

# Suss Microtec MJB4 Mask Aligner Operating Procedure

## 1. General Perspective

This document describes the basic operating procedure to perform contact UV exposure for photolithography.

### 1.1 General Safety Precautions

1.1.1 Do not perform any work that you are not specifically trained to do.

1.1.2 Never look directly at the UV light, which is harmful to the eyes.

### 1.2 Process Failure

If a problem that is not covered in this document occurs:

**Do not try to fix or adjust anything by yourself.**

1.2.1 Hold all work affected by the problem.

1.2.2 Report the problem to SYSTEM OWNER OR OMSCIENTIFIC staff immediately

1.2.3 In case of a lamp explosion, lamp breakage or any other danger, turn the main switch to “OFF”, leave the room and close the door immediately.

## 2. System Description and Specification

The MJB4 Mask Aligner can perform contact UV exposures for a variety of sample and mask sizes. Sample sizes that can be accommodated range from small pieces to 4 inch wafers. It can be used with masks of up to 5 by 5 inches. The maximum combined thickness of the substrate and mask is 9 mm. The achievable position alignment accuracy is  $\sim 1 \mu\text{m}$ . The MJB4 allows 1  $\mu\text{m}$  resolution in vacuum contact mode. The tool has 5 different contact modes (proximity, soft, hard, low vacuum, and vacuum), and three different exposure modes (flood, first, and align and expose).

## 3. Operation

### 3.1 Open CDA, N2 and vacuum line:

3.1.1 . Open the main valve of **Nitrogen cylinder** gas line.

Notes: Turn on the lamp without gas flowing might cause the explosion of the Hg lamp and damage the system permanently. Turn on the switch of **vacuum line**. The machine should have the following pressure values:

- **Compressed air: 5.5 bar**
- **Nitrogen: 1.5 bar**
- **Vacuum: -0.8 bar (0.2 bar absolute)**
- **Vacuum chamber indicator value > 0.1**
- **WEC pressure: 0.05 - 0.1**

### 3.1.2. Power on the system:

- Turn the main switch clockwise to “ON” and press the “Electronics ON/OFF” button. The start page appears in the display. It takes about 5 seconds for the system initializing. Then press “=>” on the lower right of the touch screen to open the **MAIN MENU**.
- On the **MAIN MENU** screen, press and hold the button “Maskvacuum is on”. Note: the button has to be pressed and hold for  $\sim 10\text{sec}$  until it changes to “Maskvacuum is off” after beeping once.
- Check and make sure all “Air”, “Nitrogen”, and “Vacuum” showing “OK” on screen. **If**



**NOT, stop here and inform for help!**

### 3.1.3 Igniting the exposure lamp (Controller CIC1200):

- The CIC1200 controller will be powered on automatically once system is powered on. Wait until “STAND BY” show on the alphanumeric display and make sure all “Air”, “Nitrogen”, and “Vacuum” showing “OK” on the **MAIN MENU** screen (see step 3). Then press the key “ON” in the control panel of the CIC1200. Wait until “READY” show on the alphanumeric display.
- Press the key “CP”. Wait until “=>>START” shows up.
- Press the key “START”. The display shows “LAMP COLD” and in the annunciator group FAILURE the LED of LAMP LIFE/POWER is flashing until the lamp reaches the operating condition. Wait until the completion of the warm up sequence and the real value of the power of the exposure lamp shows up (**350W** ).

**Note: The machine will warn users by beeping if it does not work properly.**

**In case it happens when the lamp is on, turn the main switch to “OFF”, leave the system as it is and report to specialist immediately.**

### 3.1.4 Loading the mask:

**Caution! Before loading or unloading a mask, the microscope must be moved to the “up” position. This is accomplished by pressing the MICROSCOPE IS DOWN button on the computer screen. The tool will beep, the display will change to MICROSCOPE IS UP and the microscope will move to the “up” position.**

- Loosen the knurled knobs on the side of the mask holder frame and slide out the mask holder. Turn over the mask holder so that the vacuum ring faces up. (Blow any unwanted particles off your mask with the nitrogen gun before loading if necessary.) Place the mask completely over the vacuum ring with the emulsion/chrome side up.
- Adjust the mask to the proper position. Press the button “Mask vacuum is off” once. The mask will stick to the holder.
- Turn over the mask holder so that the mask is facing down. Slide the holder back to the frame with the mask and tight the knurled knobs with fingers.

