

NRF Tencor Alphastep AS500 SOP

Description:

The ALPHA-STEP® 500 is a stylus-based surface profiler. The system provides complete and detailed two-dimensional analysis of surface topography on a variety of surfaces up to 300um in height. It accurately measures surface characteristics such as step height, roughness, and etch depth on a wide variety of substrates. Applications-specific recipes easily programmed to provide automatic leveling, scaling, and measurement analysis—eliminating errors due to operator interpretation and sample positioning. Stylus force—adjustable between 1 and 100 mg—can be tailored for specific surface conditions.

Safety

Moving Components – The User should be aware at all times of the moving components associated with this tool.

Equipment Restrictions

Do not load samples taller than 15mm.

Samples step heights must not be greater than 300um or serious damage to the stylus tip will result.

Specifications:

Vertical resolution 1A with 10A repeatability

Scan length maximum – left to right 10mm, right to left 2mm

Horizontal resolution up to 0.01um (depends on scan speed and sample rate)

Up to 5000 data points per scan

Stylus radius 5 µm (yellow ring)

Ranges and resolutions: 13 µm at 1 A, 300 µm at 25 A

Zoom optics with magnification up to 210x

Max sample dimensions: 150 mm wide, 15 mm thick

Scan Types: continuous, segmented, or multi-scan averaged up to 10 times

Note: This SOP describes simple step height measurements. For more complex measurements, refer to the Tencor Alpha-Step 500 Profiler Manual which may be downloaded from the docs section of the AS500 equipment page of the NRF web site.

