BIO X Photocuring Toolhead

User Manual

CELLINK®

Contents

01
Package contents

01 Package contents

Item	Part number	Quantity
Photocuring Toolhead	D16110020849 (365 nm) D16110020851 (405 nm)	1

02

Technical specifications

02 Technical specifications

- **Dimensions (height x width x depth): 93 x 34 x 55 mm.**
- **Weight: 130 g.**
- **Material composition:**
  - **External surfaces: Powder-coated steel on front, top and bottom; polyamide plastic on back; aluminum light funnel**
  - **Internal surfaces: N/A**.
- **Recommended operating temperature: 20-23 degrees Celsius.**

NOTE: We recommend operating BIO X in temperatures between 20 and 23 degrees. In normal operating conditions, the chamber temperature of the BIO X will rise 2-3 degrees above the ambient temperature.

- **Wavelengths:**
  - **365 nm.**
  - **405 nm.**
  - **Custom.**

Table 1: Intensity (mW/cm^2) and stability at 100% power, 2 cm distance.

Time from UV Onset	365-nm Photocuring Toolhead (mW/cm^2)	405-nm Photocuring Toolhead (mW/cm^2)
0 min	16	34.7
10 min	14.74	33
20 min	14.89	31.9
30 min	14.98	32.2

02 Technical specifications

Table 2: Intensity (mW/cm²), intensity percentage, offset (mm), and height (cm) of 405-nm toolhead.

0 mm offset	INTENSITY %	0 cm	1 cm	2 cm	3 cm
	5%	5.88	3.42	2.05	0.99
	10%	10.03	4.82	3.36	1.78
	25%	25.47	13.04	7.27	4.04
	50%	42.14	24.46	13.44	7.6
	75%	62.75	36.44	19.94	11.35
	100%	82.37	47.8	26.08	14.84
2.5 mm offset	5%	-	2.2	1.36	0.86
	10%	-	3.73	2.34	1.49
	25%	-	8.36	5.24	3.38
	50%	-	15.67	9.85	6.36
	75%	-	23.39	14.66	9.5

2.5 mm offset	100%	-	30.67	19.23	12.47
5 mm offset	5%	-	0.65	0.66	0.53
	10%	-	1.09	1.1	0.9
	25%	-	2.4	2.45	2.04
	50%	-	4.5	4.58	3.89
	75%	-	6.69	6.82	5.73
	100%	-	8.76	8.94	7.52
10 mm offset	5%	-	0	0	0.14
	10%	-	0	0.16	0.24
	25%	-	0	0.34	0.52
	50%	-	0.22	0.62	0.99
	75%	-	0.32	0.93	1.48
	100%	-	0.41	1.22	1.94

02 Technical specifications

Table 3: Intensity (mW/cm^2), intensity percentage, offset (mm) and height (cm) of 365-nm toolhead.

0 mm offset	INTENSITY %	0 cm	1 cm	2 cm	3 cm
	5%	5.14	2.98	1.65	0.99
	10%	9.14	5.27	2.98	1.70
	25%	21.64	12.21	6.89	3.98
	50%	41.74	23.98	13.53	7.81
	75%	61.38	35.04	19.8	11.47
	100%	81.04	46.67	26.20	15.26
2.5 mm offset	5%	-	1.83	1.13	0.74
	10%	-	3.23	2.04	1.32
	25%	-	7.54	4.72	3.15
	50%	-	14.71	9.38	6.18
	75%	-	21.51	13.72	9.1

2.5 mm offset	100%	-	28.4	18.28	12.02
5 mm offset	5%	-	0.49	0.51	0.49
	10%	-	0.99	0.99	0.99
	25%	-	2.18	2.23	1.79
	50%	-	4.32	4.4	3.59
	75%	-	6.32	6.46	5.26
	100%	-	8.32	8.59	7.02
10 mm offset	5%	-	0	0	0.14
	10%	-	0	0.14	0.2
	25%	-	0	0.33	0.49
	50%	-	0.14	0.85	0.99
	75%	-	0.2	0.99	1.33
	100%	-	0.32	1.13	1.98

