SENSOFAR

METROLOGY

INTEGRABLE HEADS

Integrable solutions

Robust and reliable

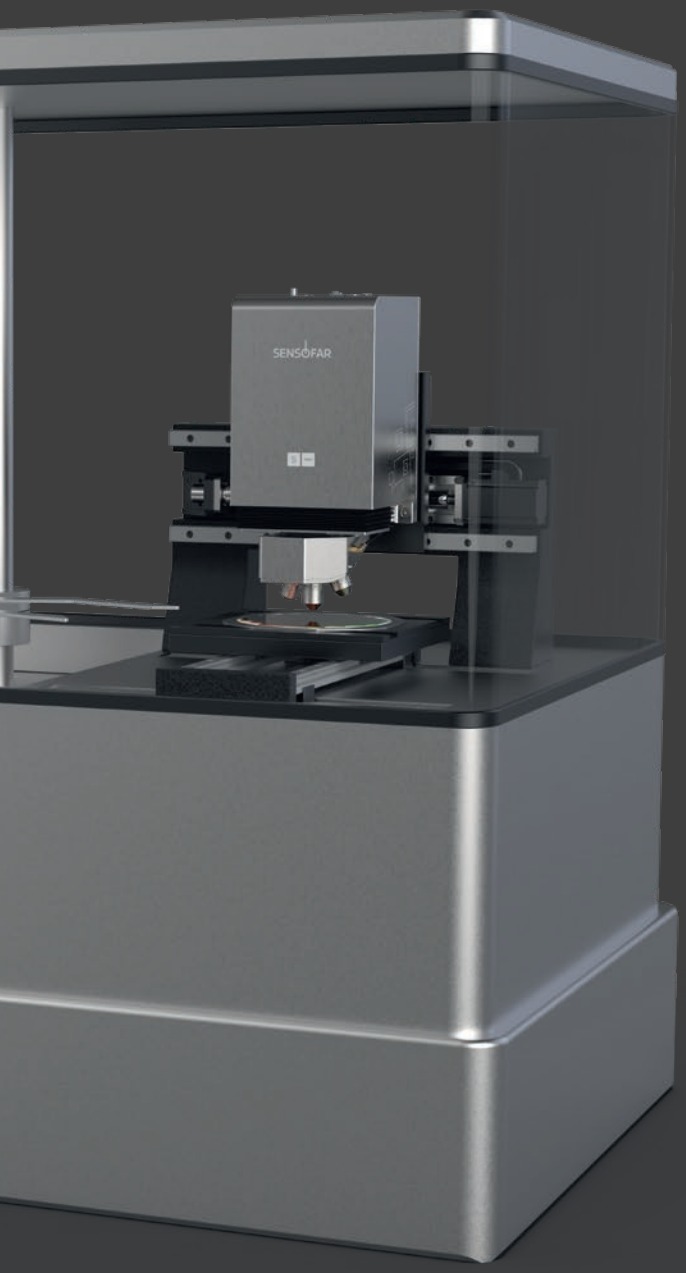
Production environments are not always the most friendly: variable conditions, vibrations, aggressive materials, etc. making measurement tasks more difficult. Our integrable sensors have been designed with exactly this in mind. The sealed sensor head keeps out debris and particles and our optical assembly contains no moving parts, so the sensors stay clean and aligned.

Compact, light, and orientation independent

Small size and low weight make designing for integration easy. Functional in any orientation, Sensofar sensors can be positioned as the application requires. Cable lengths are up to 20 m. Our sensors are perfectly adaptable for both in-line production and robot-mounted sensing applications.

metrology

Sensofar's integrable metrology systems are the culmination of more than 20 years experience in surface metrology systems



They are designed from the outset to be integrated into the harshest manufacturing environments. Compact, lightweight and with flexible mounting options, Sensofar sensors put high-performance surface metrology right where you need it – at the application.

Applications

- Display
- Optics
- PCB
- Semiconductors
- Surface finish
- Tooling

Cleanroom compatible

Fraunhofer IPA TESTED DEVICE SENSOFAR METROLOGY S NEOX 090 CR Report No. SE 2110-1269

Some production environments such as those in semiconductor manufacturing are normally within strict conditions of particles. Now the S neox, our most powerful system, has the option to be ISO Class 1 thanks to a hardware innovation based on three main features: a stainless steel enclosure, a sealed PU bellow covering the gap between the sensor head and the nosepiece and air extraction system.

	S mart	S neox
		
	The S mart 2 is the only areal confocal sensor on the market which is also an autonomous sensor. It is the perfect combination between compact design and versatility.	**The S neox addresses the need for maximum measurement flexibility in an integrable sensor and is thus the most versatile industrial system on the market.**
Technologies		
FOV (single shot)	Up to 3.4 x 2.8 mm [1]	Up to 6.8 x 5.6 mm [1]
Speed acq.	2 s [2]	3 s [2]
Optical Resolution	Down to 155 nm [3]	Down to 148 nm [3]
Measurement noise	Down to 1 nm [4]	Down to 0.01 nm [4]
Weight	5.3 kg [5]	8.3 kg [5]
Cable length	5, 10 or 15 m	5 or 10 m
Computer	Embedded in the head	External
Range of magnifications	5X – 100X	2.5X – 150X
Interface of comunication	DLL libraries	
Export files	SensoSCAN (Acquisition software): .plux, .dat, .bmp	

1 5X objective.
2 Confocal, 20X BF and Z range=200 µm, speed 4X. **3** 50X EPI (NA 0.95; L&S Line and Space values for blue LED) objective. **4** 50X EPI (NA 0.95, WD 0.35 mm objective). **5** This is the weight of the sensor head with one objective in the turret.

1 2.5X TI (NA 0.075, WD 10.3 mm) objective.
2 Confocal, 20X BF and Z range=200 µm, speed 5X. **3** 150X EPI (NA 0.95 L&S Line and Space values for blue LED) objective. **4** PSI with PZT using any interferometric objective. **5** This is the weight of the sensor head with one objective in the turret.

Fringe Projection · Ai Focus Variation · Confocal · Interferometry · Spectroscopic Reflectometry

S neox

Cleanroom

The S neox Cleanroom is the most versatile integrable head on the market and the only one to be ISO Class 1 compatible.

S wide

The S wide is designed to measure large areas in one single shot, suited for those applications where speed and shape measurement is the priority.

Up to 6.8 x 5.6 mm [1]	34.7 x 29.1 mm
3 s [2]	1 s
Down to 148 nm [3]	–
Down to 0.01 nm [4]	1 µm
13.6 kg [5]	8 kg
5 or 10 m	5 or 10 m
External	External
5X – 150X	1X - 6X[1]

(C++ or C#, Windows® - 64 bits)

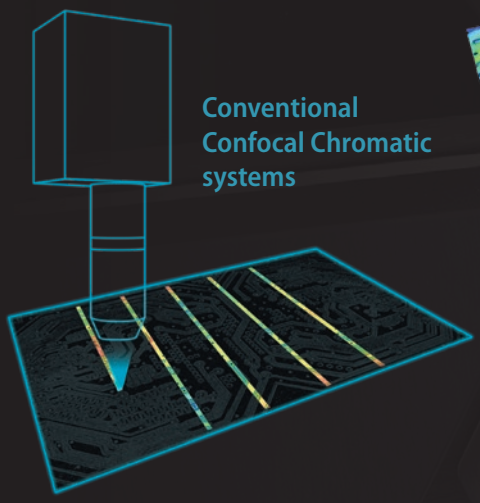
SensoVIEW (Analysis software): .plux, .x3p, .dat, .pcl, .stl

1 2.5X TI (NA 0.075, WD 10.3 mm) objective. **2** Confocal, 20X BF and Z range=200 µm, speed 5X. **3** 150X EPI (NA 0.95 L&S Line and Space values for blue LED) objective. **4** PSI with PZT using any interferometric objective. **5** This is the weight of the sensor head with one objective in the turret.

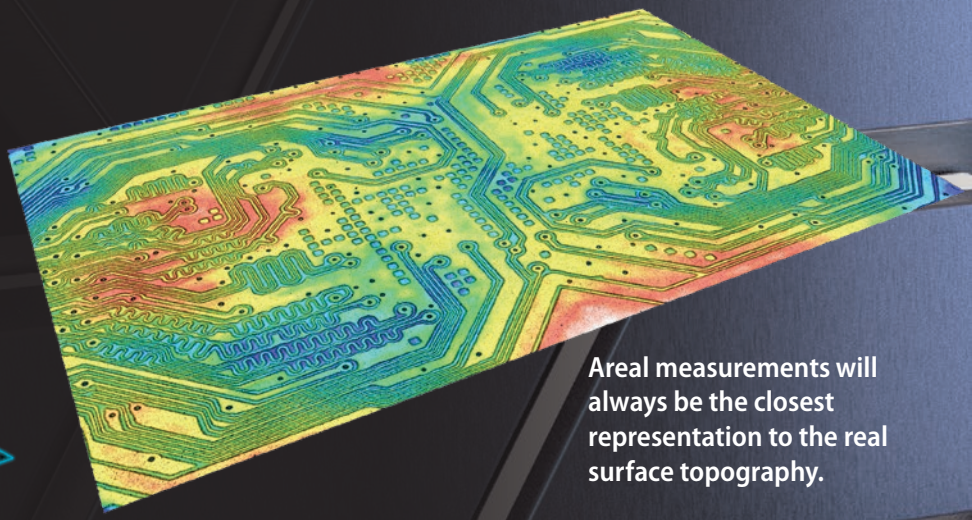
1 These magnifications refer to digital magnifications. The optical magnification is 0.243X.

The real areal confocal head

The **S mart 2** areal confocal capability images an area at a time, so the lateral resolution and X and Y remain the same, unlike point or line confocal chromatics. In addition, our areal measurements are traceable to certified calibration specimens from national measurement institutions such as PTB, NPL or NIST.



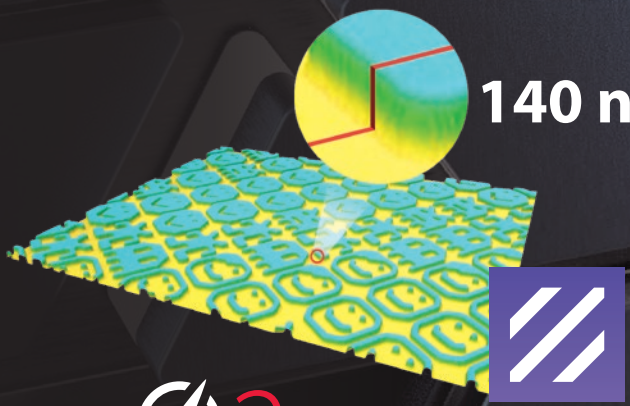
Conventional Confocal Chromatic systems



Areal measurements will always be the closest representation to the real surface topography.

Performance you'll want to see

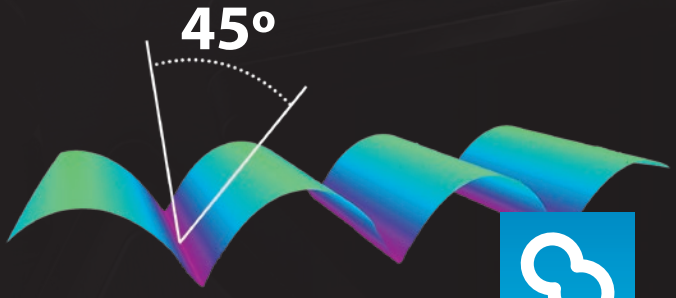
To scan with the most suitable technology, the **S mart 2** comes with three technologies to measure in the same head: Ai Focus Variation, Confocal and Interferometry.



140 nm

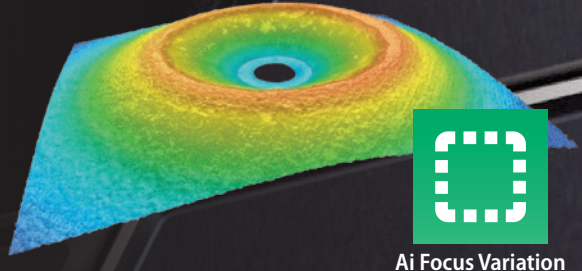
Interferometry

Shape measured in 2s



45°

Confocal



Ai Focus Variation

Easy to fit, easy to connect

The shape of the integrable head has been engineered to improve the fitting of the system. Its narrow width allows the integrable head to be installed in zones that will not interfere with the user or the manufacturing operations.

Designed to be exceptionally easy to integrate, the **S mart 2** has all the electronics inside the head, including the computing power. Never before has it been so easy to install a Sensofar system, the **S mart 2** has two single connections: an ethernet cable and a power supply.

Our sensors product portfolio has been designed to fulfill the automatization typically required in manufacturing lines. The measurement is done with just one click, the sensor finds the focus, optimizes the light and Z range and the user gets the result.

AUTOMATIC 3D

Efficient Design

3-in-1
Confocal
Ai Focus Variation
Interferometry

AUTOMATIC 3D

Autonomous areal confocal

The **S mart 2** is the only autonomous areal confocal profilometer in the market and that is a must when high standards of lateral resolution, accuracy, and repeatability are required by the customer. Its powerful features and compact design turn it into a breakthrough in the optical field. The sensor head incorporates all the electronics, even the computing power, to facilitate its integration. Apart from Confocal, the **S mart 2** has in the same head two more optical technologies: Ai Focus Variation and Interferometry (CSI, ePSI), which allow the customer to scan with the most appropriate technique for the task at hand.

