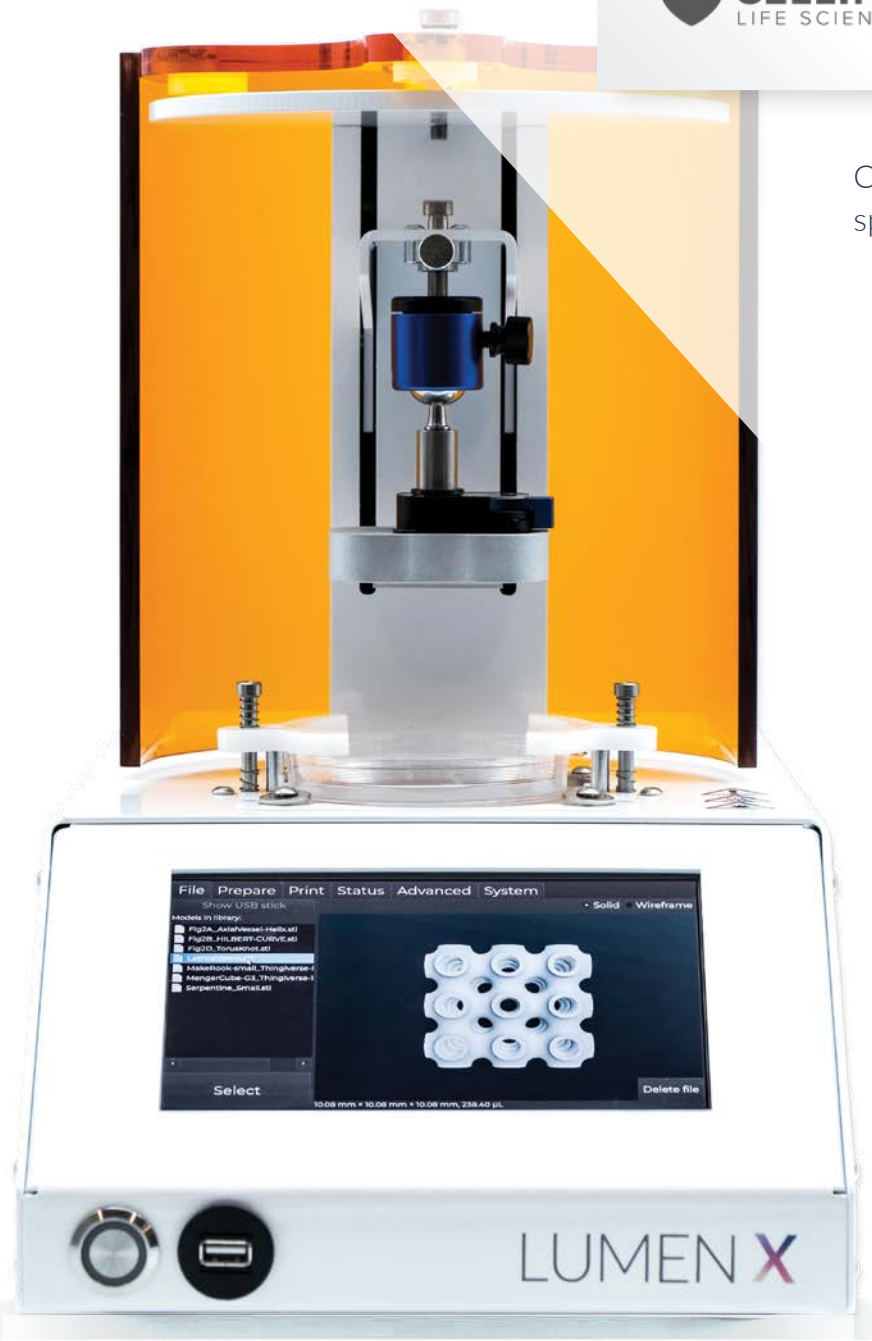
LUMEN X

CELLINK LIFE SCIENCES | powered by Volumetric

Construct microscopic features with speed, fidelity and precision.



