

SENSOFAR<sup>®</sup>  
METROLOGY

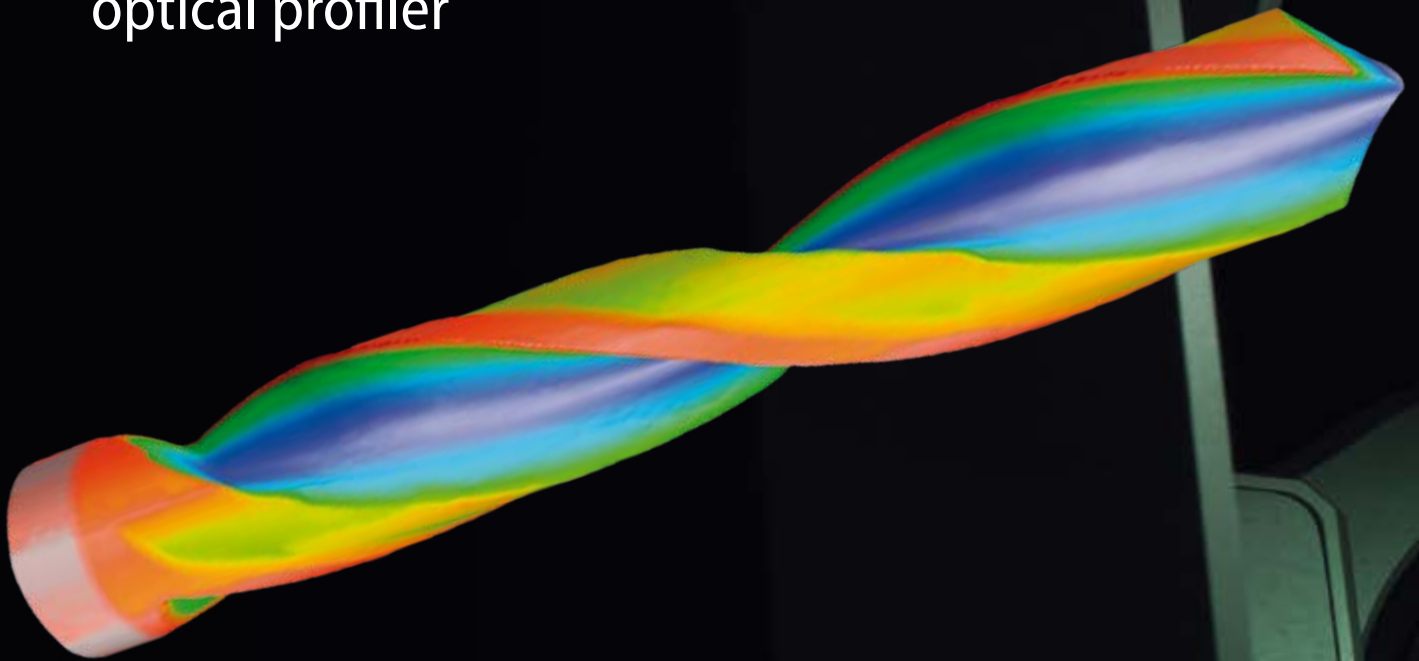


Complete 3D  
Measurement  
Solution



# Complete access

The **S neox Five Axis 3D optical profiler** combines a high-accuracy rotational module with the advanced inspection and analysis capabilities of the **S neox 3D optical profiler**



This enables automatic 3D surface measurements at defined positions which can be combined to create a complete 3D volumetric measurement. S neox 3D measurement technologies cover a wide range of scales, including form (Ai Focus Variation), sub nanometric roughness (Interferometry) or critical dimensions that require high lateral resolution as well as vertical resolution (Confocal).

