

# MicroWriter ML<sup>®</sup>3 family overview

Durham Magneto Optics Ltd

The MicroWriter ML<sup>®</sup> products are a range of photolithography machines designed for rapid prototyping and small volume manufacturing in R&D laboratories and clean rooms.

Conventional approaches to photolithography are usually based on exposing through a chromium-glass mask manufactured by specialist vendors. In R&D environments it is often necessary to change the mask design frequently. Direct-write lithography tools overcome this problem by holding the mask in software. Rather than projecting light through a physical mask, direct-write lithography uses computer-controlled optics to project the exposure pattern directly onto the photoresist.

The MicroWriter ML<sup>®</sup>3 family comprises four compact, high-performance, direct-write optical lithography machines which are designed to offer unprecedented value for money in a small laboratory footprint.



*MicroWriter ML3*

## MicroWriter ML<sup>®</sup>3 Baby

This is our entry level machine and is one of the lowest cost direct-write optical lithography machines available anywhere in the world. It operates at a single minimum feature size of 1  $\mu\text{m}$  with a wavelength of 405 nm and is designed to sit on a standard laboratory bench either in a clean-room or in a general laboratory. A high quality optical microscope with a x10 Olympus objective allows exposures to be aligned to existing structures or to the edges of the substrate. Despite its low cost, it is still fast with a top writing speed of 50  $\text{mm}^2/\text{minute}$ , allowing a typical 50 mm x 50 mm area to be exposed in under 1 hour.

## MicroWriter ML<sup>®</sup>3 Baby Plus

The Baby Plus adds a number of features to the Baby which are usually only found in high-end machines. Two different minimum feature sizes (1  $\mu\text{m}$  and 5  $\mu\text{m}$ ) can be selected automatically via software and without the user needing to exchange any lens manually. This allows non-critical parts of the exposure to be performed rapidly at 5  $\mu\text{m}$  minimum feature size while retaining high resolution writing for critical parts. Locating alignment markers or edges of substrates is faster thanks to an automatic lens changer on the optical microscope allowing the user to switch between x3 and x10 objectives via software. The MicroWriter ML<sup>®</sup>3 Baby Plus also features an optical surface profilometer tool and an automated wafer inspection tool for examining fabricated structures. A laser-based edge locator allows wafers and dies to be centred automatically. As with all of our machines, writing speeds are some of the fastest on the market: up to 50  $\text{mm}^2/\text{minute}$  at 1  $\mu\text{m}$  minimum feature size and up to 180  $\text{mm}^2/\text{minute}$  at 5  $\mu\text{m}$  minimum feature size, allowing a typical 50 mm x 50 mm area combining critical and non-critical areas to be exposed in under 30 minutes.

## MicroWriter ML<sup>®</sup>3

This is our flagship machine and offers no-compromise sub-micron lithography on up to 9" wafers. Four different resolutions (0.6  $\mu\text{m}$ , 1  $\mu\text{m}$ , 2  $\mu\text{m}$  and 5  $\mu\text{m}$ ) can be selected automatically via software and without the user needing to exchange any lens manually. The optical microscope contains a full set of high performance bright and sharp infinite conjugate objectives (x3, x5, x10 and x20) with a software controlled automatic lens changer, allowing large substrate areas to be searched rapidly and individual sub-micron objects such as nanowires and crystal flakes to be accurately located. Top writing speeds are very fast: 25  $\text{mm}^2/\text{minute}$  at 0.6  $\mu\text{m}$  resolution, 50  $\text{mm}^2/\text{minute}$  at 1  $\mu\text{m}$  resolution, 100  $\text{mm}^2/\text{minute}$  at 2  $\mu\text{m}$  resolution and 180  $\text{mm}^2/\text{minute}$  at 5  $\mu\text{m}$  resolution, allowing a typical 100 mm x 100 mm area to be exposed at 2  $\mu\text{m}$  resolution in under 2 hours. In addition to the optical surface profilometer tool and automated wafer inspection tool present in the Baby Plus, there is also a Virtual Mask Aligner mode in which the pattern to be exposed is displayed on top of the real-time microscope image, allowing the machine to be used like a traditional mask aligner.

