



**EXTRA FAST**

# PicoMaster<sup>XF</sup> 500-H

Holographics – UV laser based origination system

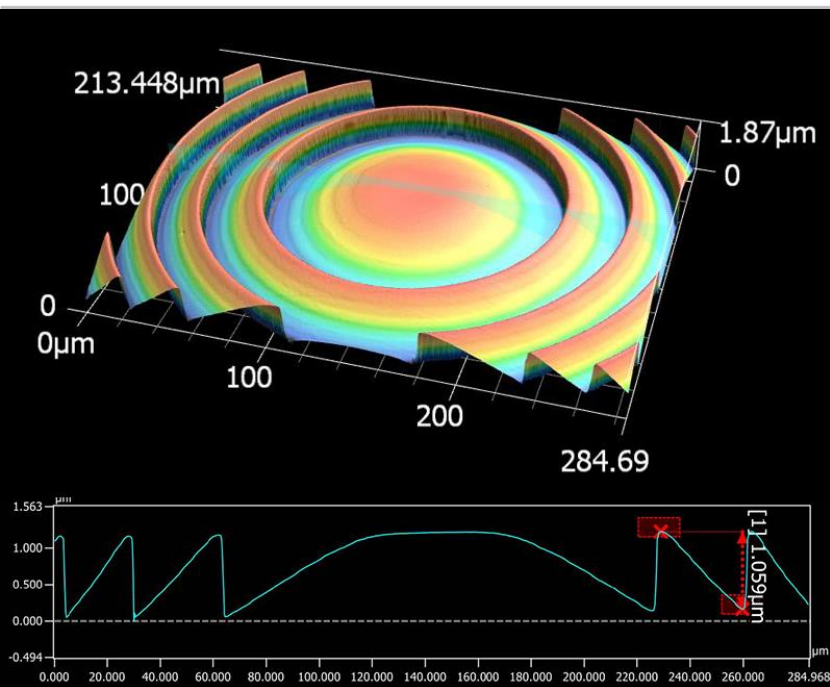
**Ultimate speed** - create excellent 3D micro structures

- 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

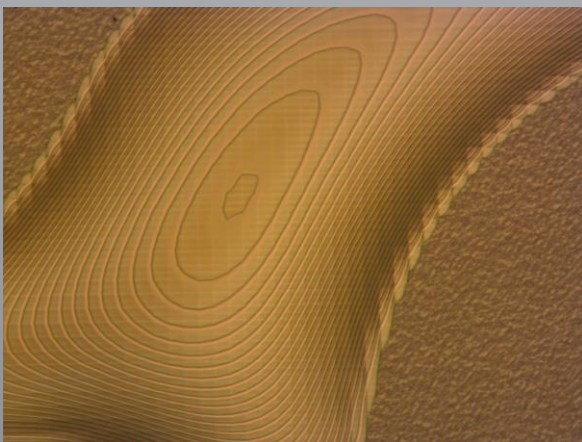
***Unique opportunity  
for packaging and  
label manufacturers***  
*The high resolution  
capabilities in  
combination with the  
high speed of the  
PicoMaster<sup>XF</sup> 500-H  
allow manufacturers  
to create innovative  
packaging solutions*

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*Sample of fresnel lens*



*Sample of relief structure*

## Introducing the ideal tool for the production of Fresnel lenses and other blazed grating images

### Large area origination equipment supporting ultimate speed

The PicoMaster <sup>XF</sup> 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 1200 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 <sup>XF</sup> 500-H base system is a fully operating system. It includes a 405 nm optical module capable of writing lines as small as 500 nm in photo resist layers. This user friendly tool supports up to 256 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 1200 lines per mm.
- Critical dimension of 500 nm.
- Up to 256 levels of grayscale or pure binary mode. Grayscale writing allows for blazed gratings and other types of gratings.
- EXTRA FAST: expected maximum recording time 500 x 500 mm: 28 hours.
- Software controllable selection of write modes.

### ■ 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 <sup>XF</sup> 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 <sup>XF</sup> 500-H comes with a small server rack to support the powerful multicore computer and closed circuit water cooling.
- Optical Module: use a spare optical module for revolutionary machine downtime reduction.
- Minimal maintenance costs, no regular maintenance required.



# PicoMaster Machine Controller Software

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

The Picomaster <sup>XF</sup> 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.