# sibility

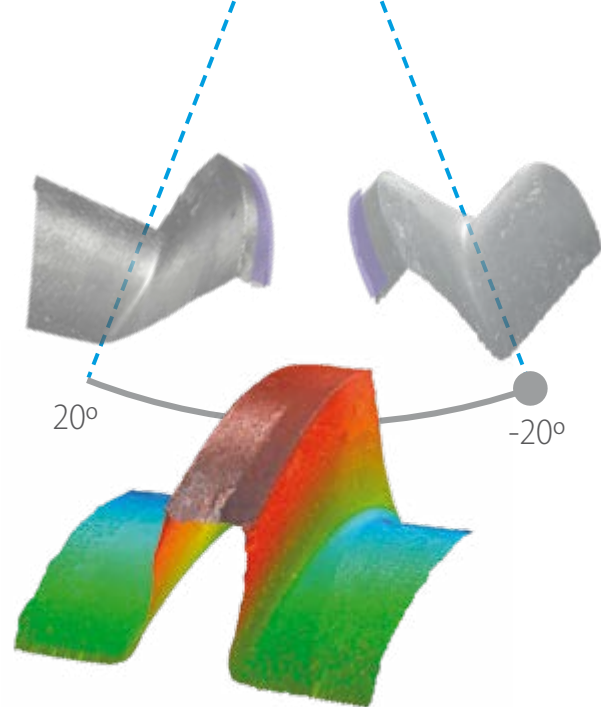
## Rotational stage

The Five Axis rotational stage consists of a high-precision motorized rotating A axis with 360° of endless rotation, 10 arc sec positioning repeatability, a motorized B axis, -30° to 110°, 0.5 arc sec resolution, with limit switch. It is equipped with a System3R clamping system.

## Markets and applications

- Aerospace & Automotive
- Forensics
- Gears
- Medical Devices
- Micromanufacturing
- Sharp Objects
- Surface Finish
- Tooling Industry
- Watch Manufacturing

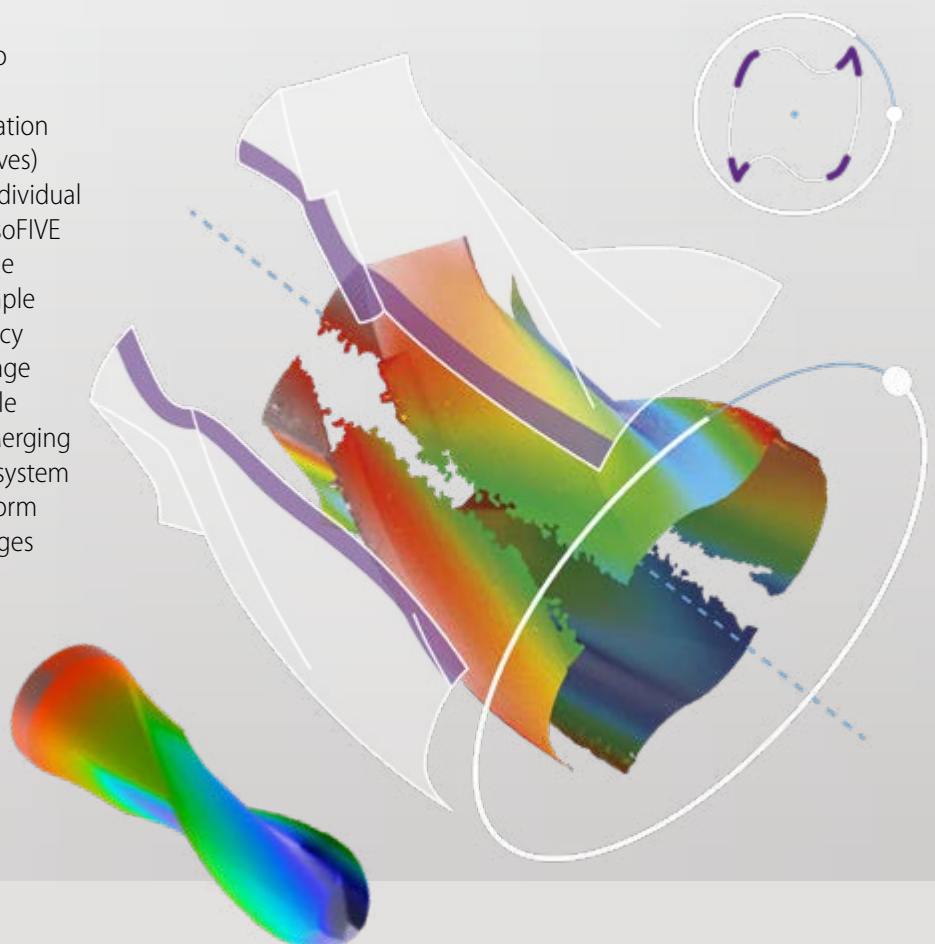
The S neox Five Axis makes it possible to take automatic 3D surface measurements at defined positions, and combine them to create a complete 3D volumetric measurement