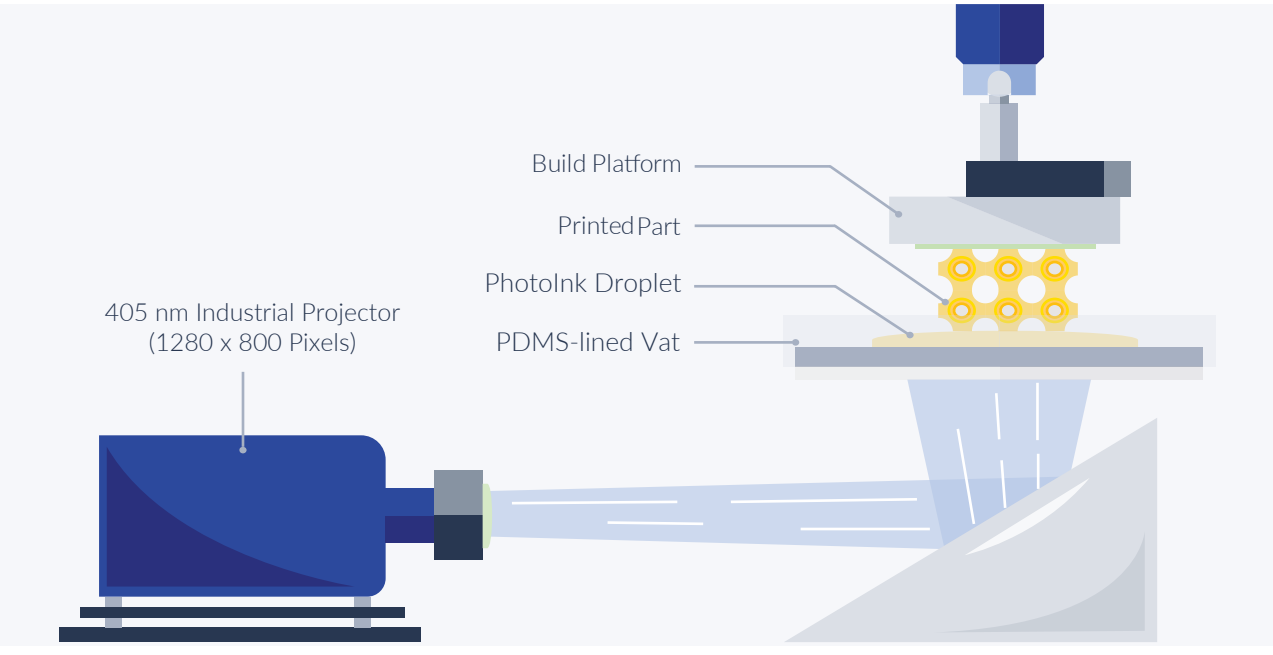
Lumen X ™

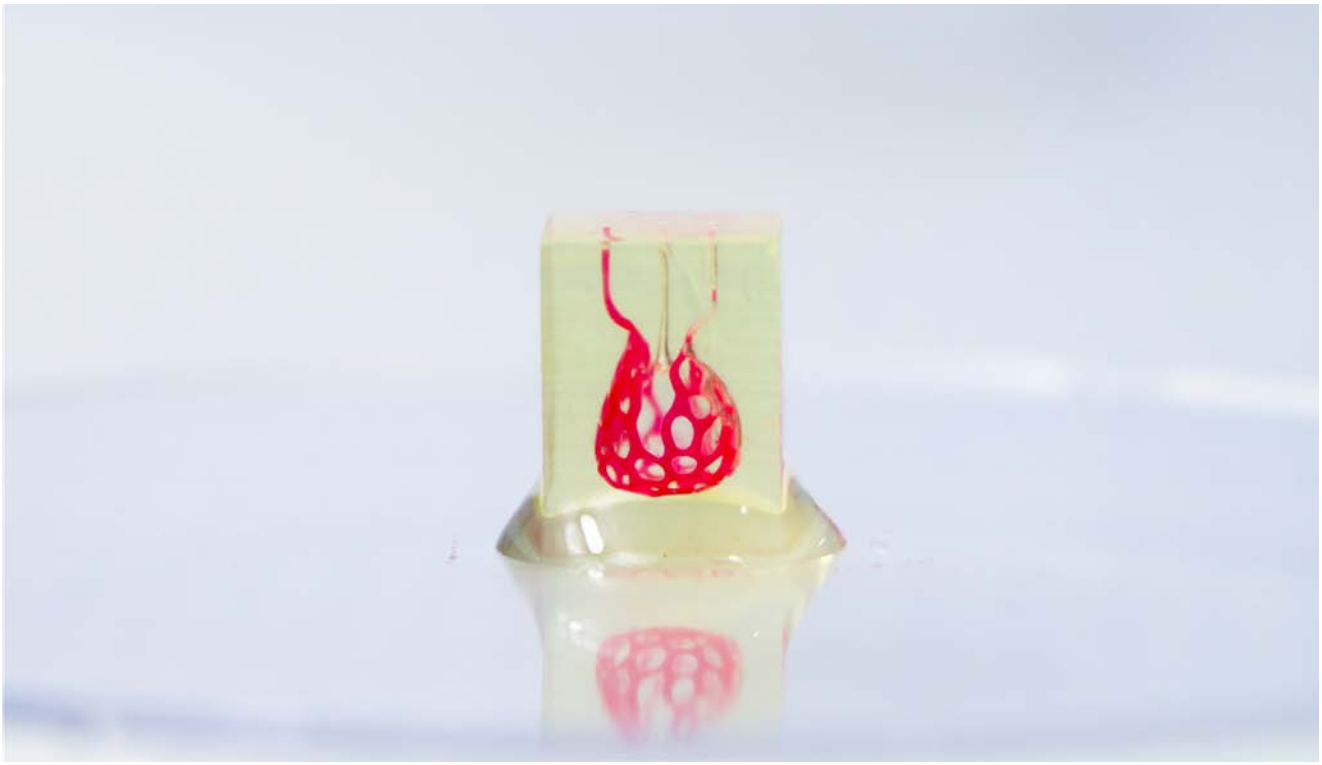
The Lumen X, powered by Volumetric, leverages digital light processing (DLP) printing to offer users high resolution, high throughput and high fidelity, enhancing applications in microfluidics, cell-laden hydrogels, macroporous structures and more. Designed to bioprint vasculature with visible blue light (405 nm), the Lumen X gives you a powerful advantage in achieving complex branching and tapering of vessels.

