EVG 610 mask aligner User Manual

Version of 2024-11-19.

1. Introduction

This manual explains how to operate the EVG 610 in mask-aligner mode to expose a 4inch or 6inch wafer using a Cr mask (5 inch or 7 inch).

Available alignment modes are: 1) First Mask, 2) Top-side alignment (TSA), 3) Back-side alignment (BSA).

Exposure with top-side alignment is described in the following section.

Note: The EVG 610 standard operation mode is wafer to wafer bond aligner. Users are trained and responsible for switching the EVG 610 set of tools from bonding to aligner, and back at the end of the process.

The EVG 610 is the first of CMi's mask-aligner to include a LED-based illumination system. It features 3 groups of LEDs emitting @ 365nm, 405nm and 436nm. The intensity on each group can be adjusted from 0% to 100%, and combined to the user liking. The following 3 sets are available and calibrated by the staff.

- I-line 20mW: 20mW/cm² @ 365nm
- H-line 20mW: 20mW/cm² @ 405 nm (wavelength equivalent to MLA 150 systems)
- Broadband 20mW: 20mW/cm² distributed evenly on the three wavelengths.

2. Login on CAE

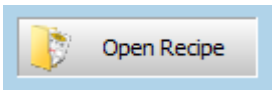
Login with your "CMi" username and password on the Zone 06 CAE accounting computer.

Select the "EVG 610 – Double side mask aligner and bond aligner"

3. Setting up a "mask-aligner" job with the EVG 610 User Interface

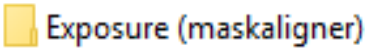
The EVG 610 user interface should be always opened. At the bottom of the user interface, different tabs are available, but only **"Recipes"**, that should be active by default, is used by the operator.

Recipes are loaded into the main window by clicking on:



In the default "Recipes" folder, five recipes will be available for mounting wafers on the EVG 510 chuck for bonding experiments.

Recipes for the mask-aligner mode, will be found in the "Exposure (maskaligner)" folder :



! Do not change the parameters in the recipes unless it has been discussed and approved by the Staff. User-modified recipes should be saved in the "User" folder!

The following recipes are available:

[1] FP.rcp: First mask exposure without alignment. Corresponding process: *Man. First Print – Top*

[2] TSA.rcp: Exposure with top-side alignment. Corresponding process: *Man. Top Side*

[3] BSA.rcp: Exposure with bottom-side alignment. Corresponding process: *Man. Bottom Side*

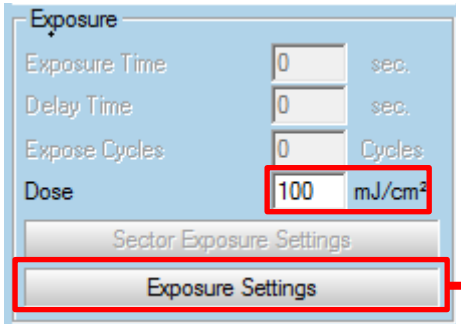
[4] Flood.rcp: Flood exposure (no mask). Corresponding process: *Man. Flood*

In the left-side "General" section, the following parameters can potentially be changed:

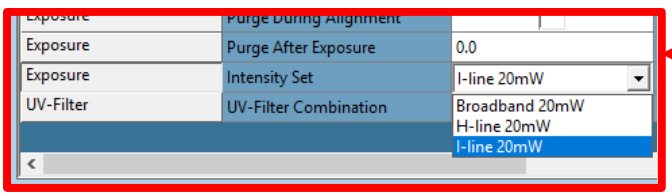
Exposure Mode:

The standard exposure mode for most CMi users & applications is "Constant Dose", which uses a calibrated sensor to measure the real-time light intensity and calculates the opening time of the lamp shutter. The LED lamp controller should be set to "CP".

Users enter the optimal dose in [mJ/cm²] in the exposure section.