### 3.1.5 Loading the sample:

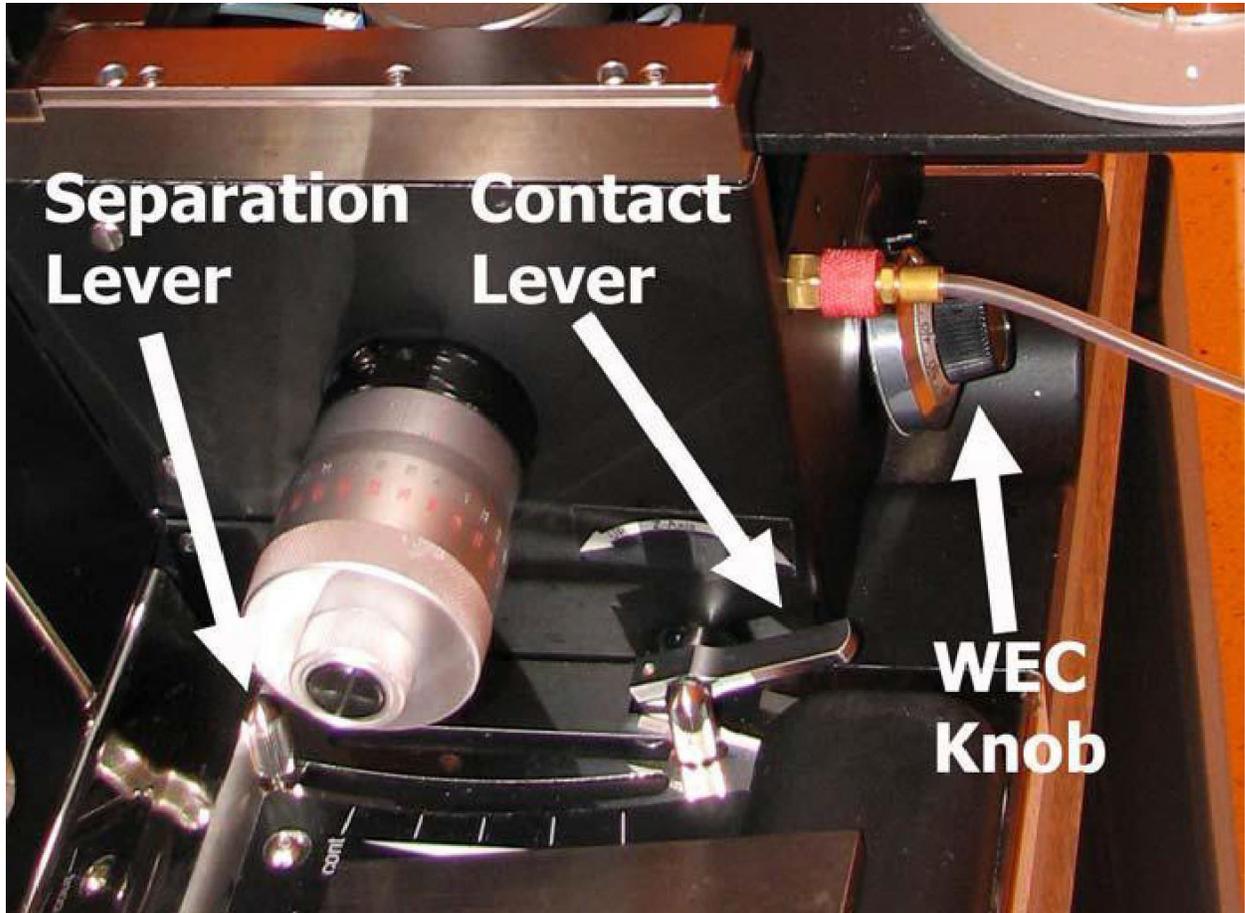
- Pulling out the transport slide gently until it stops. Put the sample on top of the chuck.
- Press and hold the hand valve on the front right side of the transport slide to switch on the transport vacuum and carefully insert the slide back until it reaches the end stop.

