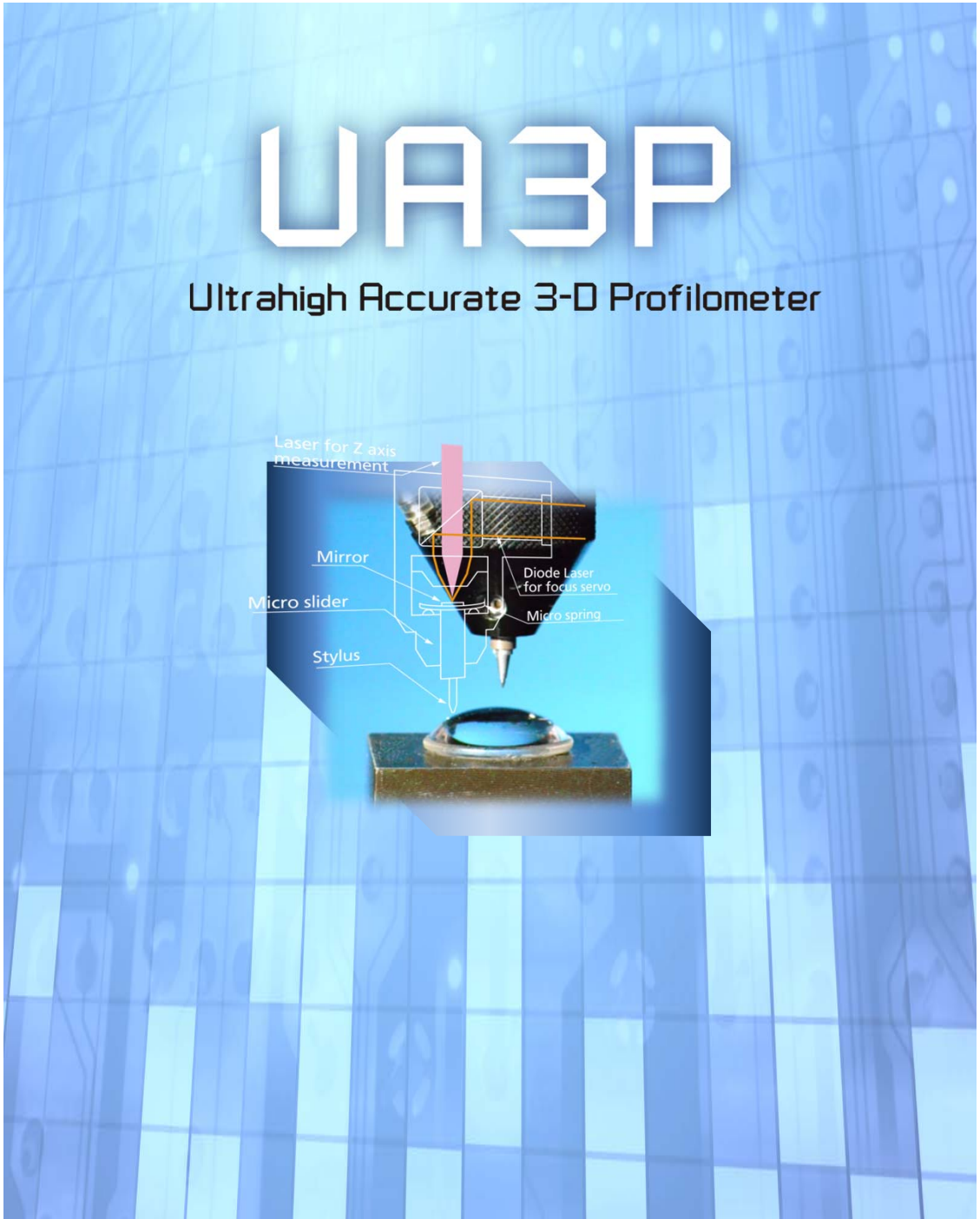
Panasonic

Ultrahigh Accurate 3D Profilometer
General Catalog



⚠ Safety Cautions

- Please read the User's Manual carefully to familiarize yourself with safe and effective usage procedures.
- To ensure safety when using this equipment all work should be performed according to that as stated in the supplied Operating Instructions. Read your operating instruction manual thoroughly.

eco ideas **Panasonic Group products are built with the environment in mind.**
http://www.panasonic.com/jp/corporate/sustainability.html

ISO 14001 Panasonic Group builds Environmental Management System in the factories of the word and acquires the international Environmental Standard ISO 14001:2004.

