MarSurf

MarSurf
LD 130 / 260 Aspheric

HIGH-PRECISION 2D/3D MEASURING STATION FOR MEASUREMENT AND EVALUATION OF OPTICAL COMPONENTS

- Measuring range 130 mm or 260 mm
- High measuring speed
- Chip-coded innovative probe arms

This is what we mean by EXACTLY.

- 0 +

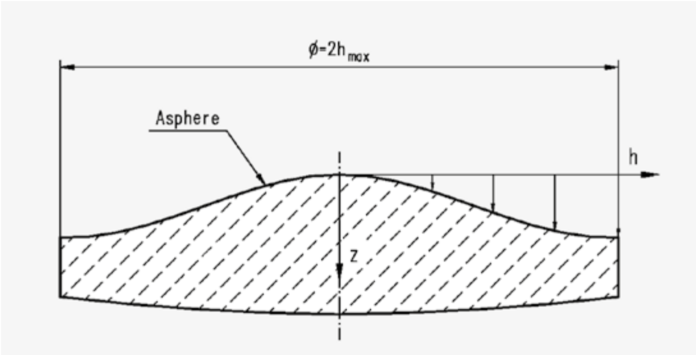
Mahr

EXACTLY

ASPHERE - DEFINITION

An aspherical surface is a refracting or reflecting surface which deviates from a spherical surface. The mathematical description of the sagitta Z (dependance of the vertical height to the horizontal coordinates) of aspherical surfaces based on a conical section is given in the following equation:

$$z(h) = \frac{\frac{h^2}{R_0}}{1 + \sqrt{1 - (1+k)\cdot\left(\frac{h}{R_0}\right)^2}} + \sum_{n=1}^{m} A_n \cdot h^n$$



R_0 = Radius of curvature

h = Radius of interest

k = Conic constant

A_n = Aspherical coefficients

More info and videos.
www.mahr.com Webcode 21880

DESCRIPTION

An increasingly more compact and favorable system design is demanded on optical systems such as zoom lenses, optics for DVD drives and lenses in cameras of mobile phones, for example. For this purpose, in addition to classic spherical lense shapes, the optics industry is increasingly producing aspherical (not sphere-shaped) lenses. The evaluation program serves to analyze measurements on aspherical surfaces with Mahr contour measuring units. Measured profiles are imported, the nominal form of the aspheres are defined and the residual error is determined compared to the nominal form. The data of the determined differential profile is made available in a machine-readable format for correction of the processing machine (closed loop). In comparison to a laser interferometer, the tactile measuring technology also allows 2D and 3D measurement of optically rough surfaces, so that testing and correction is already possible in the beginning of the production process (grinding).

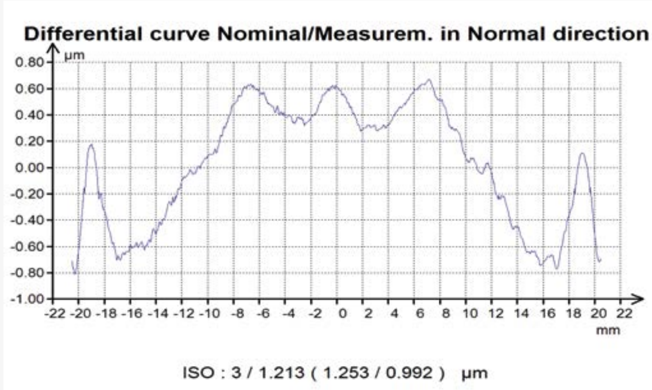
APPLICATIONS IN OPTICAL INDUSTRY

Contour and roughness measurement of:

- spherical and aspherical lenses
- cylinder lenses
- lens mounts
- housing and other mechanical components