# A complete 3D measurement



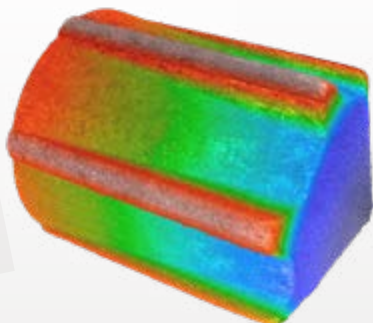
S neox Five Axis is able to measure the sample at different positions of rotation and elevation (perspectives) generating a group of individual measurements. The SensoFIVE software merges all of the surfaces providing a sample surface with high accuracy by using the stacked image information of each single surface measurement. Merging different elevations, the system can provide shape and form information on sharp edges and/or critical surfaces.





## Connecting adjoining surfaces to measure angles greater than 90°

Measuring complex surfaces which contain steep angles is very difficult due to shadowing effects that prevent you from obtaining a complete measurement within a single acquisition. It is necessary to tilt the sample in order to measure it from two different positions and combine the two topography results to obtain the complete measurement. Five Axis rotational stage allows the sample to be positioned in opposite directions to make the entire surface visible. The system will acquire the individual measurements and then, it will merge them automatically to get the complete 3D volumetric measurement.



## Multiple axis positions, measurements without limitation

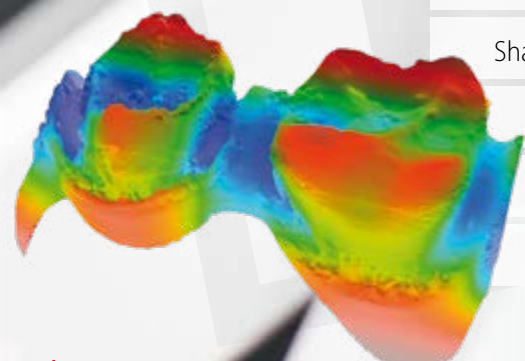
Measuring different parts of the sample with one click is possible thanks to automation routines. A user-friendly interface allows you to find the measurement position without any constraints. Then focus on the critical parts of your sample and add them to the automation routine. Finally click Acquire to obtain all parts measured with one single click. This is an incredibly fast and easy way to automate the measurement routines.





The **S neox Five Axis** is the most comprehensive and complete solution in the market for micro- and nano- scale imaging

# Maxim



Ai FOCUS VARIATION



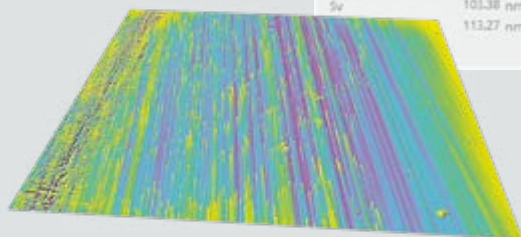
CONFOCAL



INTERFEROMETRY

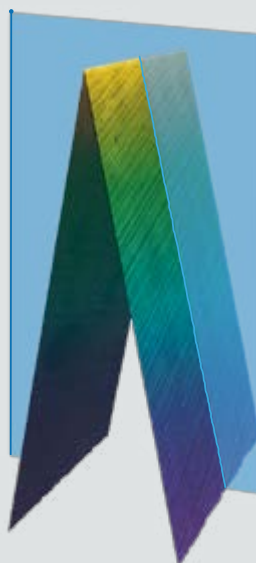
Shape & Form rough surfaces	☆☆☆	☆☆	
Shape & Form shine surfaces	☆	☆☆☆☆	
Surface finish	☆	☆☆	☆☆☆
Small details	☆	☆☆☆☆	☆☆☆
High local slopes	☆☆☆☆	☆	

