

# U-FAB

User manual



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## A. Introduction to the U-FAB 3D Bioprinting System



### Specifications

(for U-FAB 'Master' configuration; see the table below)

- ✓ Size (Height × Width × Depth, in mm)
  - 1952(H) × 1178(W) × 930(D) / 2.14 m<sup>3</sup>
  - 1952(H) × 1772(W) × 1200(D) / 4.15 m<sup>3</sup> (Maximum dimension including the Computer/keyboard)
- ✓ Maximum printed volume (Height × Width × Depth, in mm)
  - 200(H) × 150(W) × 150(D) / 4500 mL
- ✓ Weight: 500 kg Maximum (Estimated)
- ✓ Power input: 220 V(Default) / 120V (120 V/220 V transformer is required)
- ✓ Rated power consumption: 6 kW max
- ✓ Recommended operating ambient temperature: 10–25°C
- ✓ Recommended operating ambient humidity: 20–60%
- ✓ Air pressure input: 0.8 MPa max (a separate air compressor is required)

Category		Key features		Basic	Expert	Pro	Master
Essential components	Biosafety Cabinet	▪ HEPA filtered Class II biosafety cabinet with UV-based sterilization		✓	✓	✓	✓
	BIOLET™	▪ Individual temperature control and swappable modular design ▪ 15 multi-channel capability	▪ Droplet-based dispensing module for low viscosity materials ▪ UV LED and UV protection shutter technology ▪ Simultaneous 6-channel printing	§	✓	✓	✓
	BIOXT™ - LV		▪ Extrusion dispensing module for low/intermediate viscosity materials ▪ Simultaneous 6-channel printing	§	✓	-	✓
	BIOXT™ - HV		▪ Extrusion dispensing module for high viscosity materials	-	-	✓	✓
	Control PC	▪ Touch screen PC including U-FAB bioprinting software (U-Studio)		✓	✓	✓	✓
	Build plate	▪ Monitoring systems for printing status observation ▪ Include features for individual nozzle alignment ▪ Temperature-controllable printing platform from 4 to 50 °C		✓	✓	✓	✓
	Nebulizer	▪ Nebulized crosslinking technology: 3 Nebulization crosslinkers		✓	✓	✓	✓
Optional components	Omniculture™	▪ High-intensity UV crosslinker port for Omniculture™		Optional			
	Light guide			Optional			
	Bioscope™	▪ Microscope camera unit designed for the observation of printed cells		Optional			

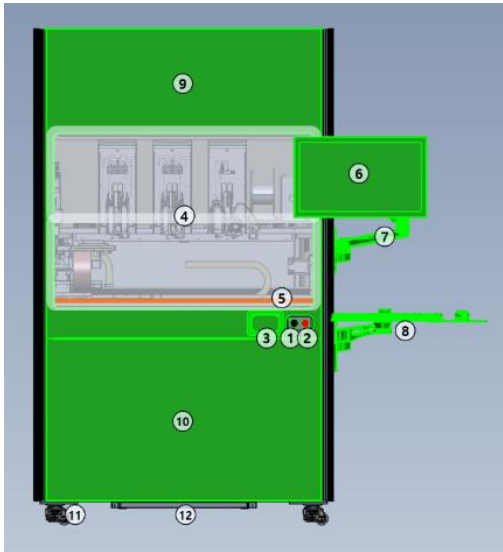
§ Customers choose either BIOLET™ or BIOXT™ - LV

## B. Warnings and Disclaimers

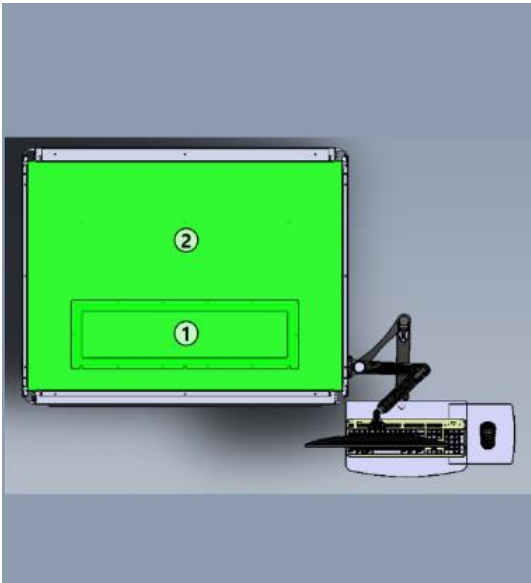
- ① For correct and safe operation of the printer, please carefully read and understand the content of this manual prior to printer use. The manufacturer is not liable for any direct and/or indirect loss or damages caused by the user's negligence and failure to comply with the precautions.
- ② Except for the replacement parts and components, please do not attempt to assemble the printer by yourself.
- ③ In case of device malfunction, please contact customer services for repairs.
- ④ After initial installation, please contact the manufacturer if you would like to change the position of the PC/Keyboard console.
- ⑤ During printing operations, keep your hands and head outside of the biosafety cabinet. Failure to comply may result in bodily injury.
- ⑥ Other than the company-provided accessory box, do not put any foreign objects within the U-FAB's printing space. Failure to comply may result in collisions among moving parts of the printer and cause damage.
- ⑦ Remove the coolant/heating fluids from the chiller/heater before moving the U-FAB printer to other locations. Failure to comply may result in overflow of the fluids and concurrent damages to the electronics.
- ⑧ Do not clean the device while the power is on.
- ⑨ Be careful not to let any fluid enter the circuit boards.
- ⑩ When cleaning the surface of printing channels/blocks, do not let the fluid touch the circuit board. Use the printer only after drying the surface completely.
- ⑪ Do not look directly into the UV-light inside the printer as the UV light is harmful to the eyes and skin.
- ⑫ Avoid putting excessive pressure onto any glass materials.

## C. System Components

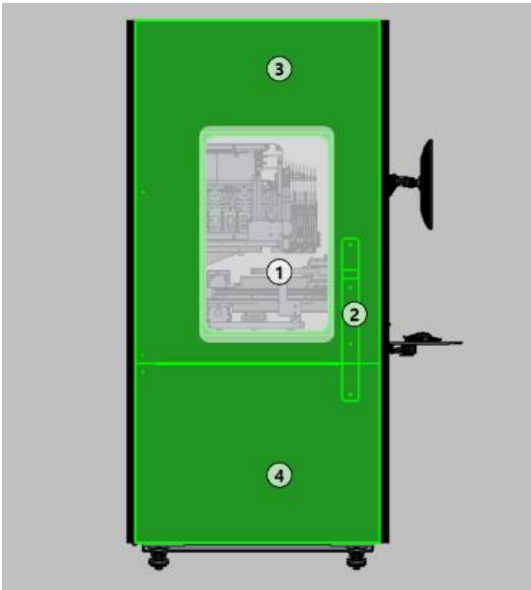
### ① U-FAB Exterior (Front panel)

Image	Name	Function
	① Main Power Switch	Press this Main Power Switch to turn on power to the system, including the LCD panel.
	② Emergency Stop Switch	Press this switch to turn off the printer during emergencies that may occur during device operation.
	③ LCD(Liquid-crystal display)	You can check/control the power status of the U-FAB, control the Biosafety cabinet (BSC), and monitor the humidity levels within the BSC.
	④ Sliding Glass Sash	This glass sash acts as a barrier from the external environment and protects users from UV light. The panel also prevents the printed material from polymerization/hardening via external UV light (i.e. sunlight).
	⑤ Sliding Glass Sash Handle	This is a handle to open and shut the Sliding Glass Sash.
	⑥ Control PC	This is an integrated PC that controls the U-FAB operation. U-Studio is pre-installed, and the monitor has touchscreen features. Users can opt to have it installed on the left side.
	⑦ Monitor Mount	The height and angle of the U-FAB monitor (all-in-one PC) can be adjusted using this mount. Users can opt to have it installed on the left side.
	⑧ Keyboard Mount	The height and angle of the keyboard/mouse can be adjusted using this mount. Users can opt to have it installed on the left side.
	⑨ Upper Front Panel Cover	This is the upper front panel cover of the U-FAB.
	⑩ Lower Front Panel Cover	This is the lower front panel cover of the U-FAB.
	⑪ Casters	High-strength caster wheels for moving the U-FAB.
	⑫ Drain Pan	If there is condensation from the system, the water will be drained and collected here. Unless excessive condensation occurs, the condensates will be evaporated without separate drainage.

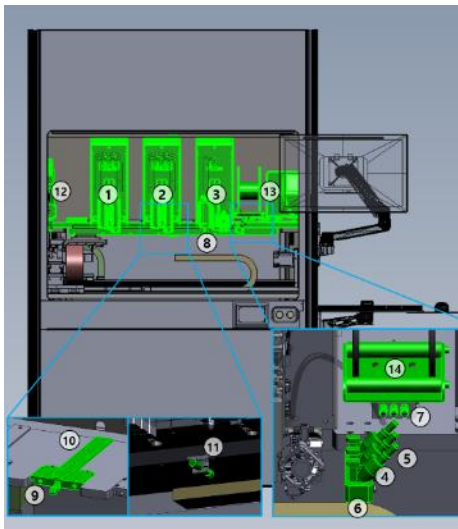
② U-FAB Exterior (Top Panel)

Image	Name	Function
	① Out-flow HEPA Filter	This is the out-flow HEPA Filter for the Biosafety Cabinet(BSC). It filters out-flow air from the device.
	② Top Cover	This is the top cover of the U-FAB.