Lumen X is being launched through an exciting partnership with CELLINK and Volumetric, a Texas-based startup. We have combined our expertise to optimize the technology for all your bioprinting needs.

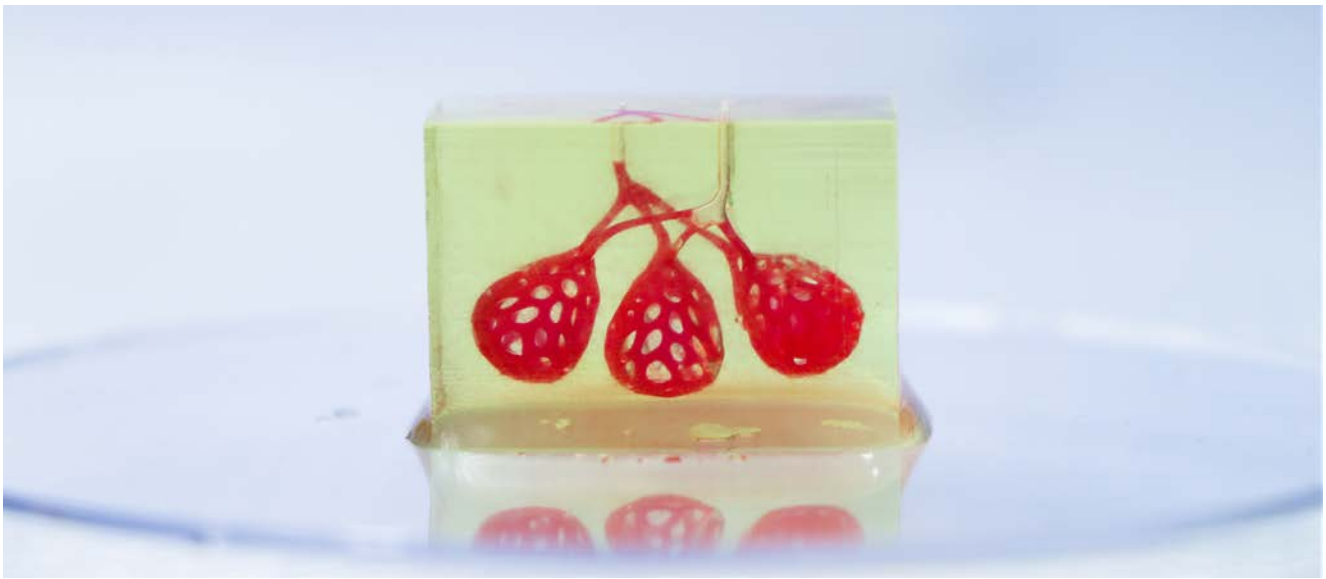
The Printing Principle

The Lumen X builds solid hydrogels by beginning with a droplet of light-sensitive, liquid PhotoInk™ in a vat. An industrial blue-light projector exposes a series of images onto the vat, like a slideshow. The areas of the droplet that are exposed will crosslink and solidify into a single layer. The build platform moves up to allow each layer to stack and build the part.