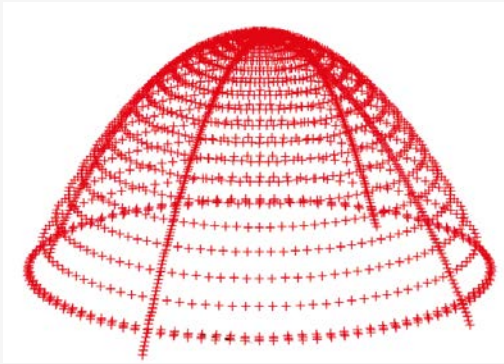
2D MEASUREMENT

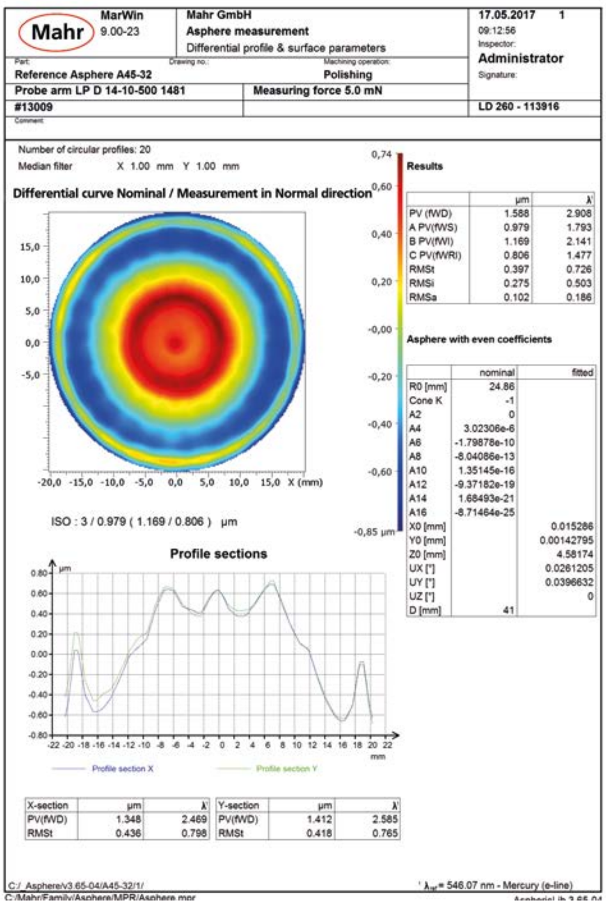
- For the 2D measurement, a linear scan over the zenith of the asphere is performed
- Data collection of the aspherical contour
- Comparison of the nominal contour with the measured data
- Results according to DIN ISO 10110-5 (e.g. PV, RMS, slope error)
- Export of the differential profile to manufacturing machines (closed loop)



3D MEASURING PRINCIPLE

For a 3D measurement, two 90° offset linear profiles are first measured across the zenith of the asphere. Second, several concentric circular profiles are gathered by rotating the C-axis. These measured points are used to create the topography. Since the probe arms can be positioned automatically, it is possible to measure discontinuous surfaces such as optics with a hole in the center, for example. The use of the machine in a vibration-damped cabinet keeps ambient influences such as vibrations and impurities away from the measuring object.





3D MEASUREMENT

Before starting the measurement, the nominal form type and set of parameters of the expected nominal asphere are selected. In the next step, the measuring data is recorded and compared to the defined nominal asphere. Results such as RMS value, PV value, and slope error are shown according to DIN ISO 10110-5.

In the software, the individual parameters such as the radius of curvature *R0*, conic constant *k* and the aspherical coefficients *Ai* can be adjusted to the measuring values when fitting the nominal asphere into the fit asphere.

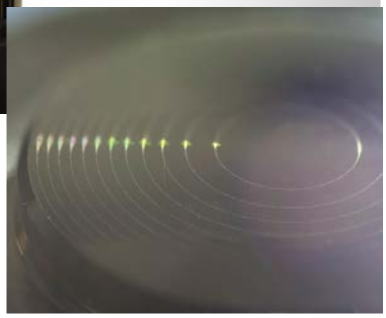
In addition to spheres and aspheres, other rotationally symmetric objects can measured and analyzed. For the nominal shape, several equations and a 2D or 3D point cloud can be used. The 2D scans and the topography can be exported for corrections in production machines.

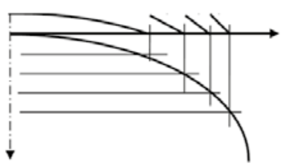
The differential profile between the determined measuring values and the nominal asphere is shown as a color-coded height picture.

