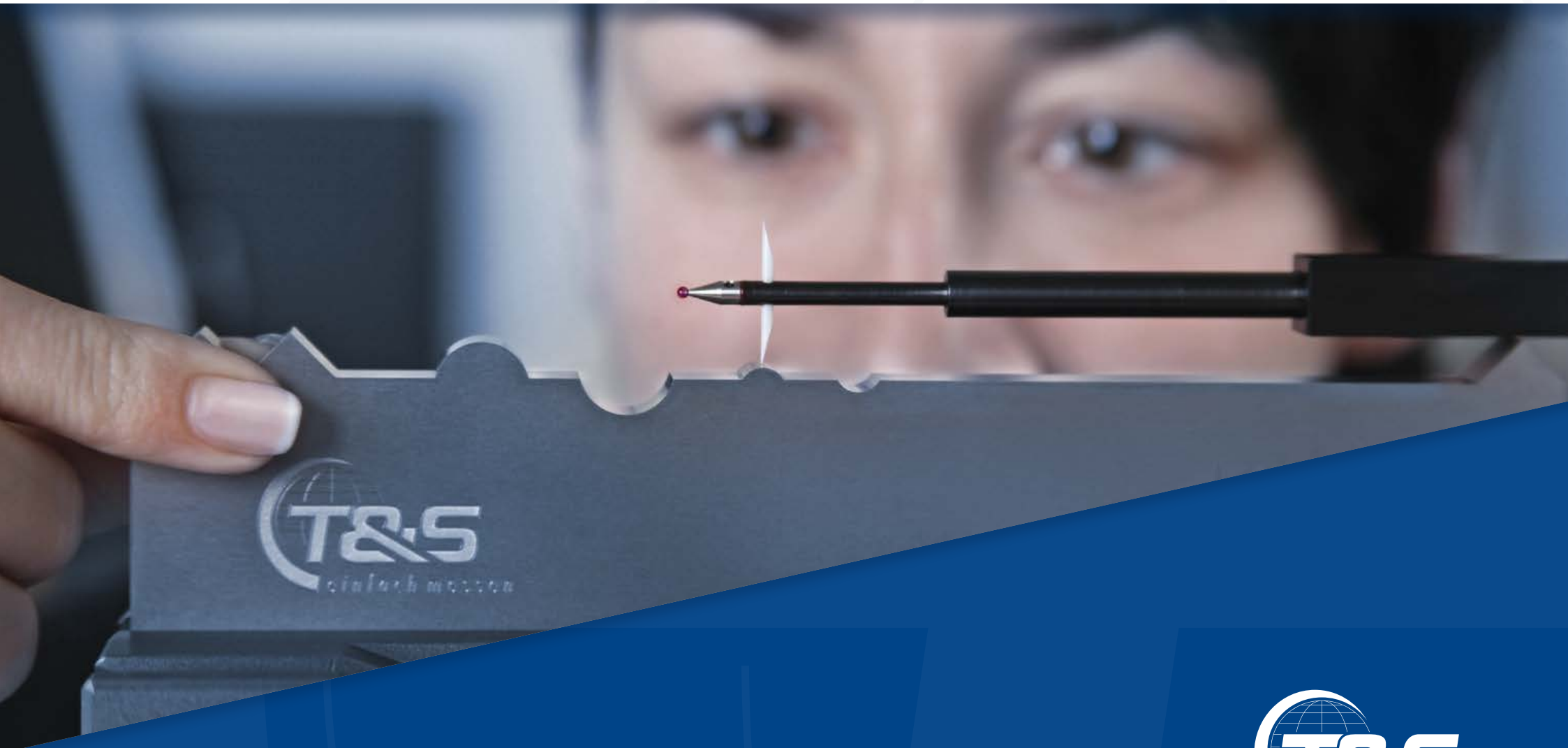


Dimensional Measuring Technology



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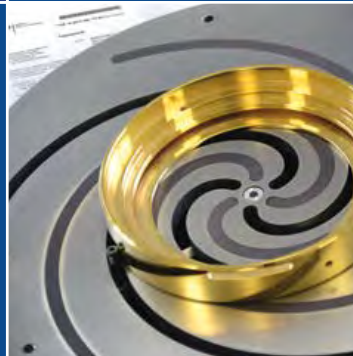
Passion –
we love our job!



Analyze existing
solutions.



Extract
relevant needs.



Explore
new solutions.

Just measure

Our main goal is achieving your satisfaction and appreciation while working together. A big part of that process is using your feedback to create new solutions, or adapt existing ones, as those needs change. The more we can help you find the right solutions and contribute to your goals, the more successful we are.

Our work is guided by the following principles:

- **Quality and reliability**
Our solutions are used where quality and precision can make or break your product. We take this responsibility very seriously.
- **Trust is the keystone of our operation**
You get to know us the way we are: competent, reliable, friendly and respectful.
- **Social responsibility**
ConturoMatic – „Made in Germany“: We make a conscious effort, within the company, to use components and services from local partners within the region where possible.
- **Lasting involvement**
We help and support people. Not just with words, but also deeds.
- **Continuity and growth**
Consistent and continuous development improves the quality of our systems, thereby we are securing the future success of our clients and the future of T&S.
- **You can count on us**
We stand for quality, service, innovation and fair prices; today and in the future, and we are proud of that.

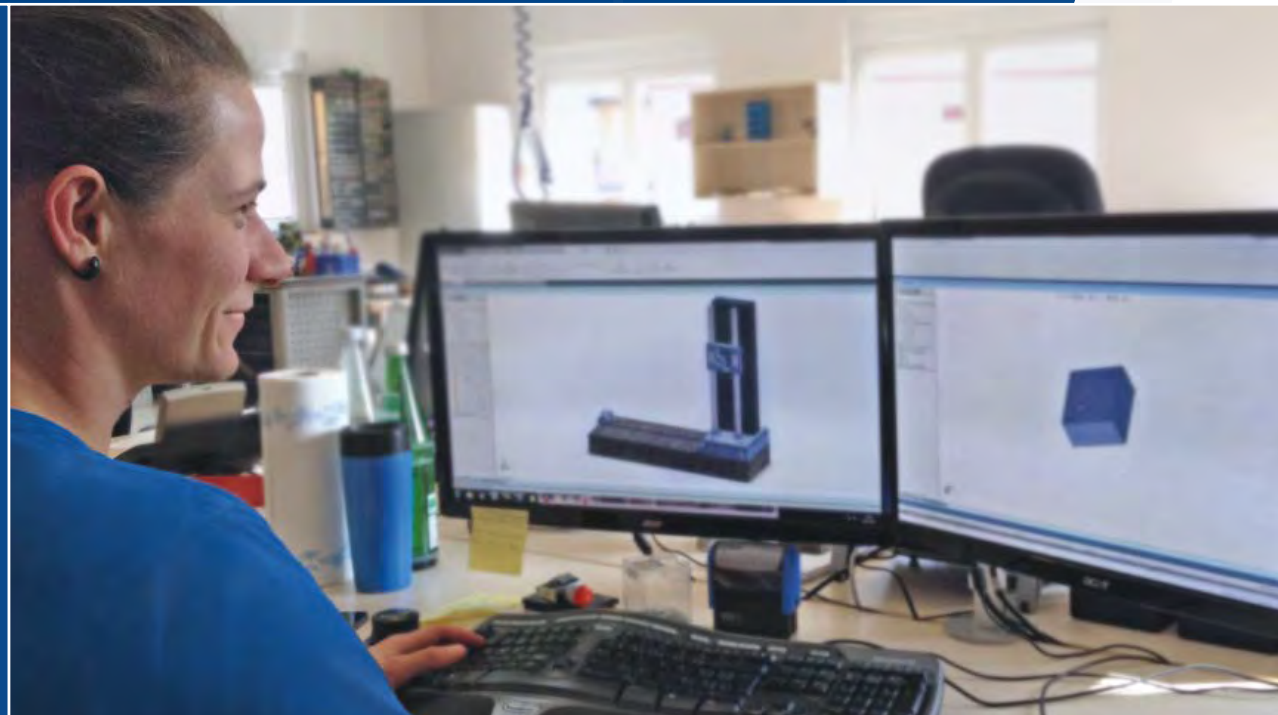


Robert Schmidt – CEO

A handwritten signature in blue ink, which appears to be 'R. Schmidt'.

Robert Schmidt – CEO

A view to
what is
essential



Quality Assurance

is far more than the use of suitable measuring equipment

T&S Gesellschaft für Längenprüftechnik mbH is a globally operating manufacturer of measuring instruments, solutions provider and project service provider for small to complex, needs-optimised auxiliary systems.

Take a closer look at our professional system solutions. Discover new potential for yourself, your costumers and your employees. Working together using our know-how and your experienced input motivates and helps us continually to develop and improve our systems.

T&S-solutions are used where your products are clearly distinguished by quality and success. By consistent further development and use of the possibilities from our state-of-the-art 3-D CAD software, we continuously improve the quality of our systems. In this way, we secure the future success of our customers – and the future of T&S.



► The result – a comprehensive range of accessories and auxiliary devices to resolve your measurement tasks.

Our facility is outfitted with the newest equipment including a fully climate controlled 700sqm production area. In order to ensure the quality of our products, some of the latest testing equipment e.g. a laser interferometer with an accuracy in the sub-micron range. Of course, variables like temperature, atmospheric pressure and humidity need to be compensated when measuring at that accuracy range. Furthermore, we use various calibration standards (in accordance with VDI/VDE guideline 2629 Page 1): reference spheres, glass hemispheres, gauge blocks and straightness standards.

