

1.0 Dektak 8 Stylus Profilometer



Figure 1: Dektak 8 Stylus Profilometer

1.1 Introduction

Dektak 8 measures the feature height or surface roughness of the samples by scanning over it with a stylus.

Only trained and approved (qualified) users may use this tool.

1.2. Features and Specifications:

- a) Designed to accommodate wafers up to 8" in diameter.
- b) Contact-based 2D or 3D topography measurement.
- c) Thin film stress measurement.
- d) Vertical Range: 50 Å to 1 mm.
- e) Scan length Range: 50 μm to 100 mm (200 mm stitched)
- f) Stylus Tracking Force: 0.03 to 15 mg.
- g) Maximum Sample Thickness: 25.4 mm (1")

1.3 Applicable Documents

Dektak manual is available for use at the tool.

1.4 Safety

- a) Pay attention to safety symbols on the equipment.
- b) Follow the operating procedure described here to use the tool safely.

1.5 Precautions

- a) Always use clean samples to avoid contaminating the stylus or the chuck. Use nitrogen spray gun and IPA if needed.
- b) Stylus is sensitive and fragile. Never let anything touch or bump into it.
- c) Never move the sample stage if the stylus is in contact with the sample. The stylus should be up when you are selecting the area to be measured.

1.6 Operating Procedure

Activate the equipment in FOM before you start. Deactivate it when finished.

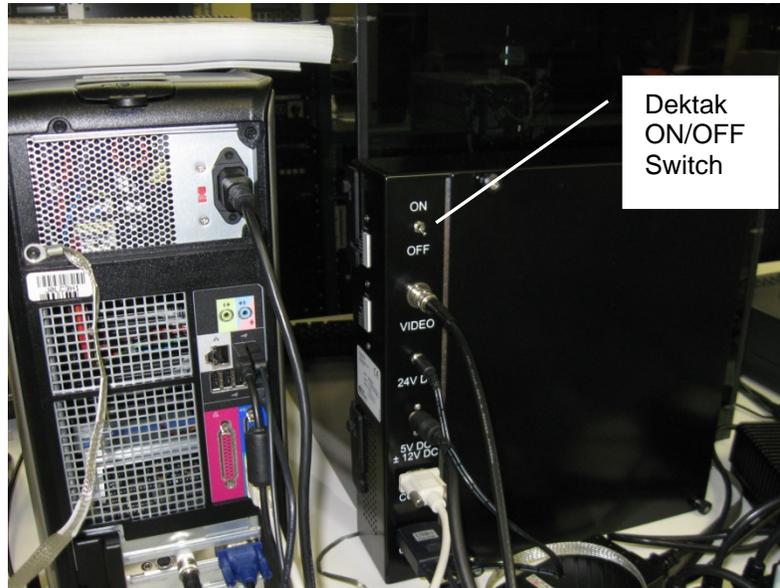


Figure 2: Backside of E-Box.

1.6.1 Power On

- Turn on the Dektak 8 by flipping the power switch on the back of the E-box (Figure 2).
- Turn the computer on by pressing the power switch on the front of the computer.
- Double click the Dektak 32 icon on the desk top. This opens the software and initializes the sample stage.
- When initialization is finished, 'Ready' appears on the lower left corner of the window.

