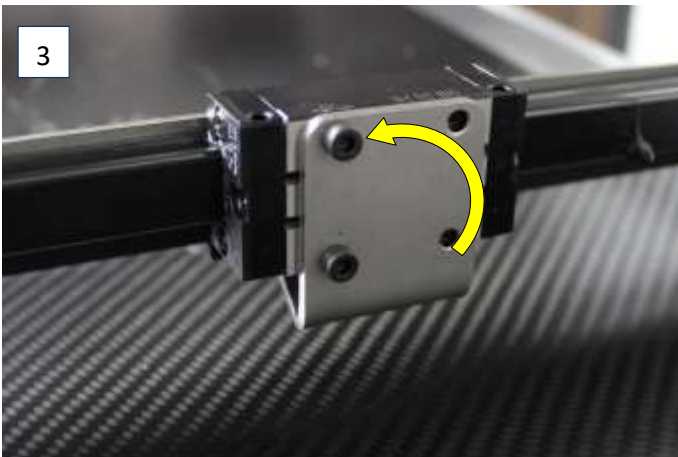
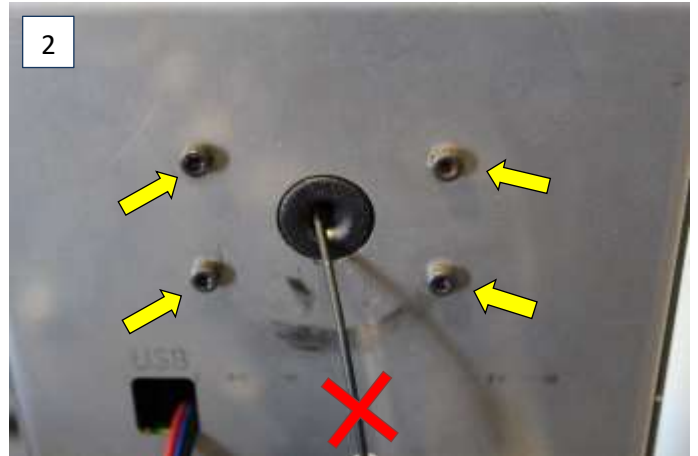
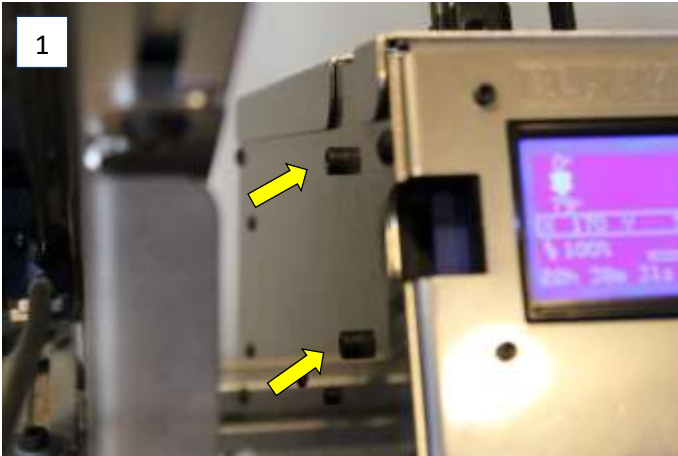
*Make sure to unscrew the installed printhead and disconnect the power from the machine.*



*Make sure to remove all grease from the belt and completely clean it with alcohol and a clean cloth after all maintenance procedures.*

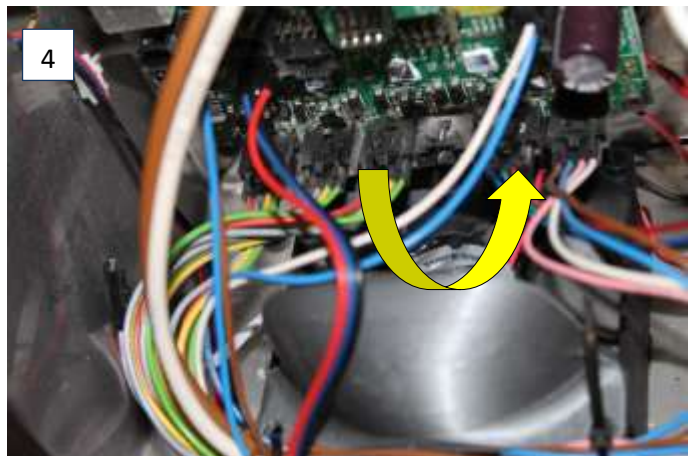
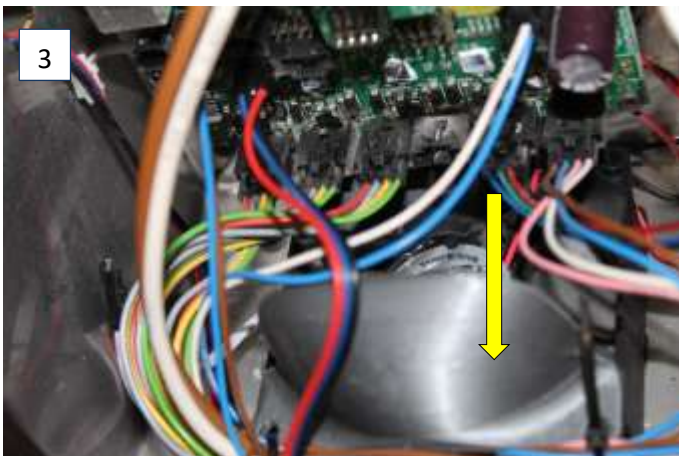
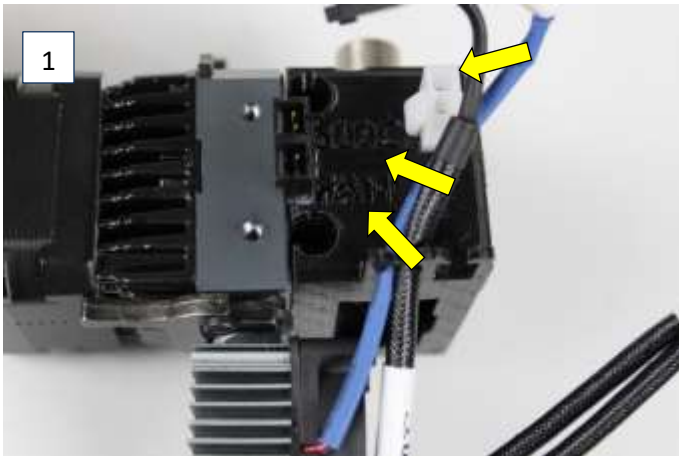
## 6.5.2 Dismantling the Bowden drive

11. Set the gantry to the 45° position.
12. Unmount the print head before starting, make sure there is no filament in the printer left.
13. Open the electrical cabin by removing the entire cover.
14. Remove all cables from the BondTech feeder [motor cable, Teflon tube, printhead cable, spring].
15. Unscrew the two M5 bolts on the back that hold the BondTech feeder and remove this unit. [1]
16. Unscrew the four screws that hold the filament guide and remove this unit [2]
17. Switch the lower right bolt on the printhead mount to upper left to prepare for the flex drive [3]