► The professional qualification of our employees is particularly important to us

At T&S our employees stay up to date with courses for new developments and regular refresher courses. This ensures excellent service and high quality products.

The following pages contain and extract of our extensive range of contour measuring instruments, accessories, specialized measurement technology and application-specific solutions.

The other solution





Contour management – away from classic paths

The connection between the X- and Z-measuring axes in a drive unit always leads to narrow tolerances.

Our solution: separation of X and Z.

The X-axis assumes the function of a workpiece mount while the Z-axis performs the scanning movement. Since both axes are motor controlled, this leads to enormous benefits. Independent of the contour incline, both axes are controlled to keep the measurement speed constant. Classic combined drive units only move at constant speeds along X, which invariably leads to increased measuring point distances along steep contour sections. This irregularity in data point equality always leads to mathematical problems that can only be solved with interpolation (algorithmically generating interim values).

Our solution automatically leads to more consistent data point distances. Calculation of results therefore always takes place using real, physically recorded, measured values.

Furthermore, the Z-movement of a straight line is guided. There is no limitation of the measuring path anymore, as is caused by the circular motion of the tracing arm of conventional drive units. Our tracing arm is almost always set horizontally. The probe tip can follow the contour dynamically throughout the measuring range of up to 280 x 350 mm, and the scanning conditions are uniquely defined within the entire measuring range. Since the probe tip position is precisely defined and repeatable within a fraction of a millimeter, secure and automatic measurement is possible even in the smallest of bores.

Additionally, guide deviations of the Z-axis, which commonly result in measuring errors due to the lever effect of the tracing arm length, are automatically compensated for by our concept.

The easy way
to measure
contours



Our ConturoMatic-Systems

It was an ambitious aim and great responsibility to develop a series of outstanding measuring devices that can be used in a production environment and in the measuring laboratory because of their extreme flexibility and high performance. Development is always focused on you, the user and technician, in measurement technology.

- The result is a new generation of contour measuring systems: the ConturoMatic series.

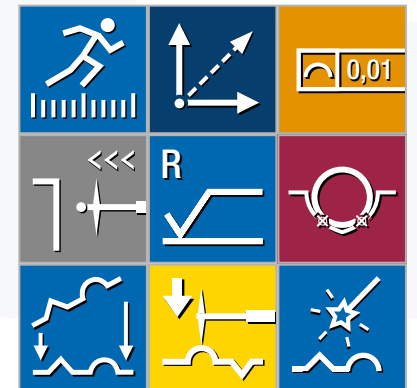
This kind of development always brings many people together and in the end, all involved parties can be proud of the results. It is part of our philosophy to let you, as our customer, contribute to this success. Your competence and suggestions help us to continually develop and optimize T&S systems further.

- All ConturoMatic-Systems are built using the same software base.

Therefore, any expansions or innovations are automatically usable on all systems. Simple operation and high flexibility at a fair price are our top priorities.

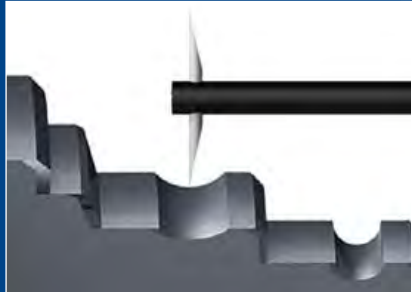
We are able to offer optimized systems to measure nearly all ranges of contour and roughness.

The application range of our ConturoMatic systems comprises both, classic models with drive units and motorized columns and a group of high-end devices with aerostatic guide units and high accuracy.



The Result –

More than the sum of individual ideas

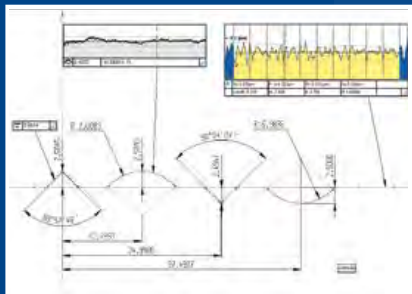


The concept behind all of the ConturoMatic TS systems mainly comprises two motor-controlled measuring axes. The X-axis carries the sample and the Z-axis scans the contours. Measurement recording and machine control are both handled by state-of-the-art digital technology. The base is high quality granite.

The effect:

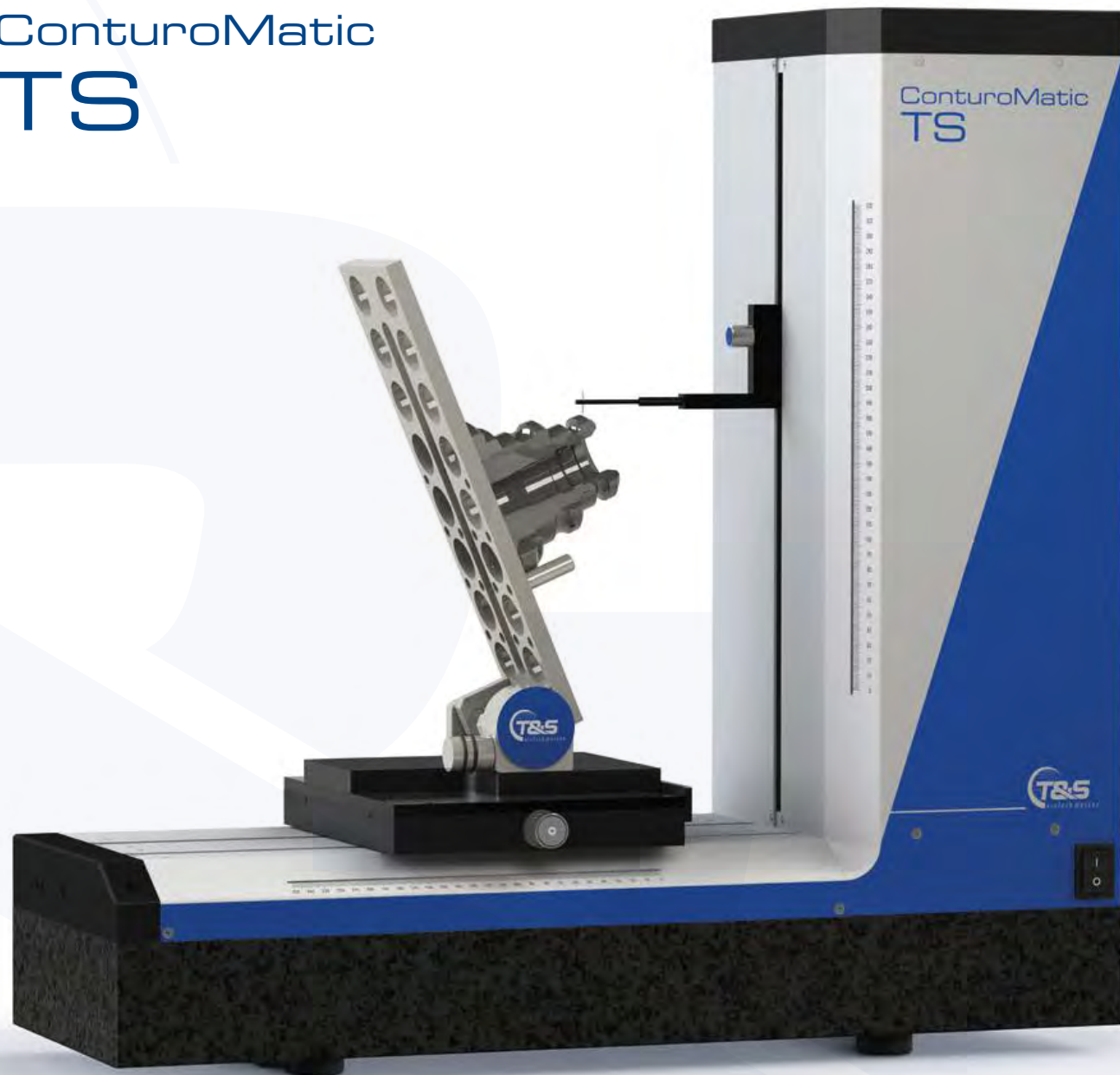
Due to the use of precision parts within our systems, there is no need for expensive and overly complicated error correction. Stability and longevity are basic elements of our ConturoMatic products. **New, different, innovative and technically revolutionary.**

Technical TS highlights:



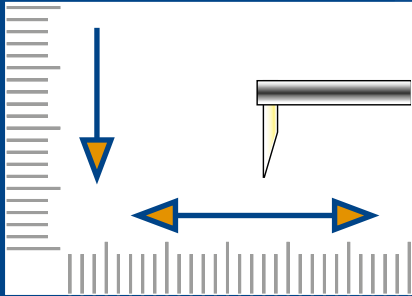
- Robust mechanical base
- Wide measuring range 250 x 320 (TS), 280 x 350 (TS-X)
- Guiding elements from granite for the highest degree of levelness
- Motorized Y-adjustable table's automatic cresting function finds highest and lowest point. (Optional)
- Motor-controlled measuring axes
- Permanent dynamic speed control. This results in the distance between data points remaining constant, regardless of profile inclination
- Non-contact incremental linear scales. Our scales are like steel when it comes to thermal behavior. Therefore, temperature compensation or extensive climate control are not necessary in most cases
- Integrated control electronics
- Data recording and control via standard interfaces warrant future use and independence, regardless of changing computer hardware
- No relevant radial movement of the tracing arm
- Unique horizontal position of the tracing arm allowing easy and safe access to inspect the piece at any time
- Accuracy: $\pm (0.9 + L/100) \mu\text{m}$ [L = measurement displacement in mm] (ConturoMatic TS)
- Accuracy: $\pm (0.85 + L/100) \mu\text{m}$ [L = measurement displacement in mm] (ConturoMatic TS-X)
- ConturoMatic software compatible with: Win10/64Bit alternatively Win7/64Bit

ConturoMatic TS

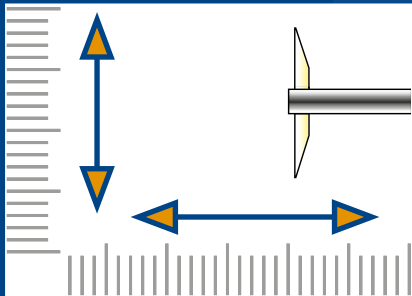


Your needs are growing?

