

# BIO X

User manual



CELLINK AB  
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SWEDEN

# Welcome to the world of bioprinting!

Not too long ago, the idea of creating living human tissue was no more than a dream. Not anymore. The technology in front of you is the next step on the path of regenerative medicine.

BIO X is designed with your research in mind. By simplifying the 3D bioprinting process, you can focus on your research and dream bigger than ever before. Only your imagination limits what you can do!

Featuring unrivalled usability and versatility, BIO X will help in taking your research to the next level. With features such as interchangeable intelligent printheads, clean chamber technology, printchamber sterilization, temperature controlled printbed, and a user friendly interface second to none, BIO X is ready for the most complex 3D bioprinting challenges.

This manual will serve as your guide to getting started with 3D bioprinting with BIO X. Make sure you take time to review the entire manual before using the product for the first time.

Let your dreams be dreams no longer, make them reality.

Welcome to the future of regenerative medicine!

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# 1. Safety Information



Before you start using BIO X, please take time to review the entire manual and the manuals for any accessories. Mishandling of BIO X can lead to severe and irreversible injuries if the safety instructions are not followed. Throughout the manual we will use the following symbols to indicate if there is risk of personal injury or equipment damage:



This symbol indicates that there are surfaces in BIO X that are heated and might cause personal injury or material damage if not handled with care. Beyond the manual, the physical surface with a heating function will be marked with this symbol in BIO X. This symbol will also be visible on BIO X's touch screen at any time a surface in the printchamber is heated.



This symbol indicates that there is risk of personal injury or equipment damage due to harmful UV radiation in BIO X. Always keep the door of BIO X closed and wear proper safety equipment when using the UV sterilization or UV curing systems. This symbol will also be visible on BIO X's touch screen at any time a UV light source is active.



This symbol indicates that there is a general risk of personal injury or equipment damage due to reasons not related to UV radiation or heated surfaces.

## Manufacturer

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## 1.1 General safety information

In order to respond to BIO X and its relevant security requirements, all personnel using BIO X must have read through the entire manual. Should anything appear out of order or a situation occur that is not described in the manual, contact CELLINK before using the instrument any further!

Use the instrument only for its intended purpose as described in the documentation. Do not modify the instrument, sub-components, or accessories. Do not open or disassemble BIO X or attempt any service beyond the maintenance instructions provided in the manual. BIO X and the CELLINK intelligent printheads are only to be used with each other, not with other equipment.



Caution! Never reach into the instrument until all components have come to a complete stop. Moving parts can cause injury.



Caution! Before cleaning or servicing BIO X, turn off the power and disconnect the instrument from any power sources and external air pressure sources.



Caution! BIO X contains UV lamps for sterilizing and curing purposes. Never look directly at the UV lamps. Never reach into BIO X while the UV lamps are on. Doing so risks causing personal injury!



Caution! BIO X contains surfaces which can reach temperatures of up to 250° C. Never touch the printheads or printbed if the heating function is engaged. Let the printheads and printbed cool before handling if the heating function has been used.



Caution! Improperly mounted equipment such as the printbed, printheads, or cartridges can be dangerous. Improperly mounted cables, liquid spouts, and air spouts can also be dangerous. Verify that all connections are properly connected and all components are specified for the intended pressure, UV and temperature conditions. Should BIO X be damaged in any way, turn off and unplug BIO X, and contact CELLINK before further use of the equipment.

Caution! Never tamper with any safety interlocks. Doing risks causing serious personal and/or equipment damage.

## 1.2 Unpacking, lifting and carrying

Please read through the instructions on how to safely unpack and set up BIO X in Chapter 3: Getting started.



Caution! BIO X is a heavy instrument. Always have a minimum of two people when unpacking or moving BIO X. Always lift and carry the instrument in the manner described in the manual.

## 1.3 Electrical information



Always connect BIO X to a grounded socket and always use the voltage provided in the specifications. Not doing this can cause personal injury and damage BIO X!

## 1.4 Protective equipment



Caution! Always wear protective goggles and gloves, and secure the environment around the instrument from other personnel while operating BIO X. All safety equipment, including UV protective safety goggles, must be used when operating the UV curing system or the UV sterilization system.



Caution! Always wear protective goggles and gloves while handling hazardous materials that can be absorbed by skin or which are toxic, strike-attractive, corrosive, allergenic, carcinogenic, reproduction-endangering, or mutagenic to humans.



Caution! Always read the material safety data sheets, packing labels, manufacturer or dealer's catalogue first, and use adequate safety equipment.

## 1.5 Hazardous materials



Caution! Before starting to work with hazardous dispensing materials, such as flammable and corrosive materials, the operator must be informed about the characteristics of the material and its compatibility with the dispensing unit. The information can be found in the material safety data sheets, packaging labels, manufacturer or dealer catalogues. Always use adequate safety equipment. If unsure about if a material is compatible with BIO X, contact CELLINK before using that material!



Caution! When using ethanol to clean BIO X, wait at least 60 seconds before starting a bioprinting procedure to ensure that all flammable vapours are ventilated out of the instrument.

## 1.6 Compliance

By using BIO X and accepting the terms of use you agree to the terms stated here in and in the warranty information (see chapter 6. Warranty information). Except for the express warranty set forth in the warranty information (and in our software license terms as applicable), the solution as well as all equipment and software provided hereunder are provided “as is” and CELLINK makes no warranty as to its use or performance. Except for any warranty, condition, representation or term the extent to which cannot be excluded or limited by applicable law, CELLINK and its suppliers make no warranty, condition, representation, or term (express or implied, whether by statute, common law, custom, usage or otherwise) as to any matter including, without limitation, noninfringement of third party rights, merchantability, integration, or fitness for a particular purpose. You assume responsibility for selecting the solution to achieve your intended results, and for the installation of, use of, and results obtained from the equipment and software. Without limiting the foregoing provisions, CELLINK makes no warranty that the equipment or software will be error-free or free from interruptions or other failures or that the software or equipment will meet your requirements. Under no circumstances and under no legal theory, whether in tort, contract, or otherwise, shall CELLINK or its suppliers be liable to purchaser or to any other person for loss of profits, loss of goodwill, or any indirect, special, incidental, or consequential damages, or damages for gross negligence of any character. Under no circumstances can CELLINK be responsible for consequences of misuse of the instrument or for use of the instrument outside the use specified in this user manual, be they material or personal.

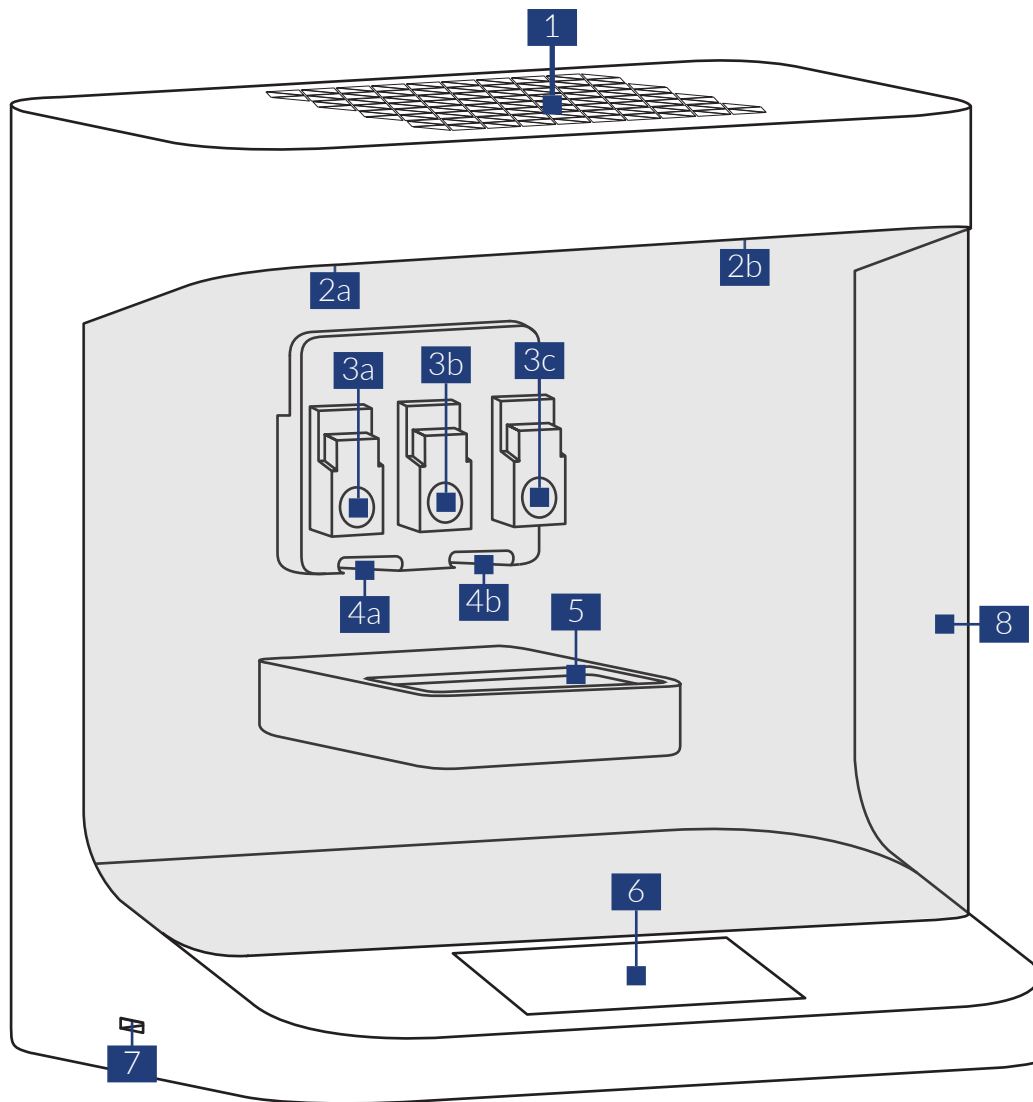




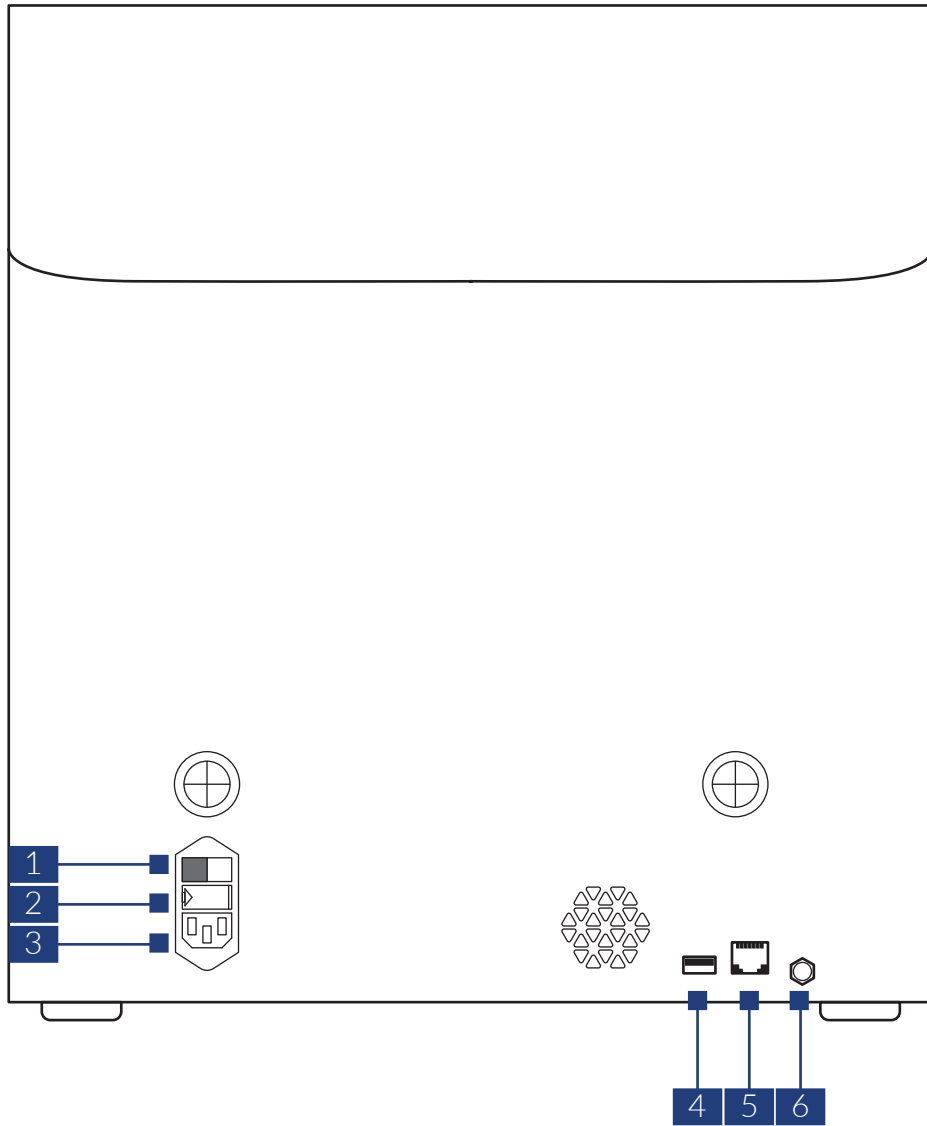
## 2. Specifications



## 2.1 Product map



- 1. Clean Chamber (tm) unit
- 2a. UV sterilization LED 1
- 2b. UV sterilization LED 2
- 3a. Printhead mount 1
- 3b. Printhead mount 2
- 3c. Printhead mount 3
- 4a. Photo curing module mount 1
- 4b. Photo curing module mount 2
- 5. Printbed
- 6. 7" touch screen
- 7. USB port
- 8. Protective door



1. Power switch
2. Fuse
3. Power socket
4. USB port
5. Ethernet port
6. Pneumatic port

## 2.2 Technical specifications

Power input:	100-240 VAC, 50-60 Hz, 600 W
Fuse:	250VAC, T8A
Air pressure input:	0-700 kPa
Weight:	17 kg
Height:	477mm
Width:	441mm
Depth:	365mm
Filter class:	HEPA 14



## 3. Getting started





## 3.1 Unpacking BIO X

To unpack BIO X, follow the simple steps below.

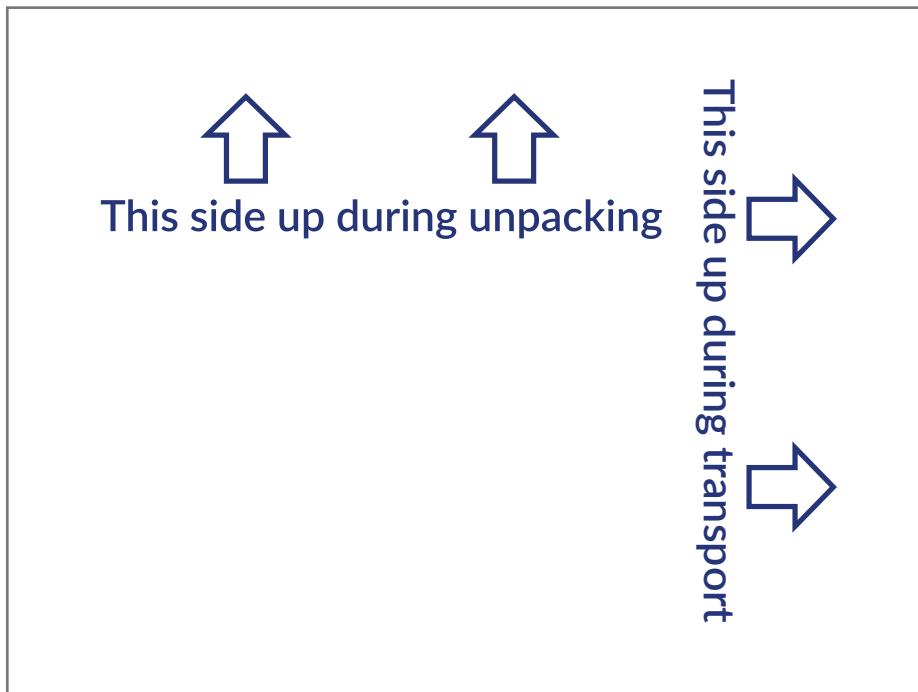


Caution! To avoid injury to personnel and to avoid damaging BIO X during the unpacking process, follow the instructions provided below. DO NOT attempt to unpack BIO X in any other way than the one instructed.



Caution! BIO X is a heavy instrument. Always have a minimum of two people when unpacking or moving BIO X. Always lift and carry the instrument in the manner described in the manual.

1. Clear a steady table and a floor space of at least 3 x 2 meters.
2. Place the box containing BIO X on its side in accordance to the arrows on the side of the box.



3. Carefully remove the tape on the top of the box.
4. Using the handles in the packaging, pull the contents of the box out onto the floor.
5. Carefully turn BIO X the right way up by lifting in the packaging.
6. Remove the top piece of the packaging, and by grabbing it at the bottom edge, lift BIO X out of the bottom piece of the packaging onto the table.
7. Remove any remaining packaging material from BIO X.
8. Remove the remaining contents of the box and check that you have received all equipment on the list below.

