GCA 8500 Wafer Stepper

(gcaws6)

1.0 Title

GCA 8500 Wafer Stepper (6")

2.0 Purpose

GCA-8500 wafers stepper is a fully automated 5 × reduction step and repeat camera (stepper), capable of resolving sub-micron features sizes as small as 0.7 µm in a production environment that can easily be pushed beyond these limits in a research facility. A field size of 10.06 mm × 10.06 mm^2 (die size) has been specified for this stepper at the wafer level (standard stepper job). Microlab members can print such field sizes using the I-line resist (standard program). Larger field sizes as large as 1.5 mm × 1.5 mm (square) can be realized; however, stepper jobs need to be changed to accommodate the alignment scheme with the correct numbers of fields exposed on the wafer. Larger die sizes up to 22 mm^2 area may be realized by exposing a different shape exposure field (rectangle), which may be more desirable for MEMS applications. This however will need some investigation, so contact staff for advice/job set up.

3.0 Scope (System Control – Overview)

This chapter covers the general operation of the GCA-8500 I-line stepper, which includes the command set, keyboard controls, information on disks and data storage, and job setup.

4.0 Applicable Documents

Revision History

The following documents are published by GCA and can be found on the shelf in Y3 adjacent to the wafer stepper.

4.1 **Wafer Stepper Operation Manual** (Document Part No 039617G2). This manual details the gcaws6 system description.

4.2 **Reticle Handbook** (Document Part No. 080360G2). This manual specifies how to make a reticle for this stepper to include, reticle alignment window, alignment target placement strategy, alignment schemes, global and local alignment target specification.

5.0 Process Terminology

Job File containing a description of all reticle changes, exposure sequences and stage motions which constitute the pattern of images to be projected onto the wafers specified by the SPEC (for new jobs) or EDIT commands (to modify existing jobs). A Job consists of one or more **passes** (see below), and must have a unique, non-blank name, which may range from a single character up to two words or strings of six characters each. Legal characters include alphanumeric, plus (+), minus (-), and period (.).

Pass Describes placement of exposures on a wafer from a single reticle. A legal name for a pass follows the same convention as a job name. During an **array pass** a wafer is covered with exposures, except for those locations specified as **dropouts**. During a **plug pass** exposures are made only at specified locations.

DSW Direct Step Wafer

AWH Automatic Wafer Handler

RMS Reticle Management System

FLOOR Slot number on the reticle cassette elevator

ELEVATOR CASSETTE LIBRARY This elevator unit holds up to ten reticles.

6.0 Safety

When manually removing a wafer from the wafer chuck stage, never touch the insitu probe; it is a $50,000 dollar lens located at the front end of the stage. This area of gcaws6 has been labeled for identification.

7.0 Statistical/Process Data

8.0 Process Notes – Command/Argument Syntax

8.1 General Description (Notes)

The GCA-8500 wafer stepper is a 5× reduction camera (stepper) that projects micro-lithographic images directly onto the I-line resist coated on 6” wafers with high precision and accuracy. Send and receive stations are equipped with GCA standard wafer carriers, each of which holds up to 25 wafers. An automatic wafer handler (AWH) pre-aligns each wafer before transferring it to the wafer chuck. Focus is controlled through keyboard input. Stage motions are laser-metered for accurate positioning over entire exposable area of wafer/stage. A die size of 10.06 × 10.06 mm^2 has been specified, as a standard die size at wafer level for this stepper. This will print a 14 × 14 array for which a job has been set up (Job name: STANDARD). Five-inch chrome masks only are used on this system as emulsion masks are not compatible with I-line wave lengths. Job parameters for a particular run are specified and entered into the computer-controlled system in advance by the user. The original DIGITAL PDP-11 computer and Winchester disk drive have been replaced with a modern x86 computer that emulates that system. A video keyboard terminal permits interactive communication between user and control system. One word commands are used to initiate the desired function, at which time the program prompts for the necessary input or action. Information pertaining to the job in progress is displayed on the LCD as it progresses.