ConturoMatic TS grows with you.



The modular concept allows cost-effective entry to the TS class with the option to retrofit additional functions at any time. With no mechanical intervention in the existing system; simply by software activation. The extension packages, which are available on an optional basis, contain all the necessary components, such as tracing arms for up/down scanning or roughness sensor with diamond tip.



The technical innovations that make our new TS system the best device in its class include the integrated, maintenance-free electro-mechanical system for tracing force adjustment. Using this function, the tracing force can be adjusted for the contour and roughness operation. These settings are individually configured for each tracing arm, managed by the software and automatically adjusted according to the required measurement function. To calibrate the tracing arm and the offset between the upper and lower probe tip, only the ball standard, which is included in the scope of supply, is required.

Due to the geometrically precise horizontal position of the tracing arm, it is possible to check contours and bores with a diameter of less than 2 mm to more than 300 mm.

Breakage of the probe tip is minimized by the integrated safety shutdown of the Z-axis movement. The roughness analysis option, which is realized through the integrated measuring force setting, can be used in combination with the contour analysis. In many cases this makes further measuring superfluous. Contour and roughness results can effectively be determined in a single step.

Other tasks that can be performed by our ConturoMatic-TS include the analysis of bores, distances from inner to outer contours, threads, taper angle and parallelism, profile defects and the measurement of discontinuous surfaces, with no loss of reference measurement.

Extensions

All options can be combined as desired.

Option UD (Up/Down):

This function allows switching of the scanning direction with no loss of reference, e.g. to define bores or reference measurements from outer to inner contours. This function is also available in combination with roughness analysis and can be integrated into automated measurement sequences.

Additional evaluation options:

- Determination of raceway diameters
- Diameter determination
- Wall-thickness variation
- Parallelity measurement
- Taper-angular measurement
- Slope determination
- Thread measurement (evaluation software optional)

Option R (roughness):

Software option for calculating the surface roughness. For a full list of assessable parameters see page 17.

- Measurement of surface roughness by means of reference surface measurement
- Contour + roughness measurements can be combined under "multi-contour"
This function is also available in combination with the option UD described above
- Roughness evaluation can also be integrated into automated measurement sequences

Option motorized Y-table:

While manual adjustment is still possible the motorized Y-adjustable table's automatic cresting function can find the highest or lowest point with the press of a button in the software. Y-adjustment range is 17 mm.

Table load capacity: TS, TS-R, TS-UD, TS-UDR = 35kg, TS-X = 25kg, TS-XHD = 50kg

The Y-search range can be adapted to avoid probe damage in small bores or narrow measuring points.

Benefits:

- User-independent calculation of reversal points with high precision
- Minimizes measurement errors due to upper and lower probe tip axle offset
- Automatic identification of convex and concave reversal points
- The automatic cresting function can be used when measuring from above and below

Thread analysis:

Software option for evaluating the characteristic values of threads and thread gauges. Usable with ConturoMatic TS-X/TS-UD/TS-UDR/T3/T1/T1-R.

Overview of the included standards:

- Metric ISO threads in accordance with DIN ISO 1502:1996 (DIN ISO 965:1998)
- Gauges for metric ISO-threads in accordance with ANSI B1.16M-1984
- Metric ISO trapezoidal threads in accordance with DIN103:1997
- „Unified“ thread or thread gauges in accordance with ANSI/AMSE B1.1-1983/B1.2-1983
- Thread gauges for „Unified“ (ANSI/ASME B1.1) in accordance with BS 919:Part:1960
- Gauges for pipe threads in accordance with DIN ISO 228:2000
- Gauges for pipe threads in accordance with DIN 259:1979(alt)
- Armoured conduit thread in accordance with DIN 40430, DIN 40431:1972
- Gauges for round threads in accordance with DIN 405:1997
- Whitworth thread or thread gauge in accordance with BS 84:1956/BS 919: Part2:1971
- NPSM thread in accordance with ANSI/ASME 1.20.1-1983
- Betress thread in accordance with DIN 513:1985/company standard
- MJ thread in accordance with ISO 5855:1989
- Gauges for thread inserts (HeliCoil) in accordance with DIN 8140:1999(EG thread)
- Metric and „Unified“ thread in accordance with Böllhoff company standard
- Valve thread in accordance with DIN 7756:1979 and ETRTO V.7
- ACME thread in accordance with ASME/ANSI B1.5-1988
- Stub ACME thread in accordance with ASME/ANSI B1.8-1988
- Thread for bicycles in accordance with DIN 79012
- Adjustment gauges for thread measuring devices in accordance with DIN 2241
- Further threads on request

Data export (optional):

Optional software to convert data created using ConturoMatic systems to qs-STAT (Q-DAS ASCII transfer format)¹. ConturoMatic measurement data can be converted and exported in a readable format e.g. Q-DAS.

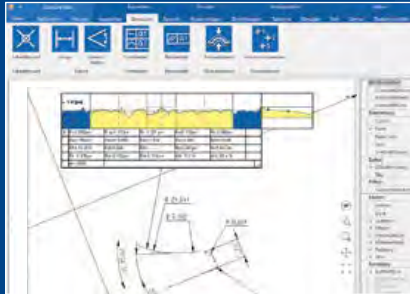
Benefits:

- No additional program needed for the conversion. The function is integrated in the main program.
- Largely freely definable fields (K-fields)
- Transfer of values (actual and setpoint value, tolerances) from the ConturoMatic software
- Header data (e.g. order number, drawing number, etc.) are taken from the ConturoMatic software
- Path for saving the DFQ-file freely definable
- Retrofittable for all ConturoMatic systems

¹ Certification of the converter by Q-DAS is not provided.

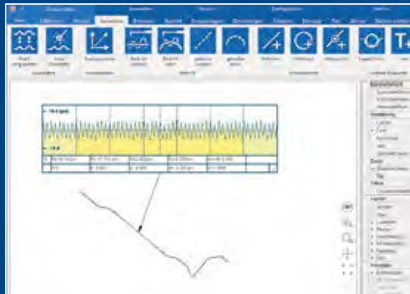
ConturoMatic Roughness

Contour and roughness measurement in one step



State-of-the-art contour measuring systems increasingly permit data acquisition and calculation of roughness parameters too. Roughness measuring of inclined contours brings more and more of the previous scanning procedures and assessment methods to their limits.

To solve this problem, our calculation algorithms have, from the start, been based on orthogonal regression. This method, in connection with dynamic speed control, which ensures even data point distance, leads to perfectly precise results – even on tilted surfaces. In contrast, conventional solutions for achieving constant measuring point distances require generating theoretical points, that haven't actually been measured, via interpolation.



With our optional surface roughness software update for the ConturoMatic TS, your contour measuring system turns into a particularly high-performance system for surface & contour measurement.

All common parameters can automatically be measured and evaluated. The software is seamlessly integrated into the standard software and can be operated intuitively. It is also possible to update every T1, T2 and TS system delivered to date. The update comprises software for surface roughness, a roughness tracing arm with 2 μm tip radius and 60° angle, as well as comprehensive operating instructions. The roughness option is standard for the ConturoMatic TS-X.

➤ Assessable parameters

- Pt, Pz, Pa, Pc, Pq, Pp, Pv, Psk, Pku, PSm, Pdq, Pmr(c)
- Rt, Rz, Ra, Rc, Rq, Rp, Rv, Rsk, Rku, RSm, Rdq, Rmr(c), Rk, Rpk, Rvk, Mr1, Mr2, RPc, Rmax (VDA 2006), R3z (DB works standard)
- Wt, Wz, Wa, Wc, Wq, Wp, Wv, Wsk, Wku, WSm, Wdq, Wmr(c)
- Optional: Dominant Waviness in accordance with VDA 2007
- Optional: Robust Gaussian Regression Filter in accordance with DIN EN ISO 16610-31 (03/2017)



➤ Applied standards for testing surface parameters

- DIN EN ISO 4287:2010-07
- DIN EN ISO 4288:1998-04
- DIN EN ISO 16610-21:2013-06
- DIN EN ISO 13565-1:1998-06
- DIN EN ISO 13565-2:1998-06
- DIN EN 10049:2014-03
- DIN EN ISO 16610-31:2017-03 (Option)
- VDA 2006:2003-07
- VDA 2007:2007-02 (Option)
- DB N 31007 (1983)

User-defined settings can also be used to deviate from the standard.

Measurement technology for highest demands



Our proven concept: “Contour and roughness measurements at the highest level” is what keeps us developing new systems. This philosophy has driven us to reanalyze every element of our ConturoMatic TS to reach a new level of system accuracy. Detailed fine-tuning of the guides, aerostatic air bearings, high-speed data transfer, fast reaction axis tracing, optimized tracing arm bearing, newly developed drive units and incremental scales of the highest quality are the results of a comprehensive, ever evolving, development process.

The result is the newest product from T&S: ConturoMatic TS-X – our high-performance measuring station.

