Mask Aligner – MA/BA6 [Cook]

Introduction

MA/BA6 is a top and bottom side contact lithography aligner used for fine line lithography down to 1 micron or better. These guidelines are not meant to be complete operating instructions. Do not attempt to operate the tool without proper training.

Features and Specifications

Mask sizes: 4”, 5”
Wafer / Chuck size: 3”
Top side wafer alignment using a conventional microscope
Bottom side alignment
Exposure modes: soft contact, hard contact, vacuum contact, and low vacuum contact.

Safety and Precautions

Moving Components - be careful
UV Radiation – harmful, avoid/minimize exposure
In rare case of mercury lamp explosion, leave the room to avoid mercury vapors
High Voltage – be careful
EMO: Emergency off button is available
Operating Procedure

0. Start up
Turn on the Nitrogen, compressed air and vacuum. The main power to MA6 is always on.

1. Check before Operation
   a. Nitrogen: 2 bar
   b. Compressed air: 5 bar
   c. Vacuum: - 0.7 bar
   d. WEC pressure: 0.1 bar
   e. Vacuum seal: 0.2 bar

2. Power up
   a. Constant Intensity Controller (CIC) for UV lamp.
      i. Make sure the POWER SWITCH ELECTRONIC (for MA6) is off.
      ii. Press the ON key on CIC.
      iii. Actuate CP. Display shows “wait”, followed by “Start”.
      iv. Actuate START. It takes 10-15 min to warm up the UV lamp (flashing LED).
   b. Turn the POWER SWITCH ELECTRONIC (for MA6) to ON position

Important: Always turn on UV lamp first and then MA6 power to avoid damage to electronics.

All motorized manipulators (TSA, BSA and alignment stage) are set to the position used before the machine was powered off.

   c. Press LOAD.

3. Select Exposure Type
   a. Press SELECT PROGRAM.
   b. Use the up and down arrow keys to scroll exposure types.
   c. When find the one you want, press SELECT PROGRAM again to select it.

4. Adjust Exposure Settings
   a. Do not change following parameters:
      i. PreVac Time: 15sec
      ii. FullVac time: 10 sec
iii. Vac. Purge time: 10 sec
iv. WEC Type: Cont
vi. WEC-Offset: Off

b. Parameters can be changed:
   i. Exposure time
   ii. Alignment gap. 50 microns (recommended).
   iii. Exposure gap for Proximity type.

c. To change the exposure time and alignment gap
   i. Press EDIT PARAMETERS.
   ii. Use the “left” and “right” arrow keys to toggle between the various parameters.
   iii. Use the “up” and “down” arrow keys to change the value of the current parameter.
   iv. When finished, press EDIT PARAMETERS again to confirm.

**Important:** Only the EXPOSURE TIME and ALIGNMENT GAP are to be adjusted. Any user should not change any other settings without permission.

5. Save, Load, and Delete Programs

a. Save
   i. After all parameters are edited, press the EDIT PROGRAM key and toggle to “SAVE” using x-ARROW keys.
   ii. Select a program number using the y-ARROW keys.
   iv. Press EDIT PROGRAM.

**Important:** The number you choose must be empty program. Each user only can have one program number.

b. Load
   i. Press EDIT PROGRAM key
   ii. Toggle to “load” using x-ARROW keys.
   iii. Select the number of the program to be used.
   iv. Press EDIT PROGRAM.

c. Delete (if needed)
   i. Press EDIT PROGRAM key
   ii. Toggle to “delete” using x-ARROW keys.
   iii. Select the program to be deleted.
iv. Press EDIT PROGRAM.

6. Load Mask
   a. Press CHANGE MASK.
   b. Gently slide the mask holder out.
   c. Press ENTER to toggle the mask vacuum off.
   d. Place the mask on the mask holder.
   e. Press ENTER to toggle the mask vacuum on.
   f. Push down the metal clamper on the mask holder to clamp the mask.
   g. Slide the mask holder back into the machine (and push it to the right side to lock).
   h. Press CHANGE MASK again to lock the mask holder. The message display should read “Ready for Load”.

