

Allegro 3D, Inc.

BIONOVA X

Model: NOVAX-1001

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1. Safety and compliance

Before you start using your BIONOVA X Model NOVAX-1001, please carefully review the entire manual. Improper operations of the bioprinter can lead to serious personal injury and equipment damage.

1.1 General safety information

Keep your workplace tidy. Do not operate the BIONOVA X Model NOVAX-1001 in the presence of flammable liquids, gases, or dust. The BIONOVA X Model NOVAX-1001 should be operated by the trained personnel, who are aware of the risks and dangers that can be induced to themselves and the staff in close proximity to the bioprinter. The staff involved in the installation or maintenance of the system, or a part of the system, must be qualified through appropriate training. Use the instrument only for its intended purpose as described in the documentation. Do not modify the instrument, sub-components, or accessories.

WARNING!

- Please do not refit the BIONOVA X Model NOVAX-1001 plug.
- Please do not use the BIONOVA X Model NOVAX-1001 in damp or wet locations.
- Please unplug the BIONOVA X Model 3 D printer if you do not intend to use it for a long period of time to prevent uncertain accidents.
- Never reach into the bioprinter while it is in operation. BIONOVA X Model 3 D printer has many different moving parts that can cause serious personal injuries.
- Do not leave the printer unattended while it is in operation.
- Always wear protective gear including gloves and eye protection when using the printer or handling hazardous materials.
- Before cleaning, inspecting, adjusting, repairing, or disassembling the instrument or the dispensing units, stop the instrument, turn off the main switch, and disconnect it from its electrical power source.
- Verify that all connections are properly connected and all components are properly mounted or installed before using the bioprinter.
- Only use consumables that are designed for and compatible with the BIONOVA X Model NOVAX-1001.

1.2 Protective equipment

WARNING!

- Always wear protective goggles and gloves, and make sure the environment around the instrument is secure from other personnel while operating the printer.
- Always wear protective goggles and gloves while handling dangerous materials that can be absorbed by the skin or which are toxic, strike-attractive, corrosive, allergy inducing, carcinogenic, reproduction-endangering, or mutagenic to humans.
- Always read the safety data sheets, packing labels, and manufacturer's catalogue before use, and make sure to use adequate safety equipment.
- Please keep your hair, clothing, and gloves away from moving parts.

