



# IIT Bombay Nanofabrication Facility

**Tool Name: Double Sided Aligner (DSA)**

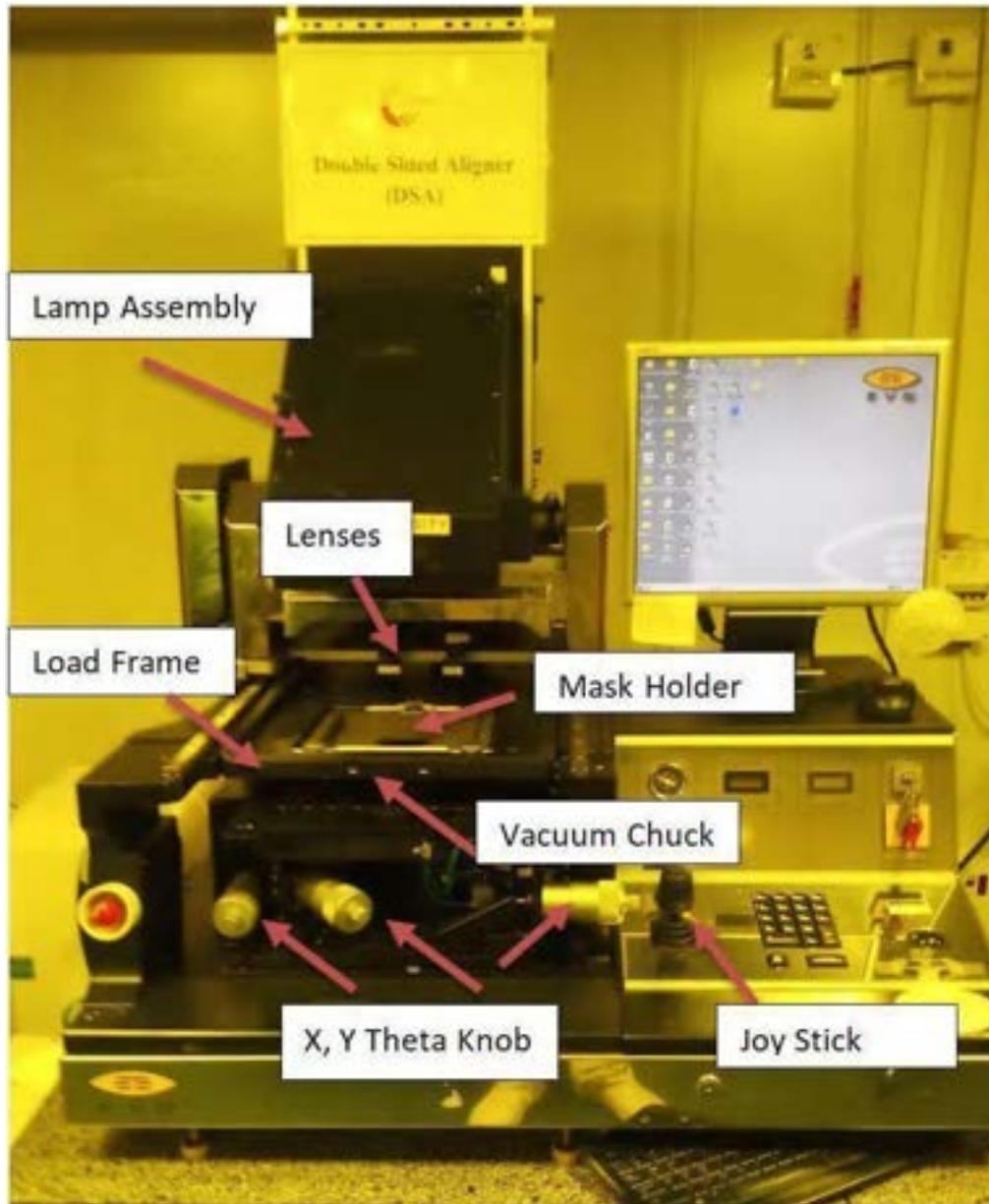
**Standard Operating System (SOP)**

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## Tool's Overview



*Fig. DSA*

## Checklist (Before starting the tool)

**Humidity: below 55 %**

**Temperature: below 25° C**

**GN2 Pressure : 6 bar**

### Restrictions & Precautions:

1. For 20 X lens separation between mask and wafer should not be more than 20um.
2. Enter the lamp usage hours i.e. the numbers of hours it was ON.
3. DO NOT turn the micrometer screw gauge beyond 10mm. If you are not able to align samples remove and repeat the step. Extra force changes the center position of the stage.
4. Stage center is 5mm now so use 5mm as center position.
5. DO NOT TOUCH the lamp house controller settings.
6. If the message for Symantec back up is shown on the screen please allow the system to take backup.
7. While changing the lens be very careful. DO NOT tighten the lens with the assembly. Extra force can tilt the lens in the assembly itself.
8. DO NOT USE two adaptors for any type of lens. All lens work on single adaptor.
9. Any problem during the system initialization report immediately to the system owner.
10. Any doubt in usage of the system call authorized user/ system owner for guidance. DO NOT assume things. Substrate should be clean while the alignment.