ONLY SOLVED BY A REAL AREAL CONFOCAL

Objective lenses

	Brightfield					Interferometric							
Magnification	5X BF	10X BF	20X BF	50X BF	100X BF	2.5X TI	5X MC	10X MC	10X MR	20X MC	20X MR	50X MR	100X MR
NA	0.15	0.30	0.45	0.80	0.90	0.075	0.14	0.10	0.28	0.10	0.38	0.50	0.70
WD (mm)	20.00	15.80	3.00	1.00	1.00	10.30	13.00	25.00	8.00	16.70	6.00	3.60	2.00
FOV[1] (µm)	2826 x 2826	1413 x 1413	707 x 707	283 x 283	141 x 141	5652 x 5652	2826 x 2826	1413 x 1413	1413 x 1413	707 x 707	707 x 707	283 x 283	141 x 141
Spatial sampling[2] (µm)	2.76	1.38	0.69	0.27	0.14	5.52	2.76	1.38	1.38	0.69	0.69	0.27	0.13
Optical resolution[3] (µm)	0.94	0.47	0.31	0.18	0.16	2.34	1.25	1.75	0.63	1.75	0.46	0.35	0.25
Measurement noise[4] (nm)	120	45	10	4	3	CSI <1 nm, ePSI <0.1 nm							
Maximum slope[5] (º)	9	17	27	53	64	4	8	6	16	6	22	30	44

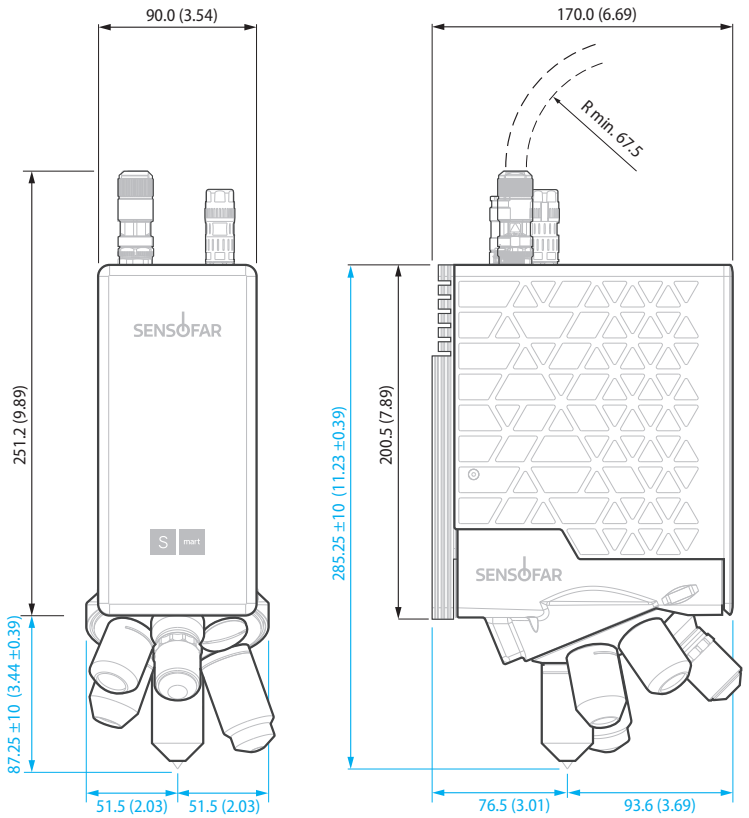
System specifications

Measuring principle	Confocal, CSI, ePSI and Ai Focus Variation
Measurement types	Image, 3D, 3D thickness
Camera	1 Mpx: 1024x1024 pixels (150 fps)
Confocal frame rate	60 fps
Vertical scan range	Linear stage: 20 mm range; 5 nm resolution
Max. Z measuring range	20 mm
LED light sources	Blue (460 nm); white (580 nm; center)
Nosepiece	6 positions fully motorized
Sample reflectivity	0.05 % to 100%

Advanced Software Analysis	Inc: SensoVIEW; Op: SensoPRO, SensoMAP
Communication protocol	DLL; gRPC (optional)
Operating system	Microsoft Windows 10®, 64 bit
Cable Length	3 m (5 or 10 m optional)
Environment	Temperature 10 ºC to 35 ºC; Hum. <80 % RH; Alt. <2000 m

Dimensions mm (inch)

Weight[6]: 5.3 kg (11.7 lbs)



Head dimensions

Working distances

1 Maximum field of view with 2/3" camera and 0.25X optics. **2** Pixel size on the surface. **3** L&S: Line and Space, half of the diffraction limit according to the Rayleigh criterion. Spatial sampling could limit the optical resolution for interferometric objectives. Values for blue LED in brightfield objectives and white LED in interferometric objectives. **4** Values are assessed through repeated measurements on a reference standard performed under environmentally controlled conditions in accordance with Sensofar's metrology protocols. **5** On smooth surfaces. Up to 72° on rough surfaces. Other objectives are available. **6** This is the weight of the sensor head with one objective in the turret.

Extreme versatility

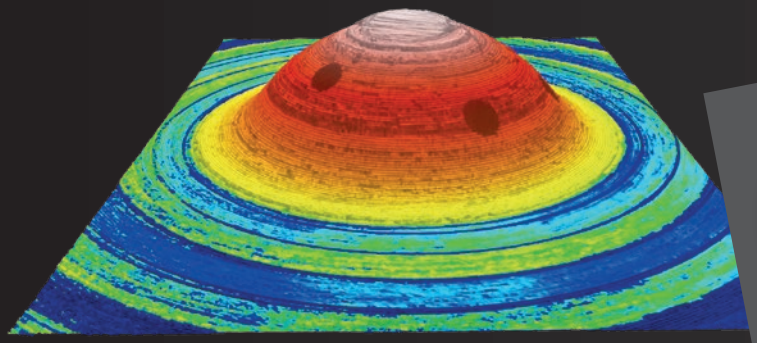
with high performance

4x4

4-in-1 technologies
Ai Focus Variation | Confocal
Interferometry | SR

4 LEDs
Red I Green I Blue I White

The **S neox** pushes versatility to the extreme with 4-in-1 technology, providing unparalleled adaptability for different application requirements and maximum measurement flexibility on any surface. The versatility of the S neox allows for having DIC that enhances contrast to spot surface defects while choosing from 37 different objectives. Also, the option to add a piezoelectric Z motor provides the S neox with the highest performance in optical metrology.



AUTOMATIC 3D

0.01 nm

Measurement noise

Objective lenses

	Brightfield						Interferometry						
MAG	5X BF	10X BF	20X BF	50X BF	100X BF	150X EPI	5X MC	10X MC	10X MR	20X MC	20X MR	50X MR	100X MR
NA	0.15	0.30	0.45	0.80	0.90	0.90	0.14	0.10	0.28	0.10	0.38	0.50	0.70
WD (mm)	20.00	15.80	3.00	1.00	1.00	1.50	13.00	25.00	8.00	16.70	6.00	3.60	2.00
FOV[1] (µm)	3378 x 2826	1689 x 1413	845 x 707	338 x 283	169 x 141	113 x 94	3378 x 2826	1689 x 1413	1689 x 1413	845 x 707	845 x 707	338 x 283	169 x 141
Spatial sampling[2] (µm)	1.38	0.69	0.34	0.13	0.07	0.05	1.38	0.69	0.69	0.34	0.34	0.13	0.07
Optical resolution[3] (µm)	0.94	0.47	0.31	0.18	0.16	0.16	1.00	1.40	0.50	1.40	0.37	0.28	0.20
Measurement noise[4] (nm)	115	30	8	4	3	2	PSI/ePSI 0.1 nm (0.01 nm with PZT); CSI 1 nm						
Maximum slope[5] (º)	9	17	27	53	64	64	8	6	16	6	22	30	44

System specifications

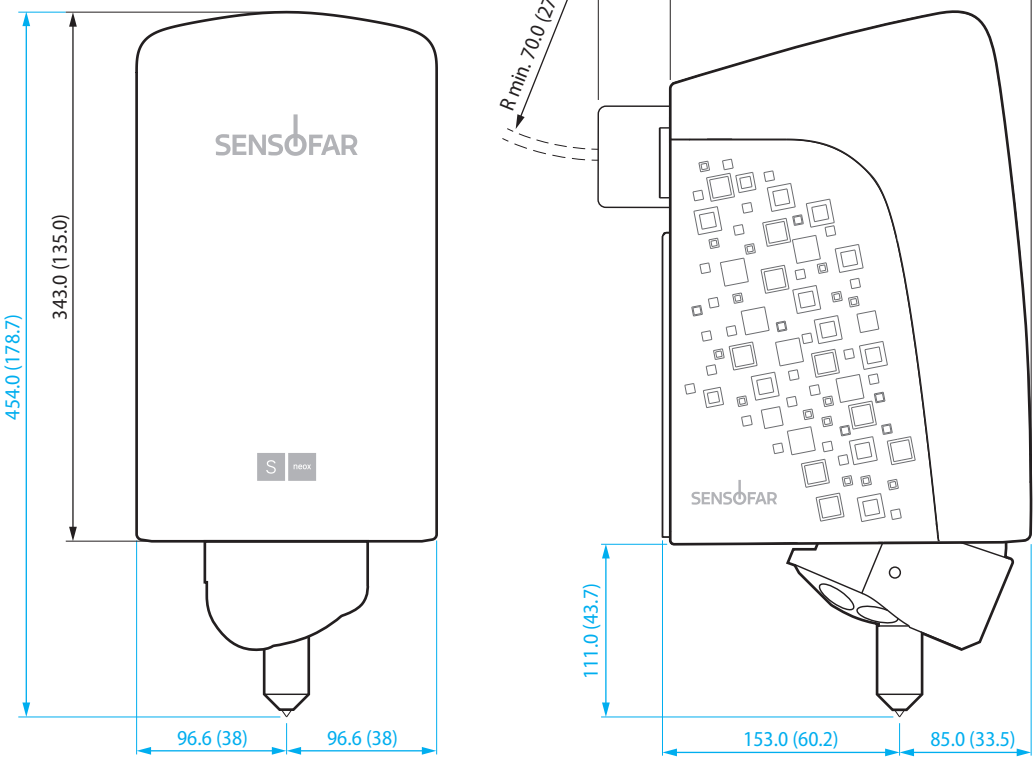
Measuring principle	Confocal, PSI, ePSI, CSI, Ai Focus Variation and Thin Film
Measurement types	Image, 3D, 3D thickness, profile and coordinates
Camera	5 Mpx: 2448x2048 px (60 fps)
Confocal frame rate	60 fps (5 Mpx); 180 fps (1.2 Mpx)
Vertical scan range coarse	Linear stage: 40 mm range; 5 nm resolution
Vertical scan range fine	Piezoelectric scanner with capacitive sensor: 200 µm range; 1.25 nm resolution
Max. Z measuring range	PSI 20 µm, ePSI 10 mm, CSI 10 mm; Confocal & Ai Focus Variation 34 mm
LED light sources	Red (630 nm); green (530 nm); blue (460 nm) and white (575 nm; center)
Nosepiece	6 positions fully motorized

Sample reflectivity	0.05 % to 100%
Advanced Software Analysis	Inc: SensoVIEW; Op: SensoPRO, SensoMAP
Communication protocol	DLL; XML (optional)
Computer	Latest INTEL processor
Operating system	Microsoft Windows 10®, 64 bit
Cable Length	3 m (5 m, 10 m optional)
Environment	Temperature 10 ºC to 35 ºC; Humidity <80 % RH; Altitude <2000 m

Dimensions

mm (inch)

Weight[6]: 8.3 Kg (18.4 lbs)



Head dimensions

Working distances

SPECIFICATIONS

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, half of the diffraction limit according to the Rayleigh criterion. Spatial sampling could limit the optical resolution for interferometric objectives. Values for blue LED. **4** Measurement noise measured as the difference between two consecutive measures on a calibration mirror placed perpendicular to the optical axis. For interferometry objectives, PSI, 10 phase averages. The 0.01 nm are achieved with Piezo stage scanner and temperature-controlled room. Values for green LED (white LED for CSI). Values obtained in a VC-E vibration environment. **5** On smooth surfaces. Up to 86° on rough surfaces. **6** This is the weight of the sensor head with one objective in the turret.

Highest flexibility compatible with Cleanroom

4x4

4-in-1 technologies
Ai Focus Variation | Confocal Interferometry | SR

4 LEDs
Red I Green I Blue I White

The **S neox Cleanroom** is a technological milestone without precedent in optical metrology. This version of the S neox has been carefully engineered to overcome the strict test to be ISO Class 1 and ESD compatible. The S neox Cleanroom has all the versatility that comes with an S neox and matches with the production environments typical of medical devices, microfluidics, and semiconductors industries.

