

# Süss MJB4 Mask Aligner User Manual

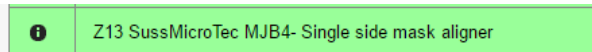
Version of 7.3.2019. Get the latest one at <http://cmi.epfl.ch/photo/files/MJB4/MJB4.manual.php>

## 1. Introduction

This user manual explains how to operate the Süss MJB4 mask-aligner. **Default illumination setup on MJB4: Intensity = 20mW/cm<sup>2</sup>, i-line (365nm) illumination.**

## 2. Login & System Initialization

- Login on "SüssMicroTec MJB4 ..." with CAE on zone 13 accounting computer.



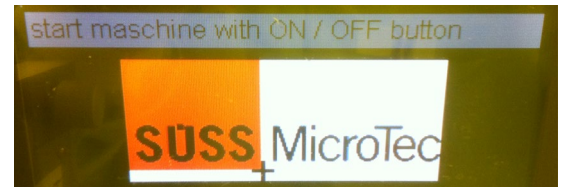
- Check if the main power switch is turned on. If not, turn it on.



- Before starting with the machine, users should check that the mercury (Hg) lamp is on. Note that the lamp will be automatically turned off 45 minutes after the last user logs out.
- Check the lamp power supply (CIC):
  - If the lamp is on, CP button LED will be on and you will be able to read light intensity (0.0) and lamp power values. Continue to the next section.



- If the lamp is off, the CIC power supply will be either off or show "Standby". If the touch panel displays "start maschine with ON/OFF button", then press the ON/OFF button on the left front panel. The CIC will turn on.

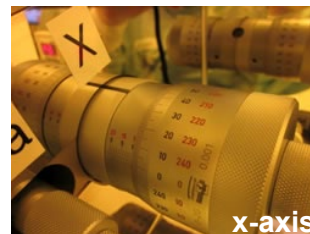


Then use the following sequence to start the lamp:

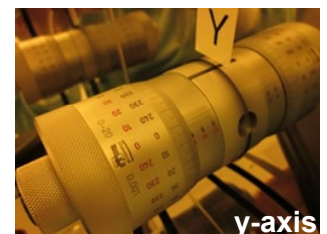
Display **Standby** → Press "On".  
Display **Ready** → Press "CP".  
Display **Start** → Press "Start".

The display will show blinking "cold". Wait at least **10 minutes** before exposure to make sure the lamp temperature is stable!

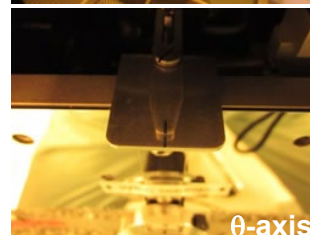
- Reset wafer & chuck positioning/travel range by adjusting the following :
  - Center position for x-axis (knob to 10)
  - Center position for y-axis (knob to 10)
  - Center position for  $\theta$  angle
  - Chuck rotation at "zero"



x-axis



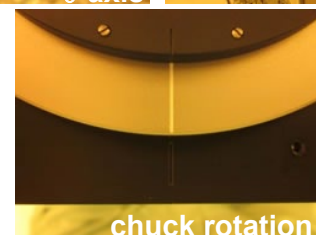
y-axis



$\theta$ -axis



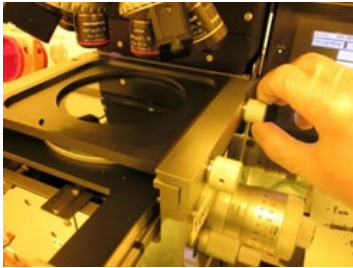
$\theta$ -axis



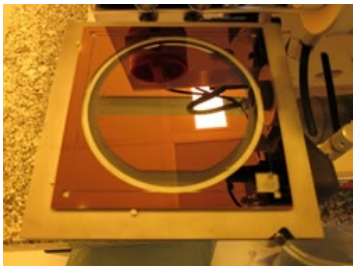
chuck rotation

### 3. Preparation: Mask Loading

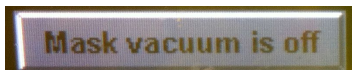
- Unclamp the mask holder with the 2 screws on the right side of the frame.