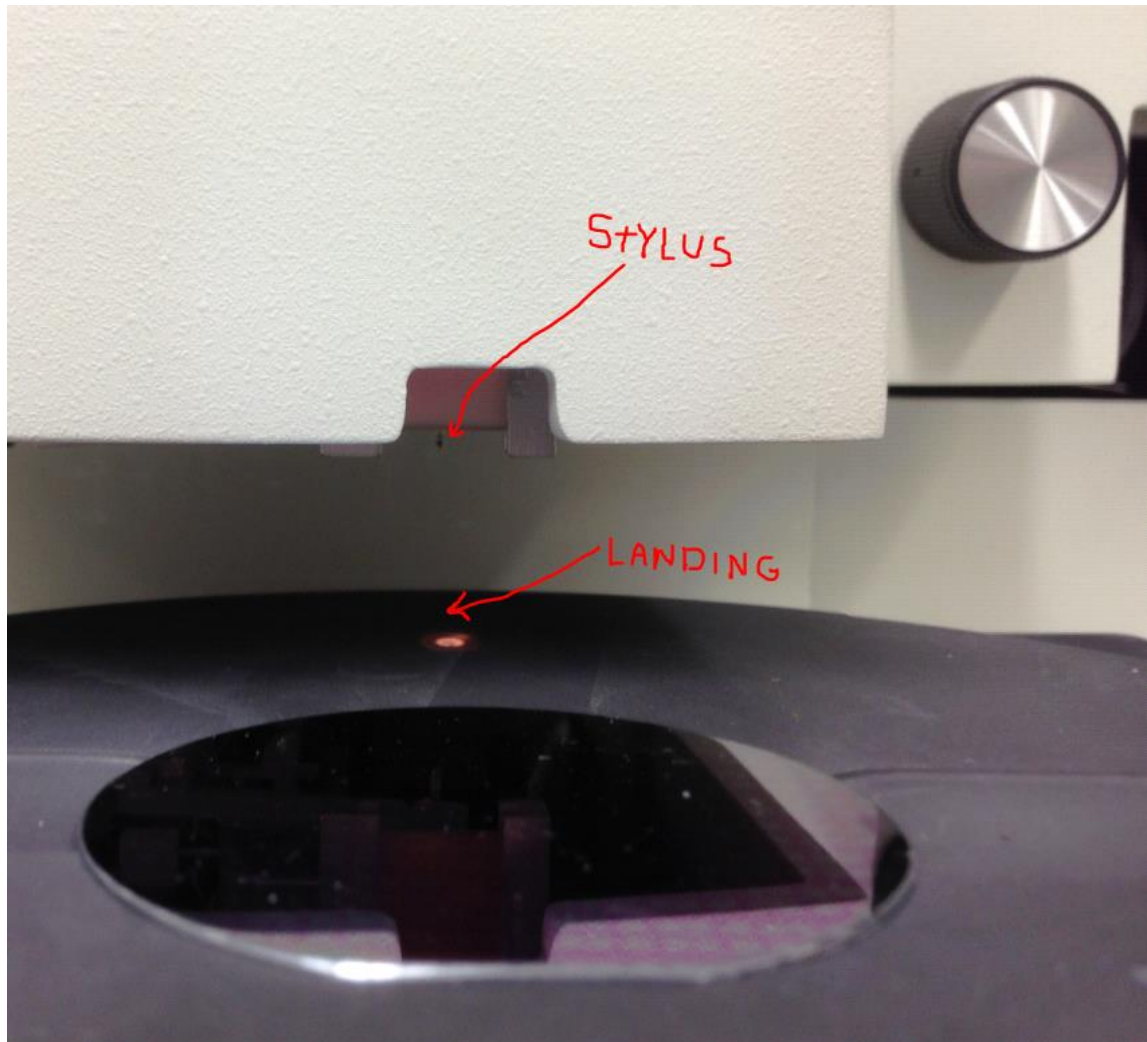
1. Operation

1.1. Loading a Sample

- 1.1.1. Verify both video monitors are on. The monitor on top of the tool is for viewing the sample position in the camera.
- 1.1.2. Press F5. Press and hold the up arrow ↑ to raise the stylus head (i.e. lower the sample table) until the table stops. The Z position (elevator position) should read <200um.
- 1.1.3. Turn the x and **y-axis adjustment knobs (located lower left side of machine) to move the stage to front/center position.**



- 1.1.4. **Open the acrylic air flow protection door. Place your sample on the center of the table and move the stage backward** until your wafer is under the stylus. See the pic below for the stylus location and landing point located just behind the camera light spot (see below). Move the measurement area of your sample to the landing point using the X/Y knobs.



- 1.1.5. Press and hold the **down arrow** key to move the stage up until the stylus stops on the wafer surface. Press the down arrow again and verify the Z position on the screen is the same when "nulled" the 2nd time. This will guarantee the stage is really in contact with the sample.
- 1.1.6. Tap the **up arrow** key once (don't hold down) to lift the stylus up (never move the wafer while the stylus is on the wafer surface). You should see the stylus raised up OFF the sample and out (or barely visible at the top of the camera screen) of camera view.
- 1.1.7. Turn **X and Y knobs** to move to just left (or right depending on scan direction setting) the feature to be measured.

CAUTION: Stylus should be retracted before moving the stage!

1.1.8. Turn the **Zoom** knob change magnification of the video image if needed.



1.1.9. You may scan the sample immediately by editing the scan parameters or you can create and save a recipe tailored to your samples. If you would like to use your recipe see section 1.2.

1.1.10. Press the **Escape** key. On the menu bar, use **right or left arrow keys** to select **Recipe** and press **Enter to View/Modify** recipe parameters.

1.1.11. Parameter Settings

Parameter	Range or Description	Typical Value for most step measurements
Scan Length	1-5000um	500um
Scan Speed	2-200um	50um
Sampling Rate	50-200 Hz	50
Direction		->
Multi-scan average	1 to 10	1
Segmented		no
Stylus Force	staff adjustable only	20
Contact Speed	1 to 6	3
Radius Required	5um radius tip is installed on the NRF tool	parameter does not need to be entered and not part of calculation
V. Range/Resolution	13um, 300um	13um
Profile Type	only available for 300um range	
V. Display Scale	Manual or Auto	Auto
Graph	see Tencor manual	raw data
long wave cutoff	see Tencor manual	off
short wave cutoff	see Tencor manual	default
Fit and Level	see Tencor manual	off
Cursors: Absolute um		
Measurement	measurement cursor positions	100, 300
Leveling	leveling cursor positions	10, 100
Delta Meas Width	changes the measure cursor from single point to average of data within cursor width	50, 50
Delta Level Width	changes the leveling cursor from single point to average of data within cursor width	50, 50

1.1.12. Press F8 "Start" to start scan **Start** (F8) key to start the scan (don't touch the tool or table during the measurement!). You can press STOP (F9) key to abort a scan

at any time. When the scan is completed, the stylus lifts up and the Data screen is displayed with the profile plotted in dimensional coordinates.