## 3.2 Contents of the box

[1x] BIO X 3D printer.....	<input type="checkbox"/>
[3x] Pneumatic-based printheads.....	<input type="checkbox"/>
[3x] Pneumatic adapter for 3cc cartridge.....	<input type="checkbox"/>
[1x] 365 nm UV module.....	<input type="checkbox"/>
[1x] 405 nm UV module.....	<input type="checkbox"/>
[1x] Power cord.....	<input type="checkbox"/>
[1x] USB Memory drive.....	<input type="checkbox"/>
[1x] Surface probe adapter.....	<input type="checkbox"/>
[1x] Petri Dish Holder kit.....	<input type="checkbox"/>

### **Bioink consumables box containing:**

[2x] 3mL CELLINK bioink (sterile).....	<input type="checkbox"/>
[1x] Material safety data sheet and Application note.....	<input type="checkbox"/>
[5x] 3mL CELLINK GelMa bioink (sterile).....	<input type="checkbox"/>
[1x] Material safety data sheet and Application note.....	<input type="checkbox"/>
[2x] 3mL CELLINK START bioink (sterile).....	<input type="checkbox"/>
[1x] Material safety data sheet and Application note.....	<input type="checkbox"/>
[1x] CELLINK START kit.....	<input type="checkbox"/>
[2x] 50mL of CELLINK Start.....	<input type="checkbox"/>
[5x] Female to female luer lock adapters.....	<input type="checkbox"/>
[20x] 3mL empty cartridge with piston and end caps.....	<input type="checkbox"/>
[2x] STARTINK-kit (sterile), each containing:.....	<input type="checkbox"/>
[1x] Cell syringe.....	<input type="checkbox"/>
[1x] Syringe with 3 mL of CELLINK Bioink.....	<input type="checkbox"/>
[1x] Dispensing unit.....	<input type="checkbox"/>
[1x] Mixing unit.....	<input type="checkbox"/>
[1x] Filling cartridge.....	<input type="checkbox"/>
[2x] Crosslinking solution.....	<input type="checkbox"/>
Application note.....	<input type="checkbox"/>

### **Nozzles and consumables box containing:**

[1x] Sterile empty 12mL syringe.....	<input type="checkbox"/>
[1x] Sterile nozzle kit.....	<input type="checkbox"/>
[1x] High precision conical nozzles, 50 pcs (Blue, GA 22).....	<input type="checkbox"/>
[1x] High precision conical nozzles, 50 pcs (Red, GA 25).....	<input type="checkbox"/>
[1x] High precision conical nozzles, 50 pcs (Clear, GA 27).....	<input type="checkbox"/>
[1x] Blunt needles 20G, 50 pcs.....	<input type="checkbox"/>
[1x] Blunt needles 22G, 50 pcs.....	<input type="checkbox"/>
[1x] Blunt needles 25G, 50 pcs.....	<input type="checkbox"/>
[1x] Blunt needles 27G, 50 pcs.....	<input type="checkbox"/>
[2x] Glass petri dish.....	<input type="checkbox"/>

### 3.3 Setting up BIO X

When BIO X is unpacked, it is time to set up. Before connecting BIO X to a wall socket, ensure that the socket is grounded. Next, connect BIO X to the power outlet (see 2.1 Product map) and the grounded wall socket with the included power cable.

BIO X has an internal air supply capable of supplying 200 kPa to the printheads. If you wish to use a higher pressure than this, connect an external air supply to the back of BIO X (see 2.1 Product map).

Next switch on the instrument using the power switch on the back (see 2.1 Product map) and you are ready to go!



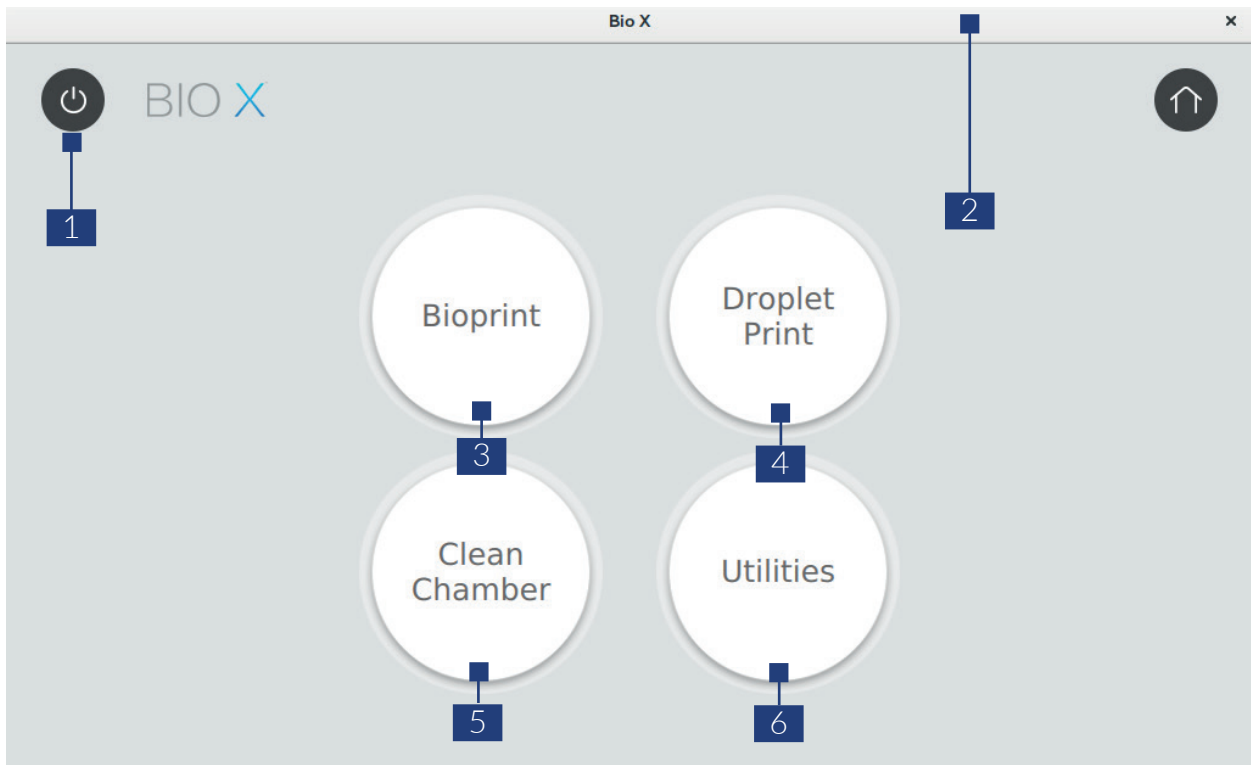
Caution! Connecting BIO X to a non-grounded socket could cause personal injury or damage to BIO X!



Caution! Ensure that the external air supply does not exceed the pneumatic specifications (see 2.2 Technical specification)! Not complying with these specifications could cause personal injury or damage to BIO X!

## 3.4 Starting BIO X for the first time

The first time you start BIO X you will be required to accept a licence agreement. After accepting the licence agreement, you will be taken to the home screen and BIO X is ready for use.



1. Standby – Tap to put BIO X in standby mode. To start BIO X from standby mode, turn off the power using the power switch on the back, wait 30 seconds and turn it back on.
2. Status bar – Symbols in this area will alert you of potential hazards such as hot surfaces or active UV lights (see the symbols below). Use caution when these symbols are displayed.



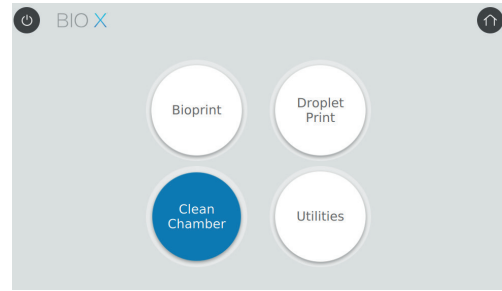
3. Bioprint - Tap to start a 3D Bioprinting process
4. Droplet Print - Tap to use the droplet menu. It allows the user to print droplets only by selecting the wellplate -used.
5. Clean chamber - Tap to toggle settings related to CELLINK's clean chamber technology or to initialize an UV sterilization procedure.
6. Utilities – Tap to open the utilities menu. The utilities menu contains advanced settings and functions for troubleshooting.

## 4. Bioprinting with BIO X



## 4.1 Clean Chamber

### Sterilizing using UV-light

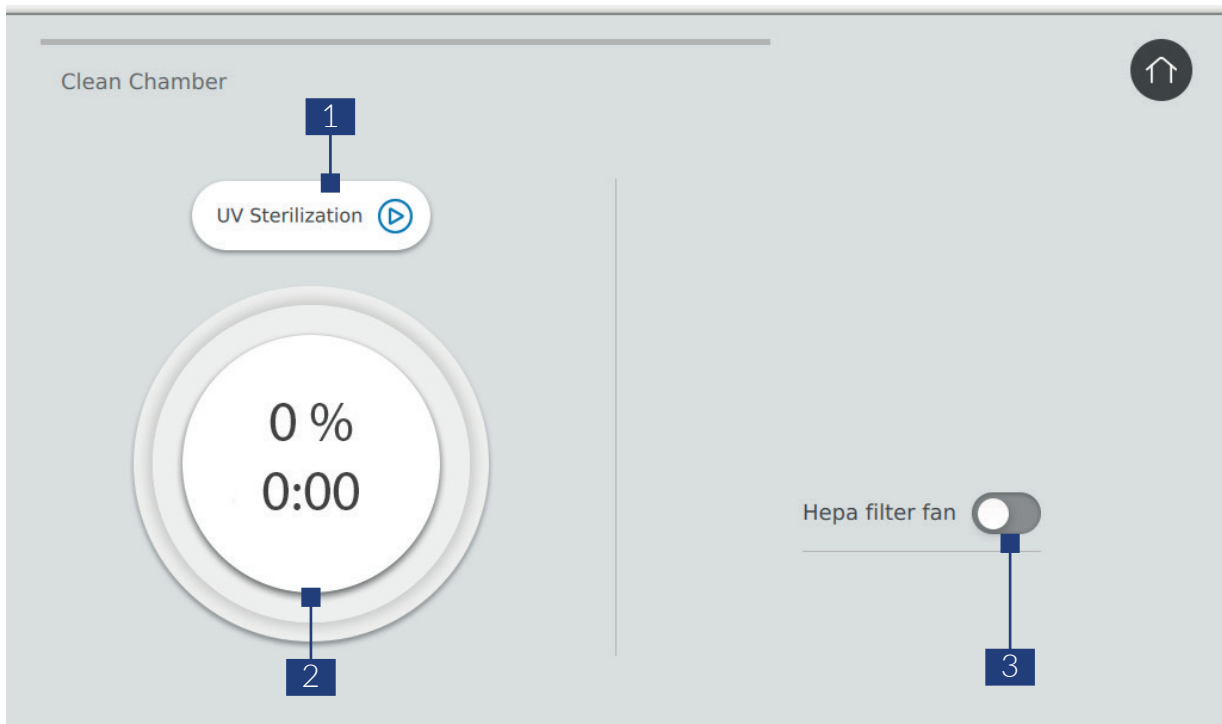


Caution! Do not reach into the printchamber or look directly at the UV lamp during the UV sterilization procedure. Doing so risks causing personal injury!

Attention! The UV sterilization procedure will kill or damage any living organisms inside the printchamber. Make sure to remove any of your cells or tissues from the printchamber before initializing the UV sterilization procedure.

To ensure a sterile environment, BIO X is equipped with a UV sterilization system which will create a sterile printchamber which is then maintained sterile by the Clean Chamber Technology. CELLINK recommends running the UV sterilization procedure before each bioprinting session.

To initialize the UV sterilization procedure, select 'Clean chamber' from the Home screen and confirm.



1. UV Sterilization - Tap to start or abort the UV sterilization procedure.
2. Progress indicator.
3. HEPA filter fan - Tap to toggle the HEPA filter fan on/off (both during the sterilization procedure and during a bioprinting process).



## 4.2 Bioprinting from a 3D model

Choose this option to start a new bioprinting process using a 3D model. BIO X will guide you through the process and help you to set up for a perfect bioprint.

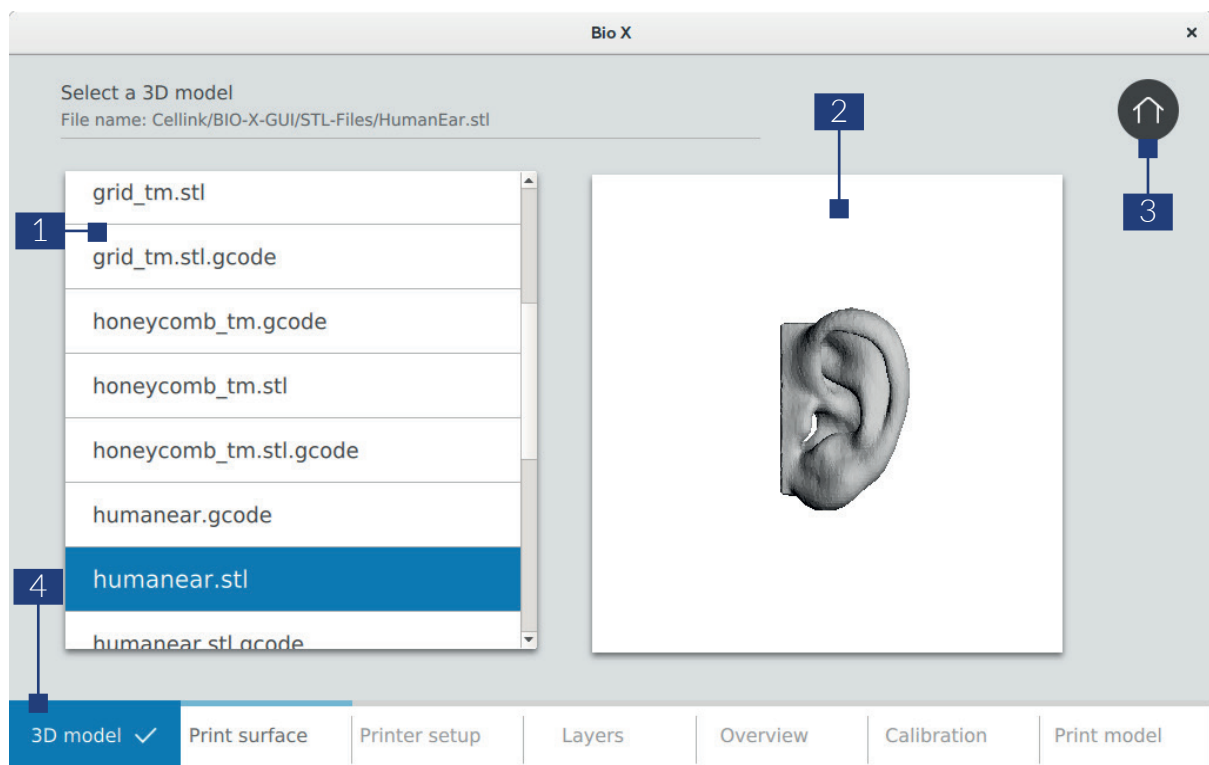


### 4.2.1 Open file

Insert an USB-drive containing your 3D model and any custom profiles you would like to use into the USB-port on the front of BIO X. Note that the USB-drive has to remain connected to BIO X until the bioprinting process has begun.

Note: The USB-Drive needs to be *readable* and *writable*.

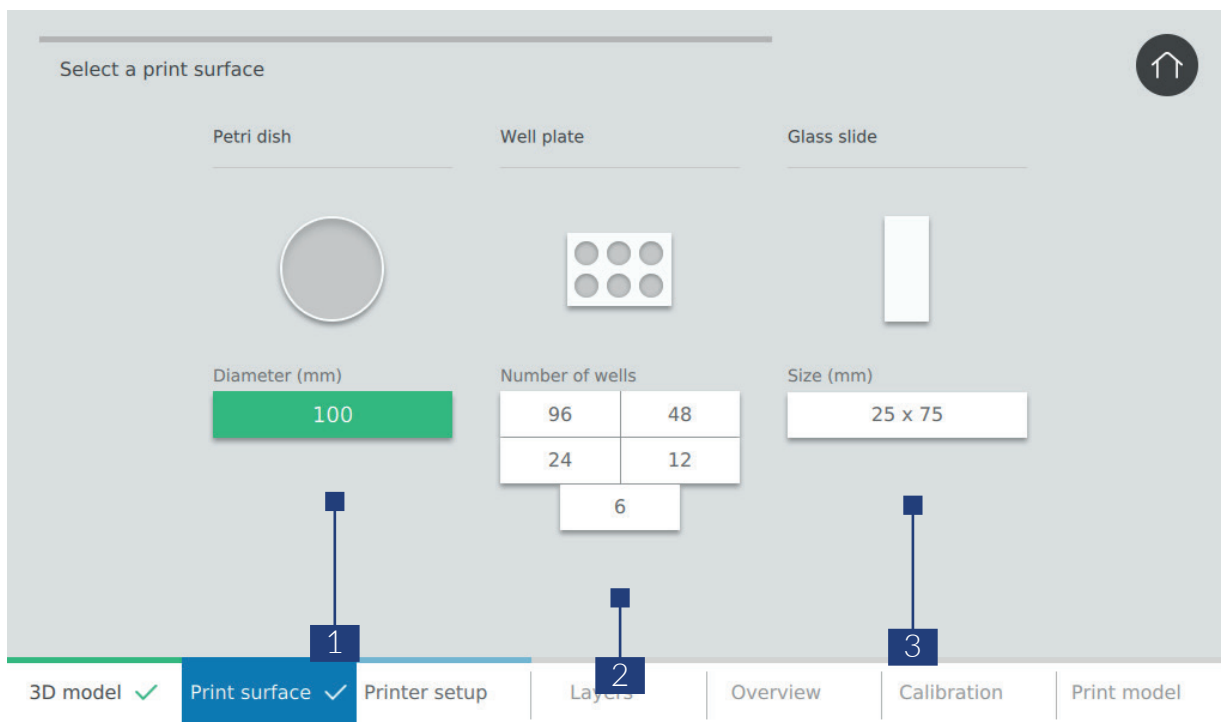
Next, choose the model you wish to bioprint. BIO X accepts the file formats .stl, .obj, .amf, and .BIOX.