Screenshot of the visual PicoHDL software

**User friendly**

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

## 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

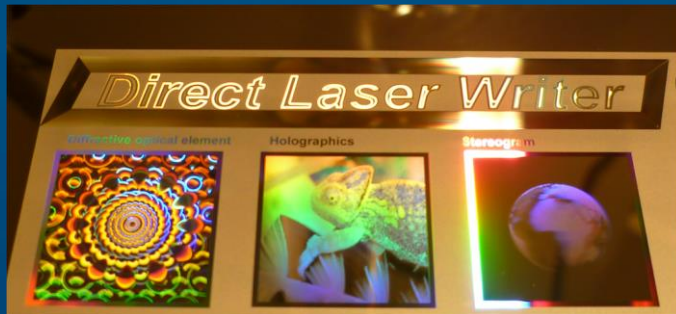
The project manager is a dedicated tool with which the user can combine images from several sources and give each image a different effect. Each image within the total design can have transparent parts, can be scaled, rotated and ordered in front / back of other images.

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 software 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 PicoHLD software 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.



*Extreme bright images*



*White relief effect*

### Supported formats

#### Standard file formats

8 and 16 bit grayscale bitmaps and TIFF files, color bitmaps  
CDR files and text files

#### Parameterization

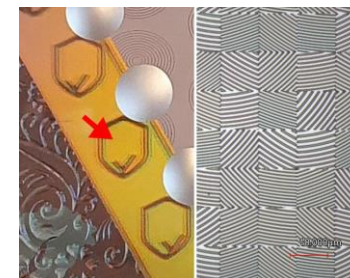
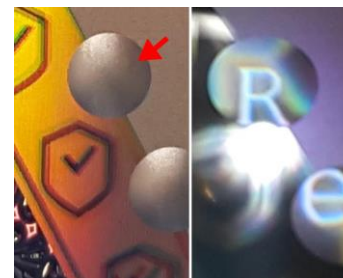
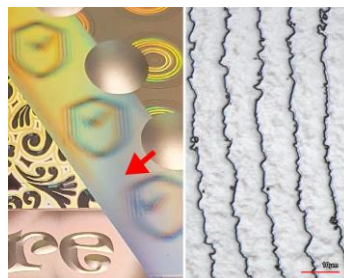
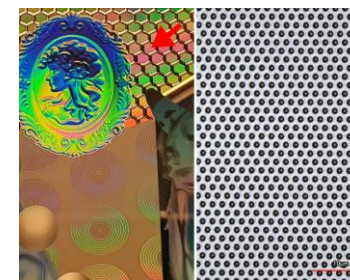
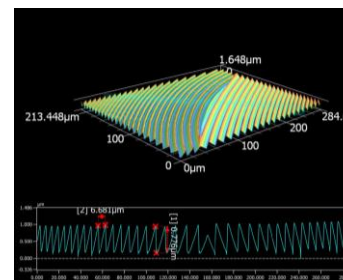
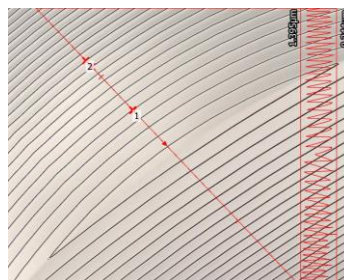
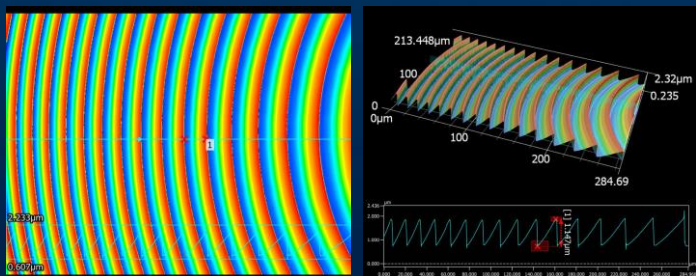
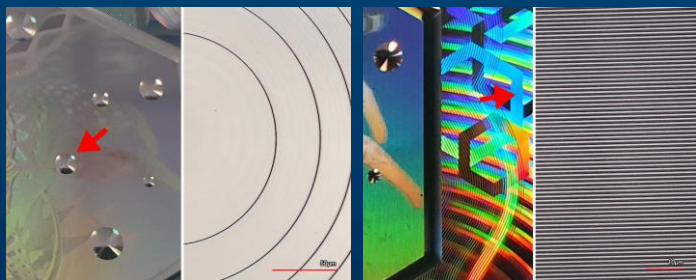
Basic shapes can be configured without source files  
such as fresnel lenses, micro lenses, micro text etc..

