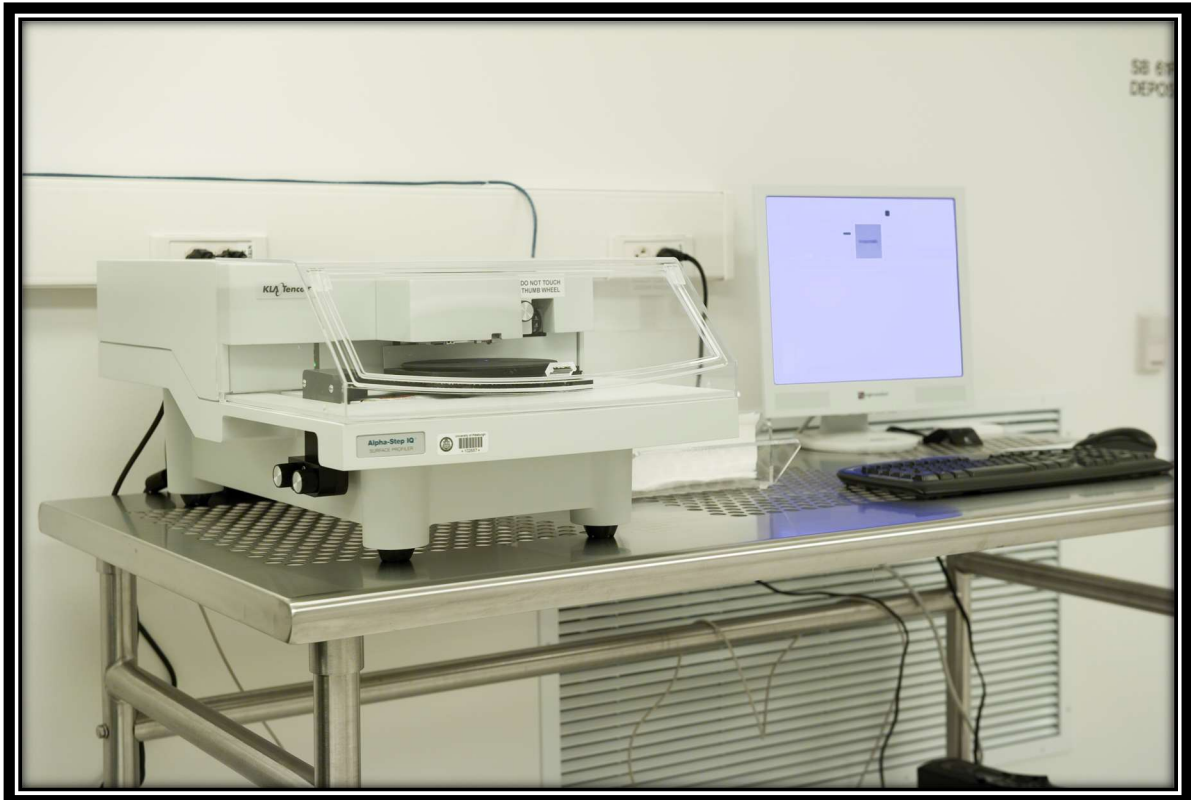




University of Pittsburgh

## Nanoscale Fabrication & Characterization Facility

### KLA Tencor Alpha Step IQ Surface Profiler Users Guide



The **Alpha-Step IQ** Profiler is a computerized, high-sensitivity surface profiler that measures roughness, waviness, and step height in a variety of applications. It features the ability to measure micro-roughness, with up to  $1\text{\AA}$  ( $0.004\ \mu\text{in.}$ ) or less resolution, over short distances as well as waviness in a scan over a full surface length of 10-mm ( $0.4\text{-in.}$ ).

