PicoMaster 150-H

Holographics – UV laser based origination system

Excellent performance in creating 3D micro structures

- Very high resolution: over 2000 lines per mm

- User friendly dedicated holographic design software with many pre-installed libraries, very easy to combine effects

- Open software interface enables users to add proprietary algorithms to the libraries

- Real time laser controlled auto focus: superb surface tracking of substrates with large height differences
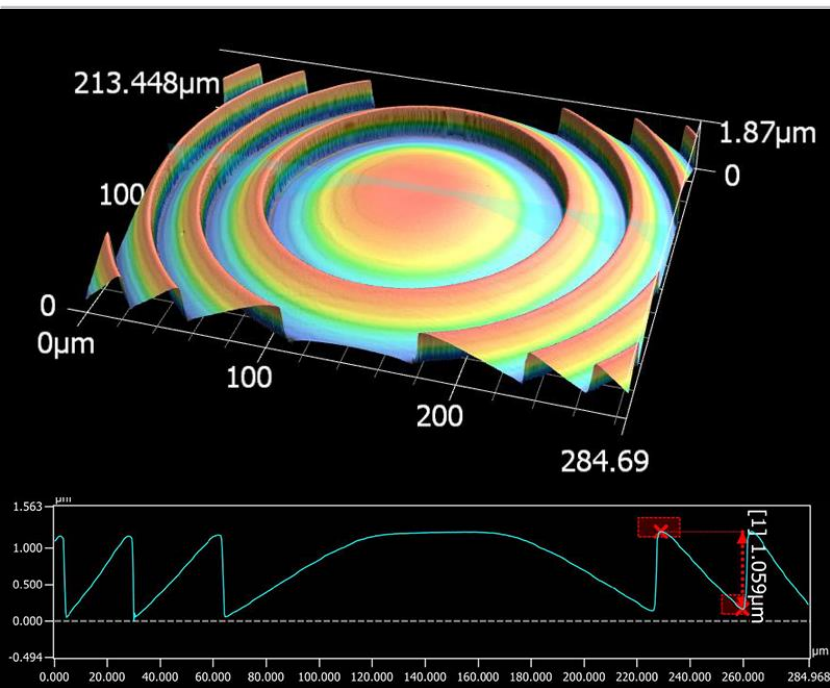
www.4picolitho.nl

Unique opportunity for security devices
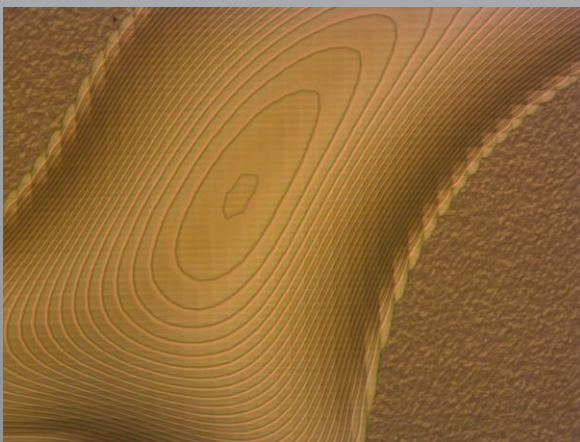*The high resolution capabilities of the PicoMaster 150-H allow for extreme viewing angles*

Contents

Sample of fresnel lens

Sample of relief structure

Introducing the ideal tool for the production of Optical Variable Devices

■ **Meet the smallest high quality laser beam spot available in the market**

The PicoMaster is a versatile UV laser writer with ultra-high precision components, specifically designed to give the user the highest degree of freedom to create micro structures in photo sensitive layers. With an output of over 2000 lines per mm the user-friendly holographic systems by 4PICO Litho provide excellent performance. Our distinctive holographic design software PicoHLD supports many pre-installed holographic effects and calculates gratings & structures itself. The ease with which effects can be combined is astounding. Add your own algorithms and structures to customize your library and create perfection.

The PicoMaster 150-H base system is a fully operating system. It includes a 405 nm optical module capable of writing lines as small as 300 nm in photo resist layers. This user friendly tool supports up to 4095 levels of grayscale or pure binary mode and allows for 3D optical structures and surface structures. Real time laser controlled auto focus and laser intensity control ensure high quality imaging during the entire exposure process.