## Effect samples

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

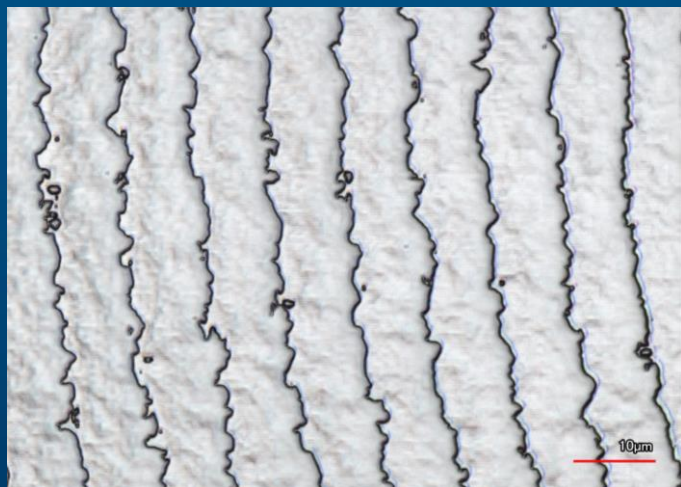
User-friendly creation of designs with effects like rainbow, hidden images, DOE's, microtext, stereograms, platinum look and many more:

- White background effect, uniform white diffuser
- Directional white effect
- Multi level Diffractive Optical Elements (DOE), Letter Lens effect
- Fresnel Lens & (broken white) Fresnel relief effect
- Uniform gratings
- True color 3D effect
- Diffraction grid
- Curved gratings