ISO 25178 / Height	
Sa	0.9742 nm
Sku	633.0968
Smean	-0.2042 nm
Sp	9.8887 nm
Sq	3.2244 nm
Ssk	22.8511
Sv	103.38 nm
Sv	113.27 nm



## Accurate and reliable surface finish measurements

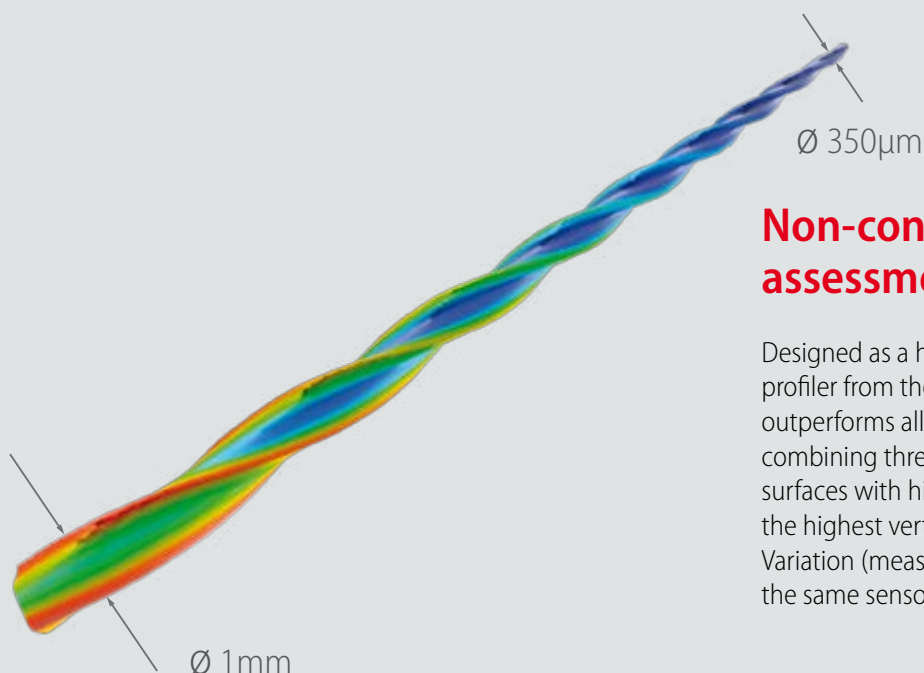
Our Confocal and Interferometry technologies allow you to measure surfaces with any kind of roughness from extremely rough (typical of additive manufacturing applications) to highly reflective surfaces of the order of 1 Å as a diamond mirror-like surface. Converting our system into repetitive and traceable, according to NPL, NIST and PTB roughness standards. Ai Focus Variation technology provides a quick and easy response for measuring outstanding slopes independently of the objective lenses.



## Overcoming the limitations of Ai Focus Variation

S neox Five Axis is able to measure the shape and surface finish. Focusing on the shape, the system is able to measure samples with small diameters up to 0.5 mm and cutting edge radius up to 150 nm. Using Confocal technology and high numerical apertural (0.95) allows you to measure small cutting edge radius.

# um versatility



## Non-contact surface assessment

Designed as a high-performance 3D optical profiler from the outset, S neox Five Axis outperforms all existing optical profilers by combining three techniques – Confocal (best for surfaces with high slope), Interferometry (yields the highest vertical resolution) and Ai Focus Variation (measure shape in mere seconds) – in the same sensor head without any moving parts.