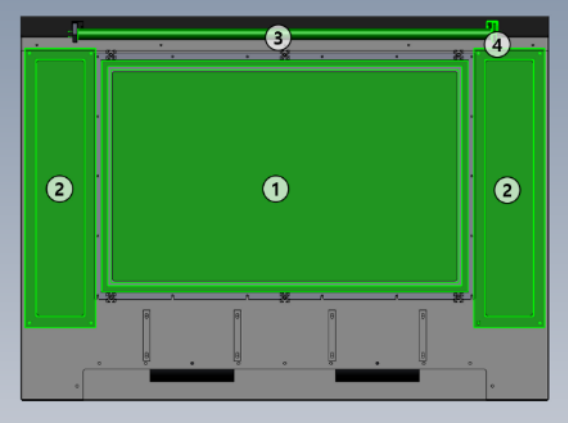
③ U-FAB Exterior (Side Panel)

Image	Name	Function
	① Side Glass Panel	This panel protects users from internal UV light. The panel also prevents the printed material from hardening / crosslinking due to external UV rays (i.e. sunlight).
	② Monitor/Keyboard Console Hole Cover	Holes for monitor/keyboard mounts. Protective covers are installed to the side that is not used.
	③ Upper Side Panel Cover	This is the upper side panel cover of the U-FAB.
	④ Lower Side Panel Cover	This is the lower side panel cover of the U-FAB.

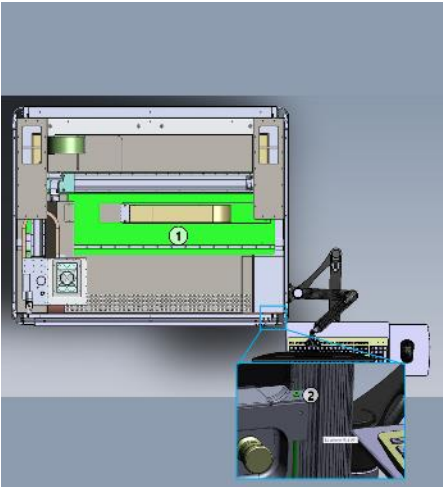
#### ④ Key Internal Components of U-FAB

Image	Name	Function
	① BIOLET™	A droplet dispensing module is used for low-viscosity biomaterial printing. (This module comes preinstalled with 6 set of droplet dispensers, but it is compatible with Low-/intermediate-viscosity Material Extruders, BIOXT™ - LV)
	② BIOXT™ - LV	A extrusion-based dispensing module is used for low-/mid-viscosity biomaterial printing. (This module comes preinstalled with 6 set of low-/mid-viscosity extruders, but it is compatible with droplet dispensers, BIOLET™)
	③ BIOXT™ - HV	This is the extrusion dispensing module for printing high-viscosity biomaterials and filaments.
	④ Nebulizer	The unit applies a fine-mist of liquid-based materials for crosslinking/polymerization.
	⑤ Nebulizer Cap	This is the cap over the Nebulizers to prevent spillage.
	⑥ Nebulizer Manifold	This is a manifold to hold the Nebulizers.
	⑦ Nebulizer Vacuum Tube Coupler	This is a coupler used to connect the Nebulizer to the vacuum tube.
	⑧ Module Stage	This is a stage that the U-FAB modules are installed onto. It houses the Bioscope, BIOLET™, BIOXT™ - LV, BIOXT™ - HV, Filament, Omnicure™.
	⑨ Module Docking Latch	This allows you to secure the removable modules (BIOLET™, BIOXT™ - LV, BIOXT™ - HV) after installation.
	⑩ Module Docking Guide Rail	This is used to physically guide the modules in place over the Module Stage.
	⑪ Temperature and Humidity Sensors	The sensors are used to check the temperature and humidity of inside the BSC. You can check the values on the LCD panel.
	⑫ Bioscope™	The Bioscope is equipped with an objective lens capable of 5X magnification and camera. Cells can be observed through the bioscope by putting a small amount of cell-containing media onto the glass slide above the build plate.
	⑬ Omnicure™	The Omnicure™ system (from Excelitas Technologies Co.) applies UV light at desired frequencies (320-500 nm).
	⑭ Filament Roller	This roller holds a filament roll (used for filament printing).

⑤ U-FAB Interior (Upper View)

Image	Name	Function
	① Internal HEPA Filter	This is the Biosafety Cabinet(BSC)'s internal HEPA Filter. It filters external air entering the U-FAB <i>via</i> a suction blower.
	② Internal Lights	Lights are installed on the right and left side, and can be turned on/off via an LCD panel on the front of the BSC.
	③ UV Lamp	This is a UV light bulb that sanitizes the internal space of the BSC, and can be turned on/off using an LCD panel.
	④ UV Lamp Socket	This is a socket that allows the installation of the UV light bulb.

⑥ U-FAB Interior (Lower View)

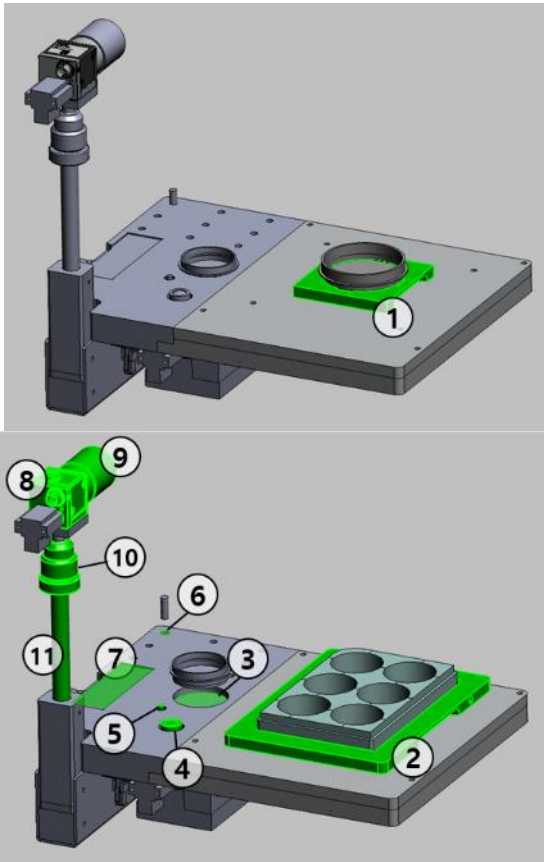
Image	Name	Function
	① X-Y Stage	This is the stage that moves the Build plate along the XY axis
	② Sash Closure Sensor	This is a sensor that senses if the Sliding Glass Sash is closed.



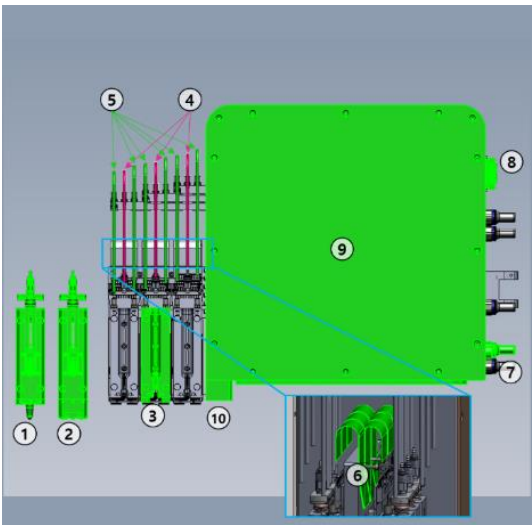
## ⑦ Internal Moving Components

Image	Name	Function
	① Build Plate	This is where the printed materials are printed onto. They are comprised of components that have various functions. Further explanation can be found in the Section ⑧ Build plate. The temperature can be adjusted between 40~50 degrees Celsius.
	② Monitoring Camera Cableveyor	The cableveyor moves the monitoring camera.
	③ X-axis Cableveyor	This is for the X-axis movement of the build plate.
	④ Y-axis Cableveyor	This is for the Y-axis movement of the build plate.
	⑤ Z-axis Cableveyor	This is for the Z-axis movement of the build plate.
	⑥ Compressor Air Filter	Multiple air filters are installed inside the U-FAB compressor line, which sequentially filter any air-borne particles greater than 5 $\mu$ m / 0.3 $\mu$ m / 0.01 $\mu$ m.
	⑦ Heater	This supplies hot water into the U-FAB's temperature controller and is used to heat build plate and the channels that require temperature control.
	⑧ Chiller	This supplies coolant liquid into the U-FAB's temperature controller and is used to cool the build plate and the channels that require temperature control.