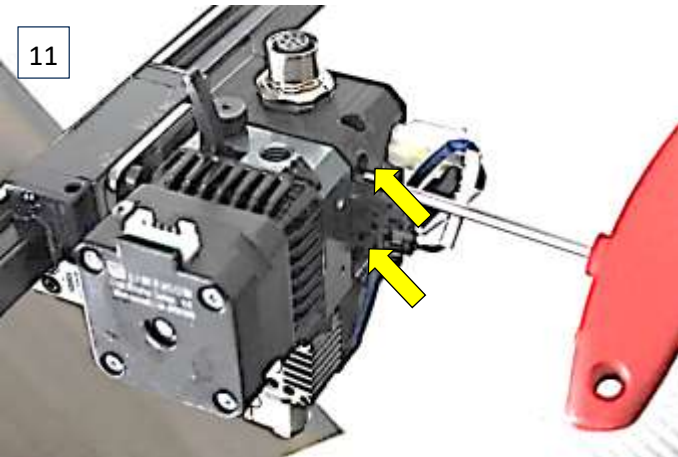
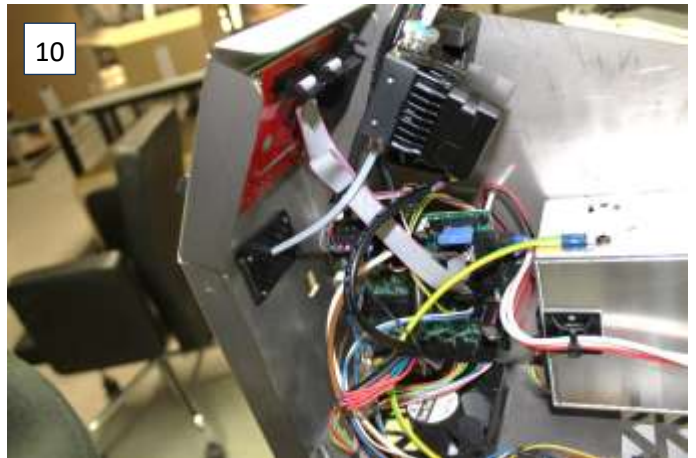
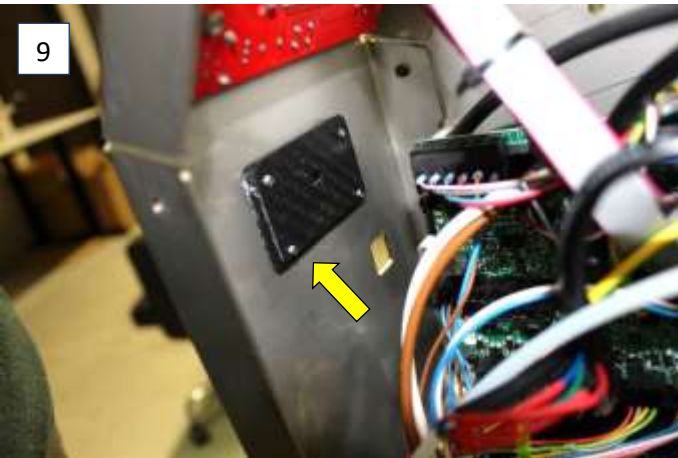
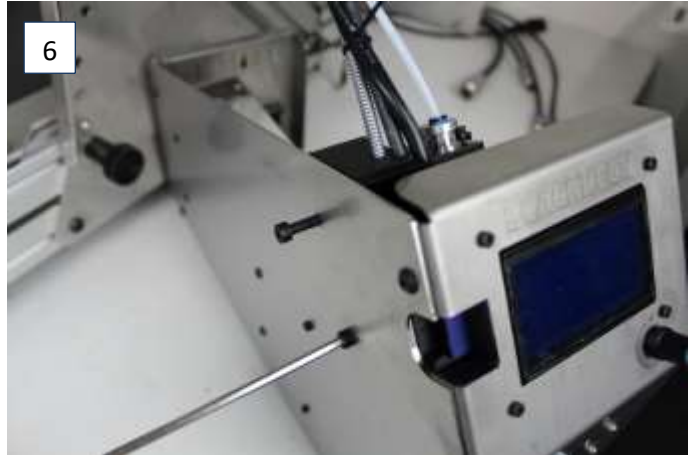
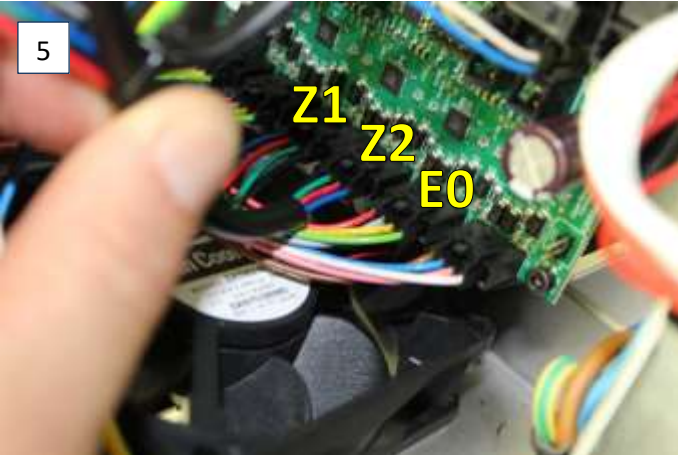


## 6.5.3 Install the varioDrive

1. Check if all the wires are connected to the correct port on the printhead. **Fan and sensor should never be switched!** [1-2]
2. Switch the Z-motor cable to the E0 position on the PCB [3-4]
3. Plug the new cables in the Z1 and Z2 port on the PCB. The printhead cable (long) is Z1 and the feeder cable (short) in Z2. [5]
4. Install the new Direct Drive feeder and make sure the top aligns with the metal edge. [6]
5. Install the spring, Bowden tube, extra motor cable and old printhead cable and make them align properly before wrapping them together. [6]
6. Install the filament tube guide with the chamfered side down. [8-9]
7. Insert the bottom Bowden tube true the hole to have a fluent filament guidance. [10]
8. Finally install the printhead on the X-gantry and mount all the cables and guides on the correct position. Two M4 bolts go in the right two holes. [11-12]
9. Check if there are no lose wires in the electrical cabinet and power the machine.
- 10. Install the new firmware manually (Marlin 1.1.9.1 BLACKBELT VarioDrive.ino.hex)**
11. The printer should now be ready to use. Make use of the project files to get the latest settings for different materials. (BB DD NinjaFlex.3mf - BB DD varioShore.3mf)