8.2 The Command Set (used at system prompt)

The following commands can be given whenever the system prompts: appears on the LCD Monitor. They are divided into four categories:

(1) Disk Manipulation
(2) Job Setup
(3) Job Execution
(4) System Utility

These commands invoke a self-prompt mode when issued without arguments, that is, the program will initiate a **dialogue** with the user in which the user is prompted for information which s/he supplies using the keyboard. The use of self-prompt mode is recommended for new users. Experienced users can issue commands with arguments to save time.

Please refer to the **DSW Wafer Stepper System Control Manual** for transcripts of the dialogues initiated by these commands in self-prompt mode, as well as explanations of each prompt. Further information on Command/Argument Syntax can be found in Section 8.0 of this manual as well as the **DSW Wafer Stepper System Control Manual**.

8.3 Disks and Data Storage

The Winchester disk system is logically divided in three **disk units**: DU0, DU1 (the two logical halves of the Winchester disk) and DU2, the 3.5” floppy disk unit. DU0 and DU1 are the **System Disks**, reserved for storage of the stepper's Master Operating System (MOP). DU2 is the **Data**

Disk, and is the primary storage disk for job files. Each research group (or individual student) is responsible for maintaining their own floppy disks. Storage for these disks is provided in Y3.

Note: Always back up your floppy disks to protect your jobs in the event that, due to malfunction, the contents of your floppy disk are dumped. Floppy disks are stored in Y3 in the stepper room rolling table drawer labeled gcaws6 group diskettes. The floppy drive on gcaws6 uses 3.5" double-sided, high-density diskettes. New diskettes can be checked out from the Microlab office. All new diskettes must be formatted on gcaws6 PC before usable.

8.3.1 Disk Manipulation Commands

LOG IN Identifies user to the program.

LISTF Lists files in the current user area, along with time and date created.

COPY Copy a source file to a destination file.

DELETE Delete a file.

RENAME Give an existing file a new name.

NEWDSK Format a new disk. Only format new disk on DU2.

Note: Never format DU0 and DU1.

SETDSK Set to DU2: to run file in floppy drive.

8.4 Job Setup and Reticle Management Commands

SPEC Specifies a new job description, which includes array dimension, the stepping distance, wafer alignment key offsets, etc. See Section 5.0 of the **DSW Wafer Stepper System Control Manual** for details.

EDIT Edits a previously specified job.

LISTF Specified job file(s).

DISP Graphically displays all or part of a job array.

RMSL Load reticle on the mask platen.

FLOOR Slot number on the reticle cassette library

INV Check reticle inventory at the reticle cassette library

RMS WINDOWS Reticle Management System Alignment Window on Reticle

RMSD Reticle Directory

RMSR Remove reticle from mask platen

Note: When specifying offsets for a job, please make note of the convention employed by this system, shown in Figure 1.

8.5 Job Execution Commands

EXEC Execute one or more passes of a job.

EXPO Initiates an exposure/focus test.

8.6 System Utility Commands

ORIG Retunes laser and originates stage laser metering.

BASIC Allows access to a 4-function calculator (+, -, *, /).

Break Soft reboot computer.

HELP List information on most commands.

8. 7 Keyboard Controls

D Enables a jog mode for joystick during wafer alignment. Stage will move one stepping distance in the selected direction.

E Cancels jog mode such as **D**, restoring normal wafer alignment motions.

F Enables a user to search for wafer alignment keys. Each issue of **F** causes stages to move a step at a time along an expanding rectangular spiral.

O Allows a user to temporarily modify wafer alignment joystick rates.

P Initiates a progress report while a pass is being executed.

Q Aborts the command in progress at the terminal.

S Halts the scrolling of the video terminal display. To resume operation, type CTRL-Q one time only.

U Erases the current line of input and positions the cursor at the beginning of the deletion.

Z Suspends system activity until a second **Z** is issued.

DELETE Removes the last character typed.

? In SPEC, EDIT, and MODE, pressing the **?** followed by a carriage RETURN backs up one line of questioning.

Enter Enter key on numerical keyboard change the microscope focus rate to slow or fast mode.

+/- + and - keys on the numerical keyboard change the focus.