•Check our website for more details ► http://industrial.panasonic.com/ww/products/fa-welding/fa/3d-profilometers

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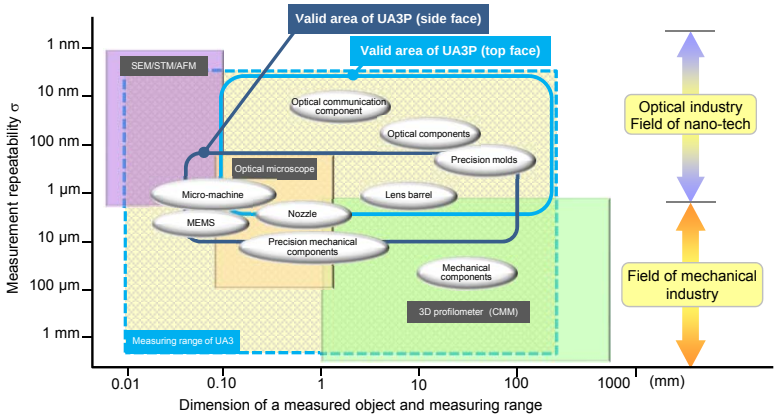
It is impossible to manufacture parts without making measurements - the UA3P series supports nanometer-accuracy manufacturing by making precise measurements of fine shapes.

The UA3P series can measure aspherical lenses and free-form mirrors and their molds, which are essential for digital consumer electronics such as mobile phones, DSCs, DVDs, and Blu-ray recorders, as well as in home security, optical communications, and vehicle HUDs, to an accuracy of up to 0.01 µm.
Easy operation supports rapid feedback to machining.

Measurement accuracy and applicable field of each profilometer



Full lineup from ultrahigh accuracy measurement of ±0.10 µm at an inclination angle of 70° to measurement of large components of □500 mm

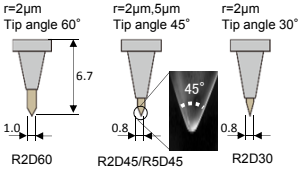
UA3P-3000

UA3P-700H

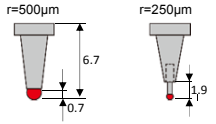
Hardware

Stylus

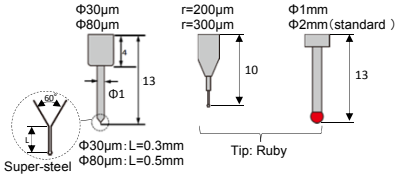
- New diamond stylus for top-surface measurement
  - Supports precise shape measurement, such as of mobile lenses and diffracting gratings



- Ruby stylus for top-surface measurement*1
  - Uses a high-sphericity ruby ball for general-purpose measurements

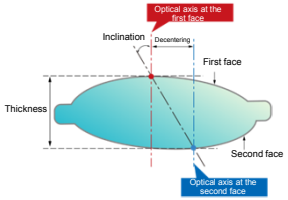


- Stylus for side-surface measurement*2
  - Super-steel or ruby available for the tip.

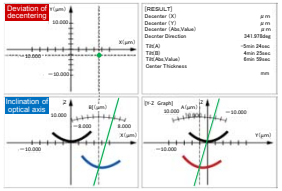


Decenter and Tilt measurement jig

- Decenter/Tilt measurement between lens faces
  The lens is fixed on a jig provided with three reference balls for combination. Any decentering between the lens faces is evaluated by measuring both faces of the lens.



Aspherical face - Aspherical face lens



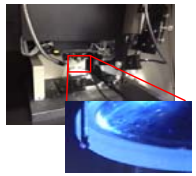
Example of evaluation of lens decenterand tilt

Decenter and tilt measurement jig

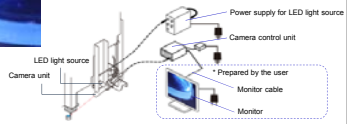
Observation camera

Applicable model: All models

A measuring point is magnified for display to enable easy positioning.

