Contour and Surface Measuring Machines

ZEISS

We make it visible.

Inspection equipment from Carl Zeiss for the production floor.

Carl Zeiss offers a complete product line for industrial metrology. From the small "handy surf" for surface measurements up to the large systems used for measuring large vehicles – whatever your application, Carl Zeiss has the right metrology equipment. Our product line also offers highly accurate measuring machines for form, contour and surface measurements.

Maximum quality – from production to service

The finishing of vital machine components is performed by specialists. Quality control of our products follows the most stringent internal testing procedures which are more exacting than the specified standards.

Furthermore, Carl Zeiss also delivers first class service whether it concerns a metrology question, maintenance or repair. Thanks to our network of regional offices, you receive the expert help you need within a short time.

Machine strategy

The right system for every measuring task

- **Surfcom 1500**
  The comfortable measuring station for surface measurements
- **Contourecord 1700/2700**
  The flexible measuring station for contour measurements
- **Surfcom 1900/2900**
  The combined measuring station for surface and contour measurements
- **Surfcom 2000**
  The system for surface and contour measurements in one pass
- **Surfcom 5000**
  Contour and surface technology for the highest demands

Measuring range

Sufficient range for the measuring task

The base plate – columns – tracer driver combination
can be adjusted as needed

Surfcom 1500/1900/2000 and Contourecord 1700/2700
Granite base plate 600 mm x 320 mm or 1000 mm x 450 mm
Optional column height 250 mm, 450 mm, 600 mm
Tracer driver 100 mm or 200 mm

Surfcom 5000
Fully enclosed DX version with granite base plate
1000 mm x 450 mm, column height 500 mm, tracer driver 200 mm

Modularity

The entire line of ZEISS contour and surface measuring machines features a modular design:

The machines are comprised of a base plate – column – feeder.

The systems can be equipped with a contour or roughness stylus-and-arm system, or upgraded later, depending on the measuring task. Furthermore, Y tables, Y driver units or CNC tables can be mounted for fully automatic contour and surface measurements, enabling the systems to meet specific customer needs.

The systems are based on the TIMS software platform that can be adjusted depending on the system of the modular hardware.

Operation

The design of the contour and surface measuring stations combined with the TIMS software strategy allows the user to easily operate the machine in the measuring lab or in production.

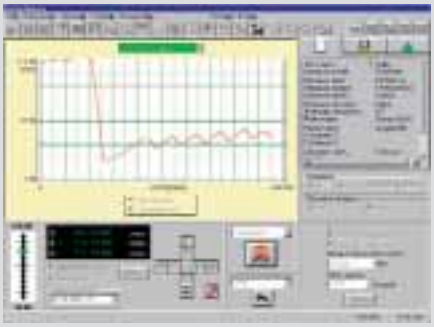
Ergonomic aspects were considered during development:
- Standard SD version features a simple and compact design
- Integrated component concepts with modular configuration
- Fully enclosed, mobile DX version

Software

TIMS – the intelligent and future-oriented software strategy

The integrated software strategy for form, contour and surfaces facilitates the exchange of measurement data, e.g. from form or roughness analyses directly to contour analysis, in order to permit the evaluation of micro-contours according to specific requirements, for example. Typical features of contour analysis, such as calculating radii, angles and gaps, can be quickly and easily evaluated with TIMS.

The TIMS surface analysis contains all standard parameters as per ISO, DIN, CNOMO, ASME and JIS, as well as optional analysis methods such as "dominant waviness".



Precision

Patented linear motor technology on all contour and surface measuring machines from Carl Zeiss

Linear motors and touch-free guideways eliminate vibration caused by the motor, gears and drive spindle. This allows maximum accuracies at very high measuring and travel speeds.

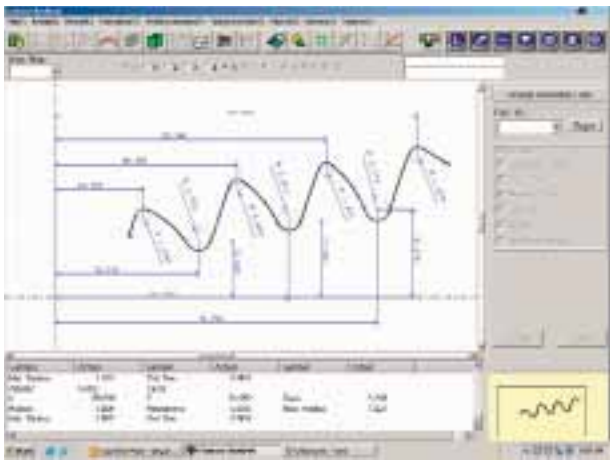
Contourecord 2700 and Surfcom 2900 are also equipped with an additional glass scale in the stylus-and-arm system for the highest demands in contour measuring.

TIMS – the intelligent and future-oriented software strategy.