- Take the mask holder out of the frame, rotate it and put it on the small table left side of the MJB4.
- Fit properly the mask on the mask holder by contacting the three metal pins.



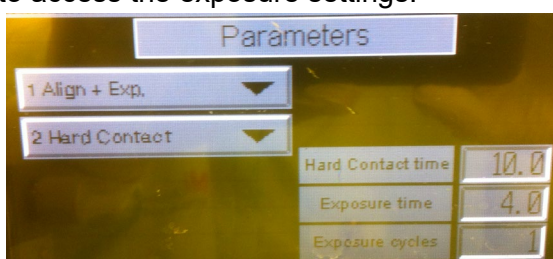
- On the MJB4 touchscreen, go in the "Main Menu" section. Press «Mask vacuum is off» to turn on vacuum clamping. Verify that the mask does not move.



- Put the mask holder with the mask back into the MJB4. Clamp the mask holder with the 2 screws. Make sure it is sufficiently fixed.

### 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 MJB4: Intensity = 20mW/cm<sup>2</sup>, i-line (365nm) illumination.**
- On the MJB4 touchscreen, press "Parameters" to access the exposure settings.



- Select the exposure mode under number 1):
  - "Align + Exp." = standard mode.**
  - "Flood Exp." = no mask, full wafer exposure.
  - "Test Exp." = to expose the wafers several (defined by the "exposure cycles" parameter) times with different exposure times.
- Select the contact mode under number 2):
  - "Hard Contact" = standard mode.**
  - "Soft Contact" = for fragile wafers or extremely thick resist.
  - "Vacuum Contact" = NOT AVAILABLE on MJB4.
  - \*Gap Exposure" = to expose with a gap between wafer and mask (proximity).
- Set-up the rest of the parameters
  - Hard Contact time: 10s
  - Exposure time: "x" (calculated before)
  - Exposure cycles: 1
- To perform split-exposure, change the "Exposure cycles" parameter to any values higher than 1. "Wait time" parameter will show up below.
- Once the recipe parameters are set, press the "Load" key to save your parameters.
- Make sure that the CIC mode is set to constant power (CP). The use of other exposure modes is not recommended with the MJB4 mask-aligner.

### 5. Preparation: WEC settings

On the MJB4, the wedge error compensation (WEC) procedure for fine tuning of mask/wafer contact position and parallelism is done manually. Follow this procedure:

- Before starting check that WEC pressure setting is higher than 0.05 MPa!** If it is lower please adjust with the appropriate knob (front panel, right of the machine).



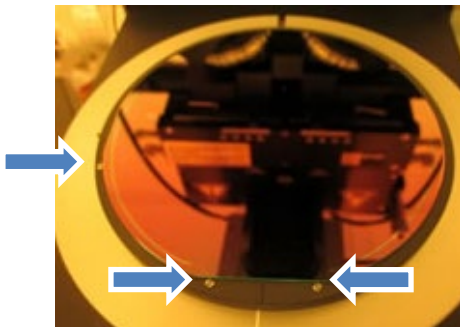


- Rotate WEC knob down (to the right) for adequate wafer to mask clearance. Position should be “0” when using a Cr-blank mask, or “16” when using a transparent sheet mask.



Note: each unit on the scale is 1  $\mu\text{m}$ . One full rotation to the right moves the WEC offset down by 100  $\mu\text{m}$ .

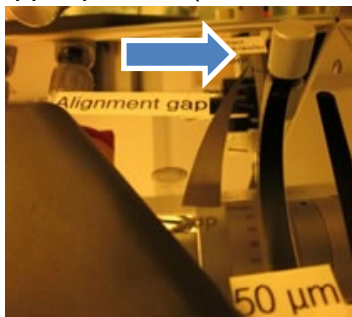
- Pull the wafer slide and place the wafer in contact with the three positioning pins. Be sure not to load on top of the pins!