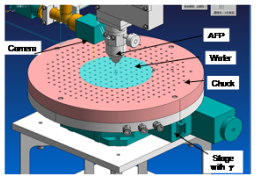


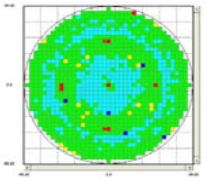
CCD camera specifications	
Viewing field range	H8 mm x V6 mm
Effective pixels	380,000 pixels (H768 x V494)
Observation magnification	40x—50x (for a 17" monitor)
Video output terminal	BNC terminal
Lighting	LED coaxial epi-illumination



Wafer level lens (WLL)

Applicable model: UA3P-500H/650H/700H





	Optional hardware	500/550H	650H/700H	3000	300	400T	Notes
1	R2D45 Diamond stylus (new diamond stylus)	O	O	O	O	O	For measuring up to an inclination angles up to 60°
2	R2D30 diamond stylus	O	O	O	O	O	For measuring inclination angles up to 70°
3	R5D45 diamond stylus	O	O	O	O	O	The long-radius tip has high wear resistance.
4	Ruby ball for calibrating diamond stylus	O	O	O	O	O	For calibrating tip R of diamond stylus
5	R250 µm ruby stylus	O	O	O	O	O	
6	Stylus for measuring R30 µm side surface	x	x	x	x	O	For measuring outlines of nozzles and detailed shapes
7	Stylus for measuring R200 µm side surface	x	x	x	x	O	For measuring the outlines of lenses and molds
8	Standard ball for calibrating small-diameter stylus	x	x	x	x	O	For calibrating tip R of stylus for side-surface measurement
9	Inclination and decentering measuring jig ϕ3-26 mm	O	O	O	O	O	Needs decenter and tilt evaluation software
10	Inclination and decentering measuring jig ϕ20-55 mm	O	O	x	x	O	Needs decenter and tilt evaluation software
11	Inclination and decentering measuring jig ϕ50-100 mm	O	O	x	x	x	Needs decenter and tilt evaluation software
12	High-inclination measuring jig	O	O	x	O	O	
13	Observation camera unit (Dedicated number for each model)	O	O	O	O	O	
14	Wafer chuck and camera unit	O	O	x	x	x	For measuring wafer level lenses, evaluation software is needed

O: Available ⊙: Standard feature x: Not available

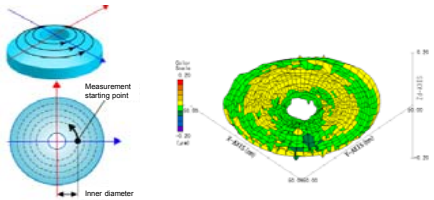
* Precautions
*1 Note that the ruby stylus is at risk of breaking due to its large coefficient of friction while measuring aluminum lenses or surface-coated lenses.
*2 The stylus for side-surface measurement (ϕ30 µm - ϕ300 µm) may require an observation camera for measurement.

■ Options

Software

Circumferential scanning measurement software

The measured object is circumferentially scanned and measured.
• Hollow objects are also measureable.
• Up to 1200 concentric circles.



User-defined software (free-form curved surfaces, etc.)

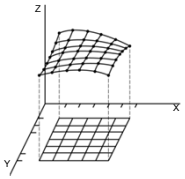
Other formulae are supported in addition to the lens design formula that is registered as a standard feature.
The use of the C language for creating the design formula and the calculation part of a partial differential equation allows all of ISO10110-12 to be covered.

ISO10110-12			UA3P Design formula type
General secondary curve	Rotation symmetry	Ellipsoid	Rotation symmetry aspheric surface
		Hyperboloid	
		Paraboloid	
		Spherical surface	
		Conical surface	User-defined formula
		Flat face	Flat face
	Rotational asymmetry	Ellipsoid Hyperboloid	User-defined formula
		Paraboloid Conical surface	
		Cylindrical face	Cylindrical
Toric			R center is constant
			X: Non-circular arc, Y: Circular arc
Undefined			Doughnut
			User-defined formula

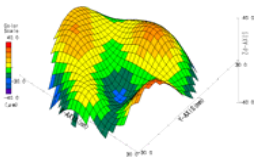
* Limited to the case that can be expressed by applicable Z = f (x, y).