1. File list - Tap to select the model you wish to bioprint.
2. Preview - The model currently selected will appear in this window.
3. Home - Use this button to abort the set up process and return to the Home screen.
4. Navigation bar - Use this bar to navigate backwards and forwards in the bioprinting setup. A check mark will appear once a step is completed.

## 4.2.2 Print surface

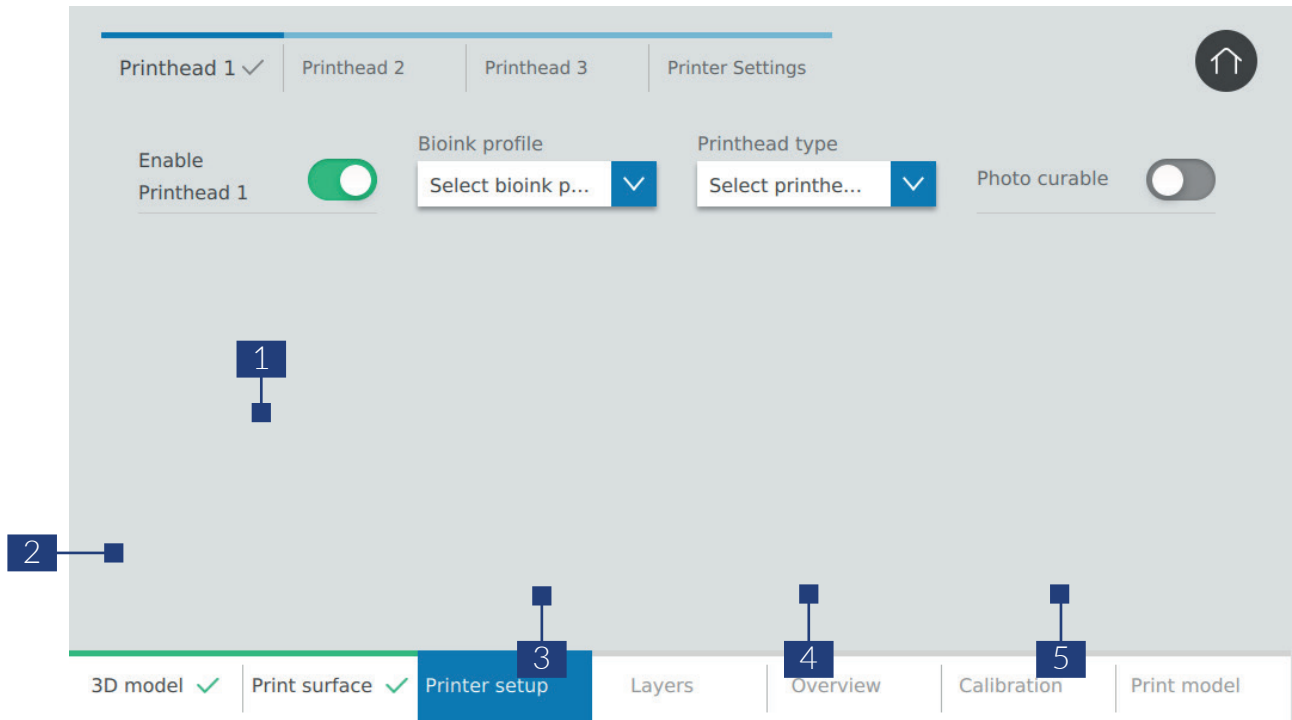
Next select the surface on which to bioprint. BIO X can bioprint on a range of different surfaces, from petri dishes to well plates to glass slides. Select the surface that you want to print on and the



1. Petri dish - Select to bioprint on a petri dish. This is a versatile option, useful for many different applications.
2. Well plate - Select to bioprint in a well plate. This is suitable if you wish to prepare samples for cell studies.
3. Glass slide - Select to bioprint on a glass slide. This is suitable if you want to examine your model using for example a microscope.

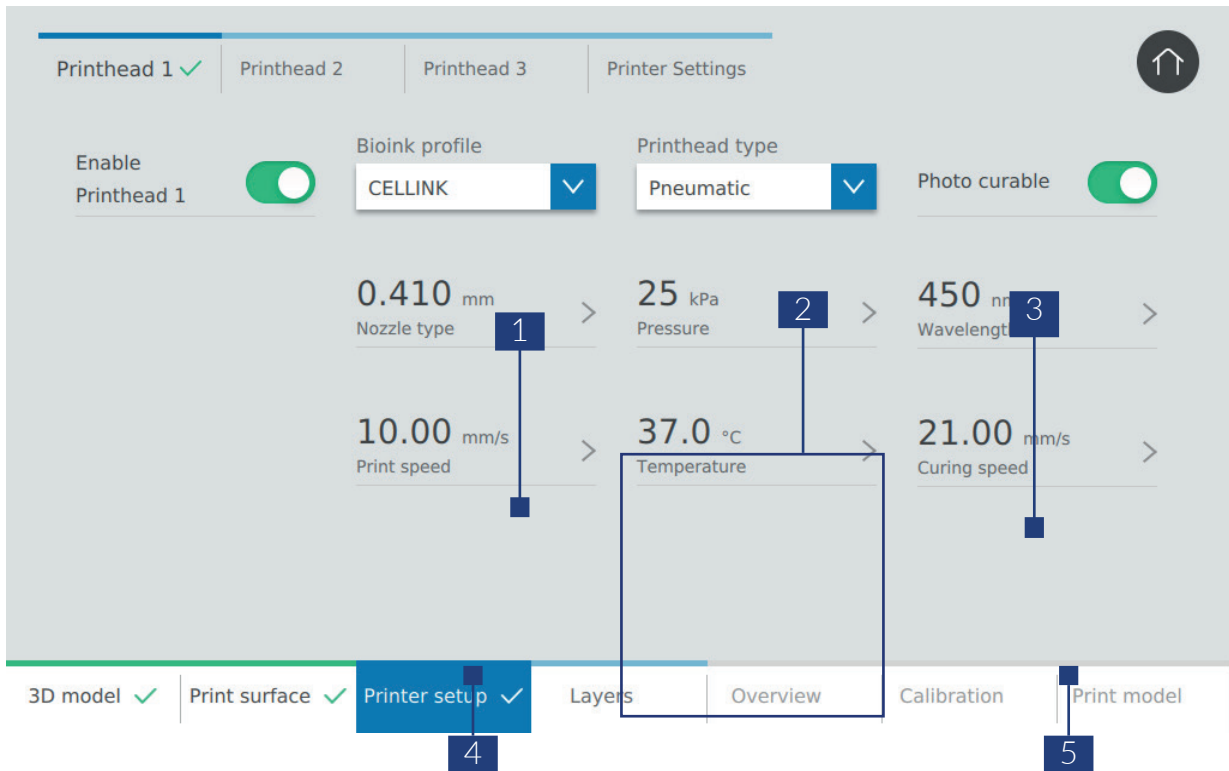
## 4.2.3 Printheads and printbed

In the next step the printheads and printbed are to be configured. Depending on which printheads are chosen, different settings are required (explained in detail in the printhead's separate manual). BIO X can bioprint using three different printheads during the same bioprint. The properties of the bioink in each printhead are also to be inserted or imported in this step.



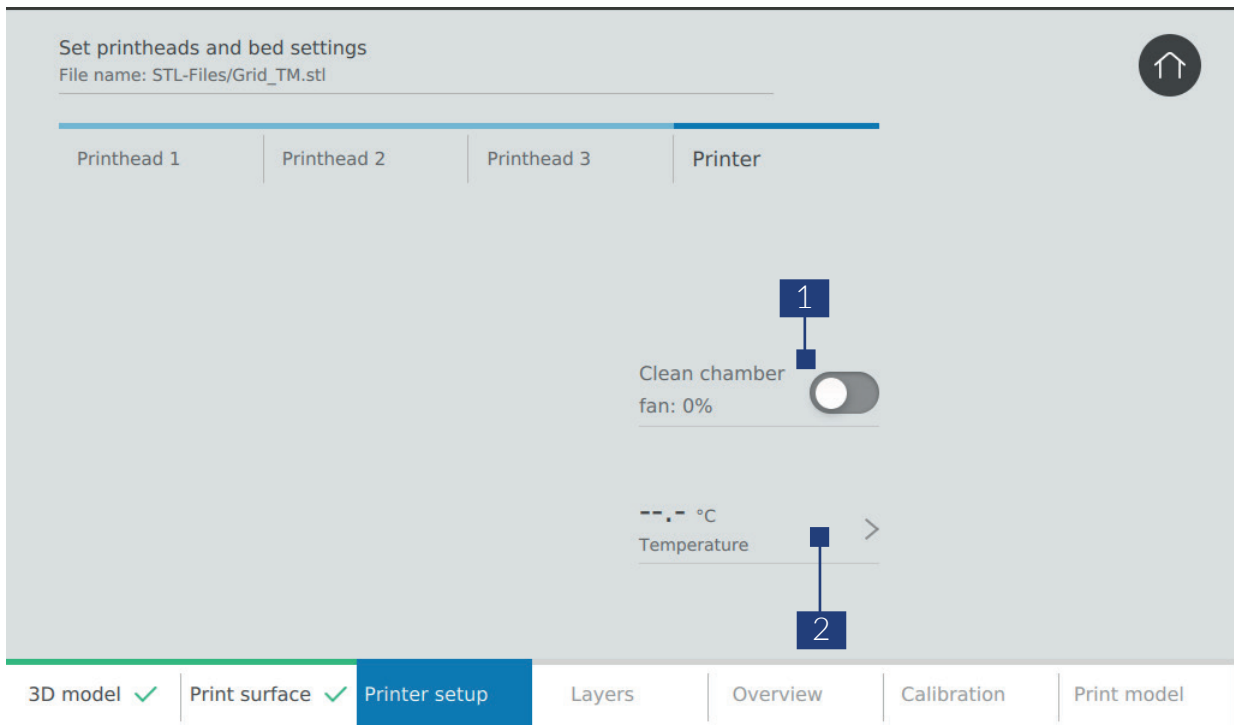
1. Navigation bar – Use this to toggle between the settings for the different printheads and the printbed.
2. Toggle printhead – Tap to select if you want to use the printhead or not. If you select to use the printhead further settings will appear.
3. Bioink profile – Select the bioink profile you want to use. BIO X comes preloaded with profiles for all CELLINK’s bioinks.
4. Printhead type – Select the type of printhead you want to use. Different settings will appear below depending on what type of printhead you select. BIO X comes preloaded with profiles for all CELLINK’s intelligent printheads.
5. Photo curing – Toggle whether to use UV to crosslink the model. If selected further options will appear.

When you have selected to use a printhead further settings regarding the printhead will appear. You can choose either to use or tweak a predefined profile or to create an entirely new one. The bioink and photo curing parameters remain the same for all different bioinks and printheads, however, the printhead parameters change depending on what type of printhead you decide to use.



1. Nozzle type – Tap to select what type and size of nozzle you want to use.
2. Printhead settings – These settings change depending on which intelligent printhead you use. Consult the manual for the specific printhead for more information.
3. Photo curing wavelength – Tap to select which wavelength to use for photo curing.
4. Print speed – Tap to select the speed of the printhead.
5. Curing speed – Tap to select the speed of the movement of the photo curing module.

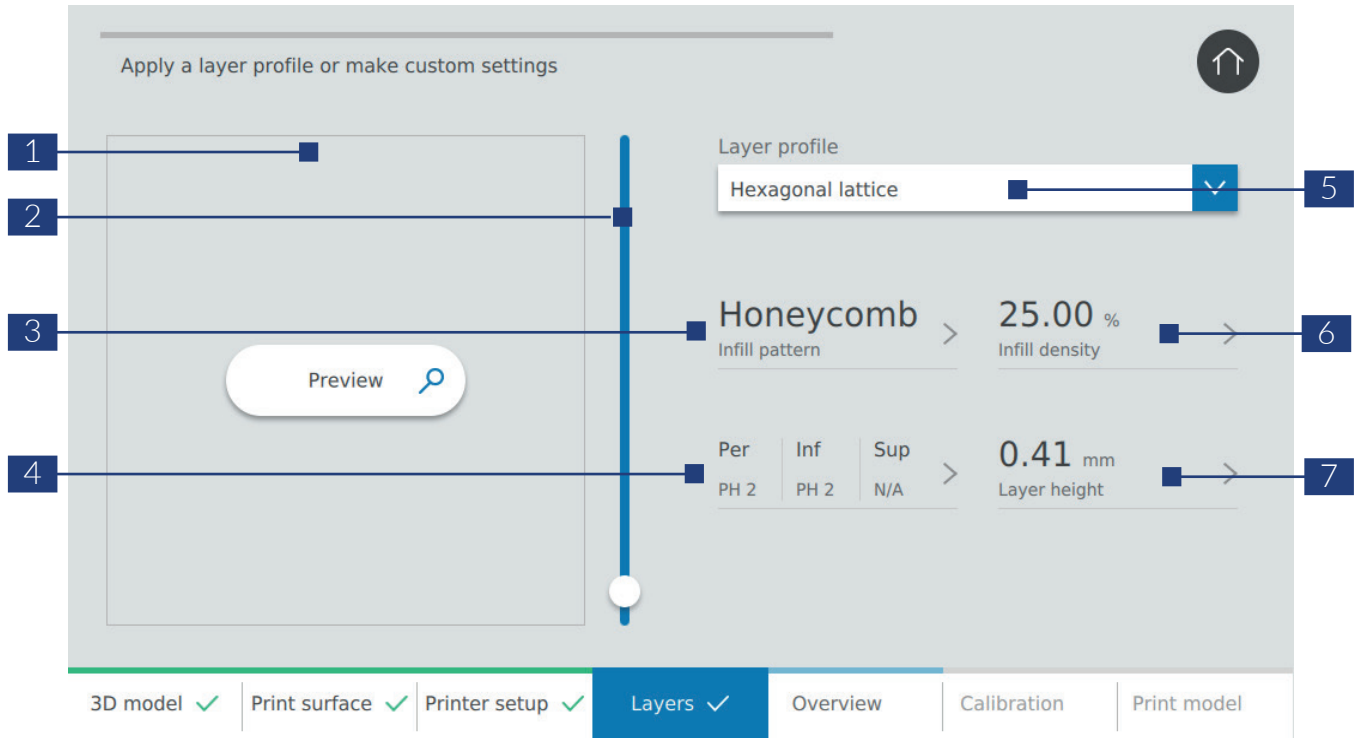
In the printbed settings you can adjust the temperature of the printbed. You can choose between having the printbed at a certain temperature or to turn the temperature control off and bioprint at the ambient temperature.



1. Clean chamber fan – Toggle the clean chamber fan option on/off.
2. Adjust temperature – If you want to use the temperature controlled printbed option you can adjust the temperature here.

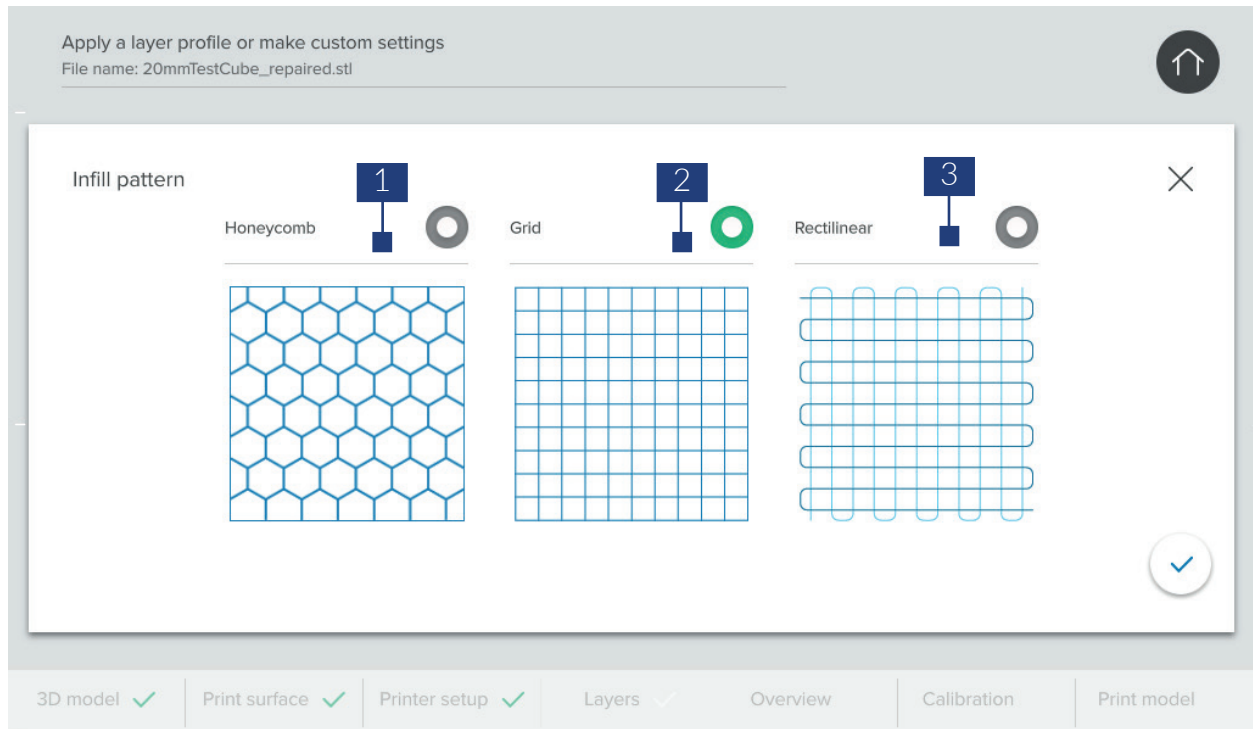
## 4.2.4 Layer settings

In layer settings you can find different options regarding how the 3D model is divided into layers and how BIO X should bioprint the model. You can choose between BIO X's predefined settings or create custom settings.



