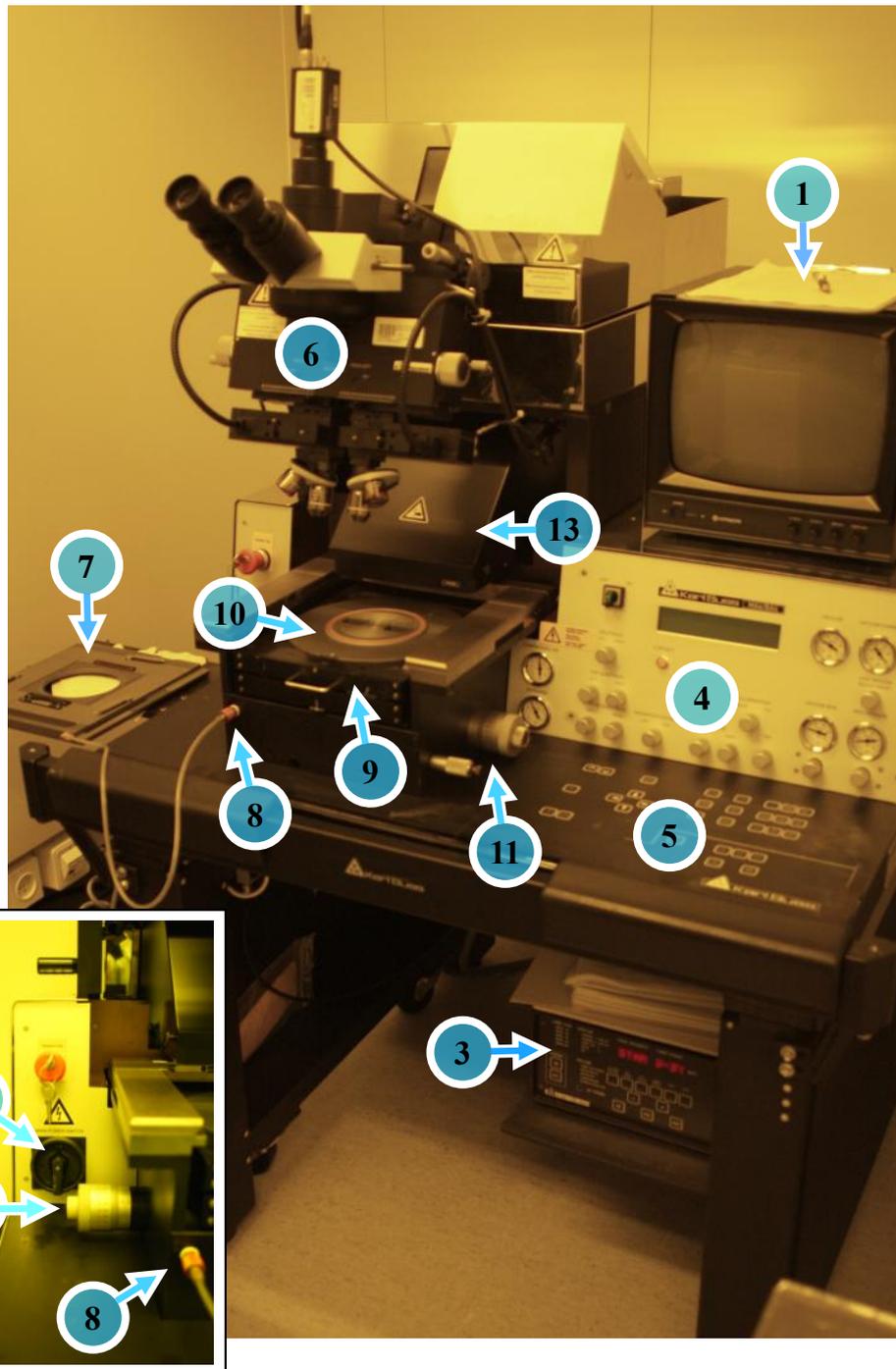# User's Guide

THE CENTER FOR NANOSCIENCE AND NANOTECHNOLOGY

MA6 MASK ALIGNER
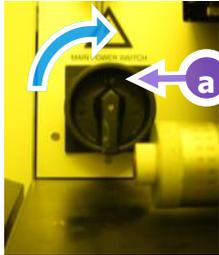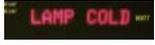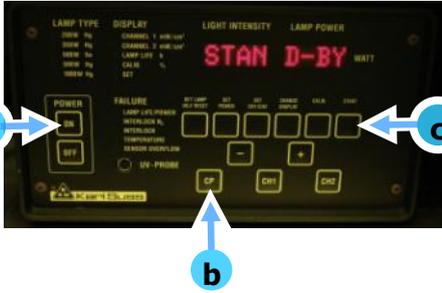
Machine Overview

Part #	Description
1	Log book
2	*MAIN POWER SWITCH*
3	Lamp power supply
4	Analog panel
5	Digital panel
6	Microscope
7	Mask holder

Part #	Description
8	Mask holder vacuum connector
9	Slide
10	Chuck
11	Chuck positioning micrometers θ (front), x-axis (rear)
12	Chuck positioning micrometer y-axis
13	Shutter

Lamp Start and Warm Up

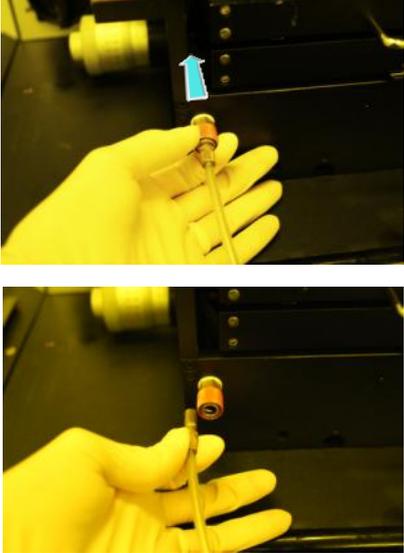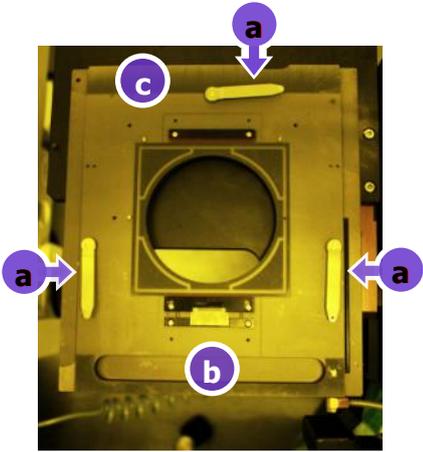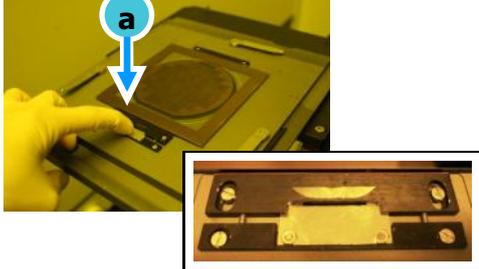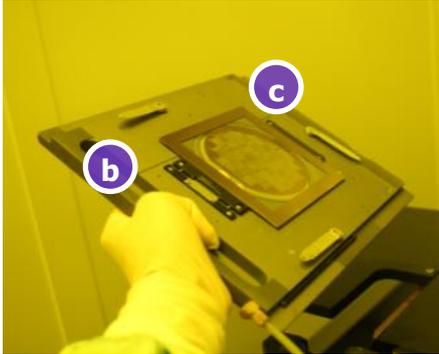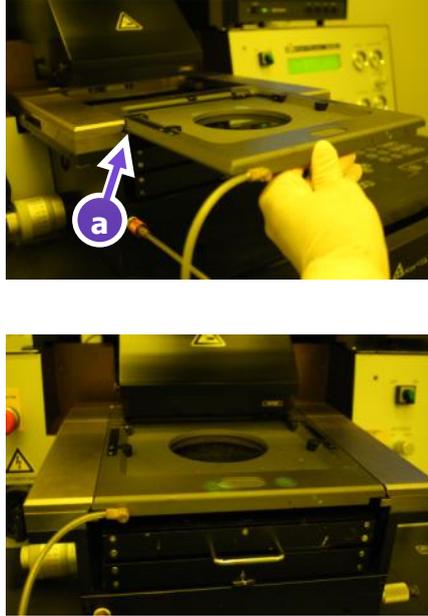|		
1	Log in on Log Book	
2	Turn *MAIN POWER SWITCH* CLOCKWISE *ON* displayed in small window **a** Power supply will read *STAND-BY*	*Part # 1*
3	**a** Wait about 10 seconds and press **ON** on the power supply Power supply will read ` -REA DY-- ` **b** Wait about 10 seconds and press **CP** on the power supply Power supply will read ` =>>S TART ` **c** Wait about 10 seconds and press **START** on the power supply Power supply will read ` LAMP COLD `	*Part # 2*
4	After several minutes values will appear on screen Wait about **15 minutes** before turning machine on	
*	If power supply beeps and displays *VOLT ERROR* Press **OFF** and then **ON** on the power supply Wait until screen displays *STAND BY* Perform STEP 3 again	