Warning: It is critical to select the desired LED illumination intensity set in "Exposure settings":



Other exposure modes are:

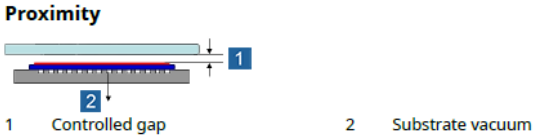
- **Constant Dose - Interval:** During constant power, the light can be turned on and off. This is used to cool down the wafer in case of long total exposure time or allow outgassing with thick negative resist.
- **Constant Dose – Sector Exposure:** A mode that allows for dose test with 8 different exposure doses on 8 different wafer sectors.
- **Constant Time modes (standard, interval, sector):** Users can input the exposure time instead of the dose. The LED lamp controller should be set to "CI".
- **Multiple Exposure:** Special mode that allows movement of the stage between concecutive exposure.

Please contact the CMi staff if you need any advice on the exposure modes.

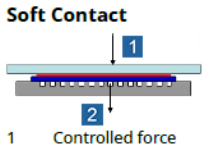
Contact Mode:

In the contact section, users define how the contact is done between the wafer and the mask during the exposure. Below are the different exposure mode and the relevant parameters.

- **Proximity:** Allows to define a gap between mask and wafer during exposure. This is typically used, in combination with proximity WEC, to avoid contamination of the mask or with fragile wafers.

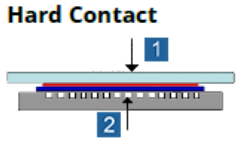


- **Soft Contact:** The wafer is fixed on the chuck by vacuum and the exposure gap is set to zero, creating a "mostly" pressure-free contact between the mask and the wafer. Minimum resolution ~ 2um.



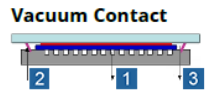
1 Controlled force 2 Substrate vacuum

- **Hard Contact:** The wafer is brought in direct contact with the mask. A nitrogen purge between substrate and exposure chuck is used to press the substrate against the mask. Minimum resolution ~ 1um.



1 Controlled force 2 Purge

- **Vacuum Contact:** A vacuum is created between mask and wafer. This is the strongest contact mode. Minimum resolution ~ 800nm.

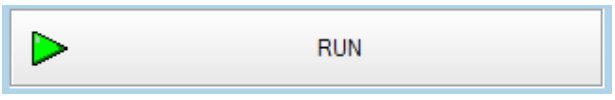


1 Substrate vacuum 2 Activated seal ring
3 Vacuum between mask and substrate

Additional modes are: **V+H Contact**, that combines vacuum and hard contact, and **"Purge"** modes that flush N2 between the mask and the wafer during operation.

Please contact the CMi staff if you need any advice on the contact modes.

Once the recipe has been selected, it will be started by clicking on:



4. Sequence example: 4 inch wafer (5 inch mask) exposure with TSA alignment

This sequence consists in a series of ~30 steps that will be detailed below.

Make sure to follow all the steps until the end of the process!

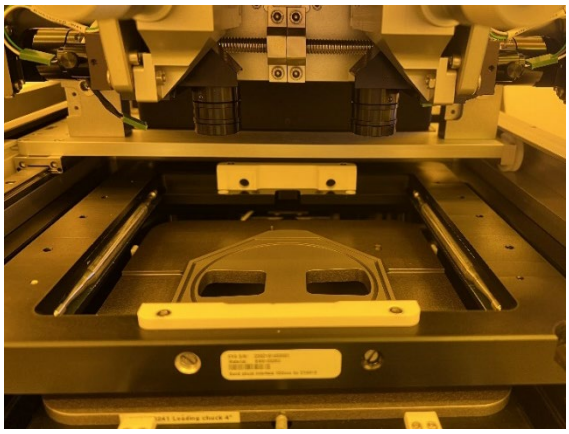
To help you progress through the steps, indications will be given in textual format, with an image and a small animation of the task to be performed.

Once completed, the operator can move to the next step by clicking on "Continue". Some steps, such as alignment, can be repeated if the user is not satisfied with the results by clicking on "Undo".