## MicroWriter ML<sup>®</sup>3 Mesa

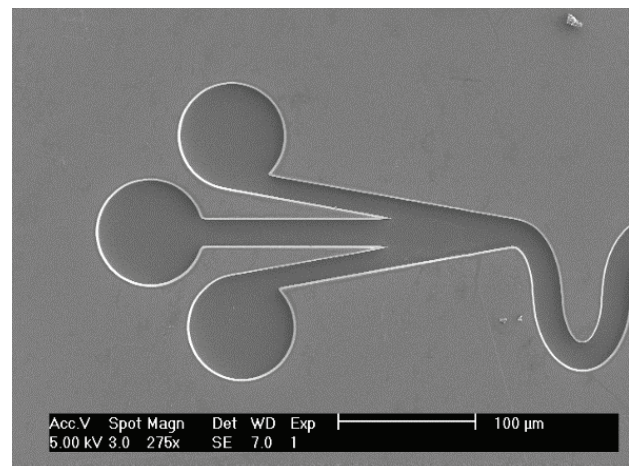
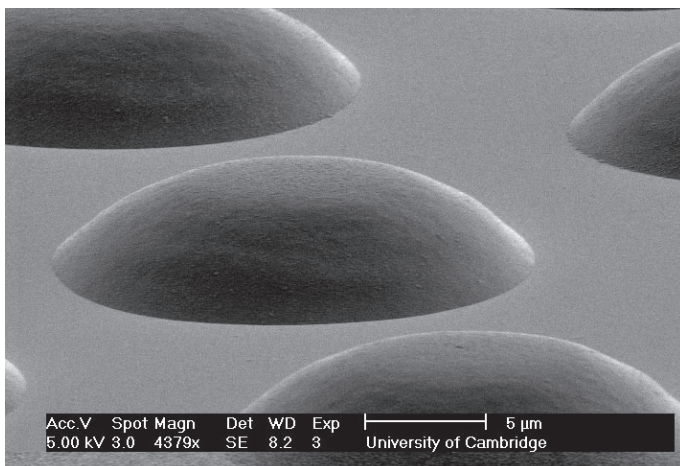
The Mesa has all of the features of the Baby Plus and adds a 0.6  $\mu\text{m}$  minimum feature size lens and x20 microscope objective, making it a table-top lithography tool with sub-micron resolution.

## MicroWriter ML<sup>®</sup>3 Pro

This is our flagship machine and best seller and offers no-compromise sub-micron lithography on up to 9" wafers. It is designed for highly demanding individual research groups or for central clean room facilities. Four different minimum feature sizes (0.6  $\mu\text{m}$ , 1  $\mu\text{m}$ , 2  $\mu\text{m}$  and 5  $\mu\text{m}$ ) can be selected automatically via software and without the user needing to exchange any lens manually. The optical microscope contains a full set of high performance bright and sharp infinite conjugate objectives (x3, x5, x10 and x20) with a software controlled automatic lens changer, allowing large substrate areas to be searched rapidly and individual sub-micron objects such as nanowires and crystal flakes to be accurately located. An additional lens offering 0.4  $\mu\text{m}$  minimum feature size and x50 microscope is available as an option. Top writing speeds are very fast: 17  $\text{mm}^2/\text{minute}$  at 0.6  $\mu\text{m}$  resolution, 50  $\text{mm}^2/\text{minute}$  at 1  $\mu\text{m}$  resolution, 120  $\text{mm}^2/\text{minute}$  at 2  $\mu\text{m}$  resolution and 180  $\text{mm}^2/\text{minute}$  at 5  $\mu\text{m}$  resolution, allowing a typical 100 mm x 100 mm area to be exposed at 2  $\mu\text{m}$  resolution in under 2 hours. In addition to the optical surface profilometer tool and automated wafer inspection tool present in the Baby Plus and Mesa, there is also a Virtual Mask Aligner mode in which the pattern to be exposed is displayed on top of the real-time microscope image, allowing the machine to be used like a traditional mask aligner. A backside alignment camera for aligning double-polished wafers is available as an option.