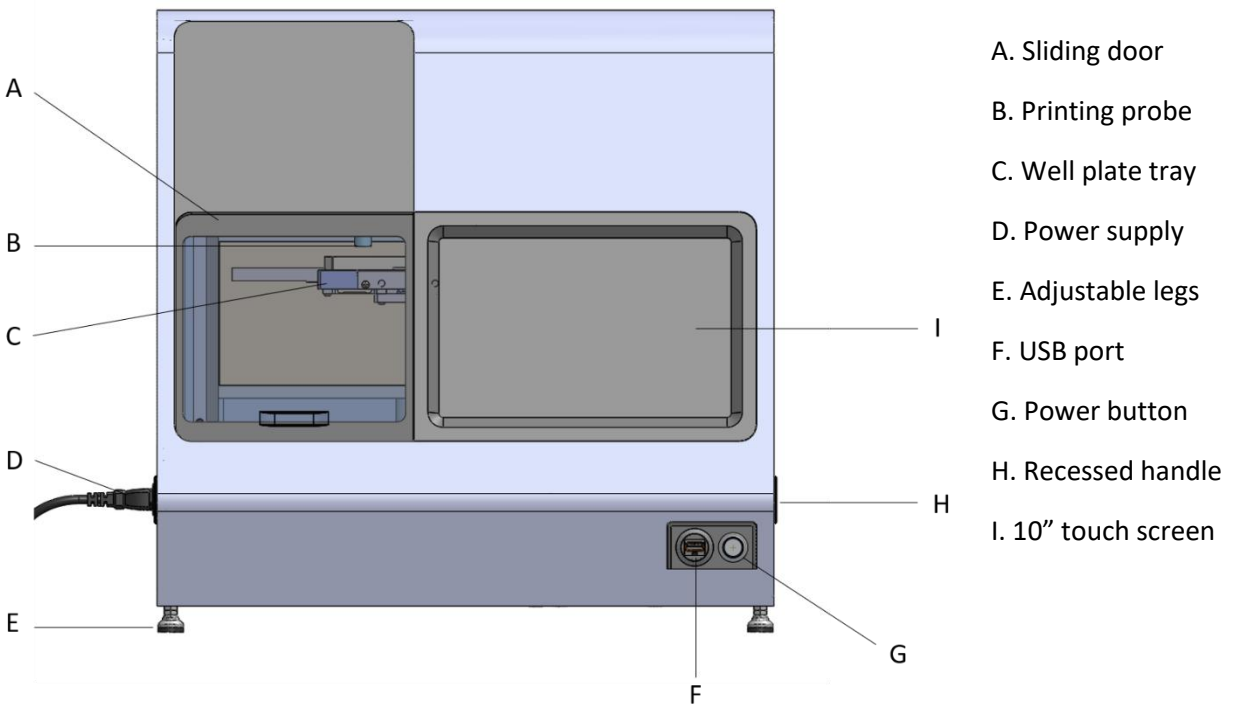
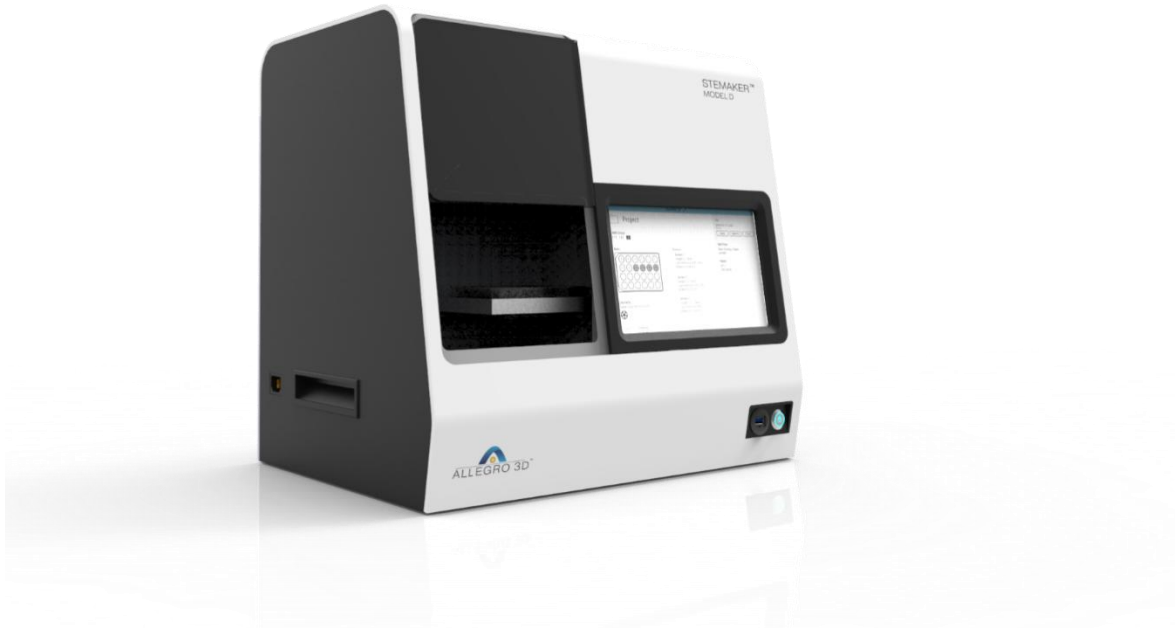
1.3 Opening the product and service

WARNING!

- The BIONOVA X™ Model D **SHOULD NOT** be taken apart. Doing so endangers both the users and the equipment, which will also void the warranty.
- Never use the device for illegal activities.

2. Specifications

2.1. BIONOVA X™ Model D Diagram



2.2. Technical Specifications

Bioprinting technology	Digital light projection based stereolithography system
Dimensions	20.3" (W) x 15" (D) x 17.4" (H) 515 mm (W) x 380 mm (D) x 441 mm (H)
Weight	90 lbs (41 kg)
Resolution	10 μ m
LED wavelength	405 nm
Heater temperature	Room temperature to 60 °C
Well plate format	24 well plate, 12 well plate, 6 well plate
Support file types	.stl, .png, .bmp, .jpg
Connectivity	1x USB port
Display	10" touch screen, glove friendly
Power supply input	100-240 VAC, 50/60 Hz, 200 W

3. Getting started with BIONOVA X

3.1. Unpacking and installation

1. Carefully open the crate and remove the printer from the packaging by grasping the printer firmly from the bottom with two people.
2. Set the printer on a leveled and steady table or biosafety cabinet surface.
3. Use the power cord to connect the printer to a power supply via the port located on the left side of the printer.
4. Power on the printer by pushing the power supply switch located on the side of the printer.
5. Power on the computer by pushing the power button located in the front of the printer.

