

Technical specifications

Measuring head

Image capture module	Max. number of measuring points in a single measurement x,y (µm²)		580x580
	Max. frame rate in (Hz) at full resolution		55
	Camera type		GigE
Adjustment travel for motorized z-axis (mm)	50		
Vertical measuring module	Fine adjustment (piezoelectric module)	Vertical measuring range (µm)	250
		Repeat accuracy¹ (nm)	10
Light source	High performance LED (nm)	505	
	MTBF (h)	50,000	
Typical measuring time (s)	2–8 (depending on the number of confocal sections)		

Basic configuration

Measuring system	Dimensions W×H×D (mm³)	281 x 678 x 281	
	Weight (kg)	15	
Positioning module	φ-positioning module (axis of rotation) (degrees)	355	
	y-positioning module (immersion depth) (mm)	up to 165	
	z-positioning module (bore diameter) (mm)	68 - 150	
Stand	To support the measuring system when not in use. Allows modular expansion to liner and/or piston measuring station.	Dimensions W×H×D (mm³)	600 × 384 × 324
		Weight (kg)	62
Top deck adapter	Adapter plate to position the measuring system on the top deck (includes centering aid)		
System controller	Rolling container 19"	Dimensions W×H×D (mm³)	600 × 600 × 615
	Motor controller	Positioning module controller	
	Computer type	Brand computer / industrial PC	
	Energy supply	Voltage (V)	100-240
		Frequency (Hz)	50-60
		Max. power consumption (W)	700
Standard holder	Module to hold the standards used for calibration and verification of the measuring system.		
Norms	Flatness standard, lateral standard, roughness standard, depth standard		

Lenses

	1600S	800XS	320S
Lens magnification	10×	20×	50×
Lateral measuring range x,y (µm)	1100	550	220
Lateral measuring range x · y (mm²)	1.21	0.3	0.0484
Numerical aperture NA	0.3	0.6	0.8
Working distance (mm)	10.1	0.9	1
Resolution z¹ with fine adjustment (nm)	20	<10	<2
Lateral resolution² (µm)	1.9	0.95	0.38

1) Measurement noise to VDI 2655-1.2
2) Measuring point distance

L: long working distance
S: normal working distance
XS: short working distance

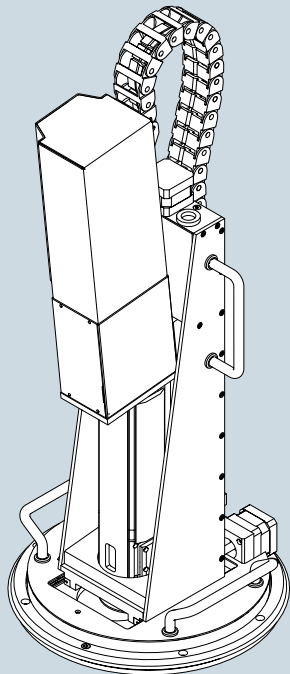
Software packages

µsoft metrology Advanced Stitching Module	Included	Records up to 100 frames with HD stitching
µsoft automation	Optional	
µsoft analysis	Optional	
µsoft pore	Optional	
Specialist software	On request	
Export formats	X3P, NMS, OMS, ASCII, SDF, TIF, BMP, SUR	
Language packs for µsoft metrology	German, English, French, Italian, Spanish, Portuguese, Polish, Russian, Turkish, Japanese, Korean, Chinese	

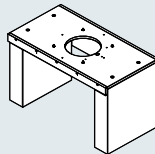
Additional components

Line walking (Travel rail for automated series measurement of multiple cylinder bores)	Max. travel path 3-4 cylinder (mm)	280	
	Max. travel path 4-6 cylinder (mm)	500	
	Weight of 3-4 cylinder version (kg)	8	
	Weight of 4-6 cylinder version (kg)	13	
	Controller	NanoFocus USB, separate controller	
	Software requirements	Requires μsoft automation in order to function	
Adapter plate	Adapter plate(s) customized to top deck geometries		
Lifting arm	Height adjustment range (mm)	450	
	Length adjustment range (mm)	700	
	Rotation (degrees)	360	
	Dimensions W×H×D (mm³)	1080 × 1400 × 400	
	Weight (kg)	120	
Low base frame	Dimensions W×H×D (mm³)	1600 × 530 × 750	
	Weight (kg)	approx. 350	
	Equipment	Tool trays	
	Granite	Dimensions W×H×D (mm³)	900 × 100 × 750
		Net weight (kg)	185
	Passive vibration isolation with level control	Frequency range (Hz)	>6-3
		Max. load (kg)	400
		Compressed air supply (bar/Pa)	8 / 80000
	Active vibration isolation with level control	Frequency range (Hz)	1-200; >200 passive isolation
		Max. load (kg)	300
High base frame	Dimensions W×H×D (mm³)	900 × 800 × 750	
	Weight (kg)	approx. 350	
	Granite	Dimensions W×H×D (mm³)	900 × 100 × 750
		Net weight (kg)	185
	Passive vibration isolation with level control	Frequency range (Hz)	1-200; >200 passive isolation
		Max. load (kg)	400
		Compressed air supply (bar/Pa)	8 / 80000
	Active vibration isolation with level control	Frequency range (Hz)	>6-3
		Max. load (kg)	300
	Clamping chuck for cylinder liners	Module for cylinder liner measurements	Diameter of cylinder liner (mm)
		Height of cylinder liner (mm)	290
Piston	Module for measuring pistons and piston rings	Cylinder diameter (mm)	>140
Laboratory table	WT 100	Dimensions W×H×D (mm³)	1000 × 750 × 800
		Weight (kg)	40
		Max. load (kg)	200
	WT 150	Dimensions W×H×D (mm³)	1500 × 750 × 1000
		Weight (kg)	70
		Max. load (kg)	200
	WT 200	Dimensions W×H×D (mm³)	2000 × 750 × 1000
		Weight (kg)	90
		Max. load (kg)	200

