GCA 6300 DSW Projection Aligner
Operating Instructions

Stepper Instructions (Brief)

Introduction

The **GCA 6300 DSW** stepper has chucks for 3", 100 mm, and 150 mm wafers. Pieces can also be used, but there is no special chuck for this purpose. In addition to this summary for using the steppers, there are 2 GCA manuals available for more information.

Log into CORAL

Log into the **CORAL** system and enable the stepper.

Log into the Stepper

Log into the system by typing: **L I [XXX,YY]** where **XXX,YY** is your account number. Verify that the system is set properly for the chuck size you are using by running the **CHUCKS** command. Set the **Transparent / Opaque** switch to the proper position. Verify the positions of the **Aperture Blades**.

Load and Align Reticle

THE PLATEN SHOULD ALWAYS BE COVERED! Remove the platen cover. Place the reticle on the platen vacuum chuck Cr side down. Using the silver handle provided, slowly rotate the pivot table all the way to the stop so that the alignment microscope is over the reticle (the illumination should come on automatically). It is easiest to move the reticle by hand to coarsely align to the platen fiducials (If you can't see anything, the marks on the mask are too far from the microscope objectives and mask platen fiducials). There is a focus knob on top of the microscope unit. When you have the reticle in position, lock the **SPINDLE LOCK** gently. This will cause the micromanipulator vacuum chuck to lower onto the reticle and hold it for alignment. Use the X and Y knobs for the right fiducial. Use the θ (theta) rotation knob for the left fiducial. The alignment steps may have to be repeated several times - be patient! Push in the **PLATEN VACUUM** button when satisfied. Check the alignment again to ensure its position.

Unlock the **SPINDLE LOCK**. Rotate the pivot table to the lamp position. Lock the **SPINDLE LOCK** gently.

Load Wafer

If the stage is not at the front right position, type **LOAD**. Choose the correct chuck, connect its vacuum hose to the vacuum switch box, align your wafer to the flat stop, and turn on the wafer vacuum switch. While being careful not to bump the chuck against the lens column above it, place the chuck on the theta stage and move it toward the back of the tool until you feel it against the stops. Turn on the theta stage vacuum switch. Close the chamber doors.

Expose Wafer

Prior to starting the job, press the following key sequence:

Press **RES**, wait 2 seconds.
Press **MAN** and the **S/C** button together and hold for one second.

If your job has already been defined, start the exposure sequence using the **EXEC** or **EXPO** commands. (If not, then define a job using the **SPEC** command first.) Follow the prompts to enter the exposure and focus settings. When the tool prompts you to press **RES** and start the AWH (automatic wafer handler, which our 6300 does not have), press only the **MAN** button instead.

At this point, the wafer stage will move under the lens to check for the presence of a wafer. Next, the stage moves to the alignment position where the video microscope image will appear on the screen. If the stage does not move, try pressing the **MAN** button again. If this doesn't work, start the sequence over.

*** If the microscope image is on the screen and you need to abort, use <**Ctrl-C**>, then **A**, then <**Enter**> to abort first, then press the **RES** button to remove the image from the screen. Type **LOAD** to return the stage to the loading position. ***

Align the wafer if needed and press the expose button when you are ready to continue. The tool should now expose the wafer and signal when it is complete.

Unload Wafer

Open the chamber door, turn off the theta chuck vacuum, and remove the chuck while being careful not to bump the structures above it. Turn off the wafer vacuum and remove your sample. Load another wafer for another exposure or return the wafer chuck to the holder and close the chamber doors.

Unload Reticle

Release the **SPINDLE LOCK**. Turn the pivot table. Pull out the **PLATEN VACUUM** switch and remove the reticle. COVER THE PLATEN!!

Log Out of the Stepper

Quit the job by typing <**Ctrl-C**>, then **A**, then <**Enter**> to abort. Type **LOAD** to return to the loading position if not there. Type **L O** when you are done.

Log out of CORAL

Log out of the tool using the **CORAL** system.

CHUCKS Command

The software can be invoked by entering **CHUCKS** at the system prompt. The following screen prompt will appear and the user can then select a new chuck size and modify the loading correction offsets.

: CHUCKS
WORKING...
--- MOP Command Extension Ver 1.1 Jan 2005 (H&L Associates) ---

C - Change chuck size
L - Change loading offset correction
Q – Quit

      Select command [C, L, Q] >>

To change chuck size type: C <**Enter**>

After choosing to change the chuck size, the user will be prompted for a numeric value. This value must be one of the indicated valid chuck sizes; otherwise the command will be ignored.

      Select command [C, L, Q] >> C

++ Chuck change V1.5 (c)H&L Associates Feb 2005 [6in]
.. Current chuck : 3 [AWL type : 6]
.. Valid sizes : 3,82,100,125,150,200

      Enter chuck size >> 100

++ Chuck change V1.5 (c)H&L Associates Feb 2005 [6in]
.. Current chuck : 3 [AWL type : 6]
!! New chuck : 100

++ LCO Loading correction V1.5 (c)H&L Associates Jan 2005 X-
.. Current loading correction (mm)x:0.00000   y:-35.00000
!! New loading corrections (mm)   x:0.00000   y:-20.00000

      Select command [C, L, Q] >>

Loading corrections will automatically be set to the correct default values. If different values are required, continue with the next command.

To Change Loading Corrections: type L <**Enter**>

After choosing to modify the current loading correction values, the user will be prompted for the X and Y offset values in millimeters. Values outside of the range ±150 mm will

be rejected. Just pressing **<Enter>** at the prompt will cause the current X or Y setting to remain unchanged.

Select command [C, L, Q] >>

++ LCO Loading correction V1.5 (c)H&L Associates Jan 2005 X-
.. Current loading correction (mm) x:0.00000 y:-35.00000

Enter loading correction X(mm) >> 1.23
Enter loading correction Y(mm) >> 3.45

++ LCO Loading correction V1.5 (c)H&L Associates Jan 2005 X-
.. Current loading correction (mm)x:0.00000 y:-35.00000
!! New loading corrections (mm) x:1.23000 y: 3.45000

Select command [C, L, Q] >>

NOTE: Make sure that the Loading Correction values match the Chuck sizes listed in the table below:

Chuck Size	X Offset	Y Offset
3"(or smaller)	0	-35
100mm	0	-20
125mm	0	-10
150mm	0	0

Additional Commands

Here is a short list of other stepper commands that may prove useful: (see the command list in the back for more)

LOAD - puts the stage back into the wafer loading position
ORIG - retunes the laser and originates the stage laser metering
COPY - allows a user to copy files from another user's directory to his own
RENAME - gives an existing file a new name
? - typing **?** followed by <**Enter**> will back you up one line at a time in the **SPEC** or **EDIT** mode

OTHER TIPS:

If you get a **FOCUS ERROR**, there are 3 things to try:
- the focus knob near the monitor could be at the limit; center it.
- Check the **CHUCKS** command to make sure it is set correctly for the wafer chuck you are using.
- the stepper can't focus on your wafer (too thick? piece not centered?)
    - is your wafer too thick? (most chucks are nominal ± 100 um)
    - check to make sure the piece is centered on the chuck
    - check to see if there is any residue on the backside - clean it!
    - make sure the chuck is set correctly on the stage, i.e. it is flat

If you get a **TIME-OUT** error:
-you may be trying to focus on the edge of your substrate
.

If the light appears on the monitor screen after going through the **RES, MAN/SC, MAN** sequence but the alignment marks don't appear, adjust the microscope illumination knob near the monitor. This may also need to be adjusted if the wafer alignment marks are out of focus.

If the micromanipulator vacuum chuck pulses on the mask when the spindle is locked, apply gentle pressure to the chuck.

Restart Procedure for GCA 6300 DSW Stepper

NOTE: Look at top of optical column for light source. Light should be seen coming from around wire entry and small round window. If lamp is on, proceed to 1.

