

SOP for Karl Suss MJB3 #1 Mask Aligner

Rev. 5 (30/11/2016)

Safety

- **UV Exposure:** The high-energy light produced by the high-pressure Mercury Xenon lamp can cause eye damage and skin burns. Be sure that the light guards around the exposure area are not removed, and the high-pressure lamp and exposure path are enclosed. Do not look directly at the mask during exposure.
- **Ozone:** The high-pressure lamp produces ozone, which can result in pneumonia-like symptoms. These effects are cumulative. The lamp may only be “on” when the HEPA air flow is “on”.
- **Lamp Explosion:** If you suspect that the UV Lamp has exploded, evacuate the room immediately and notify NRF Staff.
- **High Power:** The MA6 mask aligner uses ignition voltages of 30kV and operating voltages of 180V, with currents of 5 to 30amps. Ensure that the power line is disconnected before any system maintenance.
- **Moving Components:** Users should be aware *at all times* of the moving components associated with this tool. For instance, the topside microscope assembly moves up and down and presents a potential hazard. The users must exert caution *at all times* to ensure that a limb, finger, or article of clothing does not become trapped or entangled (or worse, violently detached) when components of the machine are in motion.

Description

The Karl Suss MJB3 Contact Aligner system can perform precision mask-to-wafer (sample) 1:1 contact printing in hard contact mode. It can accommodate exposure of irregularly shaped substrates and standard wafers up to 3”.

Features:

- Contact 1:1 aligner.
- DUV and IR capability
- Approximate exposure intensity: 8 mW/cm² at 365 nm, 12 mW/cm² at 405 nm.

1. Turning the System ON

1. Verify that the system has compressed air and N₂ pressure. The gauges should read as shown in Figure 1. The compressed air is necessary for flexible movement of microscope during exposure and N₂ is used to purge the exposure lamp.



Figure 1. Pneumatics control box Pressure readings are (from left to right): 4 bar, 2 bar, and 1 bar.

2. Turn the vacuum pump on using the red toggle switch at the rear of the table. The vacuum is needed to hold the mask on the mask holder.

Illuminator Mercury Arc Lamp Power On/Off Policy

The power for the mercury arc lamp and the main aligner should always be simultaneously ON or OFF. The lamp hour timer is on the left side of the aligner.

The mercury arc lamp must be left ON if you know it will be used within the next 2 days. If not, power it off along with the main tool power. It should always be powered off after the last class of the week.

3. If the mercury arc lamp power supply is already powered on, the red LED indicator will display the wattage as shown in Figure 2. In this case, proceed to the Operation instructions.

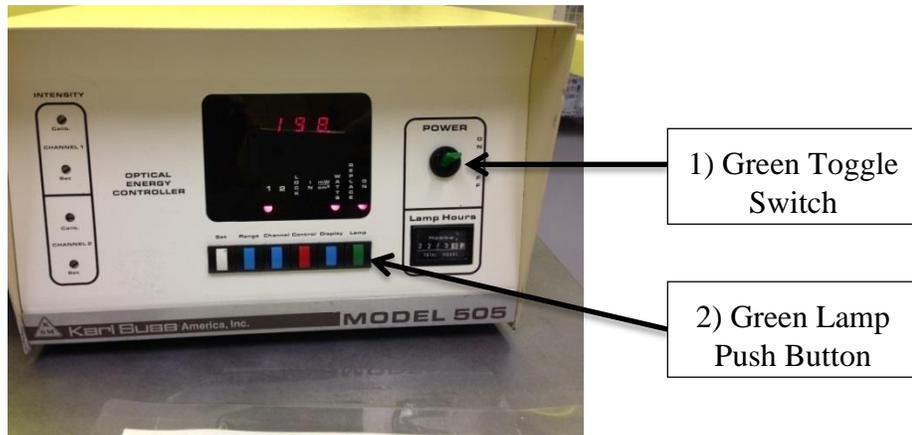


Figure 2. Arc lamp power supply.

4. Before turning the arc lamp ON, verify that the power to the aligner is OFF (black toggle switch on the control panel shown in Figure 3).
5. On the arc lamp power supply unit shown in Figure 2, turn the green toggle switch ON. Wait for 10 seconds. Then depress and hold the green “lamp” push button switch for 5 seconds. *Please log date and time when turning the lamp on. The notepad is next to lamp power supply.*
6. Switch ON the main aligner power toggle switch located on the aligner control panel (see Figure 3).