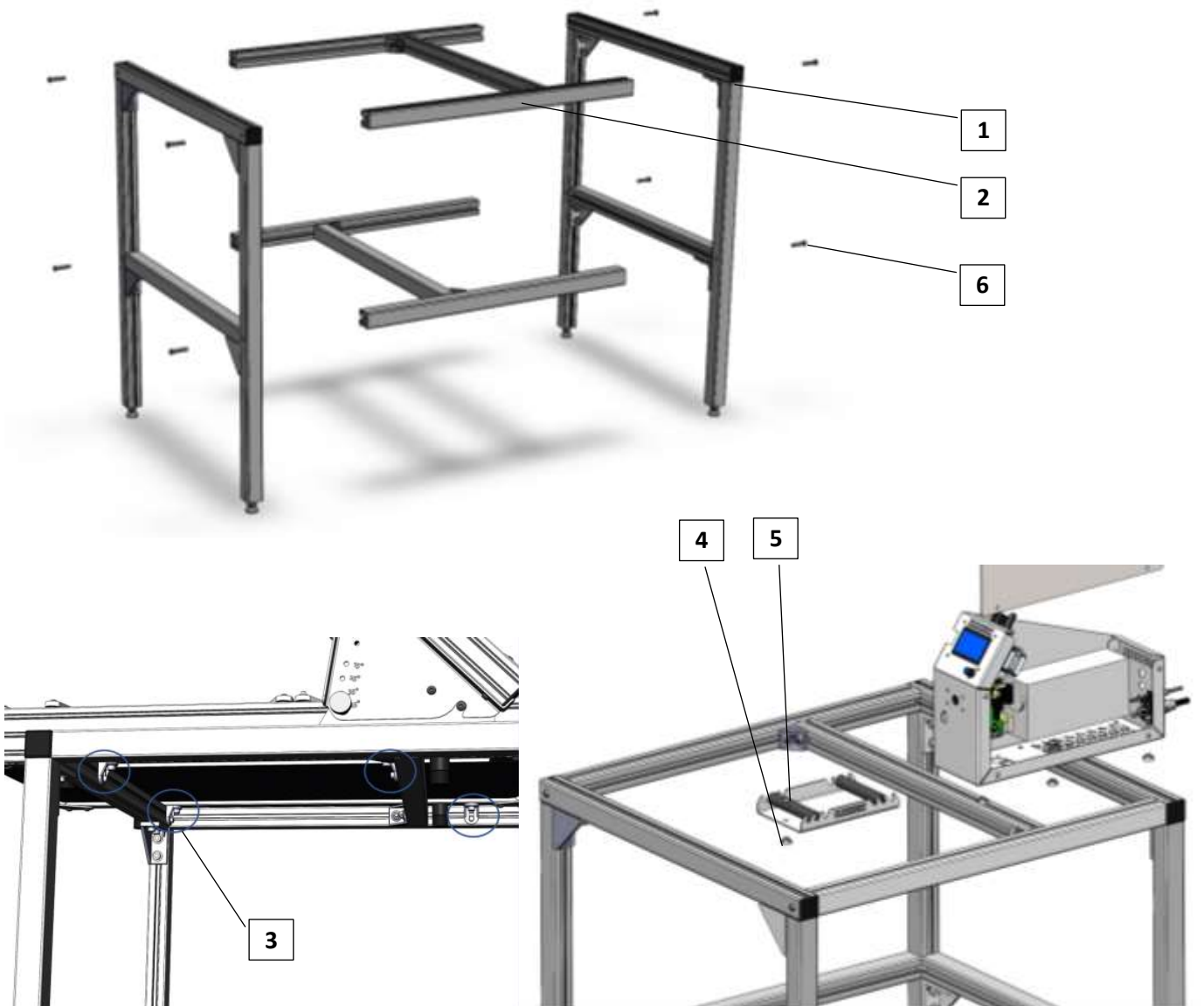


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## 6.6 BlackBelt support frame

Packing list support frame			
nr.	Amount	Description	order number
1	2	Frame pt1	use description
2	2	Frame pt2	
3	4	Printer mount	
4	4	M8 sliding nut	
5	4	M8 x 14	
6	8	M10 x 60	
7	1	5mm Allen Key	BB-P0098
8	1	4mm Allen Key	use description
9	1	Wooden packing box	BB-P0027
10	1	User manual	use description



## 6.6.1 Assembly guide

1. Mount one of the sides to the top frame.



2. Mount the second side and middle frame to the previous assembly



3. Put the entire frame up right with the feet level on the floor. Make sure the frame does not wobble and is level.

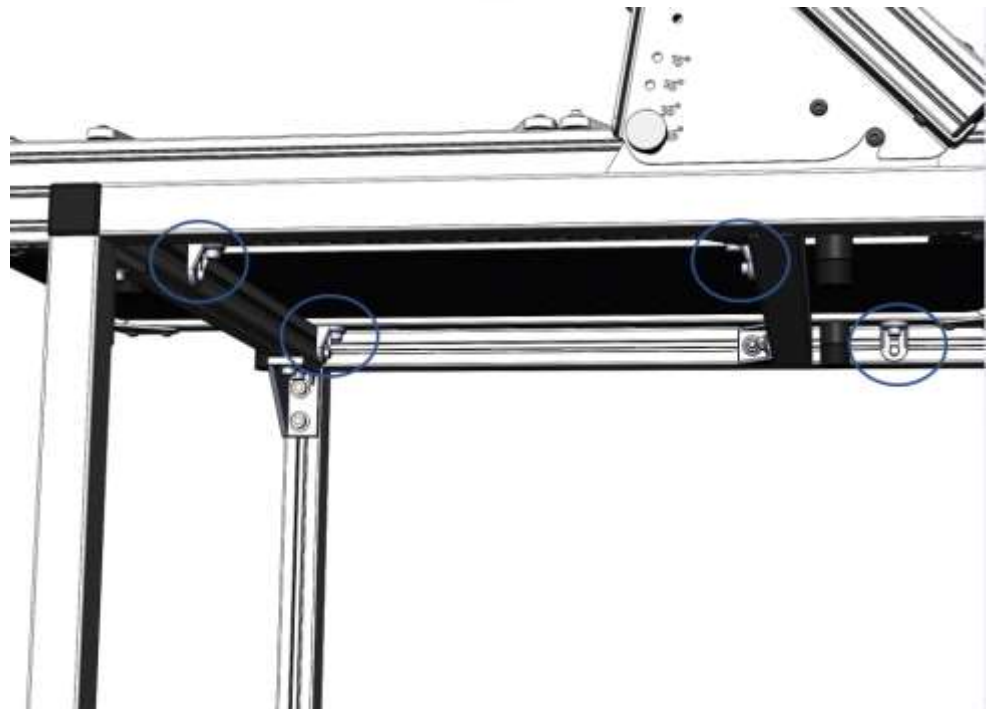


# BLACKBELT

4. Position the Printer on the frame make sure the rear feet are behind the mid-beam (orange in picture) and the front feet are in front of the frame.