Powerful platform

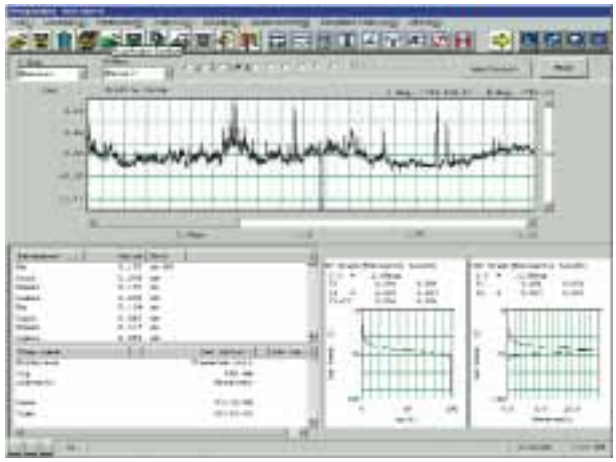
Our machines are equipped with the latest computer technology. The TIMS measuring station features a computer with network card, color monitor and printer, as well as high-quality measuring hardware. TIMS software is Windows-based.

Contour



- **Flexible TIMS measuring station for precise contour measurement and analysis**
- **Large measuring range for large contours**
- **Extensive TIMS software options for a broad range of workpieces**
- **Easy operation with support functions**
- **Automatic measuring in CNC operation, teach-in programming**
- **CAD data and plan/actual comparison, analysis of aspheres, etc.**

Roughness

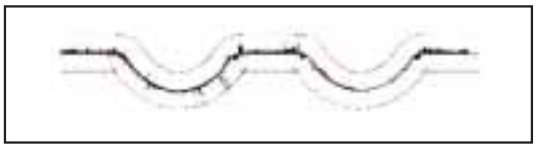


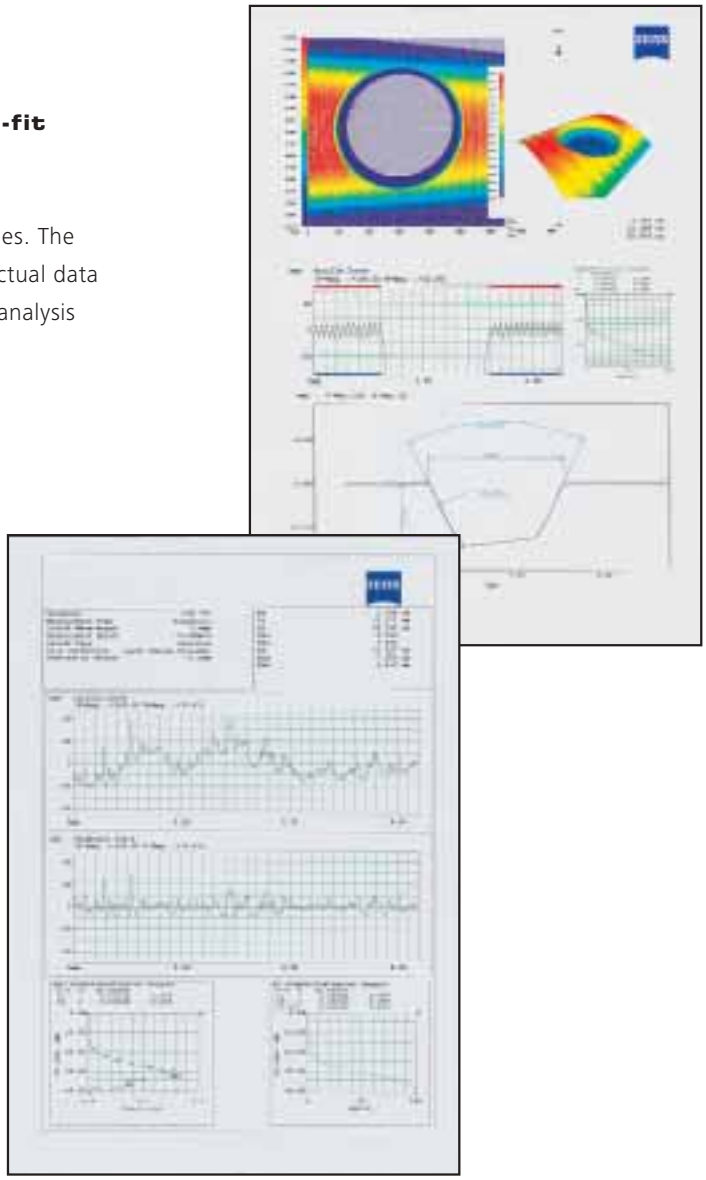
- **Evaluation of profile, roughness and waviness according to standards**
- **Fast surface inspection in the workshop, production and measuring lab**
- **Easy use of the TIMS purity software**
- **All standards, filters, curves and parameters**
- **Tolerance monitoring, internal data processing**
- **Variable layout of measurement protocol**

Plan/actual comparison and best-fit adjustment

Fast comparison of measured data with nominal profiles. The best-fit function facilitates optimal alignment of the actual data to the nominal data for the comparison. The asphere analysis function is also available.

