EQUIPMENT SPECIFICATION AND OPERATIONAL MANUAL

Nanoscribe Photonic Professional GT2

I. SCOPE

a. The purpose of this document is to describe requirements and basic operating instructions for the Nanoscribe Photonic Professional GT2 3D Printer. This tool is intended to be used as 3D printer for the fabrication of polymeric micrometer scale structures.

II. SAFETY

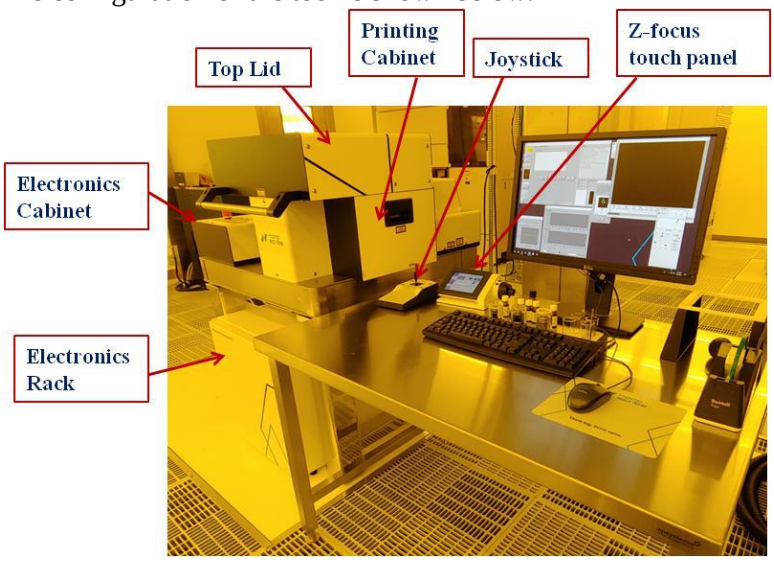
a. Be sure that you are trained and signed off to use the tool per AggieFab protocol.
b. The system is equipped with a class 3B femto-second laser. Make sure the top lid is firmly closed before starting the printing job.
c. Use care when changing the lens and sample holders.
d. Never put your arms, your hands or any part of your body in between the motorized stage and printing cabinet. Also putting your arms, hands or fingers inside the printing chamber is not allowed when closing the top lid.
e. If you are not sure the procedures or any unclear issue while operating the tool, please contact a staff member for assistance. Do not attempt to resolve an issue yourself.

III. APPLICABLE DOCUMENTS, MATERIALS AND REQUIREMENTS

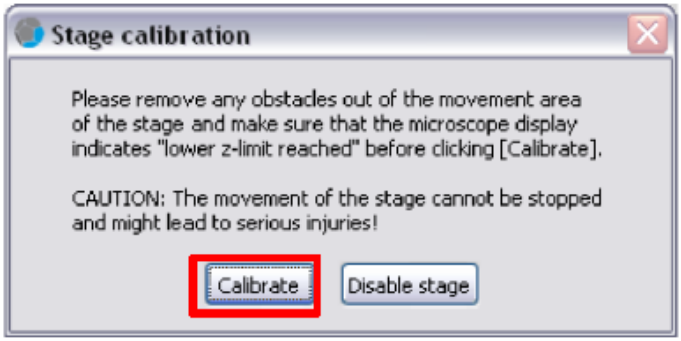
a. For more information about the detailed operation and appropriate parameters using in this tool, please refer to the operating manual of Nanoscribe Photonic Professional GT2 and the on-line NanoGuide.
b. Appendix A: small features 3D microfabrication solution set (63x objective lens)
c. Appendix B: medium features 3D microfabrication solution set (25x objective lens)
d. Appendix C: large features 3D microfabrication solution set (10x objective lens)

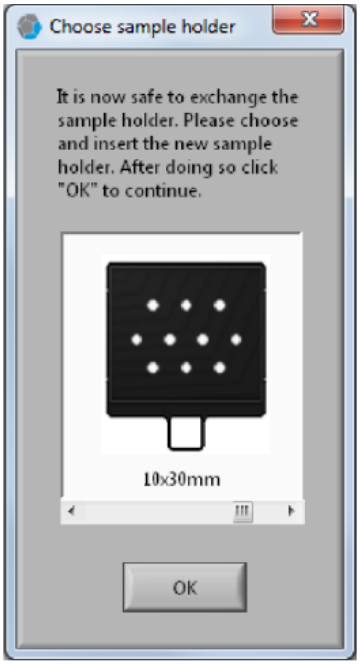
IV. OPERATION

1. The configuration of the tool is shown below.



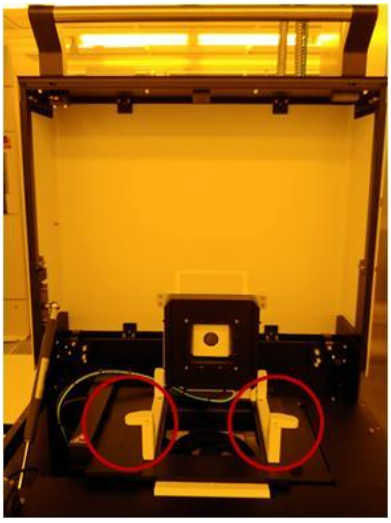
2. Prepare your design with STL file or job files from DeScribe before using the tool.
3. Log in the ‘User’ account and load your files into your own folder.
   - Extensive and complex writes should be initiated by a file located locally on the computer and not through external drives.
4. Start the ‘Nanowrite’ and ‘AxioVision’ by double clicking the respective icons. The system will initialize and calibration window will pop up.
5. Click ‘Calibrate’ and wait for the exchange sample holder pop-up window.