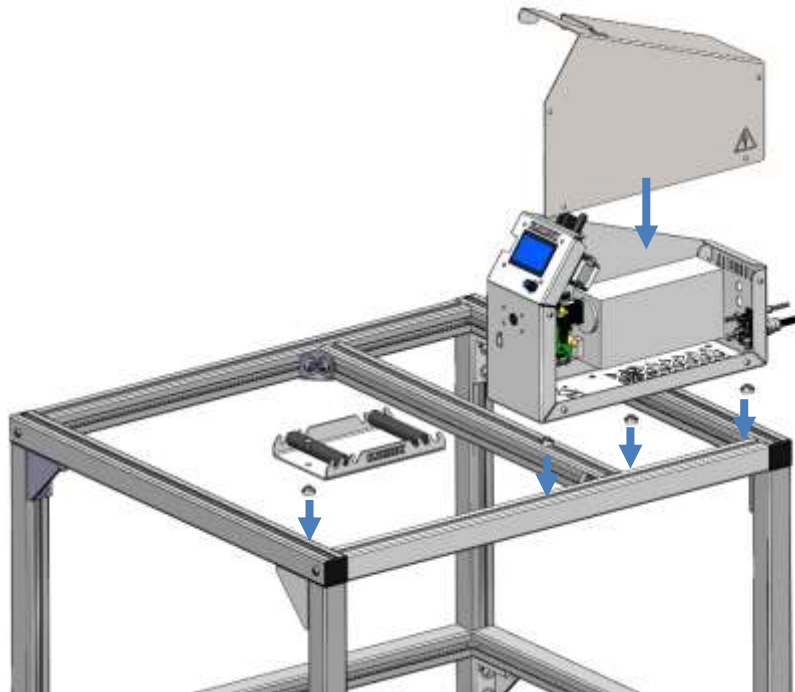
5. Fix the supplied fixtures with screws delivered as set in the package.



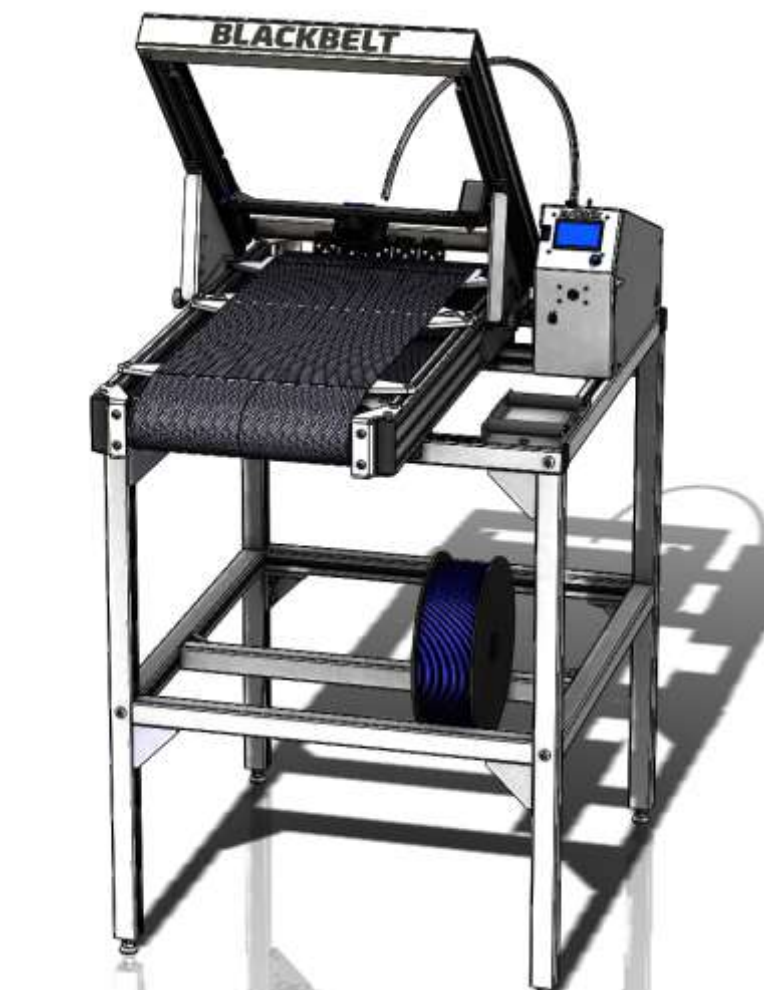
# BLACKBELT

6. Position and mount the electrical cabinet and spoolholder onto the correct locations.

Note: the printer is left out of this picture for visual purposes.



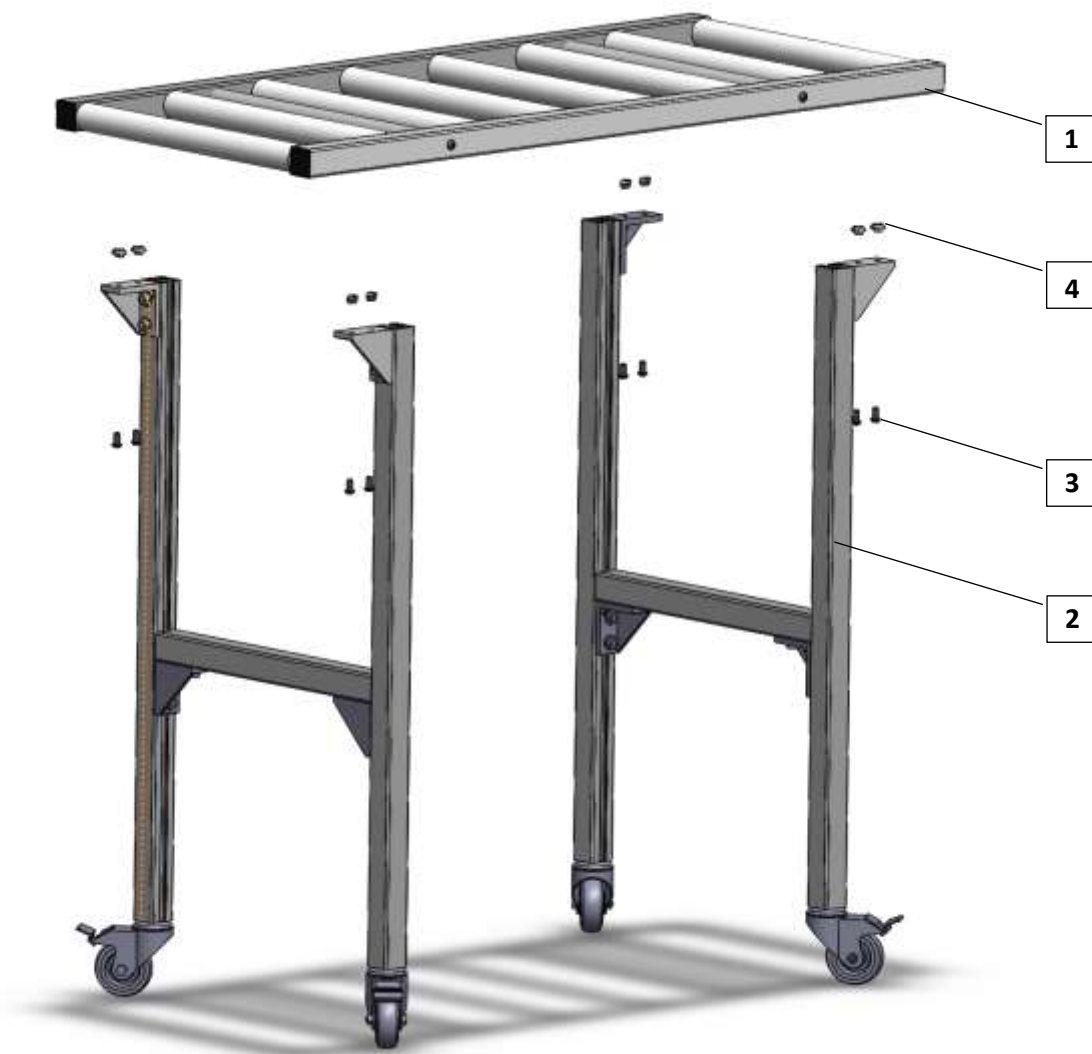
7. The result should look like this.





