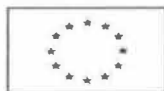




Příloha č. 1: Technická specifikace plnění dle zadávacích podmínek a Nabídky Prodávajícího

Položky nabízené konfigurace s technickým popisem

Obj. č.	Popis přístroje - dílu	Poč. ks.	
SSNEOX00-S	S neox <ul style="list-style-type: none">- 3D optický profiloměr (mikroskop) pro bezkontaktní skenování povrchů- vzpřímený stativ pro skenování vzorků s výškou 40 mm- konfokální a interferometrická metoda snímání + metoda Focus Variation, Confocal Fusion, Confocal Continuous- 4x samostatný LED zdroj světla (červená 630 nm, zelená 530 nm, modrá 460 nm, bílá)- CCD kamera s rozlišením 1360 x 1024 px- pozorování ve světlém a tmavém poli- zobrazení skenovaného povrchu vzorku v reálných barvách- zobrazení RGB konfokálního obrazu v reálném čase- 6 pozicový objektivový revolver- PC, 4 jádrový procesor, 8 GB RAM, 1TB HDD, 256 GB HD-SSD disk, Win 8, LCD monitor 27" (2560x1440px)- myš, klávesnice- joystick pro ovládání motorizovaných částí systému (funkce autofokus, automatické nastavení intenzity světla)- kalibrační zrcátko (standard)- Možnost připojení spektroskopického reflektometru pro měření tloušťky vrstev	1	
OBJN2010EPI00-S	Objektiv Nikon Plan FLUOR 10X 0.3NA 17.5WD <ul style="list-style-type: none">- konfokální metoda, Focus Variation, Confocal Fusion, Confocal Continuous	1	
OBJN2020EPI00-S	Objektiv Nikon Plan FLUOR 20X 0.45 NA 4.5WD <ul style="list-style-type: none">- konfokální metoda, Focus Variation, Confocal Fusion, Confocal Continuous	1	
OBJN2050EPI00-S	Objektiv Nikon Plan FLUOR 50X 0.8NA 1.0WD <ul style="list-style-type: none">- konfokální metoda, Focus Variation, Confocal Fusion, Confocal Continuous	1	
OBJN2150APO00-S	Objektiv Nikon Plan APO 150X 0.95NA 0.2WD <ul style="list-style-type: none">- konfokální metoda, Focus Variation, Confocal Fusion, Confocal Continuous- laterální rozlišení systému 140 nm	1	



OBJN20XDI00-S	Objektiv Nikon DI 20X 0.4NA 4.7WD - interferometrická metoda (VSI+PSI)	1	
OBJN100XDIO0-S	Objektiv Nikon DI 100X 0.7NA 2WD - interferometrická metoda (VSI+PSI)	1	
XYH101FTOP00-S	Motorizovaný XY stolek - rozsah pohybu 114 x 75 mm - přesné nastavení náklonu stolku ve všech směrech - rotační podložka vzorku 360°	1	
PIEZO200PI00-S	Integrovaný piezo senzor 200 μm pro vertikální rozlišení systému až 0.01 nm	1	
TAB20-S	Robustní stůl s aktivní antivibrační podložkou - piezoelektronicky řízené vyrovnávání bez nutnosti připojení stlačeného vzduchu - rozměry podložky 600 x 600 x 92 mm - zatížení až 105 kg - hmotnost podložky 37 kg	1	
	Ovládací software SensoSCAN - automatické skládání obrázků v XYZ - přepínání snímacích metod - ovládání posuvu v XYZ - nastavení intenzity osvětlení - vytvoření panoramatického obrazu vzorku s navigací - zobrazení 3D modelu vzorku v různých módech - možnost digitálního zoomu a rotace - 2D a profilová měření (výška, úhel náběžných a sestupných hran, radiusy) - snadné vytvoření automatického měřicího programu - měření plošné a profilové drsnosti dle standardních norem ISO - měření tloušťky vrstev - zobrazení výškové mapy		
SENSOMAPV7STD-S	Software SensoMAP STANDARD V7 pro pokročilou analýzu a přípravu interaktivních reportů - použití vyrovnávacích a filtračních algoritmů - obrazová analýza - analýza povrchové geometrie (vzdálenosti, plochy, objemy, výškové kroky)	1	



EVROPSKÁ UNIE
Evropské strukturální a investiční fondy
Operační program Výzkum, vývoj a vzdělávání



MINISTERSTVO ŠKOLSTVÍ,
MLÁDEŽE A TĚLOVÝCHOVY

	- statistika, výpočty - zadávání tolerancí s automatickým vyhodnocením - vytváření interaktivních reportů s automatickým exportem dat		
	Doprava, pojištění, zabalení	1	
	Uvedení do provozu, zaškolení	1	

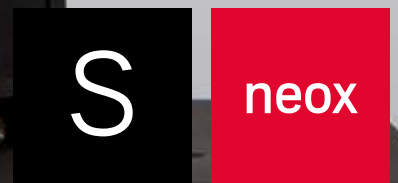
Non-contact
3D optical
profiler



SENSOFAR



SENSOFAR[®]
METROLOGY



3D Optical Profiler



Sensofar's S line

Feel the

The new S line for non-contact optical 3D profiling. The line that opens the way to a new 3D experience.

Designed as a high-performance 3D optical profiler from the outset, S neox outperforms all existing optical profilers, combining confocal, interferometry and focus variation techniques in the same sensorhead without any moving parts.

S neox, the best of three techniques.

3-in-1 technologies

3D experience

Confocal

Confocal profilers have been developed to measure the surface height of smooth to very rough surfaces. Confocal profiling provides the highest lateral resolution that can be achieved by an optical profiler. Thus, spatial sampling can be reduced to 0.09 μm , which is ideal for critical dimension measurements. High NA (0.95) and magnification (150X) objectives are available to measure smooth surfaces with steep local slopes over 70 (for rough surfaces up to 86°). The proprietary confocal algorithms provide vertical repeatability on the nanometer scale.

Interferometry

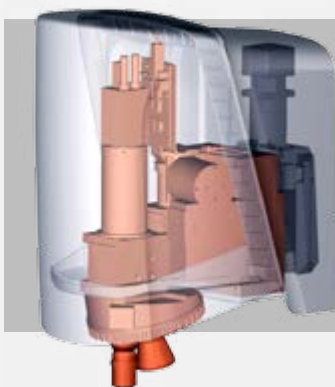
PSI Phase shift interferometers have been developed to measure the surface height of very smooth and continuous surfaces with sub-nanometer resolution. PSI profiling provides sub-nanometer vertical resolution for all numerical apertures (NA). Very low magnifications (2.5X) can be employed to measure large fields of view with the same height resolution.

VSI White-light vertical scanning interferometers have been developed to measure the surface height of smooth to moderately rough surfaces. VSI profiling provides nanometer vertical resolution for all NAs. The VSI algorithms enable the S neox to use all the available magnifications to profile shape features with the same height resolution.

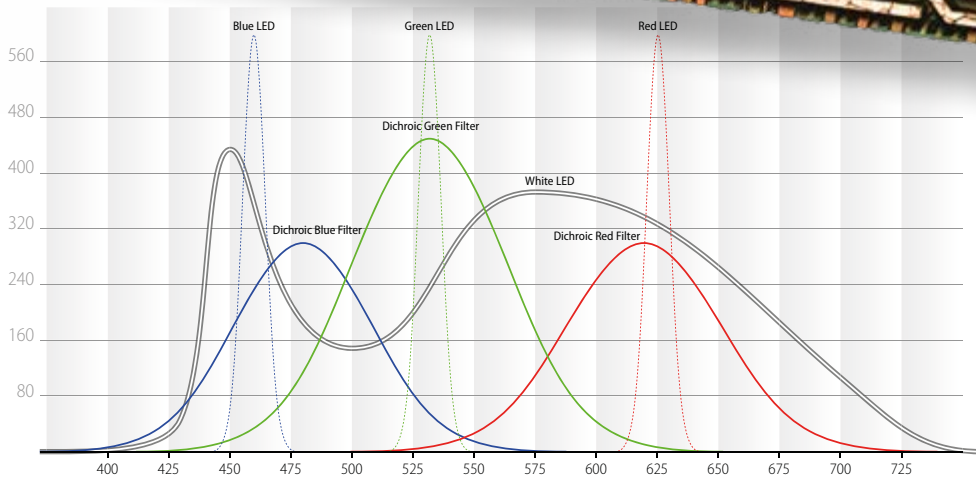
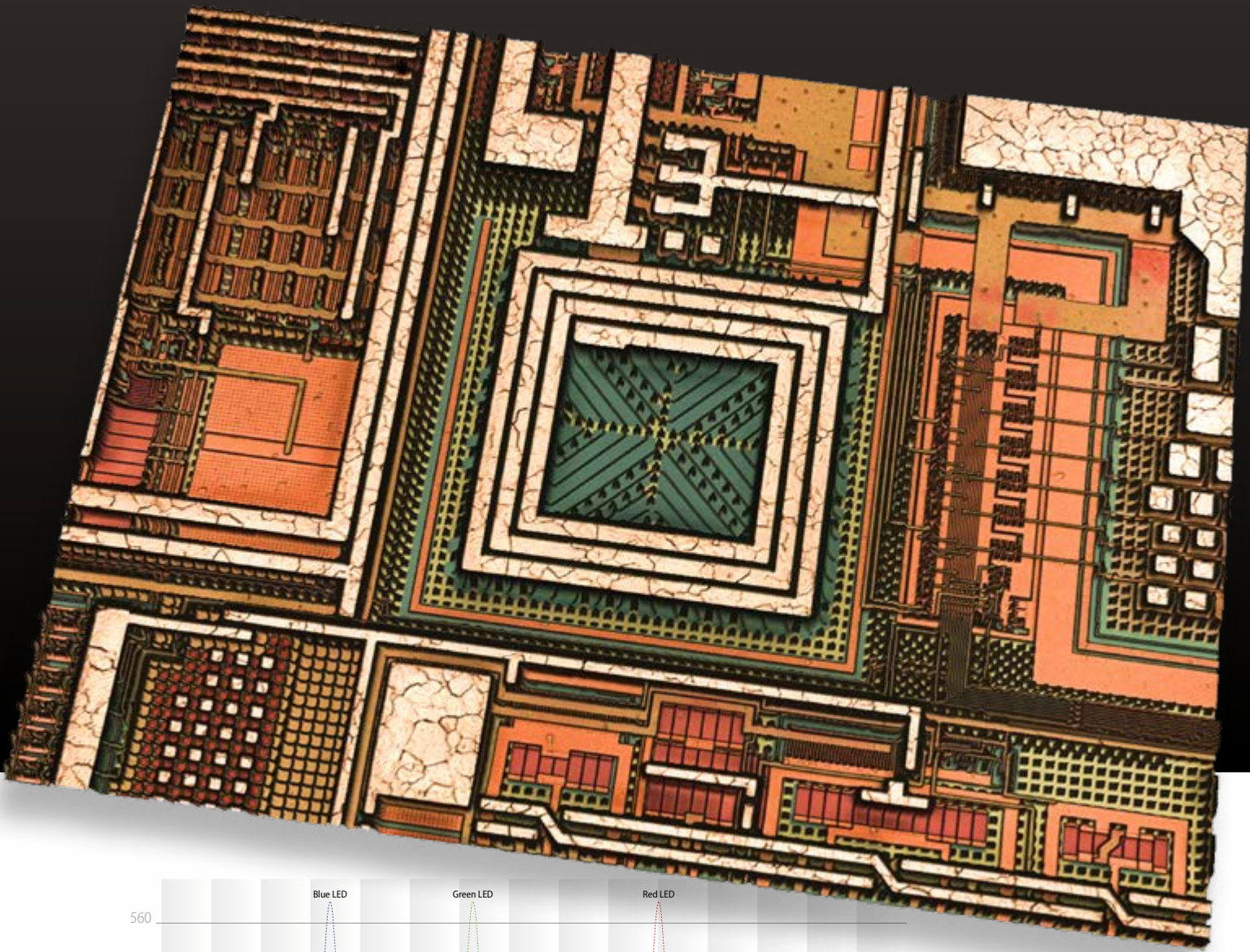
Focus Variation

Focus Variation is an optical technology that has been developed for measuring the shape of large rough surfaces. This technology is based on Sensofar's extensive expertise in the field of combined confocal and interferometric 3D measurements, and is specifically designed to complement confocal measurements at low magnification. Highlights of the technology include high slope surfaces (up to 86°), highest measurement speeds (mm/s) and large vertical range. This combination of measurement capabilities is mainly used for tooling applications.

