

Metrology Capabilities

Equipment	Measurements	Comment										
Ultra Precision 3-D Profilometer Panasonic UA3P-5H	<ul style="list-style-type: none"> Determination of surface shape deviations of spherical and aspherical surfaces Decentering of aspherical lenses Radius 	<p>Resolution depends on the type of probe</p> <p>Lateral measurement error (measuring range of the XY axes) to 100mm: within 0.05µm 100 - 200mm: within 0.1µm Measuring Range: 200 mm x 200 mm x 45 mm (280mm at 45°)</p> <table border="1"> <thead> <tr> <th>Ruby probe</th> <th>Diamond probe</th> </tr> </thead> <tbody> <tr> <td>± 0.01 – 0.05 µm / ± 30°</td> <td>± 0.1 µm / ± 30° (Standard)</td> </tr> <tr> <td>± 0.08 µm / ± 45°</td> <td>± 0.3 µm / ± 60° (new diamond)</td> </tr> <tr> <td>± 0.15 µm / ± 60°</td> <td></td> </tr> <tr> <td>± 0.15 µm / ± 70°</td> <td></td> </tr> </tbody> </table>	Ruby probe	Diamond probe	± 0.01 – 0.05 µm / ± 30°	± 0.1 µm / ± 30° (Standard)	± 0.08 µm / ± 45°	± 0.3 µm / ± 60° (new diamond)	± 0.15 µm / ± 60°		± 0.15 µm / ± 70°	
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MTF Measurement Trioptics ImageMaster HR	<ul style="list-style-type: none"> Modulation Transfer Function (MTF) of Lenses Measurement Infinity – Finite and Finite - Finite Focal length Distortion Lateral chromatic aberration, longitudinal chromatic aberration Relative illuminance F-number Scattered light 	<ul style="list-style-type: none"> MTF Measuring range 0 - 300 lp / mm Reproducibility MTF ± 1% Reproducibility Focal length 0.1% Thermal chamber integrated -20°C - +60°C 										
Refractometer 2x Interferometer > 10x 4 Inch Zygo Interferometer (Ametek Zygo)	<p>Refractive indices of Glass</p> <ul style="list-style-type: none"> Determination of surface shape deviations of spherical and slightly aspherical surfaces Inhomogeneities in glass Radiation measurement of lenses Wavefront deviation (13/...) Radius 	<p>nD 1.35 – 2.1; Abbe number</p> <ul style="list-style-type: none"> Resolution $\lambda / 10$ Measurability of aspherical surfaces with limitations $\pm \lambda / 1'800$ rms $\pm 0.001\%$ of Radii or 3 µm 										
White light interferometer	<ul style="list-style-type: none"> Roughness of optical surfaces PSD Waviness Surface Form deviation (3/...) Radius 	<ul style="list-style-type: none"> Surface topography reproducibility 0.08 nm roughness Reproducibility RMS 0.008 nm ± 0.12 nm RMS 										
Nomarski microscope	Roughness of optical surfaces	Qualitative surface evaluation										

Profile projector	Dimensional testing of optical and mechanical elements	Resolution 1D $x,y (2 + 4L/1000) \mu\text{m}$ $z (3.9 + 5L/1000) \mu\text{m}$ Resolution 2D $x,y (2.5 + 4L/1000) \mu\text{m}$
3D – Coordinate measurement Zeiss Micura	<ul style="list-style-type: none"> Dimensional testing of mechanical elements 	Resolution 3D $(0.7 + L/400) \mu\text{m}$
Measurement Microscope	<ul style="list-style-type: none"> Dimensional testing of optical and mechanical elements 	Resolution $\approx 1 \mu\text{m}$
Spectrophotometer 2x	<ul style="list-style-type: none"> Wavelength-dependent power measurement 	Wavelength range 300 – 2500 nm
Non-contact center thickness measuring 2x (OptiSurf)	<ul style="list-style-type: none"> Center thickness of lenses Center thicknesses and air distances of entire lenses 	Accuracy $\pm 1 \mu\text{m}$ combinable with thermo chamber -20°C - $+60^\circ\text{C}$
Centering measuring stations (OptiCentric)	<ul style="list-style-type: none"> Centering of lenses 	Depending on the radius to be measured
Polarimeter (Sigma Opto)	<ul style="list-style-type: none"> Birefringence stress in glass 	Polarimeter imaging measurement range 0 to 300 nm Repeatability $\pm 0.1 \text{ nm}$
Focal length measuring device	<ul style="list-style-type: none"> Focal length Front and rear focal lengths of lenses especially FAC lenses 	Reproducibility $1 \mu\text{m}$
Collimator > 5x	<ul style="list-style-type: none"> Angle measurement; Flatness of surfaces 	Resolution $\approx 5 \text{ arcsec}$
Laser power meter	<ul style="list-style-type: none"> Power measurement on lasers and optics 	
Goniometer 2x	<ul style="list-style-type: none"> Angle measurement of prisms 	<ul style="list-style-type: none"> Accuracy (Multiple Measurement) arcsec ± 1.0 Accuracy (Single Measurement) arcsec ± 1.5 Accuracy (Pyramidal angle measurement) arcsec ± 3.0 Minimal sample area (uncoated glass) 0.5 mm^2
Diverse special measuring instruments	<ul style="list-style-type: none"> For example, complete determination of all optical parameters of micro-optical components 	
2 Inch FISBA Interferometer (uPhase)	<ul style="list-style-type: none"> Surface form deviation (3/...) Wavefront deviation (13/...) Radius Inhomogeneity (2/...) 	<ul style="list-style-type: none"> $\pm \lambda / 20 \text{ rms}$ $\pm 0.02 \% \text{ of Radii}$