Before (↑) and after (↓) the best-fit-adjustment





Print

The print layout can be customized for extensive measurement logs.

- All profiles and zooms
- Result lists, measurement conditions, commentary
- Add your company's logo, workpiece drawings and pictures
- Export protocol elements for other software applications

Data processing		Surface
Profile display		R, P, W, WC, Wec and DIN 4776
Filter type		Gaussian, (DIN 4777), DIN 4776, 2 RC phase-corrected, 2 CR
Measuring range/resolution	horizontal	0.04 µm or 32,000 points
	vertical	0.02 µm–6.4 µm/0.0001
Critical wavelengths roughness		0.08–25 mm as well as variable
Critical wavelengths waviness		0.008–25 mm as well as variable
Tilt correction methods		Compensating line (first half, beginning/end), compensating curve, spline. Without correction
Roughness parameters		ISO 4287 (97) Ra, Rq, RzDIN, Rp, Rpm, Rv, RC, R3z, RzISO, RT, RmaxDIN, PC, S, Sm, RDa, RDq, Rla, Rlq, lr, Rsk, Rku, tp, tp2, Rmr, Rdc, Rk, Rpk, Rvk, Mr1, Mr2, Vo, K and in compliance with CNOMO, DIN, ASME, JIS
Waviness parameters		Wt, Wa, Wem, Wea, Wsm, ...
Mean values		from up to 512 bits of data possible
Tolerance comparison		possible
Profile analysis		Actual profile, Abbott curve, amplitude density, Fourier analysis, Dominant Waviness
Learn/repeat function		possible

Data processing	Contour
Units	µm, µinch (selectable)
Magnification	0.01–10,000,000 manual and automatic
Calculating functions	Point, straight line, circle, angle, min./max. function, distance between coordinates, polar coordinates, point of intersection, symmetry
Output functions	Calculating between profiles, set origin and X axis, rotation and translation of the coordinate system, etc.
Additional functions	Cartesian grid/polar coordinate display, angle-radius coordinate display, multiple overlay of profiles, combination/selection of profiles, tolerance comparison with nominal values, learn/repeat function

Contourecord 1700/2700

**The flexible measuring station for contour measurements.
Ease of use for efficiency.**

- Fast, easy and precise completion of contour measuring tasks
- Patented linear motor technology
- High straightness accuracy and glass scale in the X axis
- Extensive accessories enable a large range of applications
- Automated calibration function
- Software compensates for stylus and stylus tip geometries
- Upgradeable to full CNC version through modularly adaptable CNC tables
- Also expandable for 2D and 3D surface measuring tasks
- Fully enclosed DX version with integrated active vibration damping
- **Contourecord 2700** with additional glass scale in the Z axis for maximum demands on accuracy

Measurement

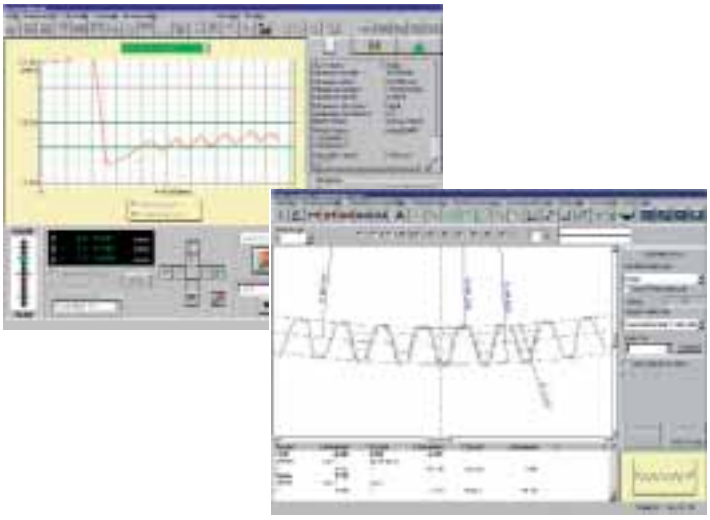
The "measurement window" offers easy access to all relevant functions, such as:

- Control of all measuring axes
- Enter workpiece data
- Specification of measurement conditions as well as the measuring point spacing
- Set automatic functions
- Automatic calibration function
- Selection of measured lengths via trace display

Analysis

The profile is available immediately after the measurement in an analysis window with a broad evaluation spectrum.