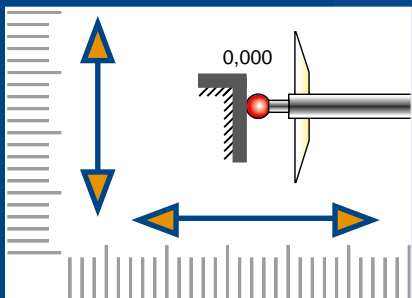
Overview of the performance features of TS-X:

- Special frictionless aerostatic air bearings for the X- and Z-axes
- Enlarged measuring range (280 x 350 mm)
- Hybrid-ceramic tracing arm bearing
- Static sensing and measurement data collection in the X direction
- Module roughness analysis in the standard scope of delivery
- Table load of up to 25 kg (optionally 50 kg)
- Y-adjustable table can be set manually or automatically using the integrated motor.
- Non-contact incremental linear scales on steel base
- Measuring system resolution 1 nm
- Outstanding price-performance ratio
- Accuracy: $\pm (0.85 + L/100) \mu\text{m}$ [L = measuring length in mm] (no measuring direction change)
- Combined contour and roughness measurements possible over the entire measuring range
- ConturoMatic software compatible with: Win10/64Bit alternatively Win7/64Bit

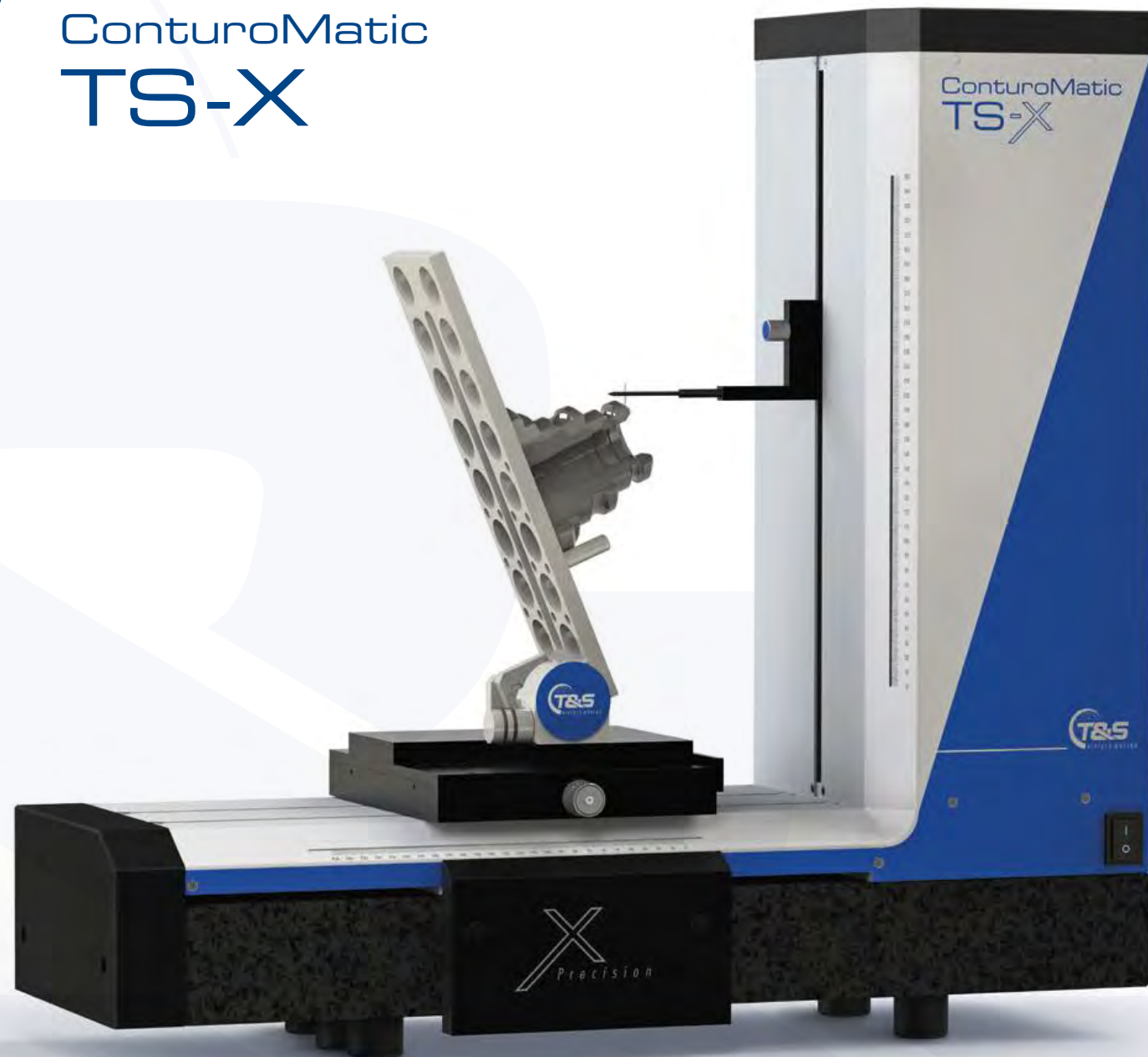
ConturoMatic TS-X surface roughness

- Measurement of surface roughness (by reference surface measurement)
- Measuring range of roughness: 280 x 350 mm
- Effective resolution: 1 nm
- Measuring speed: 0.1 - 0.5 mm/s
- Measuring force: 7.5 mN (variably adjustable)
- Measuring point distance: approx. 0.5 μm
- Suitable for roughnesses: $R_z > 0.5 \mu\text{m}$, $R_a > 0.05 \mu\text{m}$
- Accuracy: 5%

See pages 16 and 17 for description and scope of functions.



ConturoMatic TS-X



Our little one for the big tasks



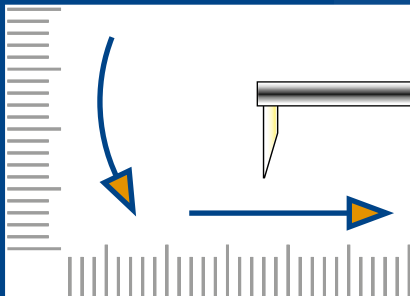
Our concept: concentrate on what is essential.

The ConturoMatic CV120 is a classic contour measuring device that boast smart functions and sensible automation. It offers everything a powerful and reliable contour measuring system needs.

Originally developed to control the quality of individual production processes, our CV120 with its robust mechanics and high-performance software does a great job in the measuring lab too. Workpieces can be automatically measured within the entire measuring range. The complete calibration process of the traverse unit is fully automated. High measuring precision, detailed assessment, very simple operation and an outstanding price make the CV120 particularly attractive. We offer these with a stone or aluminum (for mobile use) base plate.

Are you still using a contour measuring device with outdated technology?

Regardless of the manufacturer, we offer our "ConturoMatic CV120" as a retrofit system. You can continue to use all existing components that are still functional, such as X-Y adjustment table, stone slab and vice. We provide the necessary components to adapt our CV120, and you thereby gain a modern measuring device in accordance with the current state of the art at an unbeatable price / performance ratio.



Technical specifications:

- External control via standard USB interface
- Measuring range CV120: 30 x 120 mm
- Positioning range of the Z-column: 380 mm
- Software-controlled tracing arm lifting function
- Automatic measuring via teach-in programming
- Even extremely large and heavy parts can be measured
- All axis movements can be automated
- Simple change of the tracing arm
- Calibration standard for dynamic X/Z-calibration in the scope of delivery
- As a mobile system with vertically adjustable X-axis, for measuring contours of large work pieces while they are still in the machine (e.g. on the production line of large bearing rings)
- ConturoMatic software compatible with: Win10/64Bit alternatively Win7/64Bit

ConturoMatic CV120



Our large one

for measurement laboratories and production monitoring



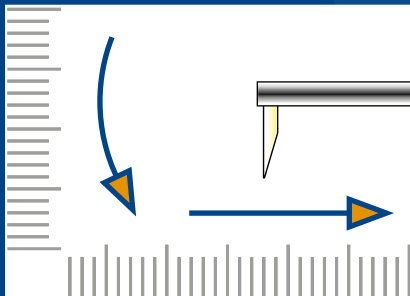
Our ConturoMatic CV300, the coherent extension of the proven principle of our CV120.

The same applies here: concentrate on what is essential. With its measuring distance of 100 x 300 mm, the CV300 offers the possibility to reliably inspect contours of even larger and heavier workpieces.

The ConturoMatic CV systems are classic contour measuring devices that boast smart functions and sensible automation. They offer everything a powerful and reliable contour measuring system needs.

Are you still using a contour measuring device with outdated technology?

Regardless of the manufacturer, we offer our "ConturoMatic CV300" as a retrofit system. You can continue to use all existing components that are still functional, such as X-Y adjustment table, stone slab and vice. We provide the necessary components to adapt our CV300, and you thereby gain a modern measuring device in accordance with the current state-of-the-art at an unbeatable price / performance ratio.



