

# Dektak XT 2D Profilometer Operation Manual

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The Dektak XT is a 2D contact profilometer used for step height, pitch and surface roughness measurements. Vision 64 application software controls the system data collection and analysis.



## Specifications

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- Stylus Contact Profilometry
- Two-dimensional surface profile measurements
- Stylus Force 1 to 15mg
- 12.5um diameter tip
- Sample X/Y Stage Manual 100mm (4 in.) X/Y, manual leveling
- Software Vision 64 Operation and Analysis Software
- Scan Length Range 55mm (2in.)
- Data Points Per Scan 120,000 maximum
- Max. Sample Thickness 50mm (1.95in.)
- Max. Wafer Size 200mm (8in.)
- Step Height Repeatability  $<5\text{\AA}$ , 1sigma on  $0.1\mu\text{m}$  step
- Vertical Range 1mm (0.039in.)
- Vertical Resolution  $1\text{\AA}$  max. (@ 6.55\_m range)

## Loading a Sample

1. Verify the system has been enabled on Badger.
2. Read all Shutdown, Problems or Comments related to the tool.
3. Make sure the system is ON. If not, press white power on button; button should light up.



4. If the Vision 64 software is not displayed, open the software. If not click on the software icon.



5. The tower assembly will move to its upper limit, the stylus in the Tower Up position and the white sample light will come on.

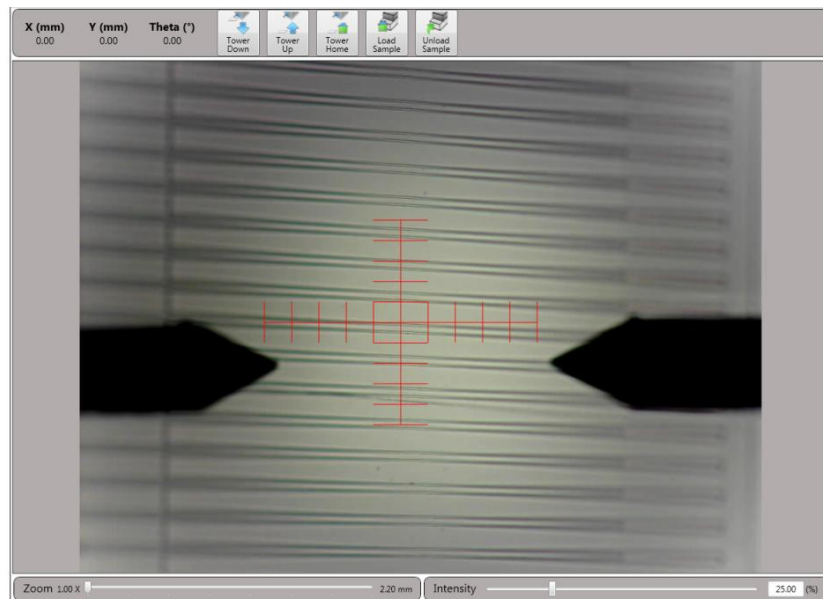
**Note: If you open the software without the system on first, the software will crash. If this occurs, press abort on the software error message and reopen the software.**

6. Wait 15 minutes for the system to warm up prior to measuring your sample.
7. Verify the Stylus is in the up position. If not click on the Tower Up icon in the Live Video control header.
8. Click the Unload Sample icon from the Live Video control header. This will move the stage forward to a safe position for loading your sample.

**Warning: Make sure the stage is forward and the stylus is up before loading your sample.**

9. Carefully place your sample on the stage, with the region of interest located as near to the center of the stage as possible.
10. Click on the Load Sample icon to move the stage back to the measurement position.
11. Click on the Tower Down icon to lower the stylus to the pre-measurement position.
12. Your sample should be visible in the Live Video panel. Use the course and find stage adjustments to locate your sample for the measurement. **MAKE SURE THE STYLUS IS NOT CONTACTING THE SAMPLE WHILE YOU MOVE THE STAGE!** The cross is where the stylus

should touch down. During the measurement the stylus will move in the +Y-direction (the stage will move in the -Y-direction).