### 3.1.6 Setting the mask sample thickness:

In order to achieve best result, the WEC SETTING needs to be reset for a new sample or if the thickness of masks/substrates changes.

- On the **MAIN MENU** screen, press the button “Setting” to setting menu and then press the button “WEC SETTING”.
- Unlock the level adjustment knob by putting the small black switch on the knob to upper position. Lower the sample by turning the knob counterclockwise to ‘10’mm position.

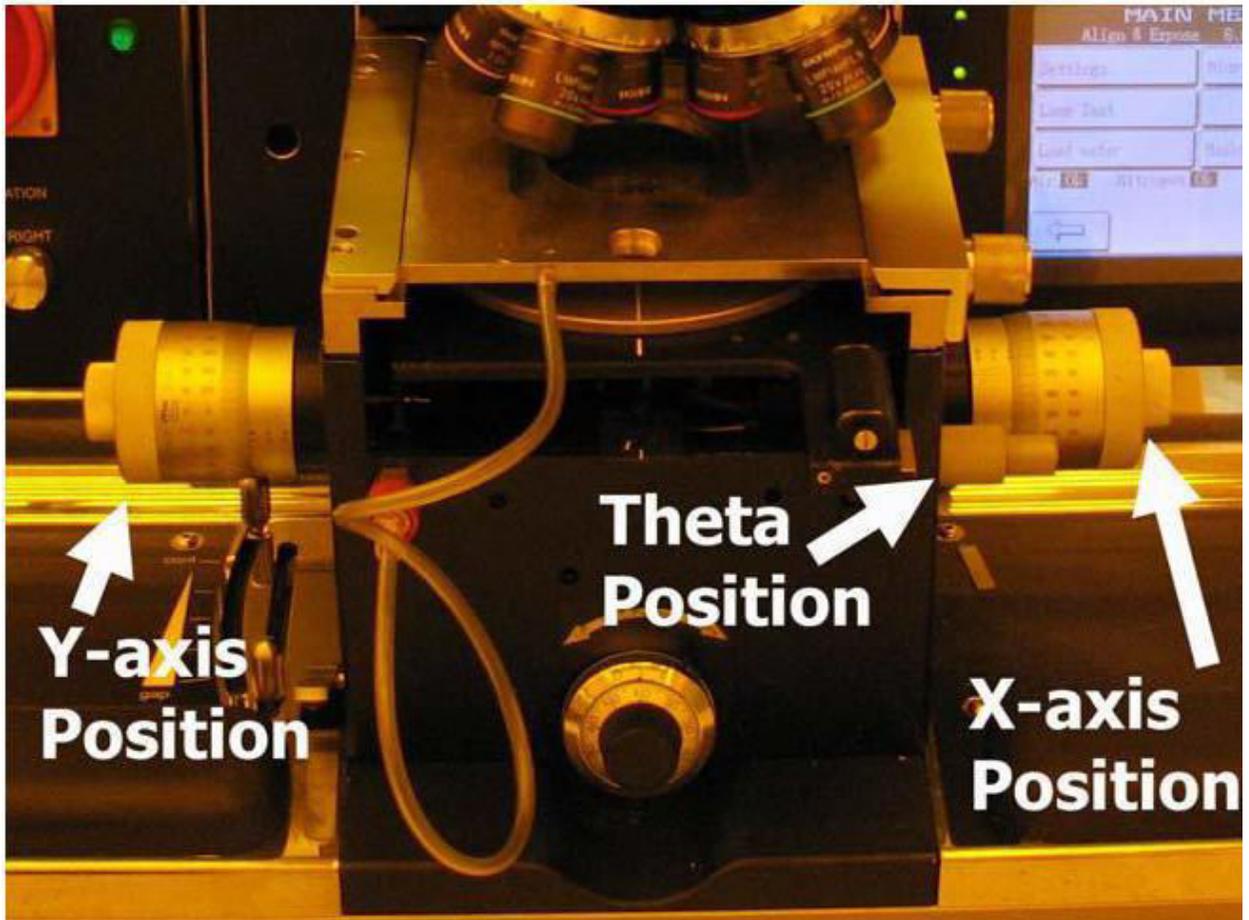
- Raise the sample by gently pushing the contact lever forward until it stops. Note: this should be a smooth process. If you feel resistance when pushing the handle, pull it back and double check the position of the sample holder. Make sure the marks are aligned. Do NOT violently push the handle. It could cause permanent damage of the system.
- Upper the sample by turning the knob counterclockwise slowly and carefully until message “Move WEC setting two turn CW down now” shows on the screen. Turn the knob counterclockwise with two turns until message “WEC setting ok” shows on screen. Lock the level adjustment knob by putting the small black switch on the knob to lower position.
- Lower the sample by pulling the contact lever backward. Press “=>” on the lower right of the touch screen to switch back to the MAIN MENU.