The control electronics are all mounted within the frame including the vacuum pump and control PC. This Microsoft Windows based desktop PC and all required software is included in the package.
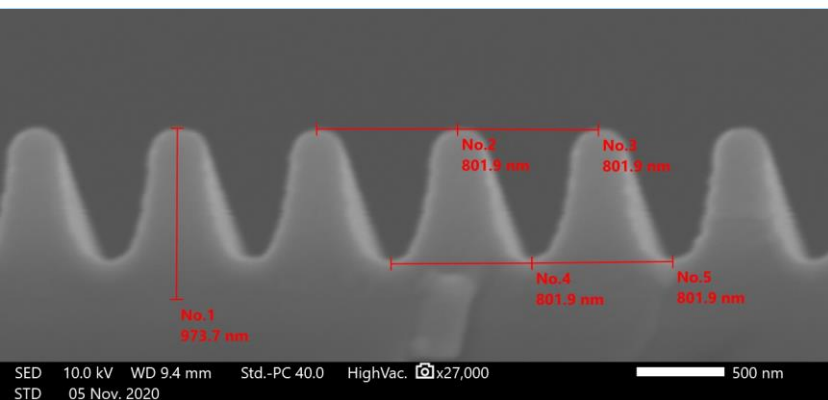
Ultra high precision

Excellent performance in creating 3D micro structures

Benefits

■ **Dedicated holographic design software: PicoHLD**

- User friendly Hologram & Lens Designer (HLD) software with many pre-installed libraries.

- Very easy to combine effects.

- Open software interface enables users to add proprietary algorithms to the libraries.

■ **Capabilities**

- Very high resolution: over 2000 lines per mm.

- Critical dimension of 300 nm.

- Up to 4095 levels of grayscale or pure binary mode. Grayscale writing allows for blazed gratings and other types of gratings.

- Software controllable selection of write modes.

- 4PICO Litho's proprietary light weight objective lens makes real time laser based auto focus possible. This enables superb surface tracking of substrates with large height differences.

■ **Operation**

- A modern Microsoft Windows based user interface allows for user-friendly operation.

- Highly automated processing, one button operation.

-Short preparation time required using PicoHLD and PicoMaster Machine Controller applications. On the fly processing of jobs, minimum pre-processing required.

- Up-to-date online manuals and remote internet support.

■ **Installation and maintenance**

- The PicoMaster 150-H is a stand alone system which allows for quick and easy installation.

- Compact optical module: use a spare optical module for revolutionary machine downtime reduction.

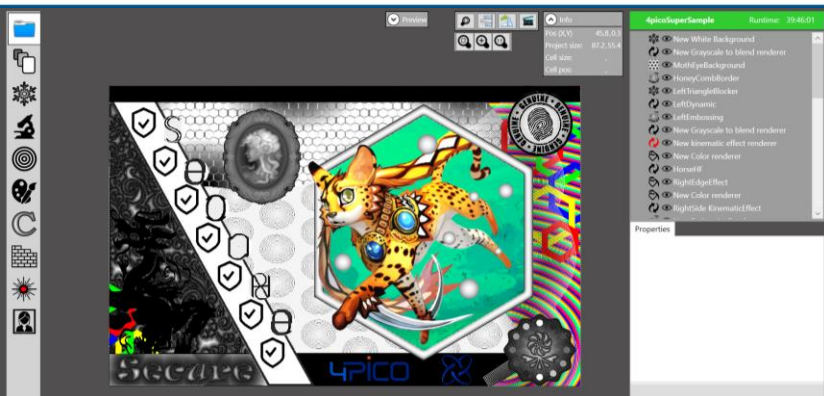-Minimal maintenance costs, no regular maintenance required.

Screenshot of the visual PicoHDL software.

User friendly

Minimum preparation time required using Pico Hologram & Lens Designer (PicoHLD) and PicoMaster Machine Controller

Software

■ **PicoMaster Machine Controller and Pico Hologram & Lens Designer (PicoHLD)**

The Picomaster comes with two Windows based applications: PicoMaster Machine Controller and PicoHLD. PicoHLD allows the user to select features and combine images while PicoMaster Machine Controller processes these jobs and control the machine. Jobs are processed on the fly, reducing preparation time to the minimum. PicoMaster Machine Controller allows the operator to queue jobs, monitor progress and gives a high level of manual control features.