Confocal with no moving parts



For confocal scanning, the neox uses the Sensofar's patented technology, which is based on a microdisplay. The microdisplay is based on ferroelectric liquid crystal on silicon (FLCoS), a fast switching device with no moving parts that makes the scanning of confocal images fast and very stable with an unlimited lifetime. Existing confocal microscopes use mirror scanning heads, which are movable mechanisms that limit lifetime and degrade pixel dithering at high magnifications.



Multispectral wavelength LEDs

Red. Green. Blue. White.

Focused on optimizing the light source for each application, S neox has four LED light sources inside its optical core: red (630 nm), green (530 nm), blue (460 nm) and white. Shorter wavelength is used on those applications where the highest lateral resolution is required.

Longer wavelengths provide greater optical coherence, up to 20 μm , making Phase Shifting Interferometry possible on large area smooth surfaces. Additionally, the red, green and blue LEDs are pulsed to acquire real color images and high contrast color-coded depth information in real time.

Amazing image quality

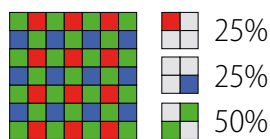
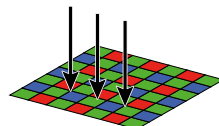
See the big picture

The S neox uses a high-resolution CCD sensor of up to 1360x1024 pixels in combination with high-resolution displays of 2560x1440. The images acquired with S neox do not need to be up-scaled or down-scaled, so they always appear sharp, vivid and realistic on-screen.

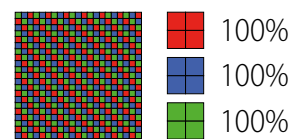
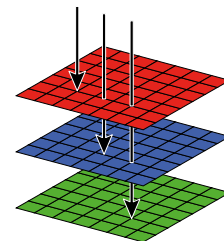
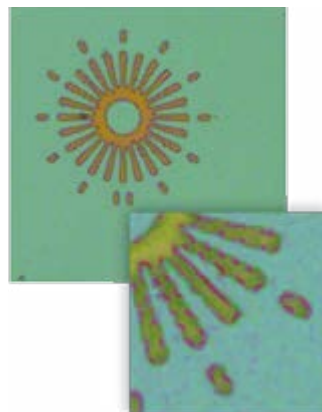
Sequential color

Each pixel in real color

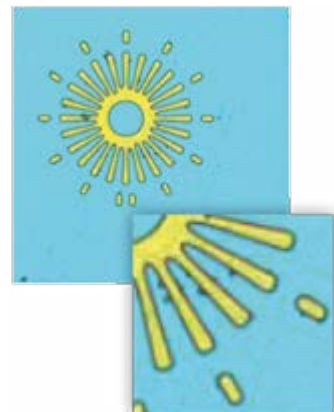
Red, green and blue LEDs are used to sequentially illuminate the surface under inspection. Three monochromatic images are taken and compounded into a high resolution color image. The benefits of this approach are high color fidelity and saturation, as well as real pixel-to-pixel color information. In contrast to color cameras based on a Bayer matrix of pixels, the S neox does not need to interpolate the color information between pixels.

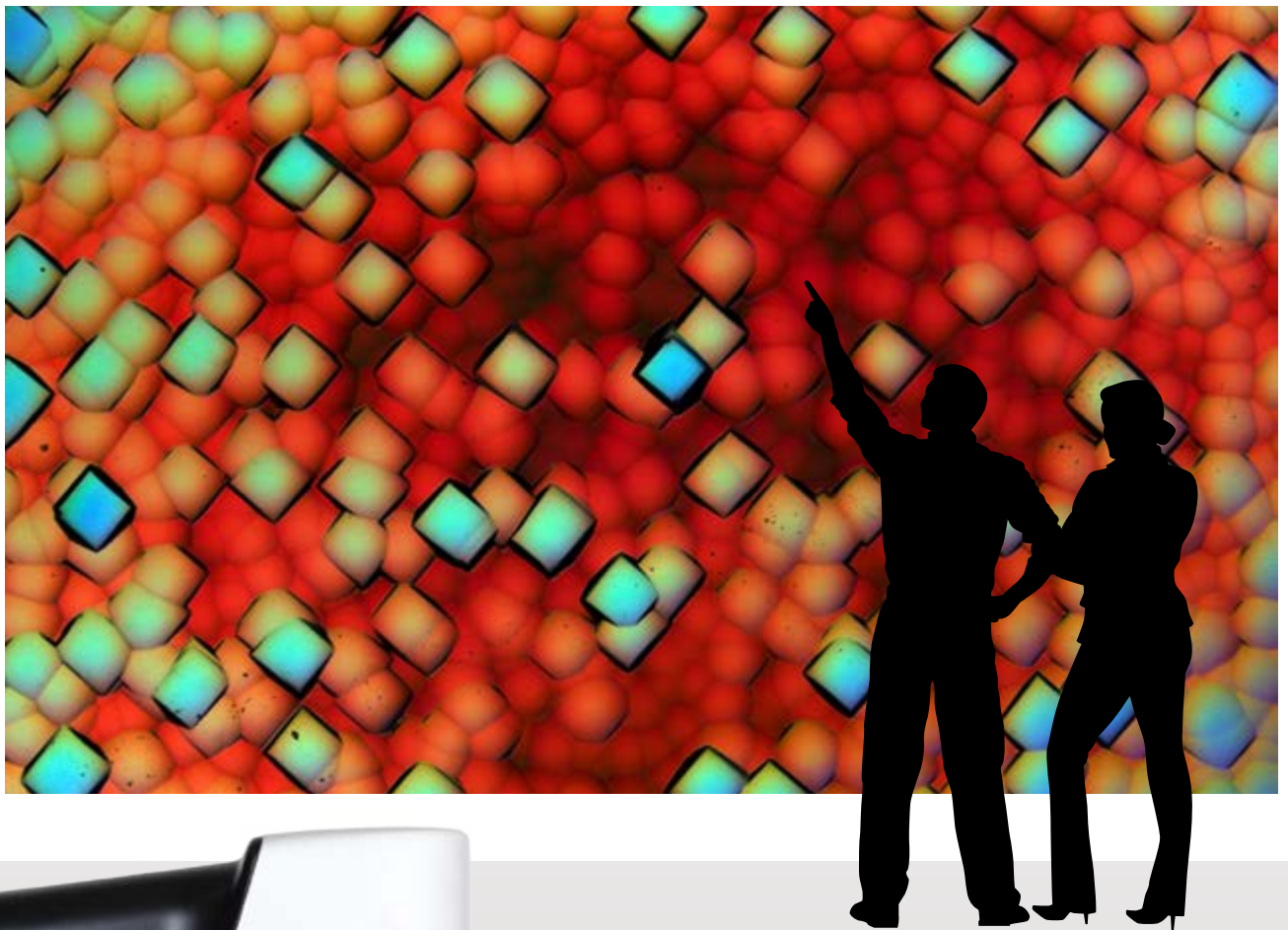


Bayer Matrix



Sensofar's S neox





Live 3D feelings

A new way to feel the 3D experience

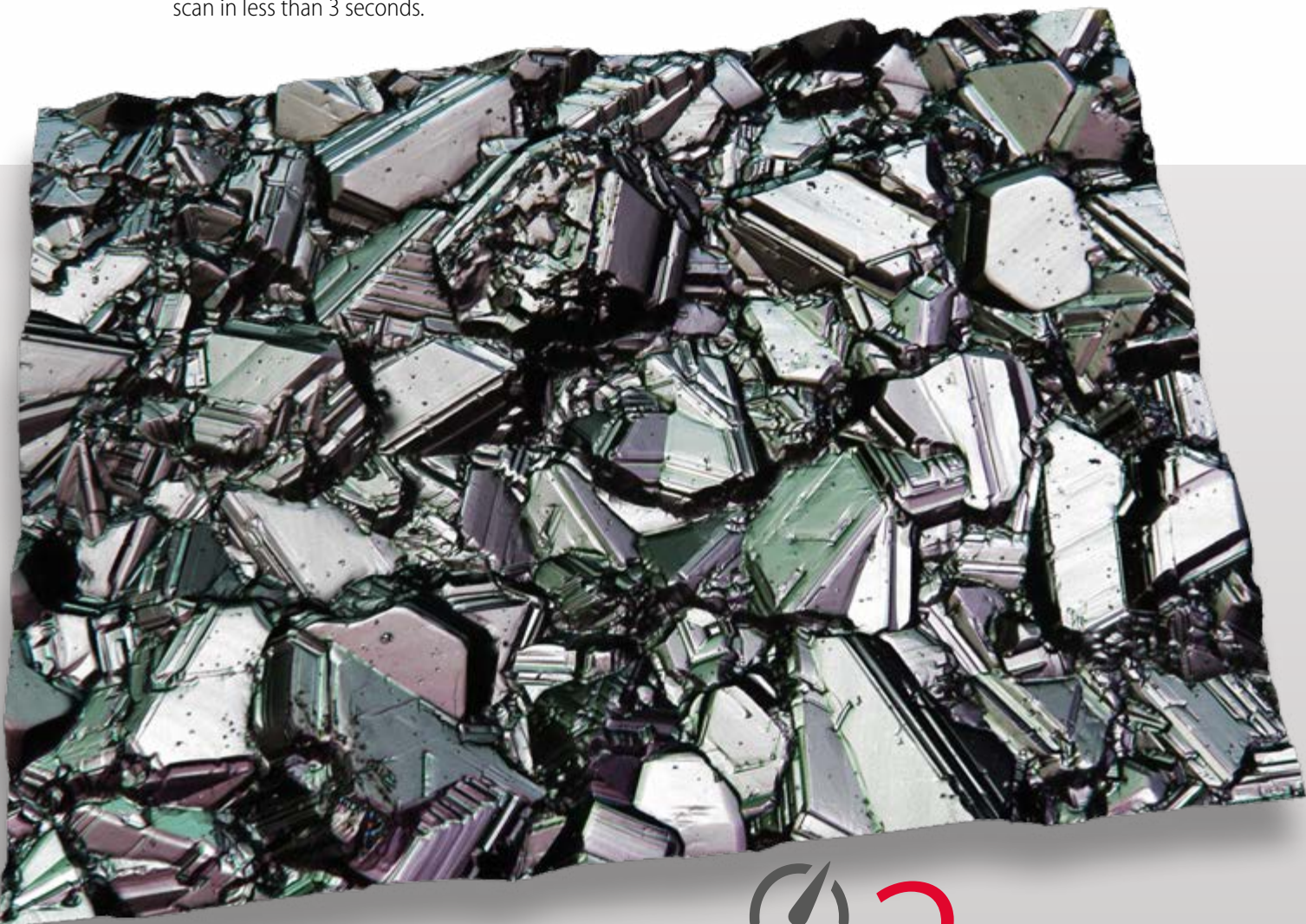
A confocal RGB image view technique allows the user to observe nano-level details within a few microns range. The red, green and blue LEDs are sequentially pulsed and synchronized to acquire three confocal images. The result is color-coded depth information determined from the chromatic depth distortion of the microscope objective, resulting in a pseudo-color topography with qualitative information of the height of the topography.

Highest level of details

From nanoworld to your eyes

Confocal images are taken at the highest camera resolution with very impressive details.

A complete 3D scan is taken in less than 10 seconds.
For high-speed applications and extremely low reflective surfaces, the camera is binned at 2x2, making it possible to acquire an incredible full 3D scan in less than 3 seconds.




Incredible
full 3D scan
in less than **3s**

S

neox

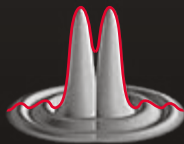
SENSOFAR

The S neox uses premium CF60-2 Nikon objectives lenses that have been designed to correct for chromatic aberrations and produce sharp, flat and clear images with high contrast and high resolution. Phase Fresnel lenses improve the operability and the working distance, meaning that S neox objectives provide the largest available working distance for each NA.