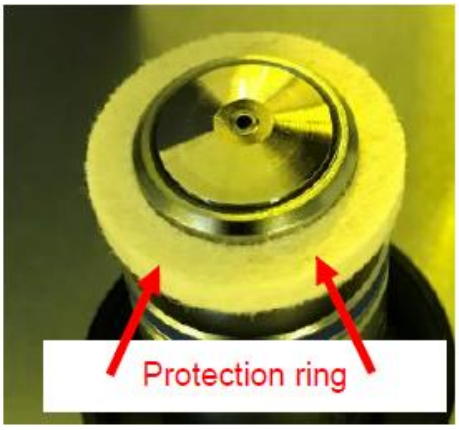


6. Press ‘open’ button on the left to release the interlock, and the light will be illuminated. Open the Top Lid all the way back using the handle.

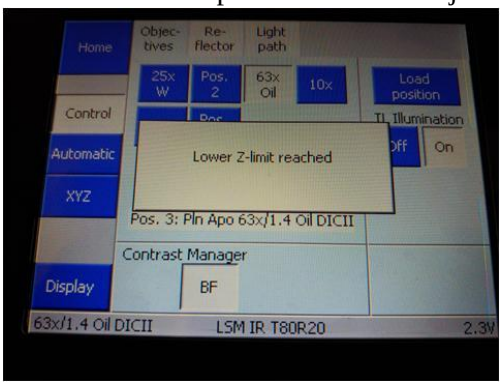
7. Carefully unlock the two clamping elements to lift up the piezo stage all the way back to its vertical position.



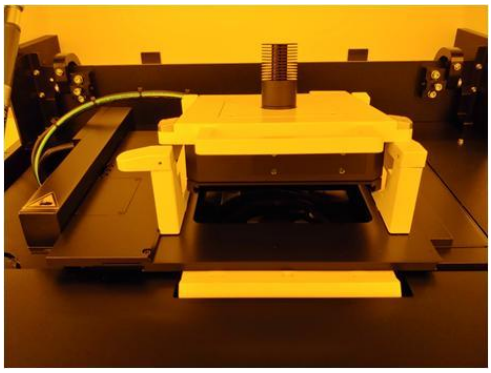
8. Unscrew the desired objective lens (63x, 25x or 10x) from the plastic box, and unscrew the black cap.
9. Check the proper felt ring on the lens to prevent the resist/oil from creeping down to the sides of the lens.



10. Use the controller to select the correct nosepiece slot for the objective lens.



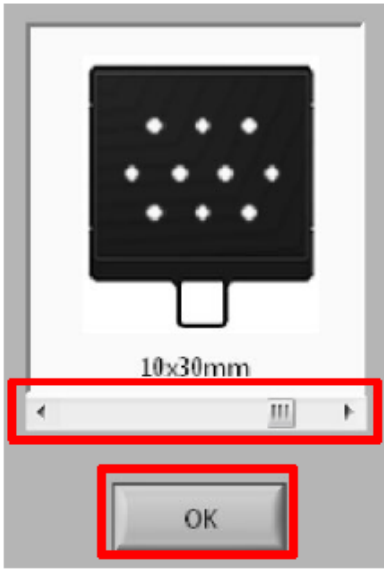
11. Remove the cap of the slot and mount the objective lens to that slot (turn counterclockwise to find the thread first and then turn clockwise to mount the lens relatively tight).
12. When the objective lens is mounted, put the stage in tilted position and proceed with the substrate and the sample holder preparation.



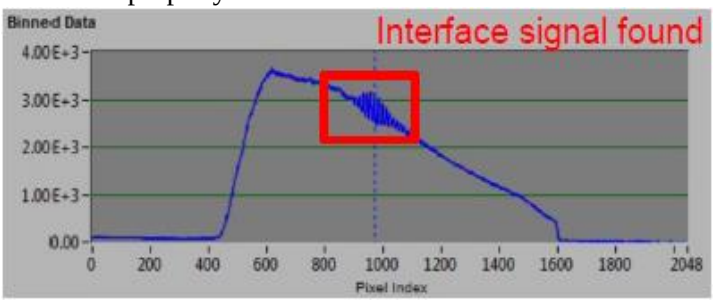
13. Preparing the samples
    a) For the sample preparation, the following items are needed.
        - Sample holder mounted on stand
        - Green tape
        - IP resins and oil bottles
        - Substrates/samples

    b) Make sure to select the correct sample holder, substrate, and IP resin corresponding to the writing configuration (DILL, immersion…)
    c) Place the substrate on the sample holder with green tape at least on two sides.
    d) Deposit one drop of IP resin on the substrate from the bottle and spread it out gently if necessary.
14. Put the sample holder to the stage and push it inside completely until hear a ‘click’ sound.
15. Then lock the two clamping elements, and close the Top Lid completely until the light of ‘open’ button is off.