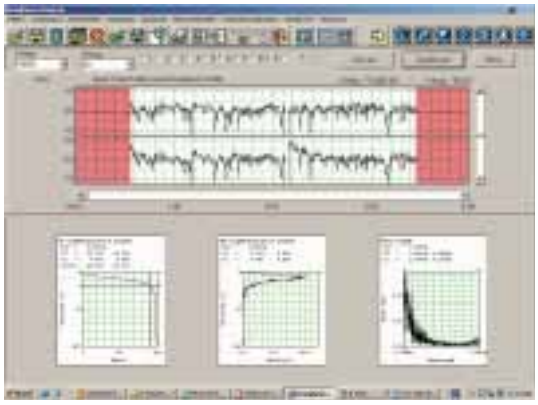
- Manual or automatic evaluation of elements such as radii, gaps, angles, etc.
- Best-fit circle and regression lines
- Repeat functions
- 10,000,000x zoom
- Max. 10 profiles with up to 100,000 profile points can be processed simultaneously
- Meaningful dimensioning



Surfcom 1500

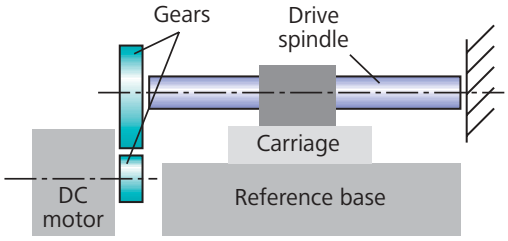
The comfortable measuring station for surface measurements. Maximum performance, minimal effort.

- Fast, easy and precise completion of surface measuring tasks
- Patented linear motor technology
- Data transfer from Handysurf and Surfcom 130
- Wide range of accessories
- Upgradeable to full CNC version through modularly adaptable CNC tables
- Also expandable for contour measuring tasks
- Topography measurements to analyze 3DF surface data
- Fully enclosed DX version with integrated active vibration damping for the highest demands

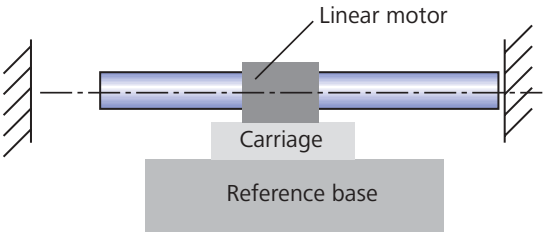


Linear motor technology

Conventional motor



Linear motor



Conventional system

At high measuring speeds, the vibrations generated by the motor, gears and drive spindle influence the measuring data.

Linear motor

Omitting unnecessary parts enables extremely fast measurements.

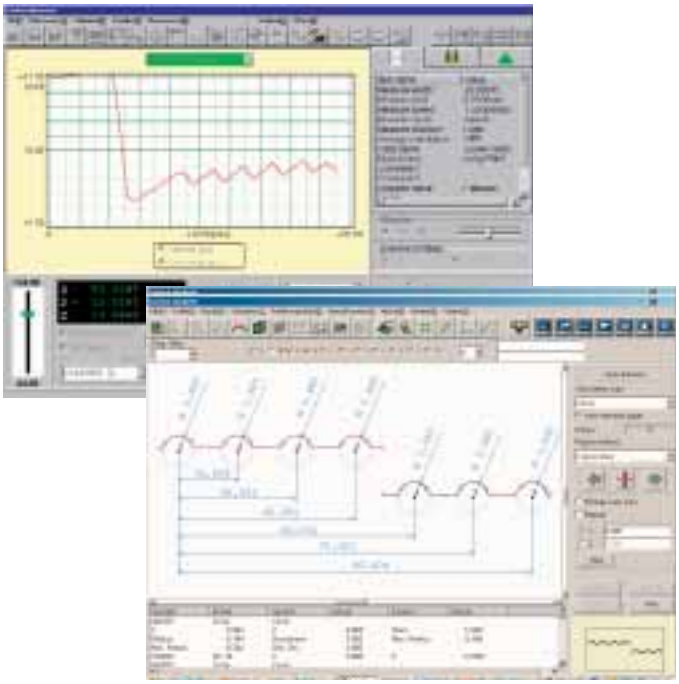
Advantages

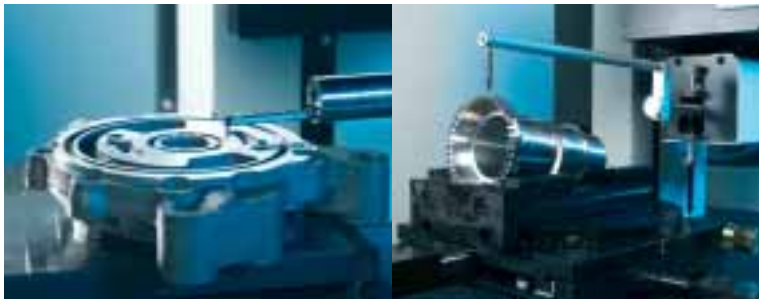
- Contact and free-from-play guideway
- Higher accuracy
- Higher measuring and travel speed
- Low vibration
- Simple design
- Easy to maintain

Surfcom 1900/2900

The combined measuring station for surface and contour measurements. Easy to use.