Technical specifications:

- External control via standard USB interface
- Measuring range CV300: 100 x 300 mm
- Positioning range of the Z-column: 400 mm (optional 600 mm)
- Software-controlled tracing arm lifting function
- Automatic measuring via teach-in programming
- Even extremely large and heavy parts can be measured
- All axis movements can be automated
- Simple change of the tracing arm
- Calibration standard for dynamic X/Z-calibration in the scope of delivery
- Available as a mobile system with vertically adjustable X-axis, for measuring contours of large workpieces while they are still in the machine (e.g. on the production line of large bearing rings)
- ConturoMatic software compatible with: W10/64Bit alternatively W7/64Bit

ConturoMatic CV300



Just
rent



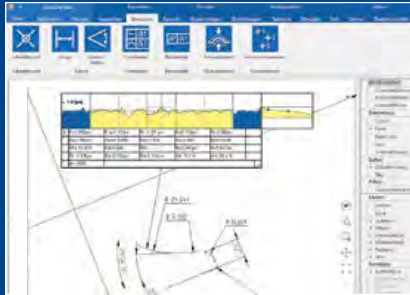
ContuRent

Rent instead of buy – a concept that pays off

Take advantage of the extensive benefits that result for your company:

- Renting allows an order-related investment
- Suitable for relieving short-term bottlenecks of existing measurement systems
- Competitive advantage when submitting your bid – Renting allows an easy cost per piece calculation
- Low capital commitment - costs only for the duration of use
- Protect your credit line by not committing yourself to long-term financing
- Save your liquidity and collateral for other projects. No financial risk when renting a machine
- Immediately deductible operating expenses – the asset is not capitalized in fixed assets
- Planning security – constant rates over the agreed term means no surprise costs
- Option to buy – Would you like to own the system after the rental date? No problem
- Periodic maintenance included in the rental costs
- If desired, we can provide project specific „full service“ solutions which may include tailored workpiece mounts, measurement program creation and operator training
- Our rental systems are always up to date
- Suitable for school and training projects – procure the system solely for the relevant training sections
- Short and long term rentals possible

ConturoMatic S1 Software



The user's needs have always been at the very top of our list of requirements. Our guiding principle has always been: contour measurement must be quick and easy. The trick is a combination of simple and intuitive operation of the system with unlimited diversity in performance.

Our solution for this feat: the ConturoMatic S1 software.

The operating concept of ConturoMatic S1 software is perfect, both for quality control on the production area and in the laboratory. All contour and roughness measuring devices are generally based on the profile method. Therefore, we have developed a consistent software basis as an interface to the user.

Higher efficiency via continuous development:

We maintain close communication with our users. Quick and expedient integration of our customers' suggestions makes continuous optimization of our software solution possible.

Benefits at a glance:

Simple measurement:

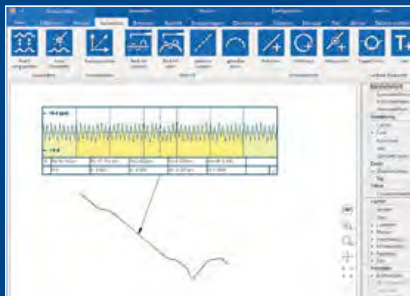
- All evaluation functions can be achieved by a single mouse click, without any elaborate menu bars and sub-functions
- Production control permits user-independence, meaning results and tolerance comparisons are conducted fully automatically and error-free
- Each measurement carried out generally contains everything needed to turn it into an automatic test process to include analysis. Teach-in in its purest form
- Three basic steps lead to automated inspection: measurement, assessment, saving

More accurate measurement:

- Parts that were difficult to measure before can now be dimensioned clearly and reproducibly
- The software is mainly form- and position-tolerant

Ready for the future:

- Our ConturoMatic software is the basis of our TS and CV systems and continuously under development
- We provide our customers with free software updates and extensions



► ConturoMatic S1 function excerpt

- Create basic coordinate system
- Regression line, single- and multi-part
- Regression circle, single- and multi-part
- Start and end angle fixing for regression circle
- Start and end fixing for regression line
- Calculation of radius, distance, angle, incline, ...
- Angle display in °/'", decimal, incline μ/mm
- Generation of auxiliary elements, circle, line, point, coordinate grid, parallel line, vertical line, angle bisector, angle line, ...
- "Fixed circle" fitting
- Intersection generation line/line
- Intersection generation auxiliary line/contour
- Intersection generation line/radius
- Generation of free reference points
- Determine highest point
- Determine lowest point
- Variable vanishing point generation mm or %
- Regression line through x points
- Regression radius through x points
- Ball adjustment
- Torus adjustment
- Form deviation, graphically scalable in X+Z
- Radius deviation, graphically scalable in X+Z
- Radius form error
- Parallelism
- Profile rotation
- Gothic profile evaluation (standard)
- Automatic dimensioning with tolerance assessment
- Integration of graphical information on the automatic test process
- Visual tolerance indicator
- DXF fitting
- Free text box
- Contour-bound text box
- Roughness measurement (optional)
- Extensive print processor
- Assign print templates to reference part measurements automatically
- Send prints jobs automatically after reference part measurements
- Output results in list form with tolerance evaluation
- Printout in portrait or landscape format
- Numbering of position valves
- Dynamic contour tracing
- Import data from third party systems using various standard formats
- Variable data export
- Automatic data export after measurement
- Export of results
- Export of raw data
- Export of DXF data
- Simple generation of autonomic measuring processes
- Smart tracing path optimization
- Grid lines can be displayed
- Dynamic axis scaling
- Individual color adjustment
- Software-assisted tracing arm calibration
- 12 selectable operating languages
- User administration
- Compatible with Windows W7 (32/64Bit) / W10

CS-Ceramic Tips



The connection between the surface and measuring device – often disregarded but still essential:

Slide friction, bending effects and tip shape are essential influences on the measured result.

Problems:

The slide friction between the probe tip and workpiece surface causes bending effects during measurement. This effect is mainly corrected by tracing arm calibration - but a residual error that cannot be corrected still remains. In addition, several workpiece materials will also cause deviating bends in the probe tip. These errors cannot be systematically corrected with reasonable effort. The only way out is by reducing friction.

Classic probe tip:

A classic probe tip weakness of contour measuring devices is the tip shape that is not uniquely defined. The transfer between various radii practically leads to only a single place of the tip radius corresponding to the requirements. The tip geometry is no longer defined outside of the axis.

CS ceramics probe tips:

The problems stemming from sliding friction, bend and tip shape are reduced first and foremost by our patented CS probe tips. The friction coefficient of our probe tips made of high-performance ceramic is far below that of carbide. Defined tip geometry prevents defective measured values caused by small positioning errors. The result of our improvement measures leads to a clear reduction in measurement uncertainty.

Benefits at a glance:

- Optimized patented tip geometry
- Significantly less time is required for precise placement at the workpiece
- Reduced friction as compared to carbide
- Electrically non-conductive
- Not magnetizable
- Resistant against attachment cutting
- Form-retaining probe tip geometry
- The scanning element follows the test piece surface much more securely in the threshold area
- Consistently high product quality
- High-tech material
- Grain size reduced by 50% as compared to conventional carbide
- Extraordinarily high-wear resistance and hardness
- Reduced susceptibility to breaks
- Lower costs

Standard probe tips

One-way contour ceramic probe tips				
Probe tips total length	Probe tip Ø	Probe tip angle	Probe tip radius	Item no.:
6 mm	1,0 mm	19°	25 µm	7181-04-CS42
9 mm	1,0 mm	19°	25 µm	7181-07-CS42
12 mm	1,0 mm	16°	25 µm	7181-082516
20,5 mm	3,5 mm	12°	25 µm	7181-03-CS42
33 mm	3,5 mm	12°	25 µm	7181-02-CS42
59,5 mm	3,5 mm	12°	25 µm	7181-01-CS42
One-way contour HM carbide probe tip, conical				
6 mm	1,0 mm	24°	25 µm	5730-08-k
20,5 mm	3,5 mm	24°	25 µm	5730-07-k
33 mm	3,5 mm	24°	25 µm	5730-02-k
Two-way contour ceramic probe tip				
2 x 5 mm	1,0 mm	19°	25 µm	7182-03-CS42
2 x 9 mm	1,5 mm	14°	25 µm	7182-02-CS42
2 x 16,5 mm	2,5 mm	12°	25 µm	7182-01-CS42
Two-way contour HM carbide tip				
2 x 5 mm	1,0 mm	24°	100 µm	6810-02-100-k
Diamond probe tip (roughness)				
1,5 mm	0,5 mm	60°	2 µm	7796
6 mm	1,0 mm	60°	2 µm	7903
10 mm	1,0 mm	60°	2 µm	7636-10
20 mm	1,0 mm	60°	2 µm	7636-2010
Two-way diamond probe tip (roughness)				
2 x 5 mm	1,0 mm	60°	2 µm	7825
One-way contour probe tip – ruby ball				
Probe tips total length	Connection thread	Shaft Ø	Ruby ball Ø	Item no.:
21 mm	M3	1	1,5 mm	7124
Two-way contour probe tip – ruby ball T-shape				
Probe tips total length	Receptacle shaft Ø	Shaft Ø	Ruby ball Ø	Item no.:
2 x 5 mm	3,0 mm	0,6 mm	1,0 mm	7487-01
2 x 5 mm	3,0 mm	1,0 mm	2,0 mm	7487-4
2 x 10 mm	3,0 mm	1,0 mm	1,0 mm	7634
Two-way contour probe tip – T-shape				
Disc Ø	Receptacle shaft Ø	Disc angle	Disc radius	Artikel-Nr.:
2,5 mm	1,0 mm	15°	25 µm	7184-101-L40
5 mm	2,0 mm	15°	25 µm	7184-102-L40

Tracing arms

A small excerpt from our comprehensive range:

One-way contour tracing arm – short version – for ConturoMatic T1/T2/T3/TS/TS-UD/TS-X			
150/20,5			Item no.: 6829-02-2 Tracing arm total length 150 mm, probe tip length 20.5 mm
150/6			Item no.: 6829-01-2 Tracing arm total length 150 mm, probe tip length 6 mm
One-way contour tracing arm – long version – for ConturoMatic T1/T2/T3/TS/TS-UD/TS-X/CV250/CV250D			
260/6			Item no.: 6829-04-2 Tracing arm total length 260 mm, probe tip length 6 mm
260/33			Item no.: 6829-05-2 Tracing arm total length 260 mm, probe tip length 33 mm
260/59,5			Item no.: 6829-06-2 Tracing arm total length 260 mm, probe tip length 59.5 mm
Two-way contour tracing arm – short version – for ConturoMatic T1/T3/TS-UD/TS-X			
150/2x5			Item no.: 6829-08-2 Tracing arm total length 150 mm, probe tip length 2 x 5 mm
150/2x9			Item no.: 6829-21-2 Tracing arm total length 150 mm, probe tip length 2 x 9 mm
150/2x16,5			Item no.: 6829-33-2 Tracing arm total length 150 mm, probe tip length 2 x 16.5 mm
190/2x1,25 Disc			Item no.: 6829-24 Tracing arm total length 190 mm, probe tip length 2 x 1.25 mm

Two-way contour tracing arm – short version – for ConturoMatic T3/TS-UD/TS-X			
150/2x9x1,5 Ruby			Item no.: 6829-87-2 Tracing arm total length 150 mm, probe tip length 2 x 9 mm and ruby ball Ø1.5 mm
Two-way contour tracing arm – long version – for ConturoMatic T1/T3/TS-UD/TS-X			
260/2x10x1,0 Ruby			Item no.: 6829-47 Tracing arm total length 260 mm, probe tip length 2 x 10 mm and ruby ball Ø1.0 mm
260/2x16,5			Item no.: 6829-10-2 Tracing arm total length 260 mm, probe tip length 2 x 16.5 mm
One- or two-way – Roughness tracing arm – for ConturoMatic T1-R/TS-R/TS-UDR/T3/TS-X			
190/6			Item no.: 6829-65-1,0 Tracing arm total length 190 mm, probe tip length 6 mm diamond 60° 2 µm
190/2x5			Item no.: 6829-89 Tracing arm total length 190 mm, probe tip length 2 x 5 mm diamond 60° 2 µm
Examples for special tracing arms			
200/90°/20,5			Item no.: 6829-11 Tracing arm total length 200 mm, 90° angled Probe tip length 20.5 mm
200/2x33 HG			Item no.: 6829-145 Tracing arm total length 200 mm, Probe tip length 2 x 33 mm 20° inclined tips – forward

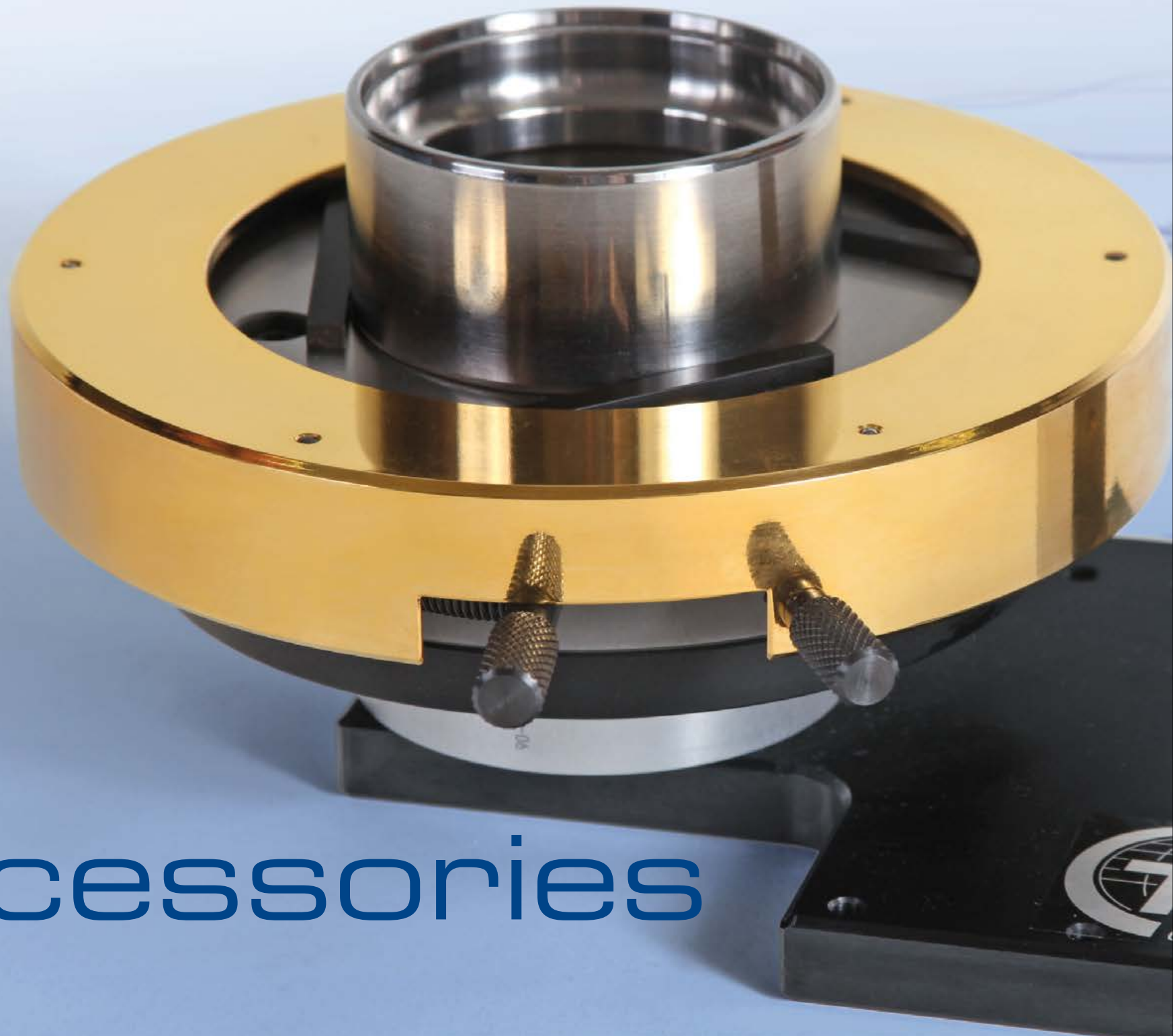
➤ On request, we will be pleased to provide you with custom tracing arms to fit your measuring needs.

Technical Data

ConturoMatic		TS	TS-X (HD)	CV120	CV300	Comment
ConturoMatic system data						
Measuring range-X	↔→	250 mm	280 mm	120 mm	300 mm	
Measuring range-Z	↑↓	320 mm	350 mm	30 mm	100 mm	
Scanning from below	↓	✓	✓	✓	✓	
Scanning from above	↑	•	✓	–	–	
Measuring direction	↔→	✓	✓	–	–	
X-scanning	↔→↔	–	✓	–	–	
Measuring speed		0,1-3,0 mm/s		0,03-1,75 mm/s		
Auto speed optimization		✓	✓	–	–	
Positioning speed		up 25 mm/s		up 25 mm/s		
Measuring system(s)		visually incremental		digital	digital	
Measuring data processing		digital				
Measuring system resolution		0,001 µm	0,001 µm	0,01 µm	0,01 µm	
Guide elements		mechanic	aerostatic	mechanic	mechanic	
Table load max.		35 kg	25 kg (50 kg TS-X HD)	30 kg	75 kg	centrically load
System inaccuracy *						
Total error		+/- (0,9+L/100) µm	+/- (0,85+L/100) µm			per scanning direction L = measuring path in mm
X-axis		+/- (0,75+Lx/100) µm	+/- (0,5+Lx/100) µm	+/- (1,2+2Lx/25) µm	+/- (1,0µm+Lx/25) µm	Lx = X - measuring paths in mm
Z-axis		+/- (0,75+Lz/100) µm	+/- (0,5+Lz/100) µm	+/- (1,8+2Lz/25) µm	+/- (1,5µm+2Lz/25) µm	Lz = X - measuring paths in mm
Guide accuracy no guide correction		(0,15+L/100) µm	(0,08+L/100) µm	(1,5+L/25) µm	(1,2+L/25) µm	L = measuring paths in mm
Measuring point distance in X		0,5 - 25 µm	0,5 - 10 µm	0,5 - 17 µm		
Radius measurement		± 0,005 % of the NW bei R12,5 mm		± 0,05 % of the NW bei R12,5 mm		NW = nominal value
Distance measurement		+/- (1,2+L/100) µm		+/- (1,8+L/25) µm		
Angle measurement		≤ 30°	≤ 20°	≤ 2°		
ConturoMatic Software						
Contour		✓	✓	✓	✓	
Diameter		•	✓	–	–	
NC-Automatic measurement		✓	✓	✓	✓	
NC-Automatic assessment		✓	✓	✓	✓	
Roughness						
Availability		•	✓	–	–	
Measuring range Z/X		1,0/250 mm	350/280 mm	–	–	
Application ranges Ra		Ra ≥ 0,1 µm	Ra ≥ 0,05 µm	–	–	
Application ranges Rz		Rz ≥ 1,0 µm	Rz ≥ 0,5 µm	–	–	
Measuring point distance		ca. 0,5 µm	ca. 0,5 µm	–	–	
Accuracy		5% MW	5% MW	–	–	MV = Measured value
Measuring speed		0,1 mm/s	0,1 - 0,5 mm/s	–	–	
Measuring force		7,5 mN	7,5 mN	–	–	

* Conditions according to T&S specification • = Option – = not available

Information without warranty as of 01.03.2017



Accessories



Quality assurance

more than the use of suitable measuring equipment

It is the optimal combination of reliable measuring instruments, ergonomic operation and the use of functional accessories.

Increasing demands in terms of flexibility, cost pressure and short set-up times call for accessories that are suitable for universal use and highly efficient in operation. Professional auxiliary systems offer you clear differentiation from the competition, for example in the form of flexibility, safety, cost efficiency and high-speed responsiveness.

