

NANOMETRICS

MODEL 210

FILM THICKNESS MEASUREMENT SYSTEM



SYSTEM DESCRIPTION

The **Model 210 Film Thickness Measurement System** incorporates every feature found in Nanometrics' earlier generation NanoSpec®/AFT film thickness measurement equipment but offers even greater speed and flexibility. The new, lower cost AFT determines film uniformity through improved wafer through-put. The higher through-put capability (resulting from a **4 times faster** measurement scan) and ultra-fast computer make the Model 210 the fastest NanoSpec to date. Smaller spot size for measurement on product wafers of smaller geometries, CRT display of data, SECS II interface (now a standard feature), and optional cassette-to-cassette NanoLoader II (allowing 6-point uniformity tests) enhance the Model 210's flexibility.

Standard features on this optical-microscope based, computerized non-contact system include a microspectrophotometer head with holographic grating monochromator; low-noise gallium arsenide PMT; linear wavelength and photo-intensity

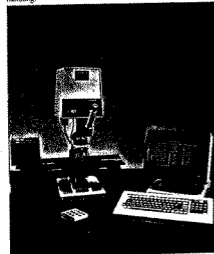
displays; customized microscope with Koehler illumination; and long-life tungsten lamp. The Model 210 also has a variable field diaphragm and turret-mounted 5X, 10X, and 40X parfocal objectives with a $.25 \pm .1$ mm diameter measuring aperture. A monocular viewer with a 10X eyepiece ensures precise location on areas to be measured, and the system's highly accurate mechanical stage has dual wafer holders and slider.

In addition, the Model 210 offers a space-saving microcomputer, CRT terminal that allows direct operator interface to standard film programs, and 32 user-defined tests, including 2-point calibrations and statistical analysis. User tests and statistics are stored in non-volatile, battery backed CMOS RAM. **Datalink II™** hardware and software (now standard) enable the Model 210 to be controlled by, and communicate with, a host or network computer according to SEMI SECS II protocol.

KEY FEATURES

- ▶ Low cost — lower than any other film thickness spectrophotometer system.
- ▶ Fast measurement scan of 2.5 seconds.
- ▶ Smaller spot size.
- ▶ New design for increased measurement accuracy and precision down to 100Å
- ▶ Microspectrophotometer head electronics engineered to produce the most stable measurement system in the industry.
- ▶ DataBank II™ for statistics and exact calibration — user-defined programs now standard.
- ▶ Reflectivity program — standard.
- ▶ Virtual system immunity to line voltage changes and temperature fluctuations.
- ▶ Special film program software available — GaAs, EPA914EZ Resist, etc.
- ▶ 3" to 6" wafer capacity.
- ▶ 8" wafer capacity available.
- ▶ SECS II interface — standard.
- ▶ Cleanroom-compatible printer available.
- ▶ Automated random access wafer load/unload available.
- ▶ Long cables offering remote computer placement to save table space.

The optional NanoLoader II allows tweezers-free wafer handling.



THE STANDARD PROGRAMS INCLUDE THE FOLLOWING FILM TYPES:

1. Silicon Dioxide on Silicon	Less than 400-40,000Å	±2%
2. Silicon Nitride on Silicon	Less than 400-10,000Å	±2%
3. Negative Resist on Silicon	Less than 500-40,000Å	±5%
4. Polysilicon on 300-1,200Å SiO2	Less than 550-10,000Å	±2%
5. Negative Resist on 500-15,000Å SiO2	4,000-50,000Å	±5%
6. Silicon Nitride on 300-3,500Å SiO2	300-3,500Å	±5%
7. Thin Oxide on Silicon	Less than 100-500Å	±5Å
8. Thin Nitride on Silicon	Less than 100-500Å	±5Å
9. Polyimide on Silicon	500-30,000Å	±5%
10. Positive Resist on Silicon	500-40,000Å	±5%
11. Positive Resist on 500-15,000Å SiO2	4,000-30,000Å	±5%
12. Reflectance Mode	370-80nm	±5%
13. Thick Films	4-50 Microns	±5%

ALSO INCLUDES OBJECTIVE LENS PROGRAM FOR EACH FILM:

OBJECTIVE LENS	SPOT SIZE (NOMINAL)
5X	50 Microns
10X	25 Microns
40X	6.5 Microns
100X (Optional)	2.5 Microns

Specifications are subject to change without notice.