Discover any geometric deviation or tolerance limit of your measured part

# SensoFIVE

## Automatic Measurement Recipes

Five Axis measurement recipes allow you, the user, to capture the entire surface area in order to measure critical dimensions (angles, radius, contour), along with surface finish according to ISO 25178 (form and roughness) and volume. Automated measurement routines can be executed for batch processing of parts for QA/QC applications.

## ISO parameters

SensoFIVE is compliant with several ISOs. A complete selection of ISO 3D areal surface texture parameters is available: height, spatial, hybrid, functional and volumetric parameters.

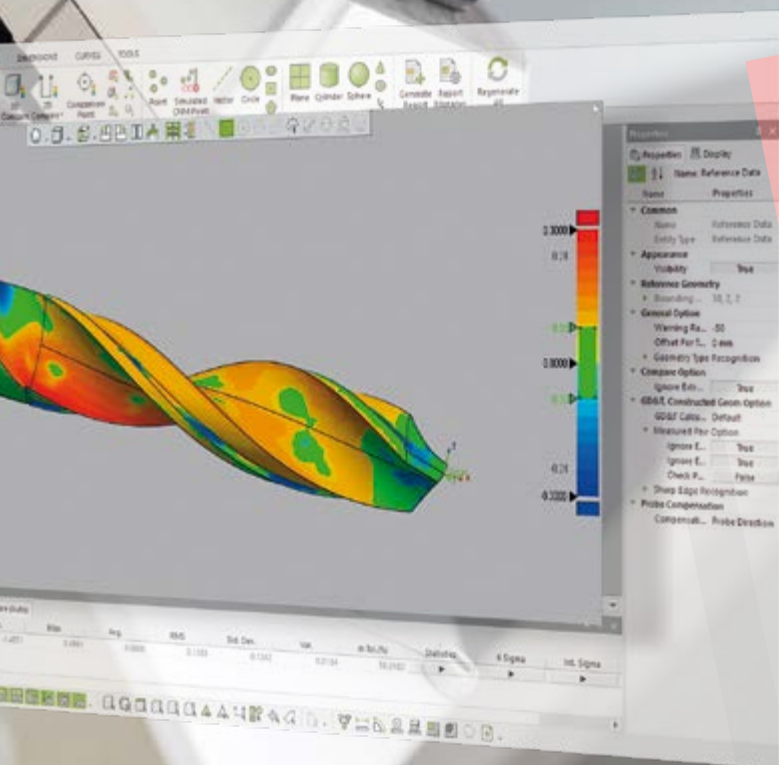
## Multiple exportable formats

All data is exportable as PLY, STL, STEP, IGES, g3d, xyz and PCD files.

The screenshot displays the SensoFIVE software interface. On the left, there are four panels: 'Holder Colet', 'Sample Cylinder', 'Result 3D', and 'Settings'. The 'Settings' panel shows 'SMR recipe' set to 'default.smr', 'Stitching' set to '50%', and 'Length (L)' set to '7.400 mm'. The main area shows an 'INFO' window for '1. default.smr' with a table of 15 positions. The table has columns for '#', 'X Rel.', 'Y Rel.', 'Z Rel.', 'A Rel.', and 'B Rel.'. The 'Z Rel.' column contains values from 3.750 to 52.500 in increments of 3.750. At the bottom, there is a navigation bar with a '5-ACQUIRE' label and a page indicator '1 / 109'.

#	X Rel.	Y Rel.	Z Rel.	A Rel.	B Rel.
1	---	---	---	---	---
2	---	---	---	3.750	---
3	---	---	---	7.500	---
4	---	---	---	11.250	---
5	---	---	---	15.000	---
6	---	---	---	18.750	---
7	---	---	---	22.500	---
8	---	---	---	26.250	---
9	---	---	---	30.000	---
10	---	---	---	33.750	---
11	---	---	---	37.500	---
12	---	---	---	41.250	---
13	---	---	---	45.000	---
14	---	---	---	48.750	---
15	---	---	---	52.500	---





## Geomagic® Control X

Geomagic® Control X is a comprehensive metrology software platform that delivers the industry's most powerful tools within straightforward workflows. With Geomagic® Control X quality managers are enabled with revolutionary ease-of-use, intuitive, comprehensive controls and traceable, repeatable workflows for the quality measurement process. Its fast, precise, information-rich reporting and analysis enable significant productivity and quality gains in any manufacturing workflow.