An overview of the user interface (UI) during the running recipe sequence is available at the end of this guide.

Steps in details:

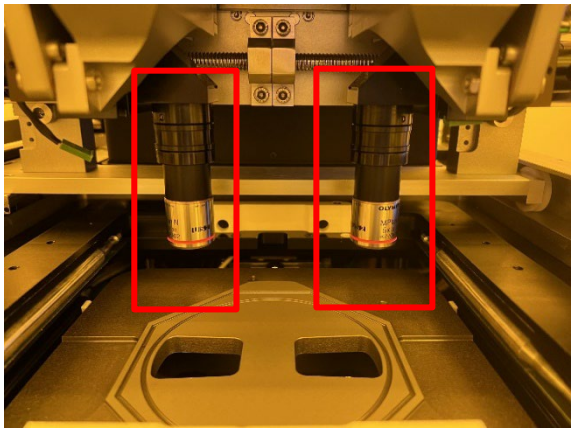
When the users start with the EVG610, the tools for the bond chuck preparation will be loaded in the machine.



Step 1: "Configure Optic" → mount de 5x MAG objectives

By default, the topside objectives are removed from their mount when using the set of tools for bonding.

Unpack the objectives from the storage box and screw them onto the left and right mounts.



Step 2: "Move Tray Out" → Pull the tray our completely

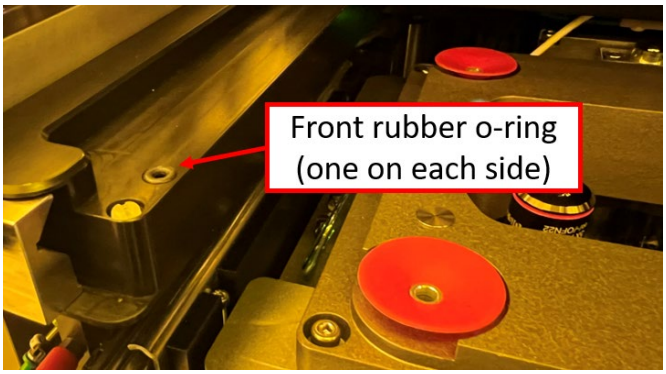
Step 3: "Insert Maskholder" → Exchange the adapter frame with the maskholder

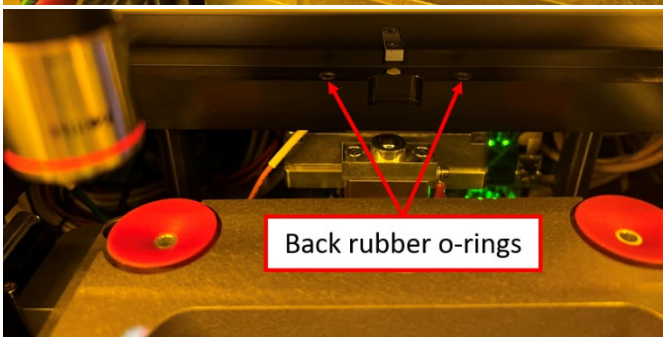
The adapter frame is loaded inside the machine and should be removed first, then the maskholder can go in.

[1] Unscrew and push the clamps out

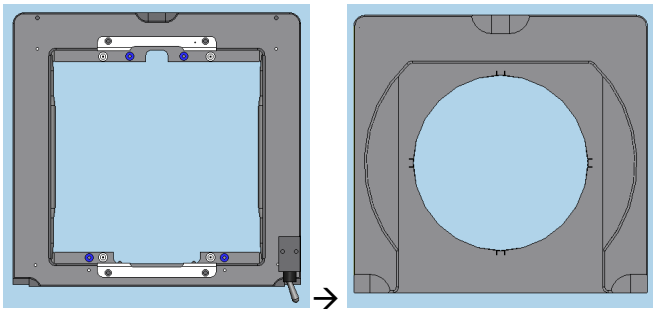
[2] Pull the adapter frame out without touching the optics

[3] Check for the presence of the 4 rubber rings!