Machine Start

5	Turn machine on Turn machine power switch CLOCKWISE Switch will spring back to middle	
6	Wait until screen reads *Ready for Start* Press *LOAD* button Wait until main screen is displayed	Ready for Start -> Press LOAD Button MA6/BA6-[S] V4.000 07.11.00 SW: none LOAD UNLOAD

7	(a) Contact *PROGRAM*
	   Vacuum, Low-Vacuum, Hard, Soft and Proximity
	
	(b) Alignment type
	   BSA—backside alignment (default)
	   TSA—topside alignment
	
	(c) Alignment gap (in microns)
	
	(d) Microscope coordinates
		Main Screen
		
		Vac-Ct/Cont X1:+25.00 Xr:+25.00
		BSA/Al. Gap: 30 Y1:+50.00 Yr:+50.00
		Ready for Load ...
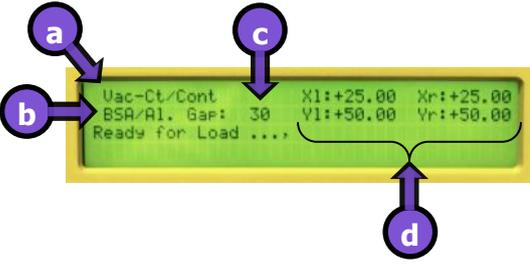
8	Replace chuck (if necessary) 1. Gently pull slide out of machine until stop 2. Raise chuck from underneath 3. Switch chuck with one from shelf 4. Lower new chuck from underneath 5. Align white stripe with pin (a) 6. Gently push slide into machine 7. Align white crosses (b) with θ micrometer (c) 5. Realign (a) if necessary	

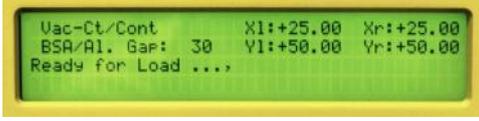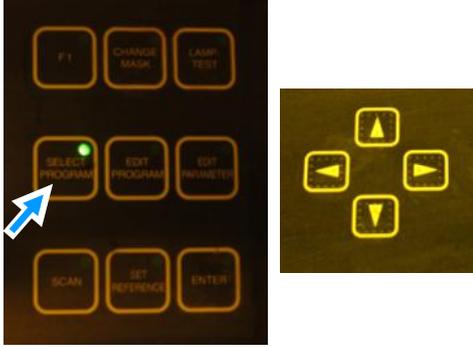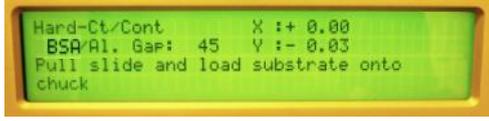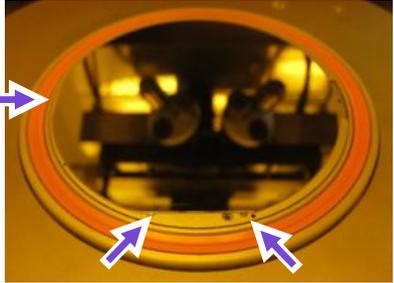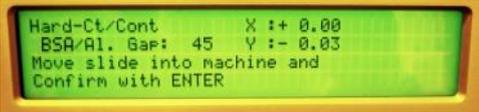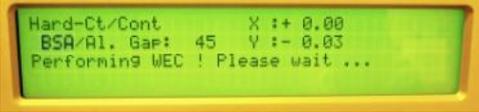|		
9	Replacing mask holder (if necessary) Push red release ring towards machine Grasp metal connector on vacuum tube and extract from machine	
10	Do NOT touch the spacer flags! **a** Switch mask holder on side tray with one on shelf, holding at **b** and **c** Place new mask holder on side tray with spacer flags facing UP Grasp metal connector on vacuum tube and insert into machine	
11	Press *CHANGE MASK* Mask vacuum is *OFF* by default	