If lamp is out: Allow 30 min. for cool-down to prevent explosion. Press **Start** button on lamp supply at bottom of rack. Allow at least 10 min. warm-up before using lamp.

1.   Log into stepper through the **CORAL** system.

2.   Open the rack door at the top of the cabinet and press the **RESET** button on the PC. Close the door.

3.   Wait for the PC to boot and load the program. Press <**Enter**> twice at prompts (OK, OK).

4.   On PC keyboard: type <**Alt-O**>, then <**Enter**> (Start). The start-up process should appear on the screen.

5.   Enter the time as HH:MM using 24-hr. format, and the date as day-month-year with 3-letter month abbreviation in caps.

6.   Open the door of the chamber and find small box with red lights in the rear left side. On Laser Compensator, press **OFF** button.

Defining a Job

This is a short version of the job setup command. Sections 5 and 6 of the system control manual have more details if they are needed.

SPEC

Output job name:	your choice
Metric or English(*M/E):	* indicates default
Comment:	
Tolerance (1,2,*3, 4, 5,6):	leave at default *3*
Scale Corrections	See section 5 of manual
X, PPM (-128<P<+128)	
Y, PPM (-128<P<+128)	
Orthogonality, PPM (-128<P<+128)	See section 5
Wafer Diameter	

<<Array Parameters>>

Step in X:	in mm
*C -ount, S -pan or A -ll:	Count - specify # of columns
How Wide? (prompt if S is chosen)	Span - spans desired width
How Many Columns? (prompt for Count)	All - fills all available width
Step in Y:	in mm
*C -ount, S -pan, A -ll:	
How High? (Span)	
How Many Rows? (Column)	
Translate Origin	Translates the entire array in X or Y
In X	
In Y:	

Display? (Y/*N)   Shows array of exposures; indicates std. keys

Pass   Array 24 exposures   total exposures=24

	1	2	3	4	5	6
1			X	X		
2		X	X	X	X	
3	X	X	X	X	X	X
4	X	X	X	X	X	X
5		X	X	X	X	
6			X	X		

Alignment Dice are Standard

          R: 4
          C: 6
          R: 4
          C: I

Layout? (Y/*N)   Position of exposures

For a Y answer, the output is:

Array has: Centered:
     6 rows   3, 4
     6 columns   3, 4

     1st row, col:
          X = -31.75000
          Y = -31.75000

Adjust? (Y/*N)   Invokes the 3 following questions
     Re-count

     Row? (M -ore/*S -ame/L -ess):   More or less will increment by 1.

     Columns? (M/*S/L):

<<Alignment Parameters>>

Standard Keys? (*Y/N)	Yes if keys are 63.5 mm apart
Prompts for Y	**Prompts for N**

Key Offset	Right Alignment Die Center
In X:	R:
In Y:	C:
	Key Offset
	In X:
	In Y:
	Left Alignment Die Center
	R:
	C:
	Left Key Offset
	In X:
	In Y:

EPI Shift   Used after an epitaxial deposition
     In X:
     In Y:

<<Pass>>

Name (<CR> to exit pass setup):	job must have at least one pass
Comment:	Will appear in the running job
Exposure (sec):	Default value when job is run
Focus setting:	Default value when job is run
Shift	Will translate exposure array; this is applied
In X:	*after* alignment; see
In Y:	separate section on this at the end

A -rray, P -lug, L -abel:

A - does all exposures with the option to drop certain die
P - inserts different dice with the option to offset them
L - is not usable in the normal mode, only in photorepeater mode

Prompts for A	Prompts for P
Dropouts:	Plugs:
R:	R:
C:	Y offset:
will keep prompting R&C	C:
until no value is entered	X offset:

<<End pass set-up>>

Save Pass? (*Y/N)

STEPPER INSTRUCTIONS (Detailed)

1. LOAD AND ALIGN RETICLE

THE COLUMN SHOULD ALWAYS BE COVERED! Remove the platen cover. Place your reticle on the platen vacuum chuck Cr side up. Rotate the alignment microscope over the reticle by using the silver handle provided (the illumination comes on automatically). Move the reticle by hand to coarsely align the fiducials (if you can't see anything, the marks on the mask are too far from the microscope objectives and mask platen fiducials). Before engaging the micromanipulator, center the knobs in their range of travel using the Alignment Travel Indicator above the knobs. Turn the spindle lock knob - DO NOT OVER TIGHTEN as it takes only light pressure to lock the spindle lock. With the spindle lock locked and the platen vacuum off, the micromanipulator vacuum chuck will lower and hold the mask for fine alignment. The right fiducial mark is for X,Y alignment. Adjustments are made using the right knob and the left most knob in the front. The left fiducial mark is for theta rotation and is the right knob in the front. The focus knob is located on top of the microscope. The alignment may take several adjustments - be patient! When the reticle is aligned to your satisfaction, push in the platen vacuum button to the left of the column. The fine alignment vacuum chuck will release. Check the alignment in the microscope again to ensure it hasn't moved. Release the spindle lock. Rotate the pivot table to the lamp position. Lock the spindle lock.
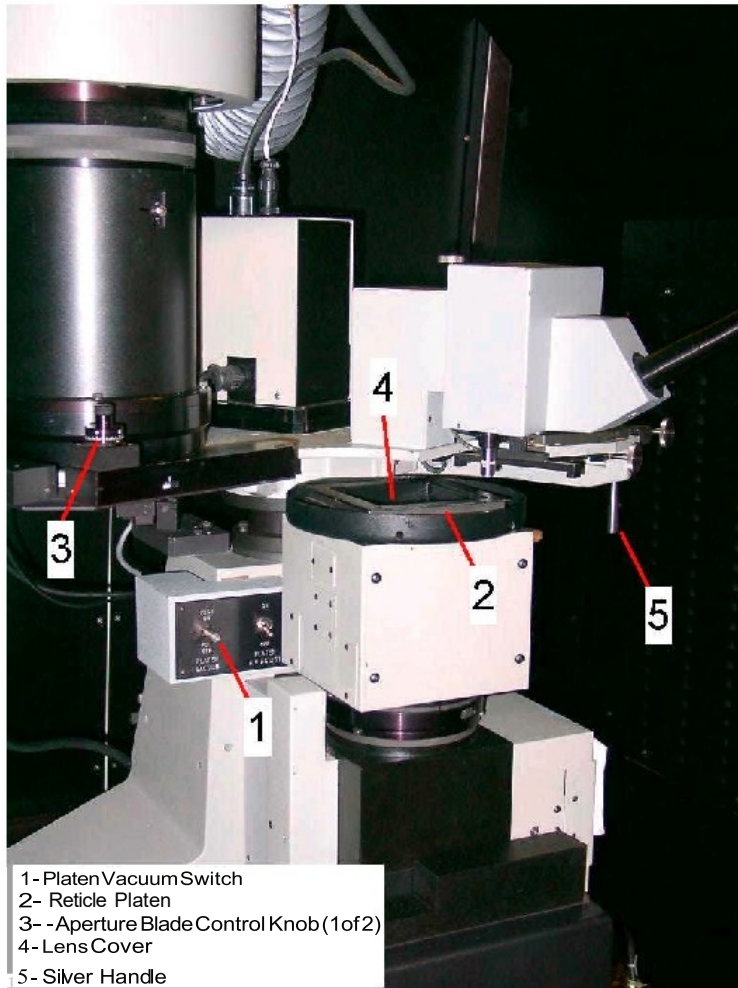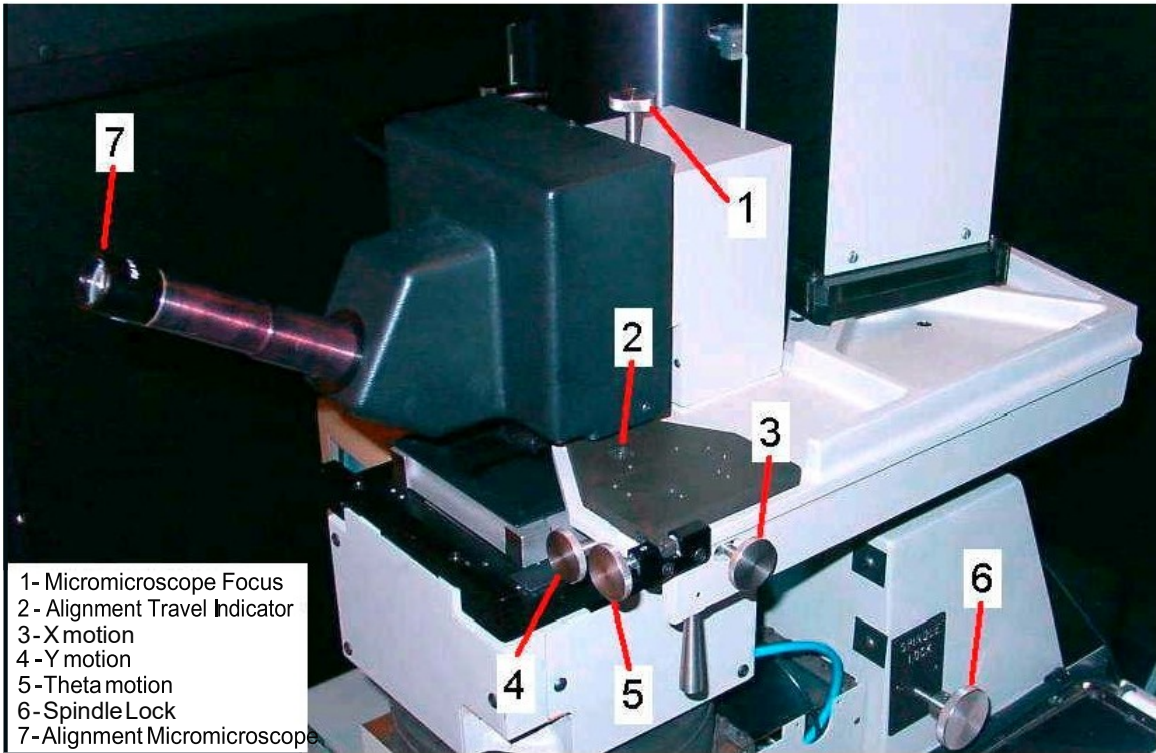
2. APERTURE OPENINGS