### 3.1.7 Adjusting the sample position:

- Raise the sample by pushing the contact lever forward. Note: the TSA microscope will lower to focus level and the screen will switch to exposure window automatically.
- The objectives can be moved to the align masks / interesting structures with the manipulator in the X and Y direction (The travel path is  $\pm 40\text{mm}$ ). The brightness can also be adjusted using the right potentiometer on the left front plate if necessary.
- Do focus on mask by using the TSA Z motion located behind the TSA microscope.
- **Lower the sample to the separation level** with the separation level knob. Then adjust the sample position by using the X, Y and Theta micrometer screws on the adjusting table (The travel path is  $\pm 5\text{mm}$ ).

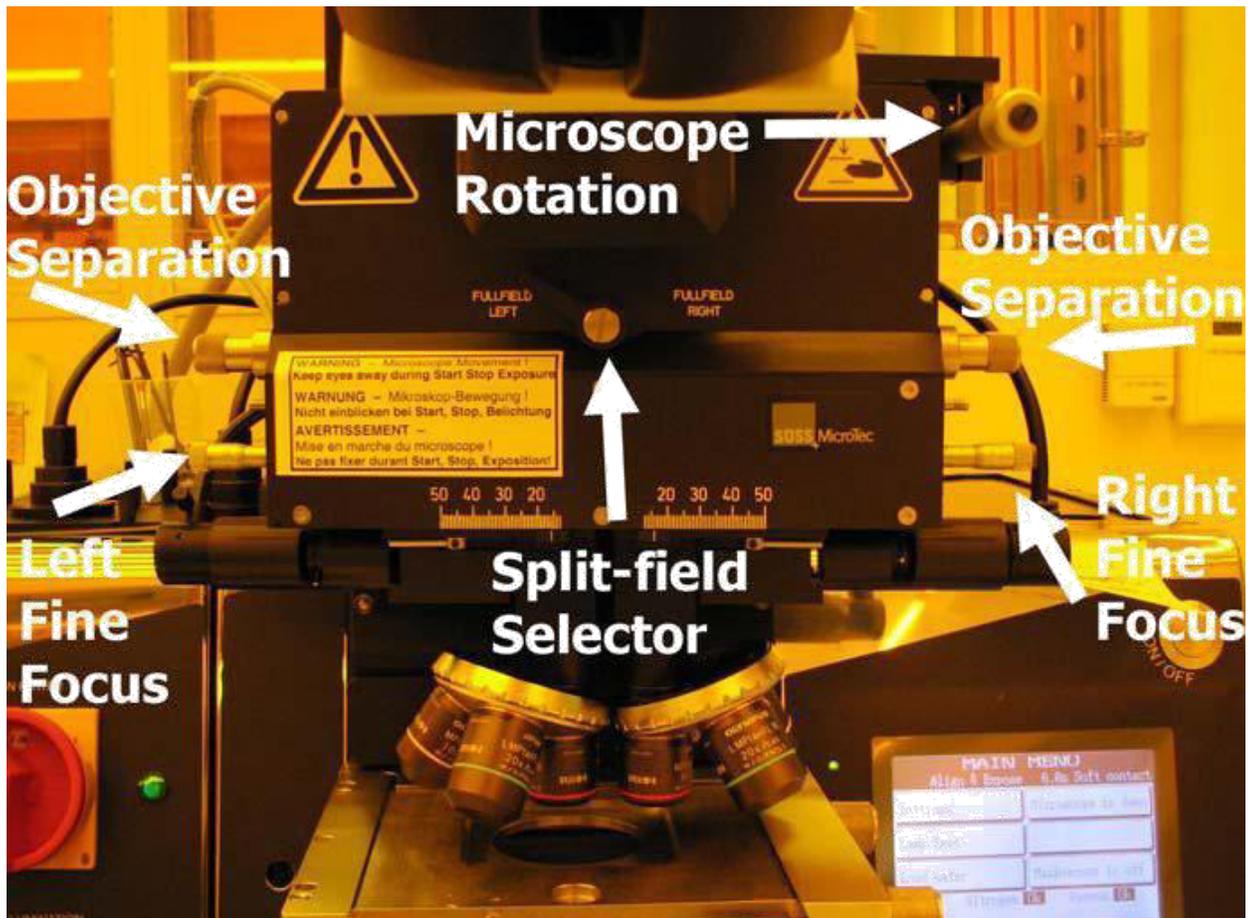
**Attention: Never adjust the sample if the mask and sample are in contact! Doing so will damage the mask and the sample.**