12	1. Place mask on holder,
	   chrome side UP
	
	2. Align mask to left pin and top bar
	
	3. Push down metal plate to
	   engage holder clip **a**	

13	Press *ENTER* To engage mask vacuum Screen should read *ON* Do not flip mask holder if mask is not held securely by vacuum	
14	Grasp mask holder at **b** and **c** Flip mask holder over	
15	Align mask holder edge with rails **a** Gently slide mask holder into machine until stop	
16	Press *CHANGE MASK* Engages vacuum between mask holder and machine Exits out of *CHANGE MASK* menu Returns to Main Screen	

17	Main screen	Vac-Ct/Cont X1:+25.00 Xr:+25.00 BSA/Al. Gap: 30 Yl:+50.00 Yr:+50.00 Ready for Load ....
18	**To change Contact _PROGRAM_** Press _SELECT PROGRAM_ Use Y arrows on digital keypad to select program Press _SELECT PROGRAM_ again to exit the menu	Vac-Ct/Cont Expose Type:Hard BSA/Al. Gap: 45 Use ARROW keys Ready for Load ....
19	**To change Exposure Time** Press _EDIT PARAMETER_ Use Y arrows on digital keypad to change Exposure Time Press _EDIT PARAMETER_ again to exit menu	Hard-Ct/Cont Exp. Time[s]: 1.2 BSA/Al. Gap: 45 Use ARROW keys Ready for Load ....
20	Press _LOAD_ Gently pull slide out of machine until stop	Hard-Ct/Cont X :+ 0.00 BSA/Al. Gap: 45 Y :- 0.03 Pull slide and load substrate onto chuck

21	Place substrate on chuck and align to pins on 3", 4" and 6" chuck (4" chuck shown) or grooves on chip chuck (not shown) Do <u>NOT</u> let wafer sit on top of pin! When in doubt, leave a small gap (**1 mm** or so) between wafer and pins	 Shown: 4" wafer properly aligned to ½ pins
22	When wafer is seated properly, press *ENTER* To turn on substrate vacuum Gently push slide into machine until stop Press *ENTER* again Chuck raises automatically Screen reads *PERFORMING WEC*	 Hard-Ct/Cont X :+ 0.00 BSA/Al. Gap: 45 Y :- 0.03 Move slide into machine and Confirm with ENTER Hard-Ct/Cont X :+ 0.00 BSA/Al. Gap: 45 Y :- 0.03 Performing WEC ! Please wait ...
23	Make sure substrate is aligned to mask! If possible, align by looking through mask at substrate edges Otherwise, set X micrometer (a) and Y micrometer (b) both to 10 mm (center position)	Hard-Ct/Cont X :+ 0.00 BSA/Exp. T.: 1.2 Y :- 0.06 Align substrate
24	Double check contact and exposure parameters! Put on UV protective glasses Press *EXPOSURE*	