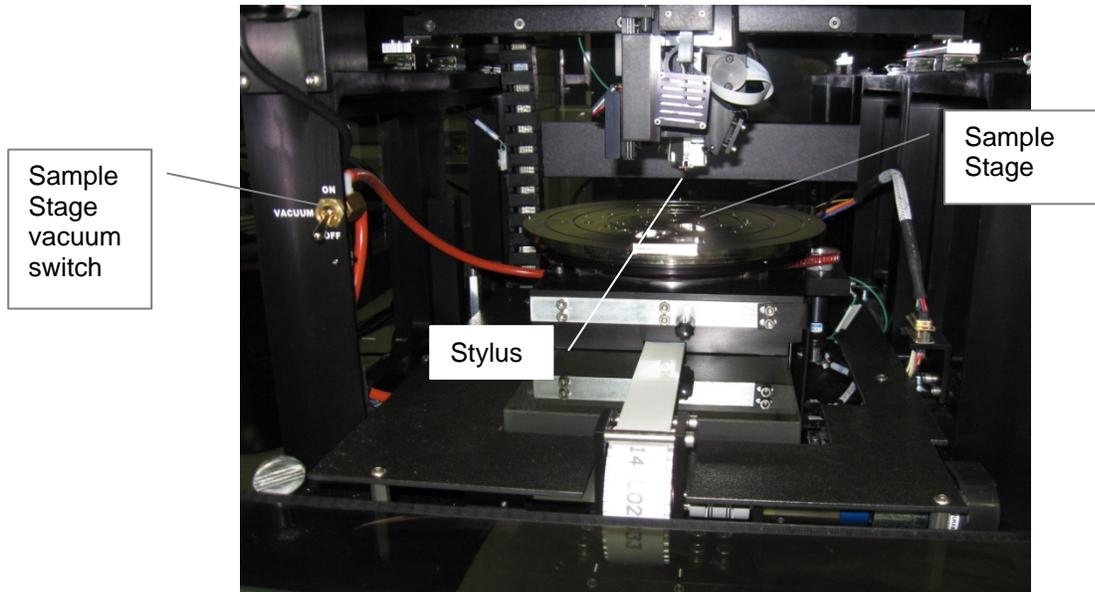


Figure 3: Profilometer view with cover open.

1.6.2 Sample Loading

- Open the door to Dektak 8 enclosure.
- Click on the 'load/unload' button in Figure 4 to move the sample stage out.
- Place the sample in the center of the stage (Figure 3).
- Click the 'stage in' button to move the stage back in (Figure 4).