- Fast, easy and precise completion of contour and surface measuring tasks
- Touch-free, patented linear motor technology
- High straightness accuracy and glass scale in the X axis
- Easy change of the stylus-and-arm system from contour to roughness, or vice versa, on the same tracer driver
- Extensive array of accessories for a wide range of applications
- Automated calibration function
- Software compensates for stylus and stylus tip geometries
- Upgradeable to full CNC version through modularly adaptable CNC tables
- Expandable for 2D and 3D surface measuring tasks
- Fully enclosed DX version with integrated active vibration damping
- **Surfcom 2900** with additional glass scale in the Z axis for maximum demands on accuracy





Surfcom 1900
=
Surfcom 1500 + Contourecord 1700

Surfcom 2900
=
Surfcom 1500 + Contourecord 2700

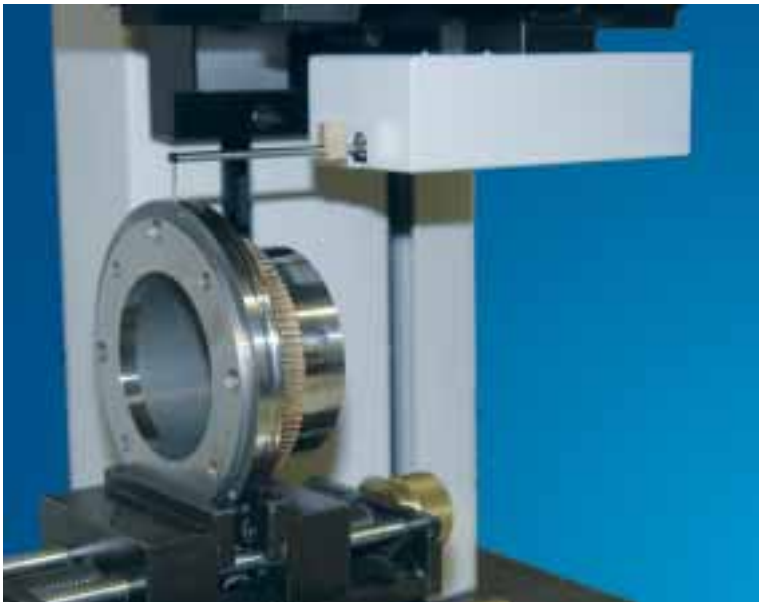
Efficiency through automatic functions

E.g. for multiple measurements on single workpieces with the same clamping

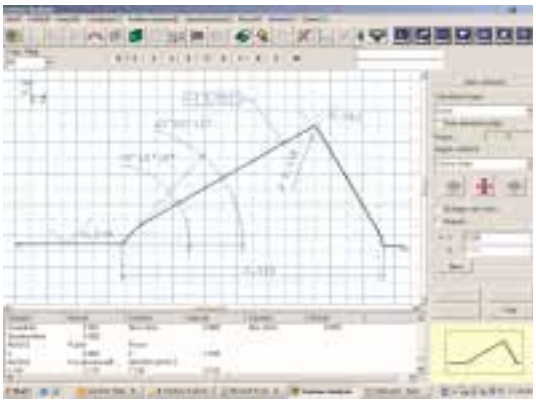
Surfcom 2000

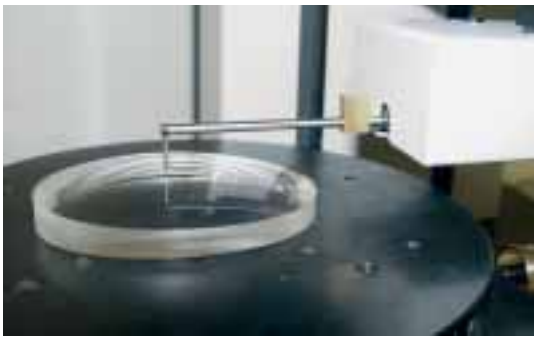
Contour and surface measurements in one run.
Short measuring times – high productivity.

- Contour and roughness measurements in one run
- Roughness detector with 5 mm deflection, 10 mm with doubled stylus length
- No unnecessary change of the stylus-and-arm system reduces measuring times and simplifies operation of the system
  – high productivity
- Friction-free, patented linear motor technology
  – Very high measuring and travel speeds
  – High straightness accuracy
  – Low background noise
  – Low maintenance and wear-and-tear
- Upgradeable to full CNC version through modularly adaptable CNC tables
- Topography measurements to analyze 3DF surface data