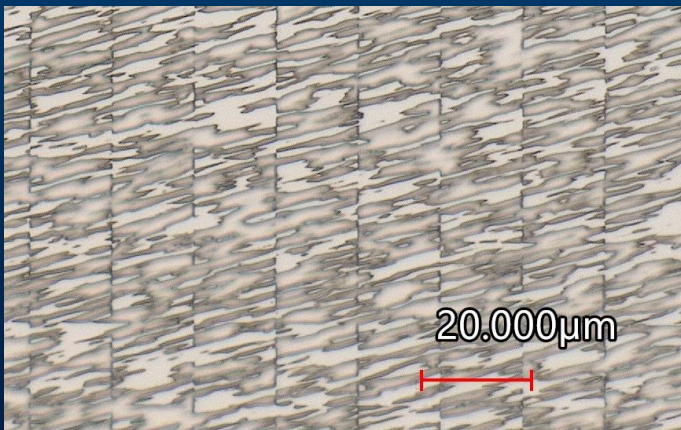




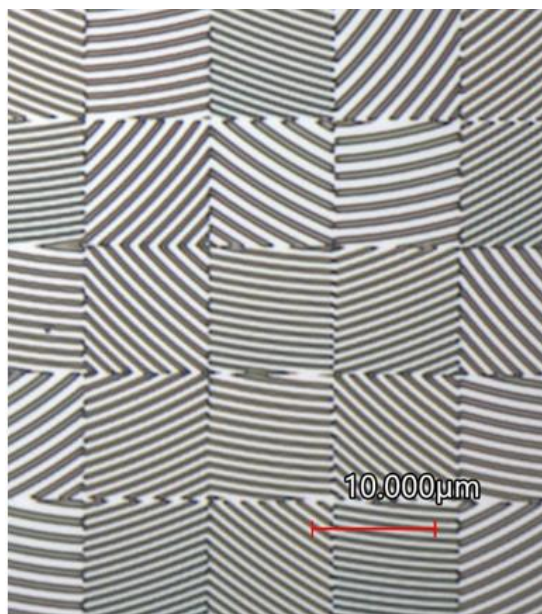
## Sample of structure types



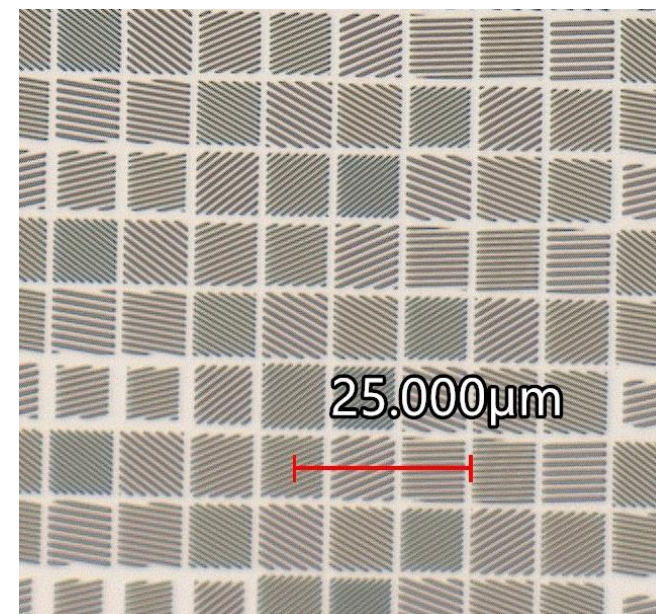
*Blazed gratings with random noise*



*Single direction white based on random*



*Curved gratings*



*Classic dot matrix style pixels with intensity control*



*Large areas of single frequency gratings*



## Optics

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

The full optical path is contained in an exchangeable 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 high power long lifetime 405 nm GaN laser diode and beam shaping optics for the best possible exposure.

#### Features:

- The integrated 650 nm red laser controlled autofocus system automatically corrects for height variations.
- Automatic Dose control.
- Closed loop water cooling to ensure maximum intensity stability.

#### Optical properties

|                               |   |
|-------------------------------|---|
| <b>Laser source</b>           | 300mW, 405 nm, GaN laser diode  |
| <b>Lifetime</b>               | >10.000 hours   |
| <b>Min optical resolution</b> | 0.5 $\mu$ m FWHM  |
| <b>NA</b>                     | 0.5   |
| <b>Grayscale control</b>      | 256 levels  |
| <b>Autofocus</b>              | 800 Hz bandwidth, 650 nm red laser controlled<br>+/- 0.15 mm height variation with auto height tracking.<br>Fast voice coil actuator for accurate real-time Z correction. |
| <b>Focus offset</b>           | Adjustable by software control.   |

## Unique

Multibeam technology  
enabling to write in  
parallel

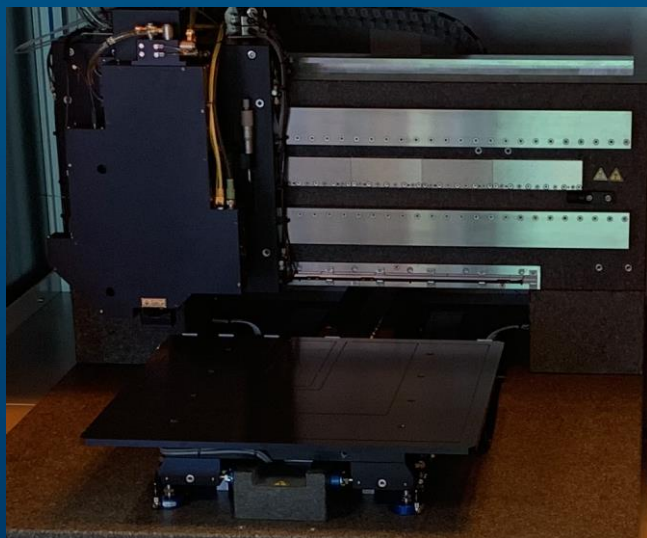
## Mechanics

The PicoMaster <sup>XF</sup> 500-H is equipped with high precision axes for X and Y motion. Both the scan axis (Y) and step axis (X) incorporate high precision 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 which are clamped down by using a vacuum chuck.