AUTOMATIC 3D

0.01 nm
Measurement noise

Fraunhofer IPA
TESTED® DEVICE
SENSOFAR METROLOGY
SNEOX 090 CR
Report No. SE 2110-1269

Objective lenses

	Brightfield						Interferometry						
MAG	5X BF	10X BF	20X BF	50X BF	100X BF	150X EPI	5X MC	10X MC	10X MR	20X MC	20X MR	50X MR	100X MR
NA	0.15	0.30	0.45	0.80	0.90	0.90	0.14	0.10	0.28	0.10	0.38	0.50	0.70
WD (mm)	20.00	15.80	3.00	1.00	1.00	1.50	13.00	25.00	8.00	16.70	6.00	3.60	2.00
FOV[1] (µm)	3378 x 2826	1689 x 1413	845 x 707	338 x 283	169 x 141	113 x 94	3378 x 2826	1689 x 1413	1689 x 1413	845 x 707	845 x 707	338 x 283	169 x 141
Spatial sampling[2] (µm)	1.38	0.69	0.34	0.13	0.07	0.05	1.38	0.69	0.69	0.34	0.34	0.13	0.07
Optical resolution[3] (µm)	0.94	0.47	0.31	0.18	0.16	0.16	1.00	1.40	0.50	1.40	0.37	0.28	0.20
Measurement noise[4] (nm)	115	30	8	4	3	2	PSI/ePSI 0.1 nm (0.01 nm with PZT); CSI 1 nm						
Maximum slope[5] (º)	9	17	27	53	64	64	8	6	16	6	22	30	44

System specifications

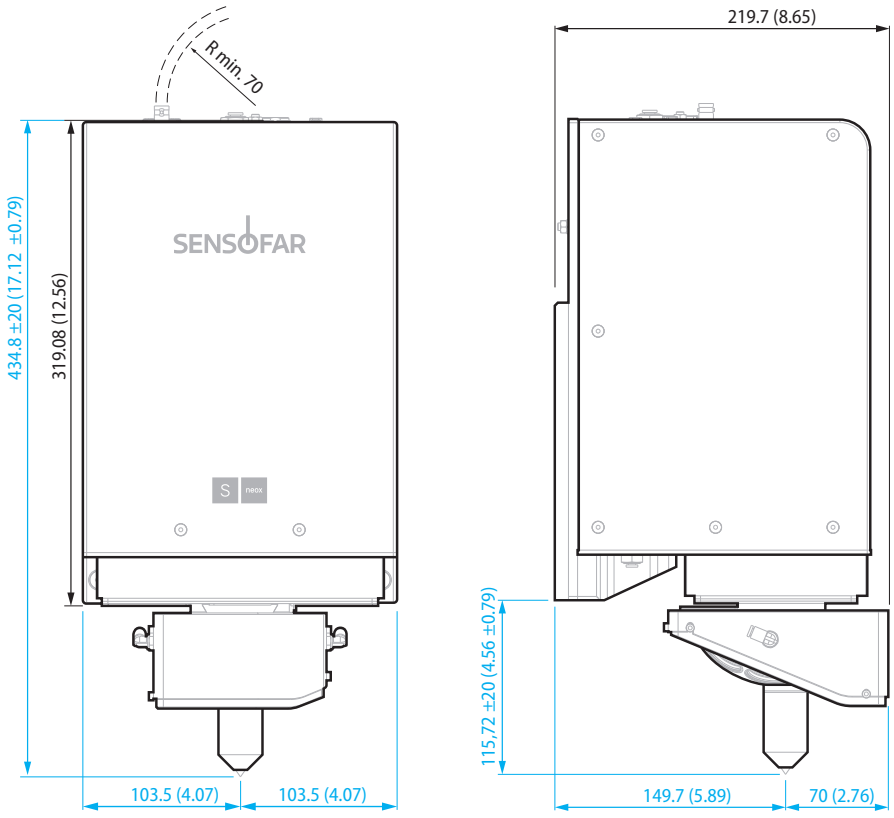
Measuring principle	Confocal, PSI, ePSI, CSI, Ai Focus Variation and Thin Film
Measurement types	Image, 3D, 3D thickness, profile and coordinates
Camera	5Mpx: 2448x2048 pixels (60 fps)
Confocal frame rate	60 fps (5Mpx); 180 fps (1.2 Mpx)
Vertical scan range coarse	Linear stage: 40 mm range; 5 nm resolution
Vertical scan range fine	Piezoelectric scanner with capacitive sensor: 200 µm range; 1.25 nm resolution
Max. Z measuring range	PSI 20 µm, ePSI 10 mm, CSI 10 mm; Confocal & Ai Focus Variation 34 mm
LED light sources	Red (630 nm); green (530 nm); blue (460 nm) and white (580 nm; center)
Nosepiece	6 positions fully motorized

Sample reflectivity	0.05 % to 100%
Advanced Software Analysis	Inc: SensoVIEW; Op: SensoPRO, SensoMAP
Communication protocol	DLL; XML (optional)
Computer	Latest INTEL processor
Operating system	Microsoft Windows 10®, 64 bit
Cable Length	3 m (5 m, 10 m optional)
Environment	Temperature 10 ºC to 35 ºC; Humidity <80 % RH; Altitude <2000 m

Dimensions

mm (inch)

Weight[6]: 8.3 Kg (18.4 lbs)



Head dimensions

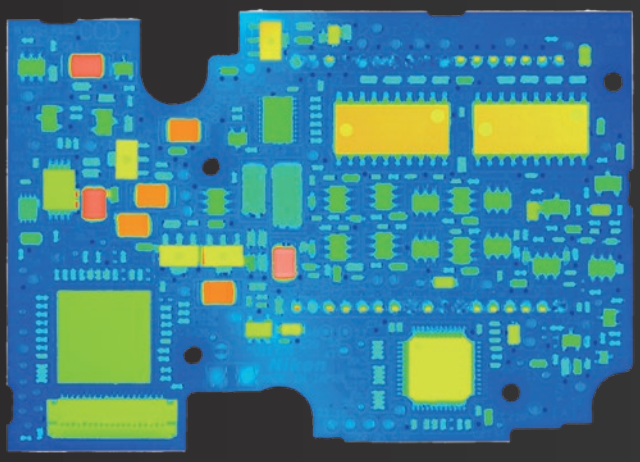
Working distances

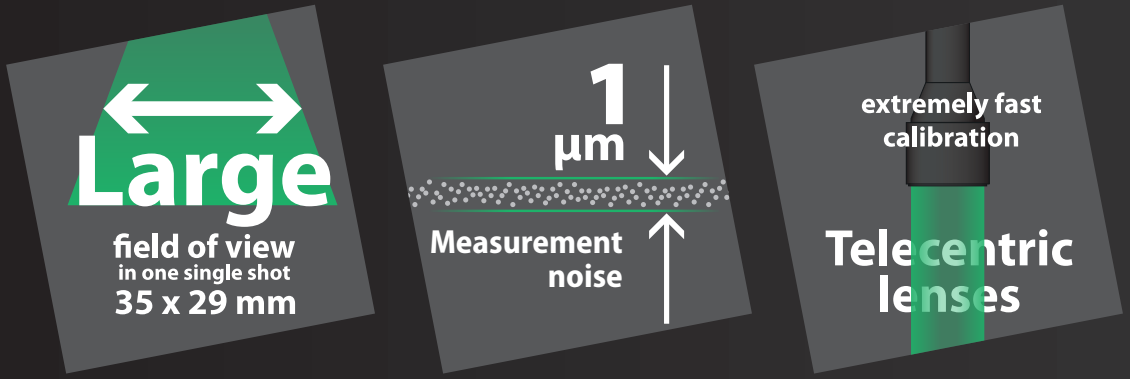
SPECIFICATIONS

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, half of the diffraction limit according to the Rayleigh criterion. Spatial sampling could limit the optical resolution for interferometric objectives. Values for blue LED. **4** Measurement noise measured as the difference between two consecutive measures on a calibration mirror placed perpendicular to the optical axis. For interferometry objectives, PSI, 10 phase averages. The 0.01 nm are achieved with Piezo stage scanner and temperature-controlled room. Values for green LED (white LED for CSI). Values obtained in a VC-E vibration environment. **5** On smooth surfaces. Up to 86° on rough surfaces. **6** This is the weight of the sensor head with one objective in the turret.

Single shot areal imaging

The S wide provides all the benefits of a digital microscope integrated into a high resolution measuring instrument. With only one shot, it acquires 35 x 29 mm of XY area and up to 40 mm of depth without any Z movement. The combination of proprietary Fringe Projection technology with telecentric lenses yields an excellent performance and 1 µm measurement noise.





System specifications

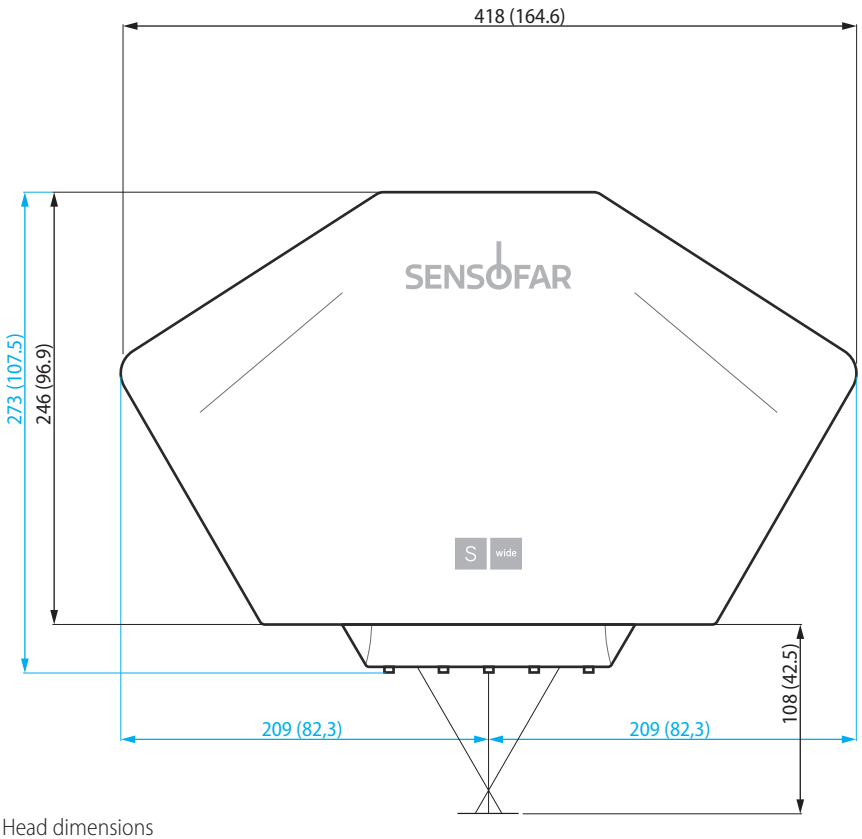
Measuring Principle	Fringe Projection (Gray code & Slit, Gray code & Phase Shift)
Observation types	Bi-telecentric lens with 0.243X magnification and 0.015 NA
Color camera	5Mpx: 2448 x 2048 pixels (60 fps)
Vertical measuring range	10 mm (up to 40 mm) without z range movement
Ring light illumination	White
LED light sources	Green (530 nm) and blue (460 nm)
WD (mm)	80
User management rights	Administrator, advanced operator, operator
Advanced software analysis	Included: SensoVIEW; Optional: SensoPRO, SensoMAP, 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
Environment	Temperature 10 ºC to 35 ºC; Humidity

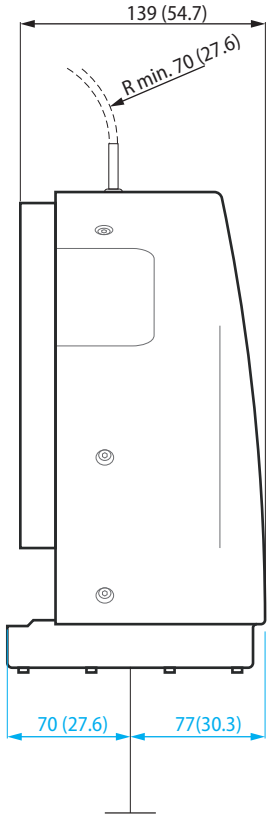
	Default	Zoom [1]		
Magnifications	1x	2x	4x	6x
Effective magnification [2]	11X	22X	44X	66X
Field of view (mm)	34.8 x 29.1	17.4 x 14.5	8.7 x 7.3	5.8 x 4.8
Stitching range full resolution (mm) [3]	348 x 291	174 x 145	87 x 73	58 x 48
Stitching maximum range (mm) [4]	1380 x 1154	346 x 289	173 x 145	115 x 96

Accuracy	Scanner U , σ
Step height	U = 2.5 µm σ = 0.05 µm
Areal roughness (Sa)	U = 1 µm σ = 0.01 µm
Profile roughness (Sa)	U = 1 µm σ = 0.05 µm
Width measurement [5]	U = 5 µm σ = 1 µm

Dimensions mm (inch)

Weight: 8 Kg (18 lbs)





Head dimensions

Working distances

SPECIFICATIONS

1 The zoom available is a digital zoom. **2** Magnifications with a 27 inch monitor. **3** 5 Mpx and overlap of 10%. **4** SD acquisition for 1X and HD for 2X, 4X and 6X with an overlap of 10%.
5 Values are assessed through repeated measurements on a reference standard performed under environmentally controlled conditions in accordance with Sensofar's metrology protocols.

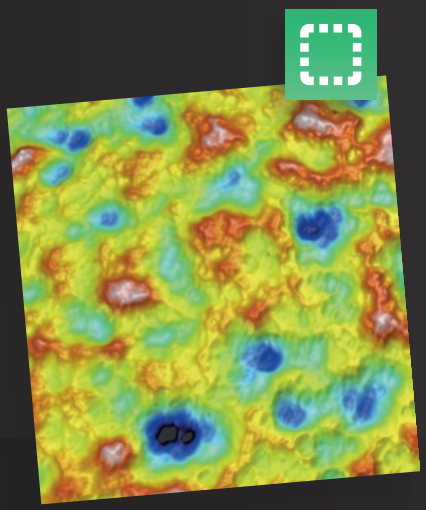
Sensofar tech

Fringe projection

Fringe projection is ideal for large area measurements, providing high vertical accuracy and repeatability with low measurement noise. Highest about the technology include: true single shot acquisition, very large areas with high vertical accuracy and repeatability ($\sigma = 0.01$ µm), and measurement noise down to 1 µm, real image color and no Z-scanning.

