D

SPECIFICATIONS

Measurements (all models)

Roughness	R_a, Arithmetic Average Max R_a, Maximum of 19 overlapping sections R_q, Root-Mean-Square (RMS) R_p, Maximum Height R_v, Maximum Depth R_t, Maximum Peak-to-Valley R_z, Ten-Point Height R_{3z}, Six-Point Height R_h, Height between two points
Waviness	W_a, Arithmetic Average W_q, Root-Mean-Square W_p, Maximum Height W_v, Maximum Depth W_t, Maximum Peak-to-Valley W_h, Height between two points
Topography	
TIR	Total Indicator Run-out
Height	Height between two points (Step Height)
Average Height	Average height of all data points between the measurement cursors relative to the leveled baseline (Delta Averaging)
Slope	Rate of change of the profile between two points
Radius	Distance from center of curvature of profile arc to the profile
Area of Peaks	Total area bounded by the leveled baseline and the profile above the baseline
Area of Valleys	Total area bounded by the leveled baseline and the profile below the baseline

Total Area	Sum of Area of Peaks and Area of Valleys
Profile Length	Length obtained from drawing out the profile into a straight line
Maximum Height	Maximum height of trace between the measurement cursors relative to the zero line
Minimum Height	Minimum height of trace between the measurement cursors relative to the zero line
Edge	Distance to rising or falling edge or apex from start of profile
Step Width	Width of profile step
Number of Steps	Number of steps between the measurement cursors
Mean Step Height	Mean value of all the steps between the measurement cursors
Std. Dev. Step Height	Standard deviation of all the steps between the measurement cursors
Mean Peak Height	Mean value of peak heights
RMS Slope	Root-mean-square value of slopes
Average RMS Wavelegth	2π times ratio of RMS deviation of R_q to the RMS slope
Standard Deviation Heights	Standard deviation of peak heights
Bearing Length Ratio	Ratio of bearing length to sampling length at chosen value of Cutting Depth
Cutting Depth	Distance below highest peak to reference line giving chosen value of Bearing Ratio
Peak Count	Number of peak/valley pairs per unit length projecting through a band of chosen width centered about mean line
High Spot Count	Number of profile peaks per unit length projecting through a chosen reference line
Mean Peak Spacing	Mean value of the local peak spacing, where peaks are defined as in Peak Count

Table D-1. *Long-Wave Cutoff Filter Wavelengths*

mm	in.	mm	in.	mm	in.
0.0045	0.0002	0.14	0.006	4.5	0.18
0.008	0.0003	0.25	0.01	8.0	0.3
0.014	0.0006	0.45	0.018	14	0.55
0.025	0.001	0.8	0.03	25	1.0
0.045	0.002	1.4	0.055		
0.08	0.003	2.5	0.1		

Table D-2. *Short-Wave Cutoff Filter Wavelengths*

mm	in.	mm	in.	mm	in.
Default[1]		0.014	0.00056	1.4	0.056
0.00025	0.00001	0.025	0.0010	2.5	0.10
0.00045	0.00002	0.045	0.0018	4.5	0.18
0.00080	0.00003	0.08	0.0030	8.0	0.30
0.0014	0.00006	0.14	0.0056	14	0.56
0.0025	0.00010	0.25	0.010	25	1.0
0.0045	0.00018	0.45	0.018		
0.008	0.00030	0.80	0.030		

[1] Default cutoff filter values differ depending on scan speed and sampling rate. See Table D-4.

Microhead II Measurement Head

Table D-3. *MicroHead II Measurement Head (Stylus Force: 0.05–50 mg)*

Scan Method	Moving stage, stationary stylus	
	Metric	**English**
Scan Length , See Appendix E		
	Metric	**English**
Scan Speed	1 µm/sec. to 25 mm/sec.	0.04 mil/sec. to 1 in./sec.
Sampling Rate	50, 100, 200, 500, and 1000 Hz nominal	
Vertical Range:		
Microhead II Low Force		
At 0.004 Å Resolution	±3.2 µm	±0.13 mil maximum
At 0.016 Å Resolution	±13 µm	±0.5 mil maximum
At 0.08 Å Resolution	131 µm	5.2 mil maximum
Microhead xr		
At 0.008 Å Resolution	±6.5 µm	±0.26 mil maximum
At 0.08 Å Resolution	±65 µm	±2.6 mil maximum
At 0.06 Å Resolution	1000 µm	39.4 mil maximum
Microhead sr		
At 0.008 Å Resolution	±6.5 µm	±0.26 mil maximum
At 0.04 Å Resolution	±32.5 µm	±1.3 mil maximum
At 0.2 Å Resolution	327 µm	13.1 mil maximum
Vertical Linearity, below 2000Å	10Å	0.04 µin
Vertical Linearity, above 2000Å	±0.5%	±0.5%
Because the instrument linearity guarantee is significantly smaller than the uncertainty of the step height standards available in the range of typical use of the instrument, step height standards cannot be used to verify the linearity of the instrument		