11. Changing lens and Intensity of lamp will be measured by system Owner Only.

## DSA OPERATING STEPS

1. Switch on the vacuum.
2. Adjust general Nitrogen pressure to 6bars.



3. Switch ON the Mains (Power Switch).



4. Check that the computer of mask aligner is ON.

(A separate power connection has been given to the computer of DSA. Computer will be kept ON 24x7)



5. Switch ON the MAIN SWITCH of the mask aligner (Red yellow button).



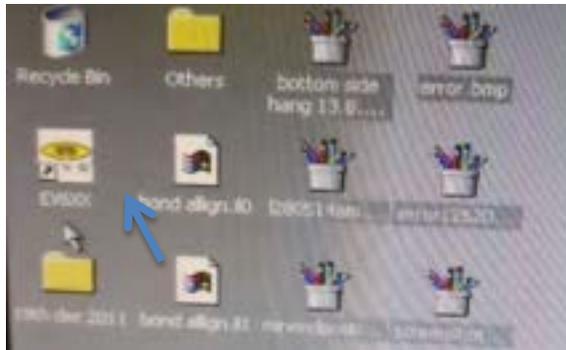
6. Turn ON power switch of the lamp power supply. Start lamp: press START key on the external lamp power supply. Enter the lamp reading and timing in the log book. Make entry in log book



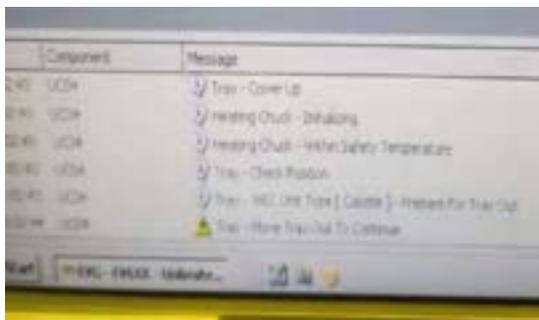
7. Turn ON KEY switch for the electronics Power On and Wait for 2 mins.



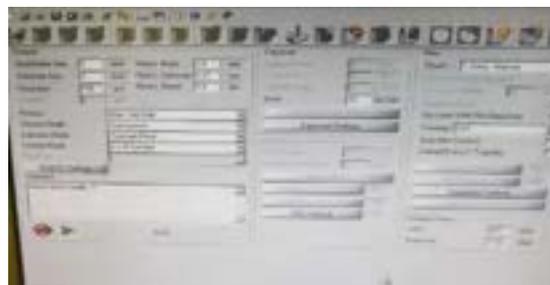
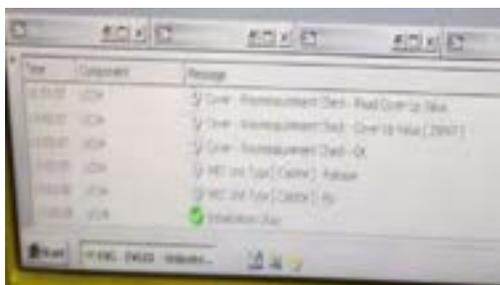
8. If monitor displays that personal computer is ready then double click the icon “EVG620”. Press Log IN and enter Username and Password (eng)



9. When you LOGIN the mask aligner make an initialization of the system. During initialization move tray out when the command appears on the window



10. Create Recipe: Double click the icon “recipe1.rcp” or create a new recipe (File- New). Set the Process Data parameters in the recipe.