- 1.1.13. Leveling the scan trace: Wait until the "Rehoming after scan" is done. Press LEVEL (F10) key if the trace is not horizontal. The leveling cursors L (left) and R (right) will appear, the activated cursor appears red. Move red cursor to the desired position with the arrow keys. Press spacebar to activate the other cursor and position it. You can press the spacebar twice quickly to activate L and R simultaneously. Press LEVEL to level the trace. (Press backspace + LEVEL to return to the previous trace if necessary.)
- 1.1.14. Analyzing the scan: Move L and R cursors to the desired positions. Reading the data in the summary box: Height - Vertical distance between trace intersections of cursors (in Delta Average mode, the vertical distance between the average values of height within the two delta width regions). Width - Horizontal distance between the cursors.
- 1.1.15. To unload the sample: Press Z key. Lower stage using up arrow key. Move stage forward and unload wafer. Switch off monitors. Log off the Tumi

1.2. Profiling from a scan recipe

- 1.2.1. Press **Escape** key.
- 1.2.2. On the menu bar, use **right or left arrow keys** to select **Recipe** and **down or up arrow keys** to select **Catalog**, press **Enter**.
- 1.2.3. Use **down or up keys** to select desired **recipe** and press **Enter**.
- 1.2.4. Writing and editing a recipe: To edit an existing recipe, press the up or down keys to select one line and to change values press the right or left arrow keys. Some fields have fixed values other fields you can type in the value from the numeric keyboard.
- 1.2.5. Saving recipes: Don't change an existing recipe! If you would like to create your own recipe, open an existing recipe, make changes, press [F1:Save], type your own recipe name, and press Enter.

1.3. Leveling the Stage (from the Tencor Manual)

6.5 LEVELING THE STAGE

If the measured surface is not parallel to the scanning motion, the trace in the Scan screen (Fig. 6-11) will not be level. This can be adjusted mechanically by turning the leveling knob.

To level the stage:

1. With the Data screen displayed, press LEVEL. Note that a new function, [F3: Mechanical Level], appears in the box along the bottom of the screen. Adjust the leveling cursors as described in Section 7-2, "Leveling the Profile."
2. Press [F3: Mechanical Level]. The following prompt is displayed:

Turn x counts (+ or -)

where x is a number calculated from the scan data.

3. Open the measurement area door. Turn the leveling knob (Fig. 6-12) by the number of counts prompted in Step 2, clockwise for + or counterclockwise for -. Note: One turn equals 10 counts.

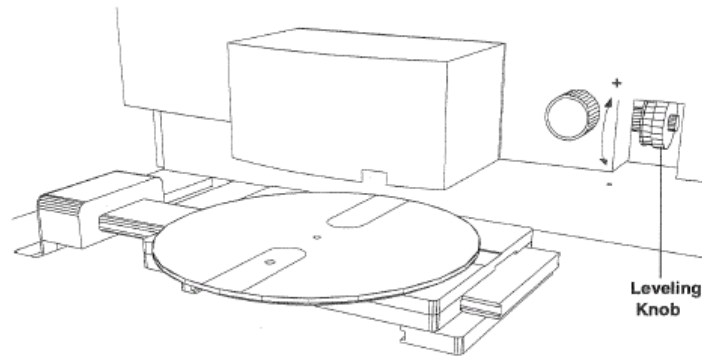


Figure 6-12 Leveling the Stage

4. Repeat the scan and check the appearance of the trace in the Scan screen.