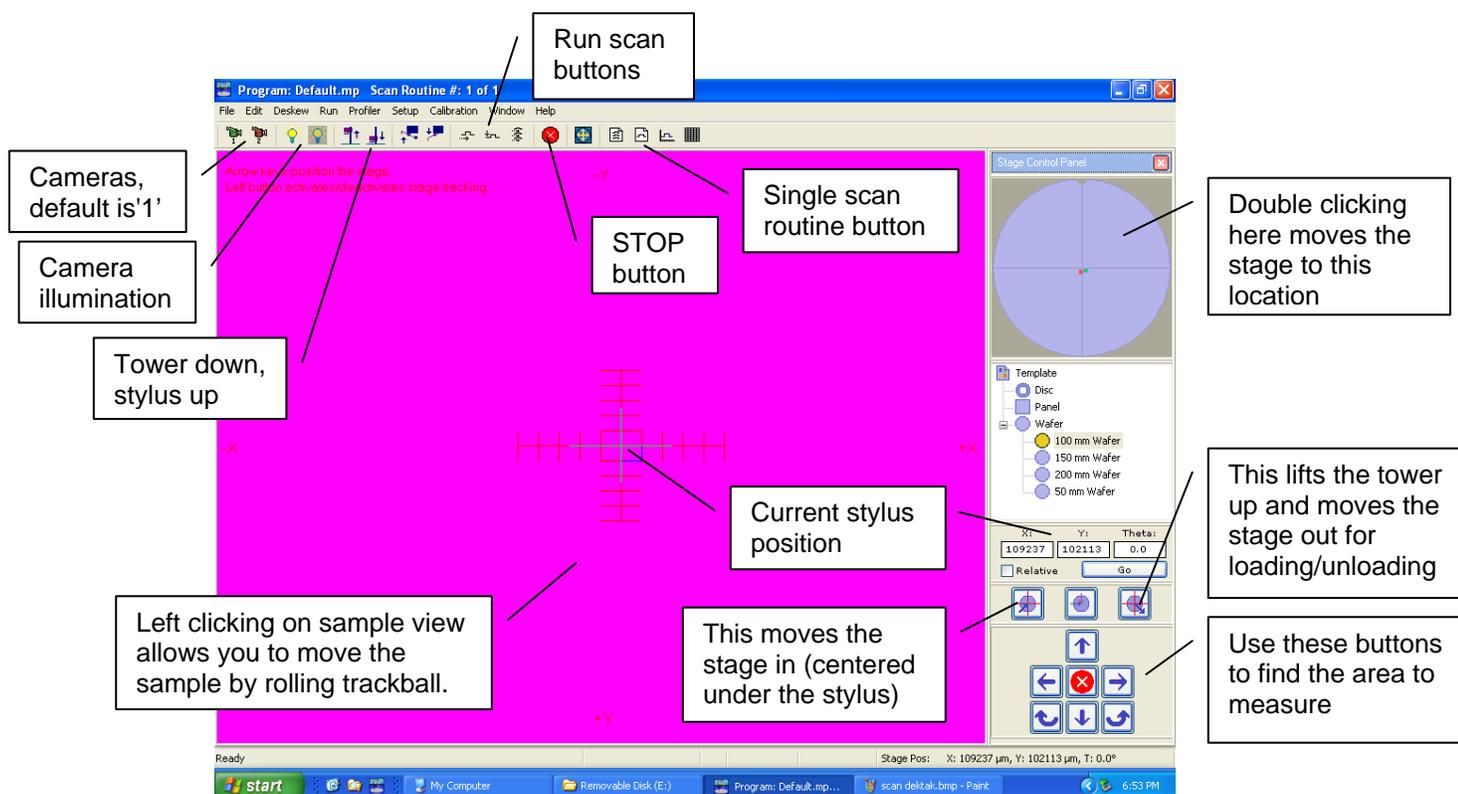


Figure 4: Software startup screen.

1.6.3 Defining Scan Location & Length

- Click 'Tower down, stylus up' button in Figure 4 and look if the stylus is coming down on the sample. If not, click on the 'STOP' button right away (Figure 4). This is very important or you can damage the profilometer.
- Lift the tower by clicking on the icon to the right of the previous if needed and readjust the sample position. For very small samples, this may require more than one readjustment.
- When stylus is coming down on sample, let it come down. It will touch the sample, the tower will stop lowering, and the stylus will retract.
- Close the profilometer enclosure cover.
- Left click on the sample view and roll the trackball to move the sample to the start scan location. The center of the screen (marked 'current stylus position' in Figure 4) is where stylus will start and move right.
- Select Edit > Define Scan Location/Length. The window in Figure 5 will show up. To save current location as scan start location, click on upper Enter button.
- Left click on sample view again and roll trackball to move sample and find the scan end location. Then click left again to stop stage tracking.
- Click lower Enter to save the scan length.

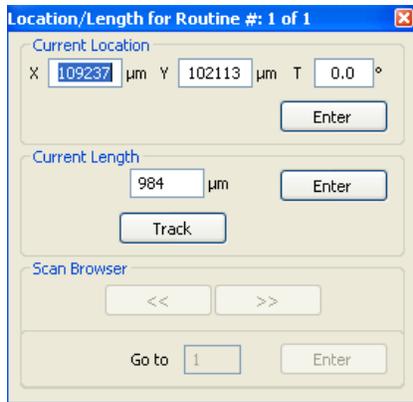


Figure 5: Selecting scan length.

1.6.4 Running a Scan

- a) Click 'single scan routine' button (Figure 4). It will open the window in Figure 6.
- b) Click on any underlined parameter on the left. It will open smaller 'scan parameters' window over it (Figure 4).
- c) You can change any scan parameters here (Figure 6) if you want, but don't change scan length since you have already selected that. You should select Meas Range bigger than your expected step height.
- d) If you are using soft polymer sample (photoresist, PDMS, etc.), select stylus force 1 mg or less. You should start with the lowest (0.03 mg) and go higher to avoid contaminating the stylus and scratching your sample. For hard samples (silicon, metals, etc.) you should start with 3 mg force and go higher if you have deep trenches and stylus is not reaching the bottom surface.
- e) Select profile according to your sample structure.
- f) Click OK to save and close 'Scan parameters' window.
- g) Click 'sample view window' (Figure 6) to go back to sample view.
- h) Click 'Run Scan' button (Figure 4) for currently active scan.
- i) The stylus will lower on the sample and then travel to the right. In most cases you will see its reflection so it will look like two styli touching tip to tip.
- j) After scan finishes, window in Figure 7 will show up with measurement result.

