Süss MA6 Mask Aligner User Manual

Version of 2016-07-04. Get the latest one at http://cmi.epfl.ch/photo/files/MA6/MA6.std.manual.pdf

1. Introduction

This user manual explains how to operate the Süss MA6 mask-aligner in standard "photolithography" mode. Default illumination setup on MA6: Intensity = 20mW/cm^2, "broadband" illumination.

2. Login & System Initialization

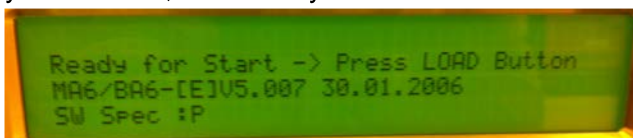
- Before login with the CAE interface, users should check that the UV lamp is on.
- If the Hg lamp power supply (CIC) display is set to "rdy", then the lamp needs to be turned on. Press the power "start" button.

- The CIC display will show "COLD". Wait at least 15 minutes before exposing your wafers!
- Login on "Suess MA&BA6" with CAE on zone 6 accounting computer.

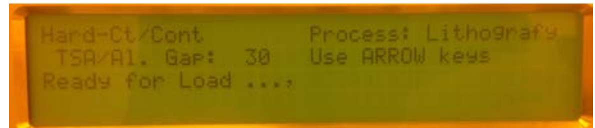
	Z06 Suess MA&BA6 - Double side mask aligner and bond aligner

- Switch on the MA6/BA6 main power (short clockwise rotation towards "On").

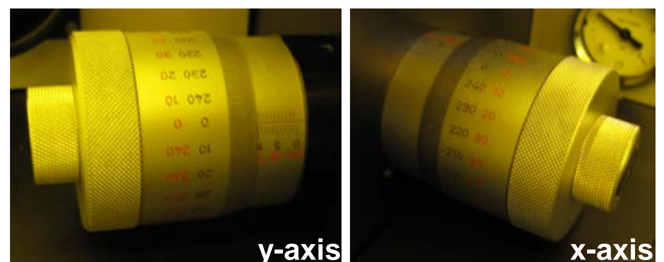
- Press the "LOAD" key when the display asks you to do so, i.e. "Ready for Start".

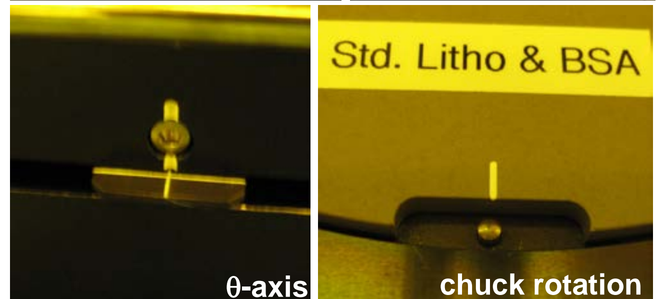


- Wait for "Ready for Load" message on the main display indicating correct system initialization.



- Reset wafer & chuck positioning/travel range by adjusting the following :
  - Center position for x-axis (knob to 11)
  - Center position for y-axis (knob to 9)
  - Center position for θ angle
  - Chuck rotation at "zero"





3. Preparation: Mask Loading

- Press the key "CHANGE MASK" to unclamp the mask holder from the frame.

- Take the mask holder out of the frame, rotate it and put it on the small table left side of the MA6/BA6.
- Fit properly the mask on the mask holder, check the mechanical clamp.

- Press "ENTER" key to toggle the vacuum ON.

- Check that the vacuum is "ON" on the display. If the message "loss of mask vacuum" appears, check the position and cleanliness of the mask and retry "ENTER".
- Put the mask holder with the mask back into the MA6. Press again "CHANGE MASK" to clamp the mask holder on the frame.