Software for creating point group data design formula

A rectangular curved surface is created using the spline function with respect to given 3D point group data.



Creation of design formula

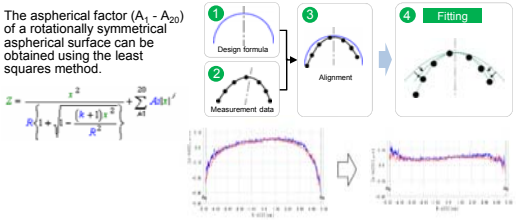


Evaluation of varifocal glasses

Fitting software (rotation symmetry)

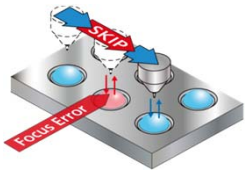
A previously unknown design formula of a measured object can be obtained from the measurement data.

The aspherical factor (A_1 - A_{20}) of a rotationally symmetrical aspherical surface can be obtained using the least squares method.



Auto-measurement

Applicable model: All models except for UA3P-400T



Fully automated, including probe movement and focus ON/OFF
Supporting various errors

Multiple measurements of mobile lenses

* The jig is prepared by the user

	Optional software	500/550H	650H/700H	3000	300	400T	Notes
1	Circumferential scanning measurement software	○	○	○	○	○	
2	User-defined software	○	○	○	○	○	
3	Base alignment software	○	○	○	○	○	
4	Coordinate axis conversion software	○	○	x	○	○	
5	Rotation symmetry fitting software	○	○	○	○	○	
6	New diamond stylus correction software (on axis)	○	○	○	○	○	Supporting only data on axis
7	Function for creating point group data design formula	○	○	○	○	○	
8	Function for creating measurement data curve	○	○	○	○	○	
9	Number of measuring points: 1 million, capture speed: 2000 points/sec	○	○	⊙	○	○	
10	V-groove measuring software	○	○	○	○	○	
11	Inclination and decentering evaluation software	○	○	○	○	○	
12	High-inclination measuring software	○	○	x	○	○	
13	Auto-measuring software	○	○	○	○	x	
14	TopFlat centering software	○	○	○	○	○	

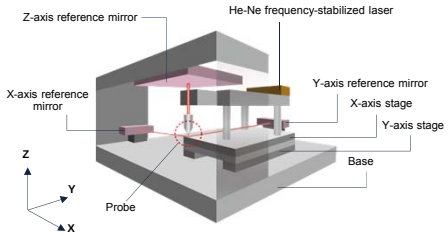
○: Available ⊙: Standard feature x: Not available

■ Technology for realizing ultrahigh accurate measurement

Coordinate measurement technology

The profilometer's coordinate system is configured with three reference flat surfaces (mirrors) independent of the stages. The length of each X, Y, and Z axis is measured to a resolving power of 0.3 nm with the laser interference method using a He-Ne frequency-stabilized laser as a light source. This suppresses the influence of squareness and straightness of the stages to achieve high-precision measurement

- Measurement error due to coordinate axis: 0.05 μm max. (up to 100 mm)
  0.3 μm max. (up to 500 mm)

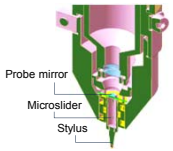


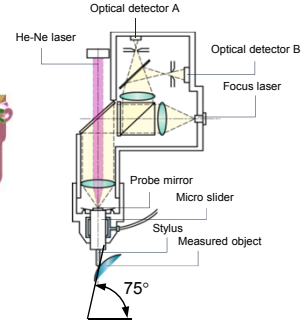
Top-surface measuring probe/AFP (atomic force probe)

AF Probe

High-precision scanning and measurement of a measured object is feasible due to the use of ultra-low measuring forces.
The stylus is held by the micro-air slider, and the focus laser detects the movement of the stylus. The position of the AFP is tracked in line with the shape of the measured object to keep the measuring force constant.