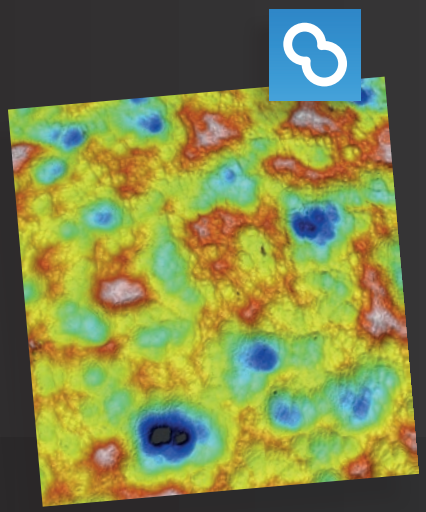
Ai Focus Variation

Active illumination 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. It has been improved with the use of active illumination to get more reliable focus location even on optically smooth surfaces. Highlights of the technology include high slope surfaces (up to 86°), highest speed (up to 3mm/s) and large vertical range measurements.



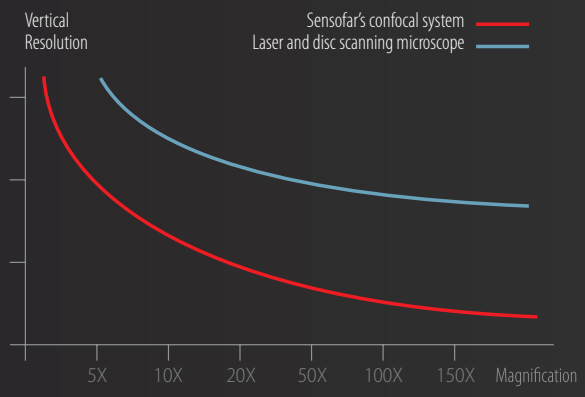
Confocal

Confocal profilers have been developed to measure the surface height of smooth to very rough surfaces. Confocal profiling provides the highest lateral resolution, up to 0.15 µm line & space, with spatial sampling can be reduced to 0.01 µm, which is ideal for critical dimension measurements. High NA (0.95) and high 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.



No moving parts

The confocal scanning technique implemented in Sensofar's systems is a Microdisplay Scan Confocal Microscope (ISO 25178-607). The microdisplay creates a rapidly switching device with no moving parts, making data acquisition fast, reliable and accurate. Due to this and the associated algorithms, Sensofar's confocal technique yields a class-leading vertical resolution, better than other confocal approaches and even better than laser scanning confocal systems.



nologies

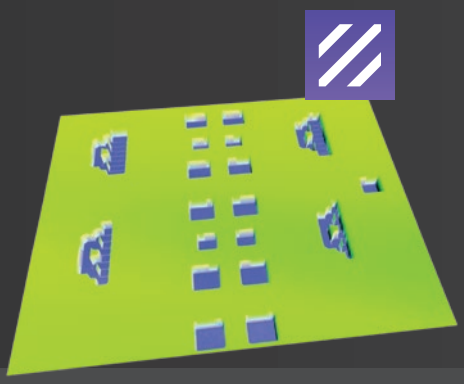
Interferometry

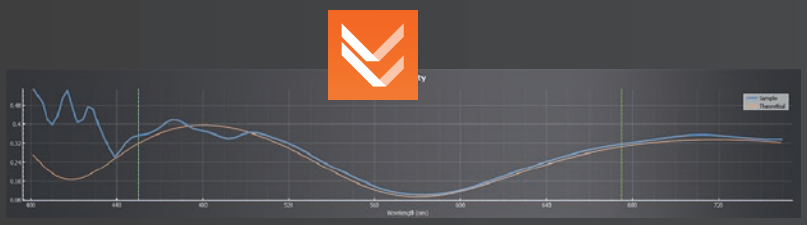
PSI **Phase Shift Interferometry** has been developed to measure the surface height of very smooth and continuous surfaces with sub-Angstrom resolution, for all numerical apertures (NA). Very low magnifications (2.5X) can be employed to measure large fields of view with the same height resolution.

CSI **Coherence Scanning Interferometry** uses white light to scan the surface height of smooth to moderately rough surfaces, achieving 1 nm height resolution at any magnification.

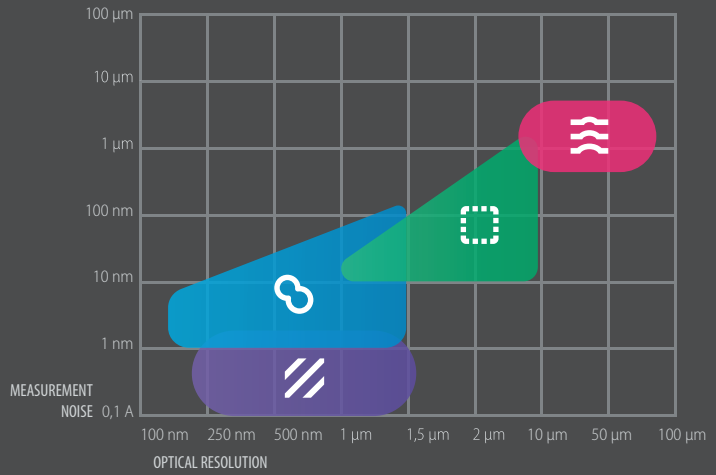
Spectroscopic Reflectometry

Thin film measurement technique measures the thickness of optically transparent layers quickly, accurately, non-destructively and requires no sample preparation. The system acquires the reflectance spectrum of the sample in the visible range, and is compared with a simulated spectra calculated by the software, with layer thickness modification until the best fit is found. Transparent films from 50 nm to 1.5 µm can be measured in less than one second. Sample evaluation spot diameter is dependent on the objective magnification which can be as low as 0.5 µm and up to 40 µm.





Technology performance comparisons

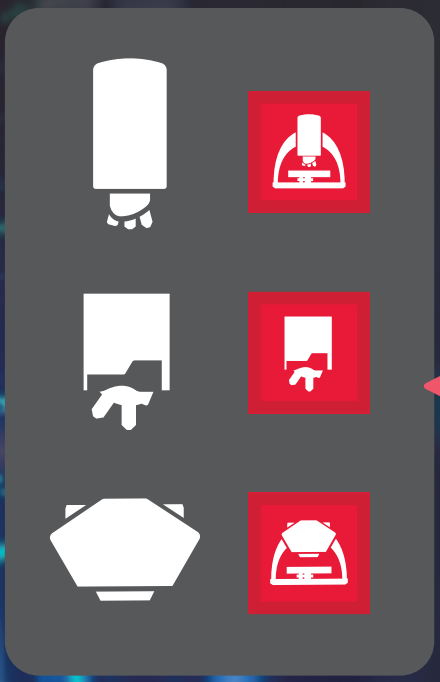


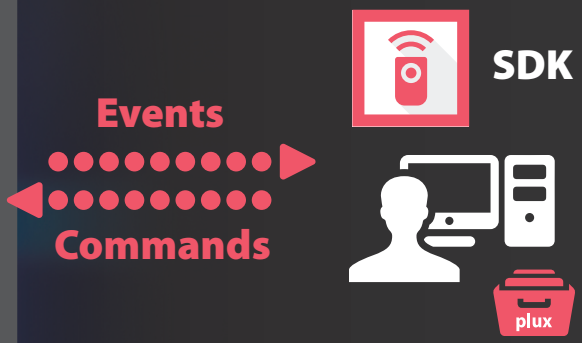
	Ai FOCUS VARIATION	CONFOCAL	INTERFEROMETRY
Rough samples	★★★	★★★	★
Smooth samples	★	★★	★★★
Micro-scale features	★★	★★★	★★★
Nano-scale features		★★	★★★
High local slopes	★★★	★★	★
Thickness		★★★	★★★

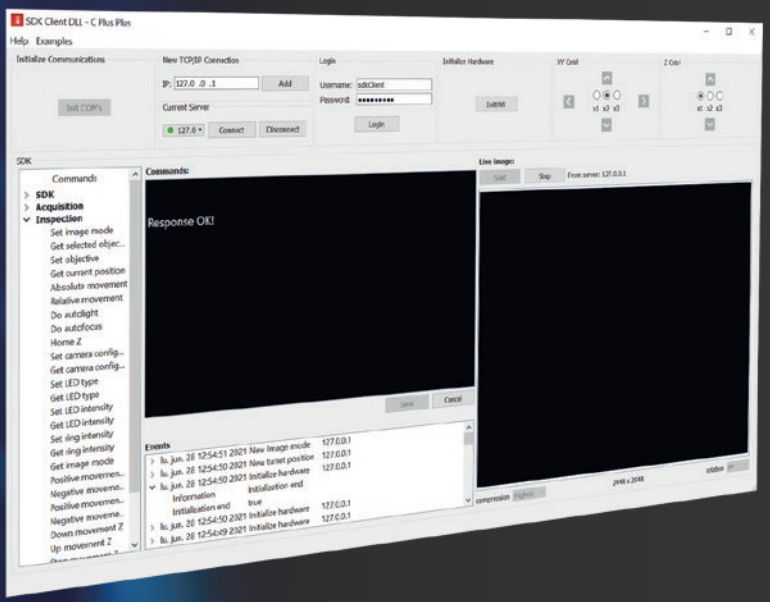
SDK

Streamlined sensor integration

We provide an SDK (Software Development Kit), a collection of tools for developing custom applications to manage sensors. This SDK facilitates the integration of our sensors with additional hardware and the design of a tailored user interface.

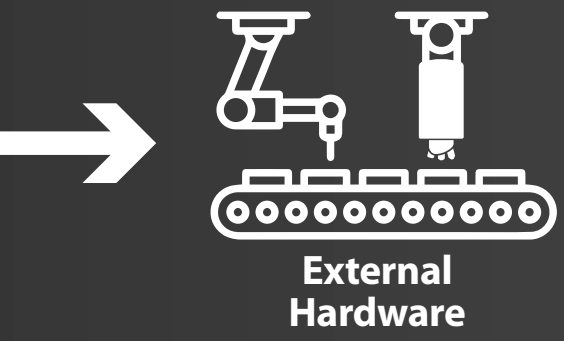






Interface of Communication	Language	Operating system
Dll library	**C++, C#**	**Windows® 64bits**

The available communication interface simplifies sensor integration, and it is compatible with any programming language that utilizes libraries.



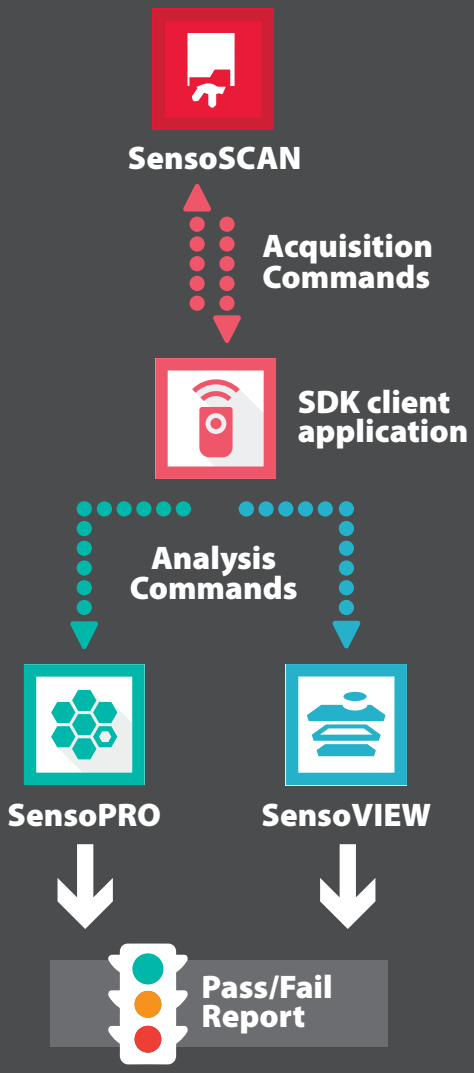
SDK client application

The SDK includes an SDK Client, a demonstration GUI that helps programmers understand the functionality of various commands and serves as a ready-made template for developing their own interface.

INTEGRABLE HEADS

Full automation of the characterization process

Data acquisition is managed using commands from the SDK, which also dictates where the raw data will be sent. Two distinct analysis tools are available to meet various requirements and enable complete automation of the entire characterization process.



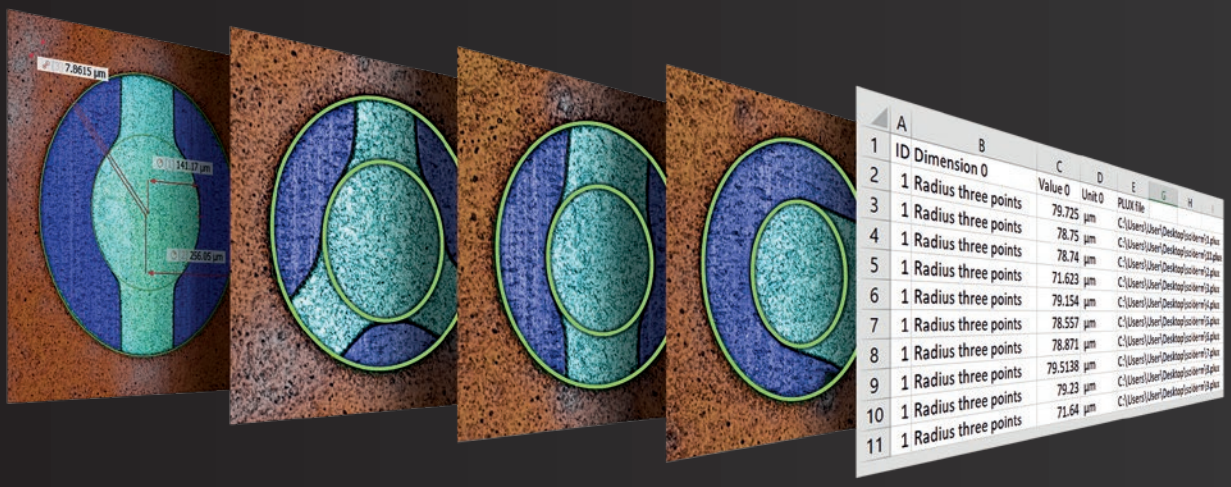
SensoPRO is a plugin-based software that automatically identifies key features and generates a pass/fail report.