MEASUREMENT OF DIFFRACTIVE OPTICS

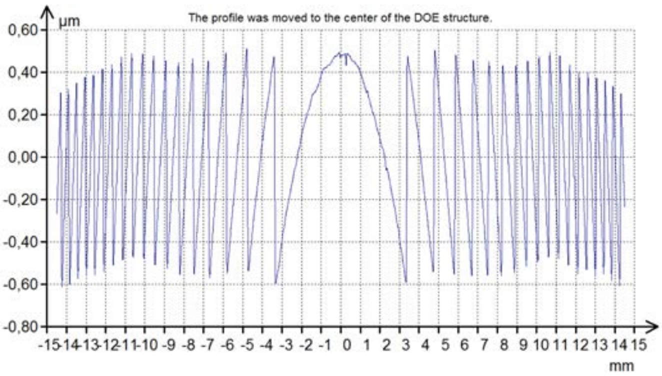
Description

- Analysis with constant zone width or constant zone height
- Analysis and subtraction of the base shape (aspherical, spherical, plane)
- Output parameters with tolerances for each zone: angle, zone height, form deviation and much more
- Profile export for machine correction





Diffractive structure with base shape removed



Detailed evaluation of each zone with tolerances (e.g. zone height)

Mahr | MarWin 9.00-21 | Mahr GmbH | Asphere measurement | Diffractive structures | 05.05.2017 3 | 15:40:56 | Inspector: Administrator | Signature:

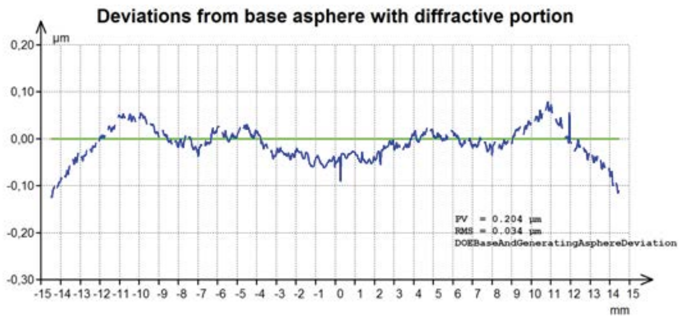
Part: Reference DOE | Drawing no.: | Machining operation:

Probe arm LP R 21-10-5_47 1123 | Measuring force 0.5 mN | LD 260 - 116215

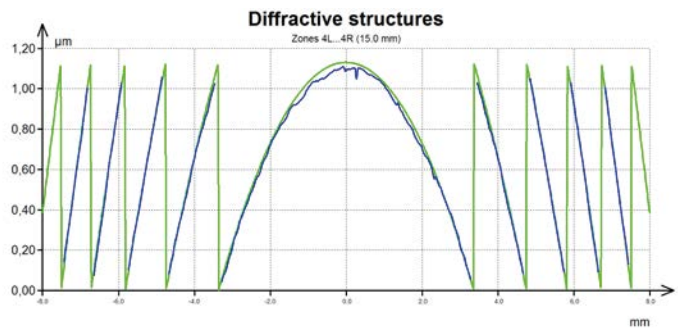
Comment:

Heights	Icon	Nominal size (µm)	UT (µm)	LT (µm)	Actual size (µm)	Deviation (µm)
ZONE_0_H_-3.3...3.3		1,130	0,200	-0,200	1,131	0,001
ZONE_1L_H_-4.7...-3.5		1,130	0,200	-0,200	1,124	-0,006
ZONE_1R_H_3.5...4.7		1,130	0,200	-0,200	1,130	-0,000
ZONE_2L_H_-5.7...-4.9		1,130	0,200	-0,200	1,157	0,027
ZONE_2R_H_4.9...5.7		1,130	0,200	-0,200	1,137	0,007
ZONE_3L_H_-6.6...-5.9		1,130	0,200	-0,200	1,141	0,011
ZONE_3R_H_5.9...6.6		1,130	0,200	-0,200	1,126	-0,004
ZONE_4L_H_-7.4...-6.8		1,130	0,200	-0,200	1,192	0,061
ZONE_4R_H_6.8...7.4		1,130	0,200	-0,200	1,174	0,044
ZONE_5L_H_-8.2...-7.6		1,130	0,200	-0,200	1,085	-0,045
ZONE_5R_H_7.6...8.2		1,130	0,200	-0,200	1,122	-0,008
ZONE_6L_H_-8.8...-8.3		1,130	0,200	-0,200	1,076	-0,054
ZONE_6R_H_8.3...8.8		1,130	0,200	-0,200	1,102	-0,028
ZONE_7L_H_-9.4...-9.0		1,130	0,200	-0,200	1,127	-0,004
ZONE_7R_H_9.0...9.4		1,130	0,200	-0,200	1,049	-0,081
ZONE_8L_H_-10.0...-9.6		1,130	0,200	-0,200	1,047	-0,084
ZONE_8R_H_9.6...10.0		1,130	0,200	-0,200	1,075	-0,056
ZONE_9L_H_-10.6...-10.2		1,130	0,200	-0,200	1,155	0,025
ZONE_9R_H_10.2...10.6		1,130	0,200	-0,200	1,049	-0,081
ZONE_10L_H_-11.1...-10.		1,130	0,200	-0,200	1,098	-0,033
ZONE_10R_H_10.7...11.1		1,130	0,200	-0,200	1,144	0,014
ZONE_11L_H_-11.6...-11.		1,130	0,200	-0,200	1,180	0,049
ZONE_11R_H_11.2...11.6		1,130	0,200	-0,200	1,290	0,160
ZONE_12L_H_-12.0...-11.		1,130	0,200	-0,200	1,246	0,116
ZONE_12R_H_11.7...12.0		1,130	0,200	-0,200	1,391	0,261!
ZONE_13L_H_-12.5...-12.		1,130	0,200	-0,200	1,189	0,059
ZONE_13R_H_12.2...12.5		1,130	0,200	-0,200	1,178	0,048