Check the dial settings at the bottom of the lamp housing. These control the opening of the **Aperture Blades** on the column and are used in the event you don't want to expose the entire mask area. If the counter scale is at 75 (default), this means that the blades are open to expose a 15 mm die on the wafer. Anything less than that may cut off some of the pattern area. Too large may expose the Insitu marks for the AS200.
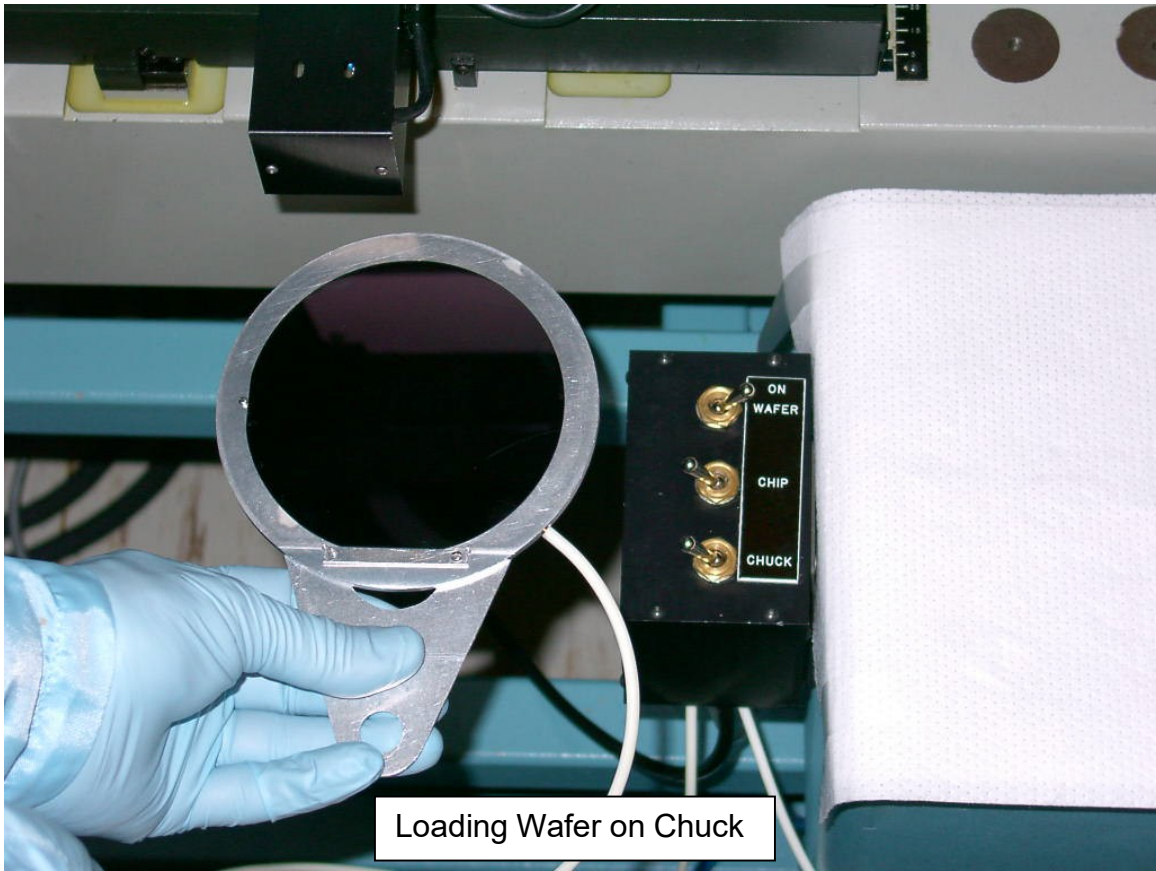
3. LOAD WAFER

Choose the correct chuck, align your wafer to the flat and turn on the wafer vacuum switch. While being careful not to bump the chuck against the lens column above it, place the chuck on the theta stage and move it toward the back of the tool until you feel it against the stops. Turn on the theta stage vacuum switch. Verify that the chuck is held by vacuum. Close the doors.
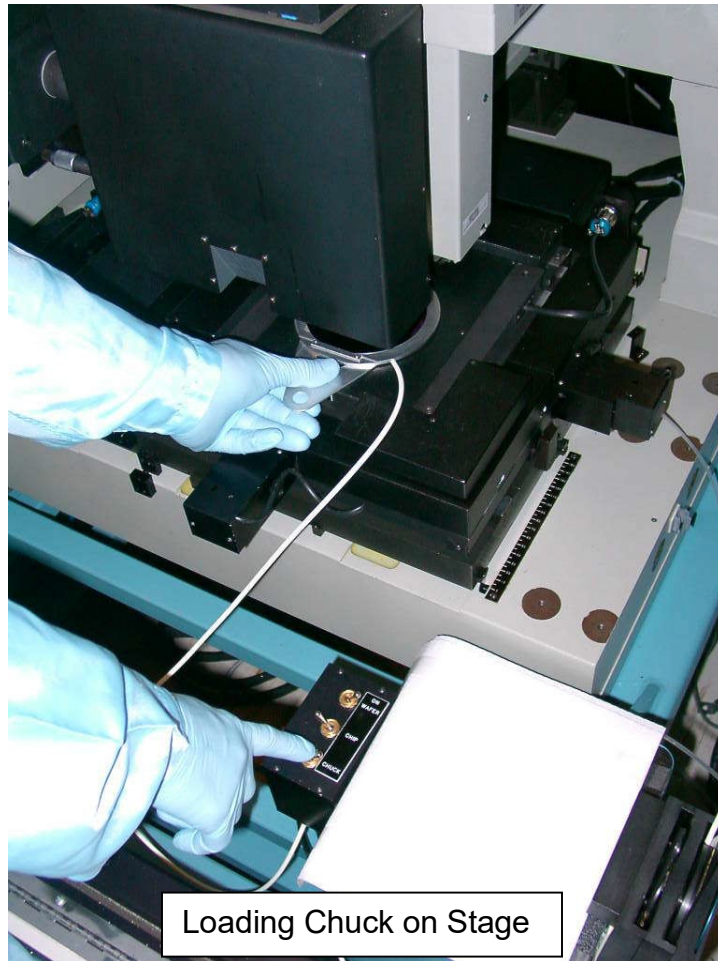
Set the **Transparent / Opaque** switch to the proper position. This switch is used to tell the autofocus system which type of substrate you are using. For optically transparent substrates or very thick (>1 μm) transparent thin films, set the switch to transparent. For all others use opaque.