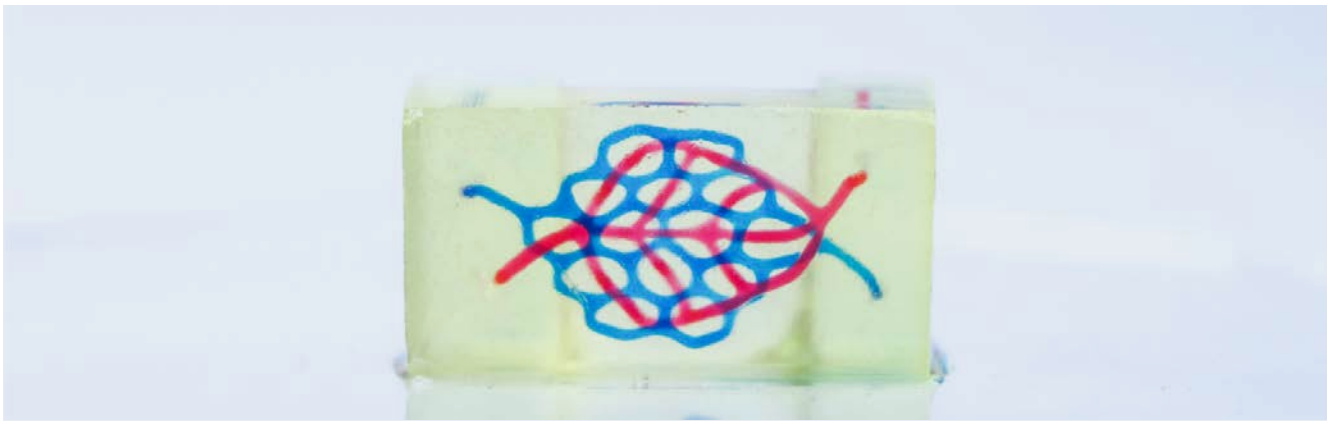


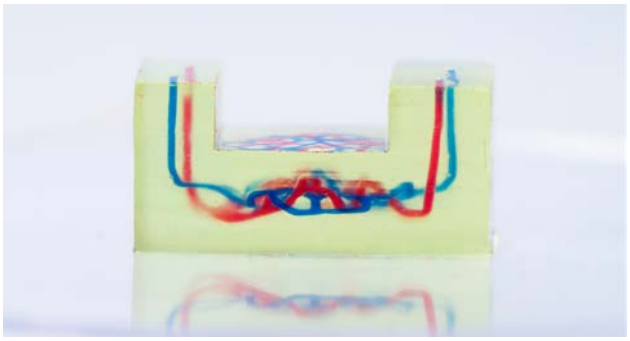


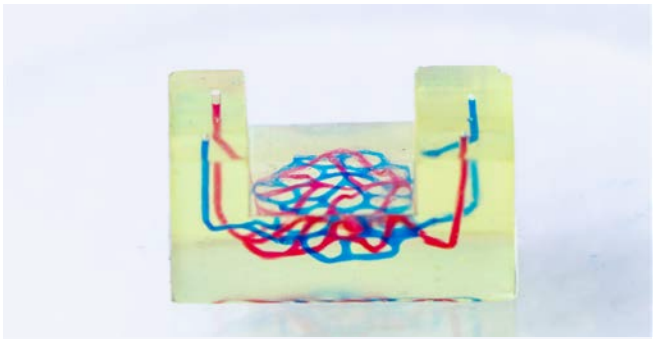
Alveolar cluster (6 x 6 x 9 mm) – Gas exchange network with fluid channels and air inlets. Smallest channel diameter is approximately 250 µm.