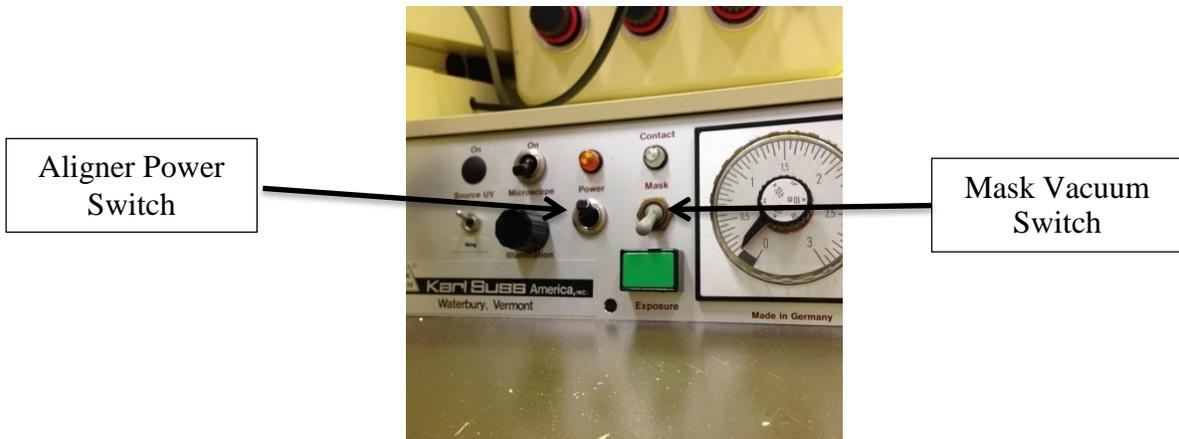


Figure 3. Aligner control panel.

2. Operation

1. Verify that the mask holder vacuum line is connected to the mask holder and place the mask (**chrome side up**) centered on the vacuum port. If exposing multiple layers on this aligner, be consistent in the mask placement.
2. Flip the gray vacuum toggle switch labeled “Mask” on the aligner control panel (see Figure 3) and verify the mask cannot be moved.
3. Turn the mask holder over and slide the holder into the dovetail mask holder groves. Slide it **all** the way in. Clamp the mask holder in place by tightening the mask holder

clamping knobs (see Figure 4).

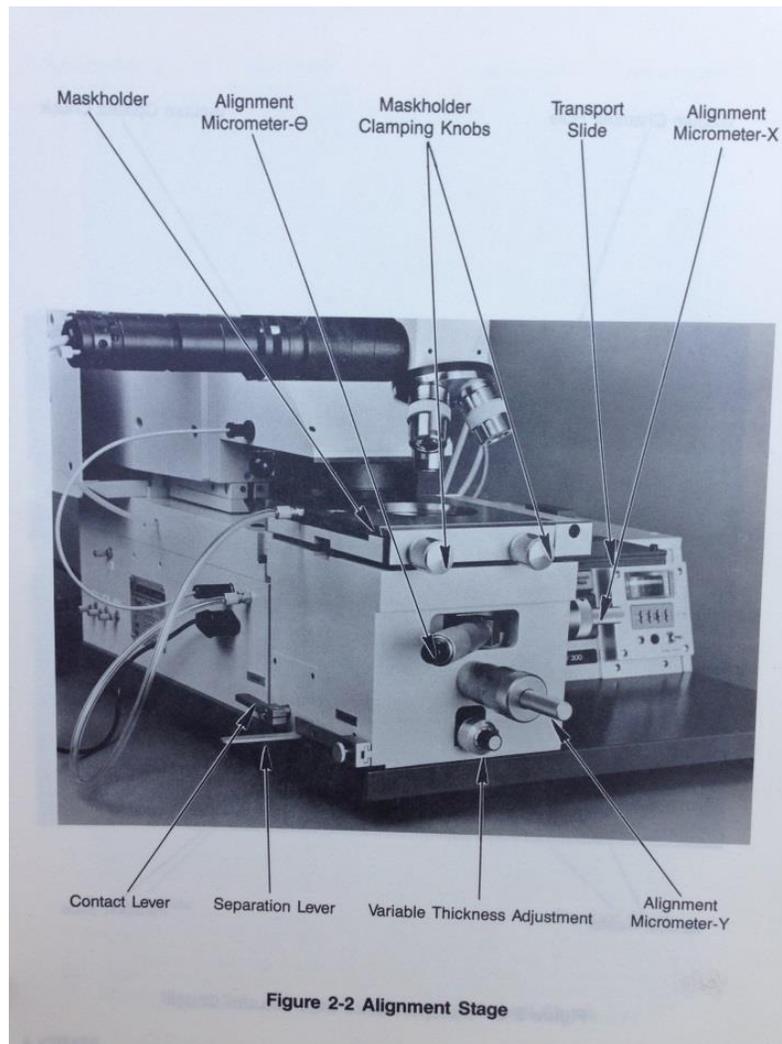


Figure 4. Mask Aligner assembly.