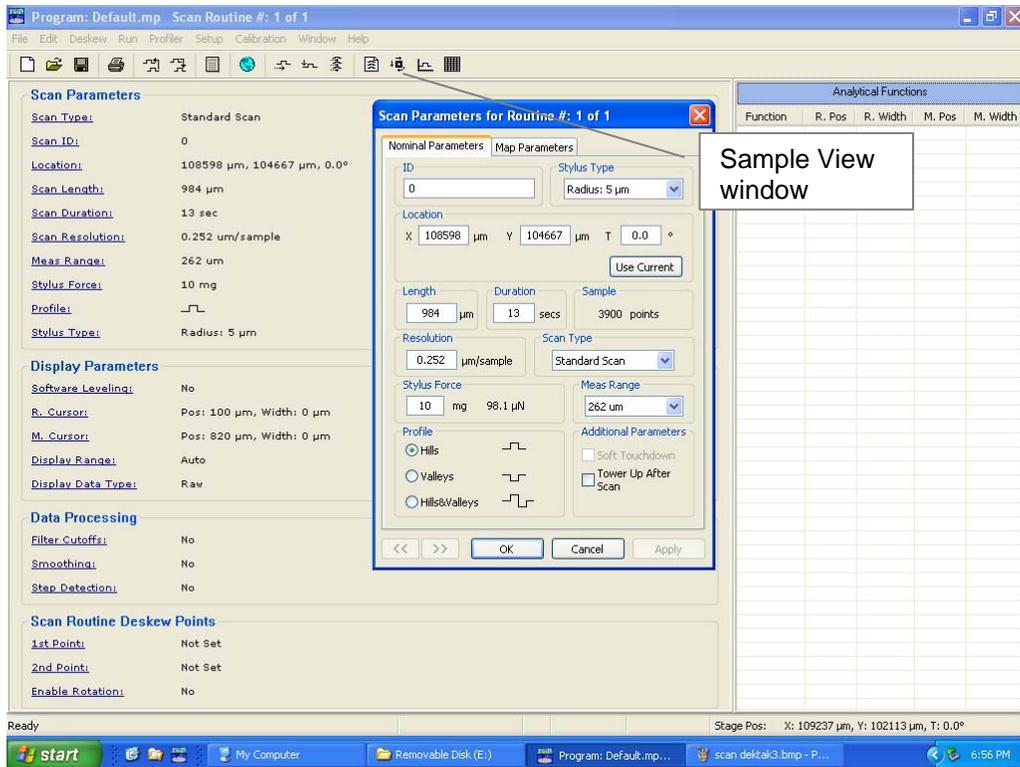


Figure 6: Scan Routine window.