## General Parameters

Parameters	Typical values
Mask holder size (inch)	Min. 3 – max. 5
Mask Thickness (mm)	Specific to the process
Substrate Size (inch)	Min. 2 – max. 4
Substrate Thickness (mm)	Specific to the process
Proximity ( $\mu\text{m}$ ) (Distance between substrate and mask during expose step)	Specific to the process
Resist Thickness ( $\mu\text{m}$ )	Specific to the process
Separation ( $\mu\text{m}$ ) (Distance between substrate and mask after Wedge Error Compensation)	Specific to the process
Mask ID	Specific to the process

Please make sure that no changes should be made in "misc. portion" of the recipe. (i.e. misc. Portion of recipe should not be edited under any circumstances).

Any changes in recipes should not be saved during or after the processes.

## TOP SIDE ALIGNMENT AND EXPOSURE

- Process: Top Side
- Process Mode: Transparent
- Exposure Mode: Constant time, Constant dose, Constant time- interval, Constant dose – interval
- Contact Mode: Soft Contact, Hard Contact, Vacuum Contact, Vac+Hard Contact, Proximity

On pressing RUN process starts.

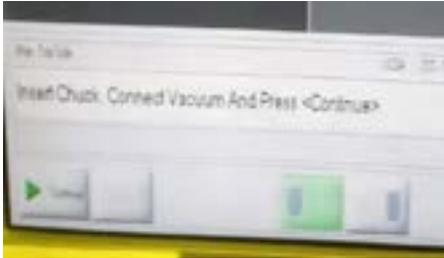
The user must wait until initialization has been completed before the system can be used.

<INIT PROCESS>

The aligner moves in the home positions.

Follow the instructions which are displayed in the window accordingly intended.

1. Insert chuck and connect vacuum and press<continue> Insert the appropriate bottom-chuck for the process and Press “continue”



2. INSERT MASKHOLDER AND PRESS<CONTINUE>

Insert the appropriate Mask holder and bottom-chuck for the process and Press “continue”.

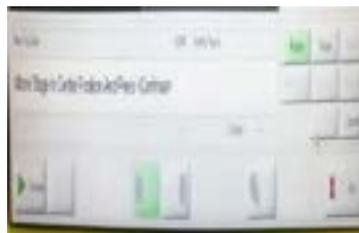
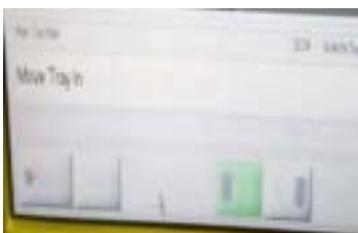
3. Fix the mask holder and press<continue>



4. <INSERT MASK WITH LOADFRAME AND PRESS<CONTINUE> Load the mask frame on the chuck and load the mask (structured surface to the bottom) pre -position it with the pre alignment pins. After loading the mask frame and the mask, press “Continue”



<MOVE TRAY IN> and Adjust center position of X,Y,Theta of adjustment knob



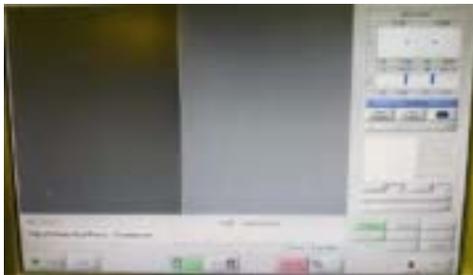
<WEDGE COMPENSATION...>



Once the tray is moved in, the aligner will start with the wedge-error compensation (Planarization) automatically.

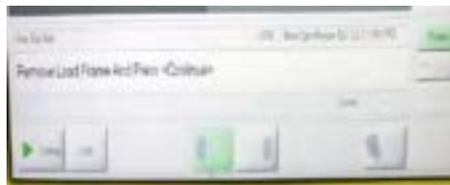
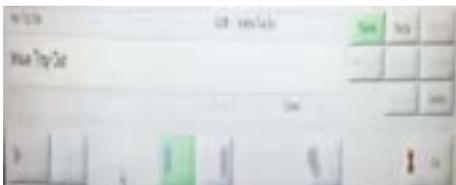
Wait for a few seconds before adjusting mask <PLEASE WAIT> <ADJUST MASK>

### 5. Adjust Mask

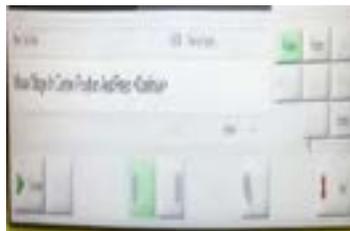
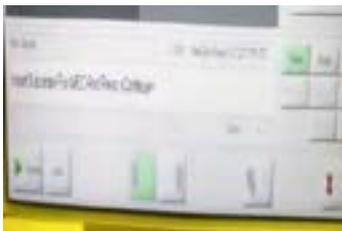


Use the joystick for focusing and movement of optics to change between the left and right microscope, press the “L” or the “R” button. When the marks are adjusted, press “CONTINUE” and the top-chuck activate the chuck Vacuum to hold the mask firmly in its setup position.