25	Chuck will lower automatically When screen reads *Pull slide and unload* *expose substrate* Gently pull slide until stop An audible beep is sounded when substrate vacuum is released	
26	Remove wafer from chuck	
27	Gently push slide into machine until stop	
28	Removing mask 1. Press *CHANGE MASK* To release vacuum between mask holder and machine 2. Slide mask holder out of machine, flip and place on side tray spacer flags facing UP 3. Press *ENTER* To release substrate vacuum 5. Insert fingernail into groove (a) and pull TOWARDS YOU 6. Remove mask from mask holder 7. Press *CHANGE MASK* 8. Press *ENTER* To confirm mask holder is not in place, returns to main screen During the day, leave MA6 in this state with Main Screen visible	 Vac-Ct/Cont X1:+25.00 Xr:+25.00 BSA/Al. Gap: 30 Yl:+50.00 Yr:+50.00 Ready for Load ....
29	Log out on Log Book	

30	Main screen	Vac-Ct/Cont X1:+25.00 Xr:+25.00 BSA/Al. Gap: 30 Yl:+50.00 Yr:+50.00 Ready for Load ....
31	To change Contact *PROGRAM* Press *SELECT PROGRAM* Use *Y* arrows on digital keypad to select program Press *SELECT PROGRAM* again to exit the menu	Vac-Ct/Cont Expose Type:Hard BSA/Al. Gap: 45 Use ARROW keys Ready for Load ...,
32	To change Exposure Time Press *EDIT PARAMETER* Use *Y* arrows on digital keypad to change Exposure Time Press *EDIT PARAMETER* again to exit menu	Hard-Ct/Cont Exp. Time[s]: 1.2 BSA/Al. Gap: 45 Use ARROW keys Ready for Load ...,
33	Press *LOAD* Gently pull slide out of machine until stop	Hard-Ct/Cont X :+ 0.00 BSA/Al. Gap: 45 Y :- 0.03 Pull slide and load substrate onto chuck