The highest quality objectives,
the highest quality performance

Outstanding lateral resolution

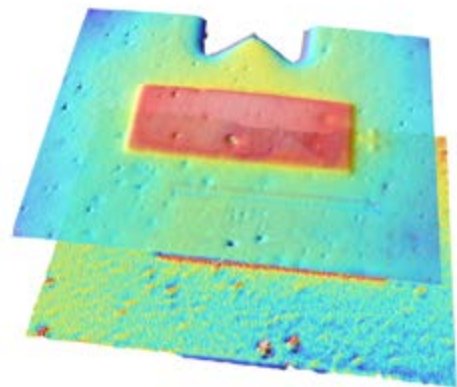
According to the well-known **Rayleigh** resolution criterion, two points are resolved when the first minimum of one Airy disk is aligned with the central maximum of the second Airy disk.



$$R_{\text{lateral}} = K \cdot \lambda / NA$$

Lateral resolution is improved when a short wavelength λ and a very high **NA** objective are used. K-factor is related with the width of the Airy disk and depends on the imaging conditions. Confocal technique reduces by about 30 percent the lateral extent of the Airy disk compared to that in a widefield microscope. Additional reduction of the K factor is obtained when incoherent illumination is used instead of a coherent light source (laser illumination).

Therefore, S neox outperforms CLSM and provides the best lateral and axial resolutions that can be attained in an optical profiler.



Thin & thick films

A full range solution is provided for thin and thick films with the optional spectroscopic reflectometer. As a flexible system, S neox can incorporate a spectroscopic reflectometer, coupled through an optical fiber, for the measurement of thin films with thicknesses ranging from 10 nm and up to 10 layer stacks. The optical fiber is imaged through the microscope's objectives. Thus, thin films can be measured with spots as small as 5 μm . The measurement is undertaken with the integrated LED light source, thus providing real-time bright-field images of the sample and simultaneous thin film measurements.



Multiple configurations

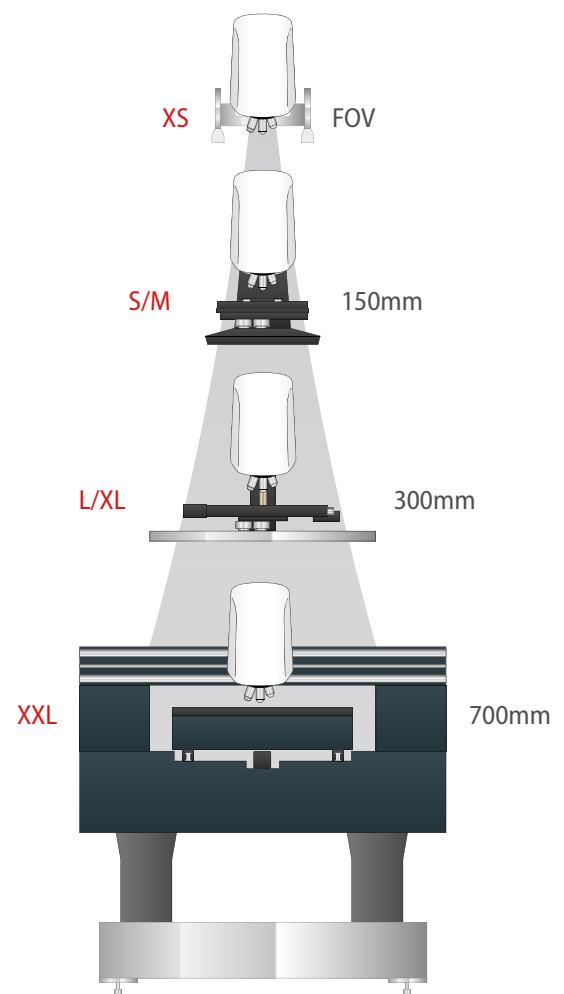
Sample size is important for us

The S neox is a complete tool. Its compact design is ideal for obtaining a fast, non-invasive assessment of the micro- and nanogeometry of technical surfaces in multiple configurations.

What size do you need?

Choose from portable to XXL systems

S neox provides the flexibility, durability and efficiency required from the standard setup for R&D and quality inspection laboratories to sophisticated, customized solutions for online process controls, measuring samples up to 700 x 600 mm².





Acquisition & Analysis Software

SensoSCAN



Save time, make it easy for yourself

SensoSCAN software drives the S neox with its clear and intuitive friendly-interface. The user is guided through the 3D world, delivering a unique user experience. SensoSCAN software provides an interface with which any measurement can easily be taken, as well as a basic set of tools for displaying and analyzing data.



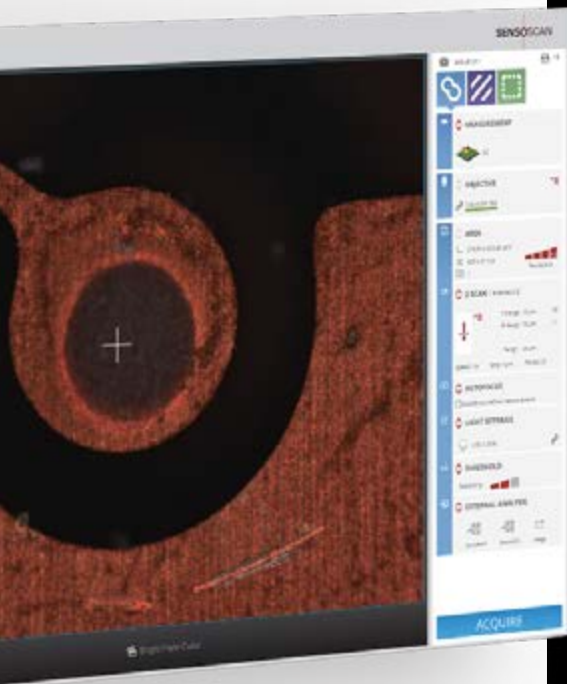
Complete tool for a complete system

An overview tool helps the user to inspect the sample during measurement preparation, check measurement positions before acquisition as well as assist in the automation procedure. Work with high magnification will be easier, as you will know where you are at every moment.



Automating procedures

Automated measurements are obtained using the Recipes tool, an easily customizable tool for creating quality control procedures. It is ideal for online inspection, it is extremely easy to define procedures for automating measurements with the profile manager tool, sample identification, data exportation and 'pass or fail' criteria.



Everything is fast, really fast

Thanks to our dedicated algorithms, the S neox allows results to be acquired in less than a minute after the sample has been positioned. Naturally any data acquisition is still made following our obsession for the best quality and performance.

Powerful Analysis Software ...need more?

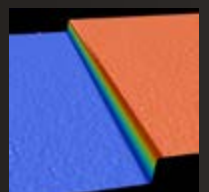
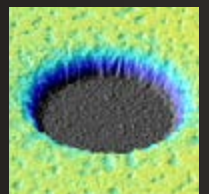
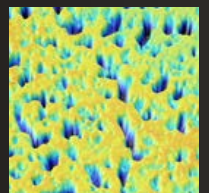
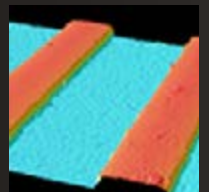
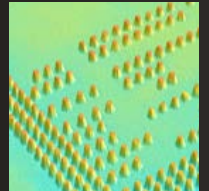
A fully automated process (measurement and analysis) can be undertaken in combination with two external software applications: SensoPRO or SensoMAP.

SensoPRO

It has never been so easy and fast to perform quality control in a production line. Thanks to SensoPRO, the operator in the production line only needs to load the sample and follow guided instructions. Plugin-based data analysis algorithms provide a high degree of flexibility. Current capabilities include PSS module (Conic, Mesa and Merging LEDs), Bump, Hole, Double Hole, Surface Texture, Step Height, Double Step Height, Trace, Silver Trench and Trench. New modules can be easily customized to other industry needs.

SensoMAP

SensoMAP, based on Mountains technology from Digital Surf, is an extremely powerful tool for analysis and reporting. SensoMAP software is completely modularly adaptable to customer requirements. Two levels (standard and premium) and several modules (2D, 3D or 4D modules, Advanced Contour, Grains & Particles, Statistics and Stitching) are available.

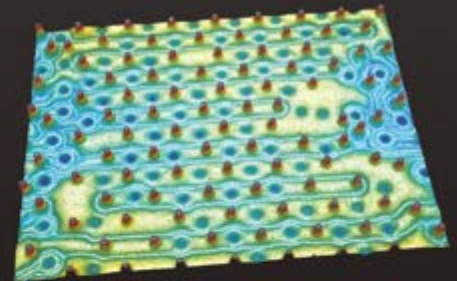




Focus



Siemens star



Solder balls

Applications

The S neox plays a key role in demanding industries such as the semiconductor, biomedical, and biotechnology industries.



Cartridge case



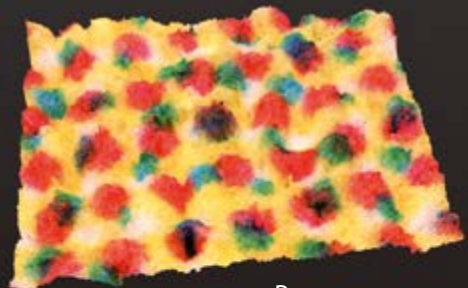
Innovation

on your needs

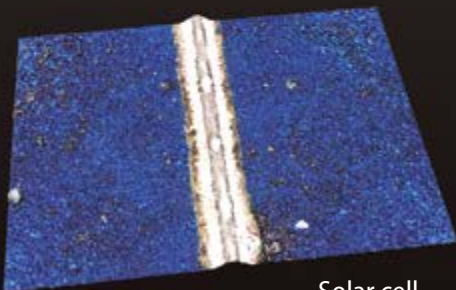
After more than 10 years as a metrology consultancy and understanding the fast changes in the market, we have learned that opening the gate to innovation is the only way to make high-end products. Sensofar optical profilers are installed in hundreds of facilities and quality control departments for micro, nano and sub-nano applications that analyze the 3D surface characteristics of the material. The S neox has been developed as a versatile and multipurpose system that focuses on solving your application. Improving your quality control process and adding value to your products is where Sensofar wants to be.