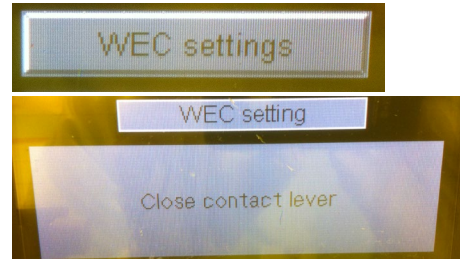
- Activate the wafer transport vacuum and push the slide at the back of the machine.



- Make sure that the “alignment gap” lever is at the upper position (Contact mask/wafer).



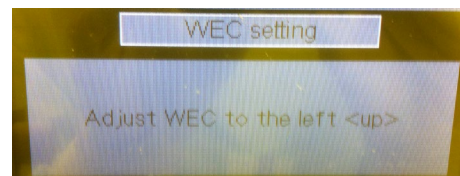
- At this point, press “WEC settings” on the touchscreen and wait for the message “Close contact lever”.



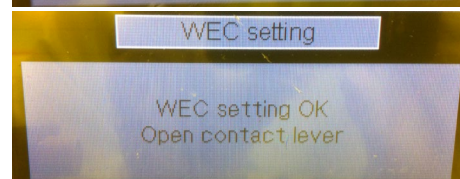
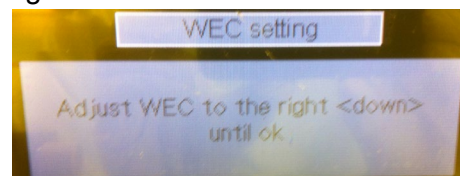
- Turn the contact lever slowly and very gently until the end the position is reached (manual z-axis). Do not force it if you feel some resistance. **! The WEC unit might be too high, check the display for errors !**



- Now, follow directions of rotation given on the display. First rotate the WEC up (to the left). For standard thin resists, contact position will be around “16”.

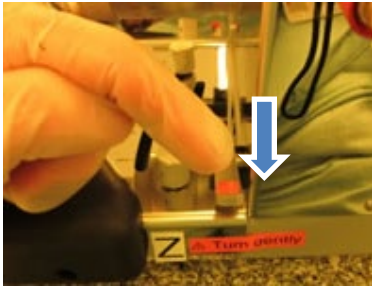


- Then the display will ask “Adjust WEC to the right <down> until ok”. Rotate the WEC to the right until you get the following message: “WEC setting OK”.



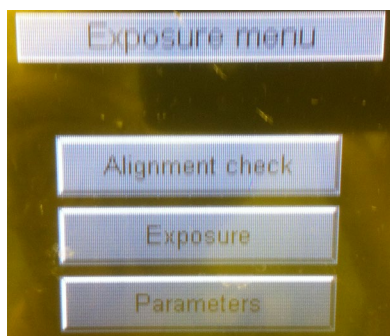
- To complete the WEC procedure, take the contact lever to “starting” position. The display

will turn back to the main menu.



## 6. Alignment & Exposure

- Once the WEC procedure is done, the MJB4 is ready for alignment & exposure. Load the wafer in contact with the three positioning pins, and push the slide at the back of the machine.
- Make sure that the “alignment gap” lever is at the upper position (Contact mask/wafer).
- Turn the contact lever slowly and very gently to move the wafer up to contact position. The display will switch to “Exposure menu” and show three options:
  - Alignment check:** to perform hard-contact before exposure and check alignment accuracy.
  - Exposure:** to expose directly (first mask exposure).
  - Parameters:** to modify the exposure parameters.



- To perform a top-side alignment (TSA), make sure that microscope illumination is on (knobs turned fully right).