SensoVIEW is a versatile software suitable for a wide array of analysis tasks, such as data preparation, surface characterization, and critical dimension measurement. It also supports automated analysis using templates.

SensoVIEW

Automatic analysis

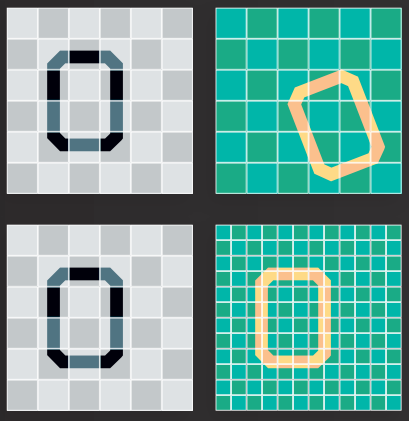
SensoVIEW is the ideal analysis software for a broad range of tasks. It includes a comprehensive suite of tools for preliminary examination and analysis of 3D or 2D measurements, allowing for roughness or volume calculations and gauging critical dimensions.

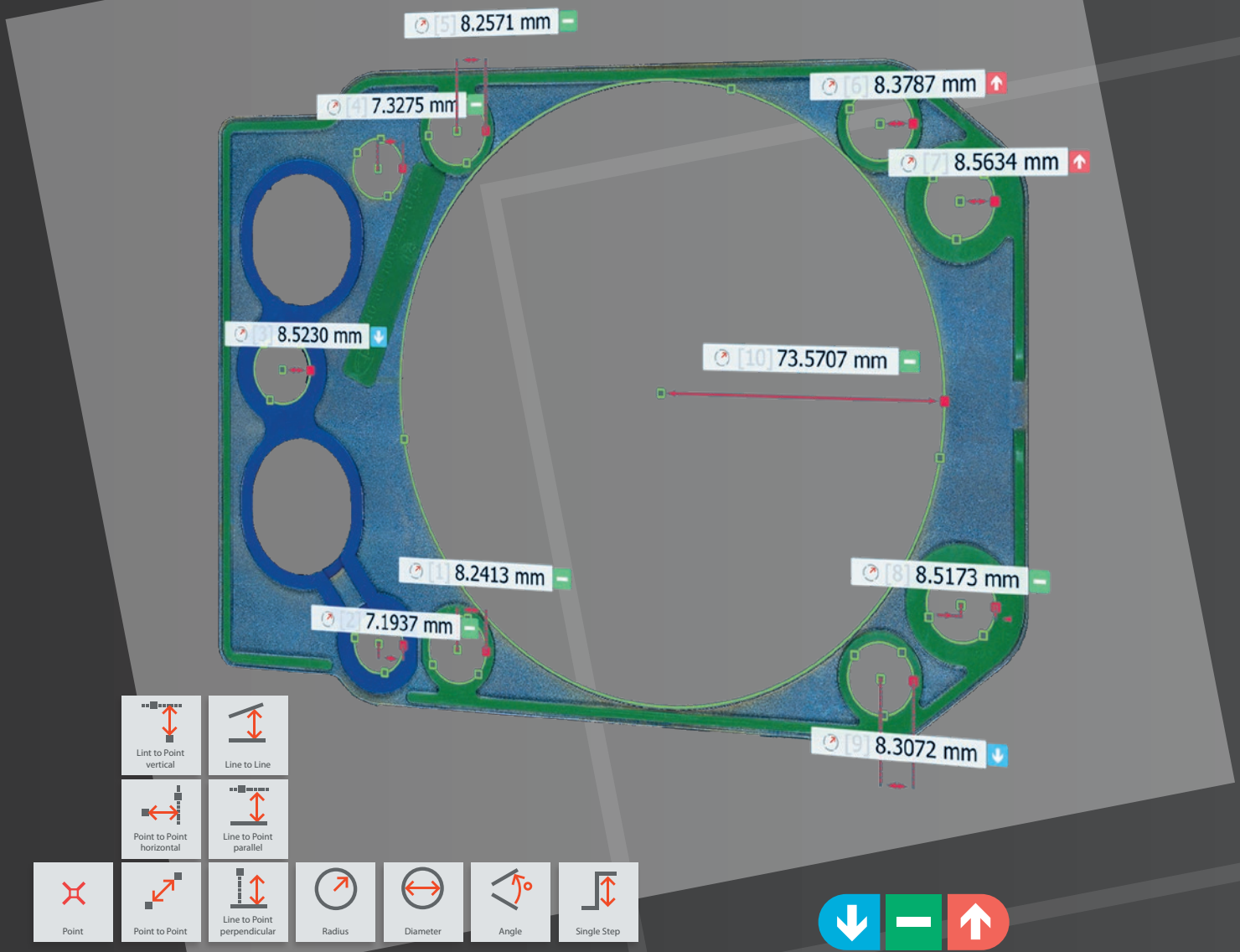


	A	B	C	D	E	G	H
1	ID Dimension 0		Value 0	Unit 0	PLUX file		
2	1	Radius three points	79.725	µm	C:\Users\User\Desktop\pcdem19.plux		
3	1	Radius three points	78.75	µm	C:\Users\User\Desktop\pcdem20.plux		
4	1	Radius three points	78.74	µm	C:\Users\User\Desktop\pcdem21.plux		
5	1	Radius three points	71.623	µm	C:\Users\User\Desktop\pcdem22.plux		
6	1	Radius three points	79.154	µm	C:\Users\User\Desktop\pcdem23.plux		
7	1	Radius three points	78.557	µm	C:\Users\User\Desktop\pcdem24.plux		
8	1	Radius three points	78.871	µm	C:\Users\User\Desktop\pcdem25.plux		
9	1	Radius three points	79.5138	µm	C:\Users\User\Desktop\pcdem26.plux		
10	1	Radius three points	79.23	µm	C:\Users\User\Desktop\pcdem27.plux		
11	1	Radius three points	71.64	µm	C:\Users\User\Desktop\pcdem28.plux		

Analysis templates

Templates can be created from analysis processes and subsequently utilized for other measurements. The template will contain all the performed filters, critical dimensions, tolerances, and export settings. SensoVIEW's templates also have pattern recognition algorithms to correct any possible shift or rotation between the template and the topography.





Critical dimension tools

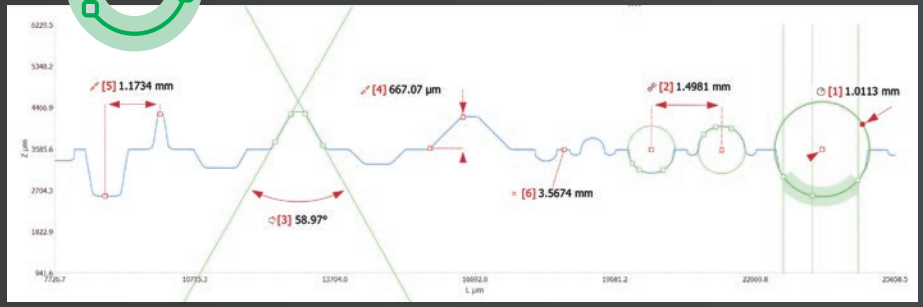
SensoVIEW supplies a complete assortment of tools ready to obtain critical dimensions (radiuses, angles, diameters, step heights, and perpendicular & parallel distances).

Adding tolerances

Tolerances are available to provide a complete dimensional characterization for both contour and profiles.

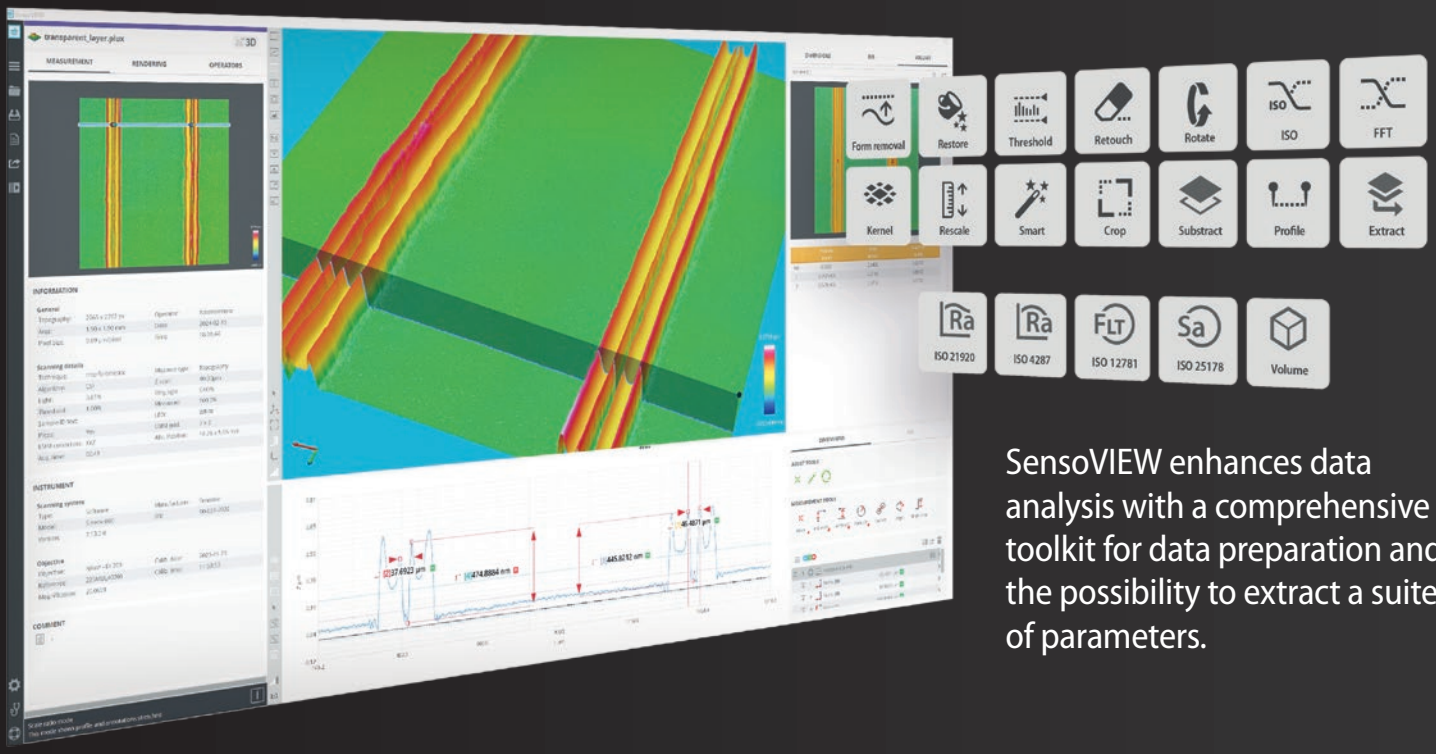
Edge detection features

The critical dimensions tools have an auto-adjustment feature. With the click of a button, the user can fit lines, circles, or points to the desired area.



SensoVIEW

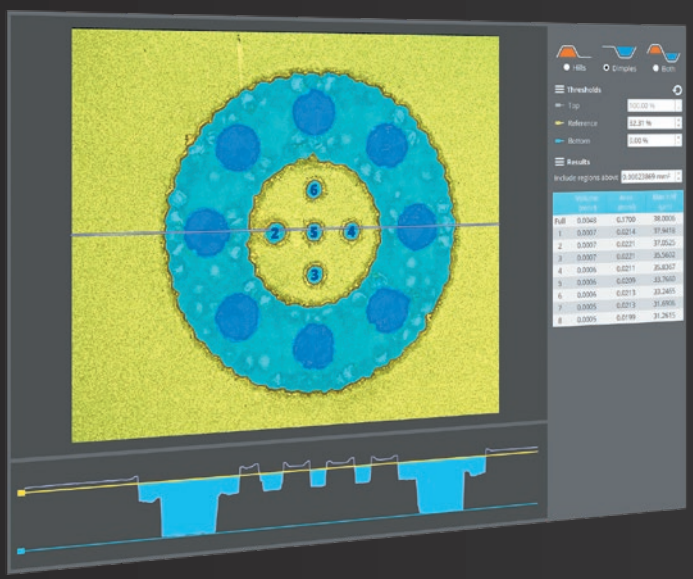
Broadening analysis horizons



SensoVIEW enhances data analysis with a comprehensive toolkit for data preparation and the possibility to extract a suite of parameters.