210 Specs

4.3 Technical Specifications

Range of thicknesses: 100 to 500,000 angstroms
 Spot sizes: 50 um with 5X objective
 25 um with 10X objective
 6.5 um with 40X objective
 2.5 um with 100X objective (optional)

Statistical data accumulation
 Datalink communication (SECS II compatible)

Film types:	Oxide on Silicon;	Nitride on Silicon;
	Negative Resist on Silicon;	Polysilicon on Oxide;
	Negative Resist on Oxide;	Nitride on Oxide;
	Thin Oxide on Silicon;	Thin Nitride on Silicon;
	Polyimide on Silicon;	Positive Resist on Silicon;
	Positive Resist on Oxide;	Reflectance Mode;
	Thick Films	EPA914EZ Photo Resist
	Very Thin Oxide (VT only)	Very Thin Nitride (VT only)

Reproducibility: 5A $\pm 5\%$ depending upon the Film Type
 Typical measurement time: 2.5 seconds
 Power dissipation: 250 watts
 Primary power: 117 volts ac $\pm 5\%$ @ 50/60 Hz
 Isolated line free of surges or pulses
 Ambient Temperature: 50 to 90 degrees F
 10 to 32 degrees C
 Temperature variation: ± 3 degrees F (± 2 degrees C)
 Humidity: maximum 90%

Dimensions:

	Inches			Centimeters		
	H	W	D	H	W	D
Microscope and spectrophotometer	36-5/8	24-1/2	20	77.79	62.23	50.80
Computer	9-1/2	7-1/2	21-1/2	24.13	19.05	54.61
Clean room printer	3-1/16	7-3/8	6-1/2	7.94	18.73	16.51
CRT Terminal	14	13-1/2	13-1/2	35.56	34.29	34.29
Keyboard	2	18-1/2	8	5.08	46.99	20.32
Chart Recorder	4-3/4	9	10-1/2	12.07	22.86	26.69

Weight:

Microscope & spectrophotometer	51 pounds
Computer	20 pounds
Clean room printer	3.5 pounds
CRT Terminal	28.2 pounds
Keyboard	3.2 pounds
Chart Recorder	7.5 pounds

Clearance must be sufficient at rear for routing cables.

Std. Prog No.	Film Type	Range, Angstroms		Repeat-ability	Under-lying Silicon Dioxide Thickness	Refractive Index
		Min	Max			
1	Silicon Dioxide on Silicon	400	50,000	±5 A	---	1.45
2	Silicon Nitride on Silicon	400	50,000	±5 A	---	2.00
3	Negative Resist on Silicon	500	50,000	±5 A	---	1.55
4	Polysilicon on Silicon Dioxide	<500	10,000	±2%	300- 1,200	3.00
5	Negative Resist on Silicon Dioxide	4,000	30,000	±5%	100- 15,000	1.55
6	Silicon Nitride on Silicon Dioxide*	300	3,500	±5%	300- 3,500	2.00
7	Thin Oxide on Silicon	<100	500	±5 A	---	1.45
8	Thin Nitride on Silicon	<100	500	±5 A	---	2.00
9	Polymide on Silicon	500	50,000	±5%	---	1.70
10	Positive Resist on Silicon	500	40,000	±5 A	---	1.64
11	Positive Resist on Silicon Dioxide	4,000	30,000	±5%	100- 15,000	1.64
12	Reflectance Mode*	370-800 nm		±5%	---	N/A
13	Thick Films**	4-50 microns		±5%	---	***
14	Red Resist on Silicon	4,000	30,000	±5%	---	
15	Very Thin Oxide #	20	450 A	±2%	---	
16	Very Thin Nitride #	20	450 A	±2%	---	