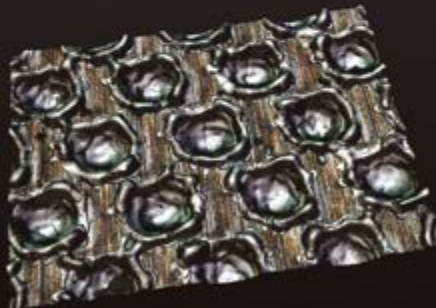
Leather



Paper

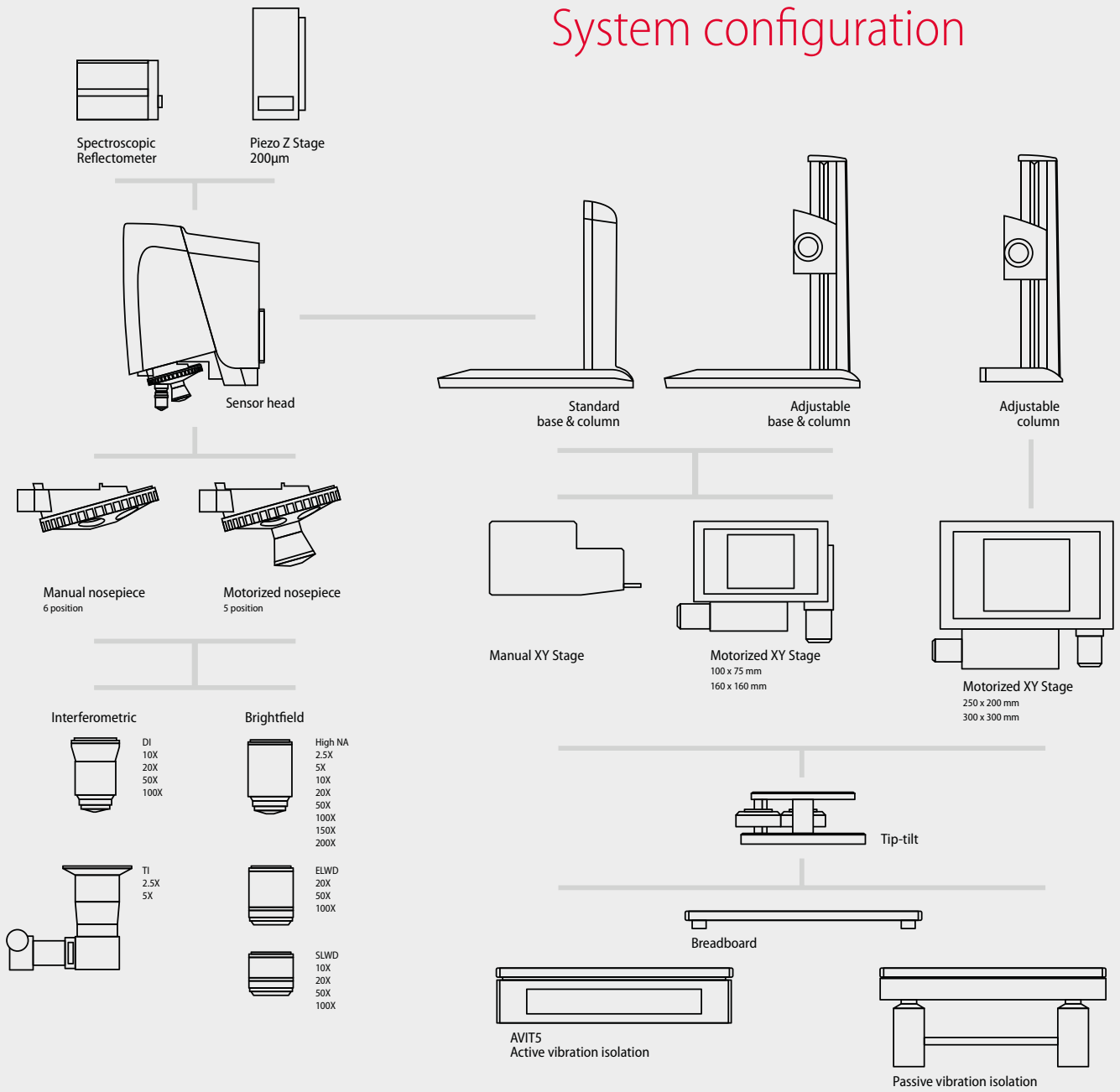


Solar cell

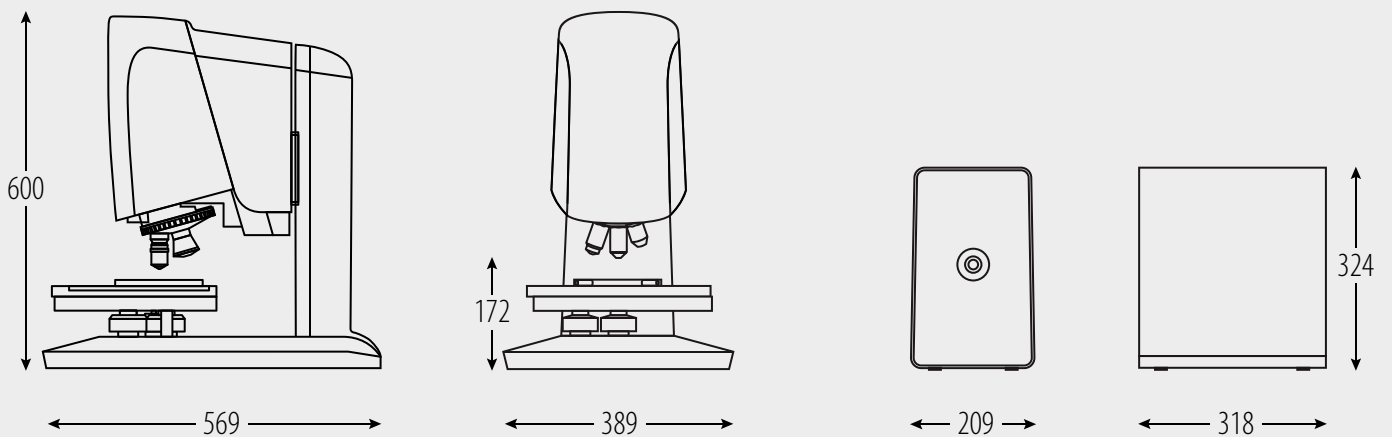


Texture surface
with electron beam

System configuration



Dimensions unit: mm



Objectives

Brightfield

Interferometric

MAG	2.5X	5X	10X	20X	50X	100X	150X	2.5X	5X	10X	20X	50X	100X	
NA	0.075	0.15	0.30	0.45	0.80	0.90	0.95	0.075	0.13	0.30	0.40	0.55	0.70	
WD (mm)	6.5	23.5	17.5	4.5	1.0	1.0	0.2	10.3	9.3	7.4	4.7	3.4	2.0	
FOV ¹ (µm)	7016x5280	3508x2640	1754x1320	877x660	351x264	175x132	117x88	7016x5280	3508x2640	1754x1320	877x660	351x264	175x132	
Spatial sampling ² (µm)	5.16	2.58	1.29	0.65	0.26	0.13	0.09	5.16	2.58	1.29	0.65	0.26	0.13	
Optical resolution ³ (µm)	1.87	0.93	0.46	0.31	0.17	0.15	0.14	1.87	1.07	0.46	0.35	0.5	0.20	
Measurement time ⁴ (s)	>3s							>3s						

Confocal

PSI / ePSI / VSI

Vertical resolution ⁵ (nm)	300	75	25	8	3	2	1	PSI/ePSI 0.1 nm (0.01 nm with PZT)				VSI 1 nm	
Maximum slope ⁶ (°)	3	8	14	21	42	51	71	3	8	14	21	25	42

Focus variation

Min. measurable roughness	Sa > 10 nm
Maximum slope (°)	up to 86°

Other objectives are available.

For Confocal / Focus Variation: Water immersion, Super Long Working Distance, Extra Long Working Distance, Collar Ring depth focusing correction.

For interferometry: Variable reflectance, Michelson, Mirau and Linnik.

- 1 Maximum field of view with 2/3" camera and 0.5X optics.
- 2 Pixel size on the surface
- 3 L&S: Line and Space, half of the diffraction limit according to the Rayleigh criterion. Values for blue LED. Spatial sampling could limit the optical resolution for interferometric objectives
- 4 For brightfield objectives, 21 scanning planes (confocal). For interferometric objectives, 10µm scanning range.
- 5 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.
- 6 On smooth surfaces, up to 86° on rough surfaces

System specifications

Measurement array	1360 x 1024 pixels
LED light sources	red (630 nm); green (530 nm); blue (460 nm) and white (550 nm)
Sample height	up to 40 mm (standard) ; 150 mm (adjustable) (larger under request)
XY sample size	up to 700 x 600 mm
Vertical range	40 mm with linear stage; 200 µm with piezo stage
Max. vertical scanning range	PSI 20 µm; ePSI 100 µm; VSI 10 mm; Confocal 37 mm; Focus Variation 37 mm
Z stage linearity	<0.5 µm/mm with linear stage and <30 nm/100 µm (0.03 %) with piezo stage
Z stage resolution	2 nm with linear stage; 0.75 nm with piezo stage
Step height repeatability	0.1 %
Step height accuracy	0.5 %
Sample reflectivity	0.05 % to 100%
Display resolution	0.001 nm
System	Line Voltage 100-240 V AC; frequency 50/60 Hz single phase
Computer	Latest INTEL processor; 2560 x 1440 pixels resolution (27")
Operating system	Microsoft Windows 8 64bits
Environment	Temperature 10 °C to 35 °C; Humidity <80 % RH; Altitude <2000 m





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 Metrology offers technology that enables our customers to achieve real breakthroughs, particularly in semiconductor, precision optics, data storage, display devices, thick and thin film and materials testing technology fields.

The Sensofar Group has its headquarters in Barcelona, also known as Spain's technological heart. The Group is represented in over 20 countries through a global network of partners and has its own offices in Asia and the United States.



SENSOFAR[®]
METROLOGY

HEADQUARTERS

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3D Optical Profiler

Objectives Specifications



Objectives Specifications

The S neox uses premium CF60-2 Nikon objectives lenses that have been designed to correct for chromatic aberrations and produce sharp, flat and clear images with high contrast and high resolution. Phase Fresnel lenses improve the operability and the working distance, meaning that S neox objectives provide the largest available working distance for each NA.

The S neox also uses interferometric objectives. The TI series are based on Michelson interferometer. They have an external reference mirror mounted on two tip-tilt screws. The DI series are Mirau objectives that create the interference internally by dividing the wavefront with a beamsplitter. The TI series are used for low magnification and numerical aperture, being ideal objectives for the measurement of very flat and thin samples. The DI series can have up to 0.55NA.

Bright field objectives

Magnification	NA	WD (mm)	FOV (µm)	Spatial Sampling (µm)	Optical Resolution Green (µm)	Optical Resolution Blue (µm)	Optical Resolution Red (µm)	Optical Resolution White (µm)	Maximum Slope (°)	Vertical Resolution (nm)
1X EPI	0.03	3.80	17540 x 13200	12.90	4.88	4.67	5.69	5.59	1	-
2.5X EPI	0.075	6.50	7016 x 5280	5.16	1.95	1.87	2.27	2.23	3	300
5X EPI	0.15	23.50	3508 x 2640	2.58	0.97	0.93	1.13	1.11	8	75
10X EPI	0.30	17.50	1754 x 1320	1.29	0.48	0.46	0.56	0.55	14	25
20X EPI	0.45	4.50	877 x 660	0.65	0.32	0.31	0.37	0.37	21	8
50X EPI	0.80	1.00	351 x 264	0.26	0.18	0.17	0.21	0.20	42	3
50X EPI	0.80	2.00	351 x 264	0.26	0.18	0.17	0.21	0.20	42	3
50X EPI	0.95	0.35	351 x 264	0.26	0.15	0.14	0.17	0.17	71	3
100X EPI	0.90	1.00	175 x 132	0.13	0.16	0.15	0.18	0.18	51	2
100X EPI	0.90	2.00	175 x 132	0.13	0.16	0.15	0.18	0.18	51	2
100X EPI	0.95	0.32	175 x 132	0.13	0.15	0.14	0.17	0.17	71	2
150X EPI	0.90	1.50	117 x 88	0.09	0.16	0.15	0.18	0.18	51	1
150X EPI	0.95	0.20	117 x 88	0.09	0.15	0.14	0.17	0.17	71	1
20X ELWD	0.40	19.00	877 x 660	0.65	0.36	0.35	0.42	0.41	21	10
50X ELWD	0.60	11.00	351 x 264	0.26	0.24	0.23	0.28	0.27	30	5
100X ELWD	0.80	4.50	175 x 132	0.13	0.18	0.17	0.21	0.20	42	3
10X SLWD	0.20	37.00	1754 x 1320	1.29	0.73	0.70	0.85	0.83	11	50
20X SLWD	0.30	30.00	877 x 660	0.65	0.48	0.46	0.56	0.55	14	20
50X SLWD	0.40	22.00	351 x 264	0.26	0.36	0.35	0.42	0.41	21	15
100X SLWD	0.60	10.00	175 x 132	0.13	0.24	0.23	0.28	0.27	30	10

The highest quality objectives,
the highest quality performance

Water immersion objectives

Magnification	NA	WD (mm)	FOV (μm)	Spatial Sampling (μm)	Optical Resolution Green (μm)	Optical Resolution Blue (μm)	Optical Resolution Red (μm)	Optical Resolution White (μm)	Maximum Slope (°)
10X WI	0.30	3.50	1754 x 1320	1.29	0.48	0.46	0.56	0.55	14
20X WI	0.50	2.00	877 x 660	0.65	0.29	0.28	0.34	0.33	23
63X WI	1.00	2.00	292 x 220	0.22	0.14	0.14	0.17	0.16	-