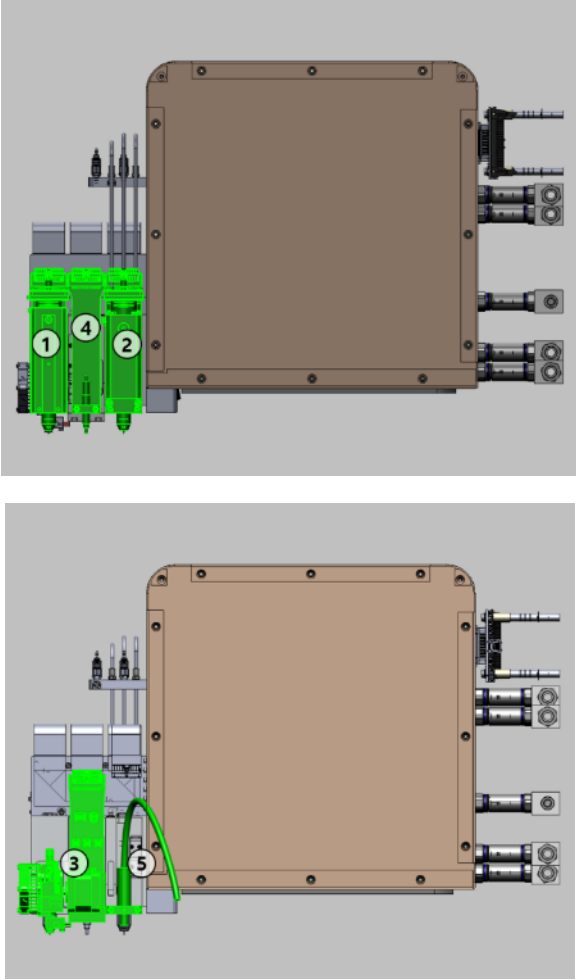
⑧ Build plate

Image	Name	Function
	① 60mm Dish Mount	This mount locks the 60 mm dish in place.
	② 6-well Dish Mount	This mount locks the 6-well dish in place.
	③ 40mm 'Flushing' Dish	This is a mount for the 40mm diameter dish which is used during flushing out the material from the dispensers. It is possible to check the nozzle's state by pre-dispensing liquids onto the dish before printing.
	④ Nozzle Alignment Camera	This camera is used to observe and correct for the XY position of each channel's printing nozzle.
	⑤ Nozzle Offset Sensor	When the Extruder is used for printing, the nozzle must be located above the Build Plate at a certain distance. The sensor measures each channel's height and allows the printing to happen at an appropriate height from the bioware (petri dish or equivalent).
	⑥ Holes for Fabric Cleaning Filters	The Fabric Cleaning Filters are used to wipe the tip of droplet-based microvalve nozzles. There are holes where you install/plug them into.
	⑦ Slide-Glass Mount	When using the bioscope. Use this to mount the glass-slide that has cells printed onto it.
	⑧ Monitoring Camera	This is a camera that monitors the printed objects.
	⑨ Monitoring Camera Lens	This lens controls the magnification of the Monitoring Camera.
	⑩ Monitoring Camera Ball-joint	This is a ball joint that adjust the angle of the Monitoring Camera.
	⑪ Height adjustable rod for the Monitoring Camera	This Rod adjusts the height of the Monitoring Camera.

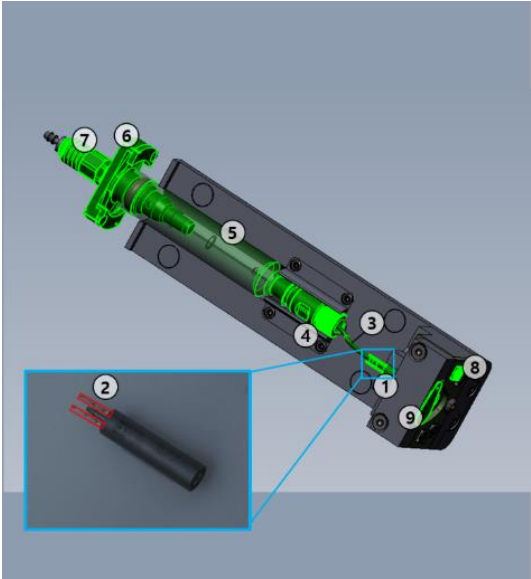
⑨ BIOLET™ & BIOXT™ - LV Module

Image	Name	Function
	① Droplet Dispenser	This is a droplet dispenser that is capable of printing low-viscosity biomaterials.
	② Low-/intermediate-viscosity Material Extruder	This extrusion dispenser is capable of extruding low-/intermediate-viscosity biomaterials.
	③ Liquid-Jacketed Block	This block mounts a dispenser to control the dispensing temperature.
	④ Compressor Tubing	The tubing provides the dispensers with the necessary air pressure during printing.
	⑤ Temperature Control Tubing	The tubing feeds coolant/heating liquids into the Liquid-Jacketed Block.
	⑥ Flat cable	This cable electronically controls function of each channel.
	⑦ Liquid Coupler	The coupler connects the module to heating/coolant liquid for temperature control.
	⑧ Module Connector	The connector electronically connects the module control board with the main control board.
	⑨ Module Enclosure	The Module Enclosure is comprised of a front/ back/ top/ bottom/ left/ right covers.
	⑩ Module Stopper	It is used to place the modules in place over the Module Stage.

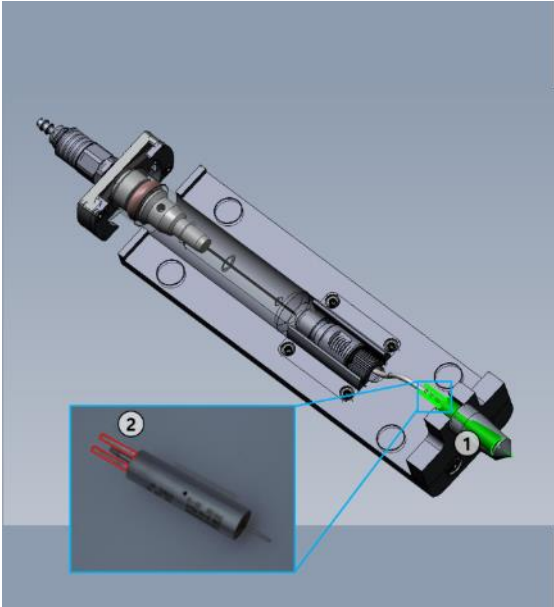
⑩ BIOXT™ - HV Module

Image	Name	Function
	① High-viscosity, high-temperature Material Extruder	This Extruder is capable of printing high viscosity(including plastic pellets) materials. The temperature can be adjusted between room temperature and 180 °C.
	② High-viscosity Material Extruder	This Extruder is capable of printing high viscosity material. The temperature can be adjusted between 40 and 50 °C.
	③ Filament Extruder	E3D's Filament extruder. This is used when printing with filament (e.g. PCL and PLA filaments). The temperature can be adjusted between room temperature and 250 °C.
	④ Surface Detector	When the Extruder is used for printing, the nozzle must be above the Build plate at a certain distance. Th detector measures the distance between the nozzle an the Build Plate.
	⑤ Omnicure™ Lightguide	The BIOXT™ - HV module include an adapter to a Light guide. Omnicure™ System's Light guide can be used to apply UV light onto desired areas.

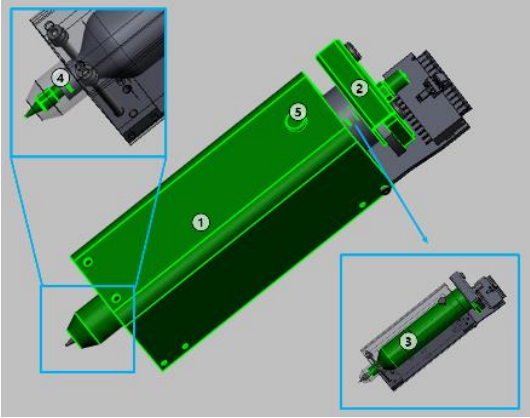
# ⑪ Droplet Dispenser Channel in BIOLET™

Image	Name	Function
	① Droplet-type Microvalve	This Microvalve (used in the droplet dispensing) is capable of dispensing low-viscosity material in a single droplet. By controlling the valve opening time, along with adjusting the pneumatic pressure, it is possible to control the volume of each dispensed material. The internal volume of the Droplet-type Microvalve is 30 $\mu\text{L}$ .
	② Electrodes for Droplet-type Microvalve	The Electrodes electronically connect the Droplet-type Dispenser to the control board.
	③ Teflon Tube	The Teflon tube connects the Luer-lock adapter and the Droplet type Microvalve. The Teflon tube's inner volume is 70 $\mu\text{L}$ , length is 54 mm, inner diameter is 1.016 mm (1/25 inch), outer diameter is 1.5875 mm (1/16 inch).
	④ Luer-lock Adapter Kit - 5mL syringe	The Luer-lock adapter kit is used to connect the Syringe to the Teflon tube.
	⑤ 5mL Syringe	This syringe is compatible with the Droplet Dispenser and Low-/intermediate-viscosity Material Extruder.
	⑥ Homogenizing Syringe Adapter - 5mL	This compressor adapter is compatible with the Droplet dispenser and Low-/intermediate-viscosity Material Extruder. It prevents the cells from clumping or settling at the bottom of the syringe during the printing process.
	⑦ Syringe Pneumatic Coupler	This coupler connects the syringe to the pneumatic tube.
	⑧ UV LED	This UV LED is used to harden photopolymers, and applies 365nm of UV light (different wavelength available upon request).
	⑨ UV Shutter	This shutter prevents the hardening of excess material inside the droplet dispenser nozzle. This can help to alleviate nozzle blockage.