8.8 General Terms

The following terms are employed throughout the DSW system dialogues:

[Prefix used with various combinations of characters (see, Identifying Terms below) to specify either:

- a) user file area,
- b) user ID, or
- c) device designation at boot time.

@ When rebooting the computer, prompts the user to identify the device from which the MOP will be read.

***** Wild card character used to substitute for names, characters or groups of characters. Allows the user to operate on large groups of files having similar names or multiple user ID's. A timesaving feature for experienced users.

: Single colon is the general command prompt for job execution, editing a job, and stage ORIG.

➢ Prompt that automatically takes the machine into the reticle management mode; use **shift ~** to get out of this mode.

:: Use CTRL/C to get the double colon prompt to abort the job followed by typing **A** to bring back a single colon prompt.

8.9 Identifying Terms

The following terms identify the various system peripherals. Each must be preceded by a **[** (see General Terms above).

DUn disk device name. See Section 8.3.1 for details on the available options.

[XX,XX] Account Numbers, which identifies the user to the system so that all files created by that user, are assigned to his/her own area on the disk by the program. The account numbers, i.e. [10,11] are generally assigned by staff according to the research group.

8.10 Sample Arguments

Most DSW commands can take arguments. A command issued to the program without an argument initiates a self-prompting dialogue. The default disk is the unit the user has specified upon logging in. If no disk is specified at that time, DU0 becomes the default disk. The default user area is that area assigned to the current user logged in. The * (wild card character) can be used with most commands.

The full command argument structure is as follows:

COMMAND [xx,xx] JOBNAME\PASSNAME

Spaces must be entered as shown.

Examples of the correct argument syntax follow. Assume user XX is logged in on DU1.

LISTF [XX,XX]

LISTF [xx,xx]

LISTF [xx,xx] Each of the above will list all of xx's files on DU1.

LISTF

LISTF [** These will list all files of ALL users on DU1.

LISTF [xx,xx] *** * List all XX's files on DU0 with 3 or less characters in the first names and any second name.

LISTF *** List all of XX's files on DU1 with a first name of 3 or less characters and no second name.

LISTF BUB*** * List all of XX's files on DU1 with a first name whose first 3 characters are B-U-B and last three are any other acceptable characters and has any second name.

8.11 Job Function Commands

Once you have established a job using SPEC, you are ready to do a run, or 'execute the job'. What follows is an overview of the control components of the hardware, followed by a detailed description of procedures.

8.11.1 Automatic Wafer Handler

The AWH system automatically loads and unloads wafers in the stepper. It is comprised of several subsystems:

Send Station
Pre-align Station
Transfer Station
Receive Station
Control Module (Button Box)

The **Button Box** is used to issue commands to the AWH. When the AWH is started, individual wafers are transferred from the send station along the send air track to the **pre-align** station. There the wafer is mechanically centered and the major flat positioned using a non-contacting photoelectric flat finder. The pre-aligned wafer is then moved via a **transfer arm** to the wafer chuck. Simultaneously, a completed wafer, should there be one, is taken from the chuck to the receive air track of the **receive station** for loading into the wafer receive carrier. The wafer loaded on the chuck is manually fine aligned using the button box controls. When fine alignment is completed, the wafer is exposed to step and repeat the desired pattern on the wafer. The cycle is repeated until all the wafers loaded at the send station have been exposed.

8.11.2 Button Box Functions

Theta (T) Joystick Used to rotate a wafer about its theta axis for minor angular adjustments.

X,Y Joystick Used for stage movement in x and y directions for wafer position adjustments along those axes. The enter key on the numeric keyboard adjusts the fast and slow align mode.

EXP (EXPOSE) Pressing this button will expose the specified pattern after fine alignment has been completed.

HLT (HALT) Stops the AWH subsystem in its cycle without halting exposure of the pass in progress. The subsystem will not resume operation until the S/C (START/ CONTINUE) button is pressed. Press this button to clear alarm sound.

RTY (RETRY) In the event that either sufficient vacuum cannot be maintained on the wafer chuck or fine alignment is not possible, press the **RETRY** button. The wafer is returned to the pre-align station for realignment and then is placed back on the wafer chuck.

