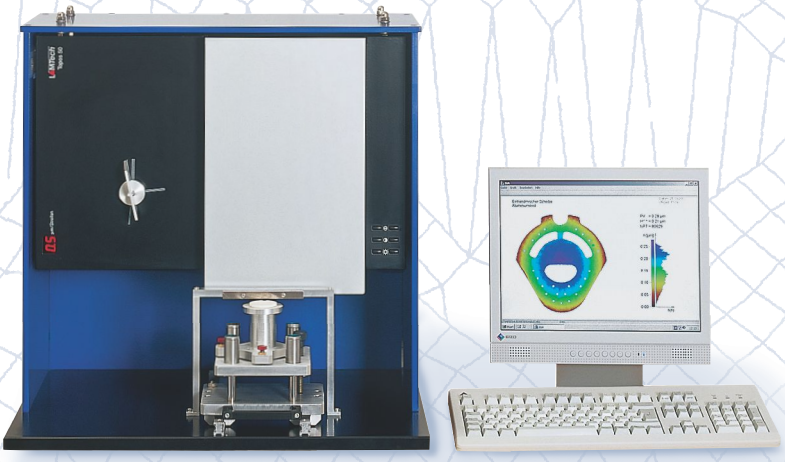
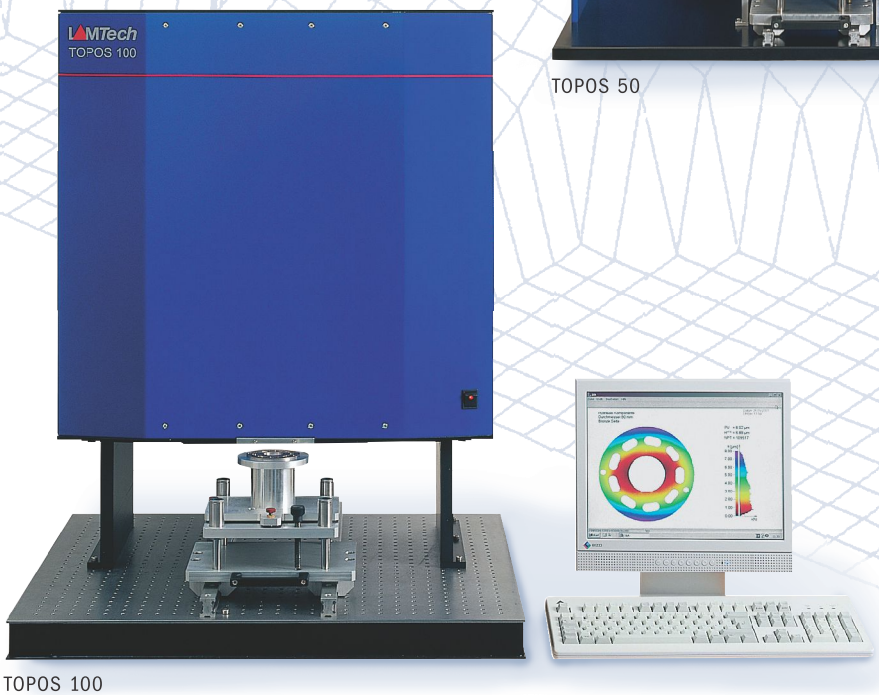
LAMTech

TOPOS

Instruments for fast, high-accuracy non-contact flatness measurement of precision parts



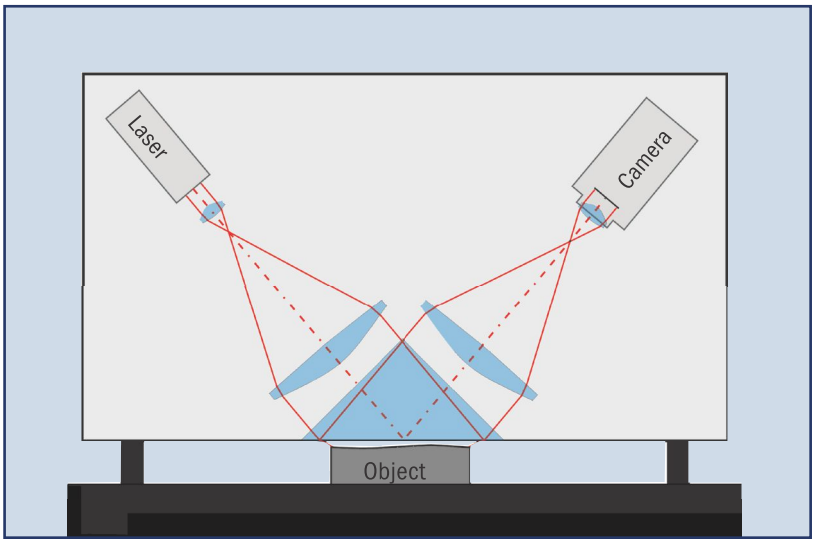
TOPOS 50



TOPOS 100

TOPOS Interferometer:

Instruments for non-contact flatness measurement of precision-manufactured surfaces with sub-micron accuracy. They meet the requirements for objectively working measurement tools for the production and quality control of sophisticated components, such as those being utilized, for instance, in fuel injection systems, pumps or valves.