# Hardware

## Ring light

The Ring light is based on an LED ring for illuminating samples in a uniform and efficient way. It is mounted above and around the objective, the ring light provides increased signal for both Confocal and Ai Focus Variation techniques. This ensures proper illumination at the focal plane.



## Large range of objective lenses

The S neox uses premium CF60-2 Nikon objective lenses that have been designed to correct for chromatic aberrations, to produce sharp, flat and clear images with high contrast and resolution by providing the largest available working distance for each NA. S neox Five Axis is equipped with these lenses for save and easy operation.



## Assorted holders & collets

Different types of holders are available depending on the sample. For rotational samples, a collet holder (multiple options are available on request) with fifteen collets, and for the others, a flat holder. It also includes a calibration pack composed of a flat mirror and a calibration specimen.



## Objective lenses

MAG	Brightfield						Interferometry					
	5X	10X	20X	50X	100X	150X	2.5X	5X	10X	20X	50X	100X
NA	0.15	0.30	0.45	0.80	0.90	0.90	0.075	0.13	0.30	0.40	0.55	0.70
WD (mm)	23.5	17.5	4.5	1.0	1.0	1.5	10.3	9.3	7.4	4.7	3.4	2.0
FOV <sup>1</sup> (μm)	3370x2826	1685x1413	842x707	337x283	168x141	112x94	6740x5652	3370x2826	1685x1413	842x707	337x283	168x141
Spatial sampling <sup>2</sup> (μm)	1.38	0.69	0.34	0.13	0.07	0.05	2.76	1.38	0.69	0.34	0.14	0.07
Optical resolution <sup>3</sup> (μm)	0.94	0.47	0.31	0.18	0.16	0.16	1.87	1.08	0.47	0.35	0.26	0.20

	Confocal / Ai Focus Variation						PSI / ePSI / CSI					
	System noise <sup>4</sup> (nm)	100	30	8	4	3	2	PSI/ePSI 0.1 nm (0.01 nm with PZT)			CSI 1 nm	
Maximum slope <sup>5</sup> (°)	9	17	26	53	65	65	4	8	17	23	33	44

## System specifications

Measuring principle	Confocal, PSI, ePSI, CSI, Ai Focus Variation and Thin Film
Observation types	Brightfield, Sequential Color RGB, Confocal, Interferential Phase Contrast
Measurement types	Image, 3D, 3D thickness, profile and coordinates
Camera	5Mpx: 2442x2048 pixels (60 fps)
Total magnification (27" screen)	60X - 21600X
Display resolution	0.001 nm
Field of view	from 0.018 to 6.7 mm (single shot)
Max. Extended measuring area	10x12 (Max. Resolution); 175x175 (Low resolution) (500 Mpx)
Confocal frame rate	20 fps (5Mpx); 60 fps (1.2 Mpx)
Vertical scan range coarse	Linear stage: 40 mm range; 5 nm resolution
Vertical scan range fine	Piezoelectric scanner with capacitive sensor: 200 μm range; 0.5 nm resolution
Max. Z measuring range	PSI 20 μm; CSI 10 mm; Confocal & Ai Focus Variation 34 mm
XY stage range	Motorized: 154x154 mm
LED light sources	Red (630 nm); green (530 nm); blue (460 nm) and white (575 nm; center)
Ring light illumination	Green ring light compatible with 6 position nosepiece
Nosepiece	6 position fully motorized
Sample reflectivity	0.05 % to 100%
Sample weight	up to 2 Kg
User Management rights	Administrator, supervisor, advanced operator, operator
Optional Advanced Software Analysis	SensoMAP, SensoPRO, SensoMATCH, SensoCOMP, Geomagic®
Power	Line Voltage 100-240 V AC; frequency 50/60 Hz single phase
Computer	Latest INTEL processor; 3840x2160 pixels resolution (4K) (27")
Operating system	Microsoft Windows 10, 64 bit
Dimensions HxWxD	794 x 635 x 539 mm (31.26 x 25.00 x 21.22 in)
Weight	83 kg (183 lbs)
Environment	Temperature 10 °C to 35 °C; Humidity <80 % RH; Altitude <2000 m