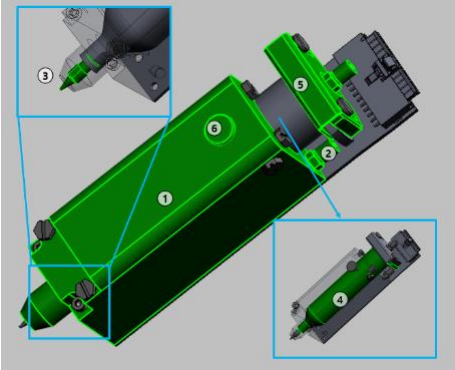
⑫ **Low-/intermediate-viscosity Material Extruder Channel in BIOXT™ - LV**

Image	Name	Function
	① Extrusion-type Microvalve	This Microvalve is used in the Low-/intermediate-viscosity Material Extruder. It can extrude low viscosity materials into fine lines. By controlling the air pressure, the amount extruded can be controlled. The internal volume of the Extrusion-type Microvalve is 30 µL.
	② Electrodes for Extrusion-type Microvalve	When the Low-/intermediate-viscosity Material Extruder is connected to the module, the Electrodes electronically connect the Microvalve to the Dispenser control board.

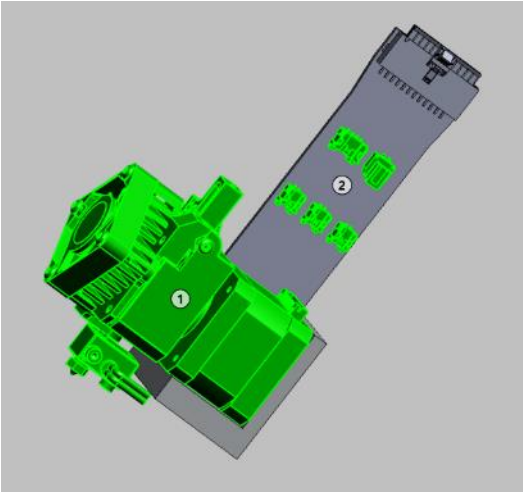
⑬ **High-viscosity material extruder (BIOXT™ – HV) High-temperature Channel**

Image	Name	Function
	① High-temperature Control Block	This temperature control block is for <b>BIOXT™ – HV</b> . The temperature can be adjusted between room temperature to 180 °C via heating element.
	② Syringe Adapter	This connects to the Compressor tube, and prevents the syringe from dislocating under high pressure. The top of the adapter comes with a syringe compressor coupler.
	③ Heat-resistant Syringe - 30ml	This is the heat-resistant syringe for the High viscosity material extruder for BIOXT™ – HV. It can withstand temperature up to 180 °C.
	④ Luer-lock Printing Nozzle	This is compatible with other Luer-lock type printing nozzles, including various nozzle materials (Plastic, Teflon, Metal, Taper, Polypropylene).
	⑤ Syringe Fastening Bolt	This bolt fastens the syringe to the block.

⑭ **High-viscosity material extruder (BIOXT™ – HV) Intermediate-temperature Channel**

Image	Name	Function
	① Intermediate-temperature Control Block	This temperature control block is for the <b>BIOXT™ – HV</b> . The temperature can be adjusted between room temperature to 40~50 °C via water cooling/heating.
	② Tube Coupler for the Temperature Control Block	This coupler supplies cooling/heating liquid to the block.
	③ Luer-lock Printing Nozzle	This is compatible with other Luer-lock type printing nozzles, including various nozzle materials (Plastic, Teflon, Metal, Taper, Polypropylene).
	④ Heat-resistant Syringe - 30ml	This is the heat-resistant syringe for the High viscosity material extruder for BIOXT™ – HV. It can withstand up to 180 °C
	⑤ Syringe Adapter	This connects to the compressor tube, and prevents the syringe from disconnection from the pressurized pneumatic line. The top of the adapter comes with a syringe compressor coupler.
	⑥ Syringe Fastening Bolt	This bolt fastens the equipped syringe to the block.

⑮ **Filament Extruder Channel**

Image	Name	Function
	① Filament Extruder	This filament extruder is E3D's Titan aero 1.751 Mirrored, capable of printing Filament. For more information, please refer to the manufacturer's manual.
	② Filament Extruder Cable Connector	This connector electronically connects the Filament extruder to the printer.



## D. Getting Started

### Part 1. Installing the U-FAB

#### ① Connecting the U-FAB to AC power source or voltage-transformer

##### I. How to Connect



1. Check the capacity of the power outlet.  
(We recommend using a wall socket, not a power extension cable)  
- Check if capacity is at 6kW  
- A ground connection is important. Please install the appropriate grounds if not present.

2. Connect the 220V power cable at the back of the U-FAB to the wall socket.

##### II. Caution

- U-FAB is for 220V and requires appropriate power transformer.
- If the building that houses the U-FAB limits the use of 6kW appliances, consult local regulatory staffs and professional for help.

#### ② Connecting the Pneumatic Compressor

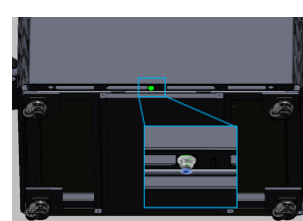
##### I. Components



1. Pneumatic Compressor  
(Optional purchase)

2. Pneumatic hose for the compressor (Included in the system; Outer Diameter 8mm, Inner diameter 6mm)

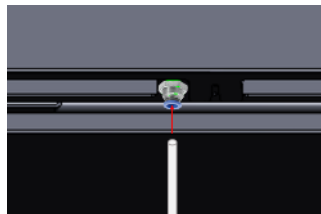
##### II. How to Connect



1. Connect the pneumatic hose to the back port of the compressor like the picture above.

2. Picture of the hose connected to the compressor.

3. Check the location of the compressor connection port to the U-FAB.



4. Connect the hose to the compressor connection port.

##### III. Caution

- Please insert the hose as far inside as possible to prevent air leakage.



③ Feeding / Removing the chiller / boiler with Coolants (Automobile Washer Fluid) / Heating Liquid (Distilled Water)

I. Components



1. Washer Fluid (4.4L)



2. Distilled Water (3.5L)



3. Funnel hose

II. How to Connect



1. Take off the U-FAB's bottom cover.



2. Connect the funnel hose to the drain port at the bottom of the cooling device/boiler



3. When feeding the liquid, face the funnel upwards. Feed 4.4L of washer fluid into the chiller and 3.5L of distilled water into the heater.




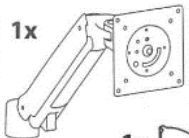
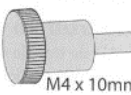
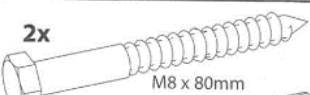



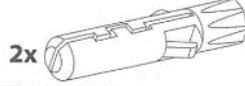

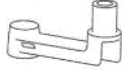

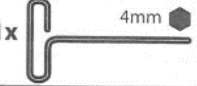

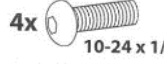


4. When draining the liquid, face the funnel downwards.

III. Caution

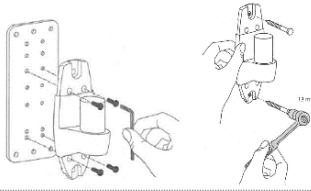

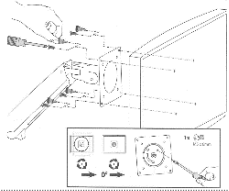
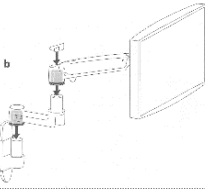
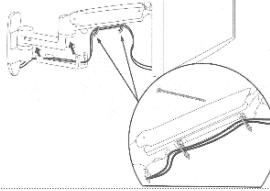
- Do not drink the coolant and avoid contact of the fluid with eyes.
- Please insert the funnel hose as far inside as possible. This is to prevent the washer fluid from leaking.

## ⑤ Connecting the monitor/keyboard and PC mounts

### IV. Components

	A	B	C	D
1	1x 	1x 	4x  M4 x 10mm	2x  M8 x 80mm
2	1x 	1x 	4x  M4 x 10mm	2x 
3	1x 	1x 	1x  M3 x 6mm	1x  4mm
4	2x 	4x  10-24 x 1/2"	1x  2.5mm	1x  1/8"

### V. How to Connect

		
1. Connect the monitor arm to the U-FAB's side panel	2. Cover the applicator with the caps.	3. Connect the U-FAB PC to the monitor arm
		
4. Connect the articulated arms to the mount as described in the picture above.	5. Use the cable ties and plastic cover to finish assembly.	