1. Preview – A preview of the chosen layer profile can be seen here.
2. Preview slider – Drag this to select which layer to preview.
3. Infill pattern – Tap to choose infill pattern.
4. Printhead use – Tap to select which part of the model each printhead should bioprint.
5. Layer profile – Select one of the saved layer profiles or choose to create a new one.
6. Infill density – Tap to select how dense the model should be (%).
7. Layer height – Tap to select layer height. CELLINK advises to use the same layer height as the nozzle diameter.

## 4.2.5 Layer settings - Infill pattern



1. Honeycomb pattern – The honeycomb pattern is suitable as an infill for tissue constructs that must be mechanically rigid such as bone. The pattern is most relevant for constructs to withstand compression.
2. Grid pattern – The grid pattern is suitable as an infill for tissue constructs that much possess isotropic mechanical characteristics. This pattern prints solid at every layer, resulting in a construct that possesses solid walls between the pores. This results in good compressive strength. Tissues such as bone and cartilage are most applicable for this pattern.
3. Rectilinear pattern – The rectilinear pattern is suitable as an infill for tissue constructs that must possess isotropic mechanical characteristics. Tissues such as skin, fascia, and cartilage are most applicable for this pattern.

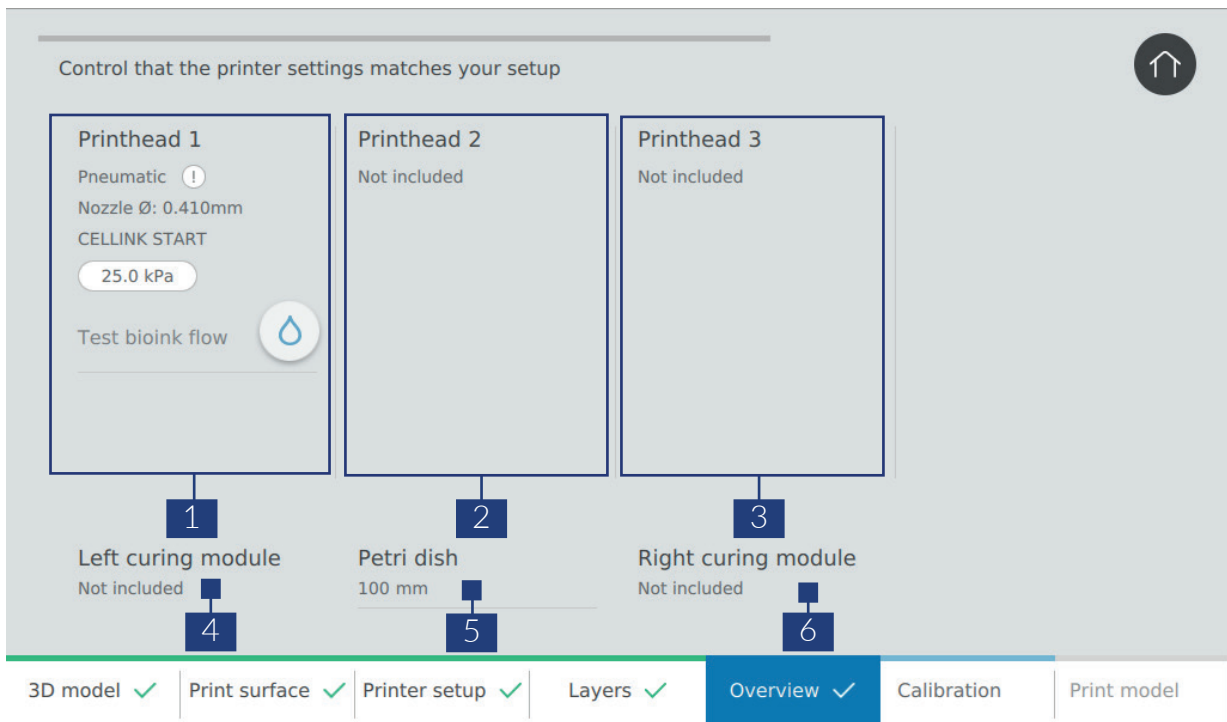
## 4.2.6 Layer settings - Printhead use

In the 'Printhead use' settings, you can decide which printhead should bioprint which part of your 3D structure. This enables you to use support structures when bioprinting, allowing for the creation of complex structures using multiple infill materials. Three different modes are available:

1. Infill – If enabled, BIO X will use the selected printhead to bioprint the infill pattern of your 3D model.
2. Perimeter – If enabled, BIO X will use the selected printhead to bioprint the perimeter of your 3D model.
3. Support – If enabled, BIO X will use the selected printhead to print a support structure for your 3D model. Use this option if you are planning to bioprint a structure which cannot support itself.

## 4.2.7 Overview and mounting of bioprinting equipment

In this step, all the settings can be reviewed. Should a setting or value be incorrect you can easily go back to that step and correct it by pressing the navigation bar at the bottom of the screen.



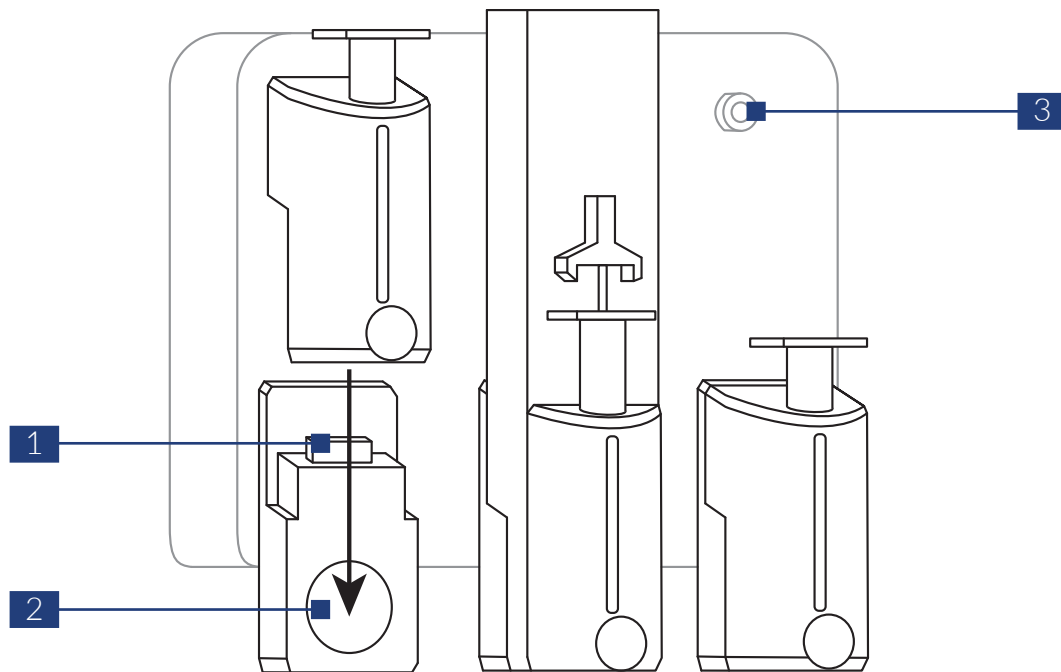
1. Printhead 1 - Settings for printhead 1.
2. Printhead 2 - Settings for printhead 2.
3. Printhead 3 - Settings for printhead 3.
4. Settings for the left UV curing module.
5. Print surface settings.
6. Settings for the right UV curing module



## 4.2.8 Overview and mounting of bioprinting equipment

It is now time to load and mount the printheads and print surface in BIO X. By following your settings on the screen, it is easy to set up BIO X correctly for your bioprinting process. Remember not to start the bioprinting process before you have correctly mounted the printheads, print surface, and bioink cartridges which you intend to use!

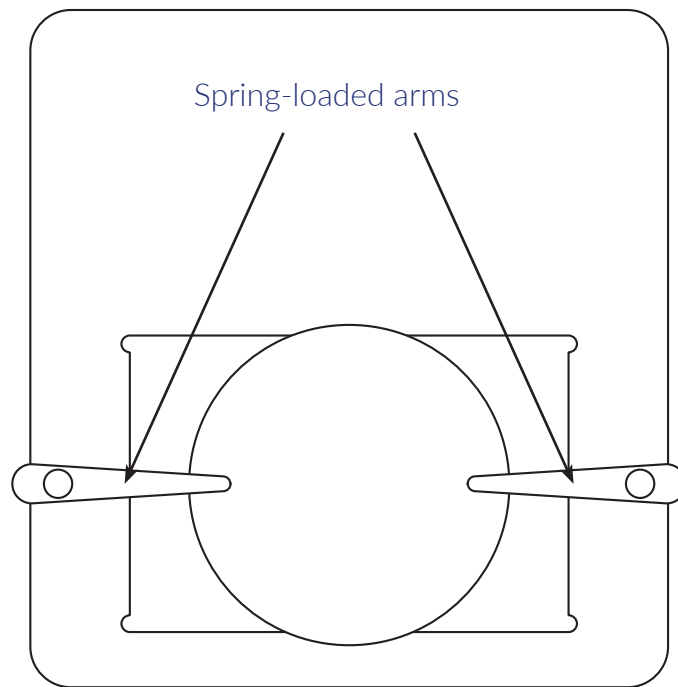
For instructions on how to mount a cartridge in your specific printhead, please refer to the manual of the specific printhead. To mount the printhead in BIO X, simply move the printhead straight down towards the printhead holder until you feel the magnet snap into place. Remember to connect pneumatic printheads to the pressure connector!



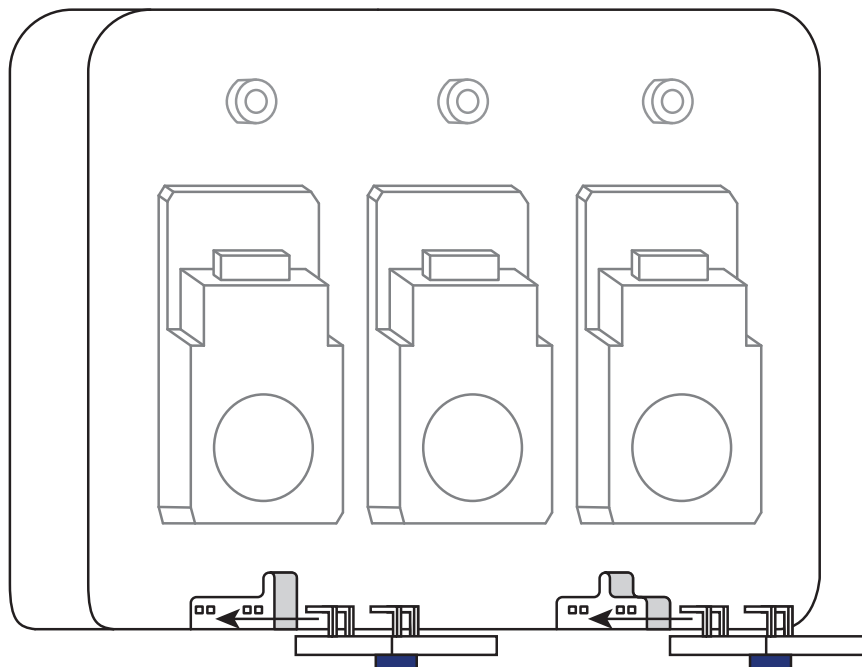
1. Intelligent printhead connector – This connector connects the intelligent printhead to BIO X's brain, allowing it to work its magic!
2. Magnet – The magnet holds the printhead firmly in place.
3. Pressure connector – A pressure connector delivering air to intelligent printheads with a pneumatic function.

## 4.2.9 Overview and mounting of bioprinting equipment

When inserting your print surface, use the spring-loaded arms to securely fasten it according to the figure below. If you are using a well plate, simply turn the arms to the sides. Note! If you are using a well plate, ensure that the well plate has the outer dimensions 128 x 85 mm.



When mounting the UV modules, be careful to mount them with the UV LED facing down and the contact facing up (see below)!

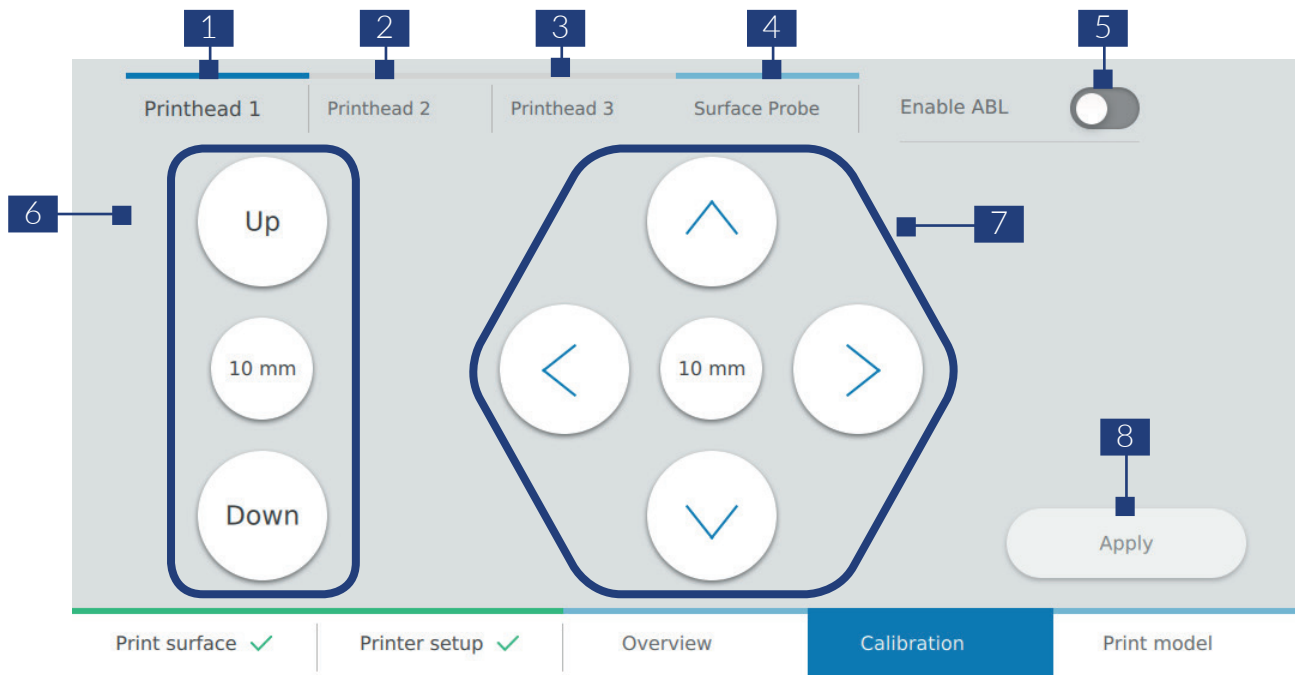


When you have mounted all printheads, print surfaces and cartridges according to your settings, simply tap 'Bioprint' and the bioprinting process will start.

## 4.2.10 Calibration and ABL

In the calibration settings, you can proceed to the calibration of your printheads and the surface probe. The surface probe is used to proceed to the ABL (Auto Bed Leveling). The ABL probes the bed at 3 points and enables bed leveling compensation in software by using a matrix to compensate for bed and/or print surface tilt.

The surface probe only needs to be calibrated once, the printer will then remember this calibration and apply it for each printings. However, the ABL must be enabled before each printing since it



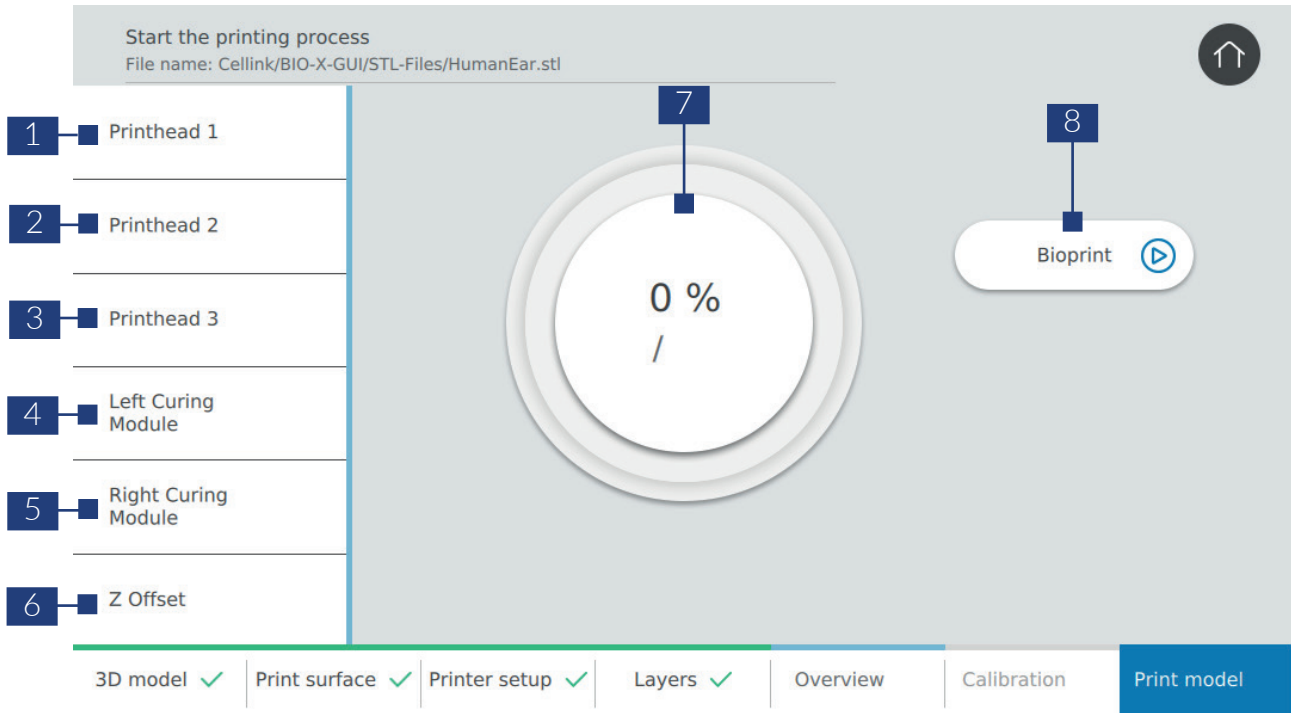
1. Printhead 1 - calibration tab for printhead 1.
2. Printhead 2 - calibration tab for printhead 2.
3. Printhead 3 - calibration tab for printhead 3.
4. Surface probe - calibration tab for the surface probe.
5. Enable ABL - Toggle the ABL option on/off.  
The ABL should be enabled after calibrating the surface probe and going back to the Printhead 1 tab.
6. Z axis command - controls the position of the printbed along the z axis.
7. X,Y axis command - controls the position of the printheads and the surface probe along the x and y axis.
8. Apply command - register the calibration settings.