13. The sliders at the bottom of the Live Video panel control the magnification and brightness of the image.

## Unloading a Sample and Shutdown

1. Open the **Measurement Setup** window and click on the **Tower Up** icon, to raise the stylus to a safe position.
2. Click on the **Unload Sample** icon to bring the stage forward.
3. Carefully remove your sample.
4. Disable the system on Badger. Add any Shutdowns, Problems or Comments you encountered during your session.

## Creating a Measurement Recipe

The screenshot shows a software window titled "Measurement Setup" with a sub-section "Measurement Options". Under "Trace", there are several fields: "Scan Type" is set to "Standard Scan"; "Range" is "6.5 μm"; "Profile" is "Hills & Valleys" with a small graph icon; "Stylus Type" is "Radius: 12.5 μm"; "Stylus Force" is "3 mg". To the right, "Length" is "2000 μm", "Duration" is "10 sec", "Resolution" is "0.667 μm/pt", "Sample" is "3000 pts", and "Speed" is "200 μm/s". Below this is an "Additional Parameters" section with four checkboxes: "Tower Up After Scan" (checked), "Use Soft Touchdown" (unchecked), "Use N-Lite" (unchecked), and "Safe Mode" (checked).

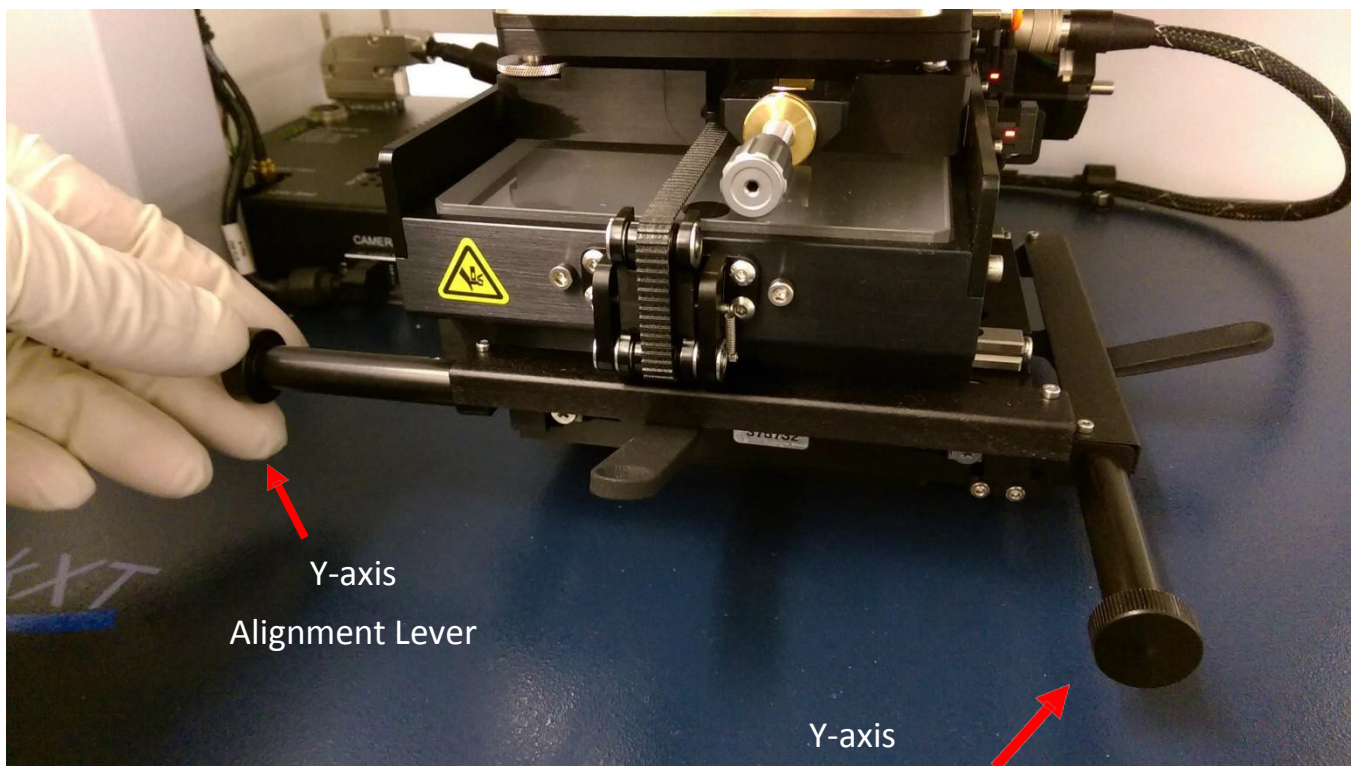
1. The Measurement Setup window is used to define the measurement parameters.
2. Scan Type: This system is only configured with the Stand Scan option.
3. Range: Defines the height resolution of the data for the scan. Note the larger the step height range selected, the lower the resolution of the measurement. A 6.5um scan results in approximately 0.1nm vertical resolution. A 65.5um scan will have approximately 1nm resolution.
4. Profile: Chose the profile that best represents your samples topography. The selection dictates where the stylus is placed with respect to the height analysis window.
  - Valleys: Provides 90% of the measurement range below the zero horizontal grid line. This option is used primarily for measuring etch depths.
  - Hills and Valleys: Provides 50% of the measurement range above the zero horizontal grid line and 50% below. This option is often used, especially if the surface characteristics of the sample are not well known.
  - Hills: Provides 90% of the measurement range above the horizontal grid line. This option is used primarily for measuring step heights.
5. Stylus Type: Select the currently installed stylus type: 12.5 um.
6. Stylus Force: Force values range between 1 mg and 15 mg. When measuring softer materials, for example photoresist and pdms. Measuring harder materials use a higher force for a more accurate reading of the surface features.
7. Length: Input your scan length between 50 um and 55,000 um.
8. Duration: Is the time required to complete the scan length. For most applications, a 10 – 20 second scan results in adequate resolution and throughput.