## Why choose the MicroWriter ML3 family?

- All of our machines are very competitively priced.
- All of our machines have fast writing speeds.
- All of our machines have a low cost of ownership. Our lightsources have a lifetime of 20,000 hours and are guaranteed for 5 years.
- The MicroWriter ML<sup>®</sup>3 Baby Plus, MicroWriter ML<sup>®</sup>3 Mesa and MicroWriter ML<sup>®</sup>3 Pro have an impressive array of advanced features usually only found in high-end machines.
- All of our machines are designed for use by PhD students and post-docs in a research environment and so have an attractive, intuitive and simple Windows<sup>®</sup> user interface while offering the flexibility and high levels of access to machine operation for those who want to develop new techniques.
- All of our machines handle the small millimetre-size chips often used in R&D, as well as large wafers.
- All of our machines share a common technology platform, allowing you to upgrade from MicroWriter ML<sup>®</sup>3 Baby to MicroWriter ML<sup>®</sup>3 Baby Plus, MicroWriter ML<sup>®</sup>3 Mesa and to MicroWriter ML<sup>®</sup>3 Pro at a later date.
- There is a well-established user base of MicroWriter ML<sup>®</sup> machines in over 60 laboratories around the world, including national labs and internationally leading Universities.
- We have an international network of trained local service engineers to keep you running.

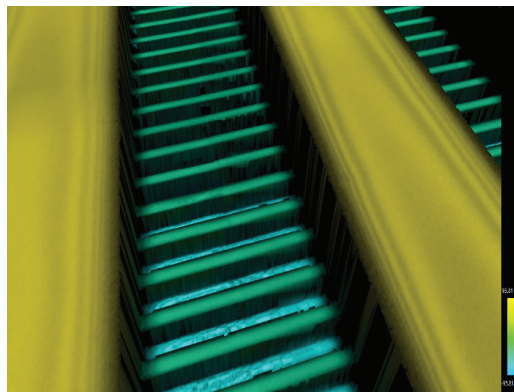
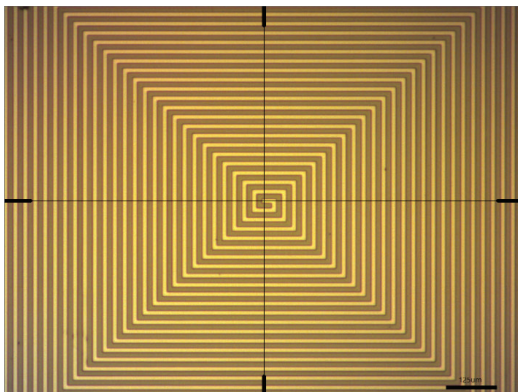
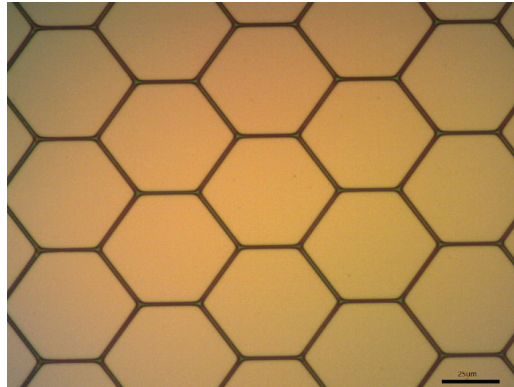
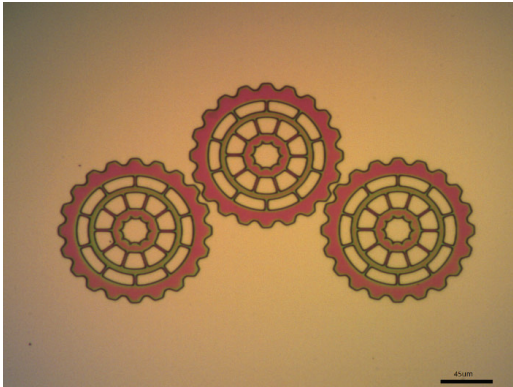