## 4.2.11 Print model

This screen gives an overview of the bioprinting process. It will allow you to monitor the activity of each printhead and curing module during the whole process.

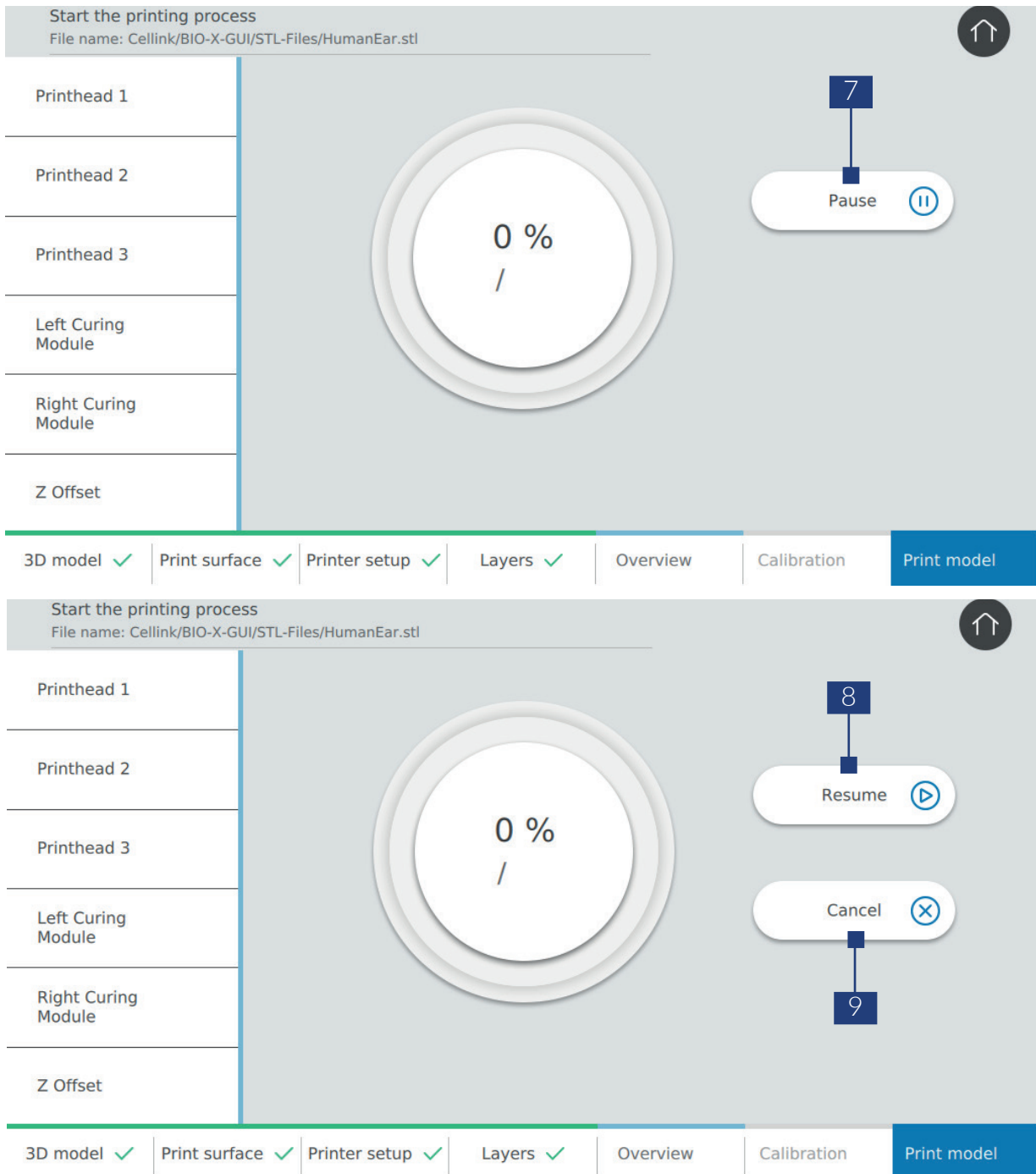


Caution! Do not open the door without pausing the bioprinting process and do not remove the printheads before the bioprinting process has completed. Doing so risks aborting the process and you risk losing your cells!



1. Printhead 1 – Allows you to monitor the specific properties of printhead 1.
2. Printhead 2 - Allows you to monitor the specific properties of printhead 2.
3. Printhead 3 - Allows you to monitor the specific properties of printhead 3.
4. Left photo curing module – Allows you to monitor the specific properties of the left photo curing module.
5. Right photo curing module – Allows you to monitor the specific properties of the right photo curing module.
6. Z Offset - Adjust printbed position during printing.
7. Progress indicator – Allows for an overview of how far the bioprinting process has come and how long it will take until it is completed.
8. Bioprint - Tap to start the bioprinting process.

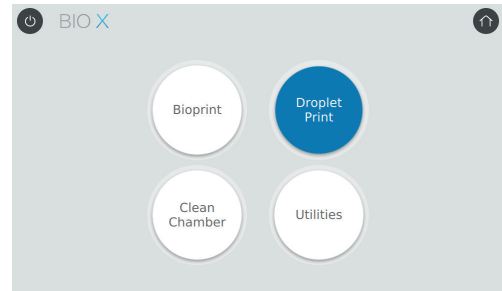
While you are printing, you can choose to pause the printing at any moment. Then you can choose to cancel the printing or resume.



9. Pause – Tap to pause the bioprinting process.
10. Resume – Tap to resume the bioprinting process. This option is only available when the bioprinting process is paused.
11. Cancel – Tap to cancel the bioprinting process. This option is only available when the bioprinting process is paused.

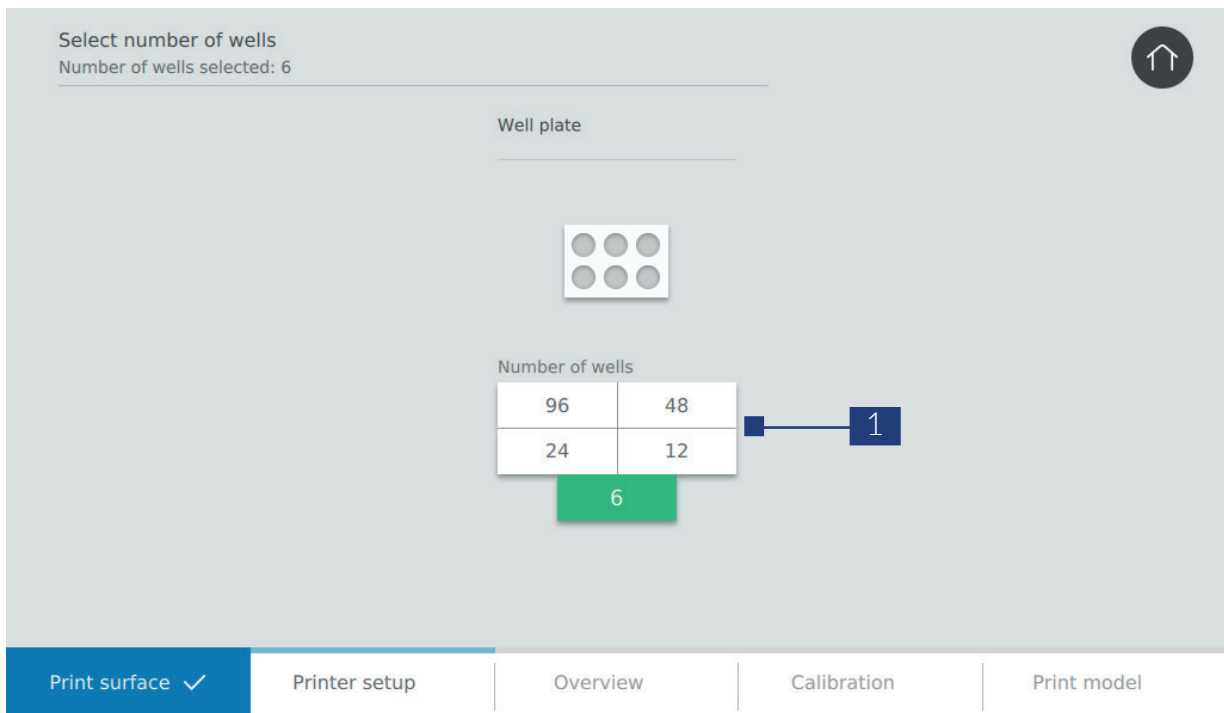
## 4.3 Bioprinting droplets

Choose this option to start bioprinting droplet without having to create a gcode for it. BIO X will guide you through the process and help you to set up for a perfect bioprint.



### 4.3.1 Choose Print surface

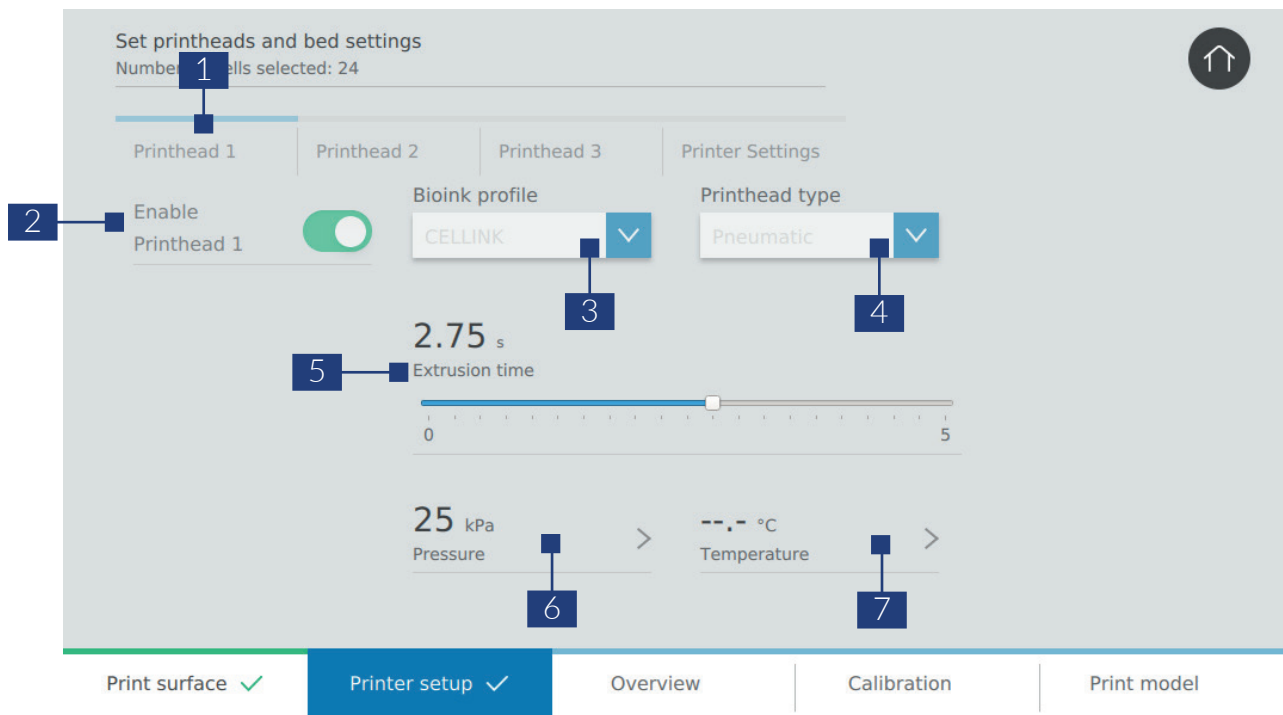
Select the wellplate on which you wish to bioprint. BIO X can bioprint on a range of different wellplates, from 6 to 96 wells.



1. Tap on the numbers to chose which wellplate you want to print in.

### 4.3.2 Choose Printer setup

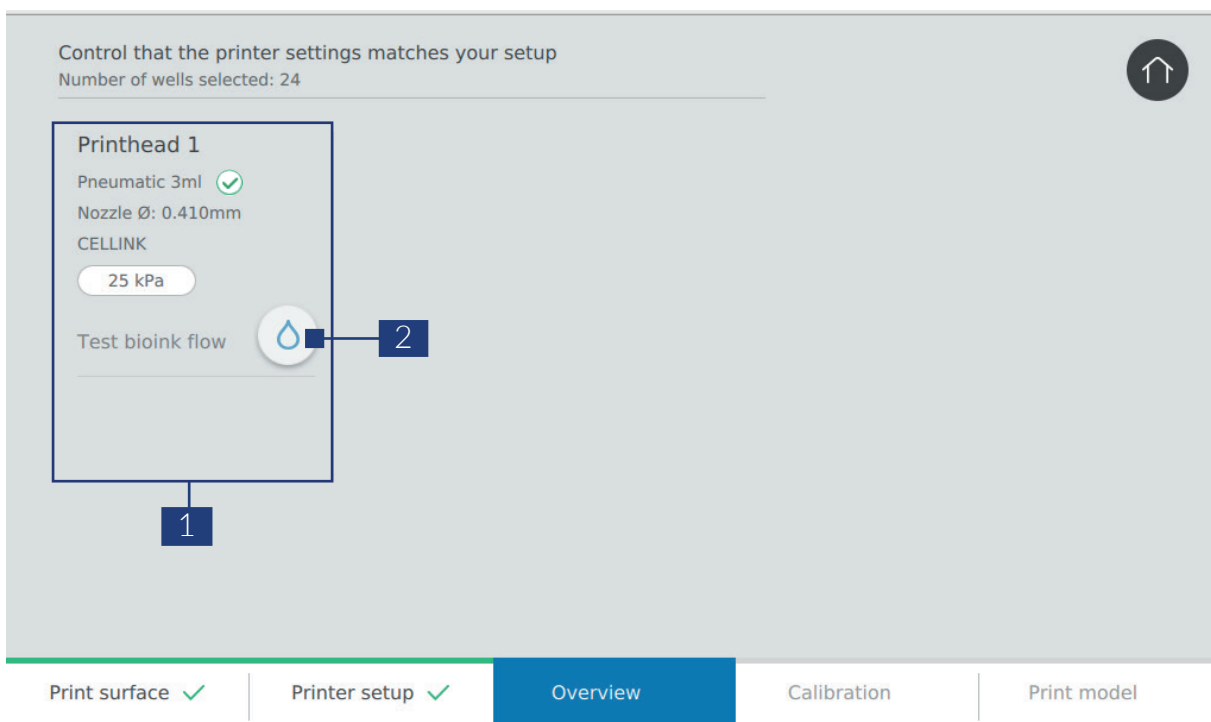
In the next step you can configure the printhead, the bioink and the printer settings. This step allows you to customize your printing according to your experiment.



1. Navigation bar – Use this to toggle between the settings for the different printheads and the printbed.
2. Toggle printhead – Tap to select if you want to use the printhead or not. If you select to use the printhead further settings will appear.
3. Bioink profile – Select the bioink profile you want to use or create a new one. BIO X comes preloaded with profiles for all CELLINK's bioinks.
4. Printhead type – Select the type of printhead you want to use.
5. Extrusion time – You can choose the extrusion time for printing the droplets by placing the slider on the graduated scale.
6. Pressure - Allows you to choose the pressure used to extrude.
7. Temperature - Allows you to choose the temperature of the printhead.

### 4.3.3 Overview and mounting of bioprinting equipment

In this step, all the settings can be reviewed. Should a setting or value be incorrect you can easily go back to that step and correct it by pressing the navigation bar at the bottom of the screen.