Profile for machine correcting



Detailed view



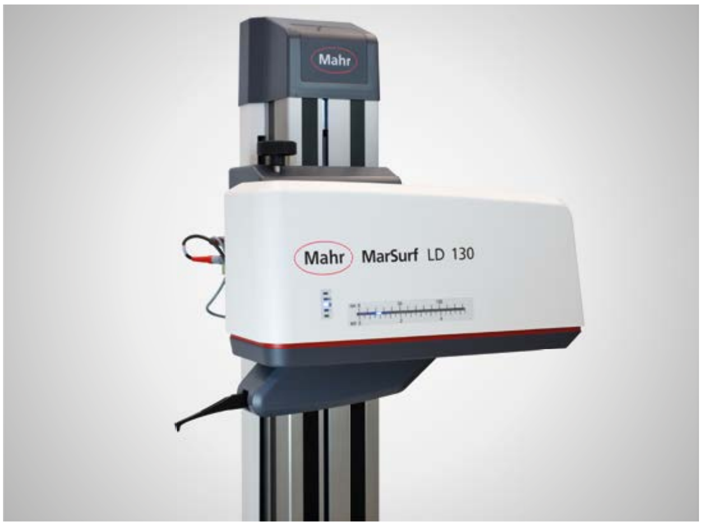
ADVANTAGES

Checking topography during the first machining operations

- Early recognition of deviations - saves time-consuming corrections
- Output of differential profile in a machine-readable format for control of the processing machine (closed loop)

Increased flexibility

- Rotational-symmetric objects like spheres, aspheres, conics, etc. can be measured with one measuring system. No additional investments are necessary.
- Large measuring range up to 260 mm
- High measuring speed and dynamics (up to 10 mm/s for large lenses / down to 0.02 mm/s for micro lenses)
- Probe tip can be positioned automatically



Probe arm LP D with innovative design

- Higher dynamics due to increased stiffness, damping and lower moment of inertia: - Optimized mechanical design
  - Innovative material selection
- Probe arm with integrated chip:
  - Detection and identification of the probe arm
  - Verification of the correct mounting position
  - Probe arm provides its parameters directly

Your results are correct

- The highly precise MarSurf LD 130 / 260 is the basis for precision measurements of your workpieces. The vertical resolution of 0.8 nm (0.03 µin) and form deviations of less than 100 nm (4 µin) guarantee an exact production of your aspheres.
- Probe arm change without new calibration
- Measurement of steep sided aspheres possible