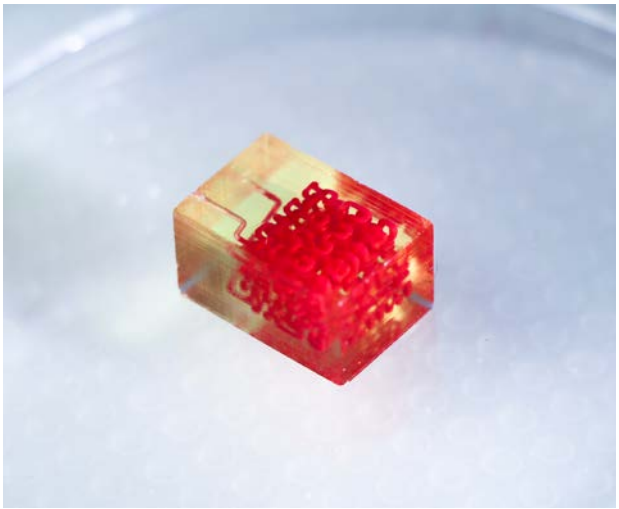
Multiple alveolar sac models (11 x 20 x 15 mm) – Combined into a cluster with common inputs and outputs. Smallest channel diameter is approximately 250 µm.

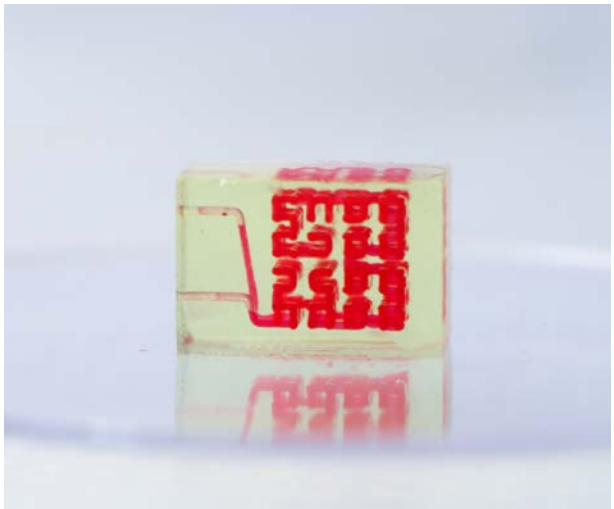






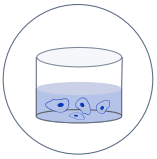
Vessel exchanger (15 x 12 x 6 mm) – Two unique vessel networks that intertwine for the exchange of gas, fluids and nutrients. Average channel diameter is 350 µm.





Hilbert space-filling curve (15 x 10 x 8 mm) – A mathematical curve converted into a 400 µm diameter channel, demonstrating the ability to construct a tortuous channel.

Features Designed for Your Success



Biocompatibility

Lumen X PhotoInks are biocompatible, so cells can be used with printed constructs. When using GelMA, cells can even be mixed into the PhotoInk. The built-in heater keeps GelMA liquefied and improves cell viability within the PhotoInk.

Open Materials Platform

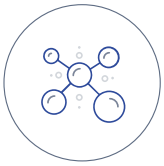
The Lumen X allows users to develop and use their own materials without workarounds or extra fees, opening the door for the development of materials with unique properties or for novel tissue engineering applications.

Flexibility

Combining the Lumen X with CELLINK's BIO X™ lets users multiply the benefits of each system's state-of-the-art capabilities. For example, the BIO X can print living cells within a structure fabricated on the Lumen X to strengthen work in applications like multimaterial research.

Speed

By curing entire layers simultaneously, the Lumen X can build structures **10 mm** tall in GelMA in 30 minutes (up to **50 times** faster than other printing methods). This translates to better cell viability and higher throughput when model building.



Isotropy

Compared to extruded scaffolds, Lumen X scaffolds are significantly more isotropic, allowing users to control mechanical properties with geometry in all dimensions. Users can also build unique structures, such as Schwarz lattices or auxetic structures.

Clarity

The photo-absorbing dye that gives the PhotoInks their color will wash out of printed structures in a matter of hours, allowing structures to be imaged via bright-field or fluorescence imaging techniques.

Resolution

DLP technology coupled with Volumetric PhotoInks allow the Lumen X to build watertight channels in hydrogels with greater consistency and precision than extrusion. This allows the Lumen X to create microfluidic lab-on-a-chip devices, strengthening work in:

- Disease pathology
- Drug screening
- Tissue engineering
- And more!