### VI. Caution

- Excessive force to the monitor/keyboard console can cause damage to the console.


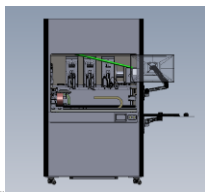
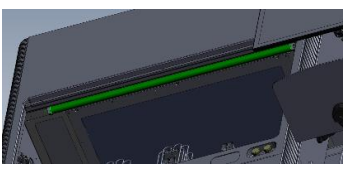
## ⑥ Installing the UV Lamp

### VII. Components



#### 1. UV Lamp

### VIII. How to Connect

		
1. Check the U-FAB's inner ceiling for the UV Lamp socket.	2. Tilt the UV Lamp like the picture above and connect it to the socket.	3. Close the Sliding Glass Sash and check the LCD display for the UV Lamp ON/OFF function.





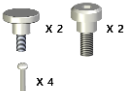
### IX. Caution

- The UV Lamp is very fragile. Please take necessary caution.
- Incomplete connection of the bulb may result in damage to the UV Lamp.

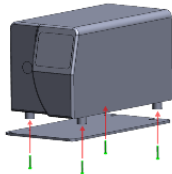
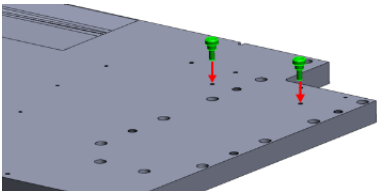
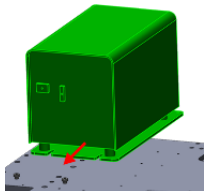
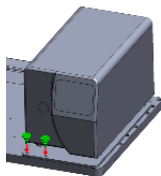
### Part 3. Installation of Internal Components

#### ① Installing the Omnicure™ Module

##### I. Components

 X 1	 X 1	 X 1	 X 1	 X 2 X 2 X 4
1. Omnicure™	2. Light guide	3. Bulb	4. Omnicure™ mount plate	5. Bolts

##### II. How to Connect







	
1. Using the available 4 bolts, fasten the Omnicure™ onto the mount plate.	2. Connect 2 bolts to the Module Stage. These will act as guides for the Omnicure™ module.
	
3. Insert the Omnicure™ module between the bolt guides.	4. Secure the Omnicure™ module with 2 bolts (with wide pan-handle screw tops).

##### III. Caution

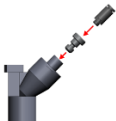
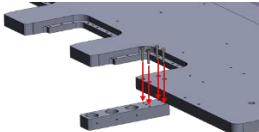
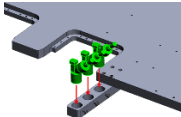
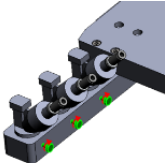

- Please consult the manufacturer's manual on how to install, use, and maintain the Omnicure™'s other components (the Light guide and Bulb)
- This device radiates potentially harmful UV rays. Please consult the manufacturer's manual for safety information.

#### ② Installing the Nebulizer Module

##### I. Components

 X 3	 X 3	 X 3	 X 1	 X 3	 X 4
1. Nebulizer	2. Nebulizer cap	3. fitting	4. Nebulizer manifold	5. Pneumatic Tube	6. Bolts

##### II. How to Connect

		
1. Connect the Nebulizer, Nebulizer cap, and fitting like the picture above.	2. Install the Nebulizer manifold onto the Module Stage with the 4 bolts.	3. Match the Manifold holes with the completed Nebulizer from step 1.
		
4. Fasten the 3 bolts into the Manifold's side until the Nebulizer is completely secure.	5. Connect the Nebulizer fitting to the vacuum tube coupler on the Module Stage, via the pneumatic tube.	

##### III. Caution while Installing

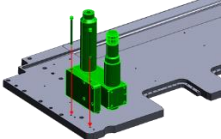
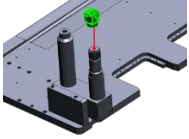
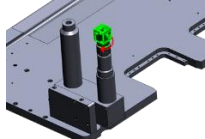
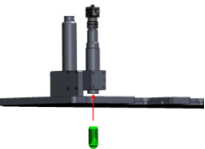
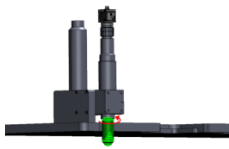
- During step 4, the plastic Nebulizer may be damaged if the bolts are fastened too strongly.

### ③ Installing the Bioscope™ Module

#### I. Components

 X 1	 X 1	 X 1	 X 2
1. Bioscope Block	2. Print Monitoring camera	3. Microscope objective lens	4. Bolts

#### II. How to Connect

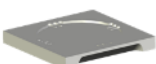



		
1. Connect the Bioscope Block with the bolts.	2. Connect the Print Monitoring camera like the picture above.	3. Fasten the Print Monitoring camera by turning it clockwise.
		
4. Connect the Microscope objective lens like the picture above.	5. Install the Microscope objective lens by turning it like the picture above.	

#### III. Caution

- Do not use excessive force when assembling the camera and objective lens.
- Dust or other particles could reduce the efficacy of the lens.

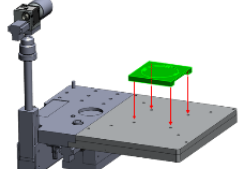
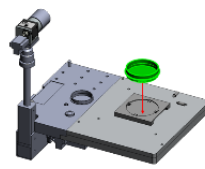
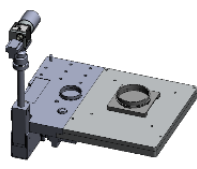
### ④ Installing the Dish Mount and Dish

#### I. Components

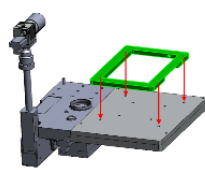
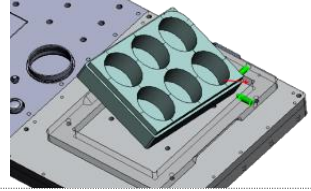
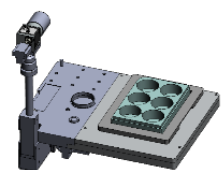
 X 1	 X 1	 X 1	 X 1
1. 60mm dish mount	2. 6-well dish mount	3. 60mm dish	4. 6-well dish

#### II. How to Connect

##### i. Preparing the 60mm dish

		
1. Fasten the 60 mm dish mount onto the holes in the Build Plate.	2. Place the 60mm dish on top of the 60mm dish mount.	3. The 60mm dish is prepared, like the picture above.

##### ii. Preparing the 6-well dish

		
1. Fasten the 6-well dish mount onto the holes in the Build plate.	2. Put the 6-well dish on top of the 6-well dish mount. The mount comes with a spring-mount plunger, which prevents the 6-well dish from shaking.	3. The 6-well dish is prepared.

#### III. Caution

- Store the mount on a flat surface, without mechanical pressure on it.
- Please re-check whether the Dish mount is properly fastened onto the build plate.

⑤ Installing the Fabric Filter

I. Components



1. Fabric filter

II. How to Connect



1. Fasten the Fabric filter onto the holes in the Build plate.



2. Press the Filter downwards until the bottom of the Filter touches the floor.

III. Caution

- We recommend you use appropriate laboratory gloves to prevent contamination. We also recommend disinfecting the gloves before usage.
- Excessive force on step 2 can result in damage to the Fabric filter.

## Part 4. Connecting the Tubing in Dispensers

### ① BIOLET™ / BIOXT™ - LV

#### I. How to connect the Luer-lock adapter

##### i. Components



1. Luer Adapter Female Luer



2. Flangeless Male Nut



3. Flangeless Ferrule



4. Teflon tube - Length: 54 mm / Inner diameter: 1.016 mm (1/25 inch) / Outer diameter: 1.5875 mm (1/16 inch)

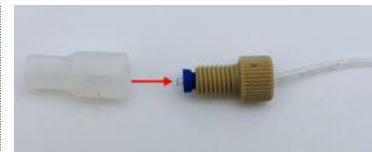
##### ii. How to Connect



1. Connect the Microvalve Teflon tube by passing it through the Flangeless Ferrule.



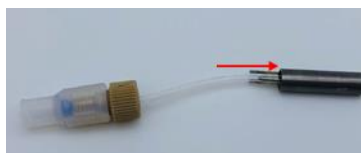
2. Connect the Flangeless Male Nut through the opposite side.



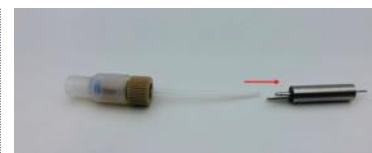
3. Connect the Luer Adapter Female Luer in the direction of the red arrow.



4. Fasten the Luer Adapter Female Luer by turning it in the direction of the red arrow. Sufficient force must be applied while fastening the Luer Adapter Female Luer. This is to prevent potential leakage.