MAN (MANUAL) ALIGN Not used. System set up to operate only in manual. Initially used in conjunction with START/CONTINUE. When both are pressed simultaneously, the stage moves to the load position in preparation for manual operation. Subsequent pressing of MANUAL ALIGN moves a wafer to the align position.

RES (RESET) Stops the Automatic Wafer Handler immediately, terminates vacuum and air, and initializes the program count. Press RES twice to raise the send and receive cassettes. Press this button when a job is finished.

REJ (REJECT) If the wafer cannot eventually be positioned properly, push the **REJECT** button. This action moves the wafer from the wafer chuck to the pre-alignment spindle and shuts off the vacuum so the wafer can be removed manually. After removing the wafer, press REJECT a second time to resume normal operation.

ELV (ELEVATE) Not in use with this machine.

S/C (START/CONTINUE) Initiates the Automatic Wafer Handler at the start of a run. Resumes operation after the **HALT** button has been pressed or an **AWH Time Out** has occurred.

1st L (FIRST LAYER) When pressed in conjunction with S/C, exposes wafers at the first level, eliminating the fine alignment step so that

	exposure is made directly on all wafers following transfer without further attention by the user.
LAMP Intensity Control Knob	Controls the intensity of the wafer illuminator.
LAMP ON/OFF Pushbutton	Turns the wafer illuminator on or off.
LOW WAFER VAC	Warns a user that the wafer chuck's vacuum level is insufficient. You can try to correct the situation by using RETRY.
Warning Light	It is normal to see the warning light blink when the transfer arm drops a wafer onto the wafer chuck.
ALIGNMENT KEY FOCUS	Adjusts the focus of the wafer alignment keys on the TV monitor when the system is in manual wafer alignment mode. Use the **-** (minus) and the **,**;(comma) keys on the numerical keyboard to adjust the focus on the monitor.

9.0 Equipment Operation

Before you begin, you should check the lamp temperature. For optimal focus and exposure results, it is important that the lamp is operating within a temperature range of 184-202ºC. Temperatures above 202ºC could result in the lamp exploding! Temperatures below 184ºC will adversely affect the focus and exposure quality. The temperature of the lamp is displayed on an LED light which can be viewed by opening the lower front panel door of the gcaws6 which is located underneath the keyboard. If the temperature is out of the optimal range, the air-cooling for the lamp will need to be adjusted. Post as a problem on FAULTS immediately.

IMPORTANT: Acclimate wafers in the gcaws6 for 5 minutes before any exposure sequence. Keep CAPLOCK button on at all time to avoid command miss recognition.

After enabling the stepper your first job is to:
(1) load the mask in the desire reticle cassette.
(2) load the reticle cassette in the desire slot # in the elevator/cassette library.

9.1 Reticle Mask Load into the RMS (Reticle Management System)

Prior to job execution, load your reticle into the cassette, then load the cassette into the desire slot (floor) in the elevator/cassette library. The numbered floor provide the system with a known location for referencing a specific reticle. Since these floor numbers are referenced within job specifications, it is important that these reticle locations remain consistent. Gcaws6 users will need to remember which slot # (floor #) the reticle was loaded in the elevator if there is no bar code on the reticle. Use the following procedure:

9.1.1 Turn on light on **contrast** and **bright** knobs on the alignment monitor. Turn the power ON on the LCD command monitor (bottom button on the back of the monitor).

9.1.2 Log into the system by typing **LOG IN** and entering your group ID and disk identifier on the DSW system monitor, e.g. DU2: [10,11].

9.1.3 SETDSK

9.1.4 Input disk identity.

9.1.5 Enter the command RMSLOAD.

9.1.6 At the elevator cassette library, pull out and hold the cassette-locking pin with your left hand. Use your right hand to pull the cassette out, then release the locking pin.

9.1.7 Place the cassette on a level surface and lift open the hinged cover with your left hand.

9.1.8 Observe the bar code orientation diagram inside the cassette. While holding the reticle by the side edges with the chrome side facing down, carefully place the leading edge of the reticle against the backstops, and slide the reticle onto the support platform with your right hand. Reticle offset alignment window or bar code should be at the bottom.