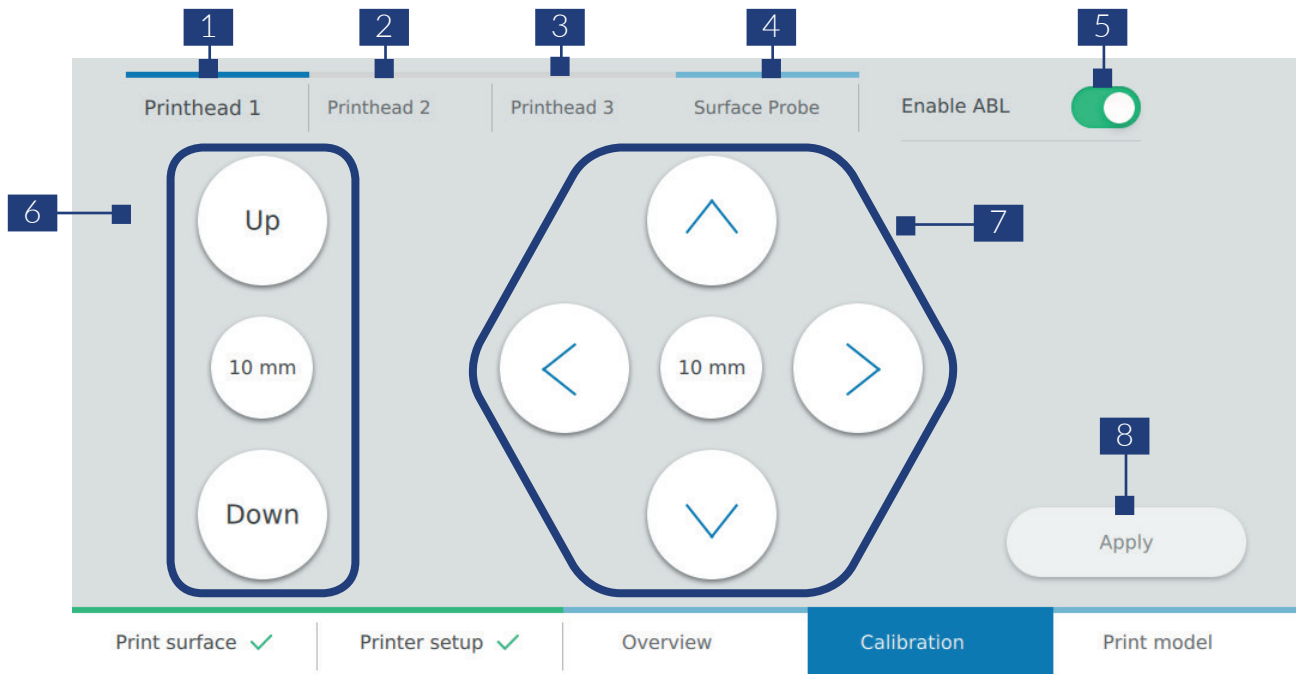
1. Printhead 1 - Settings for printhead 1.
2. Test bioink flow - Press the droplet button to assess the bioink flow.



### 4.3.4 Calibration and ABL

As in the bioprinting menu, in the calibration tab you can proceed to the calibration of your printheads and the surface probe. The surface probe is used to proceed to the ABL (Auto Bed Leveling).

The surface probe only needs to be calibrated once, the printer will then remember this calibration and apply it for each prints. However, the ABL must be enabled before each print since it compensates



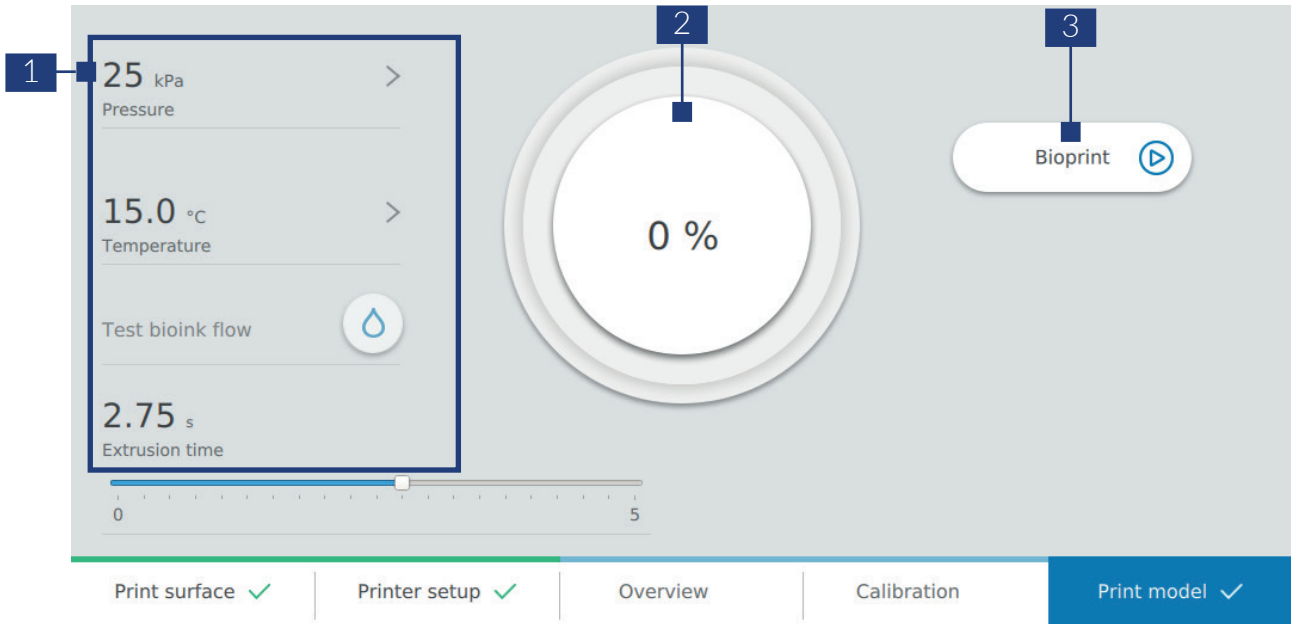
1. Printhead 1 - calibration tab for printhead 1.
2. Printhead 2 - calibration tab for printhead 2.
3. Printhead 3 - calibration tab for printhead 3.
4. Surface probe - calibration tab for the surface probe.
5. Enable ABL - Toggle the ABL option on/off.  
The ABL should be enabled after calibrating the surface probe and going back to the Printhead 1 tab.
6. Z axis command - controls the position of the printbed along the z axis.
7. X,Y axis command - controls the position of the printheads and the surface probe along the x and y axis.
8. Apply command - register the calibration set ups.

### 4.3.5 Print model

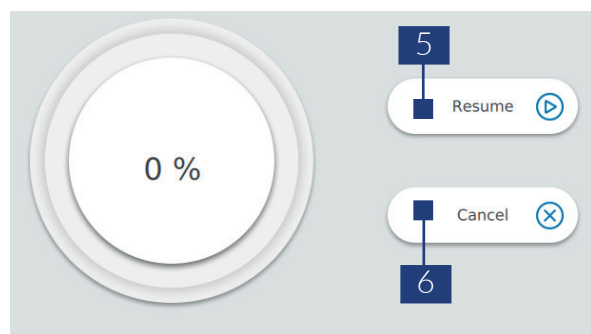
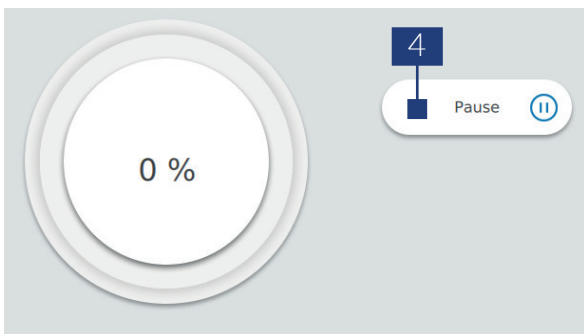
This screen gives an overview of the bioprinting process and will allow you to monitor the activity of each printhead during the whole process.



Caution! Do not open the door without pausing the bioprinting process and do not remove the printheads before the bioprinting process has completed.



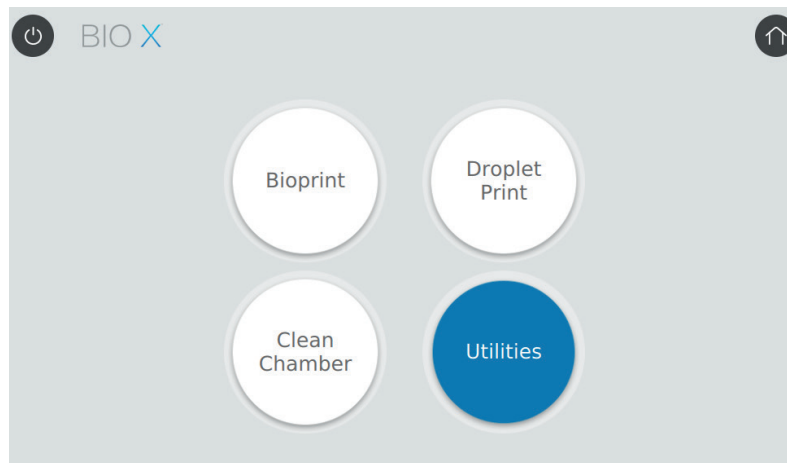
1. Printing setups - you can control the setup of your printing during the whole process.
2. Progress indicator - Allows for an overview of how far the bioprinting process has come and how long it will take until it is completed.
3. Bioprint - Tap to start the bioprinting process.



4. Pause - Tap to pause the bioprinting process.
5. Resume - Tap to resume the bioprinting process.
6. Cancel - Tap to cancel the bioprinting process.

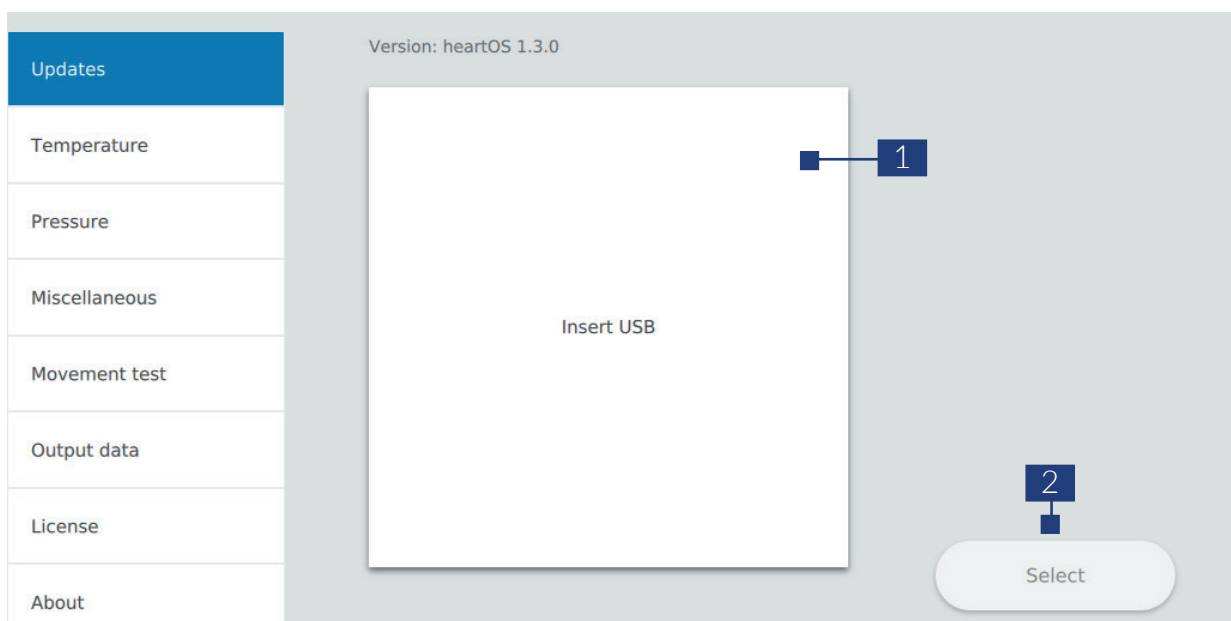
These options are available when the bioprinting process is paused.

## 4.4 Utilities



### 4.4.1 Update your Software version

The first tab in the “utilities” menu allows you to update your Software version. Once the update is downloaded on the USB drive, insert it in the BIO X. You can then access it via this tab and proceed to the updating of your BIO X.

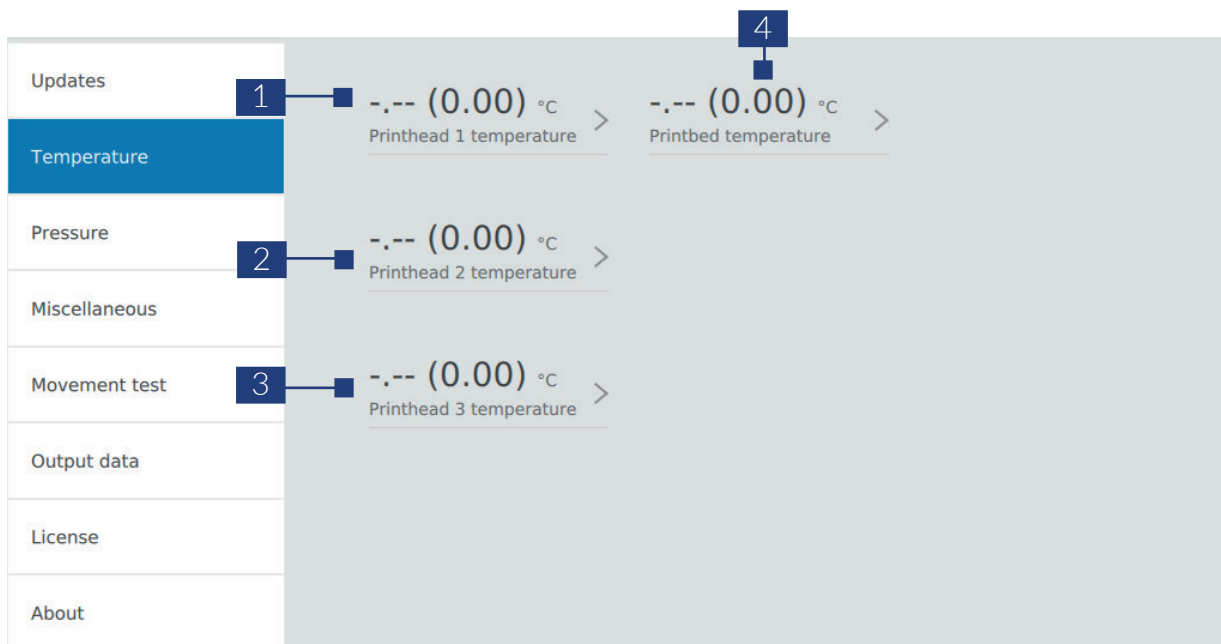


1. USB content list – allows you to select the desired update in the list in order to update your Software version.
2. Select – once you selected the desired update file, press “select” to start the updating of the software.

## 4.4.2 Printhead & printbed temperature control

The second tab allows you to control the temperature of your printheads and the printbed. That way you can choose to pre heat your printhead and/or printbed so that they would have the proper temperature as soon as you want to start Bioprinting.

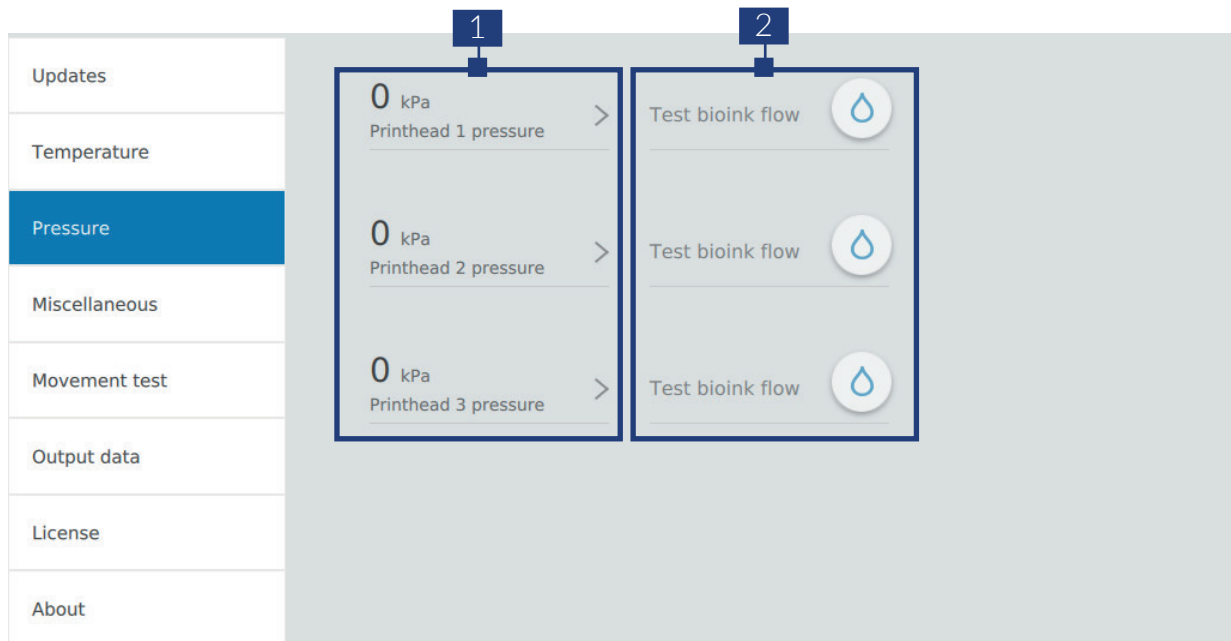
You can also choose to pre cool the printbed.



