# MicroWriter ML®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 ML®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  $1\mu$ m with a wavelength of 405nm 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 50mm x 50mm area to be exposed in under 1 hour.

## MicroWriter ML®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 (1µm and 5µm) 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 5µm 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®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 1µm minimum feature size and up to  $180 \text{mm}^2/\text{minute}$  at 5µm minimum feature size and up to  $30 \text{mm}^2/\text{minute}$  at 5µm minimum feature size and up to  $30 \text{mm}^2/\text{minute}$  at 5µm minimum feature size, allowing a typical 50mm x 50mm area combining critical and non-critical areas to be exposed in under 30 minutes.

#### MicroWriter ML®3 Mesa

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

**MicroWriter ML®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 (0.6µm, 1µm, 2µm and 5µm) 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 0.4µm minimum feature size and x50 microscope is available as an option. Top writing speeds are very fast: 17mm²/minute at 0.6µm resolution, 50mm²/minute at 1µm resolution, 120mm²/minute at 2µm resolution and 180mm²/minute at 5µm resolution, allowing a typical 100mm x 100mm area to be exposed at 2µm 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. An backside alignment camera for aligning double-polished wafers is available as an option.

## Why choose the MicroWriter ML®3 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®3 Baby to MicroWriter ML®3 Baby Plus, MicroWriter ML®3 Mesa and to MicroWriter ML®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.





	MicroWriter	MicroWriter	MicroWriter	MicroWriter
	ML <sup>®</sup> 3 Baby	ML <sup>®</sup> 3 Baby Plus	ML <sup>®</sup> 3 Mesa	ML <sup>®</sup> 3 Pro
Maximum substrate	155mm x 155mm	155mm x 155mm	155mm x 155mm	230mm x 230mm x
size	x 7mm	x 7mm	x 7mm	15mm
Maximum writing	149mm x 149mm	149mm x 149mm	149mm x 149mm	195mm x 195mm
area		4		
Exposure minimum	lum	1um and 5um	0.6um, 1um, 5um	0.6um, 1um, 2um,
feature sizes				Sum. 0.4um as
Surface tracking	Voc	Voc	Voc	Voc
autofocus system?	165	165	165	165
Edge locating laser	No	Yes	Yes	Yes
for automatic wafer			100	
centering?				
Greyscale	Yes	Yes	Yes	Yes
lithography?				
Alignment	x10	x3 and x10	x3, x10, x20	x3, x5, x10, x20.
microscope				x50 as option.
objectives				
Automatic lens	No	Yes	Yes	Yes
changer for exposure				
resolution and				
alignment				
Racksida alignment?	No	No	No	Available as option
Exposure wavelength	105nm	105nm	405nm	385nm
	385nm and	385nm and 365nm	385nm and	365nm available as
	365nm available	available as	365nm available	option.
	as option.	option.	as option.	
Maximum writing	50mm <sup>2</sup> /minute at	50mm <sup>2</sup> /minute at	17mm <sup>2</sup> /minute at	17mm <sup>2</sup> /minute at
speed	1um resolution	1um resolution	0.6um resolution,	0.6um resolution,
		and	50mm <sup>2</sup> /minute at	50mm <sup>2</sup> /minute at
		180mm <sup>2</sup> /minute	1um resolution	1um resolution,
		at 5um resolution	and	120mm <sup>2</sup> /minute
			180mm <sup>2</sup> /minute	at 2um resolution,
			at 5um resolution	180mm <sup>2</sup> /minute at
	12	14	14	Sum resolution
Overlay alignment	±2um	±1um	±1um	±0.5um
resolution				
Minimum	200nm	200nm	100nm	100nm
addressable grid	2001111	2001111		1001111
Motion stage	15nm	15nm	15nm	4nm
minimum XY step				
size				
XY interferometer	15nm	15nm	15nm	1nm
resolution				
Optical surface	Not applicable	200nm	200nm	100nm
profiler Z resolution				

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

## Structure gallery



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

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