

Grayscale lithography system

2.5D printing for rapid prototyping, patterning and mastering

Quantum X litho stands out with its precise, versatile and aligned grayscale lithography, which is ideal for high-throughput 2.5D rapid prototyping, patterning, master template fabrication and wafer-scale production. Powered by Two-Photon Grayscale Lithography 2GL®, the system

enables the fabrication of high-precision freeform micro-optics, microlens arrays, Fresnel lenses, and hybrid optical components combining diffractive and refractive features. Quantum X litho is also suited for patterning of all kinds of 2.5D topographies, such as complex microfluidic and bioinspired designs.



FEATURES

included

- ▶ Ultra-fast 2.5D printing enabled by Two-Photon Grayscale Lithography (2GL®)
- ▶ Flexibility with a wide range of printing materials and substrates

optional

- ▶ Ultra-fast 3D printing by 2GL®
- ▶ Automatic alignment to fiducials on wafers enabled by confocal detection module
- ▶ Automatic printing aligned to fiber cores enabled by the Fiber Printing Set
- ▶ High-resolution 3D printing based on Two-Photon Polymerization (2PP)
- ▶ Automatic photoresin dispenser for wafer-scale production

FOCUS APPLICATIONS



High-res 3D printing



High-res 3D biofabrication



Optics manufacturing



2.5D surface patterning

SOFTWARE

included

- ▶ GrayScribeX for 2.5D printing with Two-Photon Grayscale Lithography (2GL®)
- ▶ nanoConnectX for remote control of the printer

optional

- ▶ nanoPrintX for 3D printing by 2GL®
- ▶ DeScribeX for 3D printing with Two-Photon Polymerization (2PP)

Benchmark scores *

Surface roughness R_a	down to ≤ 5 nm
Feature size control ¹	down to 100 nm
Shape accuracy S_a	down to ≤ 200 nm
Stitching-free part diameter	up to 1,750 μ m
Maximum scan speed	6.25 m/s divided by lens magnification
Microlens array print throughput	20 mm ² /h for 100 μ m height

*Peak values, only achieved under specific conditions such as printing parameters, print heads, photoresins and designs.

General system properties

Printing setup	Upright system enabling high-resolution 3D printing with flexible DiLL and non-DiLL setups to suit various material and application requirements.
Laser source	Femtosecond laser (780 nm), avg. power 250 mW
Laser safety	Class 1 (IEC 60825-1)
Voxel modulation rate	1,000 kHz
Positioning volume	150 x 150 x 20 mm ³ , stage repeatability ≤ 150 nm
Substrates	Wafers (from 1" to 8" / 25.4 mm to 200 mm) Glass, silicon, other transparent and opaque materials
Photoresins	Nanoscribe polymer photoresins Open to third-party or custom materials
Noise emission	36 dB LpA
System dimensions (L x W x H)	161 x 100 x 179 cm ³
Weight	Up to 1,350 kg

Print head specific properties

	SF	MF	LF
Magnification / NA	63x / 1.4	25x / 0.8	10x / 0.3
Print mode	Dip-in ²	Dip-in ²	Dip-in ²
Working distance	360 μ m	380 μ m	2,600 μ m
Field of view diameter (max.)	400 μ m	800 μ m	2,300 μ m
Calibrated print field diameter	270 μ m	700 μ m	1,750 μ m
Scan speed (max.)	100 mm/s	250 mm/s	625 mm/s

Process specific properties: 2.5D surface patterning (2GL)

	SF	MF	LF
Print height (typical)	1 – 10 μ m	10 – 150 μ m	50 – 700 μ m
Shape accuracy (P – V) (typical)		1 % relative deviation	
Height tolerance		1 %; min. ± 400 nm	

SF: Small Features, MF: Medium Features, LF: Large Features

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If you have any further questions, please contact our sales team at sales@nanoscribe.com.



Software

included / optional

nanoPrintX basic version	Process parameter presets for 2PP-based 3D printing included Compatible with alignment routines Input format: STL, OBJ, lens formula
nanoPrintX 3D printing by 2GL version	<i>Additional features compared to the nanoPrintX basic version:</i> Process parameter presets for 3D printing by 2GL [®] included Throughput increase of up to 60x times at high quality Quality increase at same throughput
GrayScribeX	Software for 2.5D structures with 2GL [®] 2GL stitching for seamless prints Input format: STL, grayscale images
DeScribeX	3D printing preparation software for classic 2PP Process parameter presets for 2PP-based 3D printing included Parameter sweeps, STL scaling, print preview and simulation Input format: STL, plain text coordinates
Printer touchscreen	User interface with print job management, live-view camera and two navigation cameras, and a 3D model view "Tap to align" function for printing aligned to any position on a substrate
nanoConnectX	Remote control of the printer with complete replication of the touchscreen functionality

Application Sets

included / optional

Fiber Printing Set

Key process	Automated printing aligned to fiber cores
Alignment system	Fiber core illumination (requires FC connector, others on request)
Detection accuracy in x/y direction ³	≤ 500 nm
Compatible fiber array types	V-groove fiber arrays with 2.5 – 8.5 x 2.0 x 10.0 mm ³ block size, 127 – 250 µm or custom pitch 4 x 8 fibers Others on request
Compatible single fiber types	Single cleaved fibers (SM/MM/PM), fibers in FC or SMA connectors
Lensed fiber mode field diameter (typical)	3 - 30 µm
Height of optical elements (typical)	≤ 250 µm

Technology Features

included / optional

Automatic dispenser	Fully automatic application of Nanoscribe photoresins
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Alignment processes

included / optional

Alignment to	Fiber cores Fiducials (e.g. markers, waveguides)
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Site requirements

Conditions	21 °C (± 1 °C); 35-65 % relative humidity
Environment	Yellow light (> 520 nm) recommended, low dust, low vibration
Power supply	100 - 240 V, 50/60 Hz, standard electrical connection
Power consumption	400 W (typical)
Compressed air supply ⁴	6 - 8 bar

Specifications are subject to change without notice and may vary depending on the photoresin, print head and structure geometry.

¹ in x/y direction

² It is possible to avoid contact with the photoresin

³ Depends on print set

⁴ Compressor available on request



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Nanoscribe GmbH & Co. KG
Hermann-von-Helmholtz-Platz 6
76344 Eggenstein-Leopoldshafen
Germany

Phone +49 721 981 980 200
Fax +49 721 981 980 130

info@nanoscribe.com
nanoscribe.com

Nanoscribe China Co., Ltd.
Shanghai, China
+86 135 1215 1378

Nanoscribe
Woburn, MA, USA
+1 857 919 8069

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