Heidelberg DWL 66FS
Laser and Photomask Processing
Users Manual

Coral name: Laser Writer
Model: DWL 66FS
Location: Nanofab, Building 215
Contact: nanofab_litho@nist.gov
Version: 1.0

OVERVIEW:

This manual shows the step-by-step instructions to write a high resolution photomask using the DWL 66FS system. This system can be used for both direct write patterning and photomask patterning. Five inch soda-lime photomask blanks will be provided by the NanoFab. After successfully writing the mask this guide will step through the post write processing steps of developing, chrome etching, resist strip and clean.

RESTRICTIONS:

- System can convert the following data formats: DXF, GDS, Gerber or CIF.
- Do not attempt to write on pieces that have a diameter of less than 50mm
- Do not remove bulk resist in Nanostrip – used for cleaning post bulk resist strip
- Keep Nanostrip at room temperature
- No metal lift-off performed on mask processing bench

SAFETY PRECAUTIONS

- Be aware of the laser in the back of the system.
- Handle write-head with extreme caution when performing a write-head change.
- Be sure substrate is underneath write-head before attempting focus
- Be sure to wear proper protective gear when processing photomask
- Do not fill mask processing wet bench tanks – ask NanoFab staff if more chemicals are needed

CONTAMINATION CONTROL PROCEDURES

- No metal lift-off performed on mask processing bench
- Handle photomask with mask picks when appropriate
- Use nitrogen gun to remove any contamination on mask surface prior to placing mask on stage
- Be sure to put photomask box lid back on right after removing blank from box and put box of blanks back into desiccator

The following sections will explain how to start from data and process a complete photomask ready for contact alignment.

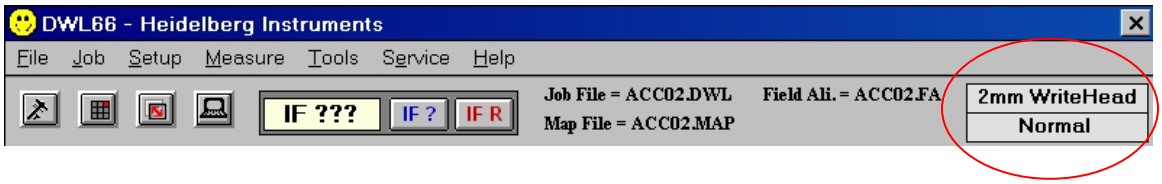
CONVERT PATTERN DATA

1. Log on to LINUX conversion computer. The user name and password are both “convert”.
2. Get your data onto the computer using USB drive, CD or floppy disc. Copy your data onto the computer in a location you can easily access.
3. Start-up conversion user interface named **XGui**.
4. Go to ***File, New Job***.
5. Name the job you are going to create. Try not to use same name in the future. Select OK.
6. Under Source File, press ***ADD*** and select your data type from drop-down menu (DXF, CIF, GDS, GERBER)
7. A file selection window will appear and you may now navigate to where your data is located. Select your data design and press **OPEN.**
8. A design window will be open. Select the appropriate layer/type.
9. Your data file now appears under the Source location.
10. An HIMT file will begin to be created. You may select **PREVIEW** to preview your data.
11. Select data options. Select appropriate write-head following general guidelines of resolution. (20mm~4 microns, 4mm~1 micron, 2mm~0.7 micron)
12. Select automatic centering
13. Select any other data or format options such as mirroring or inverting data.
14. Press **COMPLETE TASKS**, press **OKAY** and conversion will begin.
15. After completing conversion a FTP transfer window will pop-up. Do not change anything, simply press **TRANSFER.** During transfer the window will remain grayed-out.
16. Now ready to set-up write-job on other computer.

JOB SET-UP

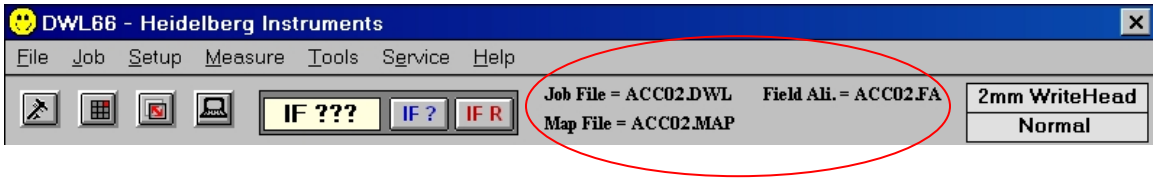
Windows based computer used to set-up write job. Generally, will fill out necessary job information and create/load 3 files necessary for exposure.