2.1. Sample Alignment

1. Turn the microscope turret by hand to the 5X objective. Make sure it is centered in the “detent” position.
2. Slide the “Separation Lever” (see Figure 4) forward, out of the “Contact” position. This lowers the sample approximately 100 μ m from the mask for alignment.
3. The microscope is moved around using the long joystick arm on the left side of the aligner. It is equipped with pneumatic brakes for both X and Y axis. Depress the red buttons (top is Y, bottom is X) on the handle to release the brake and move the microscope around, see Figure 5.



Figure 5. Microscope Joystick handle

4. Position the 5X objective over an area of your mask that you know contains exposure features.
5. Looking through the microscope objectives, focus on the mask using the focus knob (see Figure 6).

***NOTE:** This single knob controls both course and fine focus. It is initially always in the fine mode and is easy to turn. Normally, the fine mode is sufficient. However, if you need to switch to the coarse mode, keep turning the knob past the point where it feels like it is at the end of travel, i.e. the coarse focus is much harder to rotate.*



Figure 6. Microscope focus knob

6. Move the microscope to a mask alignment mark. Preferably, on the far-left side of the mask.
7. Sample alignment is done using Alignment Micrometers X,Y and Θ . For X and Y, the smaller diameter knob (long part sticking out from the micrometer) is for “coarse” movement and the larger graduated knob is for “fine” movement. The Θ micrometer has only one knob.

WARNING: the sample must NOT be moved with the “separation lever” toward the front of the aligner i.e. when the “contact” light comes on. Moving the sample while in contact with the mask will scratch the photoresist and contaminate your mask.

8. Locate an alignment mark on the far left side of the mask that will have an accompanying sample mark to align. This of course depends on the size of your sample. Align the sample using the X and Y micrometers.
9. Release the X microscope brake (lower button) and move to an alignment mark at the

same relative position on the other side of the mask. Using the Θ micrometer, move the sample “half” the distance between the present location and the alignment mark...i.e. don't actually align it. We are correcting for rotation about the center axis of the sample. Readjust X and Y alignment on right side. Move back to the mark on the left side of the mask and adjust Θ again, half the distance. Repeat this process until sample rotation is removed.

10. The accuracy of alignment may be improved by increasing magnification with the 32X objective providing the best alignment. Higher magnification corresponds to a lower focal depth so it will be more difficult to focus on the mask chrome and the sample marks at the same time. You will need to readjust microscope focus often. You can use the “separation slider” to bring the sample closer to the mask. It's best to make corrections and then slide the “separation lever” forward to make contact and see the actual result. When happy with alignment, leave the sample in contact (lever forward) and recheck all alignments left/right sides of the mask.

WARNING: Each time you move the sample into contact with the sample, rotation may change. It must be re-checked.

11. Set the exposure time:

- Set the time multiplier using the small black knob in the center of the timer, see Figure 7. The multiplier to be used is at the 9 o'clock position. For example, in Figure 7 the multiplier is set to seconds.
- Set the desired time using the outer big knob.

12. Press the green “Exposure” button to expose the sample. Stay clear from the tool since part of the mask-aligner moves to expose the sample.



Figure 7 Exposure time dial

13. Rotate the “contact lever” over toward the back of the aligner and move the separation lever back toward you (see Figure 4). Carefully slide the sample out.

14. Slide the mask back out of the tool by releasing the mask holder clamping knobs. Place the mask holder on the table with mask up and turn off the mask toggle switch to release the mask. At this point you can power off the vacuum pump (see Figure 3)

Note: Avoid turning off the vacuum pump before removing the mask from the aligner or the mask will fall and be damaged.

15. Leave all power to the aligner ON when done unless you know it will NOT be used within the next 48 hours. In the latter case, power the aligner and the lamp OFF and log the date and time on the log sheet next to the lamp. See section 1 for instructions.