Transparent / Opaque

1- Micromicroscope Focus
2- Alignment Travel Indicator
3- X motion
4- Y motion
5- Theta motion
6- Spindle Lock
7- Alignment Micromicroscope

1- Platen Vacuum Switch
2- Reticle Platen
3- Aperture Blade Control Knob (1 of 2)
4- Lens Cover
5- Silver Handle

Loading Wafer on Chuck

Loading Chuck on Stage

4. JOB SET-UP STEPPER COMMANDS

Log into the system: L I [XXX,YY] where XXX,YY is your account number.

<**Ctrl-C**>, then **A** - <**Enter**>- to abort operation.

CHUCKS – used to program the stepper with the correct settings for the chuck size you are using. See the CHUCKS section for explanation.

SPEC - to create or specify a job. There is a more detailed sheet explaining each step in the stepper manual.

EDIT - to edit an existing job.

LISTF - to list the files in the directory

EXEC - to run a job. It will prompt you for the job name and pass. A shortcut is to type it all at once, i.e. EXEC job name\pass. For multiple passes on a wafer, enter EXEC job name\pass, pass, pass etc.

EXPO - to run an exposure or an exposure/focus test for process characterization. See the exposure section for more details.

L O - to log off the stepper.

5. EXECUTING THE JOB

Prior to starting the job using the EXEC command, press the following key sequence:

Press **RES**, wait 2 seconds.
Press. **MAN** and the **S/C** button together and hold for one second.

The EXEC command prompts you showing exposure and focus settings (the defaults are your input when the job was created), allowing for changes. When the tool prompts you to press **RES** and start the AWH (automatic wafer handler), press only the **MAN** button instead.

At this point, the wafer stage should begin moving. If it doesn't, try pressing the **MAN** button again. If this doesn't work, start the sequence over.

*** If the microscope image is on the screen and you need to abort, use <**Ctrl-C**>, then **A**, then <**Enter**> to abort first, then press the **REJ** button to remove the image from the screen. Type LOAD to return the stage to the loading position. ***

Prior to exposing the wafer, you must align it.
For the first level, there will be no alignment (other than aligning the flat of the wafer to the flat of the chuck) since this is when you are printing your alignment marks (For a piece, it is more complicated and won't be discussed here). Once you have alignment marks on the wafer, and assuming they are 63.5 mm apart, you will be able to see them on the monitor. The wafer may not be in the exact position as when you exposed the

first time. Turn off the wafer chuck vacuum and rotate the wafer until you see the marks in the monitor; turn the vacuum on. This will also need to be done if you can't move the alignment marks to fit inside the marks on the monitor, i.e. you run out of theta motion with the joysticks. Using the joystick, roughly align the marks. Typing "O" will allow you to change the alignment rate - adjust this down to do the fine alignment with the joystick (the right side of the screen is X,Y adjustment; the left side is theta rotation). ONLY THE RIGHT SIDE SHOULD BE USED FOR XY ALIGNMENT! The left side mark is for rotation ONLY!

When you are satisfied with the alignment, press **EXP** on the monitor screen keyboard. The screen disappears and tells you the wafer is being exposed. When the exposure is complete, it will indicate so. To expose another wafer with the same job, put the wafer on the chuck, and then press **MAN**. The monitor will display the microscope alignment marks and you may proceed to align as before. To get out of the job, press <**Ctrl–C**>, then **A**, then <**Enter**> to abort. At this point, you can start another job, or if you're finished, log out.

6. CLEAN-UP

When you're finished, log out of the stepper by typing L O. Open the door and unlock the spindle. Rotate the column to the side, pull the platen vacuum switch out to release the reticle, remove your reticle, and REPLACE THE PLATEN COVER. Close the door. LOG OUT from CORAL.

GCA Stepper Alignment Scheme

Your alignment requirements need to be well thought out prior to CAD.

Alignment is needed on any multi-layered pattern. Alignment marks are **always** placed on the first level mask. There is a special GCA alignment key which matches a mark built into the GCA alignment microscope. Subsequent levels of lithography do not need alignment marks providing the original marks remain visible throughout processing.

The stepper uses two microscope objectives that are 63.5 mm apart and displays the alignment marks on the stepper monitor. The easiest alignment scheme has two marks this distance apart. If this is the case, when the stepper prompts Standard Keys, the response is Yes. For example, Fig. 1 has alignment marks in the center of the die (this means the key offset is at (0,0)). The stepping distance* is such that we have alignment marks 63.5mm apart, giving us standard keys of R4C1 and R4C6.

$$* \text{ stepping distance (s)} = 63.5 / (n-1)$$

where n=# of die in the row being used for alignment

Note: alignment marks must be at or below the center of a 100mm wafer (limited by the travel of the stage). Because the pattern on the reticle is inverted, the +Y direction is toward you on the wafer. See the SHIFT KEY section in the job set-up commands at the stepper.
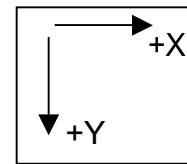
Fig. 2 shows an alignment scheme where the marks are not in the center of the die. They are centered at Y=0 and offset in X from the center by 9.75 mm. The stepping distance now is calculated by:

$$[63.5 - 2*(X \text{ offset})] / (n-1)$$

Because of the stepping distance and offset chosen, we still have Standard Keys (alignment marks 63.5 mm apart). When prompted for Standard Keys, it will also ask for a key offset in X and Y. This is where the 9.75 mm is entered.

For alignment marks that are not standard, for example on a piece, it becomes a little more complicated. At the Standard Keys prompt, the response is No. It then asks for the right alignment die center (which is the row and column of the die you will use for alignment) and then any key offset within that die (the distance in X and Y the alignment mark is from the center of the die. The **recommended** design has Y=0 so you only need to worry about X). Keep in mind the sign (+ or -) of the offset. It will then prompt you for the same information for the left alignment die center. This is how you set up the job for Non-standard Keys.

