

University of MN, Minnesota Nano Center

Standard Operating Procedure

Equipment Name:	KARL SUSS MJB3	Revision Number:	2
Badger Name:	mjb-3	Revisionist:	Paul Kimani
Model:	MJB3	Date:	October 29, 2013
Location:	Chase 4		

1. Description

- a. The MNC Karl Suss MJB3 exposure system is an optical contact aligner. It is currently only used for alignment but not for exposure. The exposure mode is disabled.

2. Safety

- a. The only safety concern is the system uses electricity.

3. Restrictions/Requirements

- a. Must be a qualified user on mbj3

4. Required Facilities

- a. Nitrogen gas
- b. House vacuum

5. Definitions

A. FRONT CONTROL PANEL

- a. **POWER Button** - Pressing the POWER button switches on the mask aligner. When the machine is powered, the **POWER** button is illuminated. Do not turn off the machine, it should always stay **ON**.
- b. **CONTACT indicator:** The **CONTACT** indicator is illuminated whenever both the contact lever and the separation lever are in the contact position. The substrate is then in contact with the mask. It is not possible to perform alignment when the **CONTACT** indicator is lit.
- c. **SEPARATION indicator:** This indicator is illuminated when the contact lever is in the contact position and the separation lever is in the separation position. The substrate is then separated from the mask by a small distance to allow alignment to be performed.
- d. **EXPOSURE button:** Pressing the **EXPOSURE** button should initiate exposure, but this option is disabled.
- e. **VACUUM MASK button:** Pressing the VACUUM MASK button switches on the mask vacuum at the mask holder and illuminates the button. In order to avoid damage to masks which may inadvertently be left in the machine, the mask vacuum is always on whenever the machine power is **OFF**.
- f. **VACUUM CHAMBER button:** In the vacuum contact (HP) mode, the vacuum between mask and substrate is automatically pulled immediately prior to exposure. However, it is possible to check the alignment with the mask and substrate in vacuum contact prior to making an exposure. This feature is particularly useful when using high magnification objectives with restricted depth of focus. Simply press the **VACUUM CHAMBER** button after moving the substrate to the contact position using the separation lever (**CONTACT** indicator illuminated), and the vacuum will be pulled. You may release the vacuum by moving the separation lever to the separation position.
- g. **HP/ST button:** Used to select either vacuum chamber exposure mode (HP) or standard exposure mode (ST). The appropriate indicator light is illuminated to indicate the exposure mode selected.

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- h. **SOFT CONTACT Button:** Used to select soft contact exposure mode. In this mode the substrate is pressed against the mask only by mechanical pressure during exposure. The vacuum under the substrate remains on. To select soft contact exposure mode, the HP/ST button must be in the ST position.
- i. **EXPOSURE TIMER:** Not applicable.
- j. **NITROGEN LOSS button and alarm:** Not applicable.

B. ALIGNMENT STAGE

- a. **TRANSPORT SLIDE:** The transport slide is located near the top of the stage at the right side and is used to transport the chuck and substrate from the loading position into the stage.
- b. **ALIGNMENT MICROMETERS (X-, Y- and Theta):** The Y- and Theta alignment micrometers are located on the front of the alignment stage while the X- micrometer is mounted on the right side. They are used during alignment to move the substrate in relation to the mask. The X- and Y- micrometers have both coarse and fine adjustment. The range of adjustment in X- and Y- is 6.0 mm and the pitch of the micrometer lead screws is 1.0 mm (coarse adjustment) and 0.05 mm (fine adjustment). The Theta (rotation) micrometer has a range of 30 with a pitch of 0.25 mm.
- c. **CONTACT LEVER:** The contact lever, which controls the Z-axis movement of the chuck, is located at the lower left side of the stage. After inserting a chuck and substrate into the stage using the transport slide, the contact lever is used to bring the substrate into contact with the mask for parallelism compensation.
- d. **SEPARATION LEVER:** The separation lever is also located at the lower left side of the stage. This lever is used to move the substrate in and out of contact with the mask in order to perform alignment, once the contact lever has been engaged.
- e. **MASK HOLDER:** The mask holder is securely clamped in the mask holder frame on the top of the stage using two knurled knobs. It is removed and reinserted into the mask holder frame from the left side of the stage.
- f. **VARIABLE THICKNESS ADJUSTMENT:** The variable thickness adjustment is located on the front of the stage immediately below the Y-micrometer. If substrates or masks of different thicknesses are to be used, this thickness difference must be compensated for, using the variable thickness adjustment.

6. Setup

7. Operating Instructions

A. POWER ON

- a. Make sure the air pressure and nitrogen on the front of the manometer box are on and the vacuum in back is on. Make sure the power on the main machine is on.

B. LOADING

- a. Blow any unwanted particles off your mask with the nitrogen gun.
- b. Loosen the knurled knobs on the main unit and slide out the mask holder. Turn over the mask holder so the vacuum ring faces up. Place the mask completely over the vacuum ring with the emulsion/chrome side up.
- c. Now press the MASK VACUUM button to activate the vacuum.
- d. Reinsert the mask holder into the stage assembly and tighten the knurled knobs.
- e. Slide out the chuck platform. Place the substrate on the chuck and gently slide it back in.

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- f. Raise the chuck by pushing the contact lever away from you making sure the separation lever is in its rear most position. Watch and make sure the wafer won't come in contact with the mask before the lever is pulled all the way back. If you think it will, bring the chuck back towards you and lower the chuck by turning the variable thickness adjustment knob. Then raise the chuck again, watching the wafer. If it doesn't come in contact this time, push the contact lever all the way back, and the contact button on the control panel will become illuminated. This does not mean that your wafer and mask are in contact, however, because this button will light whenever the lever is all the way back. With the contact lever forward, turn the variable thickness knob to the left and then try to move it to the rear again until you feel it tighten just a little. There is no need to force it! You want the contact lever to have a slight amount of extra resistance just as it is being pushed to its rear most position.

C. ALIGNMENT

- a. Pull the separation lever towards you to separate the wafer and mask. The maximum separation stroke is 30 microns.
- b. Turn on the microscope. Focus on the mask/wafer using the focus knob located behind the eyepieces.
- c. Microscope movement is controlled by the swing on the side of the unit. To move it, push top or bottom button located on the arm, and direct the microscope. The top button is front/back, and the bottom button is right / left.
- d. To align the wafer to the mask, use the silver X-, Y-, and theta knobs.

D. EXPOSURE

- a. Not applicable

E. Finishing up

- a. Remove the mask holder. Turn off the mask vacuum and remove your mask. Replace the mask holder. Turn off the microscope illuminator!

8. Problems/Troubleshooting

- a. The image not bright enough?
The brightness on the lamp is controlled by the knob besides the lamp on/off switch; just turn the knob to a higher level. Beware not to turn it too high as the bulb might burn out if it is turned beyond the 3rd click.
- b. Cannot turn theta enough?
Make sure the stage is straight before loading your sample and check that your sample is close to being straight if you can tell if it is before loading it under the mask.
- c. The sample is stuck to the mask?
If the sample is stuck on the mask, carefully return the chuck under the mask, as it might release (fall) from the mask in a few seconds. If it stays on the mask carefully remove the mask holder with the wafer. Have your hand under the mask holder as the wafer might drop free. If the wafer is still stuck on the mask, turn the mask holder upside down to have the wafer the top-side of the mask and slowly remove the wafer from the mask. Be carefully not to scratch the mask. After removing the wafer, check the amount of pressure forcing the wafer onto the mask.