Collar ring depth focusing correction objectives

Magnification	NA	WD (mm)	FOV (μm)	Spatial Sampling (μm)	Optical Resolution Green (μm)	Optical Resolution Blue (μm)	Optical Resolution Red (μm)	Optical Resolution White (μm)	Maximum Slope (°)
20X EPI CR	0.45	10.9 – 10.0	877 x 660	0.65	0.32	0.31	0.37	0.37	21
50X EPI CR	0.70	3.9 – 3.0	351 x 264	0.26	0.20	0.20	0.24	0.23	42
100X EPI CRA	0.85	1.2 – 0.85	175 x 132	0.13	0.17	0.16	0.20	0.19	43
100X EPI CRB	0.85	1.3 – 0.95	175 x 132	0.13	0.17	0.16	0.20	0.19	43

Interferometry objectives

Magnification	NA	WD (mm)	FOV (μm)	Spatial Sampling (μm)	Optical Resolution Green (μm)	Optical Resolution Blue (μm)	Optical Resolution Red (μm)	Optical Resolution White (μm)	Maximum Slope (°)	
2.5X TI	0.075	10.30	7016 x 5280	5.16	1.95	1.87	2.27	2.23	3	
5X TI	0.13	9.30	3508 x 2640	2.58	1.12	1.07	1.31	1.29	8	
10X DI	0.30	7.40	1754 x 1320	1.29	0.48	0.46	0.56	0.55	14	
20X DI	0.40	4.70	877 x 660	0.65	0.36	0.35	0.42	0.41	21	
50X DI	0.55	3.40	351 x 264	0.26	0.26	0.25	0.31	0.30	25	
100X DI	0.70	2.00	175 x 132	0.13	0.20	0.20	0.24	0.23	42	
Vertical resolution					PSI/ePSI 0.1 nm (0.01 nm with PZT)		VSI 1 nm			



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

We provide high accuracy optical profilers based on interferometry and confocal techniques. From standard setups for R&D and quality inspection laboratories to complete non-contact metrology solutions for online production processes, Sensofar offers technology that enables our customers to achieve breakthroughs, particularly in the semiconductor, precision optics, data storage, display devices, thick and thin film and material testing technologies fields. Sensofar is represented in over 20 countries through channel partners and has its own offices in Asia, Japan and the United States.

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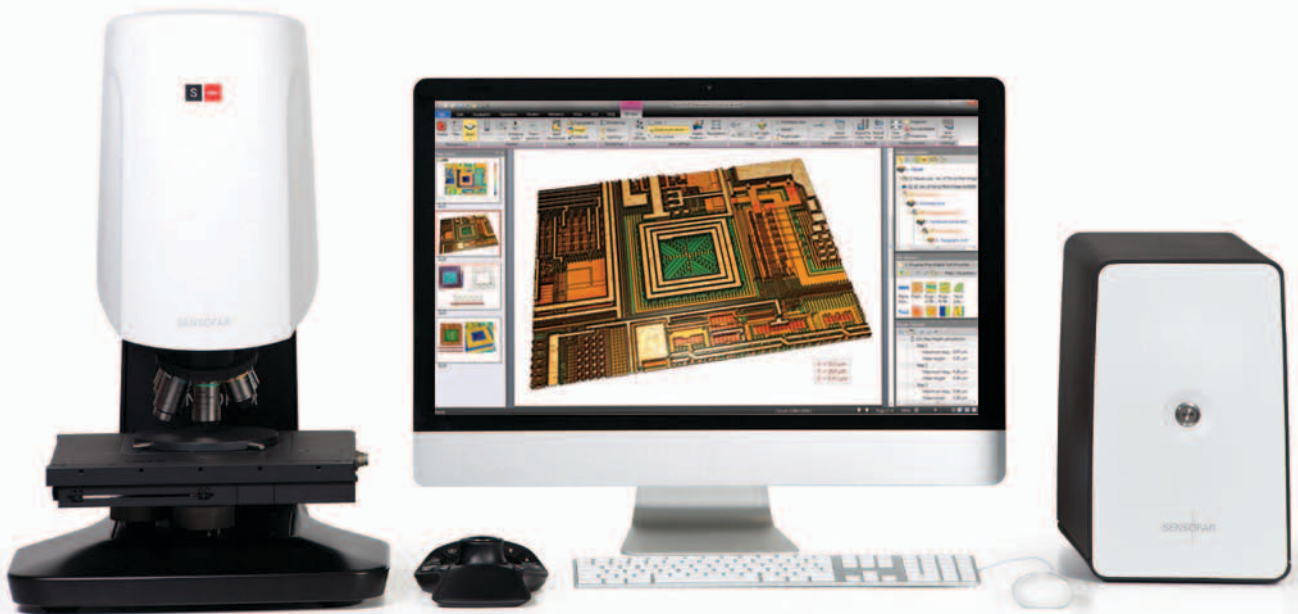
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SensoMAP

Advanced Analysis software



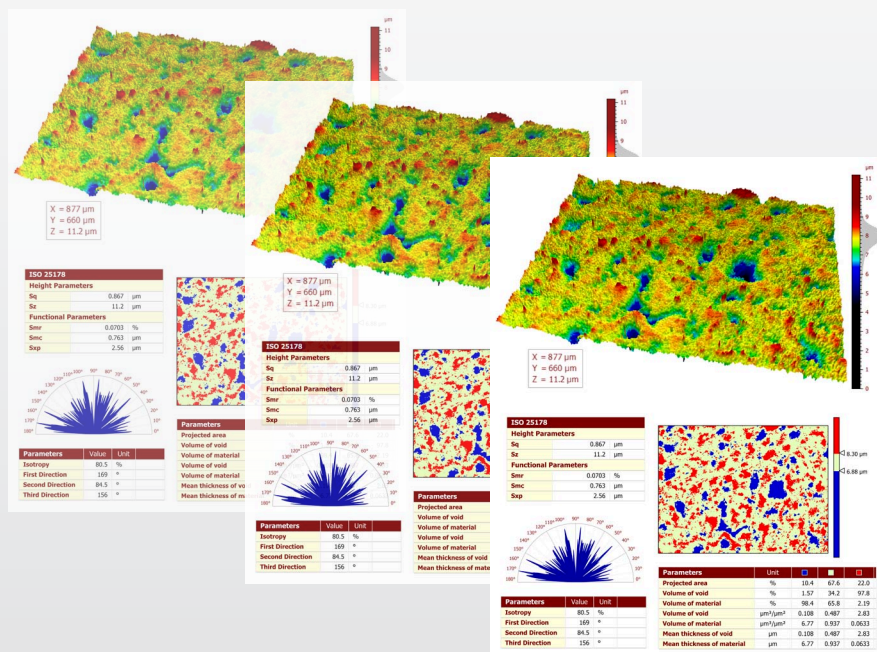
SensoMAP

Standard Features

IMAGING – METROLOGY – PRODUCTIVITY

Designed for use with the broadest range of research and industrial applications, SensoMAP software is the perfect surface imaging, analysis and metrology solution that is fully integrated with Sensofar 3D optical profilers. It includes:

- **Imaging** – visualization of surface data using cutting-edge imaging technology and intelligent filters.
- **Metrology** – analytical studies in accordance with the very latest standards and methods.
- **Report Creation** – creation of detailed, accurate multi-page surface analysis reports in a smart desktop publishing environment with powerful automation features to speed up analysis.



SensoMAP is scalable software available on two product levels:

- **SensoMAP Standard** provides the features required for standard surface imaging and analysis. It comes with numerous optional modules that can be added at any time for advanced and specialized applications.
- **SensoMAP Premium** is a much more powerful solution that includes almost all of the modules, with the exception of a few highly specialized modules that can be added if required.

SensoMAP

Standard Features

Highly intuitive desktop publishing environment

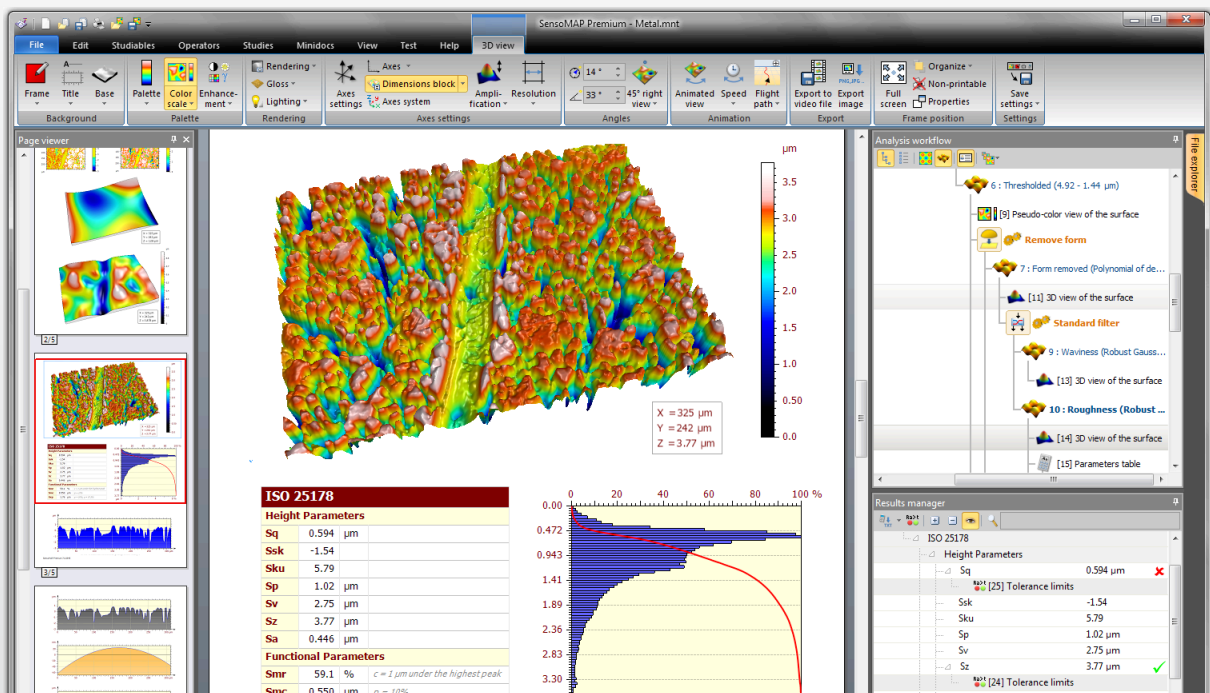
Full metrological traceability, automation, fine-tuning on the fly

Visual analysis reports

In SensoMAP you can build a visual analysis report frame by frame, page by page, working in one of six European languages, Brazilian Portuguese, Japanese, Korean or Mandarin Chinese. Frames contain 3D and other views of surface data, the results of applying filters, analytical studies, ISO and national parameters, measurement identity cards, comments and illustrations. You can navigate to any frame in a report by selecting it in the page viewer.

Smart user environment

The smart user environment – with logical top-down organization of all functions, contextual object-oriented ribbons and expanded graphical tooltips – means that you can move from idea to action with minimum effort.



Full metrological traceability

Every analysis step is recorded in a hierarchical analysis workflow to assure full metrological traceability. Analysis steps in the workflow can be fine-tuned at any time. All dependent steps are recalculated automatically.

Powerful automation features

Once an analysis report has been completed it can be applied as a template to automate the analysis of multiple measurement data files. In addition, common sequences of analysis steps can be saved in a library for insertion into future analysis reports to save time.

SensoMAP

Standard Features

Pass/fail with tolerancing

Pass/fail criteria with tolerances can be defined for any parameter. Green (pass) and red (fail) traffic lights are displayed automatically and the parameter value and tolerance limits are shown graphically.

Data export

Frames and pages can be exported as bitmaps up to 1200 dpi for poster sessions. Finished reports can be exported in PDF and RTF formats for easy circulation. All numerical results are accessible in the Results Manager panel and can be exported in Excel-compatible text files for interfacing with 3rd party software, including quality management software.