* 10X objective only

** 5X or 10X objective only (depending upon thickness)

*** Operator must input refractive index value. Default is 1.00.

Available only on Model 210VT

Table 4-5. Film Types

4.3 Technical Specifications

FOR
210 ONLY

Range of thicknesses: 100 to 500,000 angstroms

Spot sizes: 50 um with 5X objective
25 um with 10X objective
6.5 um with 40X objective
2.5 um with 100X objective (optional)

Statistical data accumulation

DataLink communication (SECS II compatible)

Film types:	Oxide on Silicon;	Nitride on Silicon;
	Negative Resist on Silicon;	Polysilicon on Oxide;
	Negative Resist on Oxide;	Nitride on Oxide;
	Thin Oxide on Silicon;	Thin Nitride on Silicon;
	Polyimide on Silicon;	Positive Resist on Silicon;
	Positive Resist on Oxide;	Reflectance Mode;
	Thick Films	EPA914EZ Photo Resist
	Very Thin Oxide (VT only)	Very Thin Nitride (VT only)

Reproducibility: 5A $\pm 5\%$ depending upon the Film Type

Typical measurement time: 2.5 seconds

Power dissipation: 250 watts

Primary power: 117 volts ac $\pm 5\%$ @ 50/60 Hz
Isolated line free of surges or pulses

Ambient Temperature: 50 to 90 degrees F

10 to 32 degrees C

Temperature variation: ± 3 degrees F (± 2 degrees C)

Humidity: maximum 90%

Dimensions:

	Inches			Centimeters		
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Microscope and spectrophotometer	30-5/8	24-1/2	20	77.79	62.23	50.80
Computer	9-1/2	7-1/2	21-1/2	24.13	19.05	54.81
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CRT Terminal	14	13-1/2	13-1/2	35.56	34.29	34.29
Keyboard	2	18-1/2	8	5.08	46.99	20.32
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FOR - 210 ONLY

Std. Prog No.	Film Type	Range, Angstroms		Repeat-ability	Under-lying Silicon Dioxide Thickness	Refractive Index
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7	Thin Oxide on Silicon	<100	500	±5 A	---	1.45
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*** Operator must input refractive index value. Default is 1.00.

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Table 4-5. Film Types

SYSTEMS

#7002-0080	Includes sturdy large-depth microscope with 5"×5" travel stage and two-position wafer slider suitable for 3" and 4" wafers, cleanroom operations manual, and one spare tungsten lamp.
#7002-0081	Same as #7002-0080 except includes sturdy, large throat-depth microscope with 5"×5" travel stage and two-position wafer slider suitable for 4" and 5" wafers.
#7002-0066	Same as #7002-0080 except includes sturdy, large throat-depth microscope with 6"×6" travel stage and two-position wafer slider suitable for 5" and 6" wafers.
#7002-0092	Same as #7002-0080 except includes sturdy, large throat-depth microscope with NanoLoader™ II Automated Wafer Loader for tweezer-free, cassette-to-cassette transfer of 4", 5", and 6" wafers.

OPTIONS

#9640-0015	100X Dry Objective provides nominal 2.5 micron spot size and the use of film programs to measure thickness in the range below 5000Å. Objective screws into the standard microscope turret nosepiece.
#8703-0181	Cleanroom Printer produces highly legible copy on particle-free thermally sensitive paper.
#8700-0304	8" Dual Wafer Stage and Stand offers 8"×8" travel stage and custom microscope for 8" wafers.
#7201-0518	5" Strip Chart Recorder (Linear Model 156) is specially modified to operate with the Model 210 Film Thickness Measurement System to plot interferograms. The recorder has 0-1 volt span, 12 chart speeds, and remote start-stop input. It includes connector cable, three rolls of chart paper, and two spare pens.
#9630-0009	Centerable Nosepiece offers par-centralization of four (4) objective lens. Useful for location of small features with high power objective lens.
#8700-0318	"CAL-PAC™" Film Thickness Reference Standard for easy and convenient monitoring of your Model 210's precision and stability.