During the alignment procedure the mask is in separation to the top-chuck. <PLEASEWAIT> <MOVE TRAYOUT> <REMOVE LOAD FRAME AND PRESS<CONTINUE>>



<INSERT SUBSTRATE AND PRESS<CONTINUE>>

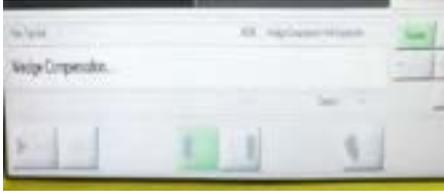


### Load Substrate

Load the substrate without a load frame on to the bottom-chuck.

Pre adjust the substrate with the help of the pre alignment-pins on the chuck.

Press “CONTINUE” and fix the bottom-chuck to the vacuumed substrate. <MOVE TRAY IN> <WEDGECOMPENSATION...>



When the tray is in, the wedge-error-compensation (planarization) starts automatically.  
<PLEASEWAIT><ADJUSTWAFER>

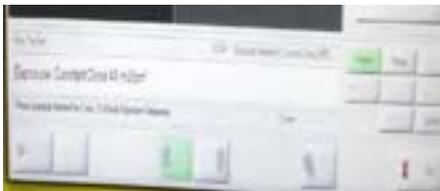
### Adjust Substrate



Press “Scan Optic” and turn the joystick clockwise or anticlockwise to focus the mask and the wafer. Adjust the marks of the substrate to the marks of the mask. During the adjustment the substrate and the mask are in separation.

To change between separation and contact press “Sep/Cont.” When you are ready with the alignment press “Continue”<PLEASEWAIT>

Exposure  
<EXPOSURE>

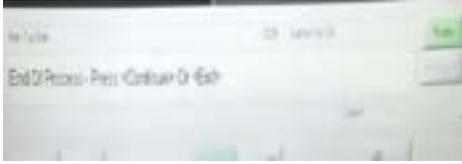


Now the exposure is ready to begin, and the exposure-time is announced. When the exposure is ready, the top-optic moves backward to the end-position. To stop the exposure in between press the button on the joystick for 2secs

6 Unload Substrate After the exposure wait until the system informs you to move the trayout:<PLEASEWAIT> <MOVE TRAYOUT>



<REMOVE SUBSTRATE AND PRESS <CONTINUE> OR<EXIT>>



Choose whether to load a new substrate or unload the mask.

To load a new substrate press “Continue”.

<INSERT SUBSTRATE AND PRESS<CONTINUE>>

To unload the mask press Exit

Unload Mask

Following message is displayed:

<INSERT LOADFRAME AND MOVE TRAYIN>

Insert the load frame, move the tray in and wait for a few seconds.

<PLEASEWAIT>

<MOVE TRAY OUT - REMOVE MASK AND LOADFRAME>

<END OFPROCESS>

With “Continue” one can start the same process again.

## **BOTTOM SIDE ALIGNMENT AND EXPOSURE**

Set process data

- Process: Bottom Side
- Process Mode: Transparent, Overlay, Crosshair
- Exposure Mode: Normal, Interval
- Contact Mode: Soft Contact, Hard Contact, Vacuum Contact, Vac+Hard Contact, Proximity

Start the process & load the mask as for bottom side alignment.

Adjust Mask

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Adjust the mask and the marks of the mask with the help of the stage and the bottom-side microscope. To ensure that the mask is straight on the stage the actual y-positions of the microscopes should show the same value (when they show the same value, they are in a straight line) and one can see both marks on the screen. Otherwise one has to turn the mask with the stage.

Press “continue” and the top-chuck suck’s the mask with vacuum.

<MOVE TRAYOUT>

<REMOVE LOAD FRAME AND PRESS<CONTINUE>>

<MOVE TRAY IN>

Move the tray in without load frame and without substrate!

When the tray is moved in, the aligner starts with the wedge-error compensation (planarization) automatically.