### 3.1.8 Align the TSA Microscope with mask.

- The left, right, or both microscope objectives can be viewed in the eyepieces by using the SPLIT-FIELD SELECTOR directly under the microscope eyepieces.
- Set the lamp brightness using the LEFT and RIGHT MICROSCOPE ILLUMINATION controls on the left front plate. There are yellow filters on the lights, so that it does not expose the photoresist.
- Focus on the mask using the COARSE FOCUS KNOB, located behind the TSA microscope.
- Fine focusing is set separately for each objective on the microscope. To do this, use the OBJECTIVE FINE FOCUS knobs for each objective.
- Move the microscope using the POSITION ADJUSTMENT knobs so that one of the mask alignment marks is in view. If necessary, change the SPLIT-FIELD SELECTOR to “both”, and then adjust the OBJECTIVE SEPARATION so that the second mask alignment mark is in view. If necessary, adjust the microscope rotation with the MICROSCOPE ROTATION micrometer.

**DO NOT FORCE ANY KNOBS IF THEY ARE NOT MOVING. YOU MAY HAVE REACHED THE END LIMIT OR SOME OBSTRUCTION IN THE MECHANICAL MOVEMENT. CALL FOR HELP.**



### 3.1.8 Setting exposure values:

- Raise the sample back to the contact level with the separation level knob. The screen will change to exposure window automatically.
- Active EXPOSURE SETTING window by press EXPOSURE VALUE button. You can set the exposure parameters through touch screen. Note: Normally the Pre vac time and Full vac time can be set as 10 sec. The exposure time depends on different resists.
- Press “=>” on the lower right of the touch screen to switch back to the exposure window.

### 3.1.9 Exposure:

- Press EXPOSURE button to perform the exposure. Note: You must press YES again on the display to confirm the exposure. The system will start the exposure procedure.  
**Attention: The microscope will move at this step. Keep yourself away from the front of the machine.**

### 3.1.10 Unloading the sample and the mask:

- Wait until the exposure procedure finishes and message “unload sample” appears on the screen.

- Lower the sample by pulling the contact lever backward. Note: the TSA microscope will be lift up from focus level and the touch screen will switch to MAIN MENU window automatically.
- Pulling out the transport slide as far as it can go. Take off the sample from the chuck. If you need to expose another sample with same type of substrate, repeat from STEP 8. If you need to change the mask or different type of substrate, repeat from STEP 7 (WEC setting). Otherwise follow the next steps.
- Carefully slide the sample holder back until it reaches the end stop.
- Loosen the knurled knobs on the side of the mask holder frame and slide out the mask holder. Turn over the mask holder so that the mask side faces up.
- Press and hold the button “Maskvacuum is on” to release the mask from holder. Note: the button has to be press and hold for ~10sec until it changes to “Maskvacuum is off” after beeping once.
- Take the mask off from the mask holder, slide the holder back to the frame and tight the knurled knobs with fingers.

**Note: mask has to be unloaded before switching off the machine.**

### 3.1.11 Switch off Procedures:

- Press “<=” button at the lower left corner of the touch screen to return back to the start page.
- Press the electronics ON/OFF button to switch off the machine. Note: a cool down procedure will activate at this time. It will take 10 minutes to finish. The machine will be totally shut down automatically after this procedure. **DO NOT** turn off the power supply and gas supply during this period. It could damage the system permanently.
- **Switch off the pump line and Nitrogen gas.**