

# Nanoscribe PPGT+: Alignment Manual

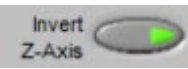
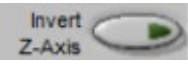
Version of 2024-11-20.

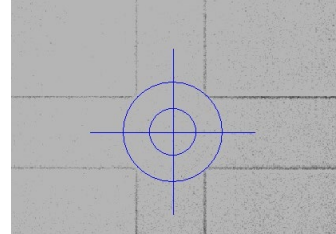
## 1. Introduction

This manual explains how to perform alignment of your 3D structures on top of existing wafer/sample topography. Users should already be familiar with the Nanoscribe general manual before attempting to align.

## 2. Alignment method N° 1: x- y- offsets (no rotation)

This method gives you a very simple way to correct x- and y- offsets of the laser beam with existing structures. It will not correct the rotation so it can be effective only with structures where the angular positioning is not important.

- Users should prepare the job, objectives, samples according to the Nanoscribe manual:  
<https://cmi.epfl.ch/photo/files/Nanoscribe/Nanoscribe.manual.pdf>
- Start the Nanowrite software as usual, initialise the stage, and load your sample holder at the “exchange holder” prompt window.
- Activate the “Invert Z-Axis” button to match your exposure job configuration:
  -  = InvertZAxis 1 (DILL)
  -  = InvertZAxis 0 (OIL Immersion)
- Perform the “approach sample” into the resist/oil and “find interface” procedure as usual.
- With the help of the camera and using the joystick, move the stage near the wafer topography you want to align with.



- In the GWL mini script window (Advanced Settings), type in “ManualControl” and click on “Submit”.

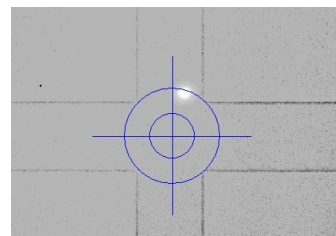


- **WARNING:** The manual control interface gives you access to advanced parameters of the Nanoscribe equipment. Only do the manipulation explained below. Do not touch anything else!!

Set the laser power to 5% (below the polymerization threshold) and click on “Shutter close” to open the shutter.



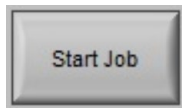
- Fluorescence from the resist will be visible at the laser focal point.



- Assuming the equipment was just initialized, the laser spot is located at the (0,0) coordinate of the galvo/piezo stages. Use the joystick to move the sample/wafer so that the laser spot is exactly on top of the (0,0) position of the existing topography.



- When the positioning of the beam looks ok, close the shutter, bring the laser intensity back down and close the “ManualControl” interface.
- Start the exposure job as usual.



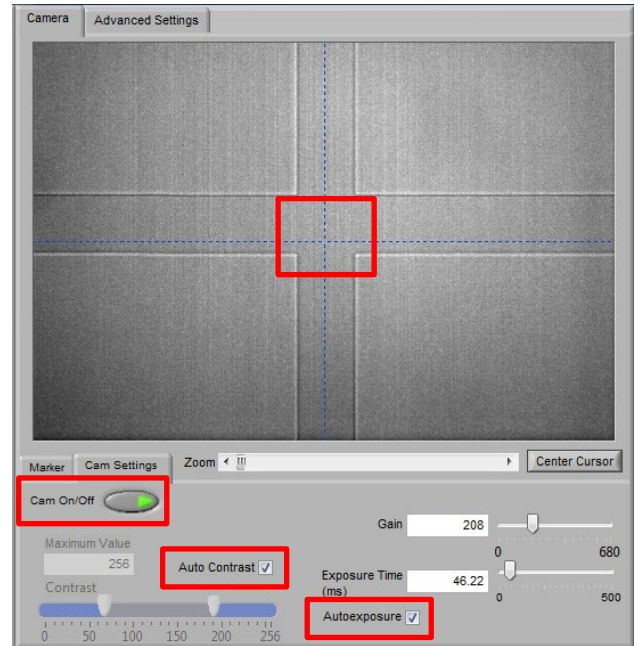
### 3. Alignment method N° 2: x- y- offsets, rotation and scaling

This advanced method gives you the possibility to correct the wafer rotation, x- and y- offsets, as well as scaling/shearing using three alignment markers.

#### Marking of the laser position

The laser offsets compared to the center of the camera is not calibrated by the software and depends on many factor (objective used, configuration, etc...). Because of this, the first step of the alignment process is to mark the position of the laser spot. For this, proceed exactly as explained in the **point 2.** above. With the joystick, move the laser spot on top of an easily identified wafer topography (the corner of a topography edge is ideal). Then proceed as follows:

- Close AxioVision: “File” → exit
- In “Nanowrite”, go to the “Camera tab” → “Cam Settings” tab, activate Cam On/Off, and check “Auto Contrast” and “Autoexposure”.
- In the camera window, move (with the mouse) the center blue cursor to the exact same position as the laser spot. **DO NOT MOVE IT AFTER THIS STEP!**

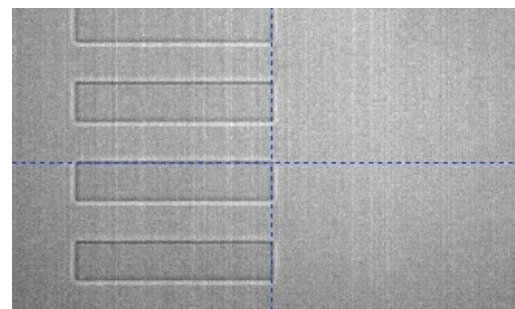


**WARNING:** Depending on the AxioVision settings, the camera view axes can be inverted in Nanowrite. Make sure to clearly identify your marks!

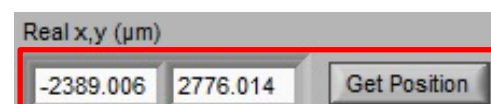
- In the “Marker” tab, activate two markers (M0 and M1) or three markers (M0, M1 and M2) and introduce the coordinates of these markers in your design.

Design x,y (µm)		
M 0	-276.000	5.000
M 1	276.000	5.000
M 2	-5.000	276.000

- For each marker, move the stage with the joystick (not the cursor!) so that the blue cursor position is exactly on top of each marker (the feature corner in the image below).



- When correctly positioned, click “Get position” to acquire the stage position of the specific marker.



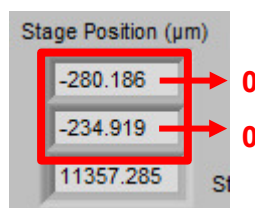
- Repeat the maker “Get Position” acquisition for all three M0, M1 and M2 markers.
- When all markers positions are correctly acquired, activate the transformation button.



- Transformation results will be shown in the Nanowrite message window. Make sure to check if the reported values are making sense.

```
Stage:
Angle X-Axis: 231.720937
Angle Y-Axis: 51.720937
Deformation X-Axis: 0.999996
Deformation Y-Axis: 0.999996
Piezo:
Angle X-Axis: 231.720937
Angle Y-Axis: 51.720937
Deformation X-Axis: 0.999996
Deformation Y-Axis: 0.999996
Galvo:
Angle X-Axis: 231.720937
Angle Y-Axis: 51.720937
Deformation X-Axis: 0.999996
Deformation Y-Axis: 0.999996
```

- **IMPORTANT:** With the joystick, move the stage back to (0,0) coordinates. The blue cursor (laser position) should now be positioned at the center of the existing topography.



- Start the exposure job as usual.