3.2. Contents of the box

- 1x BIONOVA X 3 D printer
- 1x Power cord
- 1x User manual

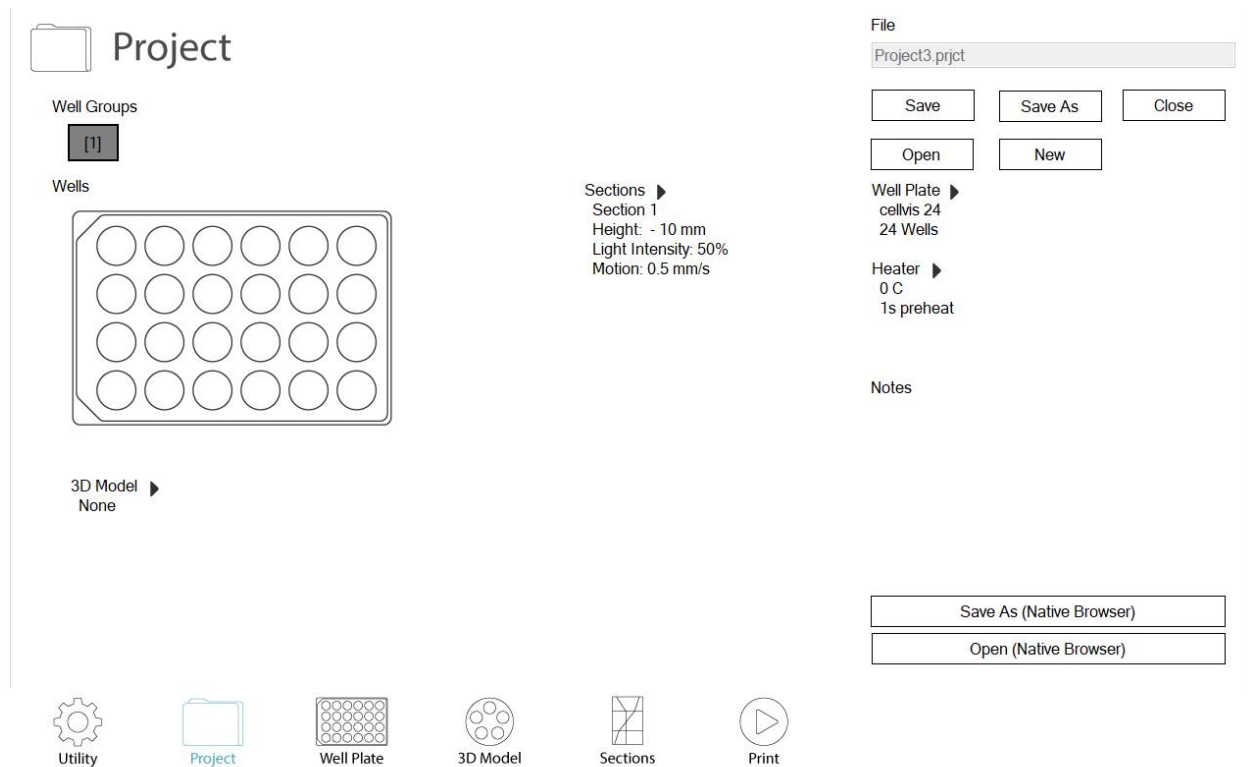
(Optional) Consumables box containing:

- 1x Stemink™ PEGDA [Poly(ethylene glycol) diacrylate] Sterile Starter Bioink, 50ml
- 2x Probes for 6-Well Plate
- 2x Probes for 12-Well Plate
- 2x Probes for 24-Well Plate
- 3x 6-Well Plates
- 3x 12-Well Plates
- 3x 24-Well Plates

4. Your first bioprint with BIONOVA X

4.1. Setting up BIONOVA X

- 1.. Power on the printer by pushing the power supply button located on the side of the printer.
2. Power on the computer by pushing the power button located in the front of the printer. The printer will initialize the software and the position of the well-plate tray. After initialization, the software interface will load the blank Project page as shown below.