## 6.7 BlackBelt roller table

Packing list roller table			
nr.	Amount	Description	order number
1	1	Roller table pt1	use description
2	2	Roller table pt2	
3	8	M8 x 20	
4	8	M8 sliding nut Top mount N10	
5	1	5mm Allen Key	BB-P0098
6	1	Wooden packing box	BB-P0026
7	1	User manual	use description



## 6.7.1 Assembly guide

1. Mount the legs to the bottom of the rollerframe.



2. Flip the construction and the final assembly should look like this in combination with the support frame.






## 7.1 Materials

The BlackBelt 3D printing platform is unique due to the carbon fiber print belt that is used as a print surface. Each print surface has its unique settings and material preferences that work well. For the Blackbelt 3D printing platform the following materials are tested and recommended. Other materials can work as well and based on test prints custom settings can be supplied with or after purchase of the 3D printer.

### Material comparison

Property	Preferred on bowden				Preferred on varioDrive			
	PLA	NGen	PETG	ABS	Cheetah	NinjaFlex	VarioShore	PA-CF
Typical printing temperature BB [°C]	180 – 220 C	220 – 235 C	230 – 260 C	240 – 260 C	240 – 260 C	230 – 240 C	190 – 260 C	255 – 275 C
Typical belt temperature [°C]	65 C	80 C	75 C	90 C	-	-	-	-
Temperature resistance	45 C	70 C	70 C	80 C	74 C	60 C	80 C	120 C
Strength	*	**	***	***	***	**	**	**
Printability	***	***	***	*	***	**	***	*
UV stability	Yes	Only in black color			?	?	?	?

For more info or data sheets please check our website: <https://colorfabb.com/>.

Supported materials Bowden system	
<b>colorFabb Economy PLA</b> 	Economy PLA is a bio-based material, perfectly suited for: <ul style="list-style-type: none"> <li>- Visual parts</li> <li>- Interior parts</li> <li>- Very low warp, perfect for e.g. extrusion profiles.</li> </ul> Note: low adhesion to the conveyor belt. Part needs a big footprint.
<b>colorFabb NGen</b> 	nGen copolyester is a multipurpose material most reliable easy to print with. <ul style="list-style-type: none"> <li>- Provides Smooth surfaces</li> <li>- Visual or Functional parts</li> <li>- Easy to post-process</li> </ul> Note: Suits many application, the BLACKBELT comes with 2 big spools of nGen.
<b>colorFabb Economy PETG</b> 	Economy PETG is a Technical material with high impact resistance <ul style="list-style-type: none"> <li>- Functional Parts</li> <li>- Mechanical applications like jigs and fixtures</li> <li>- Very affordable engineering plastic</li> </ul>
<b>NinjaTek Cheetah</b> 	<b>Suggested Applications:</b> grips, guides, hinges, sleeves & snap-fit parts. <ul style="list-style-type: none"> <li>- Shore Hardness = <b>95A</b></li> <li>- <b>Prints at speeds greater than 60 mm/s</b> with standard ABS settings</li> <li>- Significantly <b>greater impact strength</b> than all widely used materials – 84% greater than ABS!</li> <li>- Industry leading <b>toughness and durability</b> to ensure longevity in printed parts</li> <li>- <b>Abrasion resistance</b> 40% better than ABS and 76% better than PLA</li> <li>-</li> </ul>

## Supported materials varioDrive system

### NinjaTek Ninjaflex



**Suggested Applications:** Seals, gaskets, plugs, leveling feet, protective applications.

Ninjaflex flexible filament leads the industry thanks to its superior flexibility and longevity compared to non-polyurethane materials. Its consistency in diameter and ovality (roundness) outpaces other polyurethane materials. Made from a specially formulated thermoplastic polyurethane (TPU) material, this patented technology boasts a low-tack, easy-to-feed texture. The result is uniquely flexible, strong prints ideal for direct-drive extruders.

**Material needs drying 24 hours 70 degree Celsius**

### colorFabb varioShore



varioShore TPU allows users to vary the density of the material by adjusting temperature and material throughput (speed & layer height).

The base TPU is a 92A material, which will work with most standard extruder set-ups for both Bowden and direct drive systems.

- Variable shore hardness
- Active foaming technology
- Reduced weight / density
- Soft touch surface

### colorFabb PA-CF



The PA-CF Low Warp is a one of a kind polyamide formulation with the ability to print nearly warp free on non-heated build platforms. Low infill prints come out perfectly flat on cold bed for higher infill prints 40/50C temperature is enough to obtain flat prints.

Read more about print settings and advice on the dedicated landing page: <https://pa.colorfabb.com>