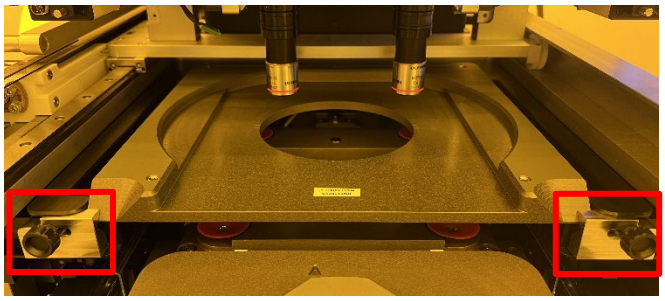




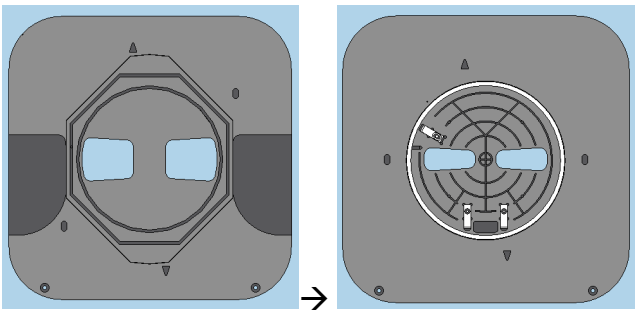
[4] Insert the maskholder



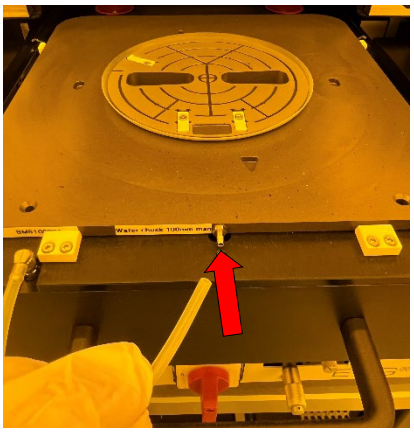
Step 4: "Fix Maskholder" → make sure to screw the maskholder in place with the clamps



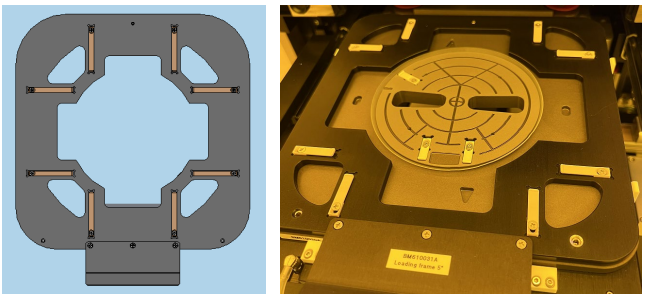
Step 5: "Insert Chuck, Connect Vacuum" → Replace the bond loading slide by the maskaligner chuck



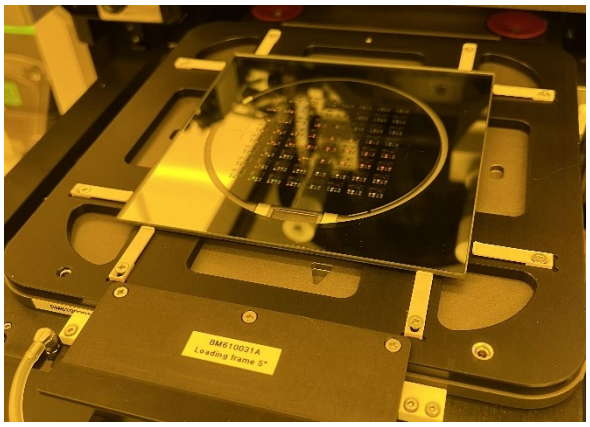
Do not forget to connect the vacuum tube!



Step 6: "Insert Loadframe" → Insert the frame to load the Cr mask.