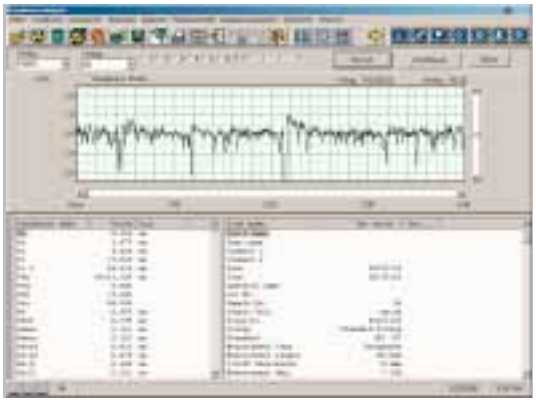


Typical applications: contour and roughness measuring tasks on small workpieces





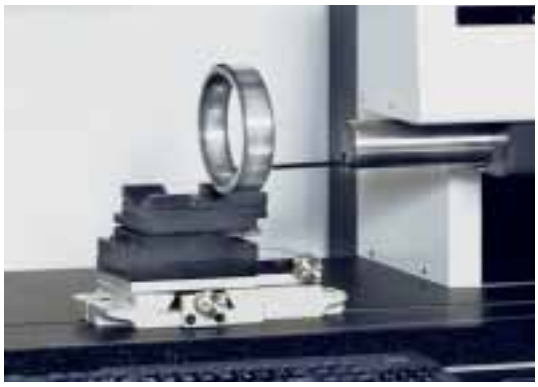
Example application:
asphere measurement on a lens



Surfcom 5000

Combined contour and surface measurements for high-end applications. Technology for the highest demands.

- Highest class of accuracy
- Contour and surface measurements in one step
- Laser interferometric stylus-and-arm system with a resolution of 0.31 nm
- New design eliminates environmental influences
- Friction-free, patented linear motor technology in the tracer driver
- Extremely high measuring and travel speeds (X = 60 mm/s, Z = 200 mm/s) reduce measuring times
- Cylindrical stylus-and-arm system permits high flexibility – even for complex applications
- Upgradeable to full CNC version with customer-specific table modules
- Topography measurements to analyze 3D surface data



Surfcom 5000 stylus-and-arm system for a measuring range of 13 mm

Surfcom 5000 –
the high-end contour and surface measuring instrument

Performance data for Surfcom 5000	
Measuring range/resolution	X = 200 mm Z = 13 mm with standard stylus length Z = 26 mm with doubled stylus length
Measuring speed	Roughness max. 3 mm/s Contour/waviness max. 20 mm/s
Travel speed	X = 60 mm/s, z = 200 mm/s
Measuring accuracy	X = ± (0.2 + L/1000) µm, L = Measuring length in mm, Z = ± (0.2 + H/1000) µm, H = Measuring length in mm
Straightness accuracy	X = 0.05 + 3 L/10000) µm, L = Measuring length in mm
Data point density per measurement	max. 150,000
Resolution	X = 0.54 nm, Z = 0.31 nm

CNC table modules

The modular system with different table modules for the automation of CNC measuring runs.

The "building set" contains three modules: the positioning stage covers the Y direction; two additional rotary tables are used to position the workpiece in the XY and ZX planes. The main advantage is the combination of table modules, depending on need, to achieve motorization of each axis for alignment and positioning of the workpiece. For more complex measuring tasks, the level of automation can be easily adjusted with a new table module. Thus, customer-specific expansion of the measuring system up to a full CNC version of the Contourecord and Surfcom lines offers maximum productivity.

- Increase in performance and quality
- Save capacity
- Maximum productivity
- Modular construction for customer-specific measuring tasks
- Can be modified later
- No special instruments required
- Can be combined with all Contourecord and Surfcom systems
- Programmable with Teach-in and TIMS software

Combination example


+ **2 axis control** = **Y axis**


+ + **2 axis control** = **Y axis 0 (horizontal)**


+ + + **3 axis control** = **Y axis 0 (horizontal) 0 (vertical)**

The third dimension: 3DF topography

3DF topography software with a variety of evaluation possibilities for the visualization of specific surface features

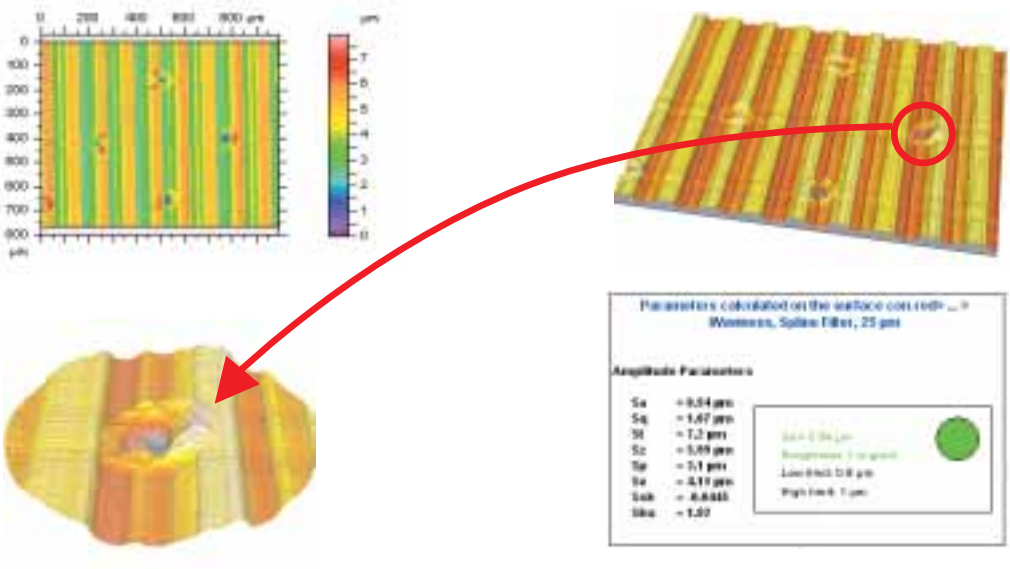
Y tables as external tracer driver for acquisition of 3DF surface data