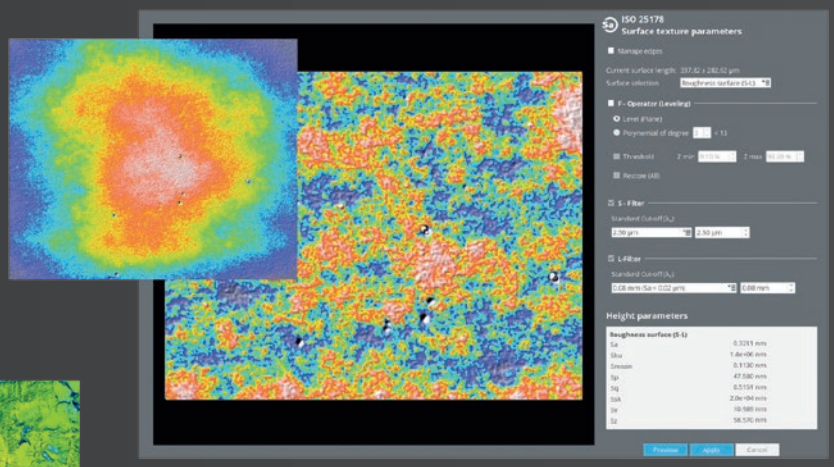
Volume geometries

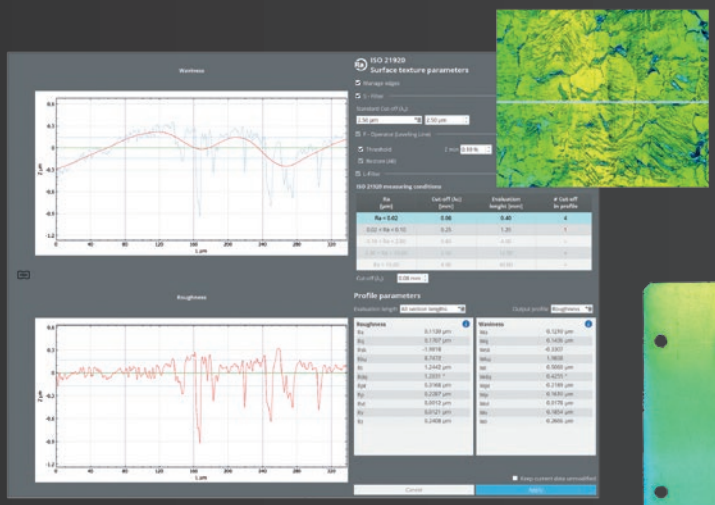
The volume operator stands out by allowing separate volume calculations for different regions within the topography. Smart segmentation algorithms utilize thresholds that can be adjusted to predefined values or carefully refined through manual tuning.

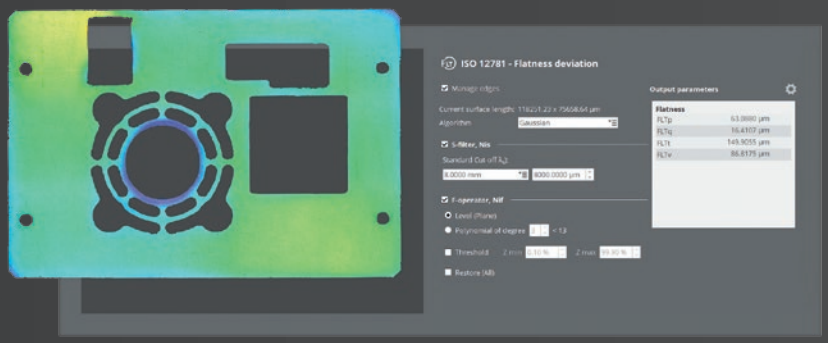


ISO 21920, 25178 and 12781 calculations

Dedicated operators are available to simplify the calculation of surface texture parameters following ISO standards: ISO 21920 for roughness on profiles, ISO 25178 for roughness on areas, and ISO 12781 for flatness.





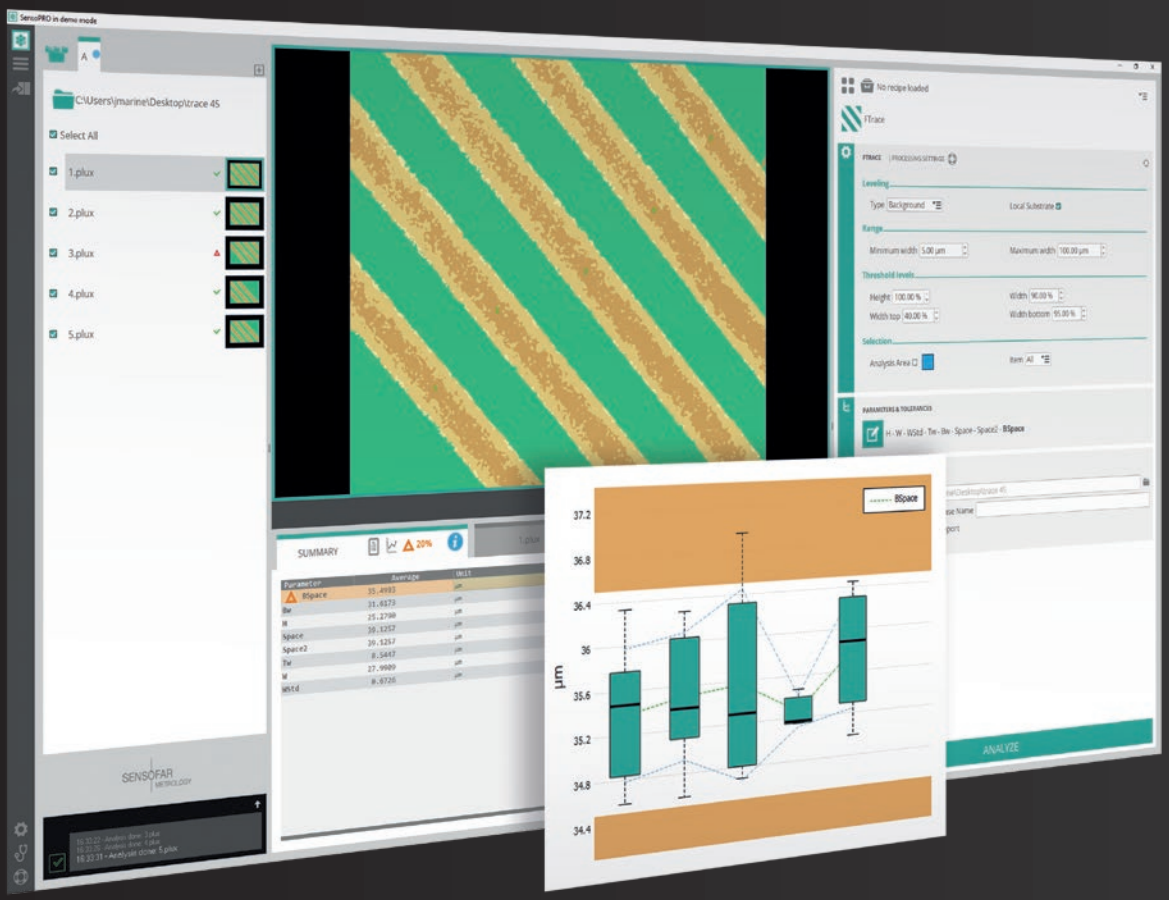


Customizable reports

SensoVIEW presents flexible reporting to obtain clear and well-structured documents displaying the acquisition information, multiple data visualizations, and all the analyses performed.

SensoPRO

Rapid Quality Control



Guide tool for the QC manager

SensoPRO additionally includes a guiding assistant that simplifies establishing tolerances and highlights the parameters that can distinguish between different data sets for enhanced production control.

Automatic recognition of the features of interest

Analysis of a massive datasets (>100 files)

1s processing time per file

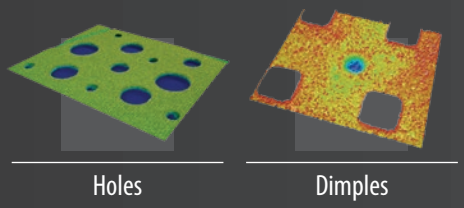
Configurable processing settings and parameters

Command line available for external SensoPRO integration

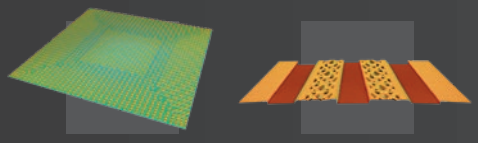
Pass/Fail reports based on predefined tolerances

Generic plugins

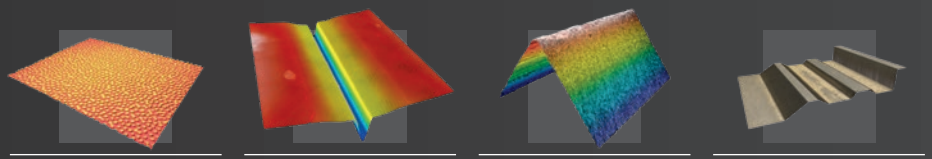
An extensive collection of general plugins addresses common structures and shapes encountered in surface characterization, offering efficient solutions for surface analysis.



Holes | Dimples



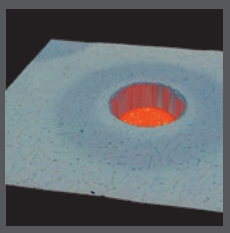
Bumps | Traces



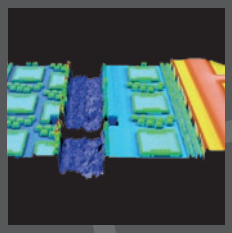
Surface charact. | Trenches & Grooves | Edges | Step height

Custom plugins

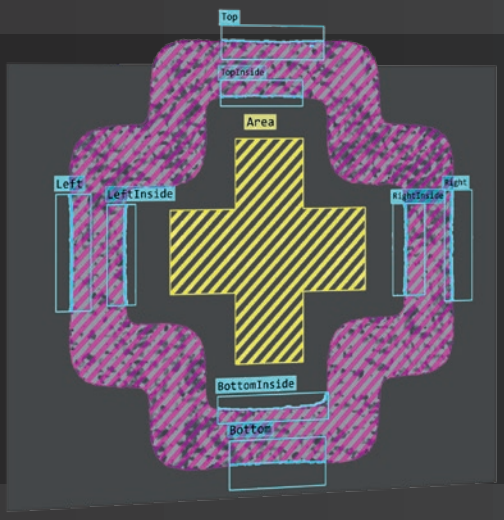
What sets SensoPRO apart is its ability to fulfill custom requirements. With over 60 plugins developed, SensoPRO has covered the distinctive needs of applications that demand complete automated analysis. Have a look at the following examples:



The Color Concentricity plugin assesses concentricity utilizing both color and height information.



The Wave Groove Line plugin set was designed to acurately define distances between specific lines, disregarding features on the top of the chip.

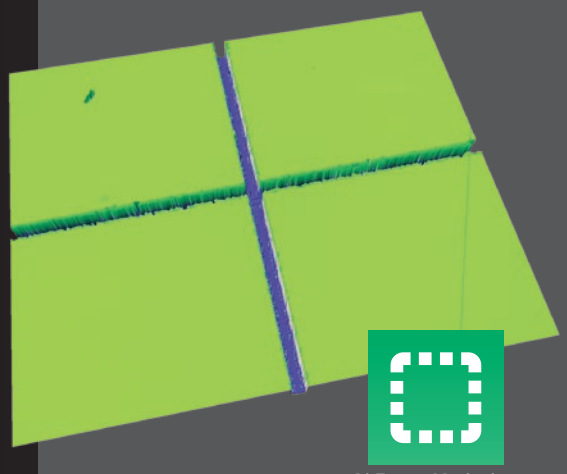


PROcanvas

Draw your own analysis recipe – in a plugin style

With PROcanvas, you control every step: detect, measure, calculate, and automate Turn complex analyses into a personalized, repeatable workflow that fits your needs.

Applications

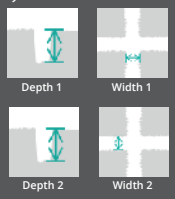


Ai Focus Variation

SEMICONDUCTORS

3D Cross kerf

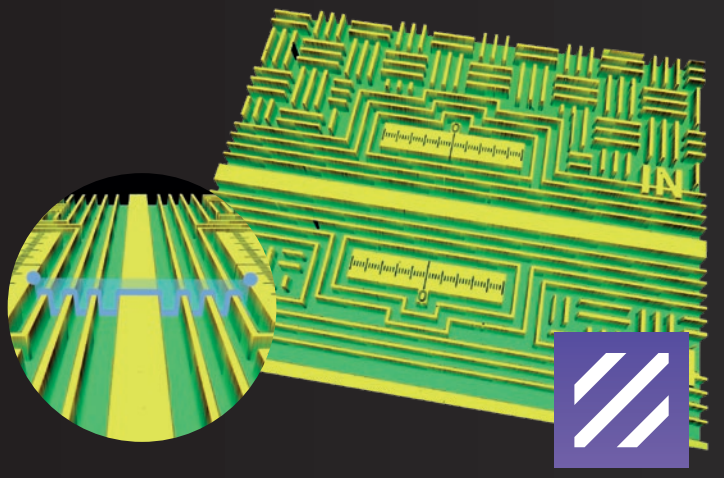
Chip segmentation has two main dimensions to characterize: height, to ensure that the bottom is not damaged, and width, which is a measure of the quality of the cut. The high aspect ratio of those dimensions is challenging and only Ai Focus Variation can resolve this application.



Cross kerf

SensoPRO **Plugin**

This plugin not only detects the cross and extracts the desired parameters but also levels the surface to make sure that an existing angle in the wafer doesn't affect the extracted data.



Interferometry (CSI)

SEMICONDUCTORS

Etched circuit

After an etching process, it is typical to evaluate the height of the resulting features. To ensure the best accuracy on the measurement, interferometry is used.

Step height

SensoPRO **Plugin**

Immediate recognition of the two levels of height regardless of the pattern analyzed.