With Standard Keys alignment marks, you can view both marks at the same time on the stepper monitor. Any other scheme requires toggling between the 2 marks by typing "**A**".
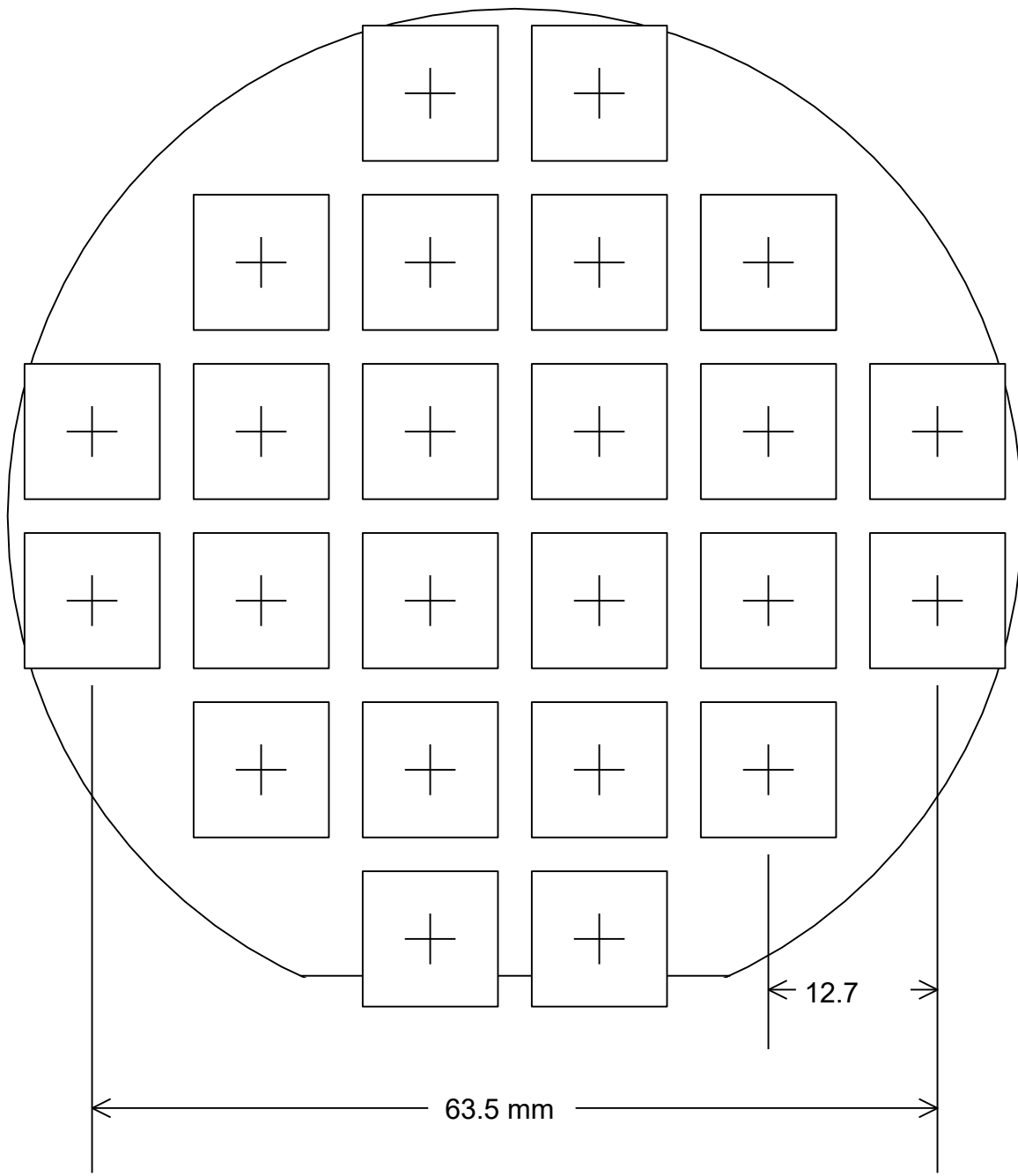
Fig. 1
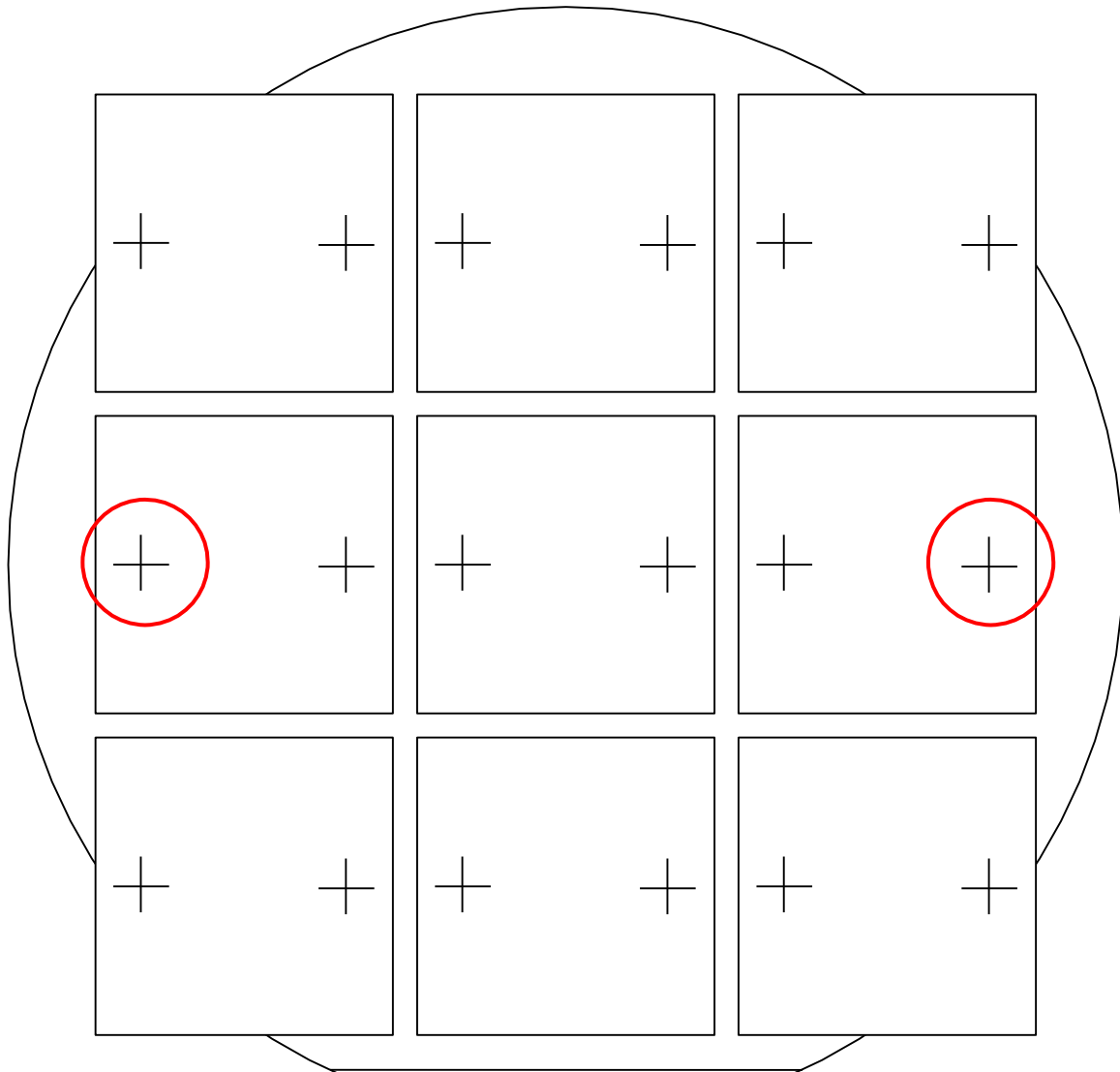
```
3 X 3 array          n=3          s=22 mm
Standard Keys:       R2C1         R2C3
Key Offset:          X=9.75       Y=0
```