1. Printhead 1 temperature – Use this to set the temperature of the printhead 1.
2. Printhead 2 temperature – Use this to set the temperature of the printhead 2.
3. Printhead 3 temperature – Use this to set the temperature of the printhead 3.  
The temperature range **for pneumatic printhead is: [room temperature - 65 °C]**
4. Printbed temperature – Use this to set the temperature of the printed. [4-60°C]

### 4.4.3 Printheads pressure control

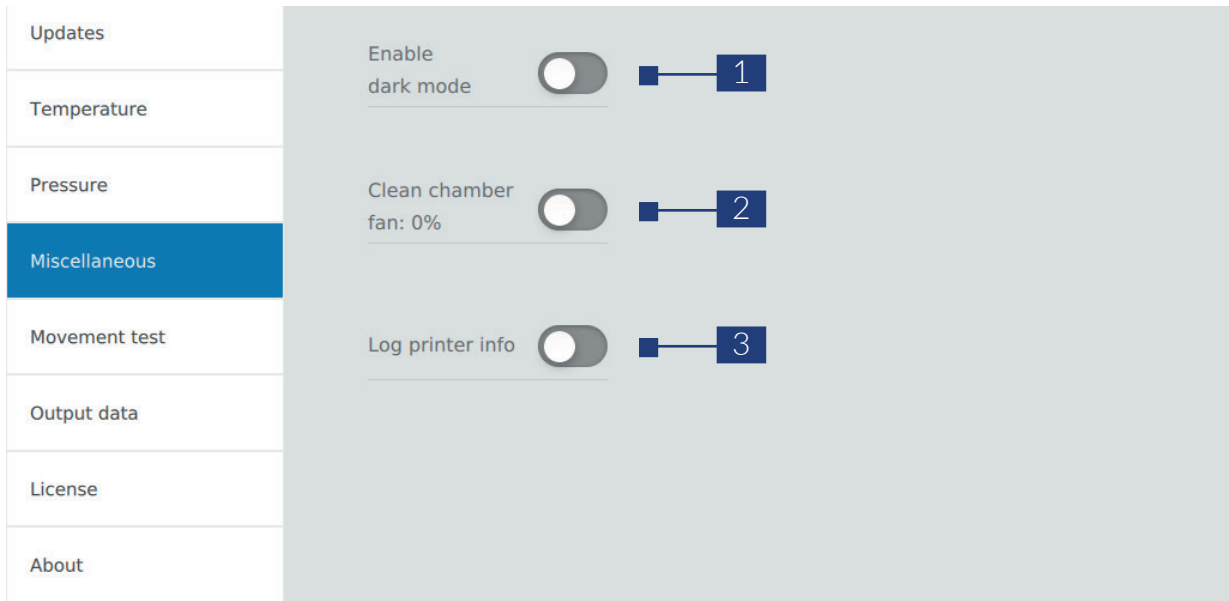
This allows you to test the pressure needed for the printhead to extrude correctly the material being used. This pressure mainly depends on the viscosity of the material.



1. Set pressure for each printhead (0-200kPa when using the internal air compressor, 0-700kPa when using external air compressor).
2. Test bioink flow - Press the droplet button to assess the bioink flow. Each droplet button correspond to one printhead for each print head.

#### 4.4.4 Miscellaneous tab

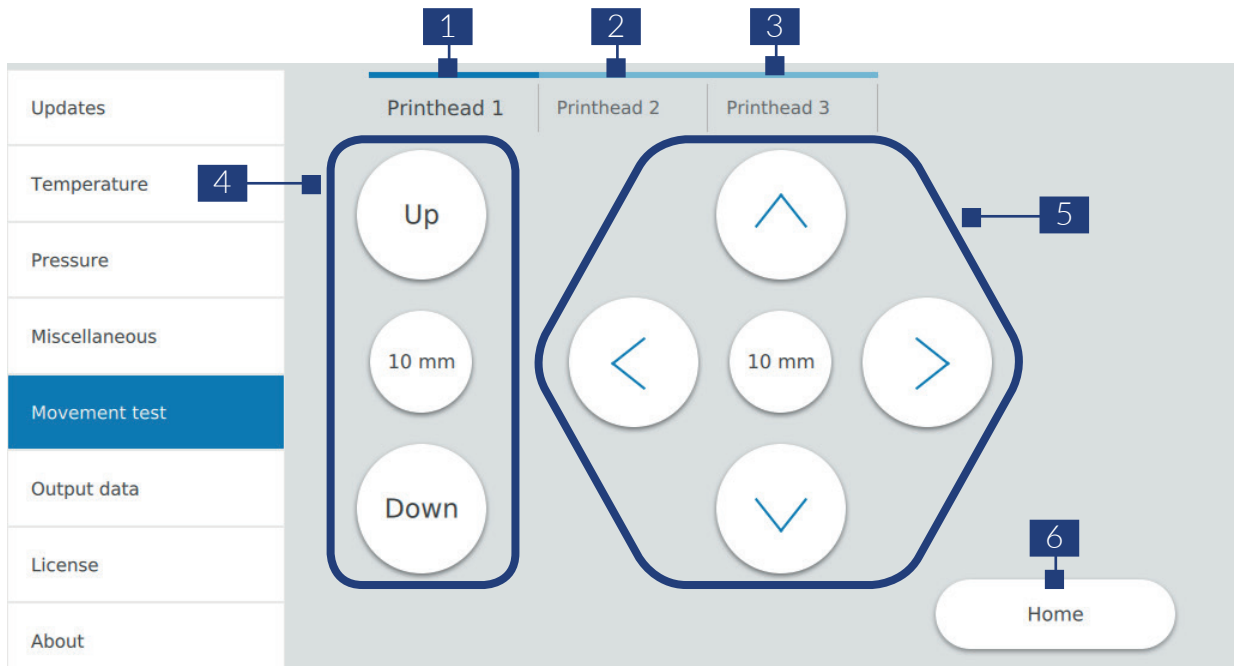
With this tab you can enable special features of the printer either for experimental or customer support purposes.



1. Enable dark mode - turn off all the chamber lights. This allows you to work with photo sensitive material.
2. Clean chamber fan - Toggle the clean chamber fan option on/off.
3. Log printer info - enable the logging of all necessary printer info when performing customer support.

## 4.4.5 Printhead movement test

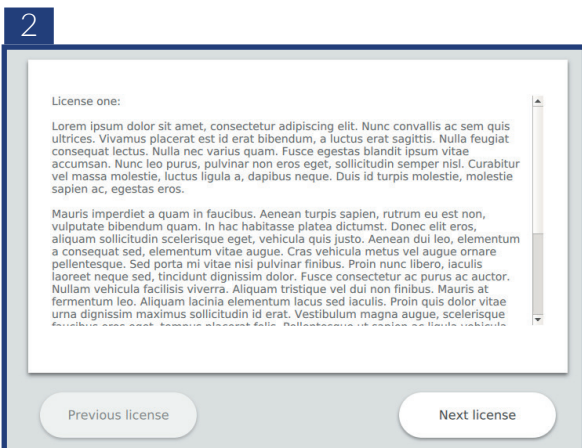
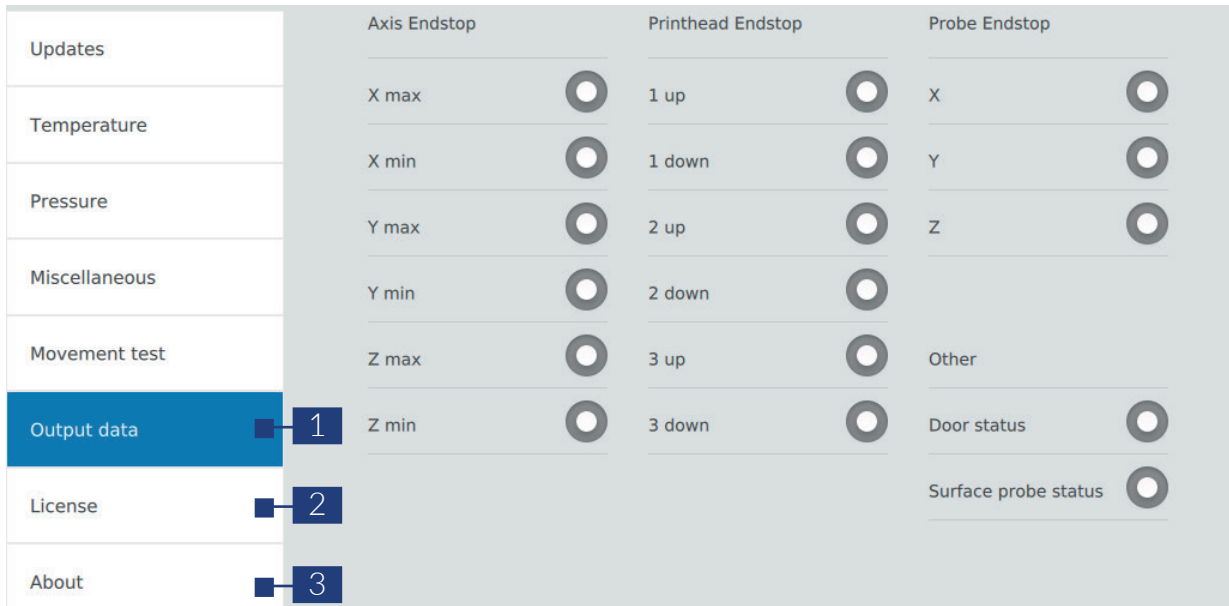
Thanks to this tab you can test the movement of the printheads along the 3 axis (x,y,z) before printing.



1. Printhead 1 - test movement for printhead 1.
2. Printhead 2 - test movement for printhead 2.
3. Printhead 3 - test movement for printhead 3.
4. Z axis command - controls the position of the printbed along the z axis.
5. X,Y axis command - controls the position of the printbeds and the surface along the x and y axis.
6. Home command - home the printer..

## 4.4.6 Customer support tabs

The output data tab is exclusively used when performing customer support. It allows us to check and test the different sensors.



1. Output data - Allows customer support to check and test the different sensors.
2. License - Gives you access to all the licenses of the printer and the software.
3. About - Gives the info for contacting the support and the version of the software.





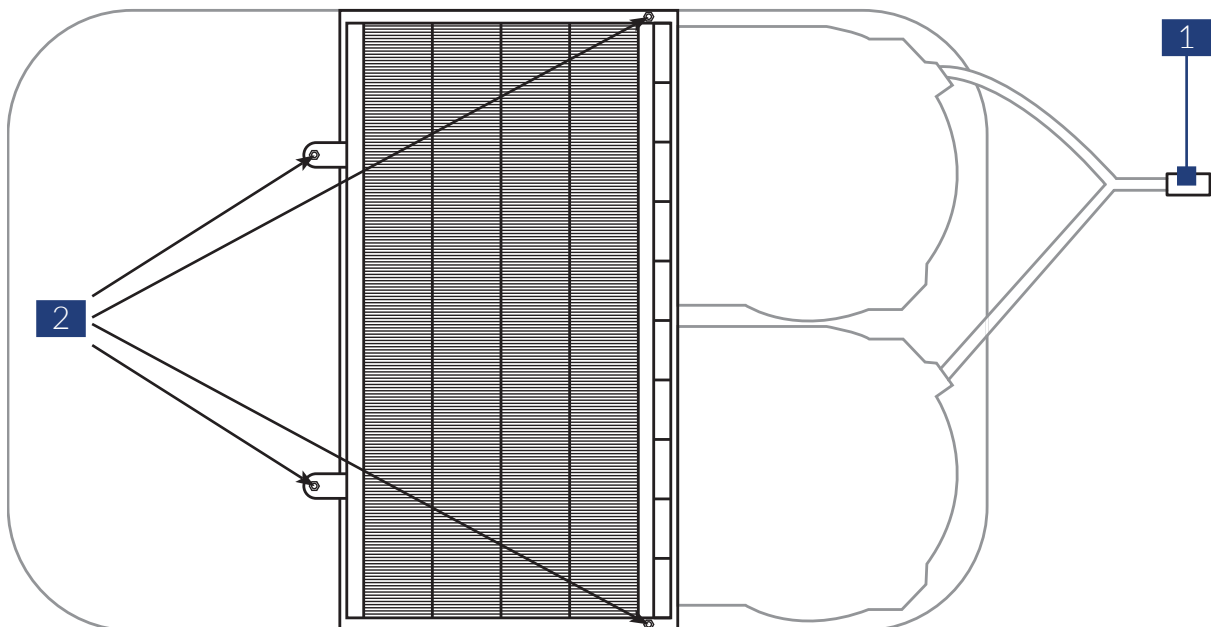
## 5. Maintenance



## 5.1 Changing the HEPA filter

The HEPA filter is part of CELLINK's patented Clean Chamber (tm) technology, ensuring a sterile printchamber for your research. To ensure this, the HEPA filter must be changed after 160 hours of runtime. Simply follow the instructions below to do this:

1. Turn off BIO X and disconnect the power cable.
2. Remove the Clean Chamber (tm) unit by reaching into the printchamber and pushing up at the HEPA filter until the Clean Chamber (tm) unit releases from the rest of BIO X.
3. Disconnect the cable powering the fans (1).
4. Put on a pair of gloves and sterilize them using >70 % ethanol.
5. Remove the four screws holding the HEPA filter in place (2).
6. Replace the HEPA filter with a clean one.  
Fasten the clean HEPA filter with the four screws and plug in the cable powering the fans.
7. Remount the Clean Chamber (tm) unit in the top of BIO X.



## 5.2 Manually cleaning or sterilizing BIO X

BIO X is covered with chemically resistant coating. It can be cleaned or sterilized with ethanol. Turn off and unplug BIO X before cleaning it with ethanol. Then simply spray the surface you wish to sterilize and wipe the surface with a soft cloth.



Caution! If ethanol has been used to clean the printchamber of BIO X, wait a minimum of 60 seconds before starting BIO X. This to vent out any remaining ethanol fumes. Not doing so can cause personal injury and/or damage to BIO X!



## 6. Terms and conditions



## 6.1 General Terms and Conditions

These General Terms of Sale (the “General Terms”) applies to all products sold by Cellink AB and Cellink LLC (the “Products”), Cellink AB for European sales at Arvid Wallgrens Backe 20, 413 46 Göteborg, Sweden and Cellink LLC for U.S sales at 2000 Kraft Dr, Suite 2125, Blacksburg, VA 24060 (“Cellink”).

The General Terms shall constitute an appendix to a purchase agreement, supply agreement, order confirmation or other agreements of a similar nature, which together constitutes the Parties agreement (the “Agreement”).

The purchaser of products from Cellink is hereinafter referred to as the “Buyer”, and “Party” means Cellink or the Buyer and “Parties” means Cellink and the Buyer together.

In the event that the General Terms contradict the Buyer’s general terms and conditions of purchase, Cellink’s General Terms shall prevail.

E-mail shall be considered sufficient wherever “written” is used in these General Terms.

### 6.1.1 Orders and Supply etc.

The Buyer shall order the Products in writing from Cellink. No order is binding until Cellink has confirmed an order. Cellink will state the price and estimated delivery time in such confirmation. Notwithstanding the provisions in the Buyer’s order, each contract of sale shall be subject to these General Terms.

The Buyer is aware and acknowledges that the Buyer’s delivery capacity varies depending on, inter alia, the general market conditions. As soon as Cellink has reason to assume that a delay in the agreed delivery could occur, Cellink shall notify the Buyer thereof and shall in such case be entitled to reasonable prolongation of the delivery date of up to twenty (20) business days. Notwithstanding the foregoing, Cellink shall always endeavour to maintain a delivery capacity that enables Cellink to deliver the Products in accordance with accepted orders.

### 6.1.2 Payment

The Buyer shall purchase the Products at the prices set out in Cellink’s price list applicable at the time when Cellink has received each respective order. Cellink has the right to change the price list at any time.

Unless otherwise agreed in writing, the Buyer shall pay for all Products no later than thirty (30) days from the date of Cellink’s invoice. When purchasing the Products marked with “advance payment” the Buyer shall pay 50 % of the purchase price in advance, in accordance with Cellink’s invoice.

The Buyer has no right to offset. The Buyer shall not have the right to withhold payments to Cellink or reduce the amount of payments owed to Cellink under this Agreement for fees, claims, damages, expenses or other amounts owed, or alleged to be owed, to Buyer from Cellink under this Agreement or any other agreement.

In the event that the Buyer at any time should fail to make payment in full on the due date Cellink shall be entitled to claim interest on the sum overdue until payment is made at the rate equivalent to the reference rate of interest (as determined by the Central Bank of Sweden) plus eight percentage points per annum. Title to the Products shall remain with Cellink until fully paid by the Buyer in accordance with this section.



### 6.1.3 Service

Unless otherwise agreed in writing, Cellink shall be solely responsible for, and entitled to, carry out after sales service and repairs on all Products.

#### 4. GENERAL CONDITIONS OF DELIVERY

The Products shall be delivered from Cellink to the Buyer under the following delivery terms:

- (i) regarding new Products or Products returned after upgrading or repair - CPT - Carriage Paid To (Incoterms 2010);
- (ii) regarding Products returned after warranty actions - DAP - Delivered At Place (Incoterms 2010).

Any delivery from Buyer to Cellink, e.g. of Products returned for repair or calibration (whether under warranty terms or not), shall be delivered DAP - Delivered At Place (Incoterms 2010).

Cellink reserves the right to make partial deliveries. Unless otherwise agreed, invoices will be adjusted pro rata. For the purpose of these terms any partial delivery will be regarded as filling a specific order.

### 6.1.5 Acceptance

The Buyer shall immediately following each delivery of any Product inspect the Product in order to identify any external damage and to ensure that the delivery is in accordance with the order. Any defects or deficiencies which are detected in conjunction with delivery shall immediately be reported in writing to Cellink.

When a Product is unpacked, and in any event before the Product has been used by the Buyer, the Buyer shall perform a full inspection of the Product where such was not possible on receipt of the Product in question. The obligation to report any defects to Cellink as set out in section below shall apply in such context.

At the request of Cellink, the Buyer shall make defective goods available to Cellink for inspection and control.

If the Buyer does not report defects or deficiencies in Products delivered within the time limits set out above, the Buyer shall have no right to make any claims against Cellink with regard to the default or defect.