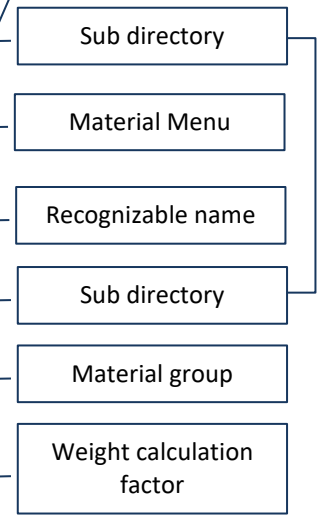
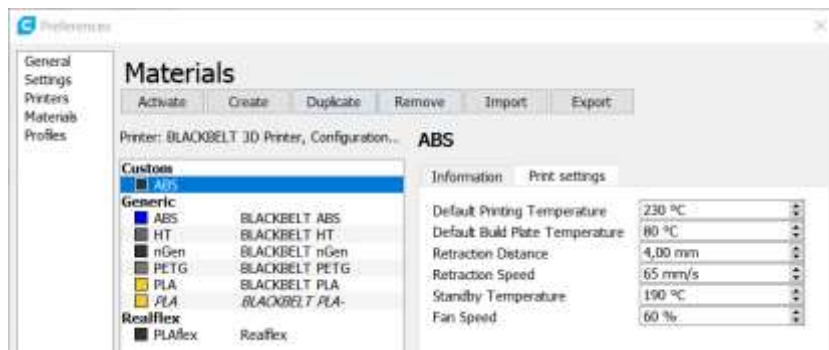
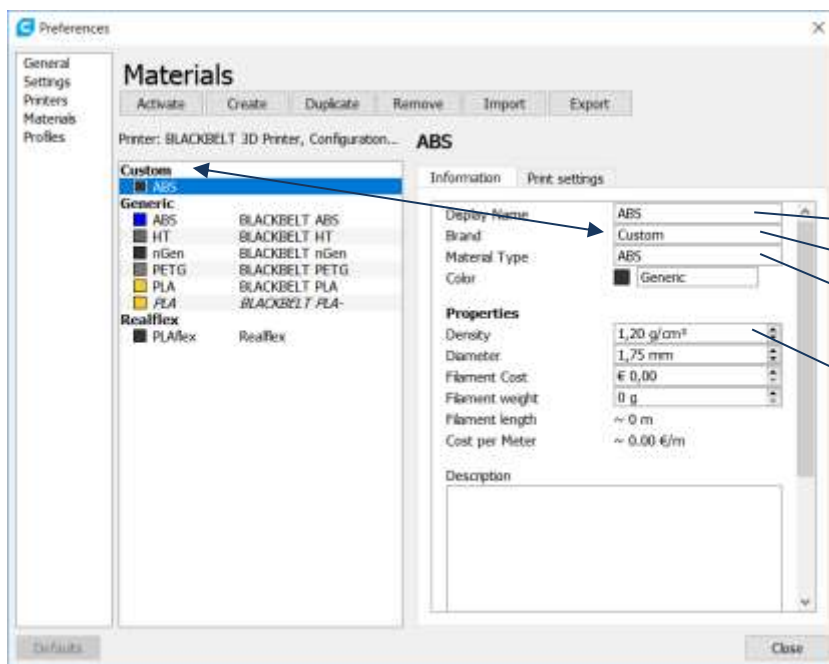
**Material needs drying 24 hours 70 degree Celsius**

Due to the close relation with colorFabb we have a good collaboration program around testing general and new materials. The Blackbelt printing platform is not limited by these materials, but there is little widely spread information on the adhesion to carbon fiber belts. Also, material suppliers often do not have info on this printing surface. If you are using a different material feel free to send us a sample and we help you with settings and adhesion agencies.

## 7.1.1 Custom Materials

Best way to keep track of all the different material settings is to make use of the Material library integrated in BlackBelt Cura. Use the following instructions to add custom materials to the library.

To add new materials, go to the *Manage Materials* menu [1] under materials tab. In the materials Menu you can use Create to generate a new material template. Use the print settings listed above and fill in the information to be able to find the material in the library.



## 7.2 Menu structure

By turning the jog button on the control cabinet, it is possible to change a setting or scroll through the menu structure. By pushing the jog button, it is possible to select a menu item or confirm the set value.

*Grey settings are only available for the varioDrive setup.*

Menu item:	Function:
Info screen	Displays all details explained in the previous chapter 2.1.5. Turn the jog button, to change the feedrate / speed of the printer. Push the jog button to access the following main menu structure.
- Info Screen	Back to the Info screen
- Prepare	"Prepare" menu
- Main	Back to prepare menu
- Move Axis	Move one of the Axis
- Move X	Move X-axis (left – right)
- Move Axis	Back to the previous screen
- Move 10mm	Move X-axis 10mm
- Move 1mm	Move X-axis 1mm
- Move 0.1mm	Move X-axis 0.1mm
- Move Y	Move Y-axis (Up and down)
- Move Axis	Back to the previous screen
- Move 10mm	Move Y-axis 10mm
- Move 1mm	Move Y-axis 1mm
- Move 0.1mm	Move Y-axis 0.1mm
- Move Z	Move Z-axis (belt)
- Move Axis	Back to the previous screen
- Move 10mm	Move Z-axis 10mm
- Move 1mm	Move Z-axis 1mm
- Move 0.1mm	Move Z-axis 0.1mm
- Home X	Move the X axis to the endstop
- Disable steppers	Disable all stepper motors
- Change Filament	Change filament function for varioDrive
- Preheat nGen	Heats up to 230 degree Celsius
- Preheat PETG	Heats up to 240 degree Celsius
- Preheat nGen	Function to preheat the printer for "nGen" Filament
- Prepare	Back to the previous screen
- Preheat nGen	Sets the printhead temperature to 230°C and the heated bed to 80°C in, to prepare for using "nGen" filament.
- Preheat nGen End	Sets the printhead temperature to 250°C
- Preheat nGen Bed	Sets the heated bed temperature to a specific temperature
- Preheat PETG	Function to preheat the printer for "HT" Filament
- Prepare	Back to the previous screen
- Preheat PETG	Sets the printhead temperature to 250°C and the heated bed to 100°C in, to prepare for using "HT" filament.
- Preheat PETG End	Sets the printhead temperature to 250°C
- Preheat PETG Bed	Sets the heated bed temperature to a specific temperature
- Control	"Control" menu

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- Main	Back to the previous screen
- Temperature	“Temperature” menu
- Control	Back to the previous screen
- Nozzle:	Set temperature printhead
- Bed:	Set temperature heated bed (belt)
- Fan Speed 1:	Set fan speed (0= off, 255=full power)
- Fan Speed 2:	Set fan speed rear fan (0= off, 255=full power)
- Autotemp:	Function, to adapt the temperature of the printhead automatically to the print speed.
- Min:	Minimal temperature for slow print moves
- Max:	Maximal temperature for fast print moves
- Fact:	Normal print temperature
- PID-P:	Set values for de heat-up speed of the printhead
- PID-I:	
- PDI-D:	
- PID Autotune:	Automatically generate values for the heat-up speed of the printhead
- Motion	Control Motion settings here (only advanced users)
- Control	Back to the previous screen
- Velocity	Allows you to change maximum Velocity Values.
- Motion	Back to the previous screen
- Vmax X:	Set max speed for the X axis in mm/s
- Vmax Y:	Set max speed for the Y axis in mm/s
- Vmax Z:	Set max speed for the Z axis (belt) mm/s
- Vmax E:	Set max speed for the Extruder in mm/s
- Acceleration	Allows you to change maximum Acceleration Values.
- Motion	Back to the previous screen
- Amax X:	Set maximum acceleration of the X axis in mm/s
- Amax Y:	Set maximum acceleration of the Y axis in mm/s
- Amax Z:	Set maximum acceleration of the Z axis (belt) in mm/s
- Amax E:	Set maximum acceleration of the Extruder in mm/s
- Jerk	Allows you to change maximum Jerk Values.
- Motion	Back to the previous screen
- Vx-jerk:	Set maximum start speed the X axis in mm/s
- Vy-jerk:	Set maximum start speed the Y axis in mm/s
- Vz-jerk:	Set maximum start speed the Z axis (belt) in mm/s
- Ve-jerk:	Set maximum acceleration of the Extruder in mm/s
- Steps/mm	Allows you to change the stepper motor steps per mm.
- Motion	Back to the previous screen
- Xsteps/mm:	Set the steps per mm for the X axis
- Ysteps/mm:	Set the steps per mm for the Y axis
- Zsteps/mm:	Set the steps per mm for the Z axis (Belt)
- Esteps/mm:	Set the steps per mm for the Extruder
- Restore Failsafe	Resets the original settings of the machine
- Print from SD	Choose a file from the SD card
- Main	Back to the previous screen