5-1. Connect the Teflon tube fastened with the Luer-lock adapter to the Droplet-type Microvalve inlet. Pinching or bending the Teflon tubing during assembly can affect the efficiency of the Microvalve.



5-2. Connect the Teflon tube fastened with the Luer-lock adapter to the Extrusion-type Microvalve inlet. Pinching or bending the Teflon tubing during assembly can affect the efficiency of the Microvalve.

##### iii. Caution

- We recommend you use Exam gloves to prevent contamination. We also recommend disinfecting the gloves before usage.
- The Luer Adapter Female Luer and the Flangeless Ferrule could potentially deteriorate depending on the materials it comes in contact with. Frequent checking and appropriate replacement of these parts are advised.



## II. How to install the Droplet-type Microvalve & Luer-lock adapter to Droplet Dispenser Channel

### i. Components



1. Droplet Dispenser Channel

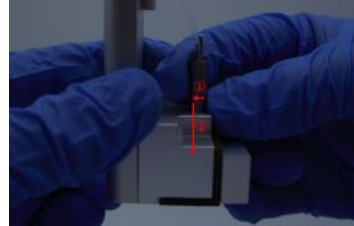


2. Droplet-type Microvalve & Luer-lock adapter Set

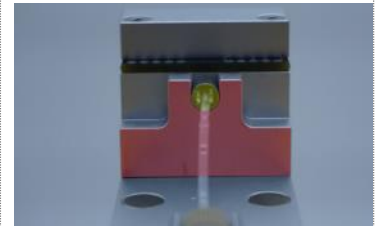
### ii. How to Connect



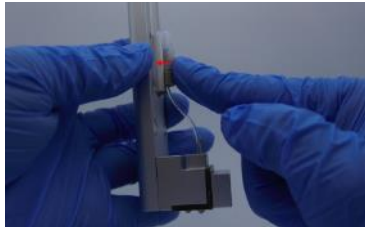
1. Point and hold the Microvalve's electrode towards the assembler to prepare for assembly.



2. Equip the Droplet dispenser to the Microvalve hole.



3. Match the top side of the Droplet-type Microvalve (in yellow) and the Channel Block area (in red) for assembly.



4. Fasten the Luer-lock adapter like the picture above.



5. Droplet-type Microvalve & Luer-lock adapter are now connected to the dispenser channel.

### iii. Caution

- We recommend you use Exam gloves to prevent contamination. We also recommend disinfecting the gloves before usage.
- It is crucial that the Microvalve's electrode be facing the correct direction, as shown in step 1.
- Do not bend the Microvalve electrodes.

### III. How to Install the Extrusion type microvalves (BIOXT – LV)

#### i. Components

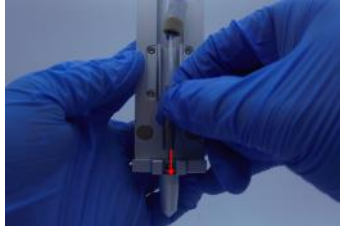


1. The dispenser



2. Extrusion-type Microvalve & Luer-lock adapter Set

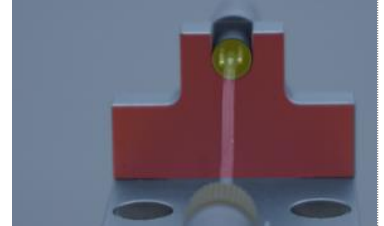
#### ii. How to Connect



1. Point and hold the Microvalve's electrode towards the assembler to prepare



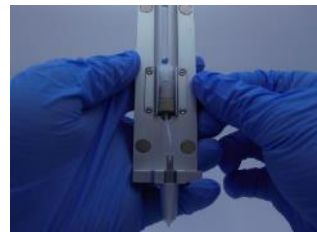
2. Insert the extrusion dispenser to the hole. IT IS IMPORTANT NOT TO touch the tip of the valve to the inner hole since it may damage the valve.



3. Match the top side of the Extrusion-type Microvalve (in yellow)) and the Channel Block area (in red)



4. Fasten the Luer-lock adapter like the picture above.



5. A picture of the Extrusion-type Microvalve & Luer-lock adapter, connected to the dispenser.

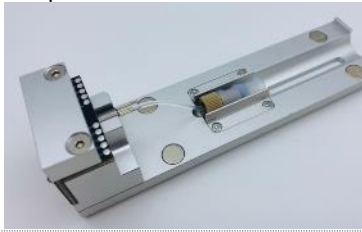
#### iii. Caution

- We recommend you use Exam gloves to prevent contamination. We also recommend disinfecting the gloves before usage.
- It is crucial that the Microvalve's electrode be facing the correct direction, as shown in step 1.
- Do not bend the Microvalve electrodes.



## V. How to connect the Syringe/Syringe Adapter

### i. Components

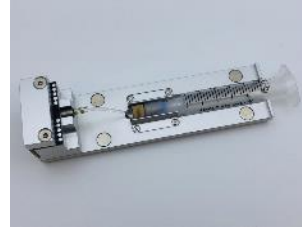


1. Dispenser Module

2. 5ml Syringe

3. Syringe Pneumatic Coupler

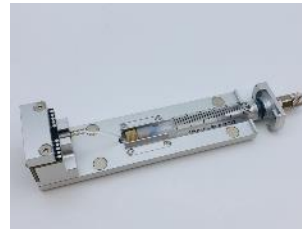
### ii. How to Connect



1. To install, hold the 5ml Syringe towards the Luer-lock adapter, and turn clockwise.

2. Picture of the equipped 5ml Syringe.

3. Hold the Syringe Pneumatic Coupler towards the Syringe, and turn clockwise.



4. To fasten, push in the Syringe Pneumatic Coupler all the way into the 5ml Syringe, and turn clockwise.

5-1. Picture of the fully assembled droplet dispenser

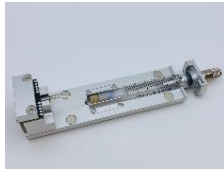
5-2. The fully assembled Low-/intermediate-viscosity Material Extruder.

### iii. Caution

- We recommend you use Exam gloves to prevent contamination. We also recommend disinfecting the gloves before usage.
- If the Syringe Pneumatic Coupler is not fastened properly, the dispenser may malfunction.

## VI. How to attach/detach the channel to the printing module

### i. Components



1. Droplet dispenser

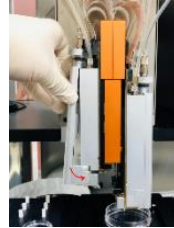


2. Low-/intermediate-viscosity Material Extruder

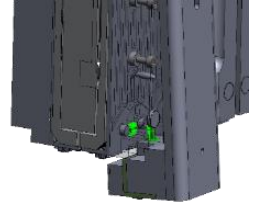
### ii. How to Connect(Steps)



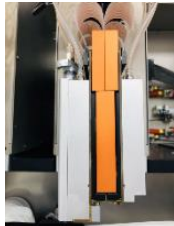
1. Hang the Droplet dispenser onto the top section of the Liquid-Jacketed Block, like the picture above.



2. Push the dispenser inwards into the direction of the red arrow. The Dispenser will attach to the Liquid-Jacketed Block through magnets.



3. The piston Connector will connect to the Microvalve electrode during step 2. (The Low-/intermediate-viscosity Material Extruder's electrode will connect in the same way)



4-1. The Droplet dispenser, fully-assembled.



4-2. The Low-/intermediate-viscosity Material Extruder, fully-assembled.

### iii. Caution

- Make sure that there is no space between the Droplet dispenser and Liquid-Jacketed Block.

## VII. How to connect the pneumatic tubing to each channel

### i. How to Connect



1. Insert the plug-equipped compressor tube into the direction of the red arrow.



2. When you press the compressor tube's plug downwards, it will click into place.



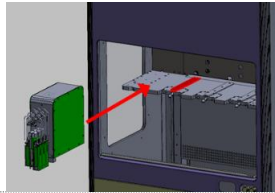
3. The compressor tube, fully connected.

### ii. Caution

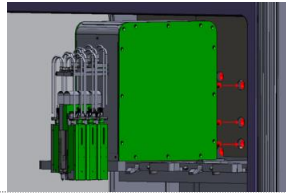
- The coupler's connector will make a clicking sound during step 2. This indicates complete coupling.

## VIII. How to Install / Uninstall the Modules

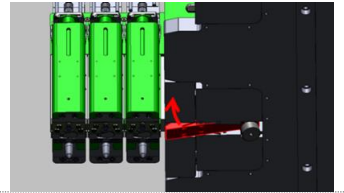
### i. How to Connect



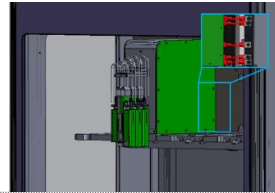
1. Place the module on the Module Stage. The guide rail is marked in red.



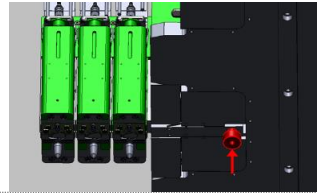
2. Push the module inwards, following through the guide rail.