02 Technical specifications

- **Build volume (X, Y, Z): 128 x 85 x 58 mm.**

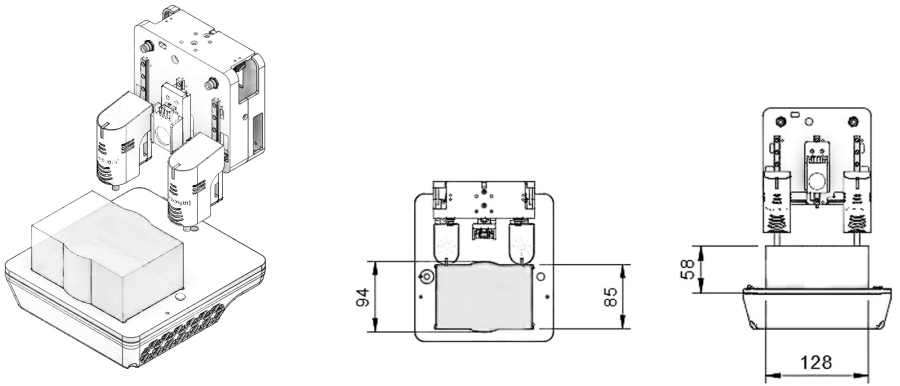

Figure 1: Theoretical maximum build volume, shown from the top and side view using the Photocuring Toolhead. Build volume may be lower when combining the Photocuring Toolhead with a printhead that restricts printbox movement. Please consult the printhead manual for the printheads being used for specific limitations.

03
Safety information

03 Safety information

3.1 BIO X system warnings

- **Please consult the BIO X manual for BIO X-specific and general warnings and safety procedures.**

3.2 Standard Photocuring Toolhead warnings

- **Do not submerge the toolhead in liquid or use excessive spraying to clean it. Liquid inside the toolhead risks damaging its circuitry and motor.**
- **Do not manually move the toolhead mount. Moving the mount manually will damage the motor. If the mount needs to be moved, place the toolhead in the loading position described in the Getting Started section**
- **Use proper method to load and unload the Photocuring Toolhead onto the BIO X toolhead mounts, as specified in the Getting started section. While loaded on the BIO X, do not pull or push the toolhead with excessive force, especially when the BIO X system is turned on. This will damage the motor and its guides.**
- **Do not use a jerking motion to remove the toollhead. Using a jerking motion risks hitting and damaging the HEPA filter.**
- **The aluminum tube may be warm after crosslinking. Do not touch this part of the toolhead when removing it from the BIO X.**
- **The symbol below indicates risk of personal injury or equipment damage due to UV radiation. Always wear proper safety equipment when using UV sterilization and UV-curing systems. This symbol will be visible on BIO X's touchscreen whenever a UV light source is active.**

- **Do not place fingers on the toolhead while it is in motion. Users risk serious, permanent injury if fingers are caught between the toolhead base and the motor arm.**

04

Getting started

04 Getting started

4.1 Unpacking and installation

NOTE: The photocuring parameters displayed on this manual might not be accurate for your specific protocol. For recommended parameters please consult the documentation for the bioink being used.

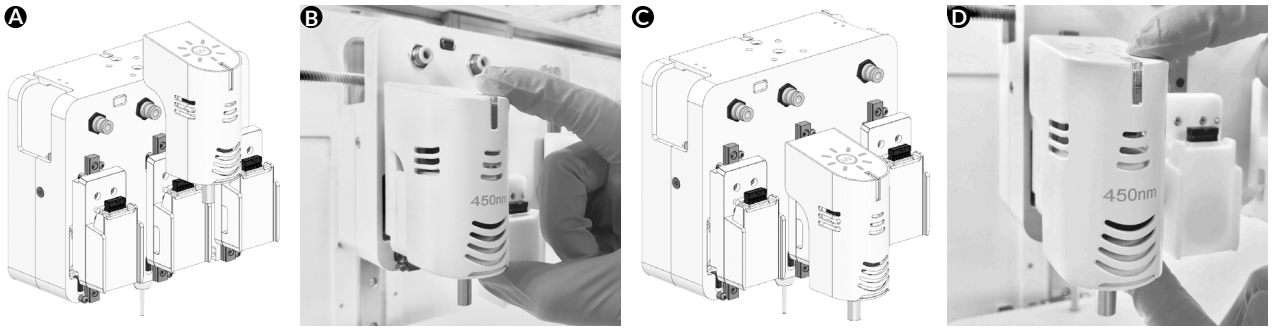

Figure 2: Attaching the Photocuring Toolhead to the BIO X. (A). Line up the toolhead with a mount on the printbox. (B) Slide the printhead down with one hand and secure the bottom of the printhead mount with the other hand. Once attached, the lights on the printhead will turn from white to blue.