SEMICONDUCTORS

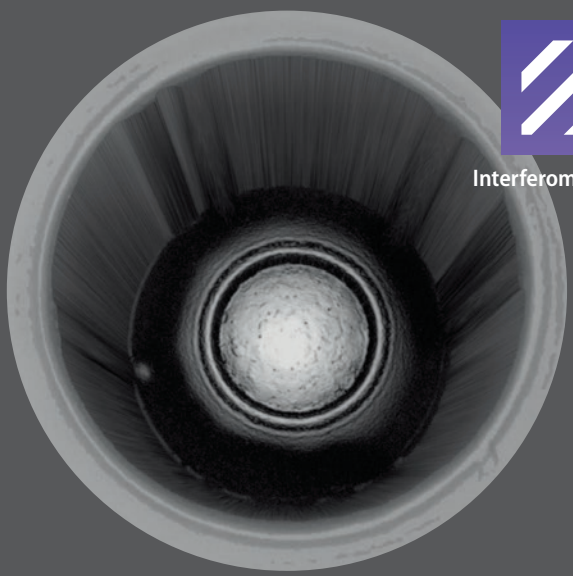
Passivation layer hole

This passivated layer hole will be one connection point of the chip. Its dimensions should comply tight tolerances to ensure a good wire bond.

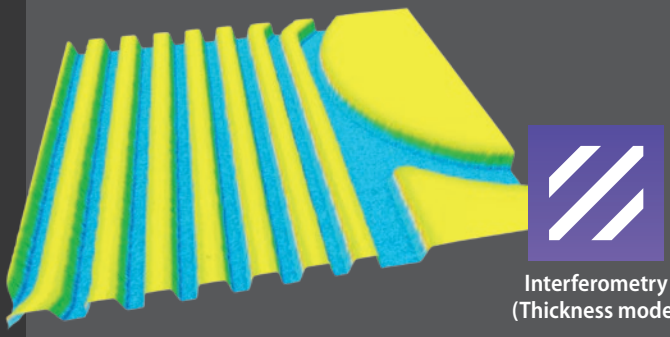
Hole

SensoPRO **Plugin**

The Hole plugin is useful in this application since it can measure holes from 50 µm to 2 mm in diameter.



Interferometry (CSI)



Interferometry
(Thickness mode)

PCB

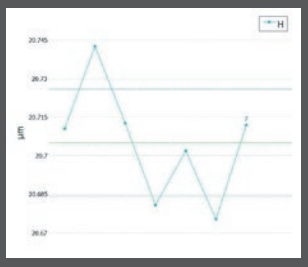
Copper trace thickness under dry film

In the electroplating process, there is an area in which copper is deposited and another one that is covered in a resin. Traditionally, a part of the PCB panel was cut through to know the amount of copper deposited during the electroplating process. This can be avoided by using our Interferometry technique which can measure through optically transparent thick ¬films. Interferometry can image the substrate and the layer so the height of copper can be characterized, leading to a better yield of the manufacturing process.

FTrace

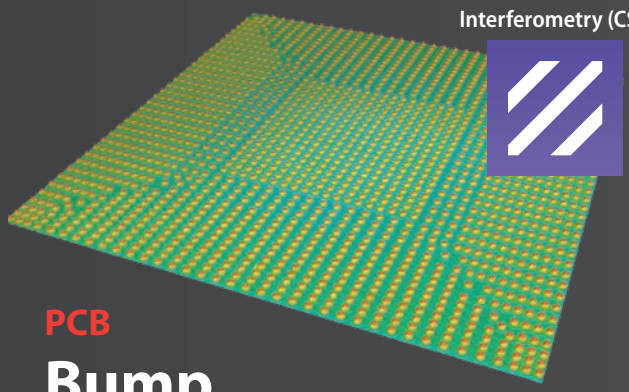
SensoPRO **Plugin**

It automatically detects traces with different directions. All the plugins in SensoPRO have the possibility to see the tendency of values per each parameter.



Sq values of background

INTEGRABLE HEADS



Interferometry (CSI)

PCB

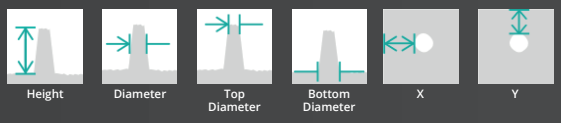
Bump characterization

These structures are the base of the pins that the chip will have. Their position, height and diameter will determine the bump-pin union.

Bumps

SensoPRO **Plugin**

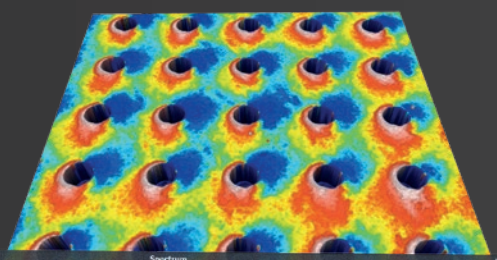
The Bumps plugin can analyze up to 14.500 bumps.



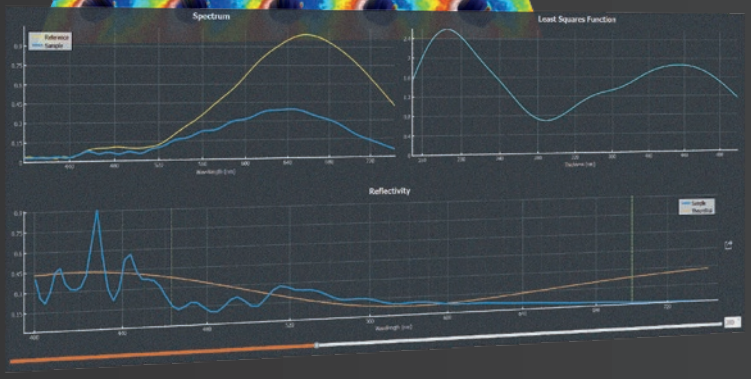
SEMICONDUCTORS

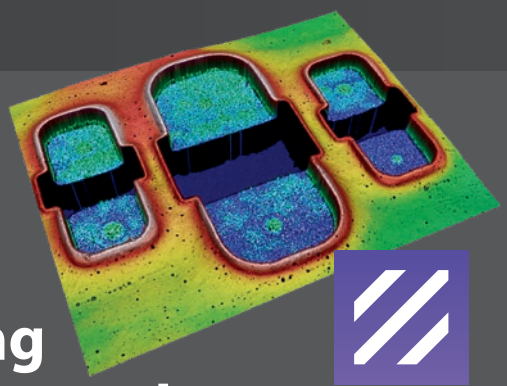
Thin film inside holes

The S neox exceeds the applications for Spectroscopic Reflectometry since it can measure inside holes with very small diameters using a spot size down to 3 µm!



Spectroscopic Reflectometry





PCB

Welding opening pad

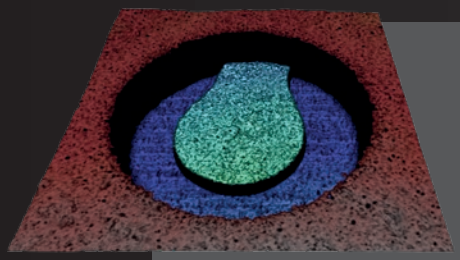
Interferometry (CSI)

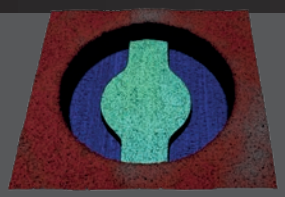
Knowing the most common disposition of pads, Sensofar has developed a specific plugin to recognize the individual pads or in any given pattern.

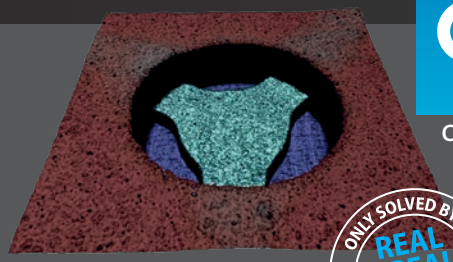
Pads

SensoPRO **Plugin**

Applications







Confocal

ONLY SOLVED BY A REAL AREAL CONFOCAL

PCB

Solder mask welding

Solder Mask layers are usually applied to printed circuit boards (PCB) as protective layers. Openings for connections can have multiple number of connectors. The Solder mask plugin can easily recognize the different configurations and analyze the key parameters.

Solder mask

SensoPRO **Plugin**

H | Orientation | X | Y

PCB

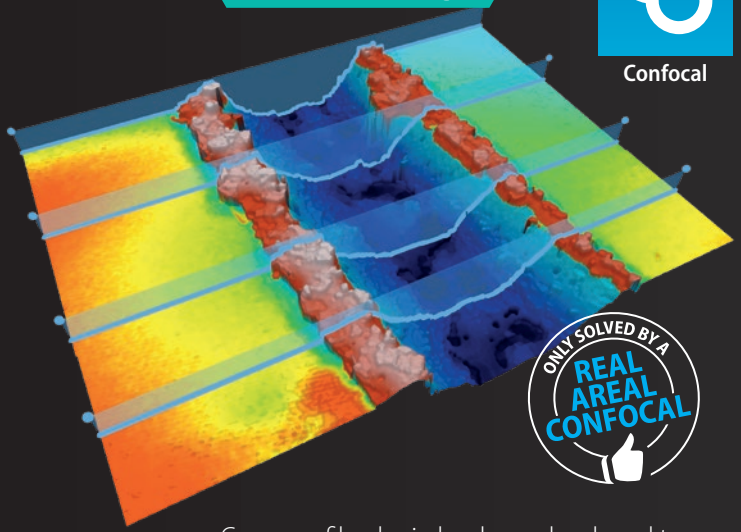
Laser groove

Laser cutting is one of the main front-end processes in the semiconductors field. In the case of PCBs, it is used for fabricating vias and channels of communication that need to be characterized (barbs, depth, etc.).

Groove profile

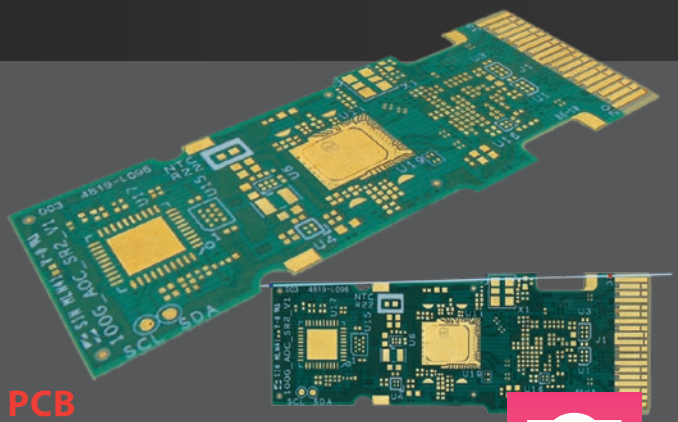
SensoPRO **Plugin**

Confocal



ONLY SOLVED BY A REAL AREAL CONFOCAL

Grove profile plugin has been developed to analyze different structures generated with a laser.



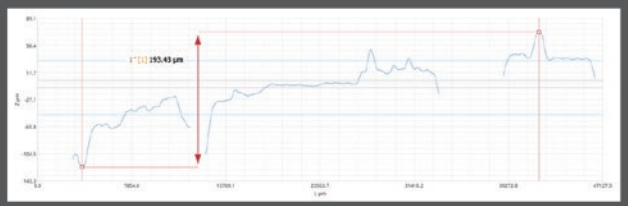
PCB

Packaging compatibility

Fringe Projection

Laser cutting is one of the main front-end processes in the semiconductors field. In the case of PCBs, it is used for fabricating vias and channels of communication that need to be characterized (barbs, depth, etc.).

SensoVIEW

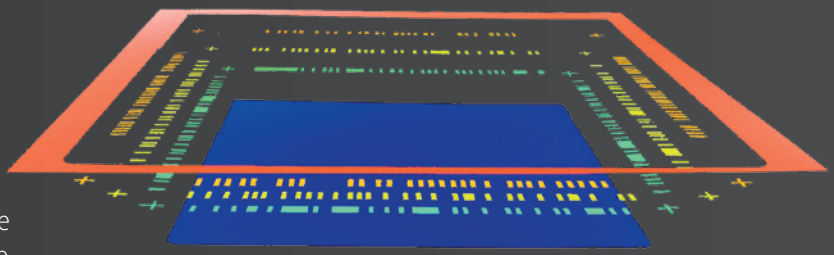


We can see where the highest and lowest points are located because SensoVIEW's profiling options include the possibility to draw profiles with the highest and lowest points included.

IC PACKING

Thermal pad

When there are parts that need an automatic and comprehensive characterization, SensoPRO can combine simultaneously different plugins. In the thermal pad case, the plugging of Surface Texture, Multiple SH and R Hole are combined to analyze the surface of the bottom, the height between the three pins' levels and the dimensions of the rectangular container, respectively.



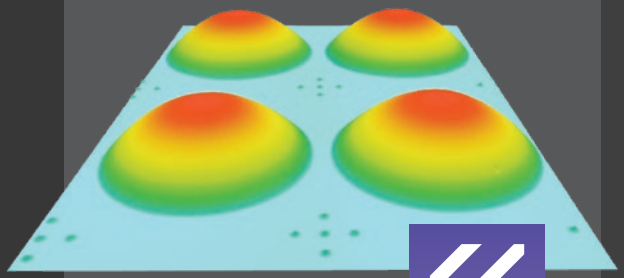
SensoPRO Plugin

Confocal

OPTICS

Microarray of aspheric lenses

Aspherical lenses, distinguished by their lower aberrations, are often used to build compact opto-electrical devices.