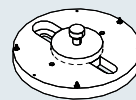
Basic configuration



1 Stand

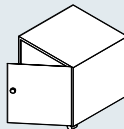


2 Top deck adapter

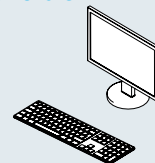


with centering aid

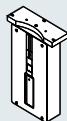
3 System controller



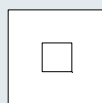
4 Peripherals



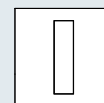
5 Standard holder



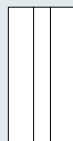
6 Flatness standard



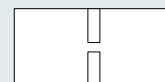
7 Lateral standard



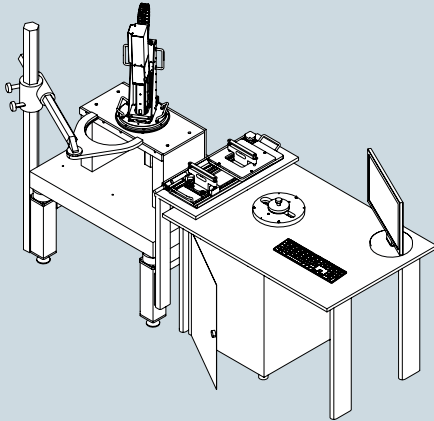
8 Roughness standard



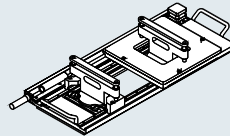
9 Depth adjustment standard



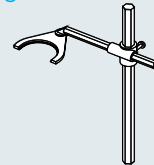
Measuring station for cylinder crankcases



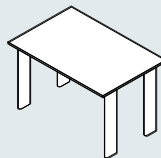
1 Line walking



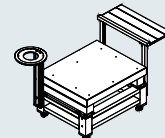
2 Lifting arm



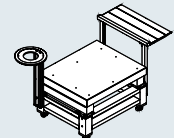
3 Laboratory table



4 Low base frame

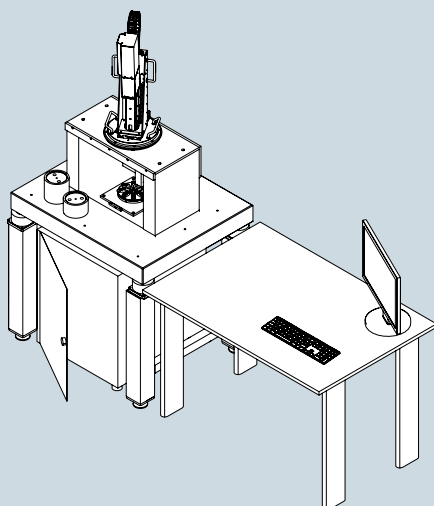


Passive vibration isolation
with level control

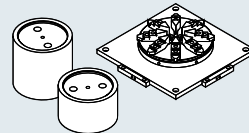


Active vibration isolation
with level control

Measuring station for liners or piston/piston rings

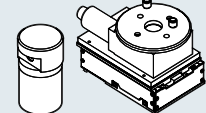


1 Measuring station



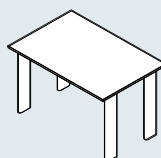
Liner measuring station

2 Measuring station

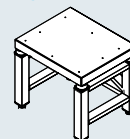


Piston and piston ring
measuring station

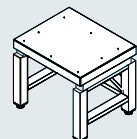
3 Laboratory table



4 High base frame



Passive vibration isolation
with level control



Active vibration isolation
with level control

General information

Languages	English, German, French, Italian, Spanish, Portuguese, Polish, Japanese, Chinese, Korean, Russian, Turkish, Arabic, others to come
Ergonomics	The user interface has a clear structure and it's easy to start a measurement in just a few steps.
Navigator	With the Navigator function, a rapid overview of the sample surface can be created in which the desired measurement range can easily be selected with the mouse.
3D preview	Fast assessment of recorded topographies using a powerful 3D view. Profile cross sections can be used for a quick initial analysis. (Pre-scan)