1. On windows PC, Open up DWL software if not already loaded.
2. Load configuration file for the write-head that will be used for exposure (same write-head chosen in step 11 of conversion). Double click upper right hand corner. Software will initialize for new configuration loaded.



3. Create Map file – Go to **SETUP – NEW** in the main menu

4. The New Exposure Map window will appear – Click **Create Map** and input an eight character or less name that will be used as project name for all exposure components
5. Confirm in dialog box to change to the new environment – you will notice 2 files are then created – a map file and a field alignment file.
6. Press **Exit** to exit from new exposure map window
7. Now it is time to edit the exposure map. Go to SETUP – EXPOSURE MAP. The exposure map design window will appear.
    - Line 1 – Field width – microns. Must be large enough for design
    - Line 2 – Field height – microns. Must be large enough for design
    - Line 3/4 – distance of alignment sites from origin (blank mask – leave default values)
    - Line 5 – Fields per row – for each row of dies, enter the number of dies it should contain separated with commas
    - Line 6 – Fields start at X – position in microns where each row is to begin in the x-direction with respect to field furthest to the left.
    - Line 7 – enter which field contains the substrate origin
8. Click **DRAW** to see the edited map
9. Close exposure map by pressing **EXIT**.
10. Now it is time to create job file. Go to **JOB – MAKE JOB**. The edit job spreadsheet will open. This sheet allows users to choose exposure conditions.
    - do column – leave blank if field NOT to be written. Place a "-1" to write that field
    - Ali, Xoff, Yoff – leave blank for mask writing
    - Design – path to your design(s) converted. Click on first row of design column. In main menu go to **FILE – DESIGNS.** Design directory will appear. Find the design you converted and double click it so that the path appears in the design field spreadsheet
    - Defoc – enter appropriate value (see write-head parameters below)
    - Energy – enter appropriate value (see write-head parameters below)
11. Close EDIT JOB spreadsheet and save .job file.
12. All 3 files are now complete. Should have job, map and FA loaded.



HARDWARE CHANGE

1. Open door to system
2. Determine if write-head needs to be changed. Should be writehead chosen during the data conversion.
3. Unplug 2 cables connected to write-head.

4. Loosen 3 screws holding write-head. Write head will fall slightly to the guiderails.
5. Carefully slide out write-head.
6. Protect lens area and place upside down on granite platform with the other write-heads.
7. Pick-up write head to be installed and slide it all the way in on the guiderails. Nameplate on writehead should be facing out.
8. Carefully tighten the 3 screws the hold up the writehead. Might need to tilt writehead up slightly for screws to catch on. Hand tighten the 3 screws.
9. Attach 2 cables onto the writehead.
10. Put on the appropriate filters for your write-head. See parameters below. Do not remove optics on the far left. Install filters from left to right, smallest to largest.
11. Close the door.

WRITE HEAD PARAMETERS FOR PHOTOMASK

Write-head	Approximate resolution limit	Filters	Defocus	Energy
20mm	4-5 microns	none	100	60
4mm	1 micron	10% + 50%	2950	100
2mm	0.7 microns	10% + 30%	1850	40

RUN JOB

1. Turn on laser
2. Go to **JOB – RUN JOB**. Job exposure window tree will appear along with field array map.
3. Click load. Wait for stage to move out to the load position.
4. Open door and place substrate in the middle of stage. Turn on vacuum.
5. Close door.
6. Click OKAY and the stage will move back to center position
7. Verify write-head is right above substrate.
8. Click focus. After a few seconds the tool will find the correct focus.
9. Click find center. Center window will appear. Click start. The tool will find each edge of substrate and then ask if you want to set new origin. Click YES.
10. Uncheck BS check.
11. Click expose. System will be begin with field one and expose the substrate. After a few minutes it will display an estimated write time.
12. After exposure complete, click unload.
13. Open door, turn off vacuum, remove substrate.

PHOTOMASK PROCESSING PROCEDURES

1. Develop in MF319 for 60 seconds
2. Rinse/Dry.
3. Chrome etch in Cr etchant 1020 for 60 seconds. Rinse thoroughly.
4. Remove photoresist in REMOVER PG for 5 minutes at 65°C. Rinse.
5. Further resist removal/clean in Nanostrip for 5 minutes at room temperature. Rinse and dry.