- Measuring force: 0.15-0.30 mN (15-30 mgf)
  * US3P-3000 requires 0.10-0.20 mN.
- Stylus: A diamond stylus with a tip angle of 30° and a radius of 2 μm can be used.



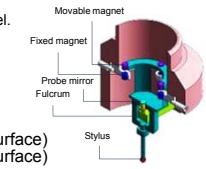


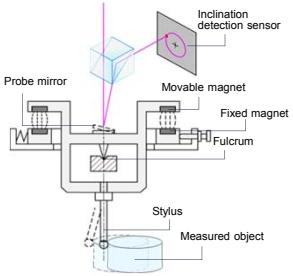
Side-surface measuring probe/S-AFP

Side-AF Probe

The inclination of a probe mirror detected at high precision is fed back to the XY stages to enable scanning measurement with low-contact force (0.3 mN).
This enables measurement without deforming resin products, such as a lens barrel.

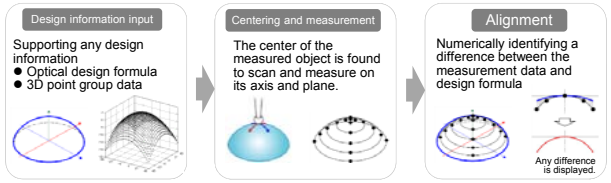
- Measuring force: 0.3 mN (30 mgf)
- Measurement accuracy: ±0.15 μm (when measuring 90° inclination)
- Maximum measuring angle:
  Horizontal measurement: 45° - 90° (angle relative to horizontal surface)
  Vertical measurement: 80° - 90° (angle relative to horizontal surface)





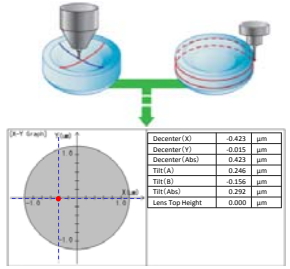
Software

Achieving high-speed and high-precision measurement with easy operation
Supporting any design information. An installation error in the measured object is three-dimensionally corrected to enable accurate profile measurement.



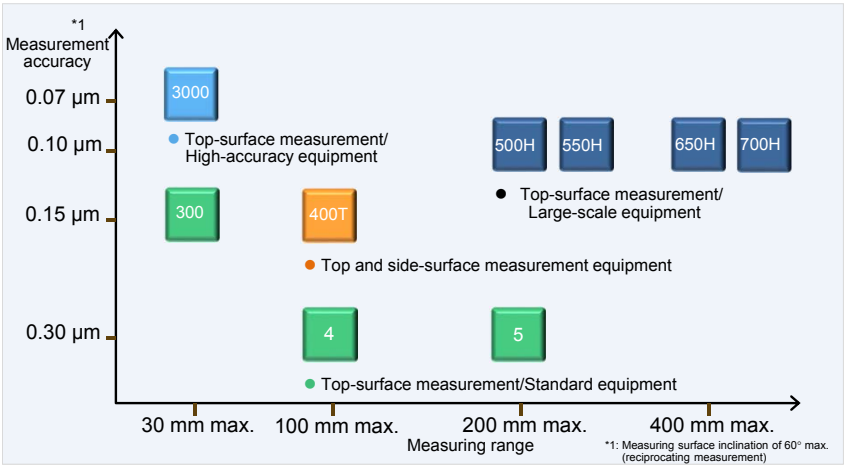
Top side surface evaluation technology

By synthesizing the top-surface data and side-surface data of a measured object, decentering and inclination of the optical axis of a lens or a mold can be evaluated with reference to the side surface.