Features of PicoMaster Machine Controller:

- On the fly processing of jobs.
- Job queuing.
- Freely definable process and substrate recipes.
- Extended history database.
- Remote support.
- Optional: User access control through login credentials or smart card.

Extreme bright images.

White relief effect.

PicoHLD: dedicated holographic design software

4PICO Litho presents Pico Hologram & Lens Designer (PicoHLD): the most user-friendly software available in the market. Use pre-installed libraries, add proprietary algorithms or parameters and combine effects very easily. PicoHLD calculates the correct gratings & structures itself!

■ Build in effects

The project manager is a dedicated tool where the user can combine images from several sources and give each image a different effect. Each image within the total design can have transparent parts, can be scaled, rotated and ordered in front of back of other images.

The effects that can be assigned to each image can be a simple rainbow effect, a stereogram effect, true color effect, flip flop effect, DOE's, relief effects and many more.

The designer also allows the user to add some build in effects for which no source image is required, such as Fresnel lenses, backgrounds, etc.

■ User Algorithms

The PicoMaster software set supports user libraries. These libraries can be written in C# or VB.net. With these user libraries the user can create his own algorithm to calculate the laser intensity at each grid point. This allows the user to generate their own proprietary unique effect.

| Supported formats	
Standard file formats	8 and 16 bit grayscale bitmaps and TIFF files, color bitmaps CDR files and text files
Parameterization	Basic shapes can be configured without source files. Such as fresnel lenses, micro lenses, micro text etc..

Effect samples

■ **Numerous high quality effects to distinguish and secure your product**

User-friendly creation of designs with effects like rainbow, hidden images, DOE's, microtext, stereograms, platinum look and many more:

- White background effect, uniform white diffusor

- Directional white effect

- Multi level Diffractive optical Elements (DOE), Letter Lens effect

- Fresnel Lens & (broken white) fresnel relief effect

- Uniform gratings

- High frequency grating

- True color 3D effect

- Diffraction grid

- Curved gratings
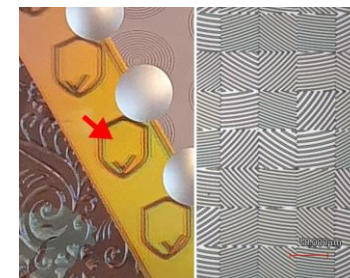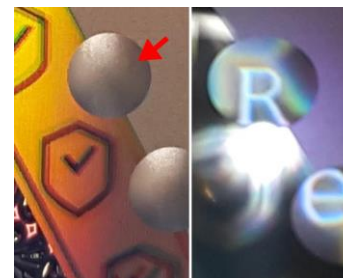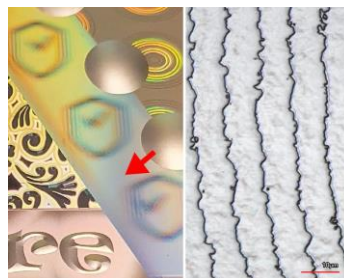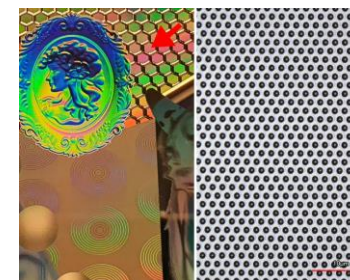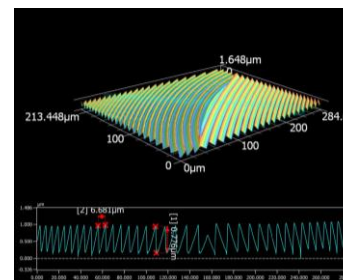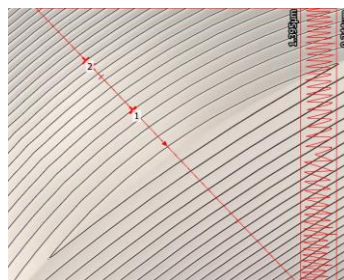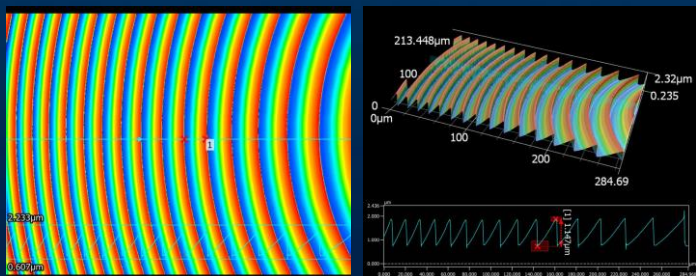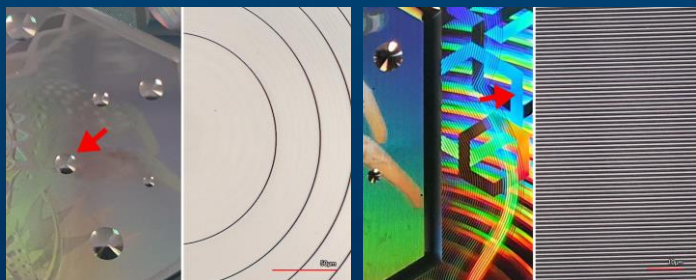
Sample of structure types
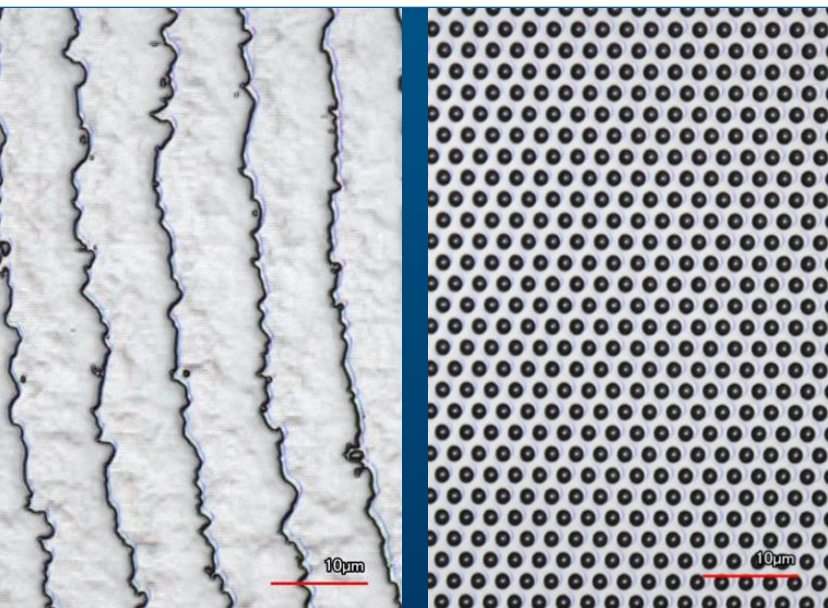
Blazed gratings with random noise

Evenly spaced holes

Single direction white based on random

Curved gratings.