7. Load Wafer
   a. Press LOAD. The message display should read “Pull slide and load wafer onto chuck”.
   b. Pull out the transport slide. Make sure the white alignment mark on the chuck is facing the positioning pin on the slide.
   c. Replace the chuck with the one that matches your wafer’s size (only 3” size available)
   d. Adjust vacuum line to match your wafer size.
   e. Place your wafer on the chuck.
   f. Press ENTER to turn on the wafer vacuum. The message display should read “Move slide into machine and confirm with ENTER”.
   g. Gently push the slide into position and then press ENTER. The message display should read first “Performing WEC. Please Wait!” and then “Align Substrate”.

8. Align Substrate (If you do not have pattern on the wafer and do not need “wafer pattern - photomask pattern” alignment, skip this part and go to next step 9)
   a. Microscope alignment
      (If microscope head is not down, press F1 and then Enter to move microscope head down)
      i. Turn ILLUMINATION to TSA
      ii. Adjust light intensity by the potentiometer under this switch.
      iii. Actuate TOP/BOTTOM key (LED on). **Important:** Make sure BSA LED is off.
      iv. Coarse focus the mask plane using the TSA Z-MOVEMENT knob.
      v. Toggle the splitfield to "left".
vi. Use the x- and y- ARROW keys to find an alignment mark on the left side of the mask. (activate <FAST> if required to move X & Y fast)

vii. Toggle the splitfield to the middle position (both left and right).

viii. Search for the closest alignment mark on the mask in the right splitfield (try to locate one on the right-most side of the mask).

ix. Rotate TSA θ-MOVEMENT knob to bring left and right alignment marks to parallel to each other.

x. Fine focus the mask plane using the TOP SUBSTRATE LEFT/RIGHT regulators.

b. Wafer alignment

i. Only if needed: Make sure Top/Bottom LED is off. Adjust the BOTTOM SUBSTRATE LEFT/RIGHT regulators to focus on the wafer plane (not needed when alignment gap is smaller than 50 microm).

ii. Use the X, Y, & θ knobs on the alignment stage to align the alignment marks on the substrate with the alignment marks on the mask that are already in view. (Note: You may have to first use the arrow keys to find a nearby alignment mark on the substrate. At any time, just press SCAN to return to your mask alignment marks).

iii. Make sure Top/Bottom LED is on and then Press ALIGNMENT CHECK. The substrate is now placed in contact with the mask such that you can preview the accuracy of the alignment before exposure.

**Important:** Do not adjust the X, Y, & θ knobs on the alignment stage while in alignment check. Doing so will cause damage to your wafer, mask, and the MA6.

iv. If you are not happy with the alignment, then press ALIGNMENT CHECK again to take your wafer out of contact with the mask, then make appropriate adjustments.

v. Once you have a satisfactory alignment, make sure to leave the machine in alignment check mode. Go to next step 9.

9. Expose

i. Press EXPOSURE to expose your wafer.

ii. If you wish to unload your wafer without exposing, press UNLOAD key. The
message display should read “Pull slide and unload wafer”.

10. Unload Wafer
   a. After exposing, the machine will automatically go into the unloading mode. The message display should read “Pull slide and unload exposed wafer”.
   b. Fully pull the slide out and unload the wafer. If the slide is not completely out, the vacuum on the wafer holder will not be turned off.
   c. The message display should read “Ready for Load” after unloading. Load a new wafer or unload the mask.

11. Unload a Mask
   a. Press CHANGE MASK. The massage display should read “Change Mask – Press ENTER to toggle mask vacuum. Vacuum: On”.
   b. Gently pull the mask holder out.
   c. Press ENTER to toggle the mask vacuum off.
   d. Unlock the safety clamp by pulling back the metal pin.
   e. Pick up the mask.
   f. Slide the mask holder on MA6 back into position.

12. Shut Down
   a. First turn off the Constant Intensity Controller (CIC) for UV lamp by pressing OFF on the CIC front panel.
   b. Then power down the MA6 machine by turning the POWER SWITCH ELECTRONIC to OFF position.
   c. If you have used the X, Y, & θ knobs on the wafer alignment stage, make sure to return it to X=10 mm, Y=10 mm, θ=0.
   d. Turn off vacuum pump
   e. After 10 minutes: turn off Nitrogen + Compressed air.

Note:
Leave Nitrogen + Compressed air ON for 10 minute for lamp cooldown, and then turn it off.

Do not attempt to ignite the lamp prior to the completion of 10 minute cooldown.