4. Preparation: Exposure Recipe

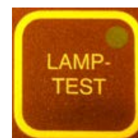
- Calculate your optimal exposure time, according to the recommended exposure dose given on the CMi website and the lamp intensity. Default illumination setup on MA6: Intensity = 20mW/cm^2, "broadband" illumination.
- Check that the key "MULTIPLE EXPOSURE" is active or not, depending on whether you need a multiple exposure. Multiple exposures are recommended when the total exposure time exceeds 20 seconds.

- Enter the recipe edition menu by pressing the "EDIT PARAMETER" key. LED will turn on.

- Navigate through the parameters with the arrows key "← and →". Change the values of the parameters with the arrows "↑ and ↓".
- Standard, recommended parameters on MA6:
  - Process: Lithography
  - Exp. time: "x" (calculated before)
  - Alignment gap: 30µm
  - Contact type: Hard.
  - HC wait time: 10s
  - WEC Type: Cont
  - N2 Purge: No
  - WEC-Offset: OFF
- Note on contact type:
  - Users can switch to "Soft" for fragile wafers or extremely thick resist.
  - Users can switch to "Vacuum" to achieve aspect ratio (AR) close to the resolution limit.
- If the "MULTIPLE EXPOSURE" key is active, two additional parameters will show up in the list:
  - Wait Time: 20s (pause between cycles for cooling the wafer down)
  - Cycles: "x" (number of times the exposure will be repeated)
- Once the recipe parameters are set, press the "EDIT PARAMETER" key again to save your parameters.

5. Preparation: CIC mode

- Select the exposure mode of the CIC between CP (constant power) or CI1 (constant intensity) following this rule:
  - **Mode CP (Constant Power): No regulation loop, recommended only for short time exposure (< <u>3.0 seconds</u>).** Accuracy of about 5%. Intensity = 20mW/cm^2, "broadband" illumination.
  - **Mode CI1 (Constant Intensity, channel 1): With regulation loop, recommended for large exposure time (<u>>3.0 seconds</u>).** Accuracy of about 2%. Intensity = 20mW/cm^2, "broadband" illumination.
  - Mode CI2 (Constant Intensity, channel 2): Optional. Used with i-line filter only. Intensity = 8mW/cm^2, "i-line" illumination. <u>! Requires STAFF Intervention!</u>
- It is recommended to measure the light intensity before loading the wafers. Press the "LAMP TEST" key.



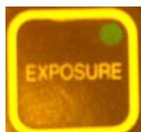
- On the Hg lamp power supply (CIC), press the "DS" button to switch the display from electrical power to optical intensity measurement from channel 1 and channel 2. During lamp test, intensity display should be 20mW/cm^2 with channel 1. If it is not the case, it means the lamp is either off or still cold.

- Three exposure modes are available on the MA6: FIRST MASK, TOP SIDE ALIGNMENT (TSA) or BACK SIDE ALIGNMENT (BSA).

6. a. FIRST MASK Exposure

- Start the wafer loading procedure by pressing the key "LOAD" and follow the instruction given on the MA6 display.

- Pull the slide out, place the wafer on the chuck using the 3 alignment pins for accurate positioning of the wafer flats.
- Press "ENTER" to activate the vacuum and clamp the wafer.
- Push the slide into the MA6 and confirm with "ENTER". The wedge error compensation (WEC) procedure will follow, pushing the wafer in contact with the mask and adjusting the mask/wafer parallelism.
- Press the "EXPOSURE" key.



- Wait for the end of the exposure procedure, pull the slide out, and unload the wafer.
- Repeat the loading-exposure-unloading loop to complete your wafer batch.
- To unload the mask, proceed the opposite way you already did for mask loading (see section 3).
- Move the mask holder slide into the machine and logout with CAE on zone 6 accounting computer.

7. b. TSA Exposure

- Use "F1 key" (confirm message with "ENTER") to toggle the microscopes down.