16. Once the objective lens and the sample holder are in place, make sure to select the correct holder from the list and click ‘OK’ in the exchanger holder pop-up window.



17. Turn on the transmission or reflection illumination lamps, and press ‘Approach Sample’.
    - Use Transmission if your print substrate is clear or translucent.
    - Use Reflection illumination for light impenetrable substrates such as silicon wafers.
18. The objective will automatically move up to the ‘snap-on’ position and dip in the resin/oil. If everything is right, the interface will be found as the following signal.
    - Common causes for inability to find interface are:
        a) Debris in the field of view.
        b) Air bubble in the field of view.
        c) Substrate not properly secured to the substrate holder.



19. Use the joy stick to move around if you need to find another location. Then, hit the ‘Find Interface’, the objective will automatically find the interface based on the presetting.
20. Press the ‘Load Job’ and find the _job.gwl file in your folder. Then, press on ‘Start Job’ to start printing.
21. Repeat the exposure/jobs as many as you need by moving to different locations on the sample.
22. When finished, click on ‘Exchange Holder’. The objective will go down to ‘Lower Z-limit reached’ position and deactivate piezo actuators.
23. Open the Lid as stated in the step 6, remove the sample holder and the objective lens. Clean the objective lens as step 26.
24. Close the ‘Nanowrite’ and ‘AxioVision’. Log out and record the date/time on the log sheet.
    - Only close the main window of ‘AxioVision’ that contains the information.

25. The sample can be developed in PGMEA for 20 minutes, and rinse with IPA for 5 minutes (recommended).
26. Clean the objective lens
    a) Screw the objective lens with black cap.
    b) Remove the excess resist/oil using a clean wipe. Repeat this several times.
    c) Blow the lens with N2 gun to get the remaining resist/oil from the lens. Wipe it clean as step b).
    d) Use another clean wipe with IPA. Clean the lens several times and blow dry with N2 gun.
    e) Repeat the step b), clean the side of the lens with IPA, and blow the lens with N2.
    f) Carefully put the objective lens back to the plastic box.

V. SIGNATURES AND REVISION HISTORY

a. Author of this document: Ming-Wei Lin
b. Author Title or Role: Associate Research Scientist
c. Date: 7/1/2020
d. Revision: A

Approvals:

Technical Manager Signature:_____

Date: ____7/1/2020_____

Revision History:

Revision	**Author**	**Date**
Original Issue	Ming-Wei Lin	7/1/2020
Rev A	Jose Wippold	7/10/2020
Rev B		
Rev C		

Appendix A – Small Features 3D Microfabrication Solution Set

Material	Description	Comment
Objective	63x NA 1.4	scan mode: galvo/piezo
		working distance: 360 µm
		printing field (Ø): 200 µm
2PP resin	IP-Dip	1.512 @ 780 nm, 20°C
Substrate	fused silica substrate (3D SF DiLL)	fused silica
		dimensions: 25 × 25 × 0.7 m^3
		refractive index: 1.45 at 780 nm
Substrate holder	multi-DiLL	
Recipe	IP-Dip 63x Fused Silica (3D SF)	hatching distance: 0.2 µm slicing distance: 0.3 µm
Other material	felt ring	22.5 mm inner diameter

Appendix B – Medium Features 3D Microfabrication Solution Set

Material	Description	Comment
Objective	25x NA 0.8	scan mode: galvo/piezo
		working distance: 380 µm
		printing field (Ø): 400 µm
		adjustment ring set on 'Glyc'
2PP resins	IP-S	1.478 @ 780 nm, 20°C
Substrate	ITO-coated substrate (3D MF DiLL)	dimensions: 25 × 25 × 0.7 mm^3
		1.624 @ 780 nm ITO; coated side facing objective
Substrate holder	multi-DiLL	
Recipes	IP-S 25x ITO Solid (3D MF)	hatching distance: 0.5 µm slicing distance: 1 µm
	IP-S 25x ITO Shell (3D MF)	
Other material	felt ring	30 mm or 32 mm inner diameter (depending on objective version)

Appendix C – Large Features 3D Microfabrication Solution Set

Material	Description	Comment
Objective	10x NA 0.3	scan mode: galvo
		working distance: 700 µm
		printing field (Ø): 1000 µm
2PP resins	IP-Q	1.480 @ 780 nm, 20°C
Substrate	silicon substrate (3D LF DiLL)	dimensions: 25 × 25 × 0.725 mm^3
		3.710 @ 780 nm; polished side facing objective
Substrate holder	multi-DiLL, 2" wafer	
Recipes	IP-Q 10x Silicon Solid (3D LF)	hatching distance: 1 µm slicing distance: 5 µm recipe download
	IP-Q 10x Silicon Shell (3D LF)	
Other material	resin stop, nosepiece cover	