Ergonomics ultimately leads to stress-free, effective working.

Take advantage of our extensive know-how and forward-looking products. Measuring instrument accessories by T&S stand for tailor-made, ergonomic, innovative concepts, from simple workpiece support to complex, intelligent measuring equipment.

Centring & clamping devices



How does the workpiece get onto the measuring instrument?

Modern manufacturing processes now facilitate levels of quality, the testing of which stretches the limits of measuring equipment accuracy. A major proportion of the uncertainties associated with testing is still very much attributable to the workpiece holder. The precise clamping and alignment of test specimens in measuring devices is often also a very time-consuming undertaking. But time is money – especially in the manufacturing industry.

And above all,

faulty test specimens that are not identified due to inaccurate measurements have a negative impact on product quality and image.

Even more important is the correct workpiece holder, as it plays a key role in determining the quality of a measurement. It is not possible to achieve a correct measurement result without the exact positioning of the test specimen. It is a fact that in practice a high proportion of the achievable measurement accuracy is lost due to inadequate positioning in the measuring instrument. To counteract this, we have developed a number of centring and clamping systems specifically for use in quality assurance. The main areas of application are contour measurement systems, form measuring machines, coordinate measuring equipment and optical testing devices.

Centring and clamping systems by T&S are specifically designed for use on testing machines and guarantee precise measurement results. If our standard does not suffice, we will find a custom solution for your specific needs.

The advantages of our centring and clamping systems:

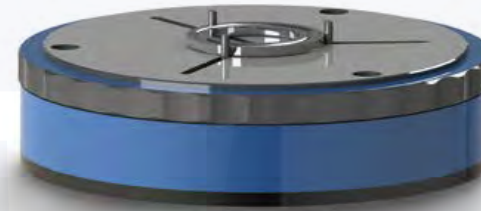
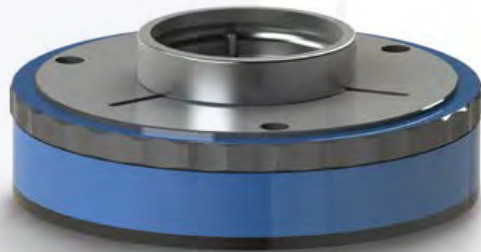
- Flexibility
- Simple, quick handling
- High precision, which generally makes re-centring unnecessary
- Robustness, designed for use in close proximity to production
- Variable clamping force for centring thin-walled parts



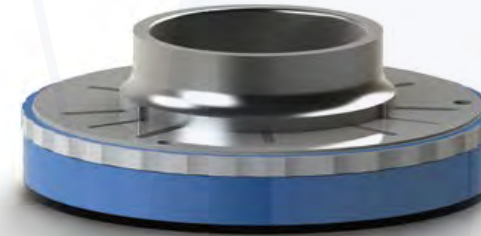
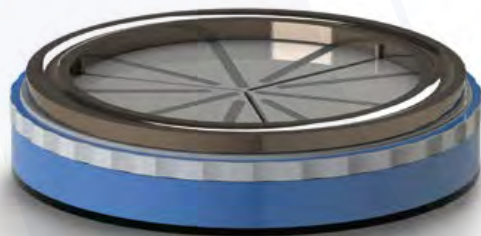
Centring & clamping devices

UZ series

Universal, patented system for external and internal centring of round test specimens. “The guide of the UZ corresponds to a non-linear curve. As a result, we achieve an outwardly increasing centring force. Larger, also usually heavier, test specimens are centred with a greater force than small, light workpieces.” The dowel pins are secured by means of threads and can be adapted for specific tasks. An adapter plate for fastening common form measuring devices to rotary machine tables is included in the delivery package.

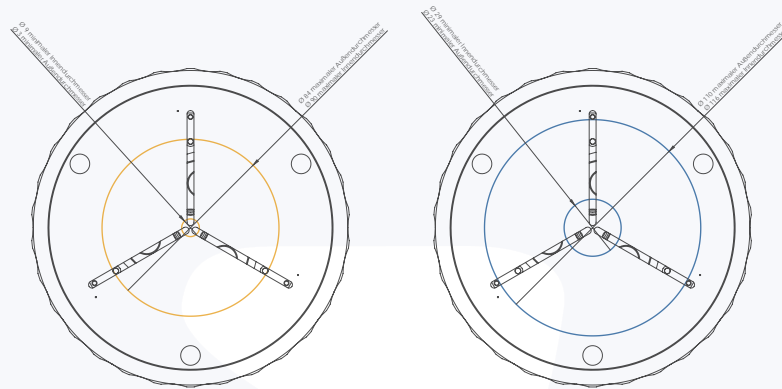


UZ-160 for external and internal centring of round specimens up to a diameter of 145 mm



UZ-240 for external and internal centring of round specimens up to a diameter of 230 mm with integrated magnetic strips (optional)

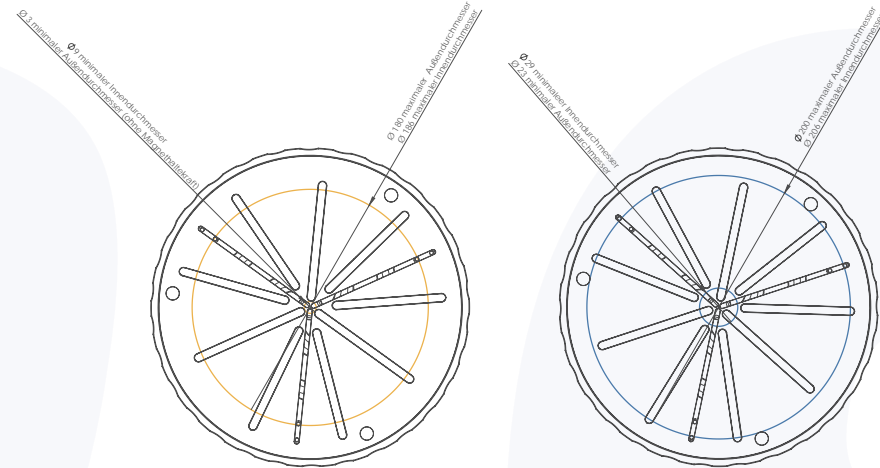
UZ-160 centring areas



Dimensions with centring pins in the inner position

Dimensions with centring pins in the outer position

UZ-240 centring areas



Dimensions with centring pins in the inner position

Dimensions with centring pins in the outer position

Application range

		UZ-160	UZ-240
DO	Outer \varnothing of device	$\varnothing 160$ mm	$\varnothing 240$ mm
H	Height without dowel pins	40 mm	42 mm
DTS	\varnothing of support surface for test specimen	$\varnothing 145$ mm	$\varnothing 230$ mm
di	\varnothing centring area, internal	$\varnothing 9 - 116$ mm	$\varnothing 9 - 206$ mm
de	\varnothing centring area, external	$\varnothing 3 - 110$ mm	$\varnothing 3 - 200$ mm

Centring & clamping devices

AZ series

Centring device designed as a centring and positioning aid for installation on form measuring devices. By rotating the outer ring, three arms are moved centrically to the centre of the holder. The arms are kept under tension by means of a spiral spring and thereby centre the test specimen. Due to the good mechanical performance, postcentring is generally unnecessary or is kept to a minimum. The low centring forces also permit the clamping of thin-walled parts without mechanical deformation.

Customised designs on request, such as:

- Height-adjustable centring arms
- Centring arms with locating holes for clamping discs, etc.
- Workpiece support plate with magnetic strips



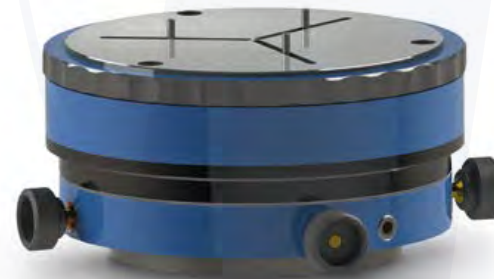
AZ-1

KZT series

Centering and tilting table for X-Y axle adjustment and leveling. The adjustment unit is carried manually by fine thread spindles. For each axis, the position and the inclination can be adjusted. Optionally, we can supply our KZT with adapted Centering unit UP/AZ.



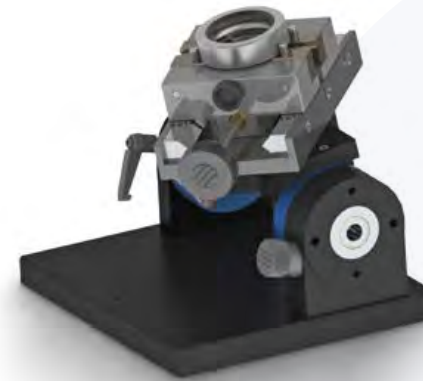
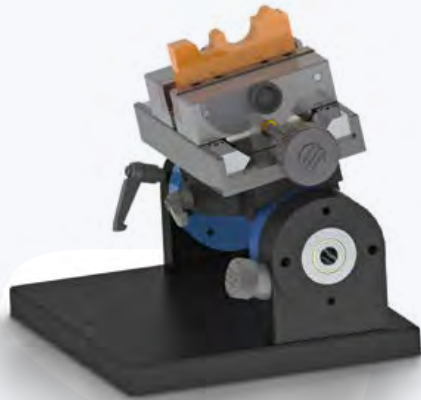
KZT-160 centering and leveling table



KZT-160 with adapted UZ-160

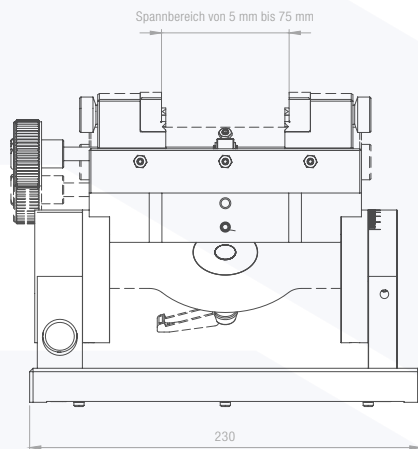
ZS series

Angle-adjustable, central clamping vice with radial rotary holder. Due to central clamping, the measuring axis of symmetrical workpieces remains in the measuring axis at all times. Constant repositioning of the workpiece holder for different test specimen dimensions is therefore no longer necessary. Our ZS vice is optionally available with radial rotary unit and angle adjustment via worm drive. The movement axes can be clamped in the respective position.