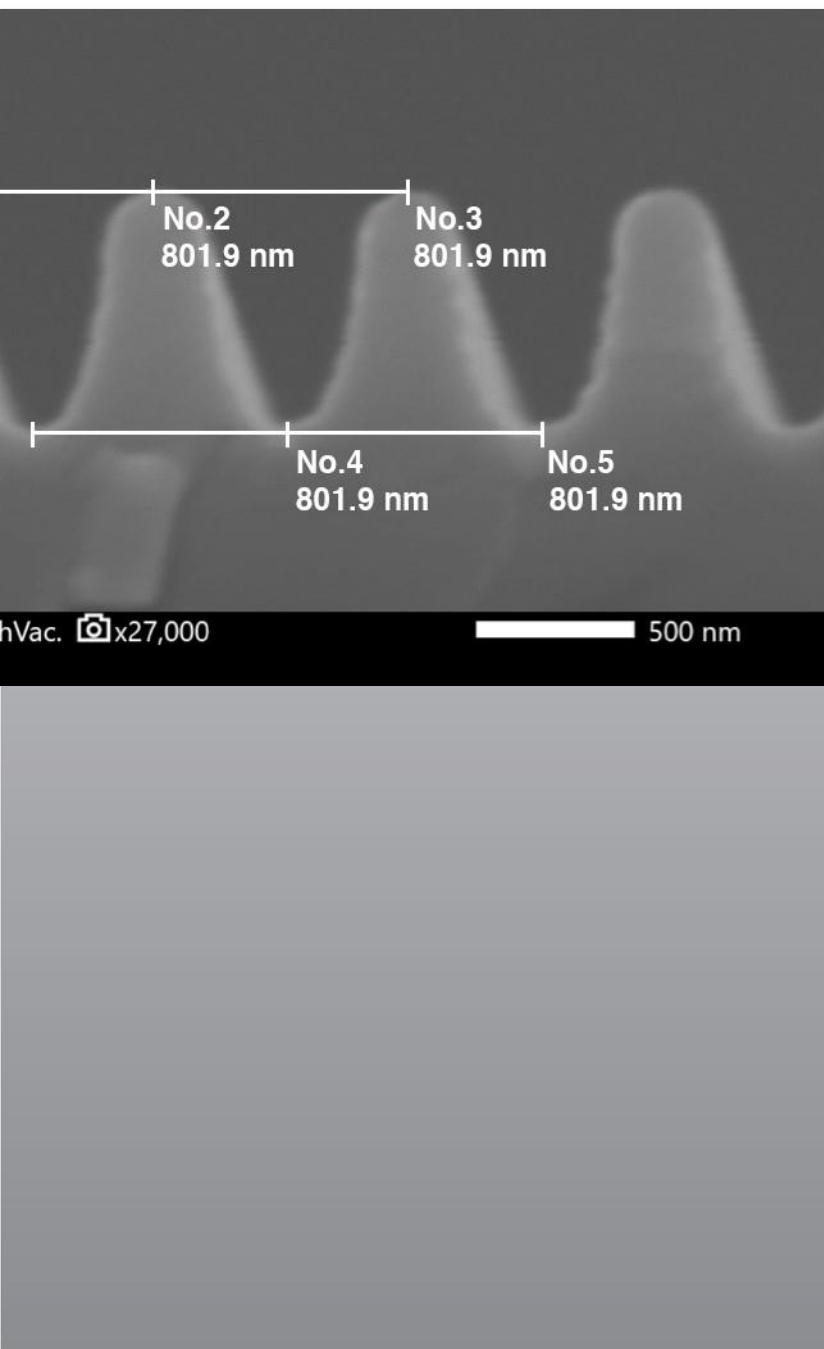
The fully enclosed frame has an integrated Filter Fan Unit to ensure proper environmental conditions within the PicoMaster <sup>XF</sup> 500-H.

### Mechanical properties

|                                      |   |
|--------------------------------------|---|
| <b>Stroke Scan and Step</b>          | Max. 600 mm   |
| <b>Repeatability</b>                 | < 20 nm RMS   |
| <b>Resolution</b>                    | 2 nm  |
| <b>Scan speed</b>                    | Max 50 mm/s   |
| <b>Substrate thickness</b>           | 0 - 14 mm manual adjustment. Optional: a motorized Z-axis can be installed. |
| <b>Substrate thickness variation</b> | Max +/- 0.15 mm   |
| <b>Substrate size</b>                | Min. 125 x 125 mm, max. 550 x 550 mm  |
| <b>Exposable area</b>                | Max. 525 x 525 mm   |



**Benefit**  
*Maintenance free axes*



## Performance

### Performance specifications

|                       |             |
|-----------------------|-------------|
| <b>CD<sup>1</sup></b> | Min. 500 nm |
| <b>Lines per mm</b>   | >1000       |
| <b>Data rate</b>      | 6Gb/sec     |

<sup>1</sup>Critical Dimension of the PicoMaster<sup>XF</sup> depends on process parameters, such as resist types and layer thickness.