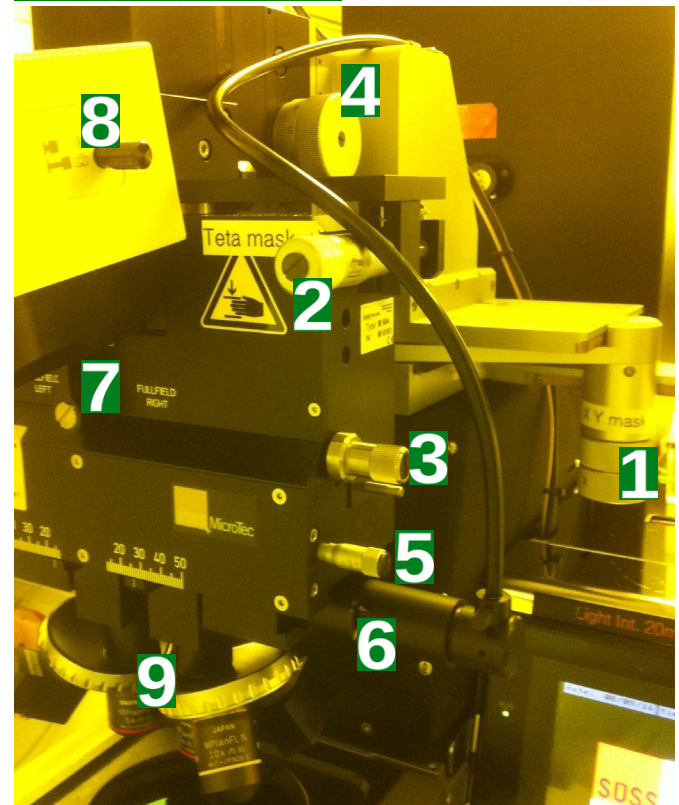


- Use the binoculars or the TV screen display to visualize the mask. Make sure “SPLITFIELD”

mode is activated on the microscope (see [7] 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:

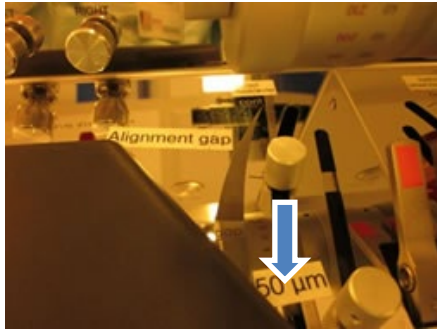


- 1** = x- / y- stage movement
- 2** = Theta axis / rotation
- 3** = intra-objective distance (one on each side)
- 4** = Coarse z-axis / focus (one on each side)
- 5** = fine objective focus (one on each side)
- 6** = illumination attenuation (one on each side)
- 7** = Splitfield mode
- 8** = Screen or binocular view
- 9** = objectives turret (manual change)

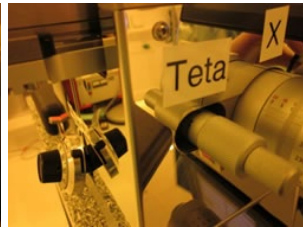
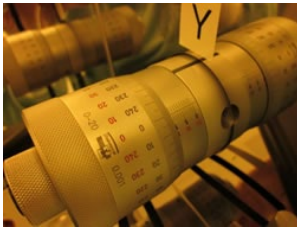
- Before moving the wafer, separate mask and wafer using the alignment gap lever. Taking the lever completely down will move the wafer



down to an alignment gap of about 50  $\mu\text{m}$ .



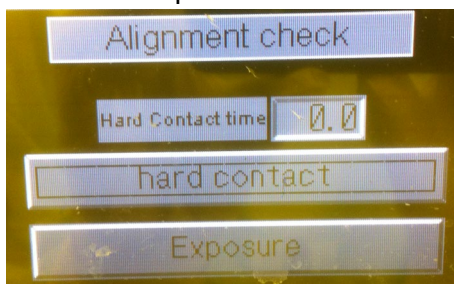
- Move the wafer using x-axis, y-axis and  $\theta$ -axis knobs in order to find the markers on the wafer.



- Move the wafer markers under the mask markers. Align precisely horizontal features on the right and left fields using the y-axis and  $\theta$ -axis knobs.
- Finish the alignment with fine-tuning of the x-axis.
- When alignment is done, move the wafer back in contact using the alignment gap lever.



- On the MJB4 touchscreen, pressing “Alignment check” will perform the selected contact procedure (hard, soft). If alignment is good, move on with “Exposure”.



- Pressing “Exposure” and confirming with “YES” will perform the exposure.

- Wait for the end of the exposure procedure, open the contact lever and pull the slide to 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 13 accounting computer.