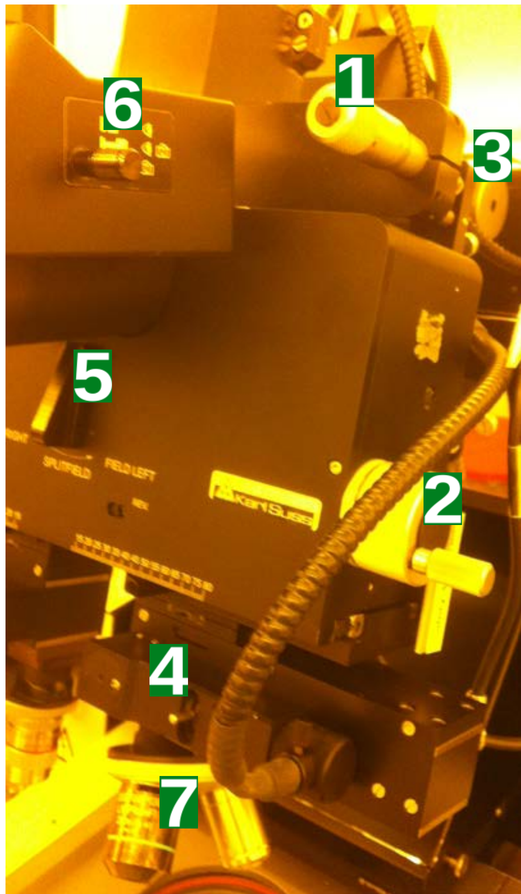
- To perform a top-side alignment (TSA), check:
  - Potentiometer *ILLUMINATION* is on TSA.
  - Potentiometer *TSA* is fully turned on the right side to increase the illumination.
  - Key "BSA MICROSCOPE" is extinct.
  - Potentiometer *VIDEO MONITOR* is turned on "TSA".

- Use the binoculars or the TV screen display to visualize the mask. Make sure "SPLITFIELD" mode is activated on the microscope (see [4] below) to see both right and left field of view.
- Move the left and right objectives on top of your alignment markers on the mask and adjust the focus.

  Top microscope controls:
  - *On the MA6 keyboard:* move the microscope module on the x- and y-axis with arrow keys "←, →, ↑, ↓". Activate the "Fast" key to move rapidly.

  - *On the MA6 panel*: control the fine focus of the left and right objectives with the "TOP SUBSTRATE" knobs.

- *On the microscope module:*



1 = Theta axis / rotation,

2 = intra-objective distance (one on each side)

3 = Coarse z-axis / focus (one on each side)

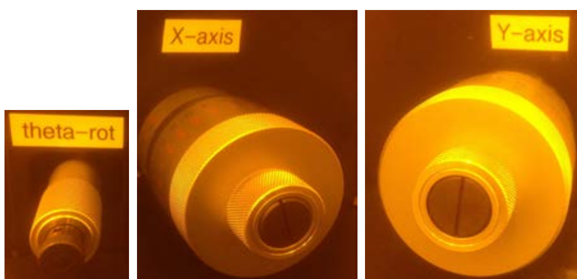
4 = illumination attenuation (one on each side)

5 = Splitfield mode

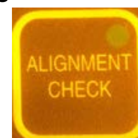
6 = Screen or binocular view

7 = objectives turret (manual change).

- Start the wafer loading procedure by pressing the key "LOAD" and follow the instruction given on the MA6 display.
- Pull the slide out, place the wafer on the chuck using the 3 alignment pins for accurate positioning of the wafer flats.
- Press "ENTER" to activate the vacuum and clamp the wafer.
- Push the slide into the MA6 and confirm with "ENTER". The wedge error compensation (WEC) procedure will follow, pushing the wafer in contact with the mask and adjusting the mask/wafer parallelism.
- Move the wafer using x-axis, y-axis and θ-axis knobs in order to find the markers on the wafer.