Table D-3. *MicroHead II Measurement Head (Stylus Force: 0.05–50 mg) (Continued)*

Horizontal Resolution At 1 µm/sec. scan speed	0.01 µm (100Å) 0.4 µin
Stylus Control	Programmable Force: Range 0.05–50 mg Resolution 0.05 mg Full retract between scans Programmable descent rate
Variable Sample Image Magnification Sideview optic Topview optic (include with optional dual-view optics)	 150–600 x 183–750 x and 300–1200 x (with user interchangeable lens)

Table D-4. *Default Short-Wave Cutoff Filter Wavelengths*

Speed (µm/s)	Sampling Rate (Hz)	Short-Wave Cutoff Frequency (Hz)	Short-Wave Cutoff Wavelength (µm)
1	50	4	0.25
	100	7.5	0.13
	200	15	0.07
	500	37.5	0.03
	1000	Not Available	Not Available
2	50	4	0.5
	100	7.5	0.27
	200	15	0.13
	500	37.5	0.05
	1000	75	0.03

Table D-4. *Default Short-Wave Cutoff Filter Wavelengths (Continued)*

Speed (µm/s)	Sampling Rate (Hz)	Short-Wave Cutoff Frequency (Hz)	Short-Wave Cutoff Wavelength (µm)
5	50	4	1.3
	100	7.5	0.67
	200	15	0.33
	500	37.5	0.13
	1000	75	0.07
10	50	4	2.5
	100	7.5	1.3
	200	15	0.67
	500	37.5	0.27
	1000	75	0.13
20	50	4	5.0
	100	7.5	2.7
	200	15	1.3
	500	37.5	0.53
	1000	75	0.26
50	50	4	13
	100	7.5	6.7
	200	15	3.3
	500	37.5	1.3
	1000	75	0.67
100	50	4	25
	100	7.5	13
	200	15	6.7
	500	37.5	2.7
	1000	75	1.3

Table D-4. *Default Short-Wave Cutoff Filter Wavelengths (Continued)*

Speed (µm/s)	Sampling Rate (Hz)	Short-Wave Cutoff Frequency (Hz)	Short-Wave Cutoff Wavelength (µm)
200	50	4	50
	100	7.5	27
	200	15	13
	500	37.5	5.3
	1000	75	2.6
400	50	4	100
	100	7.5	53
	200	15	27
	500	37.5	11
	1000	75	5.3
1000	50	4	250
	100	7.5	130
	200	15	67
	500	37.5	27
	1000	75	13

Stylus Applied Force MicroHead *sr*: 1.0–50 mg

Sample Handling (all models)

Wafer Sizes	100 mm, 125 mm, 150 mm, and 200 mm	
X-Y	Unlimited programmable locations	
Manual Control	Use trackball or keyboard	
	Metric	**English**
Maximum Sample Size	**See Appendix E**	
(Standard Configuration)	Note: 355 x 355 mm (14 x 14 in.) with side panel removed.Stylus can access any part of a 205150-mm (8.16-in.) round sample without sample repositioning.	
(P-11 Only) Maximum Sample Size (Open Frame Configuration)	430 x 430 mm	17 x 17 in.
	Note: 480 x 480 mm (19 x 19 in) with side panel removed.	
Maximum Sample Weight	2.2 kg.	5 lb.
Throat Depth	228 mm	9 in.
Throat Height, incl. Rotary Stage	63.5 mm	2.12 in.
X,Y Maximum Travel	**See Appendix E**	
X,Y Positioning Speed	Variable up to 25 mm/sec.	1 in./sec.
Motorized Stage Rotation		
Angle Resolution	0.001^{o}	
Leveling	Electronic leveling of traces is standard. Automatic mechanical leveling of sample with Motorized Level and Rotation Option.	
Vacuum Hold-Down of Sample	Standard	
Custom Fixturing Interface	Three 8-32 UNC 2B threaded holes on 3.16-in. diameter circle, 90^{o} apart	

