



# Lab Manual


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## ***Dektak 3030 Surface Profiler***

(dektak)

### 1.0 **Title**

Dektak 3030 Surface Profiler

### 2.0 **Purpose**

The Dektak 3030 Surface Profiler is an advanced surface profile measuring system, which accurately measures vertical features ranging in height from 131 micron to 50 angstroms on a wide variety of substrate surfaces.

### 3.0 **Scope**

This manual describes the basic operation of this surface profiler.

### 4.0 **Applicable Documents**

[Revision History](#)

Dektak 3030 Surface Profile measuring System Installation, Operation and Maintenance Manual (copies in Office and Laboratory).

### 5.0 **Definitions & Process Terminology**

#### 5.1 Technical Specifications

Stylus:	12.5 $\mu\text{m}$ radius (Diamond)
Scan Range:	x: 50 $\mu\text{m}$ – 50 mm z: 100 $\text{\AA}$ – 131 $\mu\text{m}$
z Resolution:	1 $\text{\AA}$ /65 K $\text{\AA}$ 10 $\text{\AA}$ /655 K $\text{\AA}$ 20 $\text{\AA}$ /1310 K $\text{\AA}$
Force:	1 – 40 mg
Zoom:	35x – 200x
Scan Speed Ranges:	Low, Med, High
Leveling:	Manual, two-point programmable or cursor leveling
Stylus Tracking Force:	Programmable, 1-40 mg (0.01 - 0.4 milli Newtons)
Maximum Sample Thickness:	45 mm (1.75 inches)
Maximum Sample Weight:	0.5 Kg (1 lb)
Sample Stage Diameter:	165 mm (6.5 inches)
Sample Stage Translation:	X Axis, $\pm 76$ mm ( $\pm 3$ inches) (from center) Y Axis, -76mm (3.0 inches)
Sample Stage Rotation:	Theta, 360°
Power Requirements:	100/115/220Vac $\pm 10\%$ , 50-60Hz, 200VA
Warm-up Time:	15 minutes recommended for maximum stability
Operating Temperature:	21° C $\pm 3^\circ$ C (70° F $\pm 5^\circ$ F)

## 5.2 Specification Summary

	Scientific*	Metric*	English*
VERTICAL DISPLAY RANGE	100 Å to 1310 KÅ	10 nm to 131 µm	0.4 µin to 5200 µin
VERTICAL RESOLUTION In a Selected Range	1Å/65 KÅ 10 Å/655 KÅ 20 Å/1310 KÅ	<u>0.1 nm/6.5 µm</u> <u>1 nm/65.5 µm</u> <u>2 nm/131 µm</u>	<u>0.040 µin/255 µin</u> <u>0.040 µin/2574 µin</u> <u>0.080 µin/5148 µin</u>
DATA POINTS PER MICRON	0.04 to 40	0.04 to 40	0.04 to 40
SCAN LENGTH RANGE	50 µm to 50 mm	50 µm to 50 mm	2000 µin to 20000 mils

Å = Angstroms    µm = micrometer (micron)

\* Switch selectable on top panel of Main Electronics Unit.

## 6.0 Safety

## 7.0 Statistical/Process Data

## 8.0 Available Process, Gases, Process Notes

## 9.0 Equipment Operation

### 9.1 Sample Loading and Viewing

- 9.1.1 Enable the system using the Wand.
- 9.1.2 Push POWER SWITCH on top ([Figure 11.1](#)) to turn the power on.
- 9.1.3 Load the sample onto the sample stage with the area to be measured centered below the stylus.
- 9.1.4 Press the stylus up/down key ▲▼ ([Figure 11.2](#)). Stylus will lower onto sample surface.
- 9.1.5 Press the FCTN key and the number 5 key to display the software reticle.
- 9.1.6 Press the VID key until the software reticle and video image appear simultaneously.
- 9.1.7 Adjust the optics height knob (large black knob on the front of the system) until the stylus tip rests along the horizontal axis of the software reticle.
- 9.1.8 Adjust the sample surface illumination (small black knob) and the contrast (thumbwheel below the video monitor) as necessary.
- 9.1.9 Press the stylus up/down key ▲▼ to raise or lower the stylus.