See everything that you measure

Real-time visualization of 3D surface topography with overlays

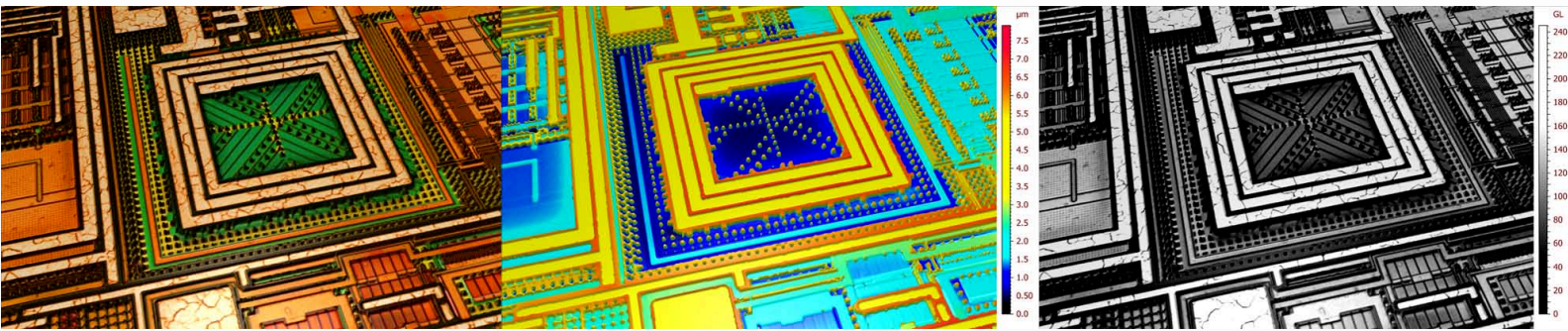
Real-time 3D imaging

In SensoMAP, you can zoom in on a 3D surface and rotate it in real time. To achieve the best image quality, you can apply image enhancement tools, choose the best lighting conditions, select renderings, set surface height amplification, and use an optimized color palette for the vertical scale. In addition, you can display contour diagrams and photo simulations and you can extract 2D profiles from a 3D surface for visualization and analysis.



SensoMAP

Standard Features



3D views of electronic circuit with 2% height amplification: (a) Color image overlay on 3D topography, (b) 3D surface topography, (c) Intensity image overlay on 3D topography.

Overlay color and intensity images on 3D surface topography

Multi-channel topography, color and intensity image layers can be manipulated simultaneously. With a single click, you can overlay the color or intensity image on the 3D surface topography to speed up the detection of surface features. You can adjust the transparency of the overlay to achieve optimal rendering.

Extract a sub-surface and analyze it just like a full surface

With SensoMAP, you can not only visualize and analyze a full surface image or measurement, but also extract a region of interest or sub-surface and analyze it in exactly the same way as a full surface.

There are several methods for extracting sub-surfaces:

- >> Extract a rectangular or non-rectangular zone.
- >> Remove the upper or lower slice of a surface by thresholding.
- >> Apply a binary mask.
- >> Automatically partition a surface into motifs (texture cells), then use the Partition and Level operator to extract a sub-surface and level it so that it is ready for independent study.

Once a sub-surface or region of interest has been extracted it can be analyzed in exactly the same way as a full surface; the parameters are calculated for the sub-surface only. For example, you can study the roughness, flatness and coplanarity of planes on MEMS and mechanical and electronic components.

Color image
0% transparency

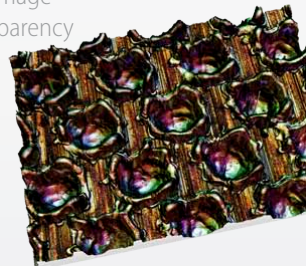


Image overlay on topography
30% transparency

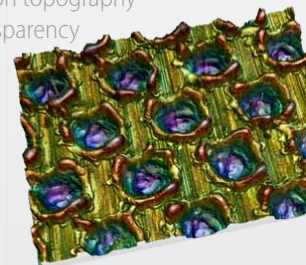
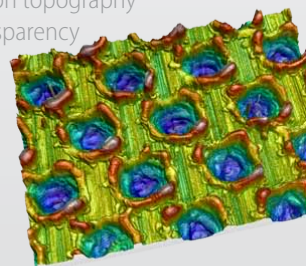
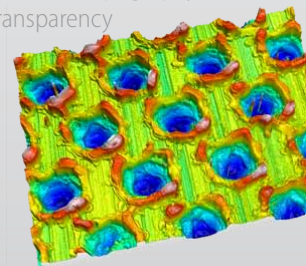


Image overlay on topography
60% transparency



Pseudo-color 3D surface topography
100% transparency



Optimal rendering can be achieved by adjusting the transparency of the color image overlay on the 3D surface topography.

SensoMAP

Standard Features

Use powerful tools to prepare surface data for analysis

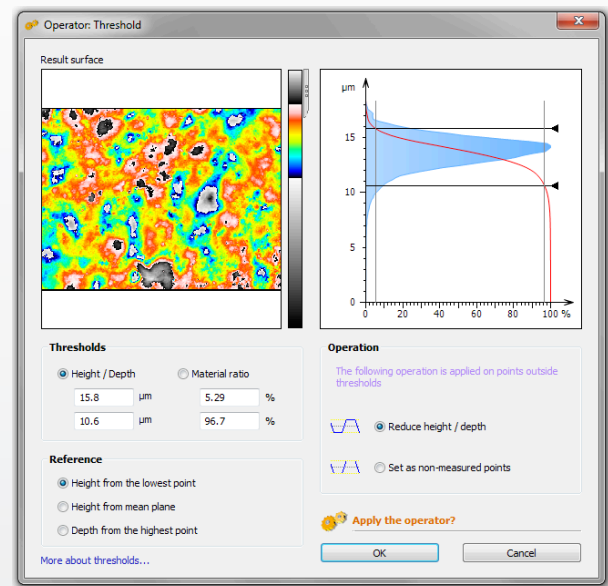
Data normalization and correction

Visual analysis reports

SensoMAP includes a full set of intelligent operators and filters for normalizing 3D surface data and removing measurement artifacts prior to analysis. They include:

- >> Leveling.
- >> Flipping in the horizontal or vertical axis.
- >> Rotation.
- >> Thresholding.
- >> Outlier removal.
- >> Filling in missing data points.
- >> Spatial filtering and surface smoothing.
- >> Retouching of isolated artifacts.
- >> Resampling to improve image resolution.

The threshold operator has pairs of interactive cursors for delimiting the height and material ratio on a material distribution plot.



Increase field of view virtually

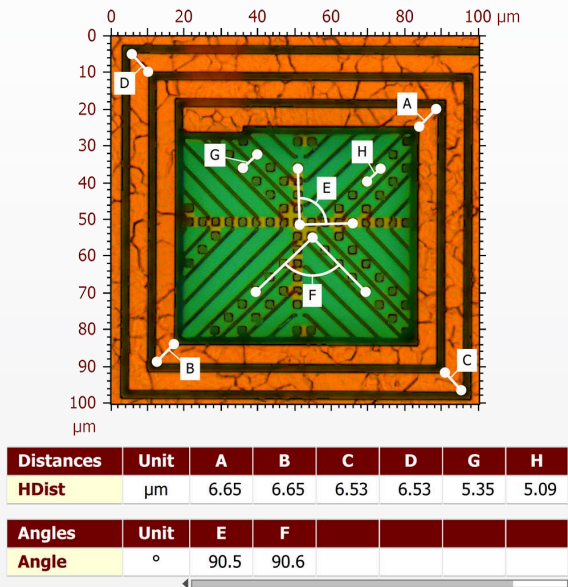
In some cases, the field of view is too limited to measure the whole surface under study. SensoMAP overcomes this limitation by stitching multiple measurements together to form a single surface that is ready for analysis.

SensoMAP

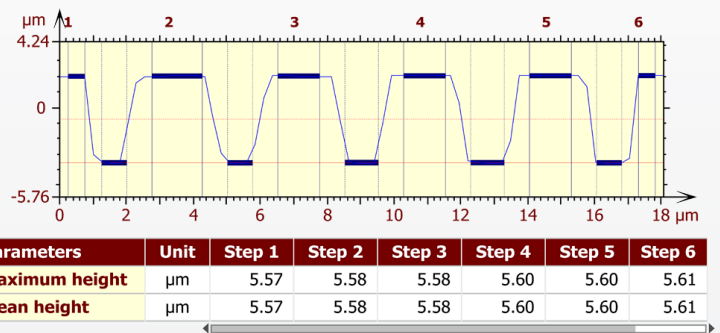
Standard Features

Analyze surface geometry

Calculate distances, areas, volumes and step heights



SensoMAP assures fast and accurate analysis of surface geometry with tools for measuring distances, angles, areas of peaks and valleys, volumes of bumps and holes, step heights on surfaces and profiles, and coplanarity.

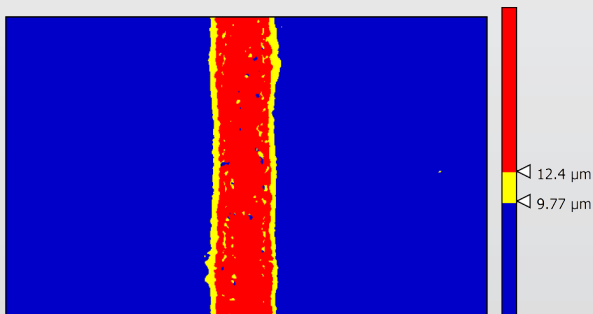


(a) Multiple distances and angles can be measured in the same frame and (b) step height measurements on a profile.

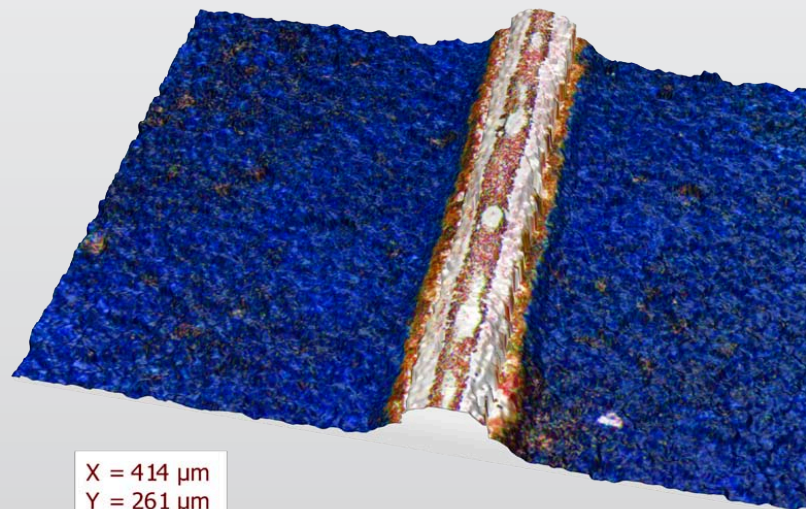
Standard functional analysis

Bearing ratio, depth distribution, volume and thickness of slices, subtraction

SensoMAP provides standard functional analysis, including the Abbott-Firestone bearing ratio curve and depth distribution histogram, the material/void volume and thickness of up to three vertical surface slices, and surface subtraction for wear analysis.



Parameters	Unit	■	■	■
Projected area	%	86.5	2.82	10.6
Volume of void	%	58.7	87.6	94.0
Volume of material	%	41.3	12.4	5.98
Volume of void	µm ³ /µm ²	5.74	2.30	13.3
Volume of material	µm ³ /µm ²	4.03	0.325	0.844
Mean thickness of void	µm	5.74	2.30	13.3
Mean thickness of material	µm	4.03	0.325	0.844



Solar cell: calculation of the volume of a drain

SensoMAP

Standard Features

Surface texture characterization in accordance with international standards

ISO filtering techniques and parameters

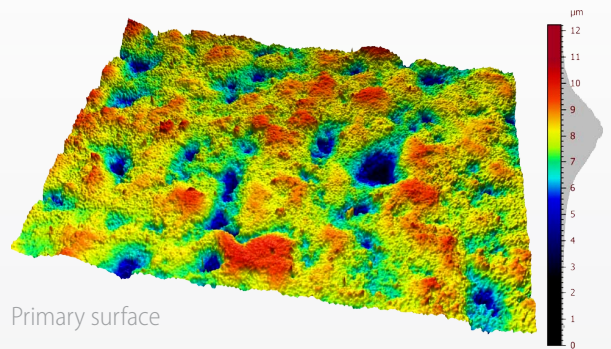
From Gaussian to advanced ISO 16610 filtering techniques

The roughness and waviness components of surfaces are separated using the latest ISO 16610 advanced filtering techniques, including robust Gaussian and spline filters. Previous filtering techniques are also supported.