10.000µm

Classic dot matrix style pixels with intensity control

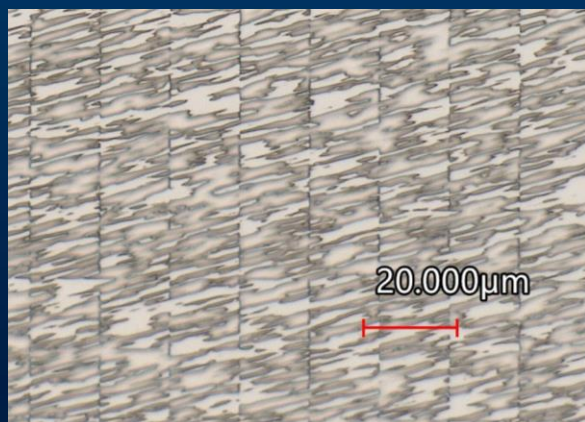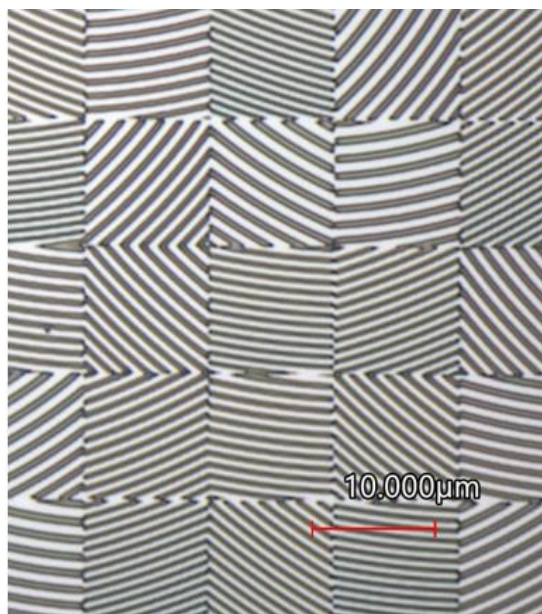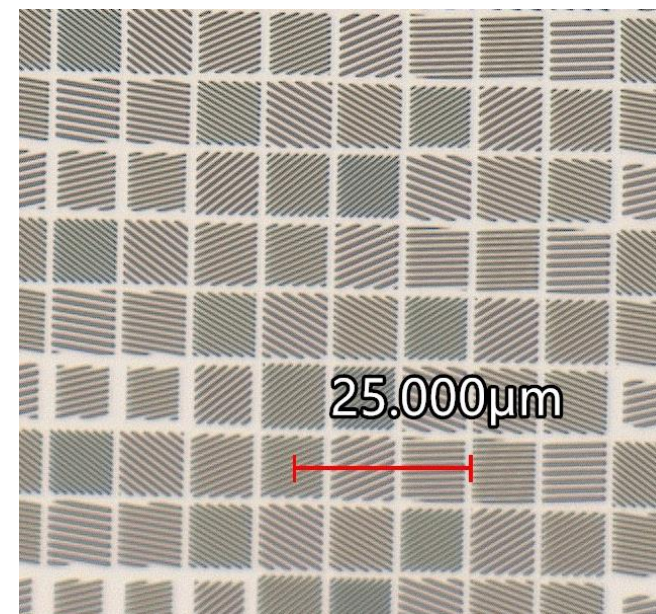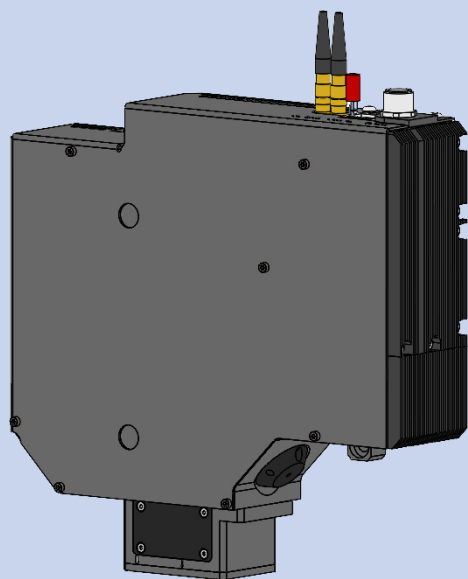25.000µm

Stitching free large areas of single frequency gratings

10µm

Optics

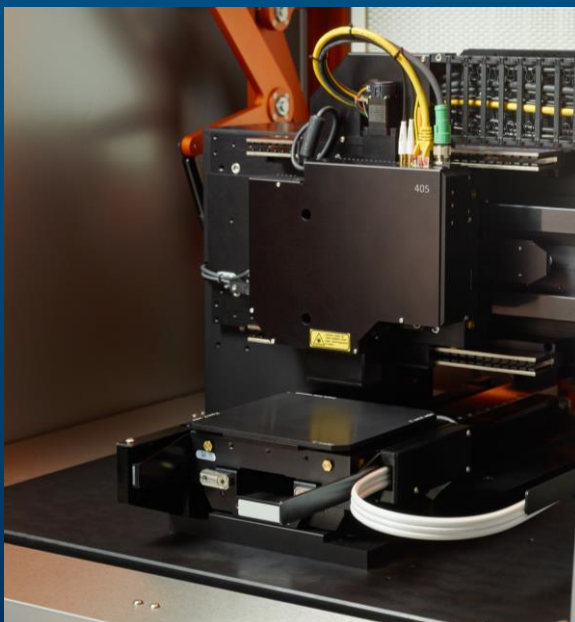■ **Compact optical module for excellent stability & revolutionary short machine downtime**

The full optical path is contained in a small easily changeable module (optical module). By keeping the optical path as short as possible, the pointing stability is greatly increased compared to traditional optical setups. The optical module contains a long lifetime 405 nm GaN laser diode and beam shaping optics for the best spot shape. Together with 4PICO Litho's proprietary high NA objective lens this results in the smallest high quality laser beam spot available on the market.