3. Make sure the sliding door is closed.
4. Go to the Utility page and turn on the UV sterilization for the desired time period.



Utility

UV Sterilization

Timer: minutes ☐

Heat Cure

Temperature: °C Heat Now Turn Off

Preheat time: seconds

Mix Bioink Before Printing

Cycles

Tray Position

Load Position Print Position








4.2. Loading bioprinting probe

1. Once the UV sterilization is completed, open the sliding door.
2. Remove the provided printing probe from the sterile packaging in a biosafety cabinet.

Caution: choose the right printing probe (i.e., 6, 12, or 24-well probe) to match the well plate (i.e., 6, 12, or 24-well plate) to be used for printing.

3. Carefully retrieve the probe adapter from above the well-plate tray. Mount the probe to the adapter of the BIONOVA X by pressing the large end of the probe into the adapter and then mount the adapter with the probe onto the printer. Make sure the probe is mounted properly and tightly.

Caution: pay attention to not touch the well-plate tray when inserting or removing the printing probe.

4.3. Preparing and loading bioink

1. Choose the provided well plate to match the loaded printing probe.
2. Remove the well plate from the sterile packaging in a biosafety cabinet.
3. Load the bioink to the well plate and do not exceed the maximum volume suggested in the following table.

4. Press the Load Position button on the Utility page and carefully load the well plate onto the tray after it is moved to the load position.

Caution: please make sure the well plate is placed in the right orientation as shown on the Project page and secure the well plate in the tray using the clamp.

Printing probe and well plate used	6-well probe and 6-well plate	12-well probe and 12-well plate	24-well probe and 24-well plate
Maximum volume of bioink for each well (ml)	8.6	3.4	1.3

4.4. Setting up a bioprinting project

1. Go to the project page and press New to start a new printing project. The Project page provides an overview of the bioprinting project and settings.
2. You can save the project using Save or Save As at this step or later.
3. You can also Open a previously saved project.

The screenshot displays the 'Project' page interface. On the left, under 'Well Groups', there are four buttons labeled [1], [2], [3], and [4]. Below this, the 'Wells' section shows a 4x4 grid of wells, each labeled with a number in brackets. To the right of the wells, the 'Sections' section shows 'Section 1' with parameters: Height: ~.5 mm, Light Intensity: 100%, and Motion: 0.1 mm/s. Below the wells, there is a '3D Model' section with a button labeled 'untitled-1 inverted.bmp'. On the right side, the 'File' section shows a text input field with 'Project demo060821.prjct' and buttons for 'Save', 'Save As', 'Close', 'Open', and 'New'. Below this, the 'Well Plate' section shows 'Stemmaker 12-well plate' and '12 Wells'. The 'Heater' section shows '0 C' and '1s preheat'. At the bottom right, there are buttons for 'Save As (Native Browser)' and 'Open (Native Browser)'. At the bottom of the screen, there is a navigation bar with icons for 'Utility', 'Project', 'Well Plate', '3D Model', 'Sections', and 'Print'.