## Detailed comparison of features and performance

	MicroWriter ML <sup>®</sup> 3 Baby	MicroWriter ML <sup>®</sup> 3 Baby Plus	MicroWriter ML <sup>®</sup> 3 Mesa	MicroWriter ML <sup>®</sup> 3 Pro
Maximum substrate size	155 mm x 155 mm x 7 mm	155 mm x 155 mm x 7 mm	155 mm x 155 mm x 7 mm	230 mm x 230 mm x 15 mm
Maximum writing area	149 mm x 149 mm	149 mm x 149 mm	149 mm x 149 mm	195 mm x 195 mm
Exposure minimum feature sizes	1 um	1 um and 5 um	0.6 um, 1 um, 5 um	0.6 um, 1 um, 2 um, 5 um. 0.4 um as option.
Surface tracking autofocus system?	Yes	Yes	Yes	Yes
Edge locating laser for automatic wafer centering?	No	Yes	Yes	Yes
Greyscale lithography?	Yes	Yes	Yes	Yes
Alignment microscope objectives	x10	x3 and x10	x3, x10, x20	x3, x5, x10, x20. x50 as option.
Automatic lens changer for exposure resolution and alignment microscope?	No	Yes	Yes	Yes
Backside alignment?	No	No	No	Available as option
Exposure wavelength	405 nm. 385 nm and 365 nm available as option.	405 nm. 385 nm and 365 nm available as option.	405 nm. 385 nm and 365 nm available as option.	385 nm. 365 nm available as option.
Maximum writing speed	50 mm <sup>2</sup> /minute at 1 um resolution	50 mm <sup>2</sup> /minute at 1 um resolution and 180 mm <sup>2</sup> /minute at 5 um resolution	17 mm <sup>2</sup> /minute at 0.6 um resolution, 50 mm <sup>2</sup> /minute at 1 um resolution and 180 mm <sup>2</sup> /minute at 5 um resolution	17 mm <sup>2</sup> /minute at 0.6 um resolution, 50 mm <sup>2</sup> /minute at 1 um resolution, 120 mm <sup>2</sup> /minute at 2 um resolution, 180 mm <sup>2</sup> /minute at 5 um resolution
Overlay alignment accuracy at best resolution	±2 um	±1 um	±1 um	±0.5 um
Minimum addressable grid	200 nm	200 nm	100 nm	100 nm
Motion stage minimum XY step size	15 nm	15 nm	15 nm	4 nm
XY interferometer resolution	15 nm	15 nm	15 nm	1 nm
Optical surface profiler Z resolution	Not applicable	200 nm	200 nm	100 nm

Automatic wafer inspection tool?	No	Yes	Yes	Yes
Virtual Mask Aligner tool?	No	Available as option	Available as option	Yes
Temperature corrected enclosure?	No	Available as option	Available as option	Yes
Can handle multiple wafers / chips?	No	Available as option	Available as option	Yes
Supplied with vibration isolating optical table?	No	No	No	Yes
Mask design software?	Open source KLayout supplied. Clewin available as option	Open source KLayout supplied. Clewin available as option	Open source KLayout supplied. Clewin available as option	Clewin supplied.
Can be upgraded to higher members of the MicroWriter ML®3 family?	Yes	Yes	Yes	N/A

**Structure Gallery:**



Courtesy of the Francis Crick Institute's Making Lab, London

October 2019  
 Specifications subject to change.  
 Distributed by:



10307 Pacific Center Court, San Diego, CA 92121  
 Tel: +1-858-481-4400 • www.qdusa.com • info@qdusa.com