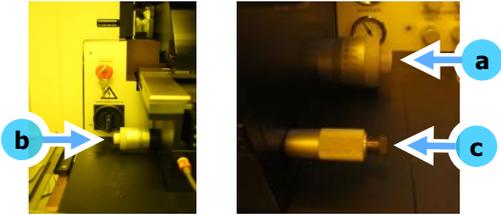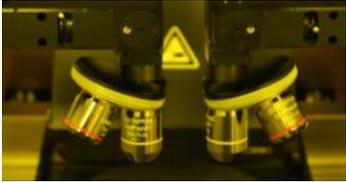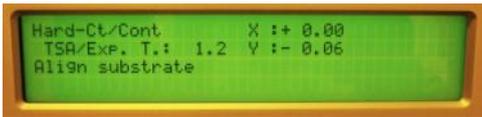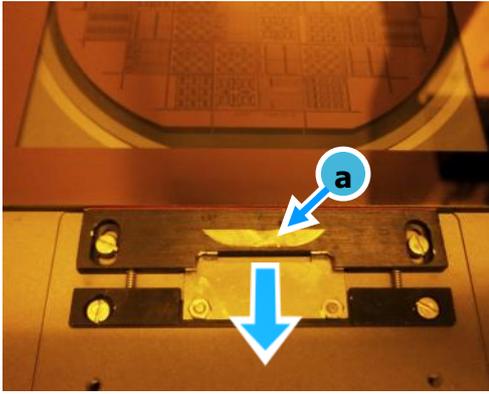|		
34	Place substrate on chuck and align to pins on 3", 4" and 6" chuck (4" chuck shown) or grooves on chip chuck (not shown) Do <u>NOT</u> let wafer sit on top of pin! When in doubt, leave a small gap (**1 mm** or so) between wafer and pins	 Shown: 4" wafer properly aligned to ½ pins
35	When wafer is seated properly, Press *ENTER* To turn on substrate vacuum Gently push slide into machine until stop Press *ENTER* again Chuck raises automatically Screen reads *PERFORMING WEC*	 Hard-Ct/Cont X :+ 0.00 BSA/Al. Gap: 45 Y :- 0.03 Move slide into machine and Confirm with ENTER Hard-Ct/Cont X :+ 0.00 BSA/Al. Gap: 45 Y :- 0.03 Performing WEC ! Please wait ...
36	Press *BSA MICROSCOPE* Turns off bottom side microscope Turns on top side microscope *TSA displayed in main screen*	 Hard-Ct/Cont X :+ 0.00 TSA/Exp. T.: 1.2 Y :- 0.06 Align substrate
37	Roughly align substrate to mask View substrate features through mask openings and use *X* (**a**) and *Y* (**b**) micrometers to align Otherwise set **a** and **b** to 10 mm	
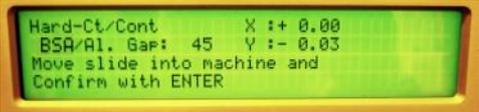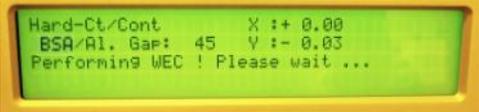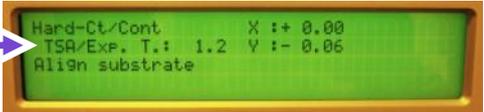
38	To lower microscope Press *F1* and then *ENTER* Caution! Make sure head is not under When it is lowering!	
39	Turn *ILLUMINATION* knob to *TSA*	
40	Rotate microscope objectives to lowest magnification (5X)	
41	Focus objectives with *TOP SUBSTRATE* fine focus knobs If focus is not possible, rotate microscope *Z* adjustment knob to the right of microscope and refocus with fine focus knobs	
42	Find alignment marks (AMs) Press *FAST* button **a** Use digital keypad **b** to move microscope and find AMs on one side Once found, use manual *X* adjusts **c** to find AMs on other side Use *SPLITFIELD* selector **d** as needed	
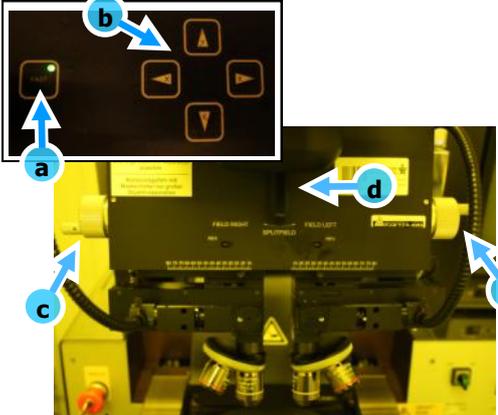
Exposure with Alignment IV

43	Check wafer/mask separation! Press *SEP* down button to view separation on screen While adjusting micrometers, minimum Z separation is **20 μm**	
44	Adjust *X, Y* and *θ* (**a** , **b** and **c**) micrometers to align substrate to mask	
45	Rotate microscope objectives to 10X to evaluate alignment (if necessary)	
46	Press *SEP* up button to raise chuck and evaluate alignment (if necessary) Caution! Do NOT adjust micrometers if *Z* separation is below **20 μm!** If re-alignment is required Press *SEP* down button until screen reads **20 μm**	
47	When alignment is achieved Double check contact and exposure parameters! Put on UV protective glasses Press *EXPOSURE*	

48	Chuck will lower automatically When screen reads *Pull slide and unload* *expose substrate* Gently pull slide until stop An audible beep is sounded when substrate vacuum is released	
49	Remove wafer from chuck	
50	Gently push slide into machine until stop	

51	Removing mask
	
	1. Press *CHANGE MASK*
	   To release vacuum between mask holder and machine
	
	2. Slide mask holder out of machine, flip and place on side tray
	   spacer flags facing UP
	
	3. Press *ENTER*
	   To release substrate vacuum
	
	5. Insert fingernail into groove **a** and pull TOWARDS YOU
	
	6. Remove mask from mask holder
	
	7. Press *CHANGE MASK*
	
	8. Press *ENTER*
	   To confirm mask holder is not in place, returns to main screen
	
	During the day, leave MA6 in this state with Main Screen visible

52	Log out on Log Book	