4. If heating or mixing of the bioink is needed, go to the Utility page and change the desired settings.



Utility

UV Sterilization

Timer: minutes ☐

Heat

Current Temperature: 25°C

Temperature: °C

Heat Now

Turn Off

Preheat time: seconds

Mix Bioink Before Printing

3 Cycles

Tray Position

Load Position

Print Position

Utility

Project

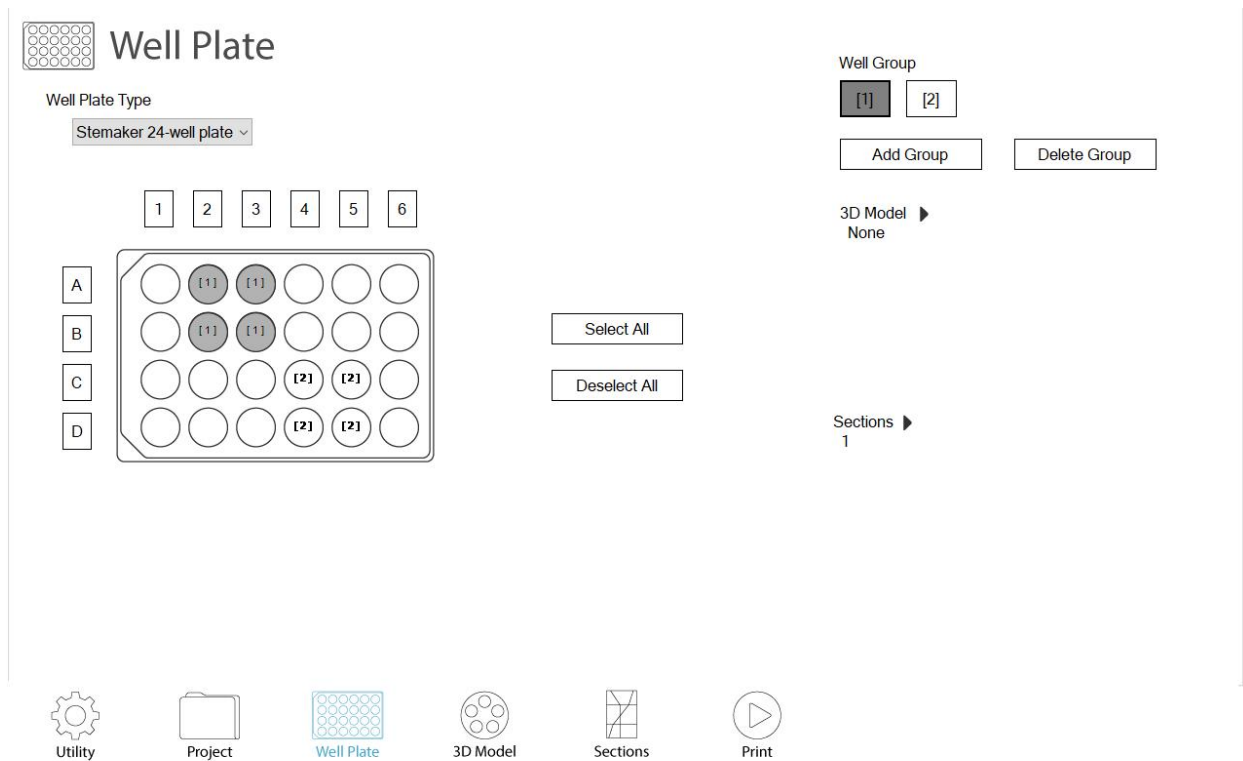
Well Plate

3D Model

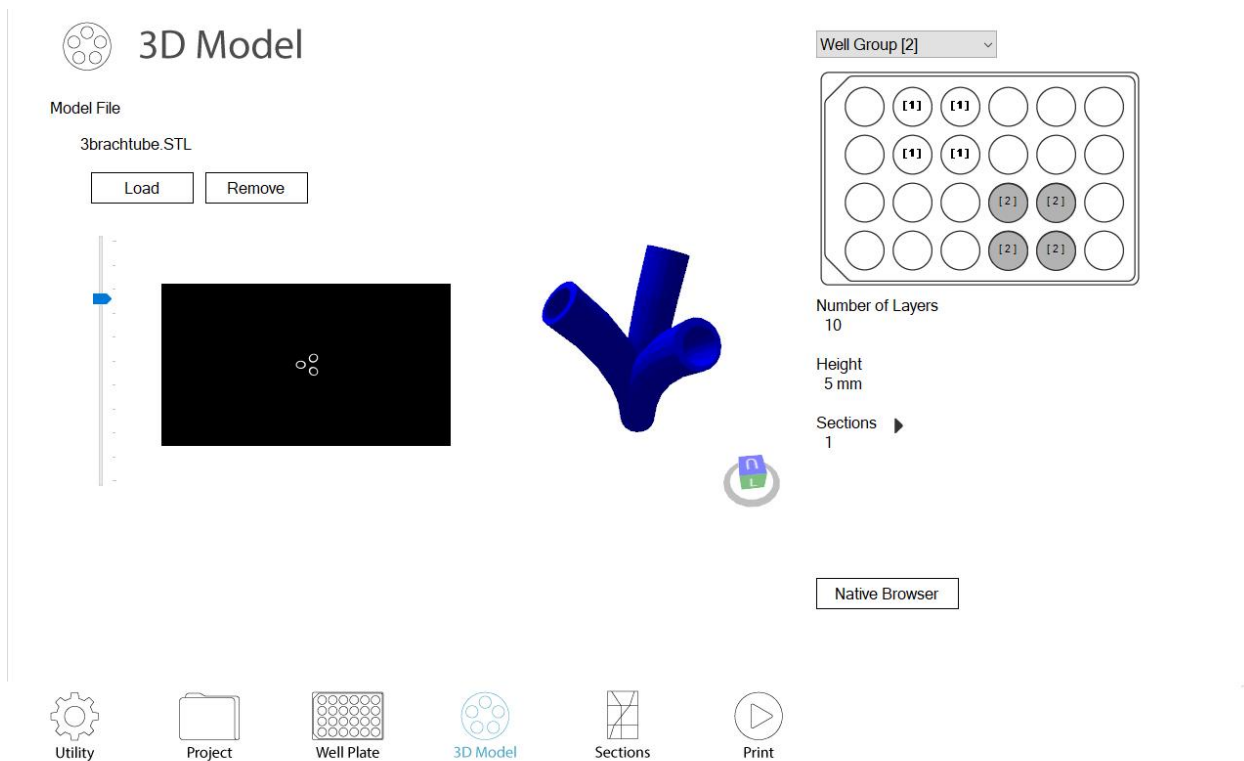
Sections

Print

5. Go to the Well Plate page and choose the desired well plate type from the drop-down menu.
6. Well groups can be added or deleted. Wells can be assigned to or removed from each well group by selecting or deselecting the wells when the target well group is highlighted on the right panel.