CALIBRATION SET FOR FIXTURE DIAMETER 25 MM

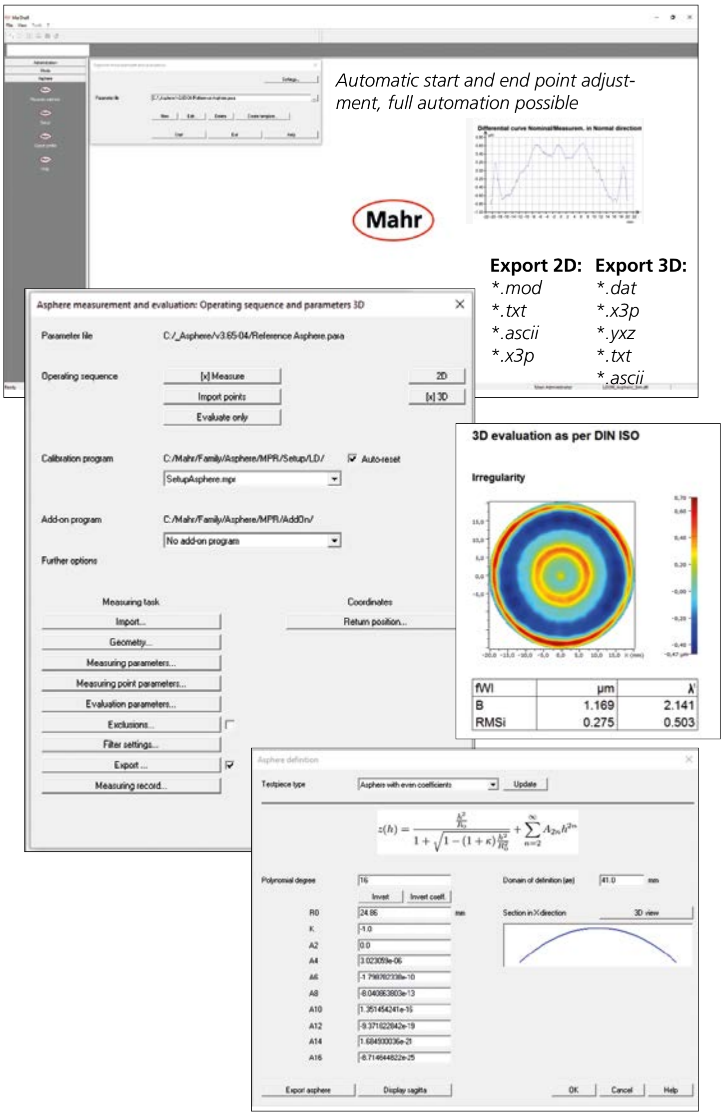
Consisting of:
- 2 cylinder for set up
- Calibration sphere
- Optical flat

Calibration Set for:

- Stylus calibration and system test
- System adjustment, cylinder with centered ball for chuck adjustment and stylus centering
- Application with automatic calibration and adjustment programs

SOFTWARE SOLUTION: ASPHERIC.LIB

- Analysis of form and contour errors of 2D or 3D measurements, including parameters according to DIN ISO 101105-5
- Automatic PDF record, including evaluation parameters and profiles
- System adjustment
- Automatic measurement
- Fit measured profile to design data (2D and 3D), best-fit radius, sag table
- Derive aspheric coefficients
- Profile export for machine correction (*.txt, *.mod, *.xyz, *.dat, *.ascii, *.x3p)



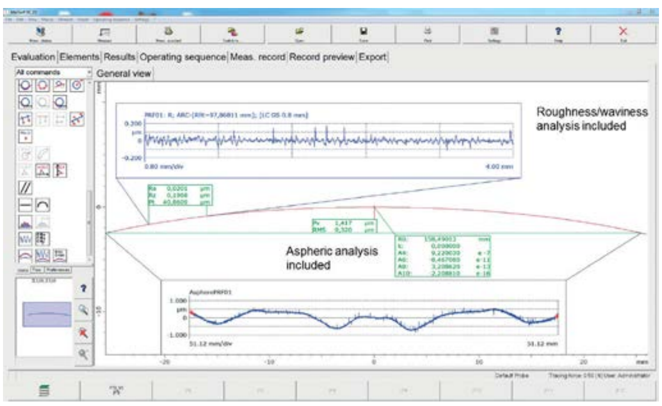
Aspheric.lib - Aspheric measuring and analysis software

Option: Diffractive opticale Elements

- Analysis with constant zone width or constant zone height
- Analysis of the base shape (aspherical, spherical, plane)
- Detailed analysis of the diffractive zones
- Differential form error analysis
- Output parameters with tolerances (errors) for each zone: angle zone height, form deviation, zone half diameter
- Profile export for machine correction

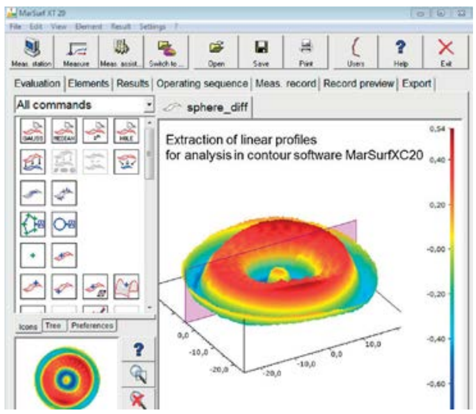
MARWIN EASYCONTOUR WITH OPTIONS

- Asphere measurments included
- Roughness and waviness analysis
- Profile analysis
- Parameters with tolerances



OPTION TOPOGRAPHY

- Measurement and evaluation of 3D surface parameters
- Extraction of linear profiles for evaluation in the MarWin Easy-Contour software.