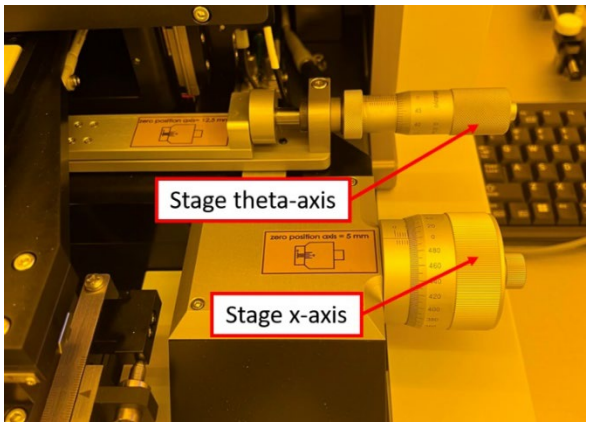


Step 7: "Insert Mask" → Place the mask on the loadframe with Chromium DOWN



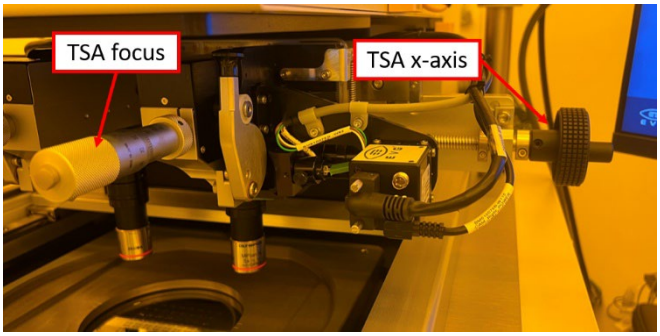
Step 8: "Load Tray In" → Push the tray all the way in the machine.

Step 9: "Move Stage In Center Position" → Adjust the knobs as required.

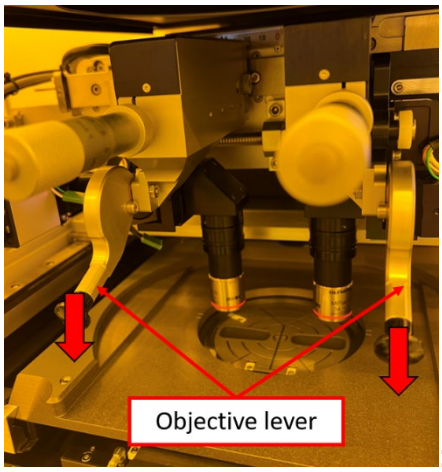


The x-axis knob zero position is 5mm, theta-axis knob zero position is 12.5mm (see above). The y-axis knob (other side of the tool) zero position is 5mm.

Step 10: "Adjust Microscope" → Adjust the position and focus of the top-side left and right microscope objectives until the alignment marks are centred in the field of view.



Note: Make sure to move the objectives to position down before starting the adjustment!