3. The module latch will click into place.



4. The module, fully-assembled.



5. Press the eject button to uninstall the module.

### ii. Caution

- The individual module weighs an approximate 15kg (~35 lbs). Please exercise caution when handling this heavy component.

## ② BIOXT™ - HV

### I. How to connect the Syringe with the Syringe Adapter

#### i. Components



1. Syringe

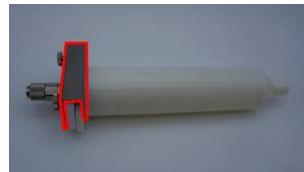


2. High-Pressure Syringe Adapter

#### ii. How to Connect(Steps)



1. Insert the High-Pressure Syringe Adapter to the Syringe.



2. Have the install bracket of the High-Pressure Syringe Adapter fully cover the top of the Syringe, like the picture above.



3. Turn the High-Pressure Syringe Adapter's fastener bolt and secure it into place.

#### iii. Caution

- If the Syringe Adapter's fastener bolt is not properly secured, the Extruder may malfunction.
- Before inserting the Syringe into the temperature control block, examine the state of the Syringe's surface. If any residue is present on the surface, please be sure to clean it as it may burn inside the High-Temperature Control Block.

## II. How to install Filament-based extruder

### i. Components



#### 1. Filament

### ii. How to Connect(Steps)



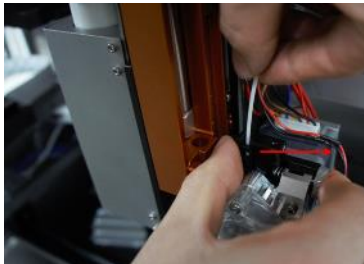
1. Place the Filament on the Filament roller.



2. Cut the end of the Filament diagonally.



3. Loosen the Filament extruder's Tension control knob.



4. Pull the Filament's area of contact and connect the Filament, like the picture above.



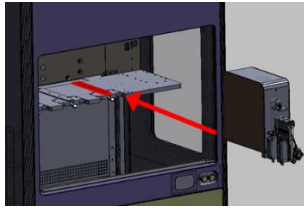
5. Tighten the Filament extruder's Tension control knob.

### iii. Caution

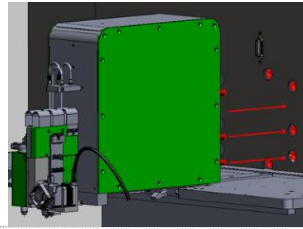
- Please do not let any foreign objects touch the Filament extruder's front Fan. The Fan's blades can become damaged.
- To ensure the proper loading of Filament, the end must be cut diagonally. Refer to Step 2.

### III. Installing / Uninstalling Modules

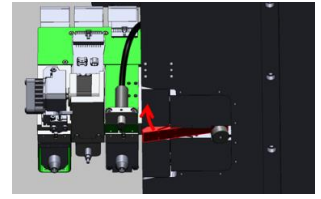
#### i. How to Connect(Steps)



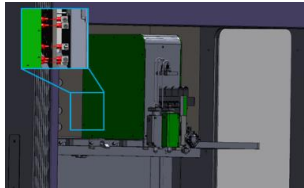
1. Place the module on the module equip stage. The guiderail is marked in red.



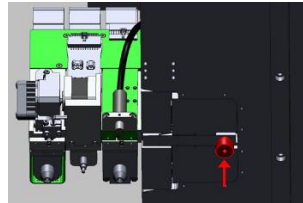
2. Push the module inwards, following through the install guiderail.



3. The module equip latch will click into place when the module is fully equipped.



4. The module, fully equipped.



5. Press the eject button to detach/uninstall a module.

#### ii. Caution

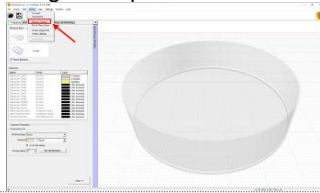
- The individual module could weigh up to 15kg ~33 lb), so please handle with care.

## Part 5. Checking Operational Status using U-Studio™

### ① XYZ Axis Operational Status

#### I. Check-List

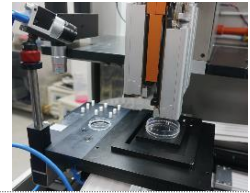
##### i. Moving to a Specific Location



1. Select the Manual control menu from U-Studio

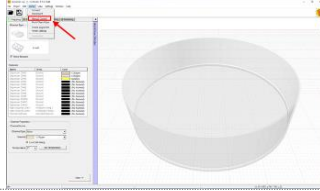


2. You can move the Build plate to specific locations(e.g. a center of build plate) from Section ①.



3. Picture of CH1 at the Build plate.

##### ii. Moving to a Specific Coordinate



1. Select the Manual control menu from U-Studio



2. You can move the Build plate to specific coordinates from Section ① in the Manual control window.



3. Select the desired coordinates, and press Go to move the Build plate. (X: 0–670mm, Y: 0–240mm, Z: 0–200mm)

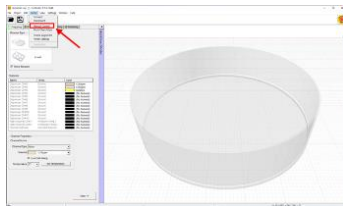


4. The Build plate, at the base coordinates. (X=0mm, Y=0mm, Z=0mm)

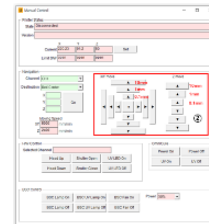


5. The Build plate, at maximum allowed coordinates.(X=670mm, Y=240mm, Z=200mm)

##### iii. Manual Movement

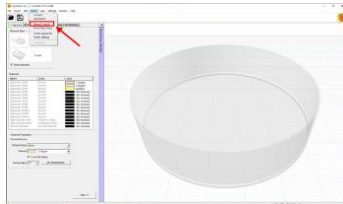


1. Select the Manual control menu from U-Studio

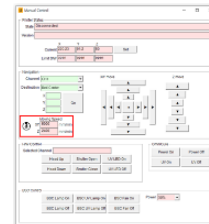


2. You can move the Build plate to specific coordinates from Section ② in the Manual control window. (Movement possible in 0.1mm/1mm/10mm increments)

##### iv. Adjusting Movement Speed



1. Select the Manual control menu from U-Studio



2. Adjust the Build plate's movement speed to specific coordinates from Section ③ in the Manual control window.

#### II. Caution

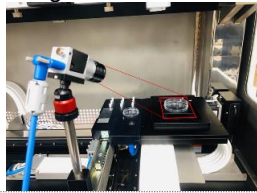
- Do not put your hands or head inside the front door of the U-FAB during operation. Failure to comply could result in injury.
- Excluding the accessory box, do not put foreign objects inside. Failure to comply may result in collision within the machine.



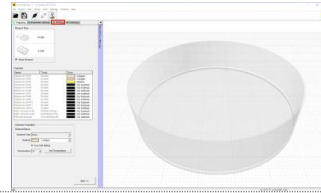
## ② Camera I/O Check

### I. Check-List

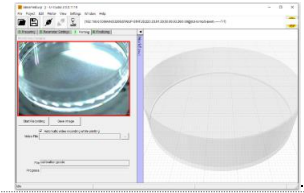
#### i. Monitoring camera



1. Point the monitoring camera towards the Dish mount plate.

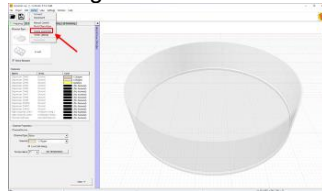


2. Select the Printing table from U-Studio.

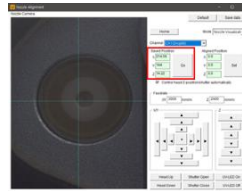


3. Monitor the Dish mount plate through the left side of the screen(double click to switch to fullscreen).

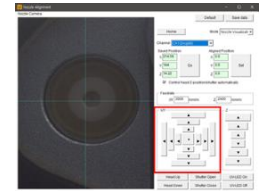
#### ii. Nozzle alignment camera



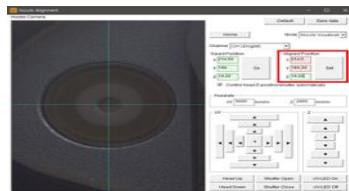
1. Select the Manual control menu from U-Studio.



2. Select the channel that you wish to perform Nozzle alignment, and press the Go button to check the location of the Nozzle.

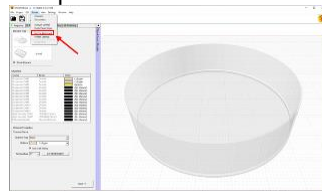


3. Perform Nozzle alignment by using the XY axis movement function.

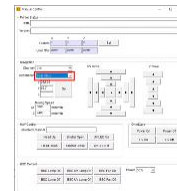


4. When you are finished aligning, press the Set button to finish Nozzle alignment.

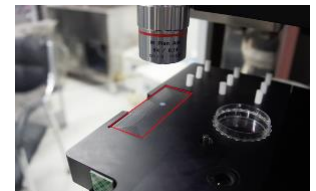
#### iii. Bioscope™



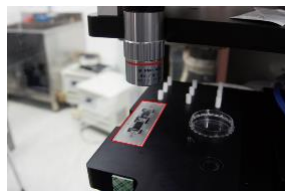
1. Select the Manual control menu from U-Studio.