| Writing mode           | Resolution (μm) | mm <sup>2</sup> /min |
|------------------------|-----------------|----------------------|
| <b>High resolution</b> | 0.5             | 150                  |



## Benefit

*PicoMaster<sup>XF</sup> 500-H:  
a stand alone system  
that allow for quick  
and easy installation*

## Additional options

### ■ Air-conditioning unit

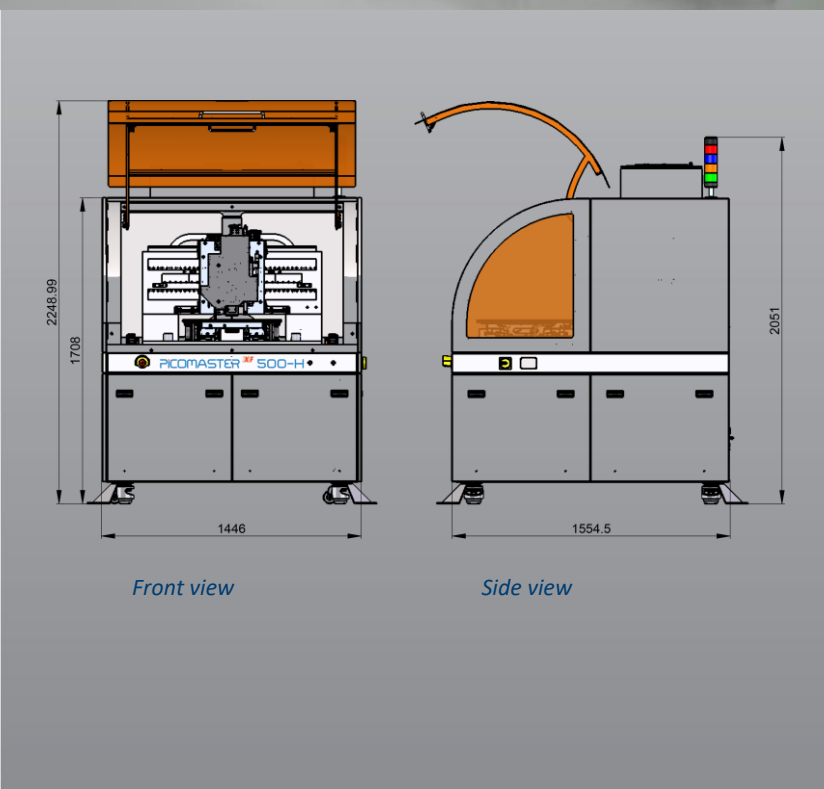
For best results the temperature inside the PicoMaster<sup>XF</sup> 500-H should be maintained at constant environmental conditions with a temperature range of  $\pm 0.5$  °C and a humidity range of 45 - 70%. It is recommended to use a dedicated air conditioning unit to supply conditioned air to the PicoMaster<sup>XF</sup> 500-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 $\mu$ m  |
| Substrate thickness | 0 - 14 mm  |



## Installation requirements

| Dimensions <sup>1</sup>                   |  |
|---|--|
| <b>W x D x H</b>                          | 1500 x 1600 x 2250 mm  |
| <b>Additional server rack</b>             | 600 x 900 x 730 mm   |
| <b>Weight</b>                             | 2000 kg  |
| <b>Electrical connection</b>              | 230V AC, max. 1.5 kW   |
| <b>Compressed air</b>                     | 5 - 7 Bar, Air quality according ISO8573-1:2010 class 3 or better. |
| <b>Ethernet</b>                           | For server connections and remote access.                          |
| <b>Conditioned air piping<sup>2</sup></b> | Ø 150 mm in and out  |
| <b>Recommended environment</b>            | Clean room ISO class 5 or better.                                  |
|   | Room Temperature 21 °C +/- 1 °C                                    |
|   | Room Humidity 45 - 70% RH  |

<sup>1</sup> Specifications may change without notification.

<sup>2</sup> It is recommended to use an air conditioner with recirculation option to maintain optimal process conditions within the PicoMaster<sup>XF</sup>. An air conditioner can be supplied as option.

## About 4PICO Litho

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

### *Innovation*

*Braintree Region:  
A perfect ecosystem  
for innovation*





**Ultramodern**  
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 <sup>XF</sup> 500-H and your application: please contact your local contact.

Disclaimer: images are for illustration purposes only.



[www.4picolitho.nl](http://www.4picolitho.nl)

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