TECHNICAL DATA

Properties of the horizontal axis X	
Traversing length	0.1 mm up to 130 mm / 260 mm
Positioning speed	0.02 mm/s up to 200 mm/s
Measuring speed	0.02 mm/s to 10 mm/s for roughness measurement recommended: 0.1 mm/s to 0.5 mm/s
Measuring point spacing	0.05 µm up to 30 µm, adjustable
Max number of points in one scan	2.6 million points (MarSurf LD 130) / 5.2 million points (MarSurf LD 260)
Resolution	0.8 nm (0.03 µin)
Uncertainty X-axis display	± (0.2+l/1000) µm; l in mm
System noise	< 5 nm RMS
Surface roughness	< 5 nm

Technical data probe system (Measuring direction Z+ / Z-)	
Probe measuring range	13 mm (100 mm probe arm) 26 mm (200 mm probe arm)
Resolution	0.8 nm
Measuring force	0.5 mN up to 30 mN (electronically adjustable)

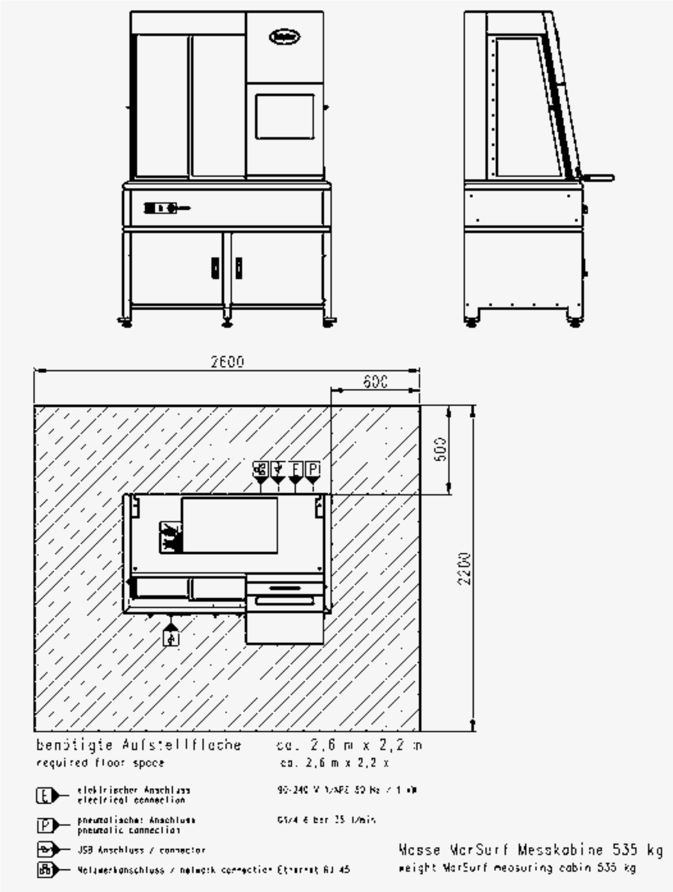
Contour - display deviation	
Distance measurement EA	MPEEA = ± (1.0+l/150)µm, l in mm
Radius measurement R_K	
R < 10 mm	MPE_R = ± 1.0 µm
10 mm < R < 300 mm	MPE_R = ± (0.17+R/12) µm
R > 300 mm	MPE_R = ± (-18+R/7) µm
Form error	≤ 100 nm (2D)* ≤ 200 nm (3D)*
Slope	< ± 45°