### 9.1 Sample Positioning

The software reticle may be used as a reference for sample positioning. The horizontal axis of the reticle indicates the path the stylus will take along the sample surface. The sample surface will move from right to left across the CRT during the scan. Position the sample feature to be measured to the right of the reticle. Dektak 3030 uses thumbwheels, located at the front of the stage, to position the sample. The left thumbwheel translates the stage along the X-axis (side-to-side). The right thumbwheel translates the stage along the Y-axis (front-to-back).

**NOTE: The video image on the CRT is rotated 90° clockwise (see table below).**

When Stage Moves ...	Video Image Moves ...
FORWARD	LEFT
BACK	RIGHT
RIGHT	DOWN
LEFT	UP

## 9.2 Programming

- 9.2.1 Press the **PRGM** key. The DEKTAK 3030 menu will appear on the CRT.
- 9.2.2 Move the prompt to the Scan Program Menu using the arrow keys. Press **ENTR** key. The Scan Program Menu will appear on the CRT.
- 9.2.3 Using arrow keys move the prompt to the Scan Length parameter. Determine the appropriate Scan Length. Type in the length using the numeric key pad, and press **ENTR**.
- 9.2.4 Enter **No** for the Auto Leveling and Smoothing parameters.
- 9.2.5 Enter *Medium* for the speed.
- 9.2.6 The Profile parameter should be  (hills and valleys).
- 9.2.7 Select the appropriate vertical Measurement Range and press the **ENTR** key.
- 9.2.8 Enter *Auto* for the Display Range.
- 9.2.9 The rest of the parameters should not be of concern. However, the stylus force may need to be altered.

## 9.3 Making a Scan

Press the **SCAN** key. The stylus will lower and the profile will be plotted.

## 9.4 Manual Leveling

**NOTE: If the initial trace is unlevelled and touches either the top or the bottom of the screen before completion of the scan, the sample must be manually leveled.**

The sample stage must be level to obtain optimum instrument performance. The large, manual-leveling thumbwheel is located at the front of the stage. The manual leveling procedure is as follows:

- 9.4.1 Press the **SCAN** key.
- 9.4.2 As the scan is being performed, turn the leveling thumbwheel until the profile trace is tracking in a horizontal line. Clockwise rotation raises the trace and counterclockwise lowers the trace.
- 9.4.3 Press the **SCAN** key again. The profile must appear totally within the graphic boundaries to achieve the minimum acceptable manual leveling. If not, repeat the manual leveling procedure above.

## 9.5 Cursor Leveling

Before accurate step height or roughness measurements can be obtained, a reference must be established. This reference is the baseline from which all measurements are made. It must be properly leveled and zeroed in software, using the Reference and Measurement cursors.

- 9.5.1 Press the **REF** key.

- 9.5.2 The Reference or R cursor may now be poisoned using the arrow keys. The R cursor should be positioned somewhere along the base of the step in an area free of excess roughness.
- 9.5.3 Press the **MEAS** key.
- 9.5.4 The Measurement or M cursor may now be positioned using the arrow keys. The M cursor should be positioned on the same horizontal plane as the R cursor in an area free of excess roughness. The R and M cursors should be positioned as far apart as possible, yet still on the same plane.
- 9.5.5 Press the **LVL** key. The trace will be replotted with the R and M cursor/trace intercepts positioned on the horizontal zero grid line with the trace leveled.

## 9.6 Step Height Measurement

Once the trace has been leveled, an accurate measurement can be obtained.

- 9.6.1 Press the **MEAS** key.
- 9.6.2 Using the arrow keys, move the M cursor to an area free of excess roughness at the top of the step.
- 9.6.3 With the R cursor positioned at the base of the step height, the difference between the R and M cursor/trace intercepts is automatically displayed in the upper right of the screen, labeled *Vert.* This is the step height.

## 9.7 Magnifying a Trace

An area of interest within a surface profile trace may be magnified for more detailed analysis or manipulation.