1. **Open the package. Remove the Photocuring Toolhead.**
2. **To insert the toolhead, align the toolhead above the desired mount (Figure 2 A, B) and push downwards (Figure 2 C, D). Secure the toolhead mount with your other hand to prevent the motors from moving during attachment.**
3. **Go to the Utilities menu and navigate to the Tools submenu.**
4. **Select the appropriate toolhead position.**
5. **Close the BIO X door.**
6. **Turn on the Photocuring Toolhead by selecting the intensity menu (Figure 3A). Set an intensity (Figure 4) and turn on the toolhead. The lamp changes from green to blue when the UV light is activated (Figure 3B).**

NOTE: The door must be closed to begin photocuring.

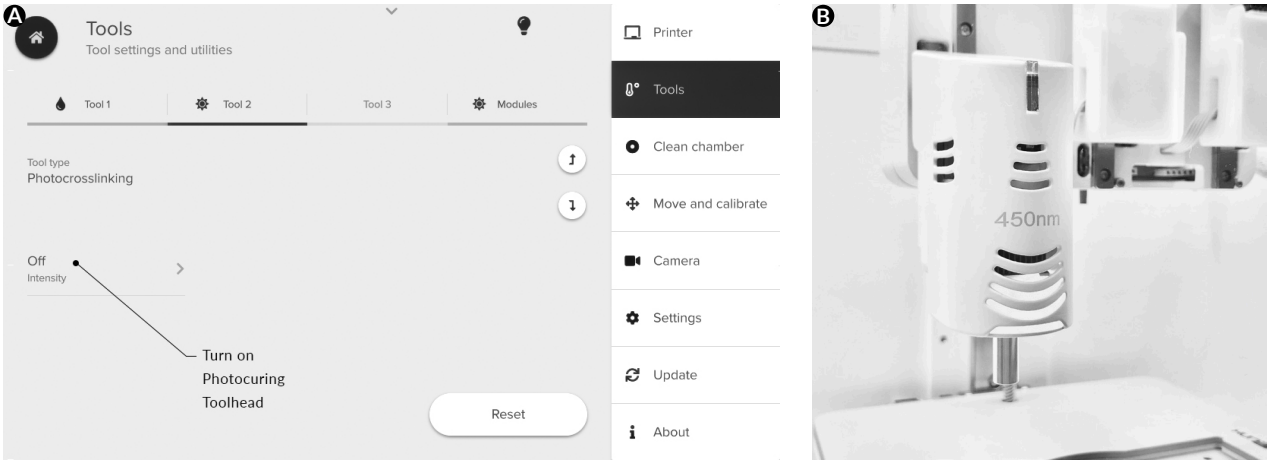

Figure 3: Testing the Photocuring Toolhead in the Tools submenu.

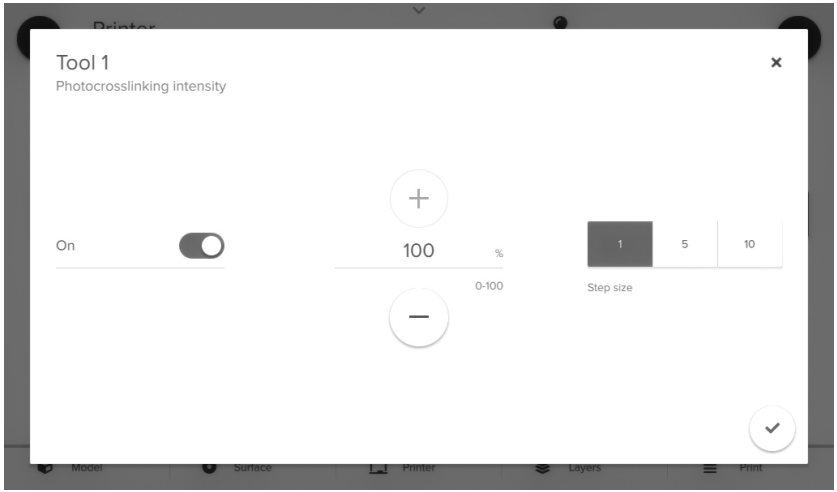

Figure 4: Setting the intensity of the Photocuring Toolhead.