Features:
- Smallest high quality laser beam spot available in the market.
- The integrated 650 nm red laser controlled autofocus system automatically corrects for height variations.
- Intergrated Dose control.
- For less demanding tasks a larger spot size can be selected by using a fully automated NA switch. This switch allows the system to use a larger spot for increased speed.

Optical properties	
Laser source	405 nm, GaN laser diode.
Lifetime	>10.000 hours
Write modes	0.3 µm, 0.6 µm and 0.9 µm FWHM.
NA	0.85 @ 0.3µm
Intensity	Max. 3 mW in the spot. Software controllable.
Grayscale control	4095 levels
Autofocus	800 Hz bandwidth, 650 nm red laser controlled -0.3…x…+0.3 mm height variation with auto height tracking. Fast voice coil actuator for accurate real-time Z correction.
Focus offset	Adjustable by software control.

Unique

*Smallest high quality focused laser beam spot available in the market*

Mechanics

The PicoMaster 150-H is equipped with high precision axes for X and Y motion. Both the scan axis (Y) and step axis (X) incorporate high precision dove tail air bearings which are driven by linear motors with nanometer resolution encoders. This system allows for extreme low mechanical errors and fast scan movements. The optional motorized controlled Z-axis has a 14 mm stroke to support various substrate thicknesses.

Substrates are clamped down by using a vacuum chuck. Vacuum chucks are easily exchangeable to support different substrate sizes.

Mechanical properties	
Stroke Scan and Step	Max. 180 mm
Repeatability	< 20 nm RMS
Resolution	2 nm
Scan speed	Max 400 mm/s
Straightness axis	< 1 µm over 230 mm
Substrate thickness	0 - 14 mm manual adjustment. Optional a motorized Z-axis can be installed.
Substrate thickness variation	Max +/- 0.15mm
Substrate size	Min. 5 x 5 mm, max. 170 x 170 mm.
Exposable area	Max. 150 x 150 mm (speed dependent).

Benefit

Maintenance free axes
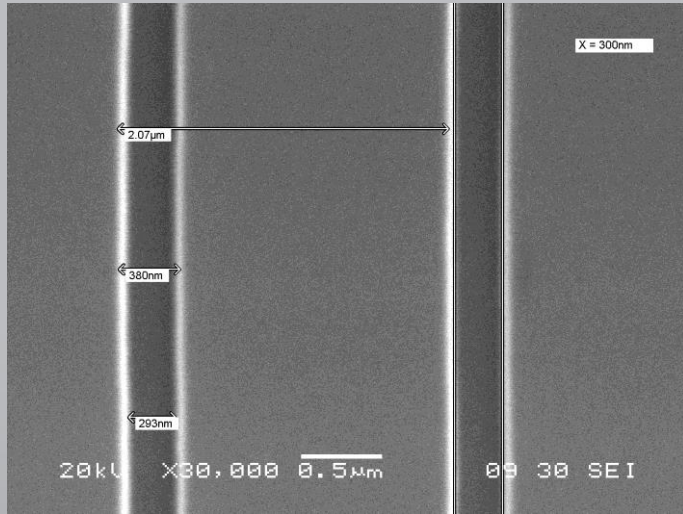
300nm lines

Performance

Performance specifications	
CD[1]	Min. 300 nm
Lines per mm	>2000
Address grid	Selectable. Standard: 40 nm in scan direction and 100 nm in step direction.
Data rate	10Mhz

[1]Critical Dimension of the PicoMaster strongly depends on process parameters, such as resist types and layer thickness.

Writing speeds	Resolution (µm)	Normal Quality (mm²/min)	Reduced Quality² (mm²/min)
High resolution	0.3	1.7	2.6
Mid resolution	0.6	3.4	5.3
Low resolution	0.9	5.2	7.7
Extra low resolution	5	26	43

Benefit

PicoMaster 150-H:
a stand alone system
that allow for quick
and easy installation

Additional options

■ Extra optical module

The compact optical module is mounted to the step axis by just 3 bolts and a few electrical connections. Within 5 minutes the entire optical module can be swapped for a different module. When uptime is of critical importance, a spare optical module can be added. There is no need for optical alignment after an exchange. This unique feature introduces a revolutionary reduction of machine downtime!

■ Air-conditioning unit

For best results the temperature inside the PicoMaster 150-H should be maintained at constant environment conditions with a temperature range of +/- 0.5 ˚C and a humidity range of 45 - 70%. It is strongly recommended to use a dedicated air conditioning unit to supply conditioned air to the PicoMaster 150-H.