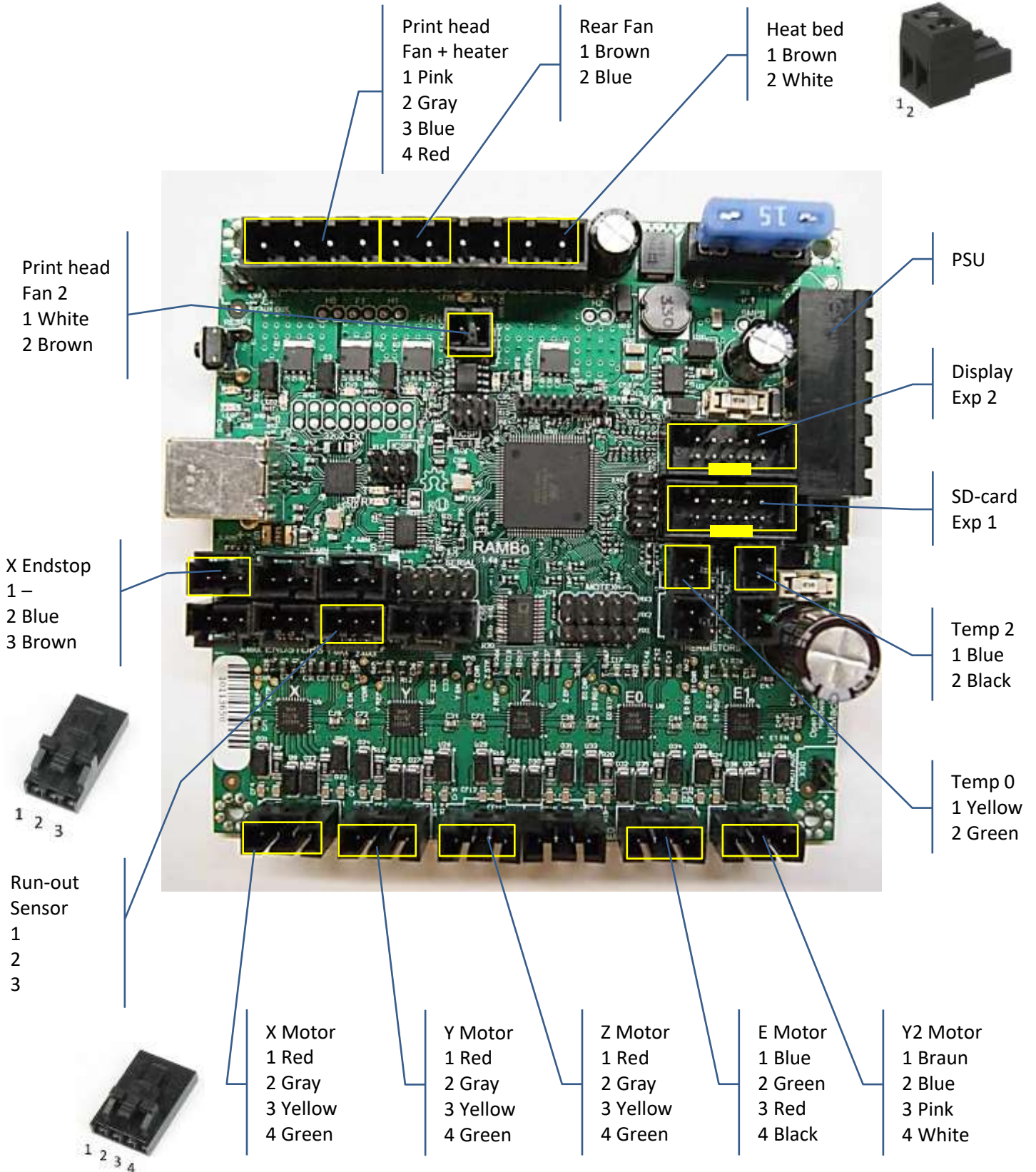


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## 7.3 BlackBelt PCB

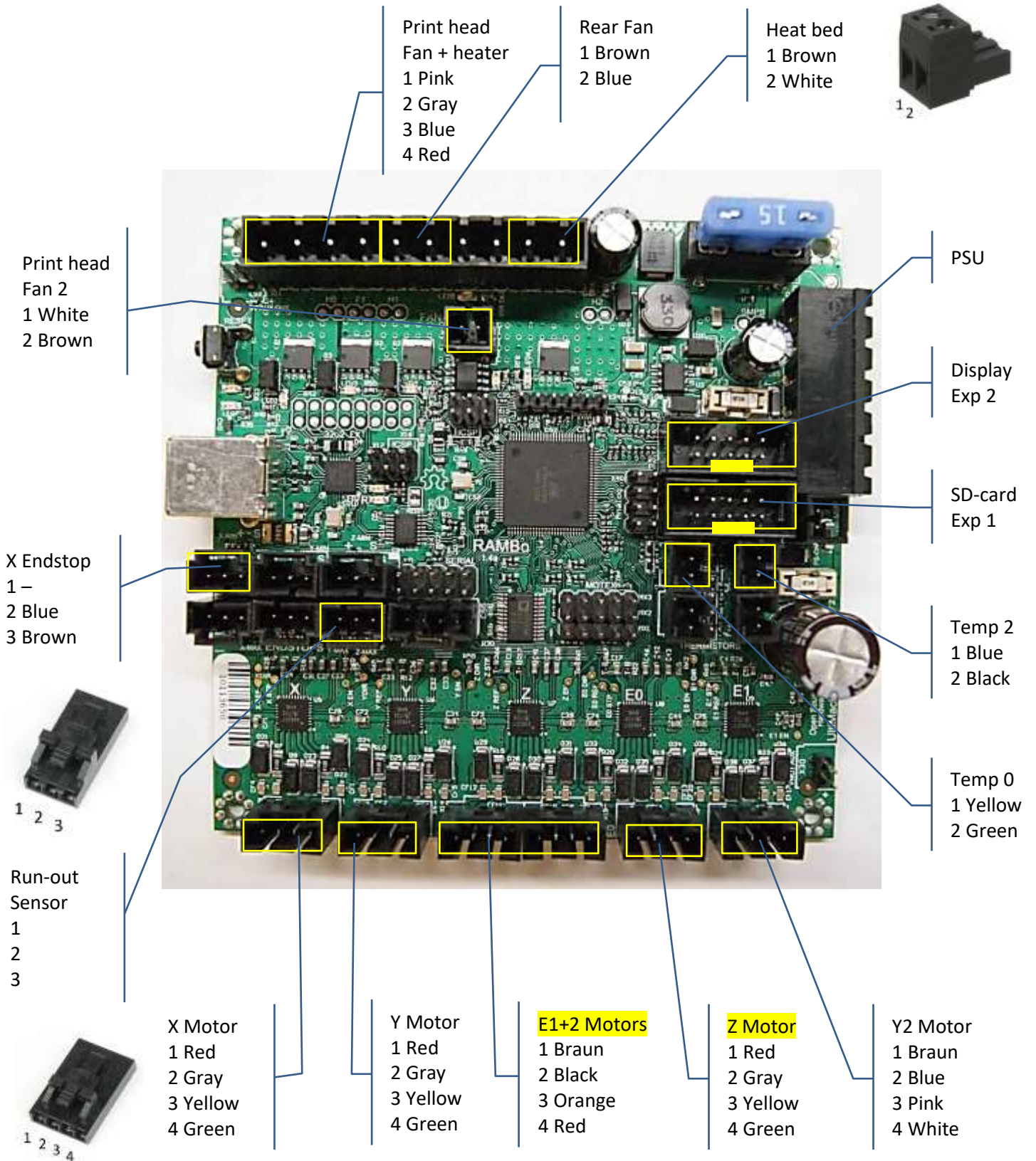
In this chapter you find the connection schedules for the different versions of the BlackBelt 3D PCB's that are on the market. We strongly advise to get in contact with us before changing any connectors or modifying wires inside the controller box.