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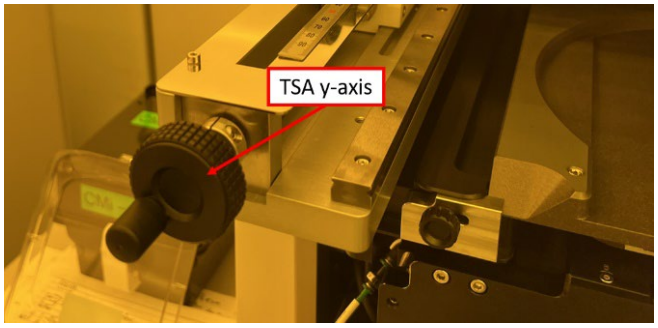
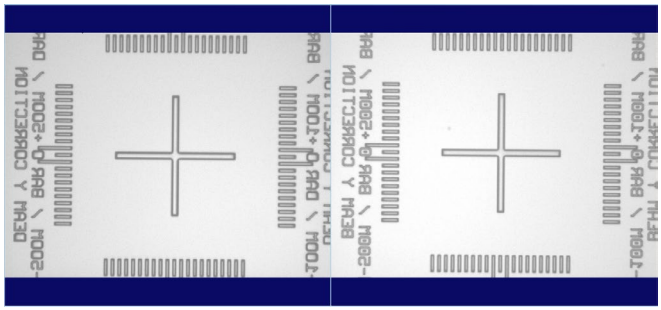
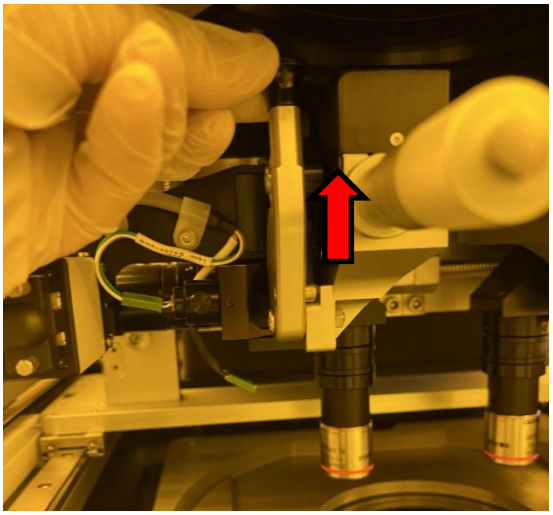
Note: A rotation shift will be corrected by using the stage theta-axis knob.





The mask will now be pushed in contact with the mask-holder (WEC) and held by vacuum.

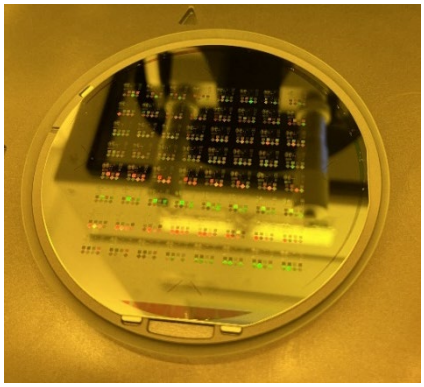
Step 11: "Move Top Side Microscope UP" → Push the lever UP on each TSA microscope



Step 12: "Move Tray Out" → Pull the tray our completely

Step 13: "Remove Loadframe" → Remove the mask loadframe from the wafer chuck

Step 14: "Insert substrate for WEC" → Load the wafer

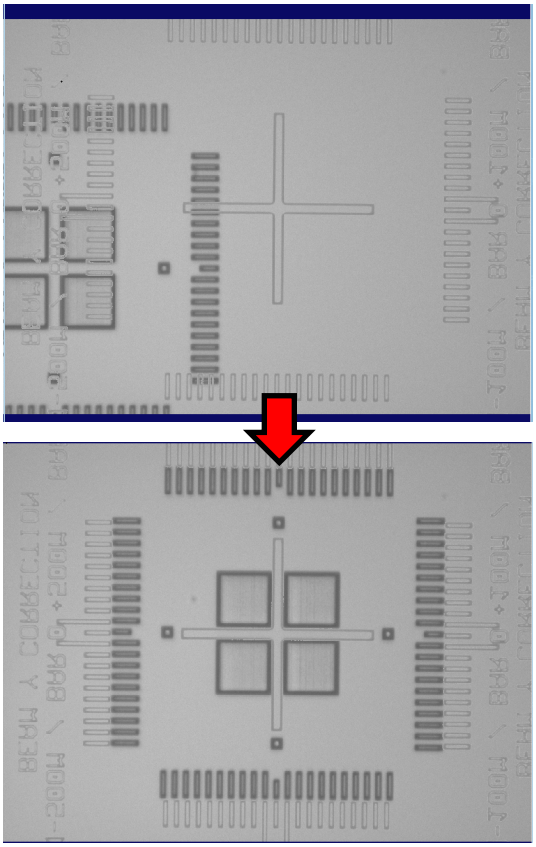


The substrate is loaded with the photoresist **UP**. Make sure to align the flat with the contact points.

