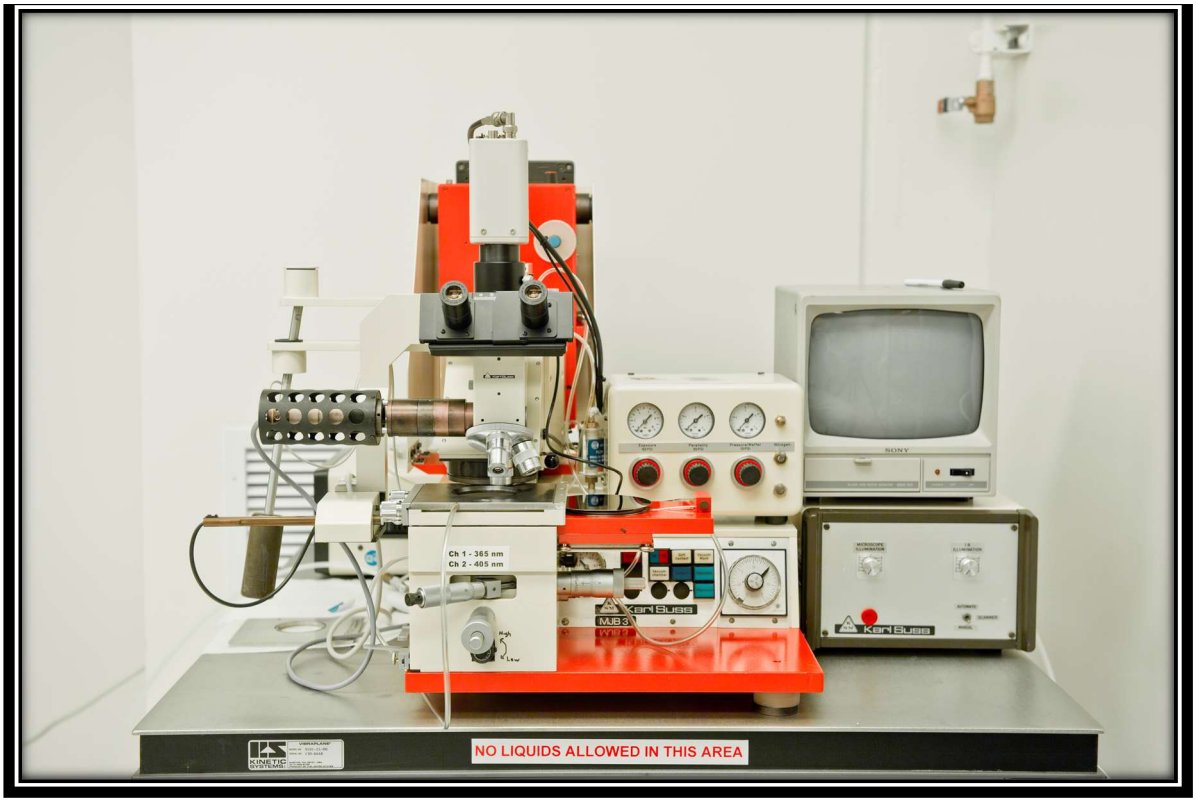
University of Pittsburgh

Nanoscale Fabrication & Characterization Facility

Suss MJB-3 Mask Aligner Users Guide



The Mask Alignment Systems are integrated optical-mechanical, pneumatic-electrical systems, which allow accurate alignment of sensitized semiconductor wafers or substrates with a mask and exposes them to ultraviolet radiation to transfer the pattern of the mask to the substrate for further processing in an effort to produce a semiconductor or other microelectronic device. The Mask Aligners consists of several coordinated, inter- related systems including the substrate loading, holding and unloading system; the mask supporting system; the substrate/mask/scan/align/lock system; the viewing system (microscope and illuminators); and the exposing system.

Operation Procedure:

1) Log into FOM.

2) Turn on the compressed air, process N2 and vacuum by opening the facility valves on the wall. The compressed air and N2 are located to the right of the machine and the vacuum is located to the right of the pass-through.

3) Turn on the mercury lamp power supply and allow it to go through the initialization process. Once the display shows "rdy" press the start button. The display will blink "cold". Once the lamp is ready the number of watts will be displayed. If it does not read "cold" after ignition, wait 1 minute and press start again. If it does not read "cold" or watts the lamp is not on.

4) Press the desired channel button for lamp intensity control: There are three options.
   a. CP "constant power" and preset to 275 Watts.
   b. Channel 1 "Cl1" is set to 14 mW/cm2 @ 365nm.
   c. Channel 2 "Cl2" is set to 25mW/cm2 @ 405nm.