### 6.1.6 Liability for defects

Cellink shall remedy any defect in Products delivered, resulting from faulty design, specification, materials or workmanship attributable to Cellink in accordance with the provisions of this section 6. Cellink is only liable for defects that appear under the intended and proper use of the Products, included printing using Cellink's bioink only. Thus, the liability does not cover defects caused by faulty maintenance, handling or incorrect storage by the Buyer, alterations of the Products carried out without Cellink's prior written consent, or normal wear and tear and deterioration.

In order to enable the Buyer to bioprint, the Buyer may insert a USB to upload an .STL-file to the Products. Cellink shall not be liable for any damage or loss caused by the Products on any other software contained on the USB. Cellink shall neither be liable to remedy any defects to the Products caused by faulty or corrupt software provided by the Buyer.

Cellink's liability is limited to defects which appear within 12 months from the date when the Products were delivered.

The Buyer shall notify Cellink in writing of a defect without undue delay after the defect has appeared, and in no case later than two (2) weeks after the expiry of the liability periods as set out above. The notice shall contain a description of how the defect manifests itself. If the Buyer fails to notify Cellink in writing within the above time limits, the Buyer forfeits its right to make any claim in respect of the defect. If there is reason to believe that the defect may cause damage, notice shall be given forthwith. If notice is not given forthwith, the Buyer forfeits the right to make any claim based on damage which occurs, and which could have been avoided, if such notice had been given. After receipt of a written notice, Cellink shall, at Cellink's option, repair or replace the Product or make a reasonable reduction of the purchase price for the Products without undue delay. If Cellink fails to fulfil its obligations under this section within a reasonable time, the Buyer may by written notice require Cellink to do so within a final time. If Cellink fails to fulfill its obligations within that time limit, the Buyer may terminate the purchase of the defective Products in question by written notice.

If the Buyer gives such notice as referred to above, and no defect is found for which Cellink is liable, Cellink shall be entitled to compensation for the work and costs which it has incurred as a result of the notice.

All transports in connection with replacement shall be at the Buyer's risk and at Cellink's expense. The Buyer shall follow Cellink's instructions regarding how such transport shall be carried out. Cellink shall have no liability for defects save as stipulated above. This applies to any loss the defect may cause, such as loss of production, loss of profit and other consequential economic loss. The limitation of Cellink's liability under this section shall, however, not apply where Cellink has been guilty of negligence.

### **6.1.7 Software**

The software (proprietary software and third party software), documentation, interfaces, content, and any data that came with the Products, which may be updated or replaced by feature enhancements or software updates provided by Cellink (the "Product Software"), is licensed, not sold, to the Buyer for use in accordance with these General Terms. Cellink [and its licensors] retain ownership of the Product Software itself and reserve all rights not expressly granted to you.

### **6.1.8 Granted rights**

Cellink grants the Buyer a non-exclusive, non-transferable, non-sublicensable, perpetual right to use the Product Software in the Products within the Buyer's own business. The Buyer shall not have any right to the Product Software apart from the right to use Product Software in line with these General Terms. Except for the Buyer's right to make back-up copies if this is necessary for the intended use of the Product Software, and to decompile the Product Software to achieve interoperability with other programs, the Buyer is not allowed to modify, copy, disassemble, reassemble, distribute, publish, reverse engineer, build a derivative or duplicate the Product Software, its components, services or features. The Buyer is only allowed to use the Product Software for your own benefit and you are not allowed to make the application available to third parties.

### **6.1.9 Trademarks and other intellectual property rights**

All intellectual property rights and other rights, including without limitation patents, design rights, trademarks, copyright and know how, relating to the Products and any and all documentation related thereto shall be the exclusive property of Cellink.

Nothing in connection with purchase of Products or in the Agreement shall constitute or be construed as a transfer of ownership of any of Cellink's intellectual property rights or other rights or to otherwise give the Buyer any proprietary rights to Cellink's intellectual property rights.

The Buyer shall not remove or change any trademark, trade name, sign or other mark on any Products or its packing, or make any alterations in the construction or design of any Product.

### **6.1.10 Permitted use of the products**

You agree to and warrant that you only will use the Products in:

- (i) accordance with these General Terms and the user manual provided for the Products;
- (ii) a way that does not promote or encourage illegal activity;
- (iii) a way that is not harmful, abusive or offensive, does not infringe the rights of any third party or in any other way can harm Cellink; and
- (iv) compliance with all applicable laws, including local laws of the country or region in which you reside or in which use the Product.

### **6.1.11 Product liability**

Cellink is not liable for any damage caused by the Product to any movable or immovable property or the consequences of such damage, which occurs after the Product is delivered to the Buyer.

The Buyer shall indemnify and hold Cellink harmless to the extent that Cellink incurs liability towards any third party in respect of loss or damage for which Cellink is not liable in relation to the Buyer following section 9. For the avoidance of doubt, the Buyer shall have a liability to recourse all costs inflicted on Cellink, due to any such claims.

Subject to the limitations stated above, Cellink is liable for claims made by a consumer, in accordance with mandatory law for personal injury or damage to property caused by the Product.

If a claim for damage as described in this section is lodged by a third party against one of the Parties, the latter Party shall forthwith inform the other Party thereof in writing.

A precondition for Cellink's liability set forth above is that Cellink has been notified in writing of such claim in accordance with above and given authority to settle the claim or control the defence of any suit and proceeding.

In the event that a Product or parts thereof becomes subject to a recall decided by Cellink, the Buyer shall participate and assist in such a process in accordance with Cellink's instructions. The Buyer is entitled to compensation for its reasonable direct and documented costs occurred in relation to the provision of such assistance.

The limitation of Cellink's liability set forth in this section shall not apply where Cellink has been guilty of negligence.

Both Parties shall keep and maintain product liability insurance in accordance with customary conditions.

### 6.1.12 Limitation of liability

Save for what follows from section 11, Cellink's aggregate liability in relation to any claim of any kind for any loss or damage arising out of, connected with, or resulting from the Agreement or from the design, manufacture, sale, delivery, resale or use of the Products or any part thereof, as the case may be, shall be limited to the refund of the purchase price of the Products with respect to which the loss, damage or breach occurred.

In no event shall Cellink be liable towards the Buyer for any loss of production or profit, loss of use, loss of data, loss of contracts or for any other consequential, economic or indirect loss whatsoever in respect of the sale, purchase, use or disposition of the Product.

The limitation of Cellink's liability in this section shall not apply where Cellink has been guilty of negligence.

### 6.1.13 Force majeure

The Parties shall be relieved from liability for a failure to perform any obligation under the Agreement during such period, and to the extent that the due performance thereof by either of the Parties is prevented by reason of any circumstance beyond the control of the Parties ("Discharging Circumstance"). If not otherwise shown, war, warlike hostilities, mobilisation, or general military call-up, civil war, fire, flood, or other circumstances of similar importance, shall be considered as Discharging Circumstances.

If a Party wishes to invoke a Discharging Circumstance, it shall give immediate notice to the other Party of the commencement and the cessation of such Discharging Circumstance, failing which, the Party shall not be discharged from liability for any non-performance caused by such Discharging Circumstance.

The time for performance of the relevant obligations of a Party shall be appropriately extended by the period during which a Discharging Circumstance continues, provided, however, that if performance of a contractual obligation is prevented by a Discharging Circumstance for a period of six (6) months or more, each Party shall be entitled to terminate the Agreement.

### 6.1.14 Confidentiality

The Parties hereby undertake, during the term of this Agreement and thereafter, to hold in confidence and absolute secrecy any and all Confidential Information (as defined below), disclosed by the other Party pursuant to this Agreement and not to disclose to third parties any Confidential Information received. Furthermore, the Parties shall take reasonable steps to prevent an unauthorised disclosure or use of such Confidential Information by employees, subagents or other intermediaries.

For the purpose of this Agreement, "Confidential Information" means any and all information (whether in written or oral form), including but not limited to technical, practical, commercial information and the contents of this Agreement, save as provided under (a) – (d) below:

- (a) information which is known or which becomes known in full detail to the public otherwise than by breach of the obligations herein contained;
- (b) information which the disclosing Party can show was in its possession before receiving it from the other Party;
- (c) information which a Party has received or receives from a third party without restraints as to the disclosure thereof;
- (d) information which a Party is legally obliged to disclose by compulsory law, court order or by order of another authority of competent jurisdiction.

### 6.1.15 Miscellaneous

The Agreement, including all appendices hereto including the General Terms, contains the final, complete and exclusive agreement of the Parties relative to the subject matter hereof and supersedes all prior and contemporaneous understandings and agreements relating to its subject matter. These General Terms shall be interpreted and construed in accordance with the laws of Virginia. The United Nations Convention on Contracts for the International Sale of Goods shall not apply. Any dispute, controversy or claim arising out of or in connection with this Agreement, or the breach, termination or invalidity thereof, shall be finally settled by arbitration administered by the Arbitration Institute in Virginia. The place of arbitration shall be Blacksburg, United States. The language to be used in the arbitral proceedings shall be English.

## 6.2 BIO X EULA

### CELLINK BIO X 3D BIOPRINTER SOFTWARE END USER LICENSE AGREEMENT

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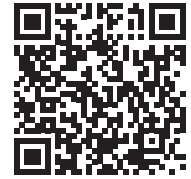
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We will also personally insure every bioprinter sent under Declared Value Insurance, also optioned by FedEx. If, in the case there is a problem with the BIO X outside of the FedEx terms, it is not the result of neglect of the purchaser and the incident occurs and is reported within 3 months (90 days) of the purchase date, conforms to all the rules of the warranty hereby included and the customer provides the original proof of purchase/ serial number, then CELLINK will work out the problem on an individual basis as each problem must be addressed this way. In the rare case of a specifically diagnosed and proven DOA (dead on arrival) part (detailed description and documentation required), CELLINK will most likely send a replacement part to you. In the case that a customer has already been through all these previous options stated and is still not satisfied with the results, the customer must have the bioprinter sent back at their own expense. Once a return is received (for example a returned bioprinter), CELLINK will then send back a new unit at our own expense. Proper packaging is required in the rare case of a returned product or part, and the product itself must arrive back in the condition in which it was originally received.

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The guarantee and warranty does not cover any alterations or repairs made by a second or third party. We are always eager to work with you personally to fix any problem that may arise in the most efficient fashion meeting its specific case, but we do not suggest you to “rig” up something outside of the recommended guidelines in your user manual unless personally instructed by us to do so. CELLINK provides no guaranties on the safety or performance of modified BIO X 3D bioprinters. We are also not responsible for incorrect voltage being used, environmental conditions (moisture, fire, water, flood, lightning, ext.), or any other form of neglect on the customer’s part. If you are unsure about something, feel free to contact us prior to using the BIO X.

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The guarantee and warranty covers critical components only. For example CELLINK will not replace a bioprinter because of a perceived blemish in the paintjob. The critical components/replacement parts do not carry a warranty themselves and are only covered in the initial 3 months warranty starting on the purchase date. Components not included in the warranty include: timing belts, linear ball bearings, rods, and the build platform. Moving parts, although of the highest manufactured quality, must be properly maintained, serviced and/or oiled, and the failure to do so will result in progressed wearing and tearing. The heated build platform itself will be subjected to unavoidable scratching and wear upon use. If you wish to order replacement parts, they are available in our online store, or by contacting us personally by telephone or email. There is no warranty issued when exotic printing material is used with the BIO X and doing so is not recommended by us at CELLINK. Foreign materials can damage the system. The warranty does not cover operating the bioprinter at not recommended speeds and settings.

In the case that a repair is determined to be outside of the warranty and the buyer decides to send back the BIO X for repairs, the buyer will ship the BIO X at their own expense. The costs to repair the BIO X will also be at the buyer's expense.

Concerning unauthorized returns:

Returns not pre-authorized will not be eligible for repair, replacement or refund. Do not send it back to CELLINK unless you have contacted us first and we have authorized you to send it.

Concerning Refunds:

A refund is possible only with the BIO X 3D Bioprinter itself and will not be offered for any filaments, or spare parts. If within two weeks (14 days) after receiving your BIO X 3D Bioprinter you are not completely satisfied, we offer you a refund option.

You ship it back at your own expense and after we receive it, we will deduct a 10% restocking fee from the total refund of the price of the BIO X 3D Bioprinter (excluding the tax and other fees). There will also be a thorough inspection of the bioprinter, and upon finding any damages deemed on the part of the buyer, other deductions from the refund would be made accordingly.

Deductions will be made for any wear perceived to the bioprinter, including scratches. The 14 day period after receiving the bioprinter will be concretely determined in calculation with the FedEx tracking information.

Limitations:

This guarantee and limited warranty are sole and final as they stand in reference to BIO X, CELLINK and it's products where permitted by law. Any implied warranty or fitness is limited to this 3 months (90 day) warranty starting from the date of purchase. CELLINK waives all liability for any incidental, exemplary, punitive, collateral, indirect, consequential, or special damages. CELLINK will determine on sole discretion whether an issue is covered under the warranty or not.

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Gothenburg SE-413 46,  
SWEDEN.

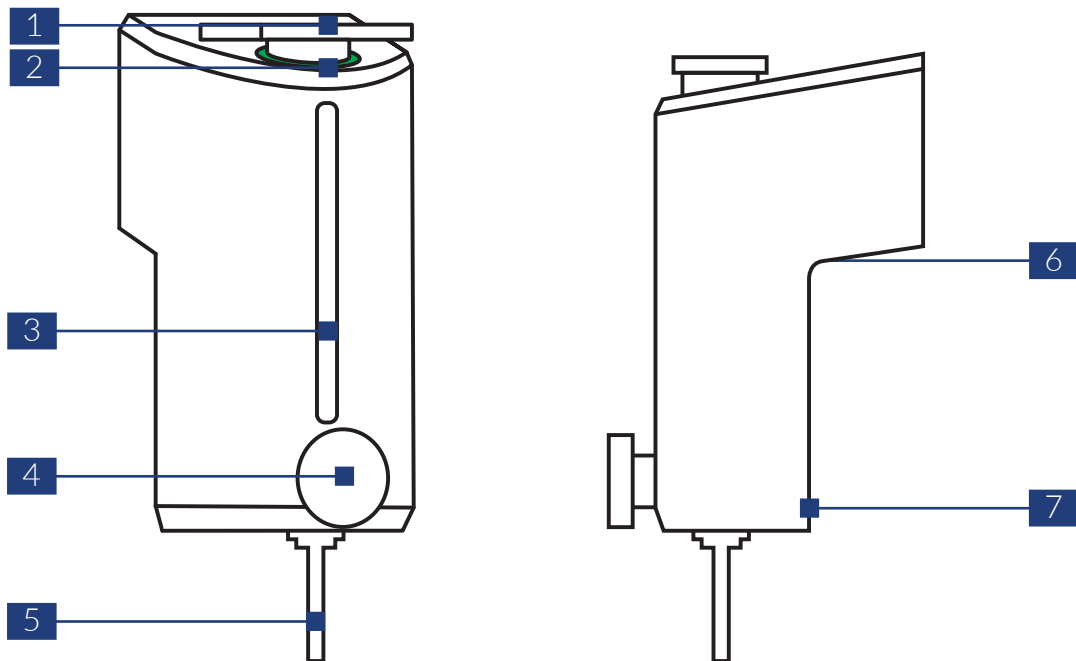
## 7. Printhead manuals



## 7.1 CELLINK pneumatic-based printhead

### 7.1.1 Printhead overview

The CELLINK pneumatic-based printhead is an extrusion based printhead. It is equipped with heating function up to 60°C and thanks to the possibility of connecting an external air supply, the CELLINK pneumatic-based printhead can be used when bioprinting most bioinks.

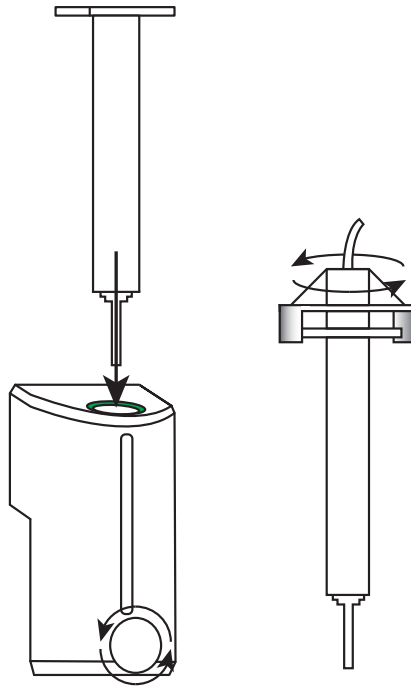


1. Cartridge
2. Heat indicator – This LED will change colour depending on the temperature of the printhead. Red is hot, yellow is normal and blue is cool.
3. Opening for cartridge overview – In this slit you can see the amount of bioink left in the cartridge.
4. Cartridge fastening screw – Use this to securely fasten the cartridge in the printhead.
5. Nozzle or needle
6. Printhead contact – The connector between BIO X and the intelligent printhead.
7. Magnet – The magnet allows for securely fastening the printhead on the printhead holder in BIO X.



### 7.1.1 Mounting of a cartridge in the printhead

To mount a cartridge in the CELLINK pneumatic-based printhead, follow the steps below:



1. Attach the pressure hose to the cartridge by twisting the pressure connector.
2. Insert the cartridge in the printhead and push it down until the wings of the cartridge touches the top of the printhead.
3. Secure the cartridge in the printhead by turning the cartridge fastening screw.

The CELLINK pneumatic-based printhead needs to be connected to an air supply in order to function. Do not forget to connect the pressure hose to the pressure connector on the printhead holder when inserting the printhead in BIO X!

Imagination is the beginning  
of creation.

You imagine what you desire,  
you will what you imagine,  
and at last, you create what  
you will.

-George Bernard Shaw

Happy 3D bioprinting!

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