Step 15: "Move Tray In" → Push the tray all the way in the machine.

The WEC procedure will start. Wait until completion.

Step 16: "Align Substrate" → Align the wafer and the mask



Note: Make sure to move the objectives to position down before starting the alignment!

The wafer and the mask should now be visible in the field of view of the microscope objectives.

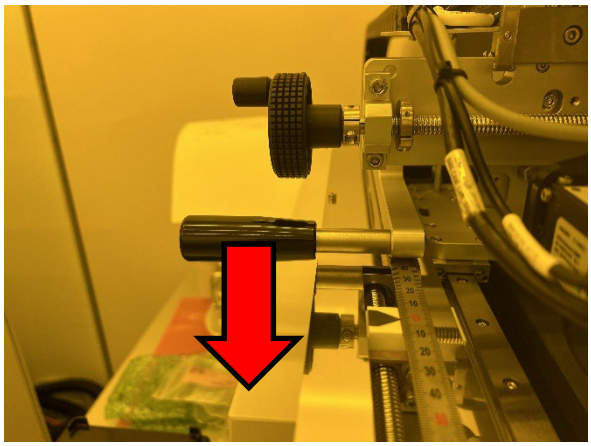
The wafer is moved with the stage knobs on both side of the machine! Move the wafer until it is correctly aligned on both sides.

After this step, the wafer moves back in contact to the mask and the contact method is activated (soft, hard or vacuum).

Step 17: "Check Contact Mode ["X" Contact]" → Repeat step 16 with an alignment shift until the wafers are correctly aligned after applying the contact mode.

Step 18: "Move Top Side Microscope UP" → Push the lever UP on each TSA microscope

Step 19: "Move Axis to Shown Position" → Move the lamphouse on top of the mask/wafer



The lamp is moved by hand on top of the mask using a lever on the left side of the machine. Pull the lever completely towards the front.

Note: A CDA "out of range" error might pop-up. You can safely ignore it by clicking "OK".

Once in position, the exposure will start.

Step 20: "Move Tray Out" → Pull the tray our completely

Step 21: "Remove Substrate" → Remove the substrate

Step 21: "End Of Process" → Press Continue or Exit

- Press “Continue” to expose additional wafers. The procedure repeats from Step 14.
- Press “EXIT” to unload the mask

Step 22: “Insert Loadframe” → Insert the frame to unload the Cr mask.

Step 23: “Move Tray In” → Push the tray all the way in the machine.

Step 24: “Move Stage In Center Position” → Adjust the knobs as required.

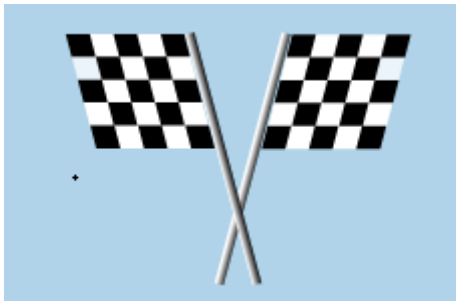
This step is to make sure the mask will be released correctly on the loadframe.