Interferometry (CSI)

Aspheric

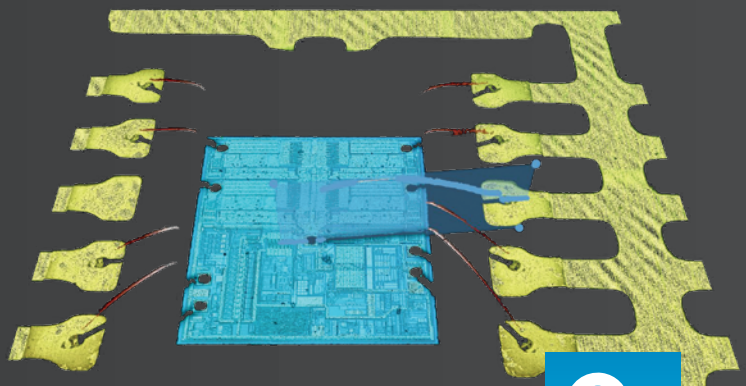
SensoPRO Plugin

The Aspheric plugin calculates critical dimensions, 10 aspheric deformation coefficients and Sa, Sq and Sz roughness parameters.

Spheric

SensoPRO Plugin

The Spheric plugin gives both dimensional parameters and residual roughness.



Confocal

IC PACKING

Wire bonding

Technology always pushes limits. Sensofar wants to be at the forefront. Vanguard technologies reduced the diameter of gold wires down to 30 µm, a significant improvement.

SensoVIEW

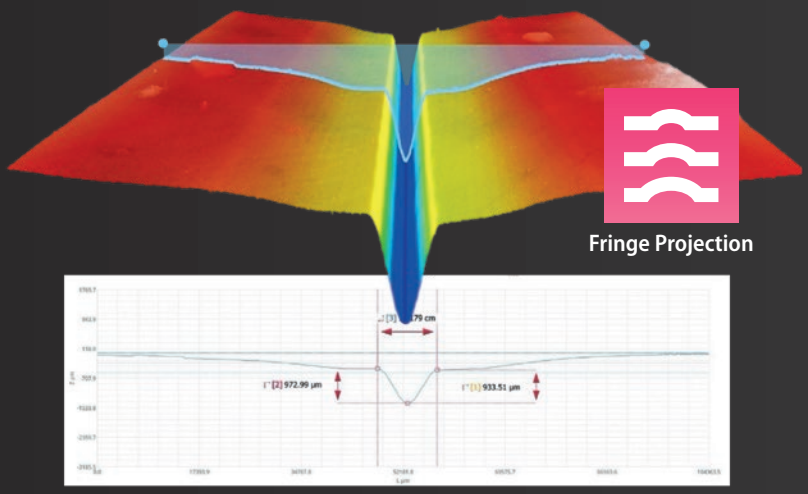
SensoVIEW can create as many profiles as needed and measure critical dimensions. This example shows the height difference between the maximum point of the wire and the chip since that parameter will determine whether or not the cable makes contact with the chip's cover.

Applications

DISPLAY

Foldable smartphone

The latest smartphones and tablets are starting to incorporate flexible screens that can be folded. Our S wide is used by screen manufacturers to characterize the depth and width of the foldable area. In this example, we have used 4×4 stitching.



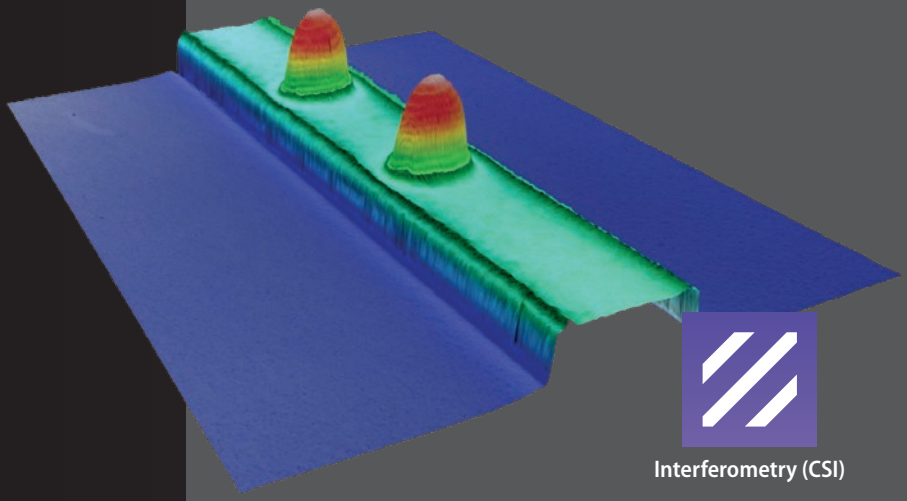
Fringe Projection

Critical dimensions on the profile are allowed in this powerful analysis software. SensoVIEW

DISPLAY

Spacer TFT

Displays are made of multiple layers that need to be separated a certain distance. Spacers are structures distributed all over the screen to ensure that gap.

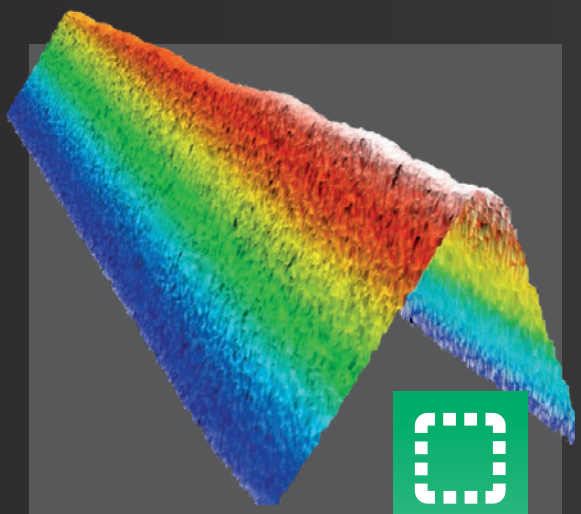


Interferometry (CSI)

Spacer

SensoPRO **Plugin**

The Spacer plugin automatically detects different shapes of spacers: oval, round and square.



Ai Focus Variation

TOOLING

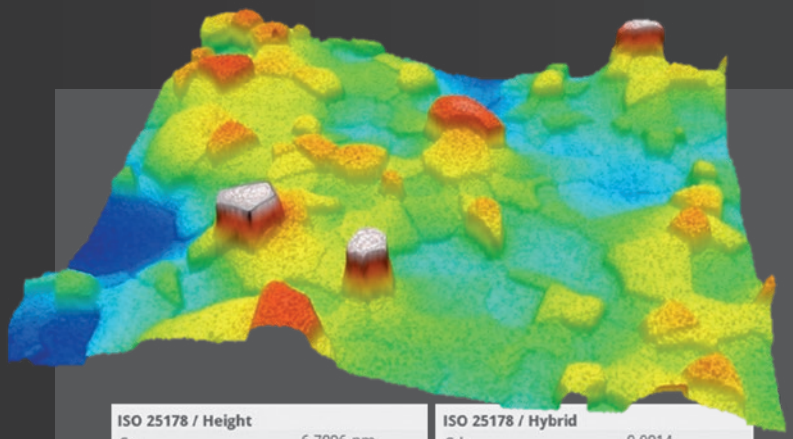
Drill cutting edge

The edge of a cutting tool is directly related to the result of the cut part. Its characterization will then predict its performance.

Edge

SensoPRO **Plugin**

The Cutting edge plugin measures the edge radius and other important parameters plus the top surface profile roughness (height parameters).



ISO 25178 / Height	
Sa	6.7096 nm
Sku	4.2318
Smean	6.0e-11 nm
Sp	41.547 nm
Sq	8.6904 nm
Ssk	0.3788
Sv	24.305 nm
Sz	65.852 nm

ISO 25178 / Hybrid	
Sdq	0.0014
Sdr	9.404e-5 %
Sratio	1.0000

ISO 25178 / Spatial	
Sal	34.320 µm
Std	118.0000 °
Str	0.5193

Autocorrelation image

Interferometry (ePSI)

SEMICONDUCTORS

SiC wafer roughness

Silicon Carbide (Si-C) wafers have astonishing electrical and thermal properties that know are a must for certain applications, like 5G chips. Since its production is using CVD (Chemical Vapor Deposition), characterizing their surface finish helps to understand if the lattice growth will be homogeneous.

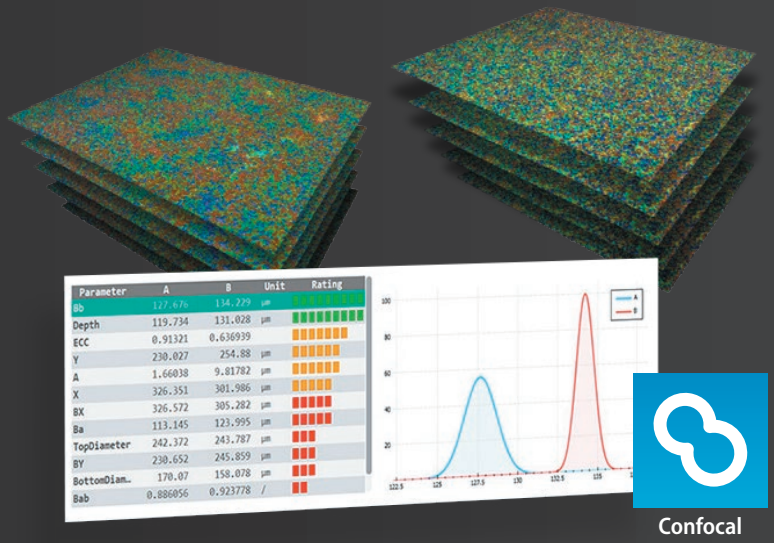
SensoVIEW

Height, Lateral and hybrid and parameters will be very interesting to characterize well the crystals.

SURFACE FINISH

Copper wire adhesion

The surface finish of a material impacts material behavior. In this case, the interesting property is the adhesion of copper with a conductive material used in the welding process.



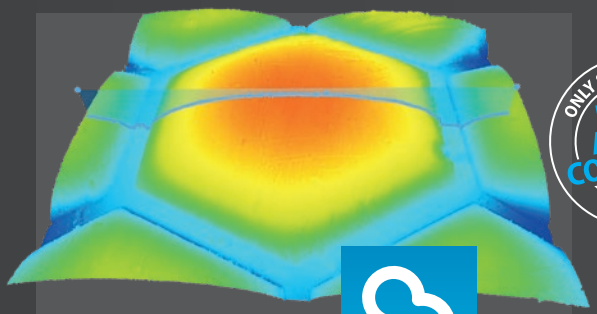
Parameter	A	B	Unit	Rating
Bb	127.676	134.229	µm	
Depth	119.734	131.028	µm	
ECC	0.91321	0.636939		
Y	230.027	254.88	µm	
A	1.66038	9.81782	µm	
X	326.351	301.986	µm	
BX	326.572	305.282	µm	
Ba	113.145	123.995	µm	
TopDiameter	242.372	243.787	µm	
BY	230.652	245.859	µm	
BottomDiam..	170.07	158.078	µm	
Bab	0.886056	0.923778	/	

Confocal

Surface Texture

SensoPRO Plugin

Understanding which roughness parameter differentiates two sets of samples with different adhesion can help the user to correlate specific roughness parameters with adhesion.

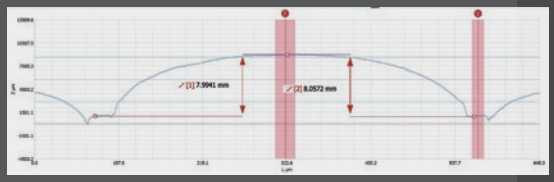


Confocal

Polygonal lenses

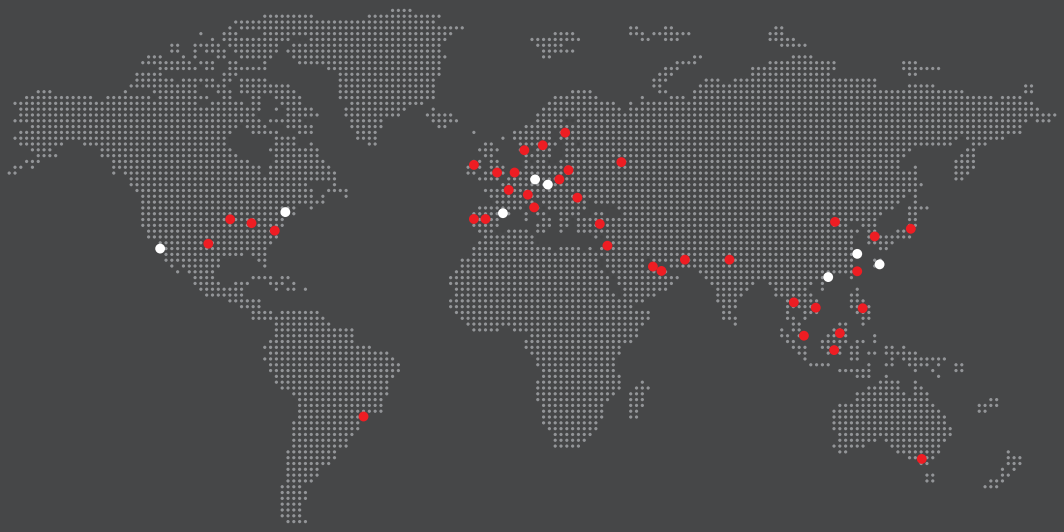
Hexagonal microlenses are a typical geometry used in lens microarrays and they stand out for their high density. Confocal technology is the best technology to measure the high slopes in this polished sample.

SensoVIEW



SENSOFAR

METROLOGY



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, focus variation and fringe projection techniques, from standard setups for R&D and quality inspection laboratories to complete non-contact metrology solutions for in-line production processes. The Sensofar Group has its headquarters in Barcelona, 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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