9.1.9 Close the reticle cassette cover.

9.1.10 At the elevator cassette library, pull out and hold the cassette-locking pin with your left hand. Insert the loaded cassette into the desired slot # (floor). Ensure that the cassette sits fully at the rear of the slot.

9.1.11 Release the cassette-locking pin to secure the loaded cassette in place.

9.1.12 Press RETURN on the DSW system monitor; the system will automatically inventory the new reticle. Note that it will list NONE when there is no bar code on the reticle.

9.2 Executing a Job

9.2.1 Load your wafers into the send cassette, making sure that they are positioned in corresponding slots on each side of the cassette. A cocked wafer will interrupt operation of a job and could cause possible damage to the system.

9.2.2 Acclimate wafers for five minutes before exposing.

9.2.3 To execute a job, the command EX is used. Enter the command EX jobname\pass, where jobname is the name of the job specification to be used, and pass is the pass number within the job.

9.2.4 Enter exposure time. Hit RETURN on focus offset (-50, -> +50): Default is the system focus value. Enter –1 on the reticle transmission % [0 –300]:

9.2.5 Enter NONE for reticle bar code:

9.2.6 For floor # : Enter the elevator slot # that you put your mask in.

9.2.7 Alignment mark phase (P/N/X): N (Enter N).

9.2.8 First Level Exposure

For automatic exposure of first or single layers, after getting the prompt **START AWH**, press **RES**, then press and hold 1st L while pressing **S/C** (Start Continue) on the button box- press this button down slowly and firmly. Be patient- it takes a few seconds before both of the cassettes lower.

9.2.9 2nd Level Exposure

For 2nd level exposure of 2nd and lateral layers, after getting the prompt **START AWH**, press **RES**, then press **S/C** (Start Continue) button on the button box. When alignment marks show up, use joysticks to align them accurately to the lens targets. Press **EXP** button when you are ready to expose. The Global alignment accuracy is ± .35 µm.

9.2.10 Field (local) Exposure

Spec up jobs as usual. Add a pass on the job and call this pass MAP. In the MAP pass, answer **Yes** when it asked **Use Local alignment?** One point alignment is good, but two-point alignment is more accurate. Make sure you know your local alignment mark offsets (X and Y coordinates). You can input P-lug or A-rray on the mapping pass. You must drop out all the edge dies that possible hit the stage limit when it does its mapping. It will calculate the average mapping alignment result on the number of (plugs or array) dies you specified and then expose all the dies on the pass base on mapping result.

First level exposure is the same as Section 9.2.8. For **Field** exposure layer, Type **MAP** filename\MAP,pass # after the colon prompt. After getting the prompt **START AWH**, press **RES**, then press **S/C** (Start Continue) button on the button box. When alignment marks show up, use joysticks to align them to the lens targets. Press **EXP** button when you are ready to expose. **MAP** uses the MicroDFAS alignment and the accuracy is +/- .15 µm.

9.2.11 Manual Alignment

When the Automatic Wafer Aligner is being operated in the manual mode, each wafer must be manually aligned on the wafer chuck using the TV alignment system with the alignment keys as guides and the stages being moved by the X, Y and theta joysticks on the button box.

(a) Originate the stepper 1 time (ORIG) before beginning alignment.

(b) To begin executing your job, type EX job name. You will be prompted for the necessary information pertaining to pass, focus and exposure, and you will be told when to start the AWH. Press S/C when ready.

(c) The AWH will bring a wafer to the chuck, and your alignment marks will appear on the TV screen. Use the joysticks to align your wafer, aligning the left cross only in the Y direction using the theta motion.

(d) When alignment is to your satisfaction, press EXP to begin the exposure sequence dictated by the pass description in your job.

(e) Repeat Steps (c) and (d) for remaining wafers.

(f) Type RMSR to unload your reticle.

(g) Type RES to reset the RMS elevator.

9.3 Baseline Correction

Baseline correction is an adjustment to the nominal offset of the X and Y stages from the optical axis when the stages are located at the **ALIGN** position. **GCA** specifies that it is absolutely necessary to correct the baseline frequently. The baseline correction is guaranteed to be stable for only six hours. This test is performed once per week by staff and when requested before a critical alignment layer.