■ Series lineup

Measurement area/accuracy by model



Measured object


Mobile lens


Lens barrel


DSLR lens

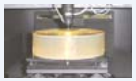

fθ lens


X-ray telescopic mirror

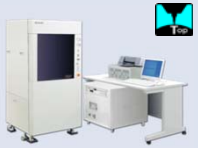
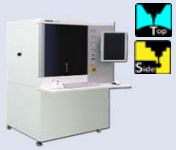

Lens mold


Camera lens


Toric lens mold


Stepper lens

Specifications

Type	Standard equipment			Large-scale equipment			Twin probe (top-surface and side-surface profilometer)	High-accuracy equipment
Model name	UA3P-300	UA3P-4	UA3P-5	UA3P-500H / 550H	UA3P-650H	UA3P-700H	UA3P-400T *4	UA3P-3000
Appearance								
Outer dimensions (W x D x H) mm	700 x 780 x 1500	1000 x 1100 x 1400	1200 x 1350 x 1550	1200 x 1350 x 1550	2100 x 1820 x 2110	2100 x 1820 x 2110	1100 x 1230 x 1540	1260 x 840 x 1510
Mass of main body	700 kg (Others: 150 kg)	1200 kg (Others: 150 kg)	1500 kg (Others: 150 kg)	2300 kg (Others: 300 kg)	8500 kg (Others: 300 kg)	9000 kg (Others: 300 kg)	750 kg	950 kg
Measuring range (X, Y, Z axes) mm	30x30x20	100 x 100 x 35	200 x 200 x 45	200 x 200 x 45(500H) / 200 x 200 x 45, 260 x 90 x 45(550H)	ϕ500 x 120 / 400 x 400 x 120	500 x 500 x 120	100 x 100 x 35	30 x 30 x 20
Measured object placement area (X, Y, Z axes) mm	100x100x100	220 x 220 x 115	330 x 330 x 230	330 x 330 x 230	600 x 600 x 330		200 x 200 x 110	100 x 100 x 110
Measuring probe	AFP	AFP	AFP	AFP *2	AFP-H *2	AFP-H *2	AFP/S-AFP	AFP-3000 *3
Resolution	0.3 nm							
Maximum inclination angle for top-surface measurement	75°	60°	60°	75°	75°	75°	75°	75°
Angle for side-surface measurement	–	–	–	–	–	–	Horizontal: 45-90° / Vertical; 80-90°	–
Measurement accuracy with top-surface probe * When using the standard ruby stylus or ceramic stylus	30° max.: ±0.05 μm (round trip) 45° max.: ±0.08 μm (round trip) 60° max.: ±0.15 μm (round trip) 70° max.: ±0.15 μm (back)	30° max.: ±0.05 μm (round trip) 45° max.: ±0.10 μm (round trip) 60° max.: ±0.30 μm (round trip)		30° max.: ±0.05 μm (round trip) 45° max.: ±0.08 μm (round trip) 60° max.: ±0.1 μm (round trip) 70° max.: ±0.15 μm (back)			30° max.: ±0.05 μm (round trip) 45° max.: ±0.08 μm (round trip) 60° max.: ±0.15 μm (round trip) 70° max.: ±0.15 μm (back)	30° max.: ±0.05 μm (round trip) 45° max.: ±0.06 μm (round trip) 60° max.: ±0.07 μm (round trip) 70° max.: ±0.10 μm (round trip)
Measurement accuracy by coordinate axis (XY axis measurement accuracy)	100 mm max.: 0.05 μm (Repeatability 0.05 μm max.) 200 mm max.: 0.1 μm (Repeatability 0.05 μm max.)			100 mm max.: 0.05 μm (Repeatability 0.05 μm max.) /200 mm max.: 0.1 μm (Repeatability 0.05 μm max.) 400 mm max.: 0.2 μm (Repeatability 0.05 μm max.) /500 mm max.: 0.3 μm (Repeatability 0.05 μm max.)			100 mm max.: 0.05 μm (Repeatability 0.05 μm max.)	
Measurement speed	0.005-5 mm/sec	0.01-10 mm/sec		0.01-20 mm/sec	0.01-30 mm/sec		0.01-10 mm/sec	0.005-5 mm/sec
Operating environment Temperature/Humidity/Vibration	20-23°C (Variation ±1°C max.) / 20-60% (Wind from air conditioners should not directly blow onto the equipment) / Allowance 2.0 cm/s² (= 2.0 gal) Recommended 0.5 cm/s²							Allowance 1.0 cm/s² (= 2.0 gal) Recommended 0.5 cm/s²
Required power source Power supply unit	100 V AC ±5% / 15A							
Air pressure source	0.5 MPa - 1.0 MPa Flow rate 150 NL/min			0.5 MPa - 1.0 MPa Flow rate 250 NL/min	0.5 MPa - 1.0 MPa Flow rate 420 NL/min		0.5 MPa - 1.0 MPa Flow rate100 NL/min	
Standard accessories	Standard ruby stylus, standard diamond stylus, AFP (Model 300: 1 pc., Models 4 and 5: 2 pcs. each), standard ball for calibration, printer			Ceramic stylus, standard diamond stylus, AFP-H (2 pcs), standard ball for calibration, printer			Standard ruby stylus, standard diamond stylus, ϕ2-mm ruby stylus AFP, side-surface probe (1 each) Standard ball for calibration, printer	Ceramic stylus, standard diamond stylus AFP-3000 (1) Standard ball for calibration, printer