5) Once the power supply is on, turn on the power strip on the side of the table. This provides power to everything except the lamp. Note that if you power the MJB3 on before the lamp power supply, it will not work.

6) Turn on the mask aligner by pressing the power button on the front of the aligner.

7) Make certain the desired chuck and mask holder is installed. If you need help installing a different size configuration or require the backside alignment configuration ask NFCF personnel to help you.

8) Place the mask onto the groove side of the mask holder in the desired position. Press the mask vacuum button on the control panel and ensure that the mask is held into position. Remember to mount the mask pattern side down so that it may be as

close as possible to the surface of the wafer to be patterned.

9) Place the mask holder onto the aligner and tighten the holder into position with the left side knobs. Be careful while flipping it into position so as to not drop the mask.

10) Use the microscope and the display monitor to focus on the mask. The illumination may be adjusted with the knob on the front of the controller.

11) Place the wafer to be patterned onto the wafer chuck. Select standard or high-pressure contact via the ST/HP button. The HP feature creates a vacuum between the mask and the wafer.

12) Slide the wafer completely to the left and position it under the mask. Make certain that there is clearance under the mask. If not, lower the "Z" axis to allow plenty of space.

13) Rotate the contact lever to allow the wafer to lift into contact with the mask. Verify the contact pressure is not to high. If it is creating too much pressure, stop and lower the "Z" axis. Slowly adjust the "Z" axis until resistance is felt and then back off slightly. Check the contact between the wafer and the mask by cycling the stage lever and observing the contact. Be careful not to apply too much pressure or the wafer and/or mask may bow or break.

14) Once contact has been verified, use the separation lever to separate the mask from the wafer. This produces a calibrated 50um gap to allow movement of the wafer with respect to the mask.

15) Align the wafer to the mask using the microscope to view the alignment marks. Use the theta, x and y micrometer adjustments to perfect the alignment. Use the "joystick" to adjust the viewing position of the microscope. Hold the top button for X

(left/right) or press the bottom button for Y (front/back) motion and press both simultaneously to move the microscope freely.

16) Rotate the separation lever to allow contact again. The contact light should illuminate.

17) Adjust the "Z" axis upwards and verify contact resistance.

18) You can now press the chamber vacuum button to hold the wafer to the mask. Verify the alignment. This will happen automatically during the exposure during the HP process but the button allows the user to see the effect of the vacuum on the alignment.

19) Set the timer for the exposure that is required by the individual photo resist that you are using. Remember to set the number and the scale to insure the correct exposure time.

20) Once you have verified there is nothing in the way, press the exposure button. The lamp will move into position and perform the exposure. Avoid exposure of the UV light to your eyes during process.

21) Rotate the contact lever to release the wafer from the mask.

22) Slide out the vacuum chuck and remove the wafer.

23) Remove the mask holder. Turn off the mask vacuum and remove the mask.

24) Turn off the power to the Suss and the lamp. Allow the lamp to cool for 5 minutes and then turn off the N2 Compressed Air and the vacuum with the valves on the wall.

25) Shut down the power strip.

26) Log out of FOM

Backside Alignment:

1) If backside alignment is required contact the NFCF staff at least 24 hours prior to usage so that the unit may be converted.

2) Insure that the lamp N2 purge valve is open. The control needle valve is located on the right hand side of the manometer box directly across from the pressure gauges.

3) Follow steps 1-14 of the directions for top alignment to set up the contact for ST exposure. Remember that to perform backside alignment you can use the standard (ST) mode only!

4) Open the vacuum valve at the lower right rear corner of the alignment stage.

5) Move the scanner toggle switch on the electronics control module to the "automatic" position. The IR lamp should move into position under your sample automatically,

6) Turn on the control knob for the IR lamp. Use the foot pedal to turn on the lamp. The light intensity can be adjusted with the knob on the front of the electronics module.

7) Use the camera and the monitor to align the features on your sample by using the IR lamp to see through the wafer. The brightness and contrast may need adjusting on the monitor for the best viewing conditions.

8) Using normal microscope lighting may also be useful to verify alignment depending on the sample.

9) Follow steps 15-20 of the normal procedure to set up and complete the exposure.

10) Turn off the IR intensity and return the scanner switch to the manual position. The lamp should pull back from the chuck.

11) Turn off the lamp purge and the vacuum valve for the backside alignment chuck.

12) Follow steps 22-28 to complete the procedure.