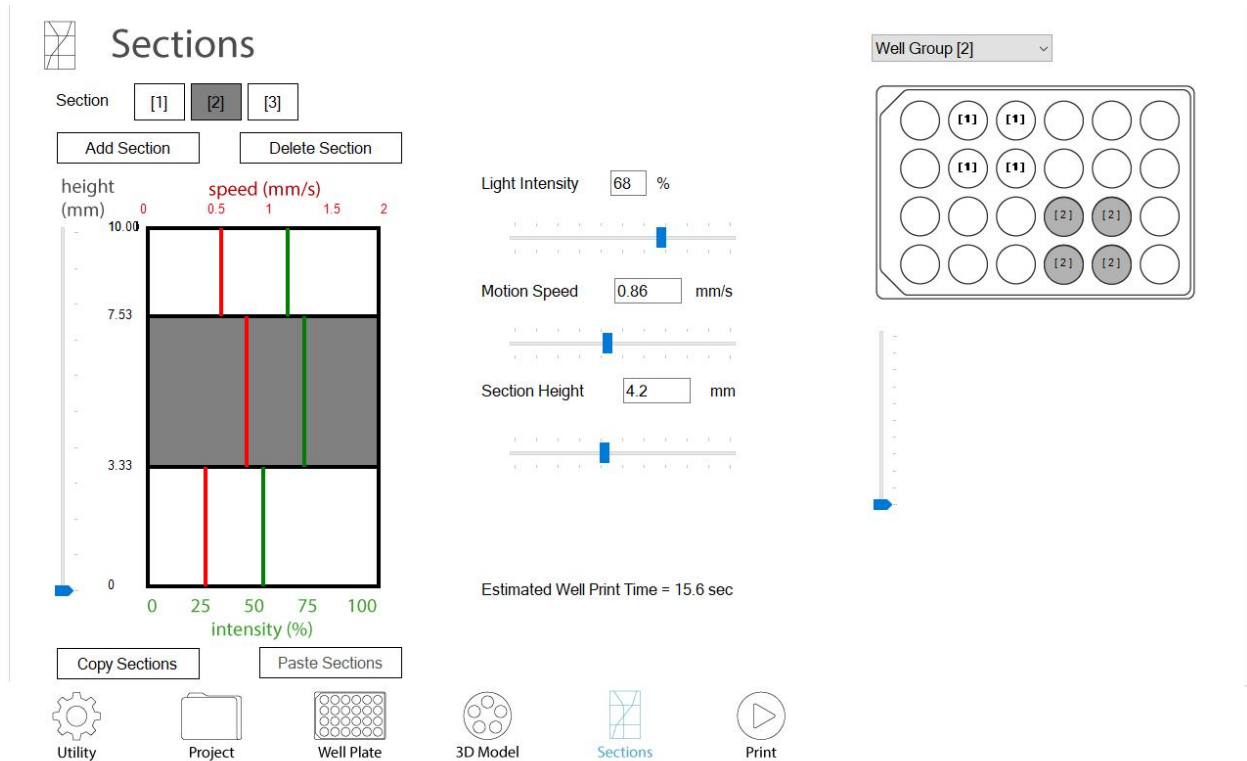


7. 3D models (.stl files) or 2D image files (.png, .jpg, .bmp files) can be loaded for each well group on the 3D Model page. When loading 3D models, the software will ask for the maximum dimensions in x, y, z directions and the number of layers to be sliced. When loading 2D image files, the software will only ask for the dimension in z direction as the x, y dimensions are set by the 2D image design. The table below provides the maximum dimensions that can be printed in x, y, z directions for each combination of printing probes and well plates.