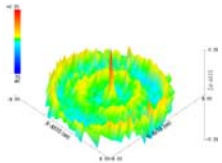
Example of measurement

Surface measurement of lens and mold

Applicable model: All models


Aspherical lens

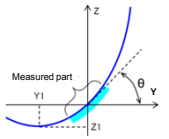

Lens mold

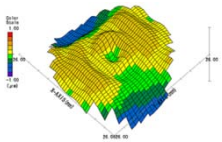


Off-axis mirror surface measurement

Applicable model: All models

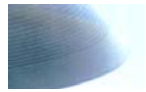
Design formula: $Z = k \times \{ (X - X1)^2 + (Y - Y1)^2 \} + Z1$

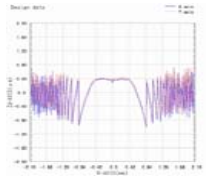



Parabolic mirror for telescope

Diffractive lens shape measurement

Applicable model: All models


Diffractive lens

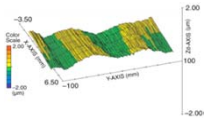


Surface measurement of free-form curved lens

Applicable model: All models


Mirror for laser beam printer

Long mold for LBP

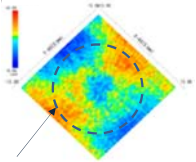


Lens tool mark measurement

Applicable models: UA3P-500/550H 650H/700H/3000

Evaluation of contours on polished lens or glass mold


Polished lens

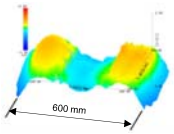

How the contour is generated on the lens

surface measurement of large object

Applicable models: UA3P-650H, 700H

Evaluation of large optical components, such as molds for head-up displays (HUDs)

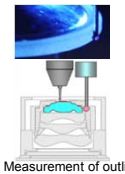

When installed in the 45-degree direction

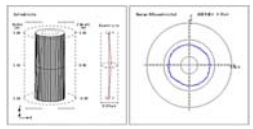


Measurement of optical axis of mobile camera lens

Applicable model: UA3P-400T

In a lens unit, shapes of molds, lenses, and barrels can be evaluated.

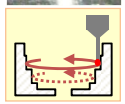


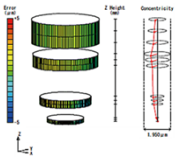

Measurement of outline reference lens

Measurement of barrel multi-stage cylinder

Applicable model: UA3P-400T

Evaluation of concentricity of each cylindrical cross-section, such as a lens barrel

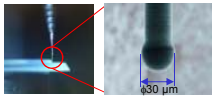


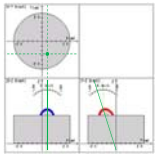


Decenter evaluation based on interlocked surface

Applicable model: UA3P-400T

Evaluation of decentering and inclination of each lens with reference to the interlocked surface of the lenses





*2 UA3P high-accuracy profilometer probe
*3 Dedicated probe for UA3P-3000

*4 • This product is categorized as a product (or technology) that qualifies as a regulated cargo as specified by the Foreign Exchange and Foreign Trade Act.
• To export or transfer abroad applicable products (or technology), you must gain permission for export in advance from the Japanese government.

Description on top-surface profilometer
Description on side-surface profilometer