Fig. 2

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Reticle Fiducials

The alignment marks, or fiducials, (made on the reticle by the Heidelberg mask writers) are used to align the reticle. These fiducials will be placed at 103 mm apart on center and are used to align the reticle to the column. The fiducials on the mask are 25 microns wide and the marks on the column are 6.25 microns wide with equal spaces (a total of 31.25 microns).
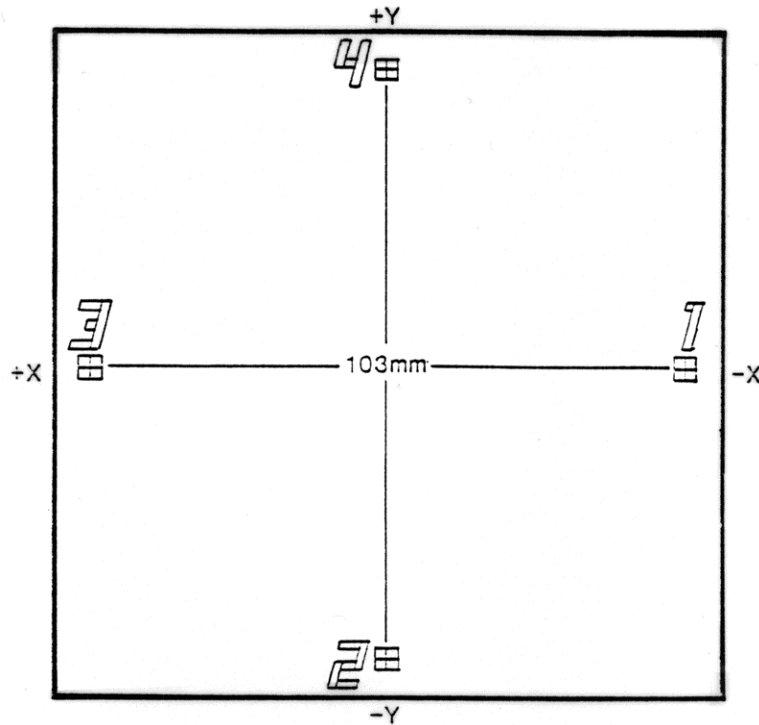
Fiducial marks placed on all GCA stepper reticles by the Heidelbergs.

Mask fiducials offset relative to the column fiducials

Mask in perfect registration with column fiducials
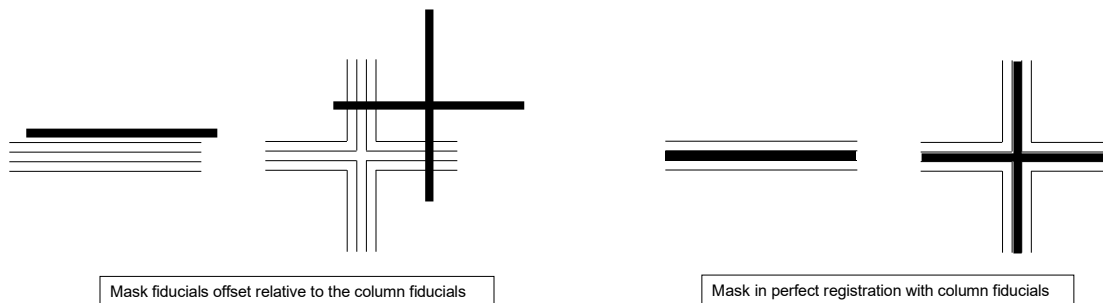
Reticle Alignment Splitfield Image

The marks or *keys* on your reticle that get transferred to your wafer during the first level patterning are used in subsequent patterning levels to align the wafer to the column. On the stepper, the alignment marks on the wafer are 2 microns wide, and the marks you align to (from the center) are 3, 4 and 5 microns wide.
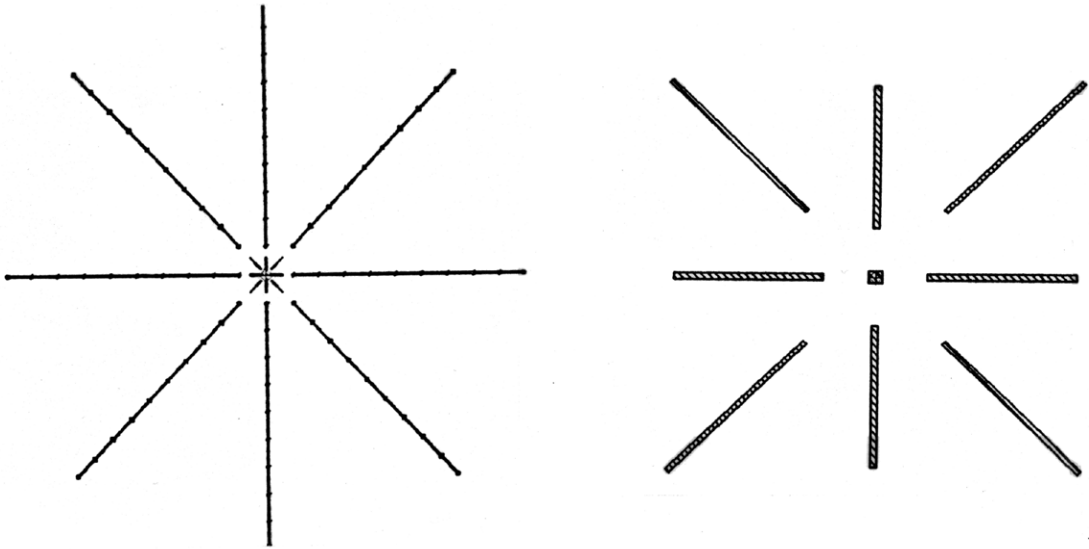
Alignment marks for the GCA steppers placed on the first level reticle.
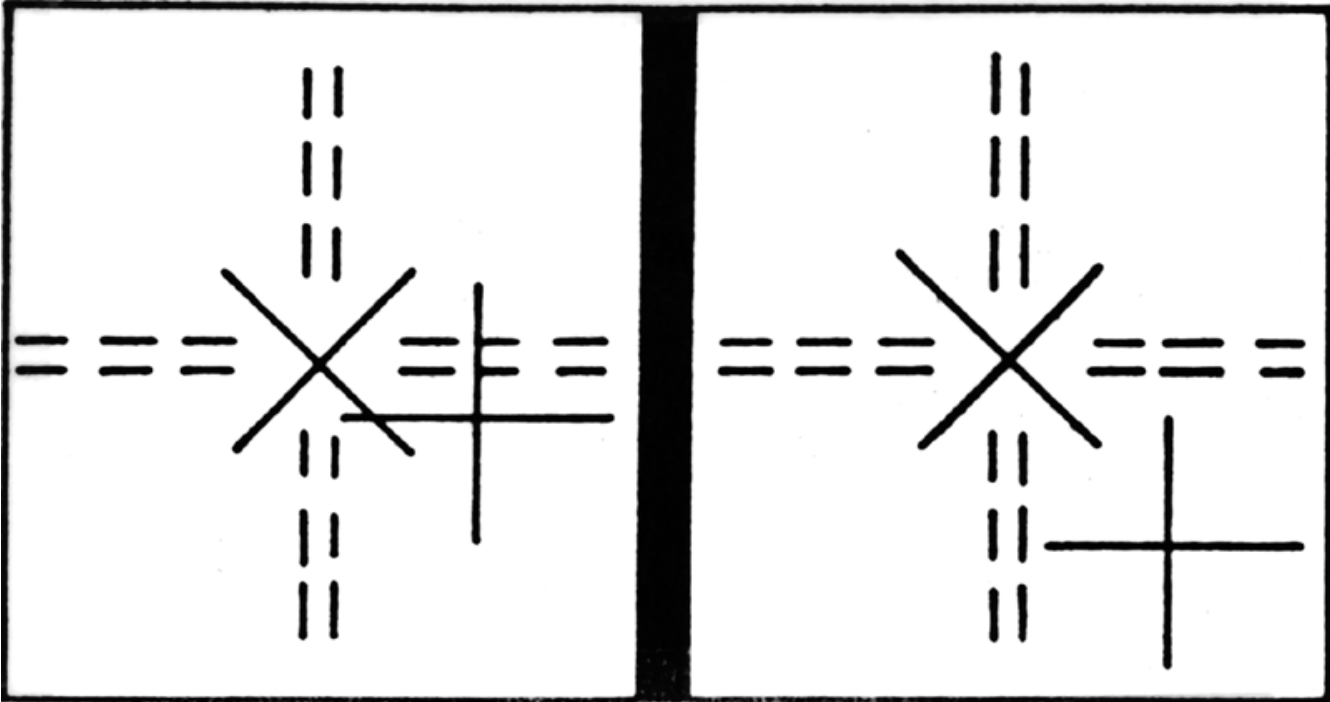
GCA stepper alignment marks offset relative to the microscope reference marks.
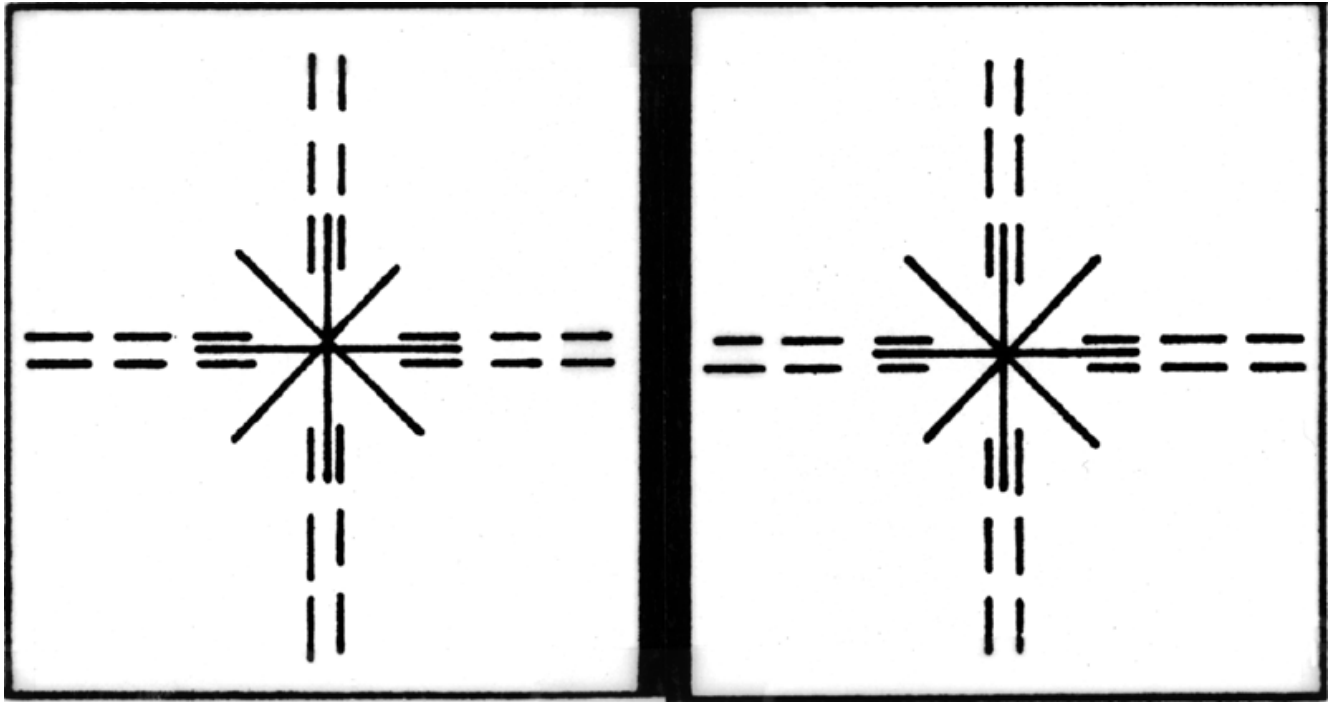
GCA stepper alignment marks in perfect registration with the microscope reference marks.