Intricacy

Gentle separation forces and material strength allow the Lumen X to build intricate scaffold geometries that include porosity and vasculature in X, Y and Z dimensions. Scaffolds can now have geometry that is far more biomimetic when engineering tissue such as trabecular bone.

PhotoInks and Consumables

PEGDA

Volumetric's Lumen X – PEGDA PhotoInk is an advanced biocompatible and nonbiodegradable bioink designed specifically for the Lumen X. It is ideal for bioprinting soft, gas-permeable microfluidic devices with intricate vascular architectures and for building macroporous scaffolds with struts >600 µm. The printed hydrogel will be mostly transparent with a stiffness closer to that of kidney fat.

PEGDA200

Volumetric's Lumen X – PEGDA200 PhotoInk is an advanced biocompatible and nonbiodegradable bioink designed specifically for the Lumen X. It is ideal for bioprinting tissue lattice structures with struts >300 µm. The printed hydrogel will be optically transparent with a stiffness that falls between that of lung tissue and skin. The PEDGA200 formula is stiffer and more durable than PEGDA but less absorbent, balancing flexibility, durability and transparency.

PEGDA500

Volumetric's Lumen X – PEGDA500 PhotoInk is an advanced biocompatible and nonbiodegradable bioink designed specifically for the Lumen X. It is ideal for bioprinting microfluidic devices and lattice structures with struts >200 µm. The printed hydrogel will be optically translucent, stiffer than cartilage and strong enough to permit the forming of thin walls and small channels. It can be used for drug delivery and constructs that do not require optical transparency.

PEGDA Start

Volumetric's Lumen X – PEGDA Start PhotoInk is an excellent starter bioink for learning to print with the Lumen X. It is ideal for rapidly testing new designs, printing microfluidic devices and building tissue lattice structures with struts >200 µm. The printed hydrogel is optically translucent and does not swell substantially in water. While its stiffness resembles that of bone, it is not as durable.

GelMA

Volumetric's Lumen X – GelMA PhotoInk is an optimized gelatin-based biodegradable bioink designed specifically for the Lumen X. Because fabricated hydrogels can be cured with little-to-no impact on cell viability, the GelMA PhotoInk can be mixed with cell pellets. It can also resolve intricate vascular networks and channels that offer endothelial and epithelial cells the essential properties of their native environments. Lumen X's built-in heating function is crucial for generating complex GelMA-based hydrogels.

Light Meter

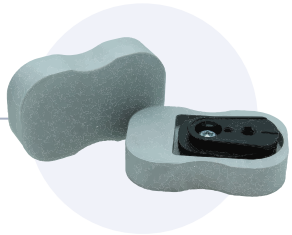
Volumetric's Lumen X – Light Meter contains a probe specifically designed for the Lumen X's biocompatible 405 nm wavelength. It can be used to precisely measure light intensity and set the ideal power output before printing with the Lumen X. Although it is not necessary to measure the light intensity between every print, we recommend checking power output at the start of each print session.

Lumen X Vats

Volumetric's Lumen X – PDMS Dishes are lined with a proprietary silicone formula to enable the gentle separation of cured PhotoInk layers while printing with the Lumen X. Sterile packaging is available for bioprinting with mammalian or bacterial cells, while nonsterile vats can be rinsed with 70% IPA or ethanol and used for multiple prints. When printing larger objects, a fresh vat is highly recommended to optimize printability.

Lumen X Build Platform

Volumetric's Lumen X – Build Platform holds prints for the duration of the build. Its small size minimizes the amount of PhotoInk required per build, conserving material and cells alike. Each one is precisely machined, so that platforms can be swapped quickly and easily with little downtime between prints. Offered in glass for better adhesion to hydrogel constructs and in metal for better adhesion to resin-based constructs.



Technical Specifications

Dimensions (L x W x H)	43 x 24 X 41 cm (17 x 9.5 x 16.5 in)
Power supply	AC 100-120V, 50/60Hz, 10A or AC 200-240V, 50/60Hz, 5A
Weight	9 kg (20 lbs.)
Projected image	1280 x 800 pixels
Pixel resolution (XY)	50 µm
Z-precision (motor-driven)	5 µm
Max build volume	65 x 40 x 50 mm
Projected light wavelength	405 nm
Intensity range	10–30 mW/cm²
Deviation from mean	<1%
Electrical power input	100–265 VAC, 50–60 Hz, 100 W
Compatible file type	STL (stereolithography file)

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