## Operation Procedure:

- 1) Log into FOM.
- 2) Turn on the computer and the profiler by pressing the computer power button. Allow windows to fully load.
- 3) Double Click the Alpha-Step IQ icon to load the software.
- 4) Log into the system using the user name and password that was set up for you during training.
- 5) Use the knobs on the left side to bring the sample stage as close to the front as possible. Open the cover. Load the sample in the center and toward the back half of the stage.
- 6) Close the cover and use the same knobs to move the sample under the stylus. You can best center your sample by viewing the stylus both from the front and the side.
- 7) Press the down button on the screen once to lower the stylus. Press and hold the down button until the stylus touches the sample and then stops. You should see your sample features and the stylus in the upper right hand software window.
- 8) **Press the up button** once to lift the stylus for aligning to the desired feature. The view of your sample will stay in focus and you can align the stylus to the desired location on the sample to begin your scan. **Make sure the stylus is raised up above your sample; otherwise, it will drag across the surface of your sample and can cause permanent damage.**
- 9) Use the side knobs to align to the sample. You may have to open the cover and rotate the sample table physically to correct for rotation. **Do not touch any knobs under the cover.**

- 10) Press the load button on the screen to select and load the desired recipe. Press the start button to run the scan.
- 11) If you need to create a new recipe, press the new button. The following features become available to you.
  - a. Scan length: This is the distance the scan will cover on the sample. Make it long enough to accurately represent your surface or feature. .1 uM is the minimum length.
  - b. Time: This is the number of repeated scans that will occur. This allows several scans of the same location to be averaged or compared.
  - c. Scan Speed: This is how quickly the stylus is moved across the sample during the scan. A slow rate can give a more accurate representative of the surface.
  - d. Sampling rate: This is the number of samples taken per second during the scan. A low scan rate can smooth out noise. A fast rate is desired if the surface is relatively smooth.
  - e. Resolution: Is the pace at which the profile data is sampled.  $\text{Resolution (uM)} = \text{Scan Speed} / \text{Sampling Rate}$ .
  - f. Scan Time: Time necessary to complete each scan.  $\text{Scan length} / \text{Scan Speed}$ .
  - g. Scan Direction: The scan can be set to occur in either direction. The software allows a maximum of 2mm right to left and 10mm from left to right. It is best to **only scan to the right**.

Long left scans can damage samples and the stylus.

- h. Sensor Range: The sensor range is the maximum height difference that the instrument can measure. ("Peak to Valley") This should be adjusted based on the suspected step height or surface roughness of your sample.
  - i. Adjustment: This setting is used to optimize the instrument for "valleys", "peaks" or a combination of both.
  - j. The Elevator Position: Displays the relative position of the stage to its origin.
  - k. Stylus Force: This defines the amount of pressure the stylus applies to the surface.
  - l. Contact speed: ON a scale of 1-10 this is how much force is applied to your sample based on the approach speed. For softer materials a low number is desired and for hard materials a higher number is used. 5 is an excellent starting point.
  - m. Required Radius: Allows the user to define the stylus tip installed as a reference.
  - n. Analysis: Defines the type of scan. Measured profile, Roughness/Waviness or Step height.
- 12) Do not forget to save your recipe and remember the name/parameters for future runs.
  - 13) Once the scan is complete, press the leveling button to perform the desired leveling procedure. If the scan is a simple step, the two-zone method is most effective.
  - 14) Place the desired zones to level on the same plane. Drag the cursors to change the position and the width of the leveling average.

- 15) Use the 2 bars or the 2 zones method to select the location of your step change. If you use the 2 zones method, the software takes an average between the zone bars. They can be dragged and adjusted to vary location and area of the average.
- 16) Select the data review button to view, analyze, and save your scan.
- 17) Press the scan button to return to the scan page
- 18) If you're finished with the Alpha Step you may now exit the software. This will automatically move the sample vertically away from the stylus.
- 19) If you are loading another sample, press the up button to raise the stylus. Press and hold the up button until the stage is lowered away from the stylus.
- 20) Open the cover and use the side knobs to move the sample to the front of the alpha step for unloading.
- 21) Remove your sample and close the cover.
- 22) If you have not already done so, press the exit button at the top of the screen. Windows will shut down the computer and the profiler automatically.
- 23) Log out of FOM.