9.4 Determining Exposure and Focus

It is necessary to determine the correct focus and exposure time as these parameters are a function of substrate, type and thickness of photoresist, development, and other factors.

Acclimate wafers for 5 minutes before exposing.

EXPO initiates an exposure/focus test function. Both row and array modes are available. The program prompts for appropriate action.

ARRAY Mode									
-------- = Wafer Major Flat at top									
1.50	1.51	1.52	1.53	1.54	1.55	1.56	1.57	1.58	1.59
1.69	1.68	1.67	1.66	1.65	1.64	1.63	1.62	1.61	1.60
1.70	1.71	1.72	1.73	1.74	1.75	1.76	1.77	1.78	1.79
1.89	1.88	1.87	1.86	1.85	1.84	1.83	1.82	1.81	1.80
1.90	1.91	1.92	1.93	1.94	1.95	1.96	1.97	1.98	1.99
2.09	2.08	2.07	2.06	2.05	2.04	2.03	2.02	2.01	2.00
2.10	2.11	2.12	2.13	2.14	2.15	2.16	2.17	2.18	2.19
2.29	2.28	2.27	2.26	2.25	2.24	2.23	2.22	2.21	2.20
2.30	2.31	2.32	2.33	2.34	2.35	2.36	2.37	2.38	2.39
2.49	2.48	2.47	2.46	2.45	2.44	2.43	2.42	2.41	2.40
1.5 = Starting exposure (sec.)									
.01 = Incremental exposure (sec.)									

ROW Mode	
	-------- = Wafer Major Flat at top
Focus = -12 or +12	1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4
Focus = -9 or +9	1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4
Focus = -6 or +6	1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4
Focus = -3 or +3	1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4
Focus = 0	1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4
Focus = +3 or -3	1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4
Focus = +6 or -6	1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4
Focus = +9 or -9	1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4
Focus = +12 or -12	1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4
Focus = +15 or -15	1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4
1.5 =	Starting exposure (sec.)
0.1=	Incremental exposure (sec.)
Note:	System focus setting is pre-recorded in MODE
+/-3 =	Focus increment/decrement. Both position and negative values are allowed.

Focus/exposure tests are done routinely by staff. If you wish to do this yourself, consult staff. If submicron resolution and critical dimension control are important for your process, it is recommended that you do your own focus/exposure tests just prior to exposing your work wafers. The focus, exposure job FOCUSEXP\1 has a 10X10 matrix with the Process Manager's (Sia Parsa) focus resolution test mask.

Note: Please DO NOT update the system focus because your best focus may not be the best focus for other users. Just put your best focus (focus offset) in your own job.

9.5 Booting the Master Operating Program

If the system computer should go down, please make a note in the gcaws6 problem log. You can then reboot the system as follows:

GCAWS6 Computer Soft Boot Procedure:

(1) Make sure that the floppy disk drive does not have a floppy disk in it.

(2) Press CTRL+ALT+DEL. If the system does not respond, press the reset button on the RESET button on the front of the blue RZA computer.

(3) Wait for the system to finish rebooting. This will take several minutes.

(4) When the system is ready, it will prompt you for the time and date. The time and date are entered in the following format HH:MM DD-MMM-YY. (i.e. 13:00 01-JUN-07).

(5) Next, insert your floppy disk in the floppy disk drive and LOG IN and then ORIG the stage 3×.

Note: If, during this procedure, the VDT symbols on the screen are cryptic, it means that the transmit and receive speeds are not at the specified 9600. To correct this, contact staff.

