MLA150 – Maskless Aligner


1. Introduction

This user manual presents the procedure to align and expose a converted design on a photoresist-coated wafer/chip with the MLA150. Follow this guide for the conversion procedure:

cmi.epfl.ch/photo/files/mla150/mla150.convert.php

2. Login & System Initialization

- Login for “Heidelberg MLA 150 – MaskLessAligner” on the zone 5 accounting computer.
- If the MLA150 menu is not already open, then double-click the icon:

3. Preparing the job

- First be aware of this color rule regarding boxes:
  - = input required
  - = input optional
- In the Job window, if you want to set up a new job, click:

Then, select the exposure mode of the machine. The two main ones are:

- Standard: will align and expose a global pattern on the wafer with one dose and one focus parameters.
- Series: will expose a small test pattern (typical 5x5 mm²) in a matrix of different dose and focus values.

- In the Substrate window, double click on “Substrate Template”.

- Find a template matching your substrate/chip dimensions, in the list. Alternatively, you can create a new template with known dimensions.

  _cmi wafer 4 inch_ 7/18/2017

If you are unsure about the dimensions of your wafer/chip, select the _Automatic (Round or Rectangular) templates._

  _AutomaticRectangular_ 7/18/2017
  _AutomaticRound_ 7/18/2017

N.B. The thickness of the substrate has no effect on the operation of the tool; it does not need to be correctly set!

- Once the template is selected, click on “Load” to go back to the job settings.

- In the Layers window, users can define two types of layers:
  - First Exposure: Exposure without alignment. The 0,0 coordinate of the layout will be at the center of the wafer.
  - Layer “X”: Exposure with alignment. Alignment marks will be detected on the wafer to synchronize the coordinate system with the new layout. ! Users should know the position of alignment marks !

- In the Laser field, choose between the 405 nm or 375 nm laser wavelength:
4. Wafer loading

- Only when all fields of the selected layer are green, users can click on “Load substrate”. The MLA150 table will move to loading position.

- Open (and close) the window bay with the appropriate button.

- Follow the instructions on the screen and on the panel inside the machine to load the wafer properly!

N. B. For back-side alignment exposure, make sure to remove the cache along the x- and y-axes of the table so that the back-side objective can detect the crosses at the back of the wafer.

- The field is optional. However, in this field, it is possible to double the range of the defocus parameter (+/- 10) for the exposure of thick resists such as Su8, AZ 40XT by choosing the “SU8” template with “large” defocus range.
• Close the window, and click on “continue”. The wafer will then move under the writehead. In the case of samples defined as “small” (<12 mm) or for the Automatic shape detection scripts, the overview camera will activate. ! Users should make sure that the wafer/chip is under the blue cross!

5. Alignment procedure (skip for first exposure layers)

• First click on:

![](Move To First Cross)

• Starting with the “overview” camera, locate your first cross on the wafer and use the navigation tools to place it of the camera window.

![](Overview) ➔ ![](Low Res) ➔ ![](High Res)

• Using the "target" button and directly clicking in the camera window is the easiest way to center the alignment mark.

![](Move To Zero) ![](Substrate Center) ![](Set Zero) ![](Stop)

• Once the cross is correctly centered in the “High Res” camera window, users can optimize brightness and focus:

![](Focus [-10...10] 4) ![](Brightness [3] 3)

• Press continue. Then, the edge detection script will find the edges of the wafer/chip, before continuing to the alignment/exposure steps.
6. Exposure

- Once the alignment procedure is completed, users will access the “Exposure” interface. In the Alignment Options tab, users can check alignment corrections to apply: Rotation should always be checked, and users can decide to apply additional scaling and shearing corrections.

<table>
<thead>
<tr>
<th>Alignment Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotation [mRad]</td>
</tr>
<tr>
<td>Scaling X/Y</td>
</tr>
<tr>
<td>Shearing [mRad]</td>
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</tbody>
</table>

- Make sure to enter dose [mJ/cm²] and defocus, based on your photoresist type and according to recommendations from the CMi website and the “Resist table”.

<table>
<thead>
<tr>
<th>Required</th>
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<tbody>
<tr>
<td>Design Name</td>
</tr>
<tr>
<td>Light Source [nm]</td>
</tr>
<tr>
<td>Dose [mJ/cm²]</td>
</tr>
<tr>
<td>Defoc [10...10]</td>
</tr>
</tbody>
</table>

- When ready, click on “Start Exposure”. The Progress Info window will follow the process steps, starting with “Converting” → “Exposing”. Users can check the timer left and the countdown of stripes.

7. Unloading and System idle

- When the exposure is finished, unloading is available:
  - Open the window, turn-off the vacuum and unload your sample.
  - Make sure to close the window bay before leaving the tool!
  - Logout of the tool on the zone 5 accounting computer.