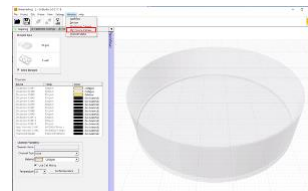
2. Select the Slide glass from the Manual control window to move the Build plate.



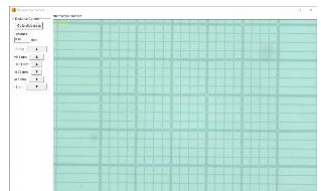
3. Locate the Slide glass mount on top of the Build plate.



4. Place the Hemocytometer on top.



5. Select the Microscope menu from U-Studio



6. Check Nozzle alignment by pressing the 'Set' button, or check the video feed.

### II. Caution

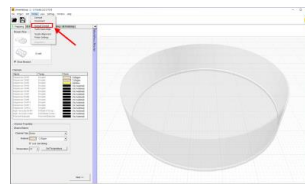
- Regularly wipe off any dust or foreign material that settles on the camera lens with a microscope objective lens cleaner.
- After adjusting the position of the monitoring camera, tighten the Ball joint fastener before use.

### ③ Omnicure™ I/O Check

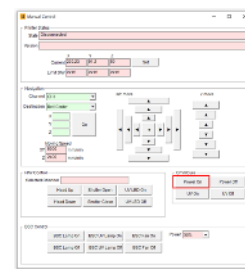
#### I. Check-List



1. See if the Omnicure™'s power switch is turned on.



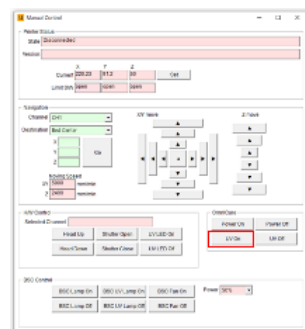
2. Select the Manual control menu from U-Studio.



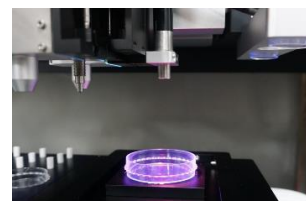
3. Click the Power on button from the Manual control window to boot Omnicure™



4. The Omnicure™ display's CLF sign will light up for approximately 15 minutes.



5. When the CLF sign stops flashing, click the UV On button from the Manual control window to activate the UV Light.



6. Check if the Omnicure™ lightguide emits UV light.

#### II. Caution

- This device radiates potentially harmful UV rays. Please consult the manufacturer's manual on how to use the device properly.
- Wear safety goggles before operation.
- The end of the Omnicure™'s Light guide is extremely hot and may cause burns. Please do not touch.

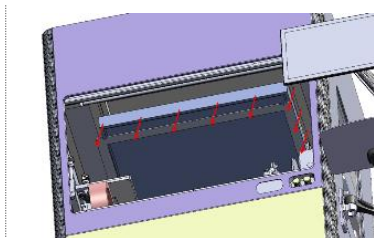


## E. Maintenance

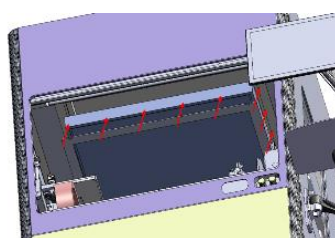
### ① Replacing the HEPA Filter (Once per year)

#### I. How to Replace(Steps)

##### i. Internal HEPA Filter

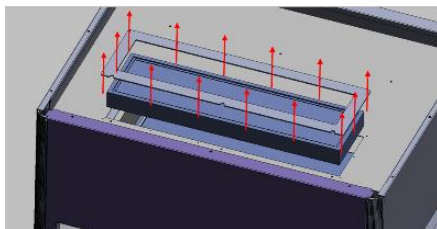


1. Remove the bolts on the top side of the internal ceiling.

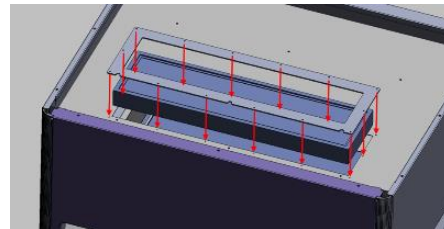


2. Remove the Internal HEPA Filter and replace it with a new one.

##### ii. Out-flow HEPA Filter



1. Remove the bolts on the top of the U-FAB.



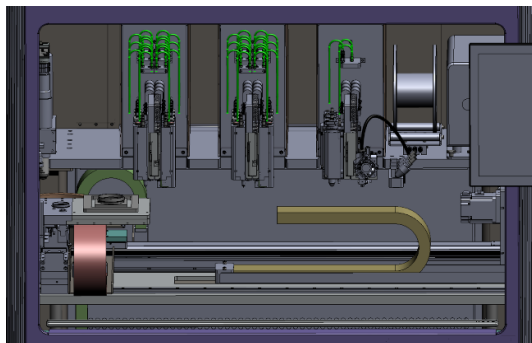
2. Remove the Out-flow HEPA Filter and replace it with a new one.

### ② Replacement of the Pneumatic/Liquid Tubes

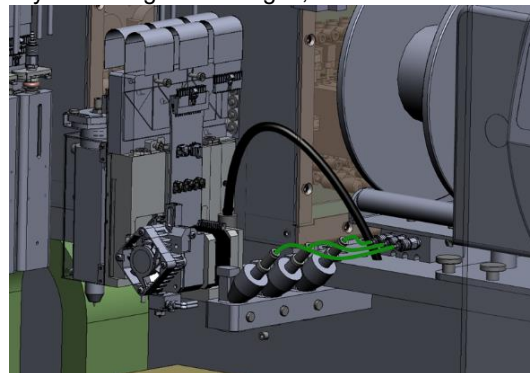
I. Regular replacement of the pneumatic/liquid tubes is not necessary, but the user must regularly check for the situations written below. If any of these are observed, replace the tubing.

- Surface damage (scratches, corrosion)
- Air leakage
- The tangling or twisting of the compressor tubes and water hose.
- The hardening, thermal degradation, or softening of the compressor tubes and water hose.

II. The steps are shown below. If any other hoses/tubing show any issues/sign of damages, contact customer services.



Temperature/Pneumatic Control Tubes



Nebulizer Pneumatic Tubes

### ③ Cleaning the U-FAB Components

#### I. Dispensers

##### Disinfection

1. Spray a generous amount 70 % ethanol onto a soft paper towel/ Kimwipes (or equivalent), and then wipe the dispenser's surface to clean and to disinfect.

##### UV Sterilization

2. After disinfecting with 70 % alcohol, apply the U-FAB's UV light onto the Dispenser for 15 minutes.

#### II. Micro-valves

##### Disinfection

1. Spray a generous amount 70 % ethanol onto a Kimwipes, and then carefully wipe the dispenser's surface to clean and to disinfect. DO NOT touch the tip of the valve

##### UV Sterilization

2. After disinfecting with 70 % alcohol, apply the U-FAB's UV light onto the Dispenser for 15 minutes.

3. For internal cleaning of the valves, use the internal flush function of the U Studio. Contact HELP line for information about compatible solvents/cleaning solutions. Application of ethanol may crosslink some materials and may clog the valve permanently.

#### III. Nebulizer

##### Disinfection

1. Excluding the nebulizing membrane, wipe and disinfect the Nebulizer's surface. Insert 1~2 mL of 70 % ethanol into the Nebulizer and shake 10 times. Minimize the amount of time of the Membrane being exposed to 70 percent alcohol to 1~2 minutes, and remove the ethanol. Dry the entire unit thoroughly.

##### Washing and Drying

2. To remove the remaining ethanol, insert 1~2 mL of DW(Deionized water)and shake 10 times. After washing, dry the Nebulizer.

##### UV Sterilization

3. After sufficient drying, shine UV light onto the Nebulizer for 15 minutes, and store in room temperature away from direct light sources.

#### IV. Luer-lock adapter set

##### Disinfection

1. Completely submerge the Luer-lock adapter set into a bowl filled with 70% ethanol to disinfect. Apply 70% ethanol through tubings using syringe.

##### Washing and Drying

2. Completely submerge the Luer-lock adapter set into DW(Deionized water)to remove ethanol. Dry afterwards.

##### UV Sterilization

3. After sufficient drying, shine UV light onto the Luer-lock adapter set for 15 minutes, and store in room temperature away from direct light sources.

Concerning any problems or enquiries, please contact us at : [info@clecell.co.kr](mailto:info@clecell.co.kr)

Returned parts / products can be sent to :

CLECELL Co., Ltd.  
C1506, H Business Park  
26, Beobwon-ro 9-gil, Songpa-gu, Seoul  
Republic of Korea

## F. Version history

[illegible]