POSSIBLE ERRORS

Alignment errors of the reticle to the column:

Perfect alignment with a mark exactly 25 microns wide has a gap of 3.125 microns on each side. For this case, the worst error would then be 3.125 microns, which translates into 0.625 microns on the wafer (n/5). This does not apply to rotational errors.

Alignment errors of the wafer to the column:

Perfect alignment with the *outer* 5 micron bar has a gap of 1.5 microns on each side. For this case, the worst error would then be 1.5 microns.

Stage error
Data input of 0.1 µm, the least count of X & Y coordinate stage motion is ±0.04 µm.
Positional precision of each stage is ±0.05 µm

When all the types of errors are added together, the typical alignment accuracy using optical alignment is around ± 0.25 microns. Occasionally, it can be better, but it is the exception, not the rule. Keep this in mind when designing your device.
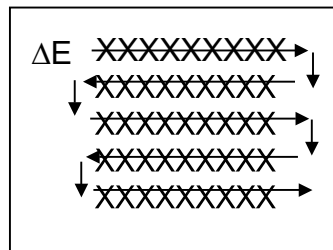
EXPOSURE

The first thing to be aware of is the thickness limit of the focus system. The stepper has chucks for nominal thicknesses +/- 100um. Choose the correct chuck for the thickness of your substrate.

Depending on the image design, thickness of the resist and wafer type, a characterization must be done to determine the best exposure time and focus value. The command EXPO is used to do this. EXPO can be used in 3 ways:

1. It can be used as an exposure/focus matrix that uses an array from an existing job. Each row is a different focus value and each column is a different exposure time.
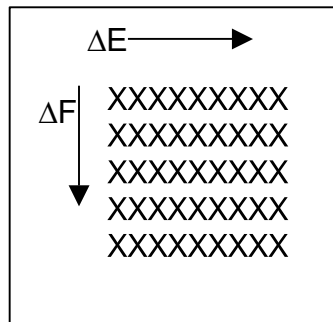
2. EXPO can also be used as an exposure only matrix which allows you to vary exposure times with each die. An important difference to be aware of is the order in which the stepper exposes the die.


3. EXPO can also be used as a focus only matrix which allows you to vary focus with each die. One value for exposure dose must be specified.
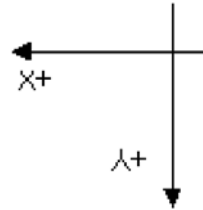
To specify the focus/exposure matrix, at the prompt for choice of test, type R. If the exposure only matrix is wanted, type E, for focus only type F. Inspection is done using the microscope looking for the die that gives you the best results.

SHIFT KEY & KEY OFFSET SECTION

In order to understand how to use these commands, it is necessary to understand the way the stepper translates the pattern from the mask to the wafer. From the mask to the wafer, the pattern gets inverted 2 times, once in X and once in Y, yielding a 180° rotation.
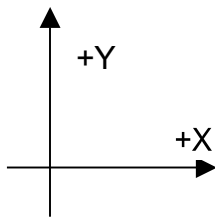

Reticle or Mask Pattern   Printing of same pattern on the wafer

Key Offset: This will be used if your alignment marks are not in the center of the die. This is explained in the stepper training session and the section above so you should already be familiar with it.

Shift: This may be used when the center of the die is not at the geometric center of the mask. For example, one reason you may need this is if you do a tone reversal and the cutout frame is not symmetric about the pattern. In CAD, the conversion program uses the outermost frame as the reference for center, in this case the cutout frame. This center point becomes the center point for all the layers that it surrounds. Because it is not symmetrical about the pattern, the center for the pattern is shifted to be the same as the center for the cutout frame. Because the mask is always aligned in the same position and the stepper knows where the center of each die is in the job you've created, the shift on the mask causes the shift of the center of the die on the wafer. The **stepper always goes to the center of the die**. To determine the shift, keep in mind this point is fixed and the wafer must be moved to adjust the center.
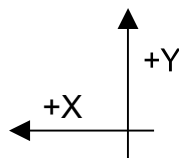For example:

inner frame center (1000, 1000) Pt 1
outer frame center (1050, 1050) Pt 2
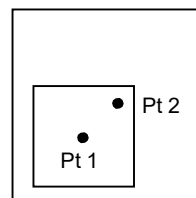
To go to inner frame center to the outer frame center would require a shift in X and Y. To determine the sign of the shift, you must know the axis directions for the stage and which way the stage, must move to get to the desired position.