Printing probe and well plate used	6-well probe and 6-well plate	12-well probe and 12-well plate	24-well probe and 24-well plate
Maximum dimension in X direction (mm)	19.2	9	7
Maximum dimension in Y direction (mm)	10.8	9	7
Maximum dimension in Z direction (mm)	9	9	6.5

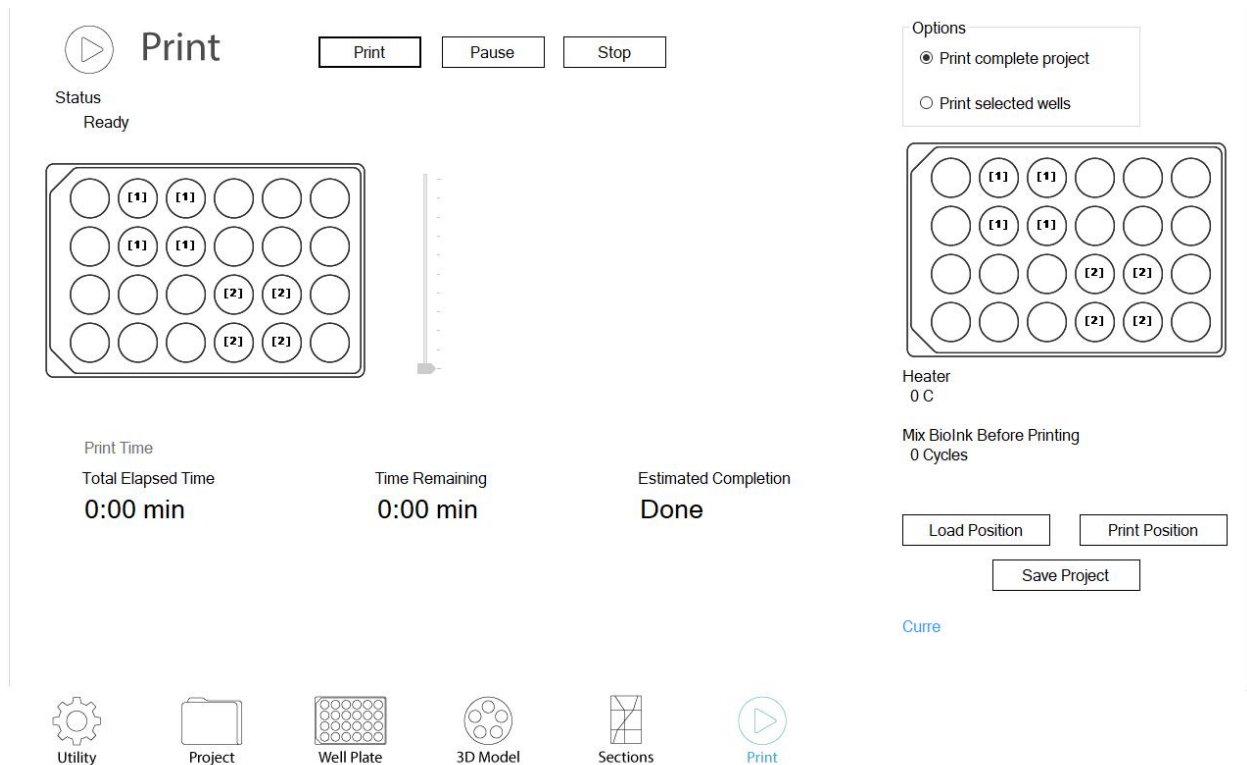
8. For each 3D model or 2D image loaded for each well group, you can set one single section or multiple sections with variable printing parameters (i.e., light intensity, motion speed, section height) in the Sections page.