Step 25: “Move Tray Out” → Pull the tray our completely

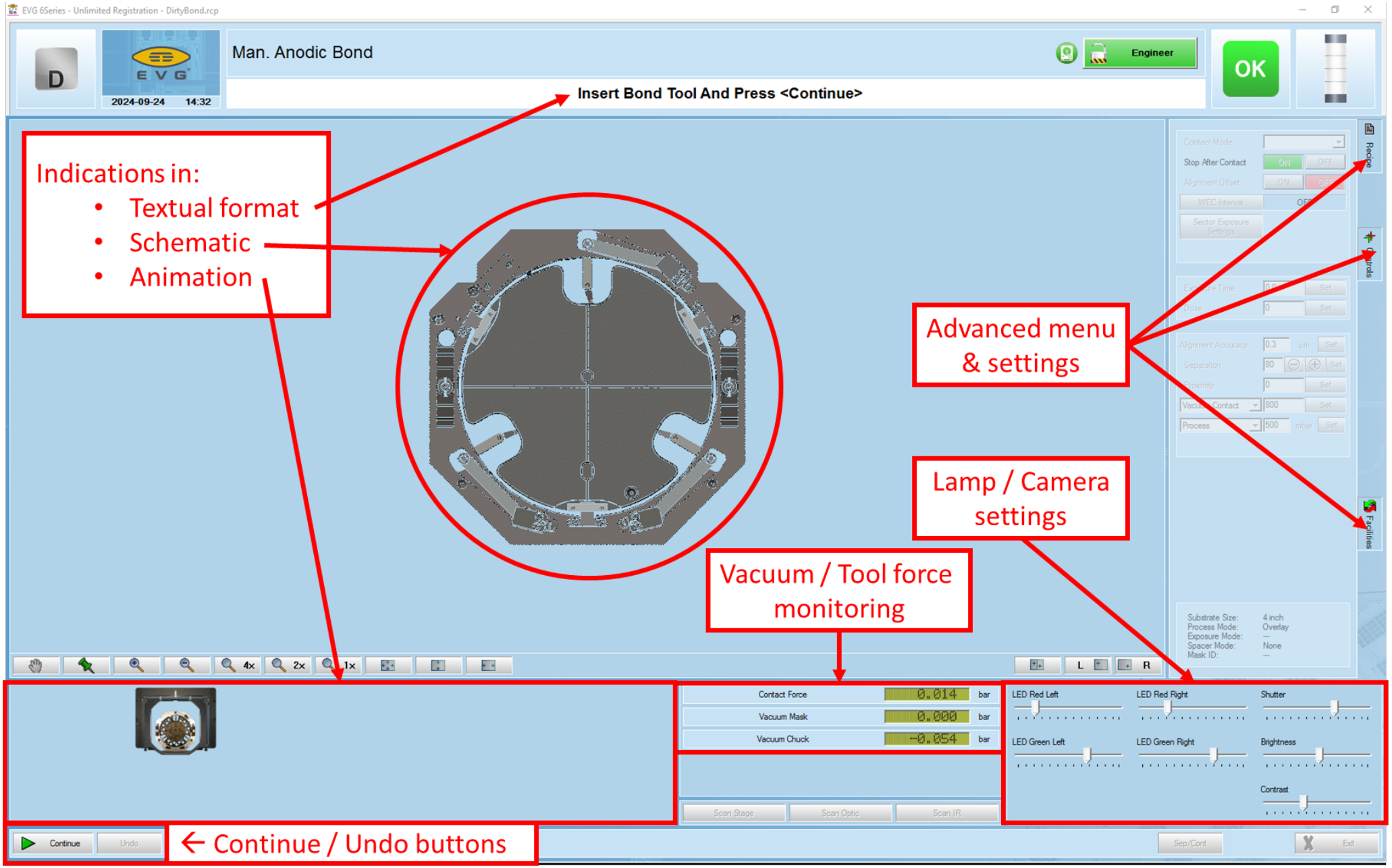
Step 26: “Remove the mask” → Pull the tray our completely

Step 27: “End Of Process” → Press Continue or Exit

- Press “Continue” to load a new mask for exposure. The procedure repeats from Step 6.
- Press “EXIT” to complete the procedure and go back to the recipe selection window.



At that point users may log out of the equipment on CAE.


Man. Anodic Bond
Engineer
OK
Insert Bond Tool And Press <Continue>
Indications in:
Textual format
Schematic
Animation
Advanced menu & settings
Lamp / Camera settings
Vacuum / Tool force monitoring
Contact Force
Vacuum Mask
Vacuum Chuck
LED Red Left
LED Red Right
Shutter
LED Green Left
LED Green Right
Brightness
Contrast
Continue
Undo
← Continue / Undo buttons