Model 2010/M Specifications

- **Index Accuracy:** ±0.0005 (worst case). Absolute index accuracy is limited primarily by uncertainties in determining the angle and refractive index of the measuring prism. For samples of reasonable optical quality, if a high resolution table is used and if the user is willing to perform a simple calibration procedure with each prism, absolute index accuracy of ±0.0001 - 0.0002 can be achieved. NIST, fused silica, and other standards are available for index calibration.

- **Index resolution:** ±0.0003 (worst case). For samples of reasonable optical quality, index resolution can be improved up to ±0.00005 by use of a high resolution rotary table, a no-cost option (see below).

- **Thickness accuracy:** ±(0.5% + 5 nm)

- **Thickness resolution:** ±0.3%

- **Operating wavelength:** Low power (0.8 mw) He-Ne laser (632.8 nm), CDRH Class II. Optional shorter wavelengths (405, 450, 473, 532, 594 nm) for measurement of thinner films and near-IR (830, 980, 1064, 1310, 1550 nm) wavelengths for fibre/integrated optics applications are available. Optional sources change CDRH safety class to IIIa or IIIb.

- **Typical measurement time:** 10 - 25 seconds with standard table, 20 - 75 seconds with high resolution table.

- **Measurement area:** While the film and measuring prism are in contact over an area roughly 8 mm square, film area actually measured is only 1 mm diameter.

Lambda Photometrics Ltd Lambda House Batford Mill Harpenden Hertfordshire AL5 5BZ United Kingdom
E: info@lambdaphoto.co.uk **W:** www.lambdaphoto.co.uk **T:** +44 (0)1582 764334 **F:** +44 (0)1582 712084
A Polytec Company Registered Office: Lambda House Batford Mill Harpenden Hertfordshire AL5 5BZ Registered in England No: 1332370- Producer Reg. No. WEE/KB0053TQ

- **Refractive index measuring range:** With standard prisms, films and bulk materials with refractive index 2.65 and below are measurable. Specialised prisms are available to permit index measurements up to 3.35 (consult Metricon for details).

- **Measurable film types/thickness ranges:** The Model 2010/M can measure virtually any film type which is not metallic or very highly absorbing at the operating wavelength. In many cases, thickness and index of one or both films of dual film layers are measurable*, provided the top film has higher refractive index. Thickness must exceed a minimum threshold which depends on film and substrate (or underlying film) index. Examples of thickness ranges measurable for common single or upper film types at the standard (633 nm) operating wavelength (for other film types, interpolate between example films with closest index):

Film Type/Index	Thickness and Index **	Thickness only (assume index)
Silicon dioxide (n=l.46) or PMMA (n ~1.5) over Si	0.48-150 µm**	0.20-0.48 µm**
Photoresist (n=l.63) over Si	0.42-150 µm**	0.18-0.42 µm**
Photoresist (n=l.63) over SiO_2 or glass*	0.70-150 µm**	0.30-0.70 µm**
Alumina or polyimide (n=l.70) over Si	0.38-150 µm**	0.15-0.38 µm**
Alumina or polyimide (n=l.70) over SiO_2 or glass*	0.50-150 µm**	0.16-0.50 µm**
Si oxynitride (n=l.80) over Si	0.35-150 µm**	0.14-0.35 µm**
Si oxynitride (n=l.80) over SiO_2 or glass*	0.45-150 µm**	0.13-0.45 µm**
Ta_2O_5 or Si nitride (n=2.05) over Si	0.32-150 µm**	0.12-0.32 µm**
Ta_2O_5 or Si nitride (n=2.05) over SiO_2 or glass *	0.30-150 µm**	0.15-0.30 µm**

* High-index films over substrates or underlying films of lower index other than silicon dioxide are sometimes measurable at thicknesses up to half as thin as the above limits. Optional shorter wavelengths are also available to extend the measuring range to thinner films. Please consult Metricon for details.
** For films which exceed maximum thickness limit, index is still measurable using bulk measurement. With VAMFO option, non-contact thickness-only measurements may be made on films as thick as 150 µ.

- **Index-only measurement of bulk materials/thick films:** Materials must be transparent or semi-transparent. Maximum index measurable with standard prisms is 2.65 (3.35 with high index prisms). Accuracy and resolution are same as for thin film measurement (see above). Typical measurement time for bulk measurement is 10-20 seconds.

- **Substrate materials/sizes:** Film measurements may be made on virtually any polished substrate material including silicon, GaAs, glass, quartz, sapphire, GGG, and Lithium Niobate and the sample can be virtually any size or shape. The standard unit accepts samples up to a maximum of 8in (200 mm) square – contact Metricon for larger sample sizes.

- **Prism types:** Four standard prism types are available for measurement of films in various index ranges. Prisms are easily interchangeable in approximately one minute to permit use of more than one prism type with a single system:

Prism type	Index range	Comments
200-P-1	<1.80	low wear, optimum for low index (<1.80) films.
200-P-2	1.70-2.45	optimum for high index (>2.10) films. Optional 200-P-2-60 prism increases index measuring range from 2.1-2.65.
200-P-3	<2.10	useful over a wide index range (1.4-2.1).
200-P-4	<2.02	low wear, useful over a wide index range (1.4-2.0).
200-P-2 and 200-P-3 prisms eventually become abraded with use and must be replaced after a typical life of 8,000-10,000 measurements.***Ten additional specialised prism types are available*** including high index prisms to permit index measurements as high as 3.35 (consult Metricon for details).		

- **Rotary table step size:** 3.0 or 1.5 minutes, keyboard selectable. Higher resolution tables (0.9/0.45 or 0.6/0.3 minutes) are also available as a no-charge option. Higher resolution tables are recommended when film thickness exceeds 5-7 microns, or when improved index resolution and accuracy are required.

- **Major options:** Options to permit measurement of waveguide loss and determination of index vs temperature (up to 150-200ºC) are available. VAMFO option allows non-contact measurement of thickness only.

- **PC requirements:** operates with Windows 98, 2000, XP, Vista, or Seven. RS232 serial (COM1) port must be available and cannot be accessed by other applications.

- **Services required:** 100-250 VAC outlets for laser power supply, interface module, and printer (0.5 amp each) and PC (2.0 amps). 60 psi air (.01 cfm). Unit can be mounted on ordinary bench top — vibration isolation not required.

- **Dimensions:** Overall system installation requires an area of 45 in (108 cm) wide, 27 in (61 cm) deep, 15 in (38 cm) tall. Total system weight, including computer is 92 lbs (41 kg). Individual dimensions/weights:

- **Optical module:** 15 in (38 cm) wide, 22 in (56 cm) deep, 12 in (30 cm) tall/40 lbs (18 kg).

- **Computer/monitor:** 16 in (40 cm) wide, 15 in (38 cm) deep, 15 in (38 cm) tall/50 lbs (22 kg).

- **Interface box:** 10 in (25 cm) wide, 7 in (18 cm) deep, 3 in (8 cm) tall/2 lbs (1 kg).