STAGE MOTION AXIS

 For the above example, the shift in X would be +50 and the shift in Y would be -50. Pt 1 (1000, 1000) is fixed. We need to move the wafer so that Pt 2 (1050, 1050) is in that position.

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You will also need to use the SHIFT if you have multiple images on one reticle. You will need to know the offset of each image from the center of the mask, as well as the size in X and Y of each. The SHIFT has to be entered in wafer dimensions, while the Aperture Blade settings are entered in reticle dimensions.

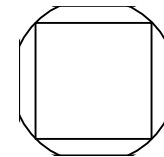**TO AVOID USING THE SHIFT OPTION:**
Always make certain that the <u>origin in CAD is at the center of your pattern</u>, as it will be placed at the center of the reticle. For tone reversal, use a frame as the "cut out" for the pattern with its center at the geometric center of the die. For a normal conversion, the program looks at the origin to determine the center of the die. If the reversal frame is not centered your alignment may appear shifted by that offset.
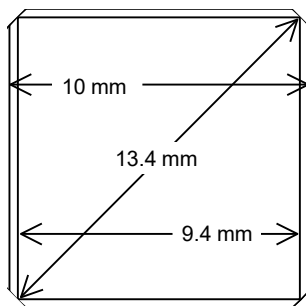
General Stepper Information

Reduction	GCA 5:1	Autostep 5:1	ASML 4:1
Field Size	15 mm	15 mm	15 mm
Wavelength	436 nm	365 nm	248 nm
N.A.	0.30	0.45	0.40 - 0.63
Resolution k=0.6 k=0.8	0.9 μm 1.2 μm	0.50 μm 0.65 μm	0.25 μm 0.15 μm
Depth of Focus	± 2.42 μm	± 0.87 μm	± 0.25 μm

22 mm

20 mm

15.5 mm
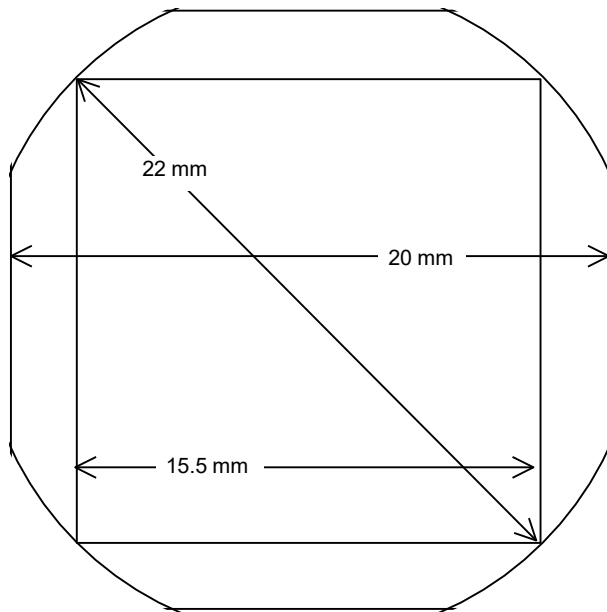
5:1 Stepper Field
(4X actual size)

5:1 Stepper Field
(actual size)

10 mm

13.4 mm

9.4 mm

10:1 Stepper Field
(4X actual size)

10:1 Stepper Field
(actual size)

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COMMAND SET

(Note: all of these commands may not be active)

1) AEXPO Retries a previously specified DEXPO file (see below) for the purpose of generating an exposure/focus matrix on a wafer (or mask).

2) BASIC Allows access to a calculator that performs addition, subtraction, multiplication and division.

3) COMP Reads and reports the last four digits of the laser compensator.

4) COPY Allows a user to copy files from another user's area to his own area on a selected disk.

5) DELETE Deletes files from user's area on a user-selected disk.

6) DEXPO Allows a user to pre-define the parameters of an EXPO run in file form. Only AEXPO can execute this file.

7) DISP Displays graphically part or all of a job array.

8) ECHO (ON or OFF) sets up a second terminal to echo or duplicate input/output communications of first terminal.

9) EDIT Modifies a previously specified job stored either in a job file on disk or read from paper tape.

10) EXEC Runs one or more passes of a job.

11) EXPO Creates a one-time exposure/focus test array made at user-selected shutter speeds and/or focus settings.

12) HISREC Displays history files.

13) LIST Prints the job name and associated pass name(s) contained in the specified job file on disk.

14) LISTF Prints from selected user area and disk file names and time and date created.

15) LOAD Positions stages for manual wafer loading or unloading. This command is usually executed automatically.

16) LOG (IN or OUT) identifies the user to the terminal.

17) MESS Allows a user at one terminal to send a message to another terminal.

18) MODE Establishes specific hardware patterns.

19) MONITR (ON or OFF) allows all activity at other terminal to be echoed at monitoring terminal.

20) OPER   Establishes wafer alignment joystick rates.

21) ORIG   Retunes laser and originates stage laser metering.

22) PFCORG Originates the Programmable Focus Control Stepper motor.

23) PRINT   Prints text files stored on disk via TEDIT.

24) RENAME Gives an existing file a new name.

25) SETDSK Allows system to recognize a new disk in unit two for a Winchester system and in unit one for a dual floppy system.

26) SHUTDN Shuts down system computer after closing current history file, if any. Must be used for shutdowns when history processing is active.

27) SPEC   Creates new jobs.

28) TEDIT   Creates, modifies and stores text files on disk.

29) TIME   Prints current time/date.

KEYBOARD CONTROLS (Note: all of these commands may not be active)

1) A Enables user to toggle between left and right non-standard alignment keys during wafer alignment process.

2) D Enables a jog mode for joystick during wafer alignment. Stages move one stepping distance in the selected direction.

3) E Cancels jog mode such as D. Normal wafer alignment modes are restored.

4) F Enables user to search for wafer alignment keys not initially in the TV field of view. Each issue of CTRL F causes stages to move a step at a time along an expanding rectangular spiral.

5) 0 Allows user to temporarily modify wafer alignment joystick rates.

6) P Initiates a progress report while a pass is being executed. The row and column of the array element being exposed as well as expected time until completion are printed, for example:

          10 EXPOSURES DELIVERED OUT OF 35 - 10:46:08 13/8/89
          ESTIMATED PASS COMPLETION IN 0 MIN 32 SEC.

7) <**Ctrl C**>, **A** Aborts the command in progress at the terminal, prints COMMAND ABORTED and returns control to the command monitor. (Also see S below).

8) S This function is useful for halting the scrolling of the video terminal display since it suspends operation at the terminal from which it was issued. To resume operation, type <**Ctrl-Q**> one time only. Typing <**Ctrl-Q**> twice after <**Ctrl-S**> will abort the command in progress. A safer alternative is to use the SCROLL LOCK key on the terminal. This toggles on and off.

9) U On a video keyboard terminal, <**Ctrl-U**> erases the current line of input and positions the cursor at the beginning of the deletion. On a hardcopy terminal, <**Ctrl-U**> cancels the current line of input. A carriage return/line feed is generated and the line may be retyped.

10) Z Suspends system activity until a second <**Ctrl Z**> is issued.

11) REPT Initiates fast line feed and is equivalent to typing <**Enter**> to each separate question. For this function the REPT key and the <**Enter**> key are held down simultaneously. On earlier systems where no REPT key is present, merely hold down <**Enter**> key. Also holding down any other key longer than one second will cause a repetitious printing of that character until the key is released.

12) <**Enter**> (Carriage Return) enters data and signal to the computer that the current user response is completed, the data is to be stored and the program is to advance to the next question.

13) RUBOUT (DELETE) Pressing RUBOUT key (DELETE on some terminals) removes the last character typed. Two RUBOUTS remove the last two characters, etc. On certain terminals RUBOUT may be a shift character. In this case the lowercase symbol (an underscore) acts like a rubout.

14) ? In SPEC, EDIT, and MODE, pressing the ? followed by <**Enter**>, backs up one line of the questioning each time it is pressed.