Y DRIVER directly on the tracer driver for acquisition of 3DF surface data on oversized workpieces

- High measuring and travel speeds resulting from patented linear motor technology
- Data acquisition by means of an external **Y table** or with **Y DRIVER** directly on the tracer

Mountains Technology software:

- 3D display and analysis of topographical measuring data
- Numerous evaluation possibilities: different alignment functions, ISO-based standards, 3DF roughness parameters, volume calculations, form filter, 3D Fourier analysis, profile intersections, photo simulation, step height analysis
- Distance and angle measurements from freely selectable profile points
- Fast and easy generation of measurement protocols
- Tolerance input with automatic inspection of the measuring results
- Various means of data output (SPC, Excel, etc.)
- Password protection
- Extensive help menu



Furniture design

**Different system furniture for different demands.
The right strategy for each customer requirement.**

Standard: SD version

- Simple design
  Granite – columns – tracer driver
- Low cost
- Compact design permits various table versions
- For all Contourecord and Surfcom systems

DX version fully enclosed

- Integrated, fully covered design requires little space
- Integrated anti-vibration table
- Simple location change without additional service expenses
- Modularly expandable
- Maximum performance
- Ergonomic design
- For all Contourecord and Surfcom systems

Integrated furniture design

- Modern design permits various applications
- Integratable, active anti-vibration elements
- Ergonomic design
- Perfect design
- For all Contourecord and Surfcom systems

Technical data

	Contour	Contour	Surface	Contour
X tracer driver	**Contourecord 1700**	**Contourecord 2700**	**Surfcom 1500**	**Surfcom 1900**
Traversing stroke	100 mm (200 mm)	100 mm (200 mm)	100 mm (200 mm)	100 mm (200 mm)
Straightness accuracy	1 µm/100 mm	1 µm/100 mm	0.05 + (L/1000) µm	1 µm/100 mm
Measuring speed	0.03–20 mm/s	0.03–20 mm/s	0.03–3 mm/s roughness 0.03–20 mm/s waviness	0.03–20 mm/s
Travel speed	0.03–60 mm/s	0.03–60 mm/s	0.03–60 mm/s	0.03–60 mm/s
Measuring principle	Linear motor with glass scale	Linear motor with glass scale	Linear motor with glass scale	Linear motor with glass scale
Accuracy	± (1 + 2 L/100) µm	± (1 + 2 L/100) µm		± (1 + 2 L/100) µm
Resolution	0.04 µm	0.04 µm	0.04 µm	0.04 µm
Max. number of measuring points	100,000 (max. 10 profiles)	100,000 (max. 10 profiles)	32,000	100,000 (max. 10 profiles)
Detector and stylus system				
Measuring range	50 mm	50 mm	1000 µm standard stylus	50 mm
Measuring principle	Electro-mechanical measuring system	Glass scale	Inductive	Electro-mechanical measuring system
Linear accuracy	± (2.5 + (2H)/100) µm/20 mm range ± (3.5 + (4H)/100) µm/50 mm range	± (0.8 + (4H)/100) µm	± 0.5 %	± (2.5 + (2H)/100) µm/20 mm range ± (3.5 + (4H)/100) µm/50 mm range
Resolution	0.1 µm/5 mm range 0.4 µm/20 mm range 1 µm/50 mm range	0.025 µm	0.1 nm/6.4 µm range 20 nm/1,000 µm range	0.1 µm/5 mm range 0.4 µm/20 mm range 1 µm/50 mm range
Stylus				
Measuring force	Max. 30 mN	Max. 30 mN	0.75 mN	Max. 30 mN
Stylus tip radius	25 µm (250 µm, 500 µm)	25 µm (250 µm, 500 µm)	Standard 2 µm/60°	25 µm (250 µm, 500 µm)
Stylus tip material	Hard metal (ruby)	Hard metal (ruby)	Diamond	Hard metal (ruby)
Follow-up angle	77° upwards/downwards	77° upwards/downwards		77° upwards/downwards
Lifting of the test arm	Automatic	Automatic		Automatic
Z Column				
Z Column height	450 mm (250 mm, 600 mm)	450 mm (250 mm, 600 mm)	450 mm (250 mm, 600 mm)	450 mm (250 mm, 600 mm)
Travel speed	max. 10 mm/s	max. 10 mm/s	max. 10 mm/s	max. 10 mm/s
Other Information				
Dimensions of the standard base plate	600 mm x 320 mm	600 mm x 320 mm	600 mm x 320 mm	600 mm x 320 mm
Material for standard base plate	Granite	Granite	Granite	Granite
Max. base plate load capacity	50 kg	50 kg	50 kg	50 kg
Total weight	125 kg	125 kg	125 kg	125 kg
Power Supply	100–240 V AC 50/60 Hz	100–240 V AC 50/60 Hz	100–240 V AC 50/60 Hz	100–240 V AC 50/60 Hz