04 Getting started

4.2 Raising and lowering the toolhead

1. Access the Utilities menu. Navigate to the Tools submenu.

2. Lower the desired toolthead mount into the active or loading position by pressing the down arrow (Figure 5).

3. Press the up arrow to return the toolhead to the inactive position.

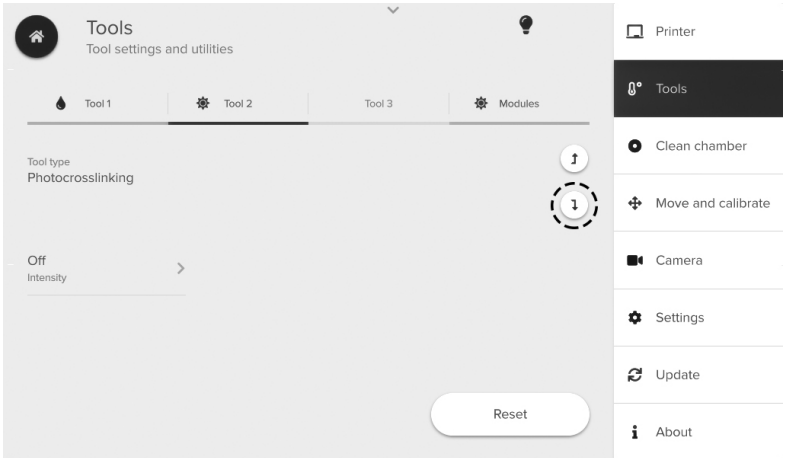

Figure 5: Lowering the toolhead into the active position.

4.3 The printing process

1. Prepare the toolhead as detailed in Section 4.1.
2. Mount a Standard Pneumatic Printhead in another mount, refer to the BIO X Standard 3-ml Pneumatic Printhead manual for instructions.
3. Go to the Bioprint menu and select a model to print using the Model menu.
4. Select the print surface in the Surface menu.
5. Proceed to the Printer menu. Toggle “Photocrosslinking” to adjust the frequency and patterning of photocrosslinking (Figure 6).
a. You can set photocrosslinking to occur once at the end of the print, or at a custom frequency (Figure 7).
b. You can set the photocrosslinking pattern to occur in the center of the construct. You can also choose to perform a line scan across the construct for a specific number of lines (Figure 8).

04 Getting started

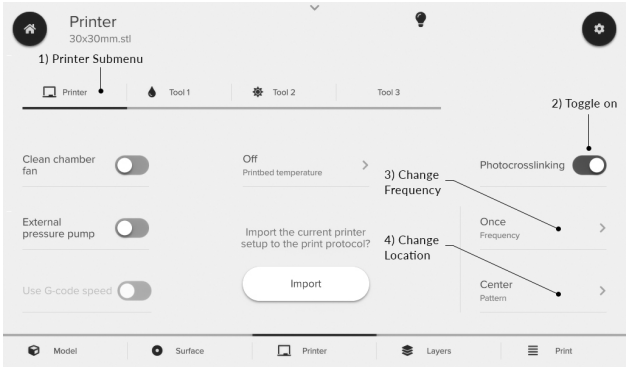

Figure 6: Designating the crosslinking frequency and pattern.

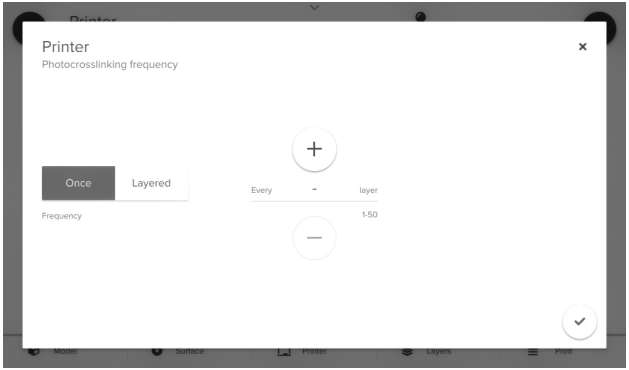

Figure 7: Setting the frequency of the photocrosslinking.