Measurement

Automatic setting of measuring range	Convenient function that allows the height measuring range to be quickly and automatically determined via software
Stitching	Creation of large-scale measurements by adjoining individual measurements (similar to a panoramic image) without reducing the measuring point density.
Shape tracing	Stitching of measurements with intelligent form tracking and automatic range tracking in order to reduce the measurement time.
Template function	Storage of the measurement currently carried out as a template in order to access the measurement settings again quickly for similar measurements.
Virtual 0/0 position	0/0 position setting to measure distances when in live view mode

General information

Languages	English, German, other languages upon request
Operation	Program supports the separation of measurement and reporting units (program is network-capable)
User levels	Multiple security levels with different permissions: administrator, process level, operator
Creating measurement recipe	Intuitive input screen for measurement position (joystick support) and sensor settings
Data storage	Storage of measurement data/analysis results in an SQL database

Measurement

Measurement settings	Sensor settings variable within a measurement run
Measurement recipe	Automatic approach and measurement at different positions
Series measurement	Comparison of position using reference points
Exporting results	ASCII export for integration into QA database, transmission to µsurf analysis software, Excel (csv)
Number of measurements per job	unlimited

Analysis and reporting

Results display	Individually designed measurement protocol, SPC chart
Reporting recipe	Each measurement point can be assigned specific measurement parameters
PLC	Input of warning and action limits for measurement data evaluation

Reporting

Connections	µsoft analysis, µsoft evaluation and other analysis software
-------------	--

General information

Languages	English, German, French, Italian, Spanish, Portuguese, Polish, Japanese, Chinese, Korean
Reporting	Automatic report creation, additional information (logos, identification, notes, figures)
Traceability and productivity	Analysis of workflow diagram, add, change, or delete analysis steps, minidocs (analysis sequences), any document can be used as a template for the reporting of multiple measurement datasets, OK/NOK criteria can be set for each parameter, results can be exported to .csv format for Excel
Statistics	Multiple populations, control overviews, parameter tables, scatter charts, histograms

Processing

Intelligent preprocessing	Orienting, form filtering, histogram function, resampling, filling out of unmeasured points, retouching, noise suppression, partition orientation, right-angled, round, or polygonal zoom
Metrological and scientific filters	Gauss, robust Gauss and spline filters, FFT, morphological filters, Laplace and Sobel filters, and so on
Segmentation	Segmentation by zoom, threshold calculation and application of binary masks

Analysis and reporting

International standards	ISO 25178 3D parameters, EUR 15178 EN 3D parameter, definitions for 2D parameters in ISO 4287, ISO 13565 and other standards, ISO 16610 extended filters, ISO 12781 evenness parameters
Functional 3D analysis	Curve of the bearing surface, graphical study of the functional volume parameters in ISO 25178, material and void volume, motif analysis, surface subtraction (wear)
Particle/grain analysis	Grain/particle detection, individual grain features, grain topography, statistics about grains and islands, distribution of peaks, number of peaks
Surface geometry	Distances, angles, areas, volumes, step heights on profiles and surfaces, contour
Contour analysis	Geometric dimensioning of vertical (z axis) and horizontal (x,y plane) profiles, analysis of form deviations with automatic generation of a results table
Extended analysis	Fourier spectrum, power spectrum density (PSD), structural isotropy, direction, and periodicity, fractal analysis (box counting method or morphological embedding method)

Presentation

Analysis of different measurement data types	2D profiles, 3D surface, 3D surface and intensity, 3D surface and RGB image, 4D series of 3D surfaces
3D surface mapping	3D views in real time, images in pseudocolors, photo simulations, contour diagrams, 4D films created from 3D surfaces, simulated flights over surfaces

General information

Languages	English, German, other languages upon request
Reporting	Output as PDF or Excel file

Analysis and reporting

Surface roughness	Calculation of parameters outside the pores: Sa, Sq, Ssk (skew), Sku (kurtosis), grain depth
Pore characteristics	Number of pores, oil retention volume, pore density
Protrusion characteristics	Number of protrusions, protrusion volume per area, protrusion density
Classification	Classification of pores or protrusion in 6 surface classes, class-based analysis using pore/protrusion density, area size, volume fraction and oil retention volume/protrusion volume

Presentation

Analysis of pores and protrusions	Color-coded presentation of the distribution of pores and protrusions
Visualisation of the material ratio	Presentation as histogram or diagram