9. Resolution: The resolution of the scan is not an open field, it is calculated from the Scan Length and the scan Duration.
10. Sample: Indicates the number of data points that the system will collect during the measurement.
11. Speed: Is the calculated scan speed in units of  $\mu\text{m/s}$  from the inputted scan Length and Duration.
12. Tower Up After Scan: Select this check box to make the DektakXT stylus profiler automatically move the stylus to a safe position after each scan.
13. You can save or open your measurement recipe by clicking on the **Save** icon or **Open** icon on the main Instrument banner.

## Making the Measurement

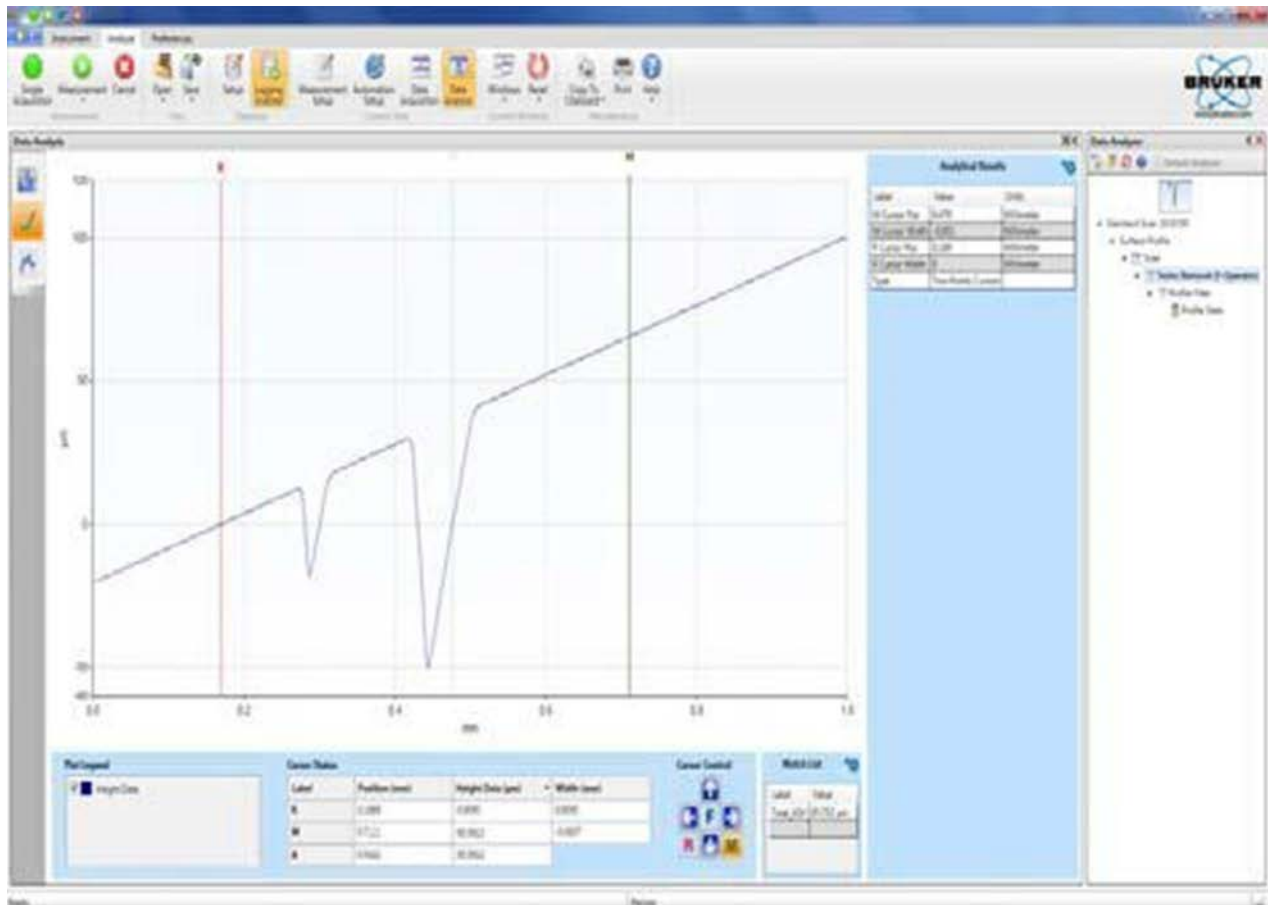
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1. The sample needs to have been loaded prior to initiating the measurement. Verify the measurement point should be located near the center stage.
2. Click on the **Tower Down** icon. The stylus will lower to find the sample surface, and then retracted to allow for alignment. Verify the red cross-hair center is where the stylus contacts your sample.
3. Use the x and y adjustment knobs to align your target structure.



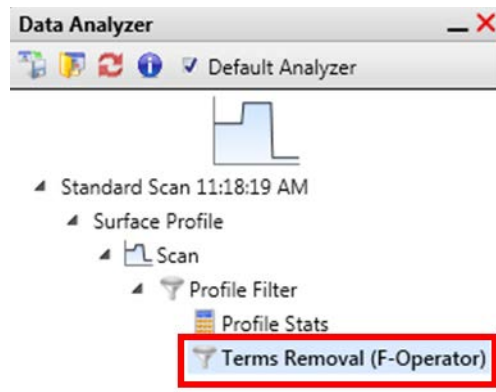
- The scan direction moves from the center of the cross-hairs towards the top of the displayed image.
- Click on the Measurement icon to initiate the data collection. The real time Data Acquisition window open, where you can track the data collection. Once the scan has completed the Data Analysis window automatically opens.

## Data Analysis



- Place the mouse cursor at the location where you want to add the **R** (Red reference cursor) or **M** (green Measurement cursor) and use the right mouse button to open up the drop down menus. Select either the **R** or **M** to insert the cursor at that location.
- The **R** and **M** cursors can be moved by clicking on the cursor and dragging. The cursor bandwidth can be expanded by clicking and dragging of the small box located at the top of the cursor line. When the **R** and **M** cursors are widened, the resulting data is the average of the data within the bandwidth of the cursors.
- The locations of the **R** and **M** cursors are listed in the **Cursor Status** box along with the delta in height.
- Verify the R and M cursors are located are in the correct location for leveling.

5. To software level the results, click on **Terms Removal (F-Operator)** under the Analysis Toolbox window.



6. On the data window, right click and select **Two-Point Linear Fit** from the Data Leveling Setting pop-up menu. The data will be replotted using the **R** and **M** cursor intercepts at zero.