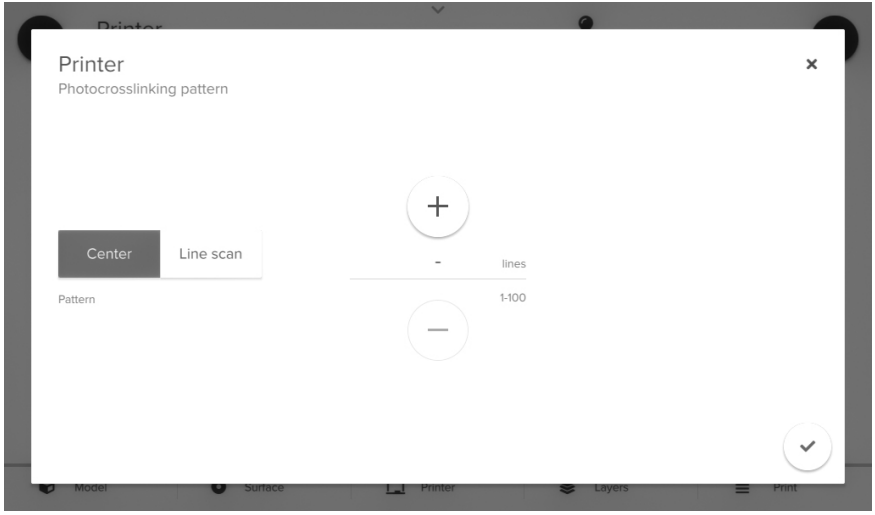

Figure 8: Setting the pattern for photocrosslinking.

6. **Select the Photocuring Toolhead in the toolhead mount submenu.**
7. **Proceed to the submenu of the toolhead containing photocrosslinkable bioink. In this tutorial, it is the first toolhead mount position (Figure 9).**
8. **Select the photocrosslinking source on the right. The photocrosslinking modules can also be selected in this dropdown menu (Figure 10).**
9. **Set the frequency and intensity of photocrosslinking.**

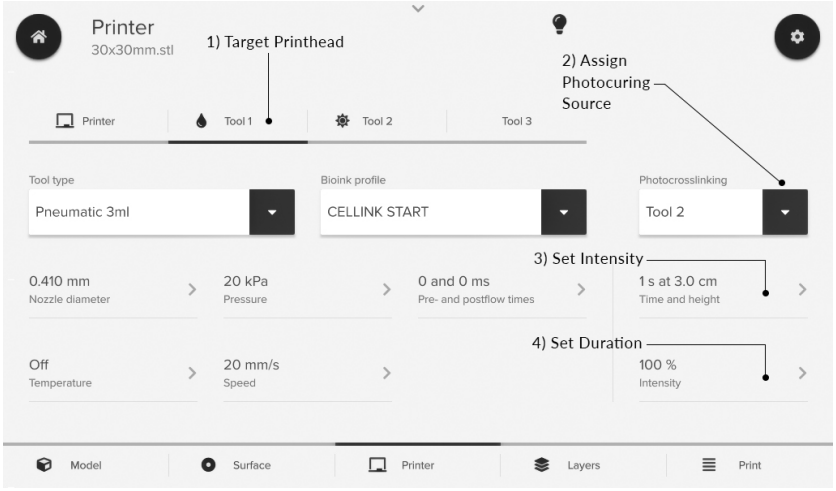

Figure 9: Selecting the Photocuring Toolhead's assignment, intensity and duration.

10. Proceed to the Layers submenu and assign the infill parameters.

NOTE: The Photocuring Toolhead cannot be assigned a perimeter or infill. It can only be assigned to the target toolhead under the Printer submenu.

11. Ensure the Photocuring Toolhead is active in the Print submenu (Figure 10).

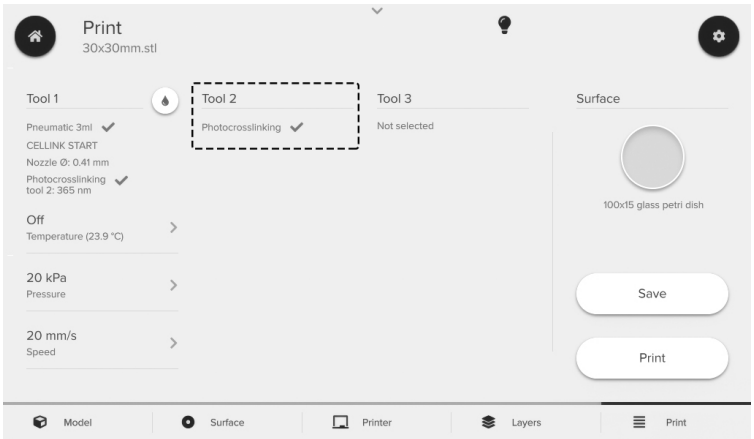

Figure 10: Verify the Photocuring Toolhead is active.