### 7.3.1 BlackBelt PCB v1.4



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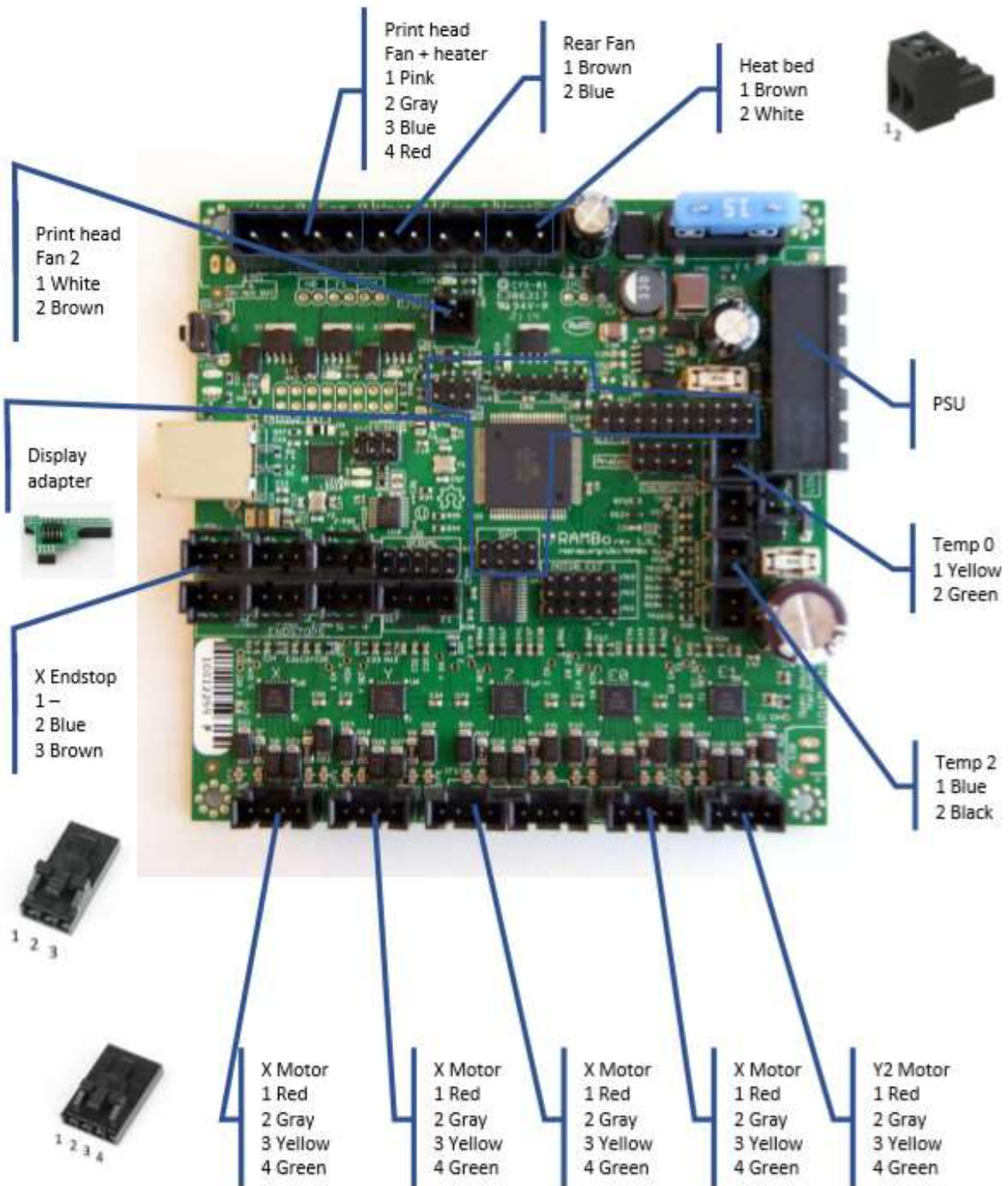
## 7.3.2 BlackBelt PCB v1.4 varioDrive



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## 7.3.3 BlackBelt PCB v1.3

For legacy machines sold in 2018



## 7.4 Possible failure mode

Problem	Possible cause	Action / solution
3D printed part detaches from the belt	Too fast belt wall or belt Temperature too low	Enable the feature "Belt Wall" In BLACKBELT Cura and set it between 10 and 15 mm/s. Slice the part and see the result in Layer View option "Feedrate". The slo wall will turn blue. Increase the temperature of the heated bed (Control -> Temperature -> Bed)
3D printed parts adheres too strong to the belt	Temperature too high or "Belt wall" too slow	Lower the temperature of the heated bed: (Control -> Temperature -> Bed) Disable the feature "Belt Wall" in BLACKBELT Cura
3D printed parts leaves marks on the belt	Belt Offset too small	Increase the belt offset (set between 0.3 and 1mm in BLACKBELT Cura)
Bad surface quality of the print	Not enough cooling	Make sure, the part cooling fan is mounted and connected to the print head. Increase the speed of the cooling fan (Control -> Temperature -> Fan speed) during a print. Or in BLACKBELT Cura, setting "Fan Speed".
Conveyor belt is running curling against the wall	Belt Calibration needed	The belt needs to be calibrated (chapter 5.7)
One side prints closer to the belt than the other side	Y calibration needed	The Y axis needs to be calibrated (chapter 5.3)

## 7.5 Disposing the machine or machine parts



*Please follow all prescriptions as described in this manual. In particular chapter 1.3 : Safety messages*

Carry out the following steps while disposing the machine:

1. Put the machine out of order and detach all electrical connections.
2. Remove all consumables.
3. Scrap / dispose all machine parts separately conform local regulations.