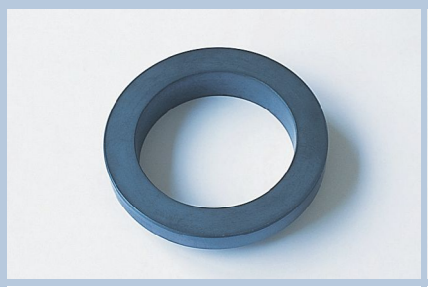


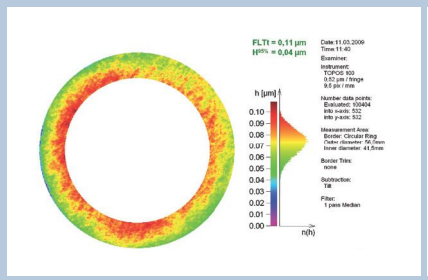
The measurement principle is based on interferometry with grazing incidence of light. This set-up allows for flatness measurements of polished as well as non-reflective, rougher surfaces, which would not be measurable with traditional interferometers for flatness testing. An air gap between reference surface and part ensures maximum possible protection against mechanical damage and facilitates simple part handling.

The sensitivity can be selected from four calibrated settings. Upon manufacturer's delivery, 0.5, 1, 2, and 4 µm / fringe are provided by default. This wide range allows for optimal setting of the measurement system to the specific properties of the test part. In this way, surfaces of ultra-high precision such as polished mechanical seals can be measured with the highest sensitivity (0.5 µm per fringe), while the lower sensitivity settings allow the measurement of rougher, uneven or highly worn-out surfaces as well. Typical areas of application for TOPOS are the flatness measurement of lapped, flat-honed and fine-ground precision parts – like valve plates, sealing and control discs, mechanical seals ... – made of ceramics (Al2O3, SiC, SiN,...), metal (steel, aluminium, bronze ...) carbon or synthetics (duroplast, thermoplast, PMMA ...).

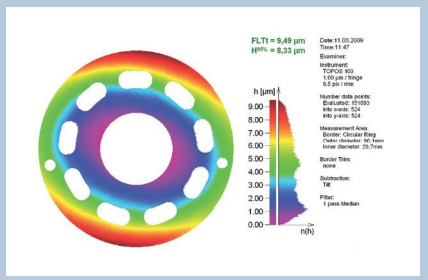
The computer based evaluation provides for three-dimensional, fast and objective parts testing. According to the principle of dynamic fringe evaluation, several phase-shifted fringe images are acquired with the built-in camera, from which the form is then determined. The measurement takes less than 2 seconds for up to 300 000 data points. The measurement area to be evaluated can be found automatically by the program

SiC mechanical seal

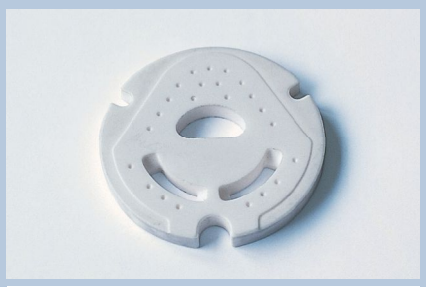


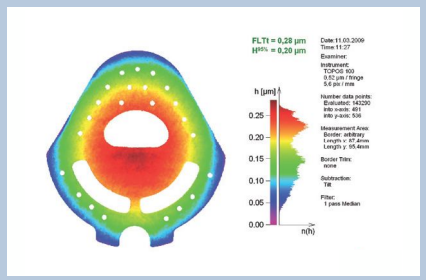


Hydraulics component



Ceramics sealing disc





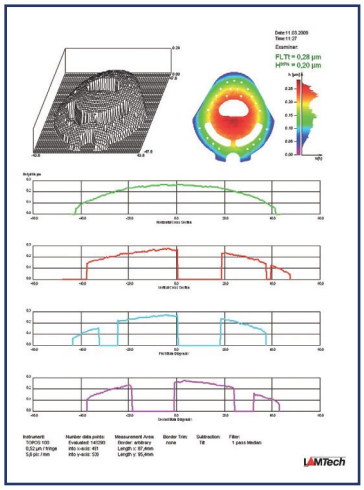
or be user-determined by selecting from a number of basic geometrical shapes (circle, ring or rectangle). Position and size can be set easily with the help of a border line which is overlayed to the image of the part. A border exclusion can be set separately for the external and the internal contour. Alternatively a part specific mask can be generated which determines the area to be measured on the part.