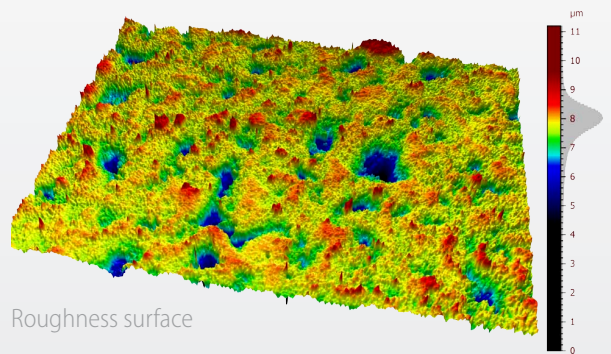
The most popular surface texture parameters from Ra to ISO 25178

The following parameters are available in all SensoMAP products:

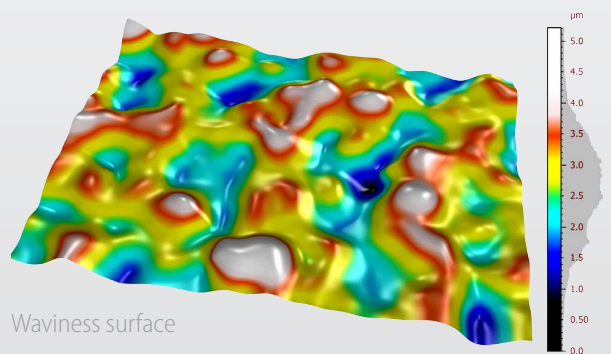
- >> ISO 25178 height (including Sa, Sq, Ssk, Sku and Sz) and bearing ratio (Smr, Sdc and Sxp) parameters
- >> ISO 4287 amplitude, spacing, material ratio and peak parameters for primary, waviness and roughness profiles (for example Ra, Rq, Rsk, Rmr, Rdc, Rdq and R_{PC})



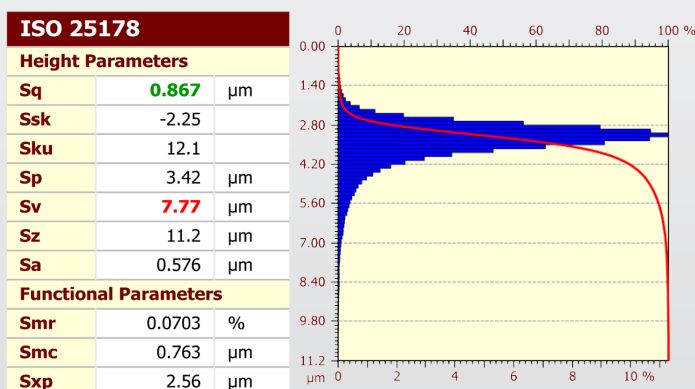
Primary surface



Roughness surface



Waviness surface



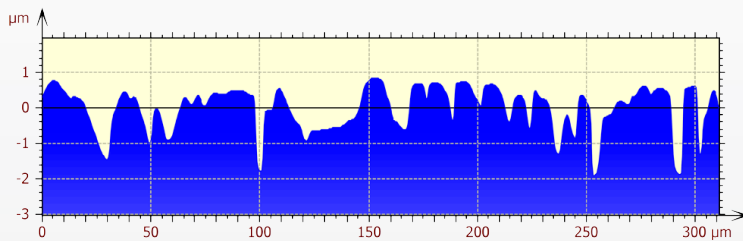
The right standards wherever you are

Wherever you are, with SensoMAP you can work with national and international standards. The software not only calculates ISO parameters, it also calculates ASME B46.1 2D and 3D parameters (USA), displays GB/T (China), DIN (Germany), JIS (Japan), NF (France), BSI (UK), UNE (Spain) and UNI (Italy) equivalents of ISO parameters when they are available, and calculates the older EUR 15178 3D parameters.

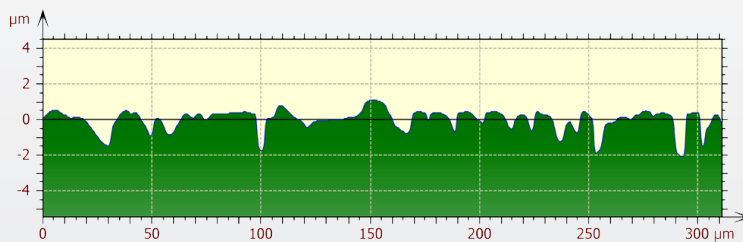
In addition to the SensoMAP standard features, there are twelve SensoMAP modules for advanced and specialized applications. Ten of these modules can be added to SensoMAP Standard and most of them, with the exception of highly specialized applications, are included in SensoMAP Premium.

Advanced 2D surface texture

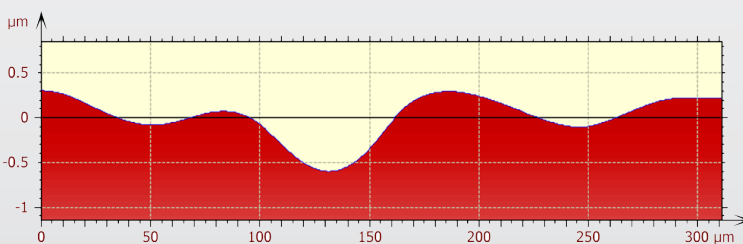
Studies, parameters and filters for advanced 2D profile analysis



Primary profile



Roughness profile



Waviness profile

Apply advanced 2D filtering techniques

Remove form and apply roughness/waviness filters from Gaussian to ISO 16610 – apply morphological filters – denoise profiles using the FFT plot editor.

Correct measurement anomalies

Use data correction tools (thresholding, retouching and resampling) to eliminate anomalies and improve resolution prior to analysis.

Study functional characteristics

Study the bearing ratio curve and depth distribution histogram – subtract profiles to assess wear.

Analyze fractal dimensions of profiles

Using the enclosing boxes and morphological envelopes methods.

Overcome measurement limits virtually

Join overlapping profiles.

Generate statistics on series of profiles

The profiles in the series can be extracted from a series of surfaces or from the same surface.

MATLABTM compatibility

Use MATLABTM scripts to define custom filters for 2D profiles – execute the scripts in SensoMAP. (Note: MATLABTM and SensoMAP must be installed on the same PC.)

ISO 16610 filtering techniques for 2D profiles with end-effect management.

SensoMAP

Modules

Advanced 3D surface texture

Studies, parameters and filters for advanced 3D surface analysis

Analyze sub-surfaces

Extract and level planes on MEMS and mechanical, electronic and other components. Analyze the planes in exactly the same way as full surface measurements.

Calculate more 3D surface texture and form parameters

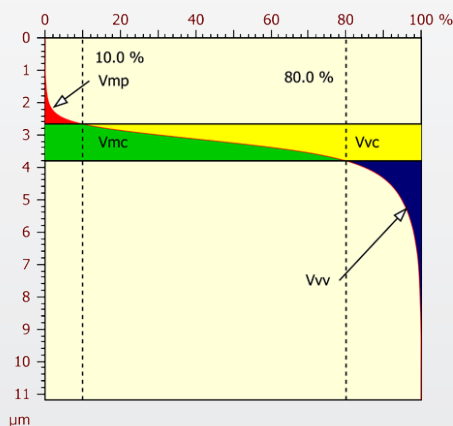
ISO 25178 functional volume (V_{mp} , V_{mc} , V_{vc} and V_{vv}), spatial (S_{al} , S_{tr} and S_{td}) and hybrid (S_{dq} and S_{dr}) parameters – ISO 12178 flatness (FLT_t , FLT_p , FLT_v and FLT_q) parameters.

Study functional characteristics

Study the bearing ratio curve and depth distribution histogram and subtract profiles to assess wear.

Study functional volume parameters associated with wear and lubrication graphically

Visualize friction, core and lubrication zones on tribological surfaces.



Parameters	Value	Unit
V_{mp}	0.0279	ml/m ²
V_{mc}	0.533	ml/m ²
V_{vc}	0.608	ml/m ²
V_{vv}	0.182	ml/m ²

Study surface isotropy, directionality and periodicity

View dominant surface directions on a compass rose and calculate parameters.

Apply morphological filters to surfaces

Erosion, dilation, opening, closing, and sequential filters.

Study circular profiles with the abscissa in degree units.

MATLABTM compatibility

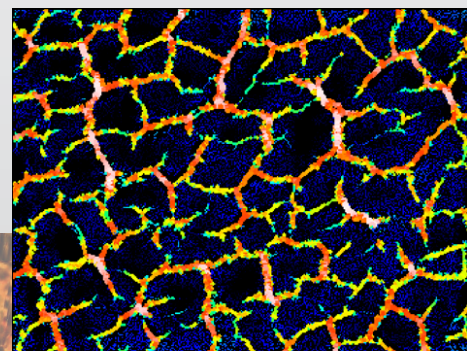
Use MATLABTM scripts to define custom filters for 3D surfaces – execute the scripts in SensoMAP. (Note: MATLABTM and SensoMAP must be installed on the same PC).

Analyze furrows

Visualize furrows and calculate furrow parameters.

Analyze fractal dimensions of surfaces

Using the enclosing boxes and morphological envelopes methods.



All furrows are displayed.

Parameters	Value	Unit
Maximum depth of furrows	110	µm
Mean depth of furrows	17.7	µm
Mean density of furrows	1206	cm/cm ²

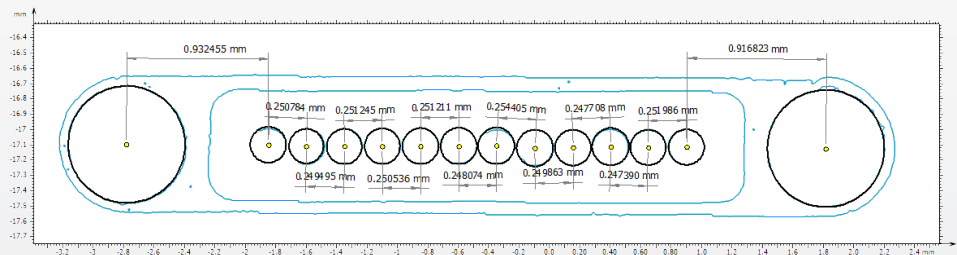
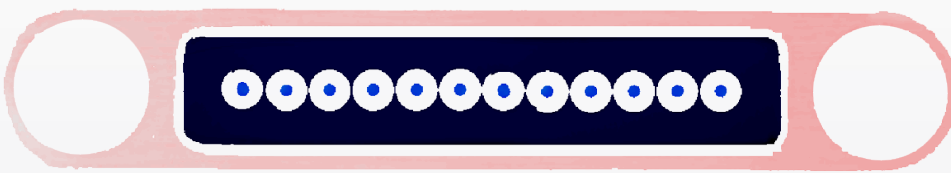
Contour

Fast geometric dimensioning of component contours

Extract vertical (x,z) or horizontal (x,y) contours from a surface.

Define nominal form using straightforward interactive tools.

Use auto-dimensioning tools to calculate dimensions including distances, radii, diameters and angles.