■ Motorized Z stage

Some applications require thick substrates. The motorized Z stage will allow the system to detect the surface of a wafer fully automatically. Operator interference for height adjustment based on the used substrate is not required.

Mechanical properties motorized Z stage	
Stroke	Max. 14 mm
Resolution	1 µm
Substrate thickness	0 - 14 mm

Front view　　　　　　　　　　*Side view*
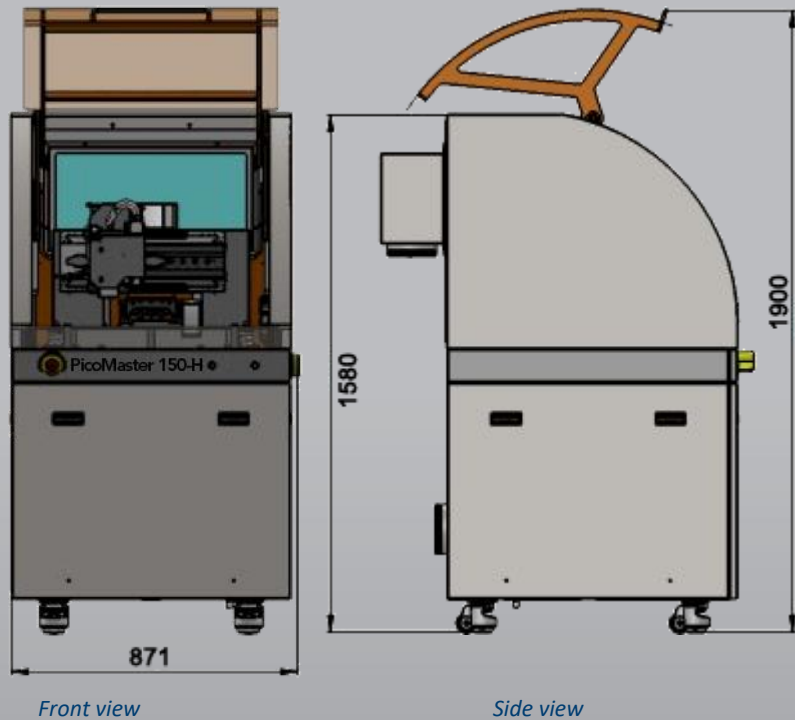
Installation requirements

Dimensions[1]	
Width	871 mm.
Height	To ceiling: 1900 mm
Depth	1160 mm
Weight	700 kg
Electrical connection	230V AC, max. 1 kW
Compressed air	5 - 7 Bar, Air quality according ISO8573-1:2010 class 3 or better.
Ethernet	For server connections and remote access.
Conditioned air piping[2]	Ø 150 mm in and out
Recommended environment	Clean room ISO class 5 or better.
	Room Temperature 21 ˚C +/- 1 ˚C
	Room Humidity 45 - 70% RH

[1] *Specifications may change without notification.*

[2] *It is strongly recommended to use an air conditioner with recirculation option to maintain optimal process conditions within the PicoMaster. A conditioner can be supplied as option.*

About 4PICO Litho

4PICO Litho is specialized in lithography equipment since 2004. The PicoMaster systems are a derivate of 4PICO's CD/DVD mastering system and built on 15 years of experience. The efficient multidisciplinary team of 4PICO Litho is based in Brainport Region and has access to high tech suppliers.
All developments are done in-house.

Innovation

Brainport Region:

A perfect ecosystem

for innovation

State-of-the-art

4PICO Litho's

demo samples are state-of-the-art

Service and dealer information

■ **Samples**

Seeing is believing… 4PICO Litho's demo samples are state-of-the-art. Send in your requirements for a sample. At all times at least 1 demo system is operational.

4PICO Litho has in-house metrology tools such as 3D Microscope, AFM and SEM for analyzing the samples.

■ **Service**

Local service engineers, remote support and minimum maintenance will guarantee a smooth and worry-free operation.

■ **Dealer**

Questions regarding the PicoMaster 150-H and your application: please contact your local contact.
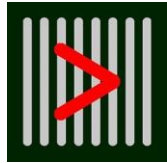
Disclaimer: images are for illustration purposes only.

Your dealer

![4Pico Litho logo]

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