- 9.7.1 Press the **LEFT** key. Use the ► arrow key to bring the left boundary in next to the portion of the trace to be magnified.
- 9.7.2 Press the **RT** key. Use the ◀ arrow key to reposition the right boundary as desired.
- 9.7.3 Press the **TOP** key. Use the ▼ arrow key to move the top boundary down.
- 9.7.4 Press the **BOT** key. Use the ▲ arrow key to bring the bottom boundary up.
- 9.7.5 Once the boundaries have been repositioned around the feature to be magnified, press the **RPLT** key.
- 9.7.6 The new boundaries will be replotted, with the magnified trace rescaled.
- 9.7.7 To restore the original boundaries, press the **RST** key and the number **0**. The initial trace will be redisplayed on the screen.

## 9.8 Printout

- 9.8.1 A printout of any CRT display can be generated, including program menus. Pressing the **PT** key, will provide a printout of the entire graphics display.
- 9.8.2 A printout of the scan summary data, minus the profile, can also be obtained, by pressing **FCTN** and then the **PT** key.

## 9.9 Shut Down

- 9.9.1 Unload the sample.
- 9.9.2 Adjust the sample illumination light to the minimum.
- 9.9.3 Adjust the CRT contrast to the minimum.
- 9.9.4 Close the environmental chamber lid.
- 9.9.5 Disable the equipment on Wand.