10.0 Troubleshooting Guidelines

Error Message	Corrective Action
Stage Limit	(1) Press CTRL and C simultaneously for the double colon prompt to show up and then type A. (2) Press the stage limit button just inside the chamber to back the stage off the limit switch. (3) Type ORIG then carriage return. (4) Execute your job. (5) If the stages go to the limit again, retry. (6) Enter the error in the comment section when disabling, or as a problem if it continues.
Can't Originate	(1) Press CTRL and C simultaneously for the double colon prompt to show up and then type A. (2) Make sure the stage is not over a limit switch by checking the red limit light inside the chamber. If it is lit, press the reset button. (3) Make sure that the stage control module is on. (4) Type ORIG then press carriage return. The terminal should respond with **originating laser counter**. (5) If the problem continues, disable the equipment, report the problem on the wand to notify staff.
Mask Alignment Problem	(1) RMS windows dirty on mask. (2) RMS window position on mask loaded in wrong. (3) Mask loaded upside down. (4) RMS alignment windows on reticle platen dirty.
Can't Find Target	(1) Press retry. (2) Confirm x and y offsets, loading corrections, job name and level. (3) Press F to progress the stages through a systematic search.
Laser Retune Failure **Laser Metering Loss**	(1) Type ORIG and press carriage return. If the error is repeated, it means the signal from the laser, which monitors the stage position, is affected. Report it as a problem on the wand if it continues.
Wafer Jam	(1) If wafer is jammed before being loaded onto the exposure chuck, press halt, and then press reset on AWH. Replace the wafer in the cassette. (2) To remove a wafer loaded onto another wafer on the chuck, press CTRL and C simultaneously and then type A. Use the joystick on the isolation table to drive the stage away from the transfer arm. Remove the wafers and avoid touching the insitu probe. (3) When disabling the machine, be sure to enter this in the comments section or as a problem if it continues to occur.
Auto-Focus Failure	(1) Check alignment lamp. (2) Retry. If it continues, report it on faults.
Light too Low	Time to check Mercury Arc Lamp.
When : CTRL C & :: A doesn't respond	When "Prepare for Local Alignment" message prompts on Metrology System monitor, press CTRL, ALT & DEL keys simultaneously on Metrology System keyboard. The bottom of the computer screen should prompt: Waiting for the MOP command <ESC> for Main Menu. The standard : prompt should be back on DSW keyboard.