Advanced contour

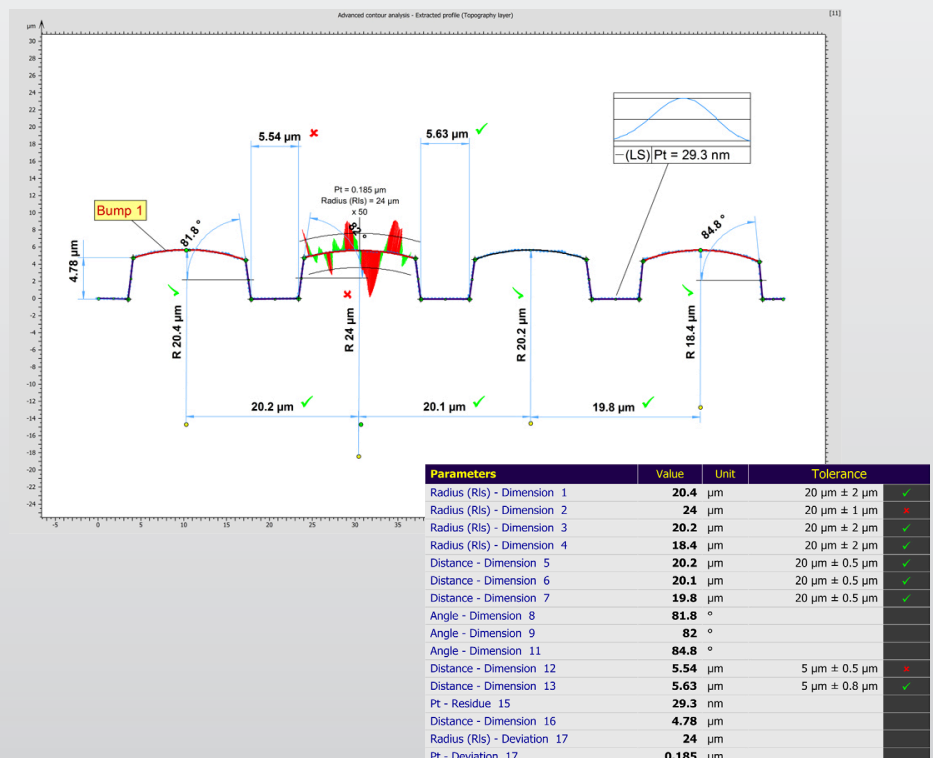
Comprehensive form deviation analysis with tolerancing

Compare measured contours with CAD data (DXF) or user-defined nominal form.

Specify tolerances including large positional tolerances if required.

Visualize form deviations easily with magnified graphics.

Automatically generate a table of results including pass/fail status.



SensoMAP

Modules

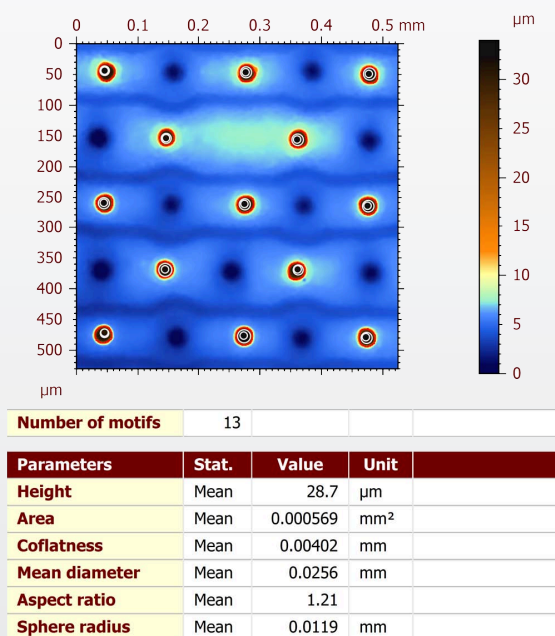
Grains and particles

Study isolated surface features

Use multiple complementary methods to detect, count and analyze grains, particles, islands, bumps, holes and texture cells (motifs), including binarization with respect to a horizontal plane, thresholding with respect to height, and segmentation by watersheds.

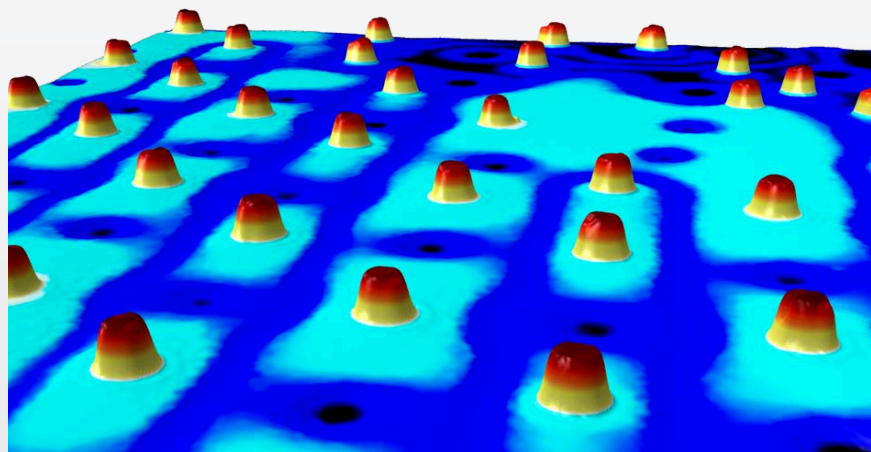
Calculate morphological parameters for individual grains, motifs, etc.

Generate statistics for all grains, motifs, etc. or subsets selected with respect to any parameter.



Calculate ISO 25178 features parameters (Spd, Spc, S5p, S5v, S10z, Sha, Sda, Shv and Sdv).

Special features for microlens arrays include the display of spherical caps and the calculation of spherical parameters.



4D series

Visualize and analyze surface evolution

Combine a series of surface measurements for 4D analysis with respect to time, temperature, magnetic field or another dimension.

Visualize surface, profile and point evolution, even fly over a surface as it changes and record a movie for presentations.

Generate statistics on surface change.

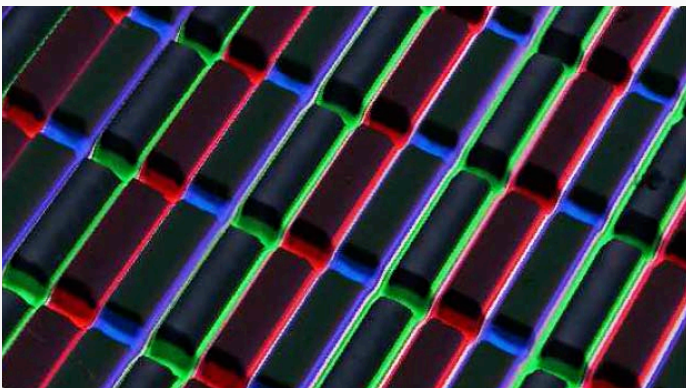
Highlight areas of preponderant change using the Karhunen-Loève transform (principal component analysis).

Colocalization

Combine surface data obtained by imaging and metrology instruments of different types

Colocalize surface data obtained by different technologies

For example correlate interferometric surface data with nice color images from the confocal scanning. The module correlates the 3D data and the image until it fits and can render the final 3D image with the color overlay.



Colocalize surface data obtained by different instruments

For example colocalize surface data obtained by 3D optical profilers and scanning probe microscopes with limited field of view and images obtained by scanning electron, fluorescence and other microscopes. (Note: instrument compatibility depends on the configuration of the installed SensoMAP software).

Statistics

Automated statistical analysis of static and dynamic measurement data populations

Prepare data automatically using templates

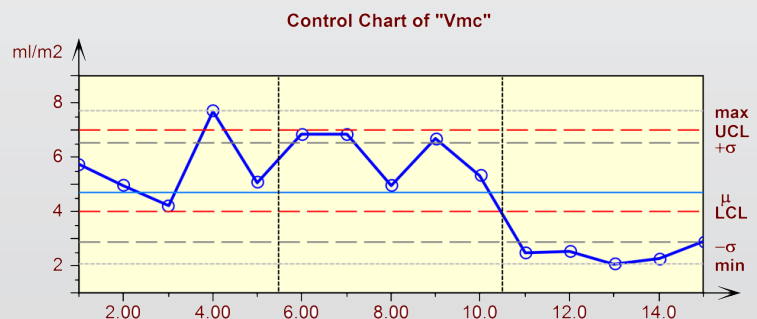
Include all parameters for statistical analysis in a predefined analysis workflow – use it as a template for automatically generating analysis reports on one or more populations.

Generate statistical reports

Select the static or dynamic population(s) to be analyzed and create a report with parameter tables, control charts, histograms, box plots and scatter plots as required – statistics for dynamic populations are updated automatically.

Monitor key parameters and process capability

Control charts include standard deviation limits (1 to 3 sigma), control limits and vertical bars separating different populations, together with yield capability (Cpk) and other parameters.



Parameters	Value	Unit	
Yield	60.0	%	
Cp	0.274		
Cpk	0.128		

SensoMAP

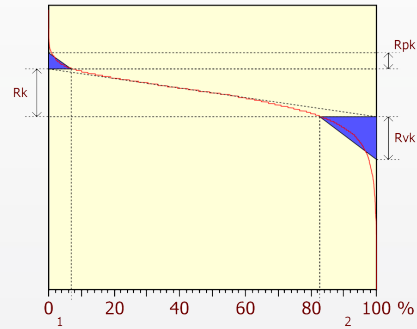
Modules

2D automotive

Assess functional performance with parameters developed by the automotive industry

Calculate a comprehensive set of 2D parameters
 ISO 13565-2 Rk parameters – ISO 13565-3 parameters – ISO 12085 motifs parameters – ISO 12780 straightness parameters – ISO 12781 roundness parameters.

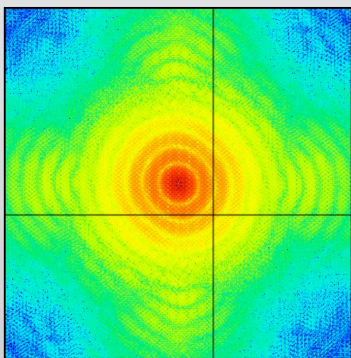
Study Rk parameters associated with wear and lubrication graphically
 Visualize friction, core and lubrication zones on tribological profiles.



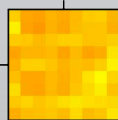
Information			
Filter settings	Double Gaussian filter, 0.080 mm.		
Parameters	Value	Unit	
Rk	0.321	µm	
Rpk	0.108	µm	
Rvk	0.288	µm	
MR1	6.91	%	
MR2	82.7	%	
A1	3.72	µm ² /mm	
A2	25.0	µm ² /mm	

3D Fourier

Use advanced FFT-based tools to analyze process-surface interactions and denoise surfaces



Parameters	Value	Unit
X	12.8	µm
Y	-14.8	µm
Wavelength	9.68	µm
Angle	-41	°
Magnitude	-21.8	dBc
Phase	59.5	°



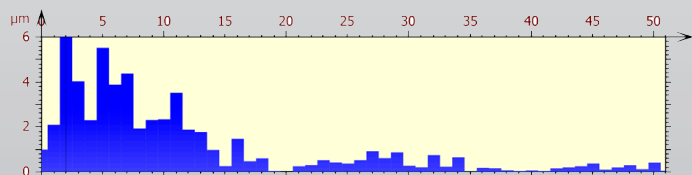
Work with a wide range of FFT-based plots

Interactive frequency spectrum, interactive power spectrum density, autocorrelation and intercorrelation.

Calculate isotropy, directionality and periodicity

View dominant surface directions on a compass rose and calculate parameters.

Denoise surfaces using the FFT plot editor.



Parameters	Value	Unit
Wavelength # 2	0.263	mm
Magnitude	6.01	µm
Phase	6.15	°

SensoMAP

Standard Features

SensoMAP Product Line

Scalable to meet your exact needs

Standard

Premium

Features		
User interface	English, German, French, Italian, Spanish, Polish, Japanese, Chinese, Korean, Brazilian Portuguese	
Reference manual	English, German, French, Japanese	
Analysis modules		
2D automotive	Option	✓
3D Fourier	Option	✓
4D series	Option	✓
Advanced 2D surface texture	Option	✓
Advanced 3D surface texture	Option	✓
Advanced contour	Option	Option
Colocalization	Option	Option
Contour	Option	✓
Grains & particles	Option	✓
Statistics	Option	Option
Requirements		
Minimum	Windows 8, 7 or Vista (64-bit or 32-bit), 4 GB RAM, OpenGL or Direct 3D hardware accelerated graphics board, 1280 x 768 resolution in thousands of colors, 800 MB HDD free space, 1 free USB port.	
Recommended	Windows 8 or 7 64-bit, quad core processor, 1600 x 1024 resolution in thousands of colors.	





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 interferometry and confocal techniques, from standard setups for R&D and quality inspection laboratories to complete non-contact metrology solutions for online production processes. Sensofar Metrology offers technology that enables our customers to achieve real breakthroughs, particularly in the semiconductor, precision optics, data storage, display devices, thick and thin film and material testing technology fields.

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