<PLEASEWAIT>

Adjust crosshair / Adjust overlay

Before starting with crosshair/overlay-adjustment, a precise adjustment of the mask alignment marks is carried out with the bottom-side microscope. One cannot adjust with the stage, because the mask is already fixed on the top chuck.

<ADJUST MASK AND

PRESS<CONTINUE>>>Now carry out the

crosshair/overlay-adjustment

<ADJUST CROSSHAIR / ADJUST OVERLAY AND PRESS<CONTINUE>>>

Optic movement after crosshair adjustment causes misalignment!

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#### A) Crosshair-Adjustment

Move the crosshair with the help of the Trackball.

In the control menu one can choose between the left and the right crosshair. Press the left button of the trackball and one can move with the crosshair. For the fine adjustments press the up/down left/right buttons in the control menu. In the controls menu one can also adjust the length, width and the color of the crosshairs. A fine adjustment of the crosshairs is possible with the left, right, up, down, buttons in the control menu. (Pixel- steps) Lay the crosshairs exactly over the marks of the mask.



#### B) Overlay-Adjustment

With the overlay-adjustment mode (select it in the recipe before starting process.

Store the image of the adjusted marks of the mask (adjust the marks and press “continue”) Later when one wants to adjust the substrate one can see the stored image of the mask marks on the screen (one can change the intensity with the overlay regulator) and adjust the substrate to the image of the mask.

Press “Continue”

<PLEASEWAIT>

<MOVE TRAYOUT>

Load Substrate

<INSERT SUBSTRATE AND PRESS<CONTINUE>>>

Pre adjust the substrate with help of the pre alignment-pins on the chuck. Press “Continue” and the bottom chuck fix the substrate with vacuum

<MOVE TRAY IN>

When the tray is in, the wedge-error-compensation (planarization) starts automatically.

<PLEASEWAIT>

<ADJUSTSUBSTRATE>

Adjust Substrate

#### A) Transparent

Press Scan Optic and turn the joystick clockwise or anticlockwise to focus the mask and the wafer. To adjust the substrate you press Scan Stage and you can move the stage with the joystick. Adjust the marks of the substrate to the marks of the mask. During the adjustment the substrate and the mask are in separation. To change between separation and contact press “Sep/Cont.” When you are ready with the alignment press “Continue” <PLEASEWAIT>

#### B) Crosshair

Adjust the substrate with the stage. Don't move with the microscope or with the crosshair; because they are already adjusted to the marks of the mask adjust the marks of the substrate exactly to the crosshair during the adjustment the substrate and the mask are in separation. To change between separation and contact press “Sep/Cont.” When you are ready with the alignment Press “Continue”

EXPOSURE, UNLOAD MASK, UNLOAD SUBSTRATE steps same as for top side alignment.

#### FLOOD EXPOSURE

Set process data

- Process: Flood Exposure
- Process mode: Transparent
- Exposure mode: Continuous
- Contact mode: No contact

MASK adjustment not required, remaining steps same as for Top side alignment.

#### PROXIMITY EXPOSURE

Set process data

- Process: Proximity Exposure
- Process mode: Transparent
- Exposure mode: Continuous
- Contact mode: Proximity

#### Load Substrate

After the initialization process, load the substrate. <LOADSUBSTRATE>

Pre adjust the substrate with help of the adjustment-pins on the chuck. Press „Continue “and the bottom-chuck fix the substrate with vacuum. <MOVE TRAY IN> <ADJUSTMENT>

Press Continue

Exposure

On pressing “continue “, the Exposure is beginning to start the process. The exposure-time is displayed on the screen. When the exposure is finished, the optic moves backward to the end position. Unload substrate

<MOVE TRAYOUT>

<REMOVE SUBSTRATE AND PRESS<CONTINUE>>

<PRESS <CONTINUE> TO

LOADSUBSTRATEOR <EXIT> TO

LEAVEPROCESS>

#### SHUTDOWN THE SYSTEM

1. Exit EVG620
2. DONOT shutdown the windows (computer should be kept on 24 x 7)
3. Turn OFF Lamp Power
4. Entry in log book
5. Wait 10 Minutes

(Please Note that MAIN SWITCH of the mask aligner (red yellow button), 2) Electronic Key Switch 3) the Mains (Power switch) and 4) Computer should ALWAYS be kept ON)

6. Turn OFF Nitrogen Pressure Valve

7. Turn OFF the Vacuum Pump

8. Please check everything once again after you are done with the shutdown