## Accuracy and repeatability<sup>6</sup>

	Standard	Value	U, σ	Technique
Step height		48600 nm	U = 300 nm σ = 10 nm	Confocal & CSI
		7616 nm	U = 79 nm σ = 5 nm	Confocal & CSI
		941.6 nm	U = 7 nm σ = 1 nm	Confocal & CSI
		186 nm	U = 4 nm σ = 0.4 nm	Confocal & CSI
		44.3 nm	U = 0.5 nm σ = 0.1 nm	PSI
Areal roughness (Sa) <sup>7</sup>		10.8 nm	U = 0.5 nm σ = 0.05 nm	PSI
		0.79 μm	U = 0.04 μm σ = 0.0005 μm	Confocal, AiFV & CSI
Profile roughness (Ra) <sup>8</sup>		2.40 μm	U = 0.03 μm σ = 0.002 μm	Confocal, AiFV & CSI
		0.88 μm	U = 0.015 μm σ = 0.0005 μm	Confocal, AiFV & CSI
		0.23 μm	U = 0.005 μm σ = 0.0002 μm	Confocal, AiFV & CSI

## Rotational stage<sup>9</sup>

Max. measurable diameter	200 mm
Max. clamping diameter <sup>10</sup>	20 mm
Max. workpiece weight	3 Kg
Accuracy (A)	5 Arc sec/°
Bidirectional repeatability (A)	10 Arc sec
Resolution (B)	0.5 Arc sec
Straightness error <sup>11</sup>	3.6 μm/40 mm
Parallelism error <sup>11</sup>	53.9 μm/40 mm
Flatness error <sup>12</sup>	20 μm

**1** Maximum field of view with 3/2" camera and 0.5X optics. **2** Pixel size on the surface. **3** L&S: Line and Space. Values for blue LED. **4** System noise measured as the difference between two consecutive measures on a calibration mirror placed perpendicular to the optical axis. For interferometric objectives, PSI, 10 phase averages with vibration isolation activated. The 0.01 nm are achieved with Piezo stage scanner and temperature controlled room. Values for green LED (white LED for CSI). Resolution HD. **5** On smooth surfaces, up to 71°. On scattering surfaces, up to 86°. **6** Objective used for Confocal and Ai Focus Variation 50X 0.80 NA and for CSI and PSI 50X 0.55NA. Resolution 1220x1024 pixels. All measurements are done using PZT. Uncertainty (U) according to ISO/IEC guide 98-3:2008 GUM:1995, K=1,96 (level of confidence 95%). σ according to 25 measures. **7** Area of 1x1 mm. **8** Profile of 4 mm length. **9** All values according to ISO1101 at 20°C +/- 1° in an anti-vibration environment. **10** ER32 collet holder. **11** St Flatness deviation according to ISO25178-2 taken on a SiC reference flat mirror and 20X objective in Confocal acquisition mode. **12** All values are taken with a 20X objective in Confocal acquisition mode and 40 mm evaluation length.



SENSOFAR is a leading-edge technology company that has the highest quality standards within the field of surface metrology

Sensofar Metrology provides high-accuracy optical profilers based on confocal, interferometry and focus variation techniques, from standard setups for R&D and quality inspection laboratories to complete non-contact metrology solutions for in-line production processes. Sensofar Group is headquartered in Barcelona, also known as a technology and innovation hub in Europe. The Group is represented in over 30 countries through a global network of partners and has its own offices in Asia, Germany and the United States.

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