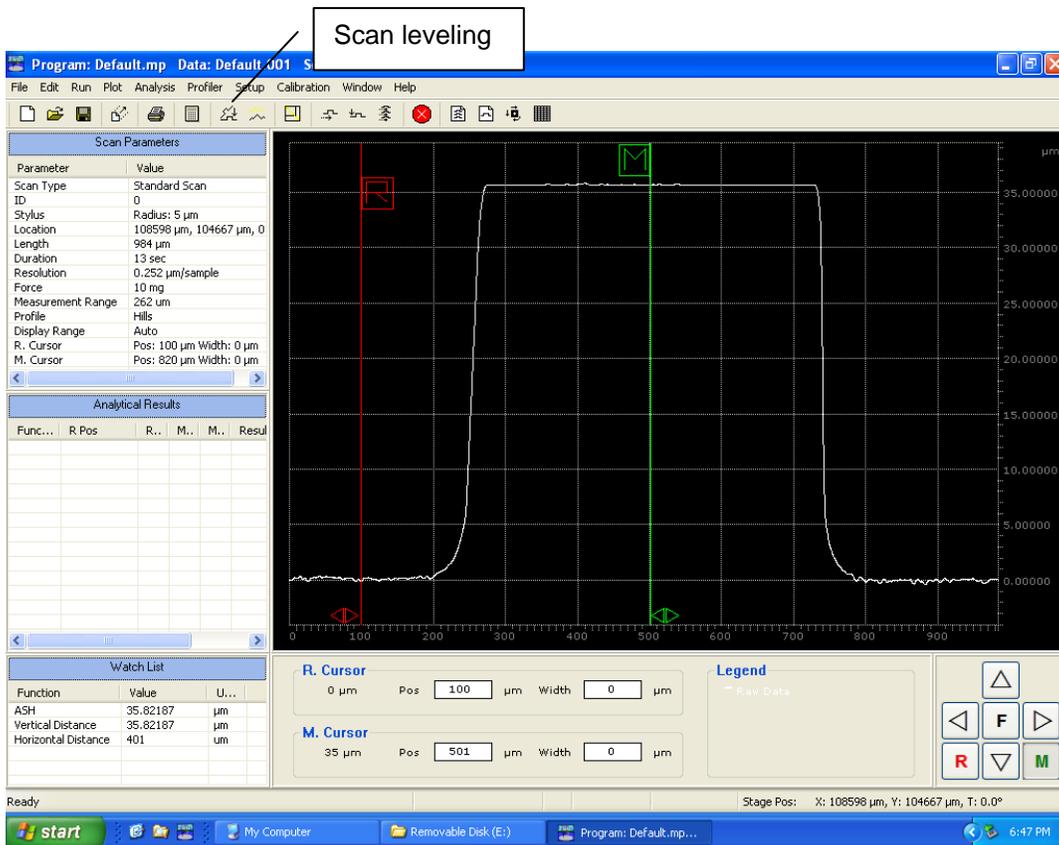


Figure 7: Measurement result.

1.6.5 Analysis

- a) Level the scan by placing R (reference) and M (measure) cursors at the baseline and clicking the leveling icon (Figure 7). It will also set baseline at zero.
- b) Cursor widths can be adjusted by clicking and dragging small triangles at the base of each cursor. The scan is averaged out in the cursor width when the heights are calculated.
- c) The parameters in watch list can be selected from a bigger list by going to Analysis> Analytical Functions.
- d) Measurement results can be saved from File menu.
- e) Automation program can be saved by selecting Window>Automation Programs, and then saving from File menu.

1.6.6 Automation Program

The automation program can be used to automate the use of the profilometer. Multiple scans, with different specifications, at different locations on a wafer can be programmed and executed by running this program. The detailed description of this is available in Dektak 8M Manual.

1.6.7 Stress Analysis

Thin film stress is measured by executing a line scan before and after deposition of the film.

- a) Drop three stainless steel ball bearings in holes in the chuck to suspend the substrate. You need training to do this.
- b) Place the wafer on the ball bearings.
- c) Define parameters of the line scan and store those in automation program file.
- d) Conduct the line scan and save it.
- e) Deposit the thin film and conduct the line scan using the same automation program at the same location on the wafer.
- f) Select Analysis>Compute Stress to display Stress parameters dialog box.
- g) Click Select in the Thin Film Substrate section to select your wafer type.
- h) Then enter film and substrate thickness.
- i) Load pre-deposition scan data file.
- j) Click OK. It will open the Stress Results dialog box with stress results displayed.
- k) To display stress data traces on the scan data plot, select Plot>Data Type to open the dialog box. You can select curve fit, pre-deposition, post deposition, and film stress curves to display.
- l) Make sure you remove the ball bearings with a magnetic tool and store those in their place.

1.6.8 3D Mapping

- a) Open the Scan Routine Window.
- b) Click any of the entries in the Scan Parameters section to open the dialog box.
- c) Under Scan Type select Map Scan.
- d) Modify any additional settings and click OK.
- e) Select Edit>Define Map Area. In the sample positioning window, locate the features to be mapped using low or high magnification camera.
- f) Roll the trackball to select x and y extent and click the left button to enter the values.
- g) Under Map parameters, select profiles (scan lines) up to 10,000 and vertical scan resolution down to 1 μ m/scan. Keep the map time in mind when selecting these. You may not want to run it for 24 hours!
- h) The Dektak 3D Mapping Option produces 3D images of a sample that are converted into data that the Vision 3D software can analyze and store in .img file. For details on this software, please see the Dektak 8M Manual.

1.6.9 Unloading the Sample

- i) Open the enclosure door.
- j) In the sample positioning window (Figure 4), click on the load/unload button.
- k) Remove your sample from the stage.
- l) Click on load/unload button to move the stage back in.

1.6.10 Powering Down

- a) Select File>Exit. If you have not saved your automation program, you will be given an opportunity to save it.
- b) Shut down the computer from the startup menu.
- c) Turn off the switch on the back of the E-box (Figure 2).
- d) Deactivate the profiler in FOM.