- Move the wafer markers under the mask markers. Align precisely horizontal features on the right and left fields using the y-axis and θ-axis knobs.
- Finish the alignment with fine-tuning of the x-axis.
- Pressing "ALIGNMENT CHECK" will perform the selected contact procedure (hard, soft, vacuum). If alignment is good, move on with exposure. If it is not the case, press on "alignment check" and try again.



- Press the "EXPOSURE" key.
- Wait for the end of the exposure procedure, pull the slide out, and unload the wafer.
- Repeat the loading-exposure-unloading loop to complete your wafer batch.
- To unload the mask, proceed the opposite way you already did for mask loading (see section 3).

- Move the mask holder slide into the machine and logout with CAE on zone 6 accounting computer.

6. c. BSA Exposure

- To perform a back-side alignment (BSA), check:
  - Potentiometer *ILLUMINATION* is on BSA/IR.
  - The 2 potentiometers BSA/IR are turned on the right side to increase the illumination.

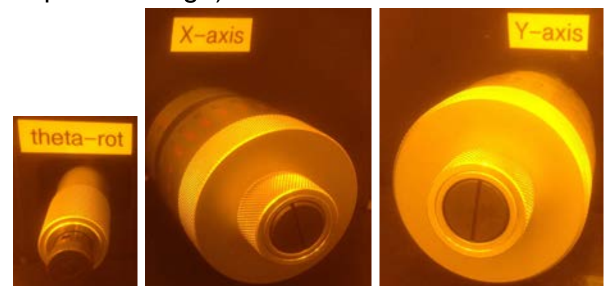
  - Keys "BSA MICROSCOPE" and "TOP/BOTTOM" are activated/on.

  - Potentiometer *VIDEO MONITOR* is turned on "BSA" (center position).
  - Check that "MAGNIFICATION BSA" is set on "LOW".
- The TV screen display is used to visualize the mask.
- Move the left and right objectives under the alignment markers on the mask and adjust the focus.
  Backside microscope controls*, on the MA6 keyboard:*
  - Select which objectives are moved on the keyboard by pressing the appropriate keys in the BSA section

  - Move the microscope module on the x- and y-axis with arrow keys "←, →, ↑, ↓". Activate the "Fast" key to move rapidly.
  - *On the MA6 panel*: control the fine focus of the objectives with the "TOP SUBSTRATE" knobs.
- Switch the "MAGNIFICATION BSA" to "HIGH".

- Once both left & right markers are centered and focused, press "GRAB IMAGE" to capture an image of the mask markers. The microscope positions will automatically move down to wafer backside positions ("TOP/BOTTOM" deactivated/off).

- Start the wafer loading procedure by pressing the key "LOAD" and follow the instruction given on the MA6 display.
- Pull the slide out, place the wafer on the chuck using the 3 alignment pins for accurate positioning of the wafer flats.
- Press "ENTER" to activate the vacuum and clamp the wafer.
- Push the slide into the MA6 and confirm with "ENTER". The wedge error compensation (WEC) procedure will follow, pushing the wafer in contact with the mask and adjusting the mask/wafer parallelism.
- Move the wafer using x-axis, y-axis and θ-axis knobs in order to find the markers on the wafer (Note that the "MAGNIFICATION BSA" can be switched back to "LOW" without losing the captured image).



- Move the wafer markers under the mask markers. Align precisely horizontal features on the right and left fields using the y-axis and θ-axis knobs.
- Finish the alignment with fine-tuning of the x-axis.
- Pressing "ALIGNMENT CHECK" will perform the selected contact procedure (hard, soft,

vacuum). If alignment is good, move on with exposure. If it is not the case, press on "alignment check" and try again.

- Press the "EXPOSURE" key.
- Wait for the end of the exposure procedure, pull the slide out, and unload the wafer.
- Repeat the loading-exposure-unloading loop to complete your wafer batch.
- To unload the mask, proceed the opposite way you already did for mask loading (see section 3).
- Move the mask holder slide into the machine and logout with CAE on zone 6 accounting computer.