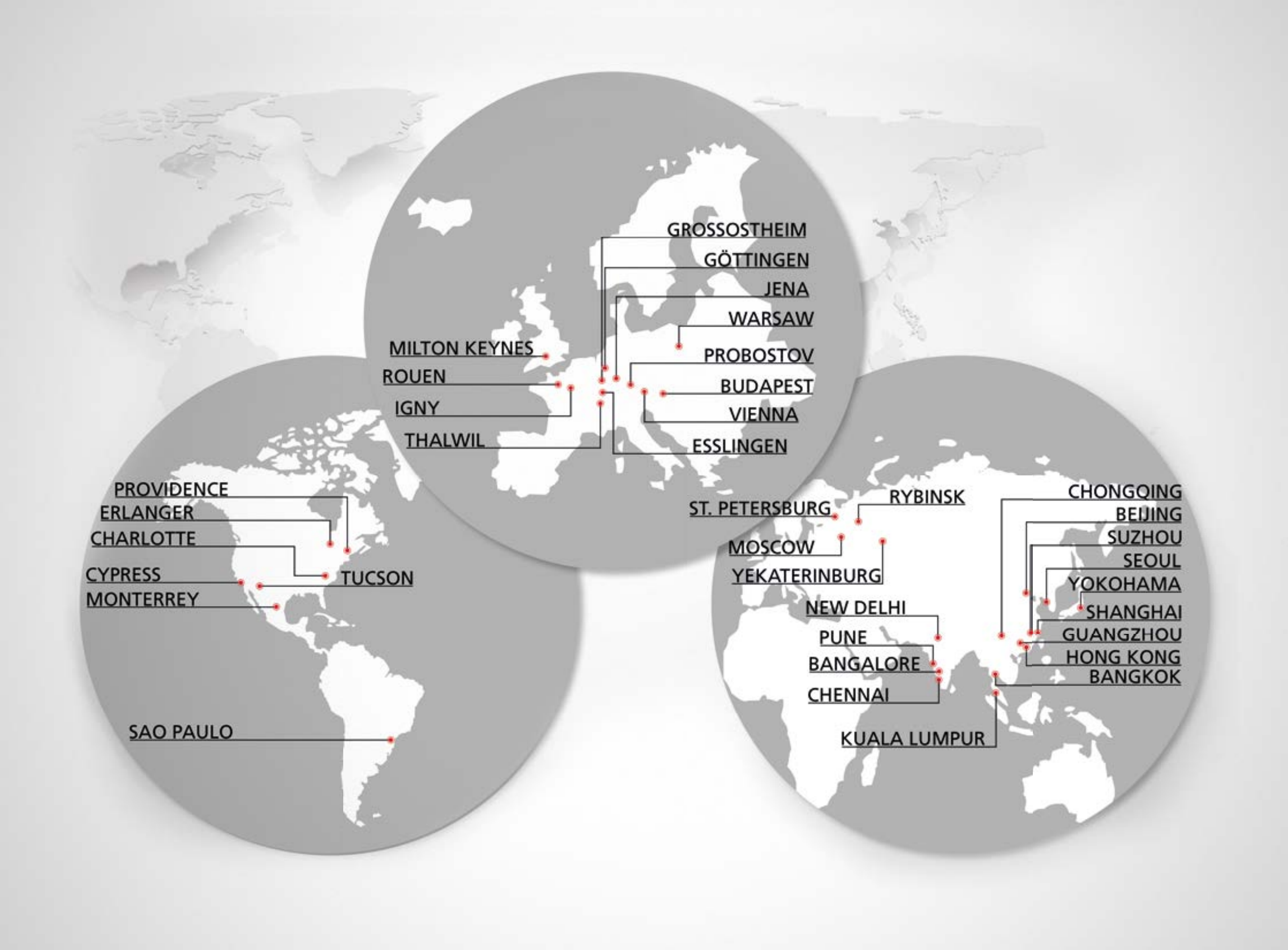
** determined at R 22.5 mm calibration ball*

Real 3D Measurement	
Measuring time	typically 5 to10 min
Point density	typically: 1 µm linear, 0.1° polar 3D: Number of polar traces + interpolation
Drive unit with automatic y-axis for centering	

General Data	
Operating temperature	+ 15°C to + 35°C
Suggested working temperature	20°C ± 2K
Temperature change	< 0.5 K/h
Active antivibration system	

High precision spindle (3D version)	
Radial error limit	± (0.01 + 0.00025H) µm; H = height above table
Axial error limit	± (0.02 + 0.0001R) µm; R = radius form center
Resolution	0.00025°
Positioning control	< ± 0.02°
Accuracy precision centering	< 0.8 µm
Accuracy precision levelling	< 0.006°





Partner of manufacturing companies worldwide.

Close to our customers.

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EXACTLY

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