12. Press Print to proceed to the calibration page. Align the Photocuring Toolhead to match the target printhead calibration.
13. Ensure the door is closed and start the bioprinting process.

Removing the toolhead:

Hold the printhead mount in place with your hand and pull the toolhead up to remove with the other hand (Figure 11). See Section 3.2 for warnings.

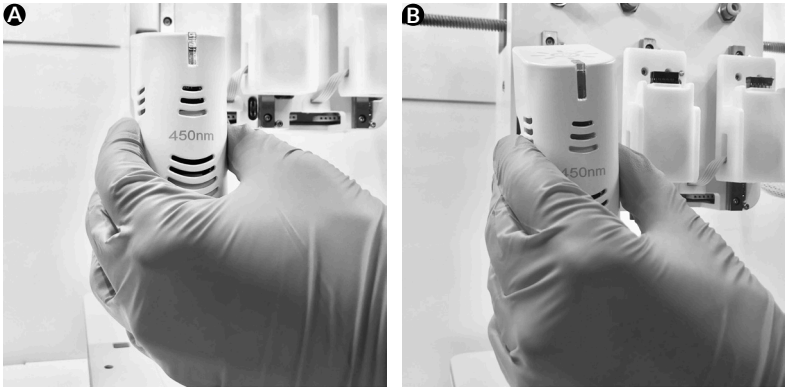

Figure 11: Removing the Photocuring Toolhead.

05

Relevant G-code commands

05 Relevant G-code commands

Commands	Description
G1 Xnnn Ynnn Fnnn	When used in combination with the G90 command, which defines absolute coordinates, G1 is the absolute move command. The values for the X and Y parameters are the coordinates (in mm) directing where to move. The F parameter is the movement speed of the toolhead in mm/min.
G1 Znnn Fnnn	When used in combination with the G90 command, which defines absolute coordinates, G1 is the absolute move command. The value for the Z parameter is the coordinate (in mm) directing where to move. The F parameter is the speed of the toolhead in mm/min.
G4 Snnn Pnnn	The G4 command tells the system to dwell. S is the wait time in nnn seconds and P is the wait time in nnn milliseconds.
G7 Xnnn Ynnn Znnn Fnnn	When used in combination with the G90 command, which defines absolute coordinates, G7 is the relative move command. The values for the X and Y parameters are the coordinates (in mm) directing where to move relative to the current position. The F parameter is the speed of the toolhead in mm/min.
G7 Znnn Ennn Fnnn	When used in combination with the G90 command, which defines absolute coordinates, G7 is the relative move command. The value for the Z parameter is the coordinate (in mm) directing where to move relative to the current position. The F parameter is the movement speed of the toolhead in mm/min.

G92 Xnnn Ynnn Znnn	G92 sets the current position of the toolhead to the specified X, Y and Z coordinates. If no parameters are given, the position is assumed to be 0, 0, 0 (this will also change the Z position).
Tx	Switch between toolhead (x). 0, 1 and 2 designate toolheads 1, 2 and 3.
M805 Tx Pyyy	M805 turns on the photocrosslinking light of toolhead Tx at intensity Pyyy, where yyy is between 0 and 255.
M805 Tx P0	M805 turns off the photocrosslinking light of toolhead Tx.

06

Frequently asked questions

06 Frequently asked questions

- **What wavelengths are available?**
The Photocuring Toolhead has light sources in 365, 385, 405 and 450 nm wavelengths.

- **Is the UV source exchangeable? Can it contain multiple wavelengths?**
The UV source of the Photocuring Toolhead is not exchangeable and cannot contain multiple wavelengths due to power restrictions.

- **What is the emission spectra of the UV source?**
Please contact support@cellink.com for specific information about emission spectra of each Photocuring Toolhead variation.

- **Can I crosslink individual wells of a well plate?**
Yes. The diameter of the targeting cylinder is meant to fit into a 96 well plate and can cure multiple wells of a 384-well plate.

07
Maintenance

07 Maintenance

- Regularly clean the printhead with a damp cloth to remove any dust or debris.
- If photocrosslinking efficiency decreases, check to make sure dust or other debris has not accumulated on the bulb. If necessary, clean the bulb with compressed air.

Support information

- Official site: **www.cellink.com**
- Contact: **support@cellink.com**
- Contact: **sales@cellink.com**
- Web store: **www.cellink.com/store**

Store

Sales

Official site

Support

Support information