For continually repetitive sequences of functions (such as measurement, border exclusion, median filtering, display of false-color image and 3-D graphics), a macro for an automated measurement procedure can be generated and saved on the computer. All parameters and settings chosen to measure a specific part can be saved into a file, which facilitates relating a measurement to a product and hence allows for rapid switches between different parts.

The flatness is calculated according to ISO/TS 12781-1 (FLTt).

Measurements can be saved and thus be evaluated and printed out at a later time.

Data export to statistics and quality control programs is established by saving the series of the measurement results either in a CSV data format,



in qs-STAT data format with a flexible input mask or via the serial interface.

For the documentation of the part's flatness, several graphical options are available: false-color image, 3-D image, cross section graphs with the four main cross sections, measurement protocol with the false-color image, the 3-D image and the section graphs, developed views for rings, and relief representation. Every graph displays the user-selectable legend and the measurement parameters.

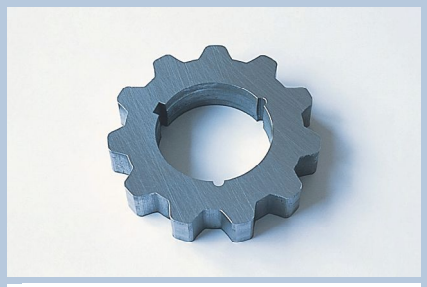
TOPOS Interferometers are available as models with either 50mm or 100mm measurement area. For the exclusive measurement of small parts, a special TOPOS 50-20 with 20 mm measuring area is manufactured.

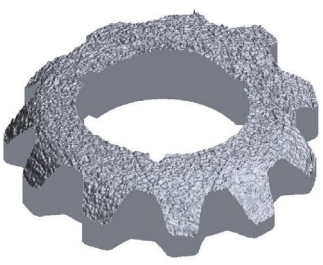
The TOPOS 100 model offers an optional zoom lens for an even larger operational range. Large rings, of diameter 420 mm for example, can be measured automatically with a TOPOS 100 featuring a supplementary rotating measurement table. Solid parts with a size larger than 100 mm can be measured with an optional xy-table. The measurement with a rotary stage or a xy-table offers the advantage of a high number of data points within the single measurements as well as an economic and flexible solution with still a short measurement of within a few ten seconds.

In the shop floor, TOPOS Interferometers are installed directly next to the tooling machines. This ensures short distances and fast monitoring of product quality. In case of special production environments, the interferometers can be encapsulated specifically with regard to dust and oil-containing air.

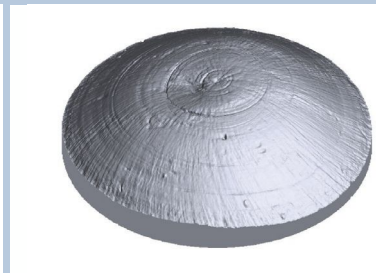
Due to their completely non-contact and fast measurement, TOPOS Interferometers are used in the automated 100% control of parts. For example, during the 100% control of mechanical seals, more than 1200 parts per hour are measured during 3-shift operation.

Gear

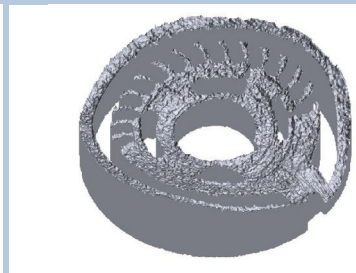




Cam follower



Fuel pump component



Specifications

	TOPOS 50	TOPOS 100
Measurement area (diameter)	50 mm	100 mm
Flatness of reference surface	better than 0.06 µm	
Material of reference surface	Quartz glass	
Calibrated sensitivities	0.5, 1, 2 and 4 µm per fringe	
Accuracy	(0.1 ... 0.4) µm + 2 % of measured value, depending on the sensitivity	
Dynamic range	Up to 100 µm, limited by the slope of the surface	
Repeatability of FLTt	better than 0.01 µm (1)	
Resolution	better than 0.01 µm	
Data Points	300 000	
Lateral Resolution	0.1 mm	0.2 mm (2)
Measurement Time	less than 2 s	
Dimensions Interferometer unit	560 mm x 300 mm x 400 mm	680 mm x 440 mm x 880 mm
Interferometer Unit	34 kg	80 kg
Dimension Interferometer Mount	615 mm x 490 mm x 600 mm	750 mm x 750 mm x 60 mm
Weight Interferometer Mount	32 kg	50 kg

(1) RMS of 50 Measurements of a reference surface measured at 1.0 µm / fringe
(2) up to 0.05 mm at 25 mm measuring area with optional zoom lens

Data subject to change. April 2011.

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