9. Once all the parameters are set, you can choose to print the complete project or only selected wells in the Print page. Start printing by pushing the Print button. The finished wells will be labeled as green, the ongoing well will be labeled as red, and the selected wells to be printed are labeled as grey.

10. You can pause or stop the printing at any time during the printing.

11. Once the printing is stopped or completed, the well plate tray will automatically return to the load position.



4.5. Retrieving the bioprinted samples

1. Please make sure the tray is in the load position before retrieving the well plate or the printing probe.
2. Open the sliding door and carefully remove the well plate from the tray. The bioprinted samples are ready for culturing, imaging or assaying.
3. Carefully retrieve the printing probe without touching the well plate tray. Clean and store the printing probe in a sterile container for later use.
4. Close the sliding door.

4.6. Powering off the printer

1. After the printing is finished, turn off the computer by pressing the power button in the front of the printer.
 2. Turn off the power supply of the printer by pushing the power switch on the side of the printer.
- Caution: When an emergency stop is needed, push the power switch on the side of the printer directly to shut down the printer.

5. Consumables

5.1. Bioprinting probes

Our probes are specially designed for our BIONOVA X 3 D printer to print directly into multi-well plates (24, 12, and 6-well plate). The probe tips are specially coated to prevent adhesion of 3D printed scaffolds to the probe during printing.

Our probes are available in three tip sizes, small, medium and large, which are designed specifically to work with our 24-well plate, 12-well plate and 6-well plate.

To use the bioprinting probe

- Choose the appropriate bioprinting probe for different multi-well plates. For example, use the probe with small tip for the 24-well plate, the probe with medium tip for the 12-well plate, and the probe with large tip for the 6-well plate.
- The new probe is sterile and comes in a sterile plastic bag. The new probe can be used directly for bioprinting. The probe can be reused. Replace the probe with a new one when there is any mark on the tip of the probe.
- To use the probe, mount the probe to the adapter of the BIONOVA X™ Model 3 D printer by pressing the large end of the probe into the adapter and then mount the adapter with the probe onto the printer. Make sure the probe is mounted properly and tightly.
- After use, gently detach the probe from the adapter and clean the probe tip with DI water or 70% Ethanol.
- Before reuse of the probe, please properly sterilize the probe, especially the probe tip. The probe can be sterilized by UV light or 70% Ethanol.
- We don't recommend using the same probe for printing with different bioinks due to the possibility of cross-contaminations.



5.2. Multi-well plates



Our multi-well plates (24, 12, and 6-well) are compatible with our BIONOVA X 3 D printer and printing probes. Our multi-well plates with high performance #1.5 cover glass (~ 0.170 mm) are suitable for high resolution imaging systems. The glass bottom is specially coated to enhance adhesion of 3D printed tissues and avoid tissue detachment during medium change.

- Choose the appropriate bioprinting probe for different multi-well plate. For example, use the probe with small tip for the 24-well plate, the probe with medium tip for the 12-well plate, and the probe with large tip for the 6-well plate.
- The new multi-well plate is sterile and comes in a sterile plastic bag. The new multi-well plates can be used directly for bioprinting.
- To use the multi-well plate, remove the lid of the multi-well plate and load the multi-well plate to the plate holder of the BIONOVA X™ Model 3 D printer. Make sure the multi-well plate is mounted to the plate holder properly, tightly, and well leveled.

Warning: Inappropriate mounting of the multi-well plate may cause the failure of the printing or even damage of the printer.

- After use, remove the multi-well plate off the plate holder of the printer.

5.3. Bioinks

Allegro 3D provides a whole series of Stemink™ bioinks with various material properties. Please visit our website at <https://allegro3d.com> for details and application notes of the Stemink™ bioinks products.

Before printing on BIONOVA X 3 D printer, load appropriate amount of Stemink™ bioink solution to our multi-well plate. Please refer to the table in Section 4.3 for maximum bioink load volume for each type of well plate. Overloading of the bioink solution will cause spills. Protect bioink solution from light when it is not used in printing.

Make sure the bioink solution is sterile before mixing with cells for cell-laden structure printings.

We do not recommend reusing the excess bioink solutions left in the multi-well plate after bioprinting.





FCC Statement

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: 1) this device may not cause harmful interference, and 2) this device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.