10.0 Troubleshooting Guidelines

11.0 Figures & Schematics

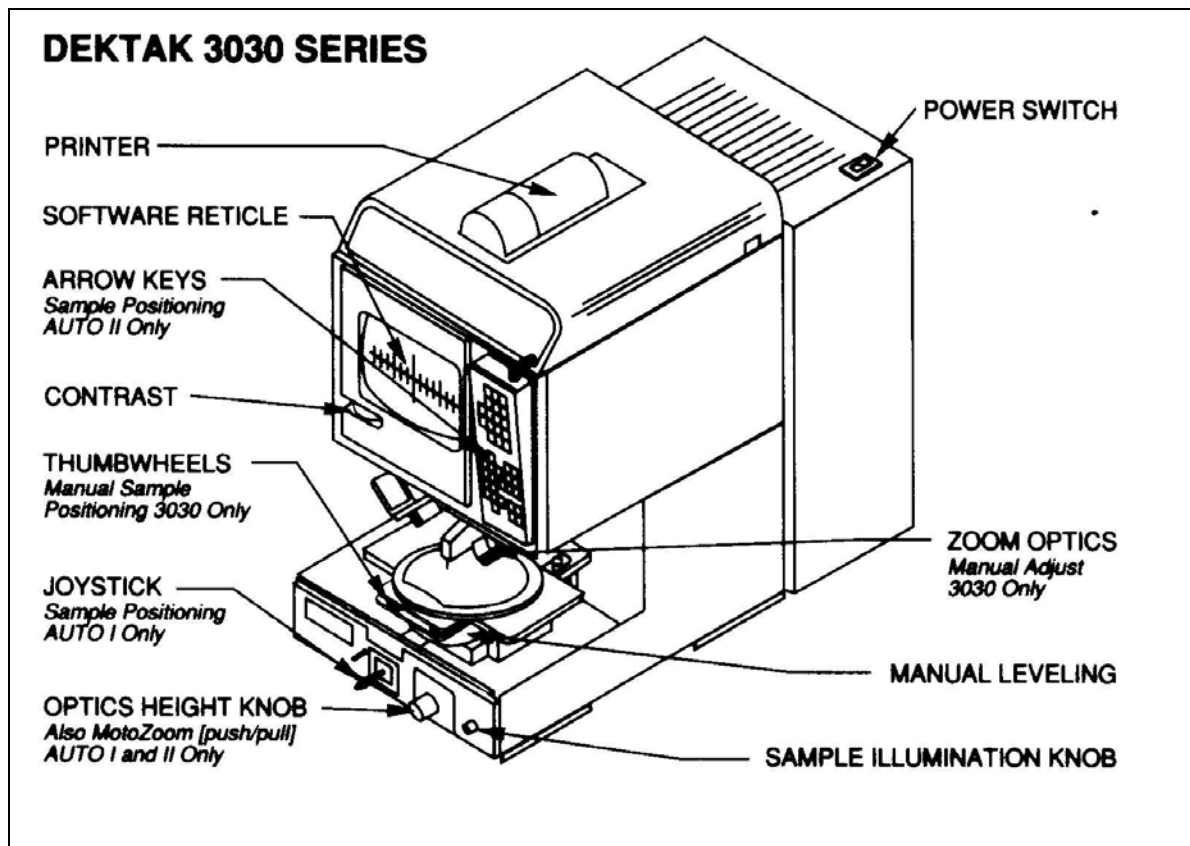


Figure 11.1

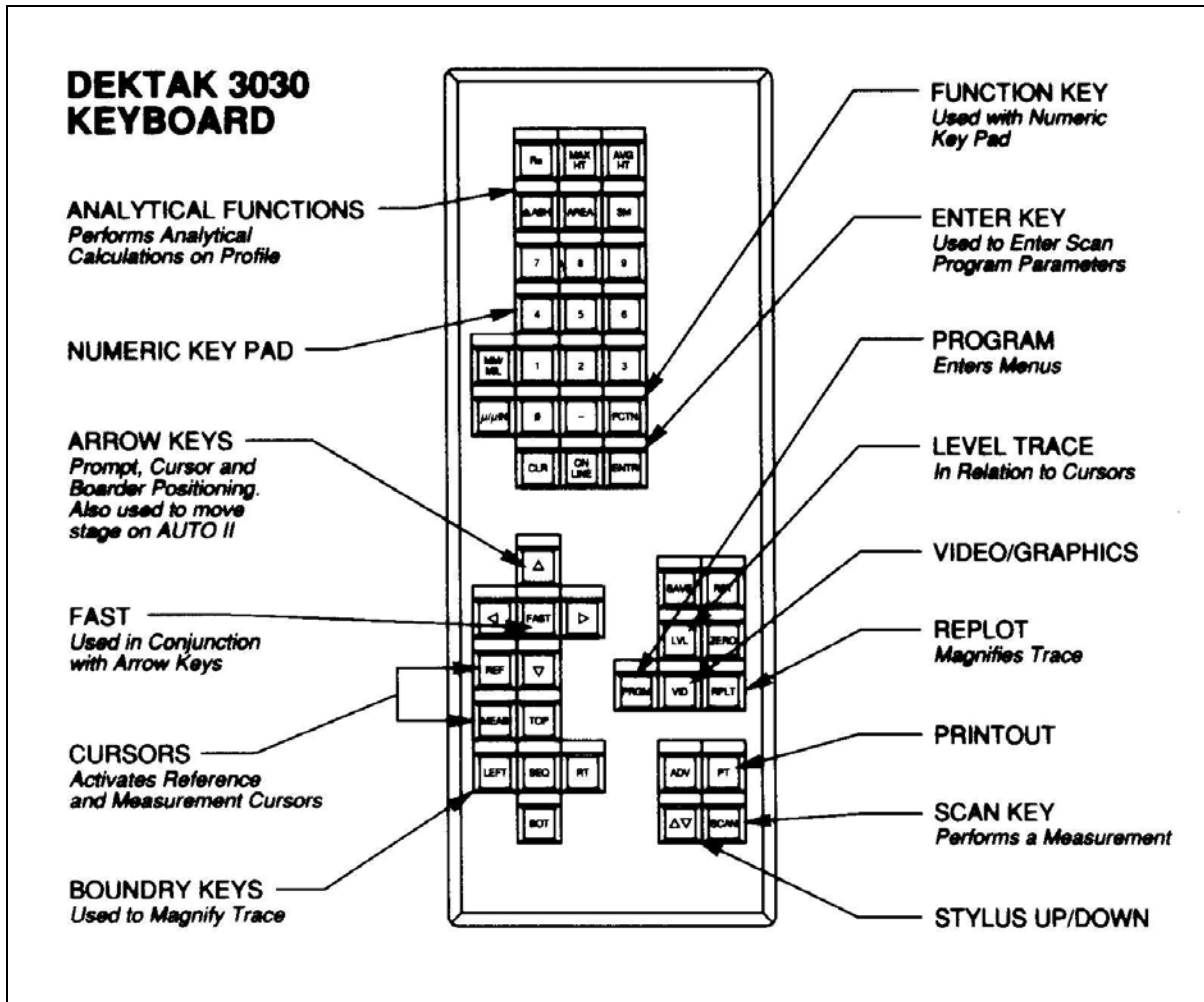


Figure 11.2