10.0 Figures & Schematics

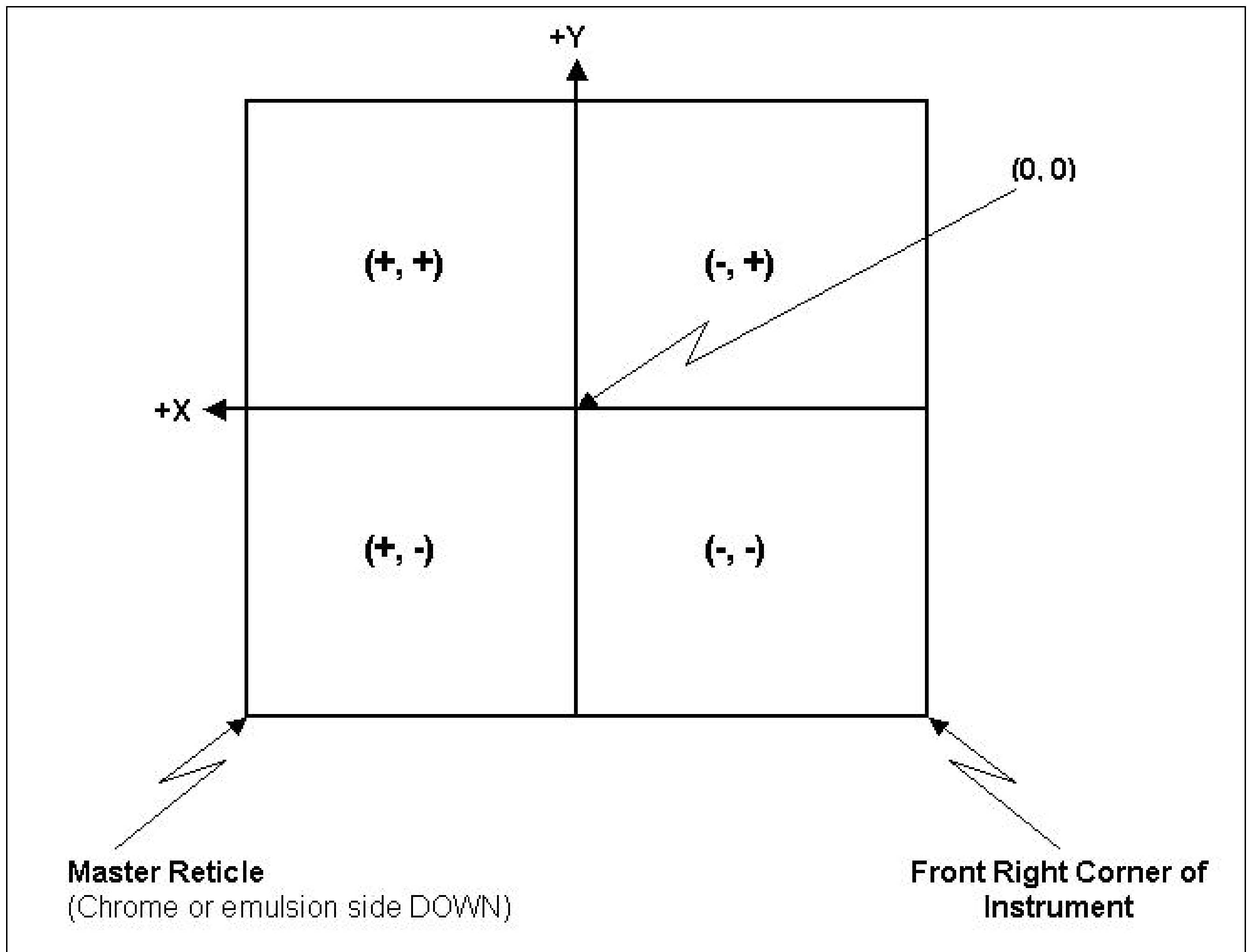

Figure 1

12.0 Appendices

APPENDIX A

Gcaws6 Light Meter Procedures

Lamp Centering

After the lamp has been replaced on the gcaws6, allow new lamp to warm up one hour. It must be centered or optimized for maximum light output. This is accomplished using the following procedure:

(1) Type UNIF after : prompt.

(2) Choose option 3- Maximus Intensity.

(3) Turn the X, Y & Z knobs on the lamp housing to maximize the lamp intensity. Watch for the intensity reading on the Metrology system monitor. Fine tune adjustments on the electronics rack with the pots. Intensity uniformity should be within 4%.

(4) Press Enter key to close shutter. Press Return key to exit.

(5) Continue procedure as below.

Energy Measurements

When starting up a new lamp, or whenever the need arises, the energy output can be measured using the following procedures.

(1) Type UNIF after : prompt.

(2) Choose option 1- Calculate & display uniformity.

(3) Choose option 4 to exist when finish checking the lamp intensity.

Note: When it asks to remove reticle, answer yes. When asks for reticle transmission % 0-300, answer -1. Type C for intensity collection. Intensity result will display on Metrology system Monitor. Press Enter when finish checking the lamp intensity.

APPENDIX B

GCA System Specifications

Parameter	Gcaws6	gcaws2
Model Number	8500	6300B
Lens	Zeiss 10-87-34	Zeiss 10-77-82
Reduction	5X	10X
Numerical Aperture (NA)	0.32	0.28
Resolution (µm)	0.9 (production) 0.7 (laboratory)	1.1 (production) 0.9 (laboratory)
Maximum Field Size (mm)	15.56X15.56mm square	10.0 × 10.0
Exposure Wavelength (nm)	365	436
Theoretical Depth of Focus Range (µm)	3.56	5.56
Alignment Tolerances (µm)	Global ± 0.35 MicroDFAS ± 0.15	± 0.3
Automatic Wafer Alignment?	No	Yes
Auto Focus Version	1 (phase-shifted infrared)	100 (white light)
Typical Exposure Times (sec.)	0.30 – 0.45 (I-line PR)	0.40 – 0.50 (G-line PR)
Lamp	1000 W (USH-1000FGL3) Maximus 2000	350 W (USH-350DP) Maximus 1000
Wafer Loading	150 mm adjustable theta control	100 mm adjustable theta control
Manual Wafer Loading?	Yes	Yes
Data Storage	3.55” double-sided, high-density floppy	3.55” double-sided, high-density floppy