Measurement Control

Manual/Single Scan Mode	Continuous or segmented scan, from recipe
Repeat and Average Mode	Scan repeated up to ten times and averaged

Data Storage

Hard Disk	835 MB or greater. Stores over 20,000 scans at 1000 points each.
Diskette	1.44 MB, 3.5 in. Data storage limited to approximately 100 recipes and 200 scans at 1000 points each. (300 scans per diskette dedicated to data.)
Storage Requirements	DOS Operating System: approx. 6 KB
(estimates only)	Microsoft Windows program: approx. 10 MB
	Tencor Profiler program: approx. 11 KB
	Recipe: 215 bytes
	Single-scan data: 652 bytes plus trace data
	Trace data: Trace data storage requirements are added to that for the scan data
	2D trace data: minimum 2K bytes for the first 505 data points plus 4 times the number of data points thereafter
	3D trace data: 2122 bytes minimum plus 2048-byte increments
	32 bytes per trace (range 1 to 210 inclusive)
	4 bytes per data point
	Approximate number of data points = number of traces × scan length × sampling rate/scan speed

Data Analysis

Interactive Graph	Two-cursor read-out. Cursors move independently or in tandem.
Measurement or Leveling	Each cursor is expandable into a region for measurement.
Zoom Box Data Expansion	Portion of a graph can be magnified.
Data Catalog	Immediate data retrieval and display from catalog
Metric Units	Parameters displayed in preprogrammed metric or English units; independent selection of horizontal and vertical parameters.

Equipment Specifications

Processor	Pentium 100-MHz microprocessor (subject to change). Runs MS-DOS version 6.22.
RAM	16 MB
Monitor	15 in. SVGA Displays magnified image of the sample or output data. Initial data trace or cross-hair identification of stylus location relative to stage can be superimposed on sample image.
	High resolution
	Color data display, user-selectable colors
Standard Keyboard	Enhanced 101 AT with trackball
Real-Time Clock	Battery-backed clock provides date and time of day.

E

THE PROFILER PRODUCTS SPECIFICATIONS

Table E-1. *Profiler Options*

Model	P-10	P-11	P-12	P-22	P-30
Scan Method	moving stage	moving stage	moving stage	moving stage	moving stage
Scan Length Max.	60 mm	205 mm	150 mm	205 mm	20T
Sample Size Max.	254 mm	200 mm	130 mm	200 mm	200
Handler	no	no	no	yes	yes
Stage Motion	150X150 mm	210 mm circle	150X150 mm	210 mm circle	20 mm
Theta	360	360	360	360	360
Leveling - Stage	optional	optional	motorized	motorized	motorized
Scan Head	MHII MHII*sr* MHII*xr*	MHII MHII*sr* MHII*xr*	MHII	MHII*xr* MHII	MHII MHII*sr* MHII*xr*
Software Platform	DOS/Windows	Windows	DOS/Windows	Windows	Windows
Pattern Recognition	no	optional	no	optional	standard
Sequencing	no	standard	standard	standard	standard
Dimensions:					
Width:	57cm (23 in.)	Same as P10	76cm (30 in.)	134cm (53 in.)	114cm (45 in.)
Height:	w/o monitor 46cm (17.5 in.) w/monitor 84cm (34 in.)	Same as P10	168cm (66 in.)	169cm (66 in.)	152cm (60 in.)

Model	P-10	P-11	P-12	P-22	P-30
Depth:	(w/o key-board) 78 cm (31 in.) (w/keyboard) 103 cm(41 in.)	Same as P10	109cm (43 in.)	77cm (30 in.)	114cm (45 in.)
Weight, Instrument:	100kg (219 lbs)	Same as P10	100kg (219lbs)	397 kg (875lbs.)	272 kg (600 lbs)
Weight, Shipping:	163kg (360 lbs)	Same as P10	163kg (360 lbs)	681 kb (1500 lbs)	363 kg (800 lbs)
Vibration Isolation Table weight:	N/A	N/A	168 kg (370 lbs)	N/A	N/A
Weight, Shipping:	N/A	N/A	232 kg (510lbs)	N/A	N/A