Accuracy information based on environmental temperature of 20 °C ± 2 °C
Subject to change as a result of technical modifications and required export licenses
L = measuring length in mm
H = measuring height in mm

Y table for 3DF surface topography		**Y Driver for 3df surface topography**
Traversing stroke	50 mm (100 mm, 200 mm)	13 mm
Length of the measured distance	0.001 mm–10 mm	
Number of single measured distances	2–2000	
Number of measuring points	Max. 64 million	
Straightness accuracy	(0.05 + 3L/1000) µm	0.5 µm
Table size	80 mm x 120 mm	
Max. load capacity	5 kg	

CNC tables	**Y table**	**Rotary table horizontal**	**Rotary table vertical**
Traversing stroke	100 mm (200 mm)	360°	360°
Travel speed	50 mm/s	20°/s	20°/s
Position accuracy	20 µm	0.03°	0.03°
Max. load capacity	30 kg	15 kg	5 kg
Weight approx.	19 kg (22 kg)	2.5 kg	3.2 kg

Surface	Contour	Surface	Contour/Surface	Contour/Surface
Surfcom 1900	**Surfcom 2900**	**Surfcom 2900**	**Surfcom 2000**	**Surfcom 5000**
100 mm (200 mm)	100 mm (200 mm)	100 mm (200 mm)	100 mm (200 mm)	200 mm
0.05 + (L/1000) µm	1 µm/100 mm	0.05 + (L/1000) µm	0.05 + (L/1000) µm	0.05 + (3L/10000) µm
				0.11 µm/200 mm
0.03–3 mm/s roughness 0.03–20 mm/s waviness	0.03–20 mm/s	0.03–3 mm/s roughness 0.03–20 mm/s waviness	0.03–3 mm/s roughness 0.03–20 mm/s waviness + contour	0.03–3 mm/s roughness 0.03–20 mm/s waviness + contour
0.03–60 mm/s	0.03–60 mm/s	0.03–60 mm/s	0.03–60 mm/s	0.03–60 mm/s
Linear motor with glass scale	Linear motor with glass scale	Linear motor with glass scale	Linear motor with glass scale	Linear motor with glass scale
	± (1 + 2 L/100) µm		± (1 + 2 L/100) µm	± (0.2 + L/1000) µm ± 0.4 µm/200 mm
0.04 µm	0.04 µm	0.04 µm	0.04 µm	0.54 nm
32,000	100,000 (max. 10 profiles)	32,000	32,000	150,000
1000 µm standard stylus	50 mm	1000 µm standard stylus	5 mm standard stylus	13 mm standard stylus
Inductive	Glas scale		Inductive	Laser interferometer
± 0.5 %	± (0.8 + (4H)/100) µm	± 0.5 %	± (2.5 + (2H)/100) µm	± (0.2 + H/1000) µm
0.1 nm/6.4 µm range 20 nm/1,000 µm range	0.025 µm	0.1 nm/6.4 µm range 20 nm/1000 µm range	0.8 nm/0.5 mm range 32 nm/2 mm range 80 nm/5 mm range	0.31 nm
0.75 mN	Max. 30 mN	0.75 mN	0.75 mN	0.75 mN
Standard 2 µm/60°	25 µm (250 µm, 500 µm)	Standard 2 µm/60°	Standard 2 µm/60°	Standard 2 µm/60°
Diamond	Hard metal (ruby)	Diamond	Diamond	Diamond
	77° upwards/downwards			
	Automatic		Automatic	Automatic
450 mm (250 mm, 600 mm)	450 mm (250 mm, 600 mm)	450 mm (250 mm, 600 mm)	450 mm (250 mm, 600 mm)	500 mm
max. 10 mm/s	max. 10 mm/s	max. 10 mm/s	max. 10 mm/s	max. 200 mm/s
600 mm x 320 mm	600 mm x 320 mm	600 mm x 320 mm	600 mm x 320 mm	1000 mm x 450 mm
Granite	Granite	Granite	Granite	Granite
50 kg	50 kg	50 kg	50 kg	
125 kg	125 kg	125 kg	125 kg	350 kg
100–240 V AC 50/60 Hz	100–240 V AC 50/60 Hz	100–240 V AC 50/60 Hz	100–240 V AC 50/60 Hz	100–240 V AC 50/60 Hz

Carl Zeiss
Industrial Metrology
73446 Oberkochen/Germany
Sales: +49 1803/336-336
Service: +49 1803/336-337
Fax: +49 7364/20-3870
Email: imt@zeiss.de
Internet: www.zeiss.de/imt

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