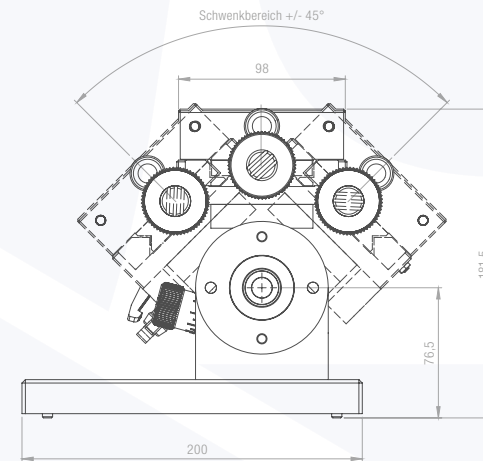


ZSR-60 jaw width 60 mm

Tilttable and rotatable vice



ZSR-60



Workpiece holders

WS series

Angle-adjustable universal clamps for the positioning of bearing rings on contour measurement systems. The central groove allows the measuring probe to pass through to behind the workpiece. The tilting movement of the workpiece is facilitated by means of a worm drive.

For the support, a movable prism and support bolts are included in the delivery package.

To prevent the tilting of the test specimen, a movable, spring-loaded retaining element is integrated into the device. Resilient reference sphere for determining the measurement of the rear face and magnetic inserts for securing the placed part are available as options.



WSE-300

WSF series

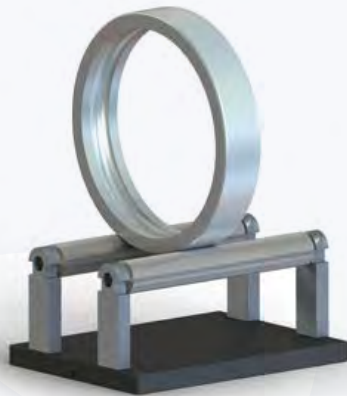
Angle-adjustable, three-jaw chuck with axial DP rotary unit.



WSF

WP/WPS series

Part support on parallel shafts (WP) as an alternative to fixed prisms and prisms with adjustable inclination angles (WPS). The advantages of this design are the low weight, large scope of application (\varnothing 25–350 mm), accessibility from above and below, and easy handling. We can supply shiftable stops as an option.



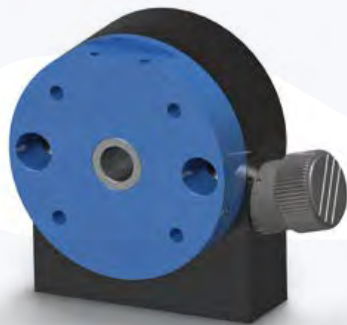
WP-100



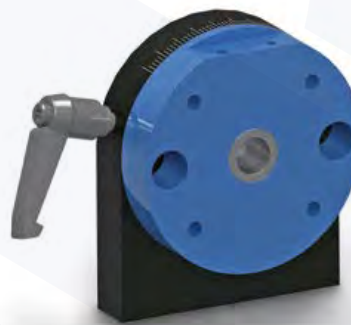
WPS

SG series

Radial rotary unit for angle adjustment with ergonomically slanted drive wheel. Reading of the swivel angle is carried out via the laser-etched scale. The rotary axis can be fixed in the set position via a clamping lever.

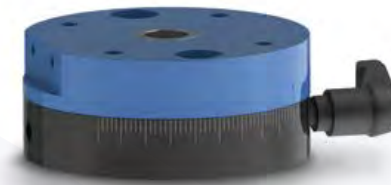


SG-1



DP series

Radial rotary unit for angle adjustment with angle scale. The rotary axis can be fixed in the set position via a clamping lever.

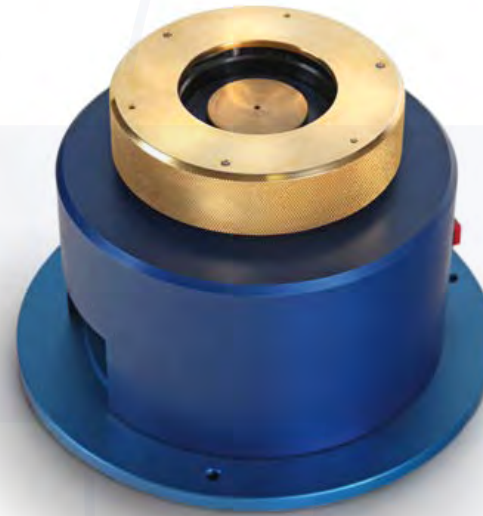


DP-1

Centring & clamping devises

VZ series

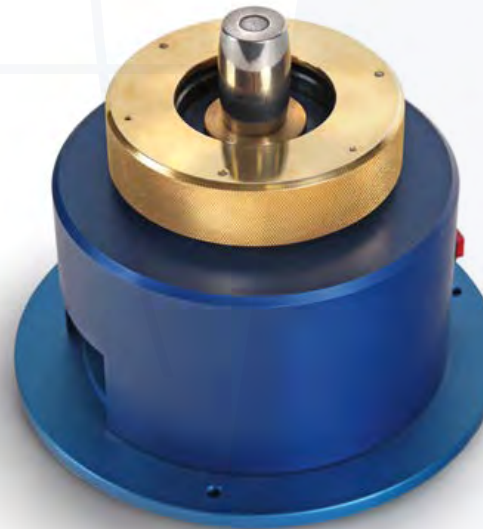
Battery-powered vacuum centring and clamping system with integrated, low-vibration special vacuum pump for rotary table systems. For test specimens which cannot be clamped using usual methods. For example, small or flat parts, balls, bolts or pins wich have to be inspected along their entire length, asymmetric parts, etc..



VZ-1 with AZ1 centring system

Benefits at a glance:

- Flexibility
- Simple, quick handling
- High precision, which generally makes re-centring unnecessary
- Robustness, designed for use in close proximity to production
- Variable clamping force for centring thin-walled parts



VZ-1 with AZ1 centring system – example of use

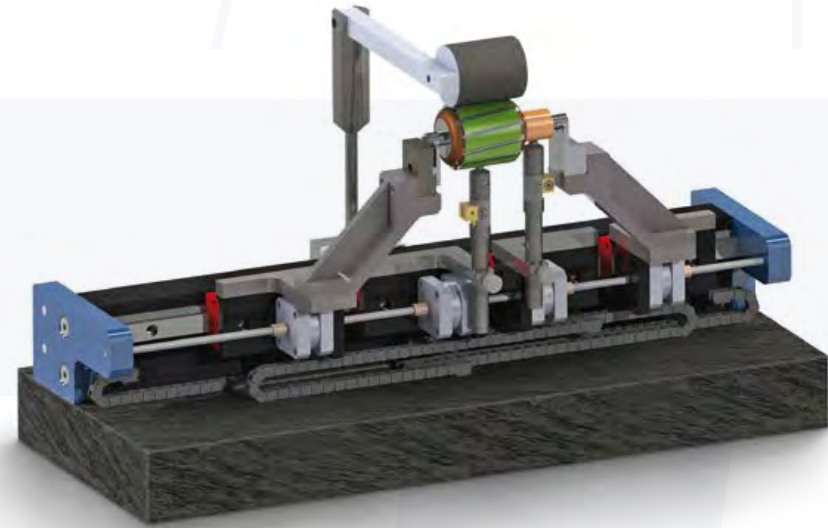
43 |

Commutator testing systems

Commutator testing systems – worldwide

We are one of the world's leading designer and manufacturer of systems for dynamic, geometric testing of electric motor rotors. Our range extends from inexpensive universal testing devices for production monitoring, through 100% in-process measurement in the production line with measurement times of less than two seconds, to intelligent measurement stations that adjust automatically to the respective test specimen type.

The quality and innovative capability of our systems is reflected not least in the fact that important competitors strongly align themselves with our approaches to problem-solving.



IKP-500 commutator testing system with automatic positioning of the measuring elements

KommutatorMatic mechanics

- **New:** Test station with measuring elements and support prisms that automatically adjust to the respective test specimen type
- **New:** Dynamic rotor test of angular offset from collector to skew-slotted disk pack
- Robust mechanics
- Ergonomic operation
- Easily adjustable elements
- Unrivalled short resetting time
- Modular design
- Easy adaptation to advanced measurement tasks
- Integration of external test systems, for example for roughness testing

Sensor technology and drive control

- Dynamic T&S USB interface
- Dynamic data recording of inductive displacement transducer signals with up to 4,000 S/s simultaneously up to 8 channels
- Dynamic data recording of analogue voltages of up to 50,000 S/s simultaneously up to 8 channels
- Integration of almost all common displacement transducers and interfaces
- Adaptable tactile and non-contact laser sensors
- Control of various motor controllers
- Communication with the PLC control unit of production lines
- Data exchange with higher-level CAQ systems
- Variable I/O for integration of remote control switches

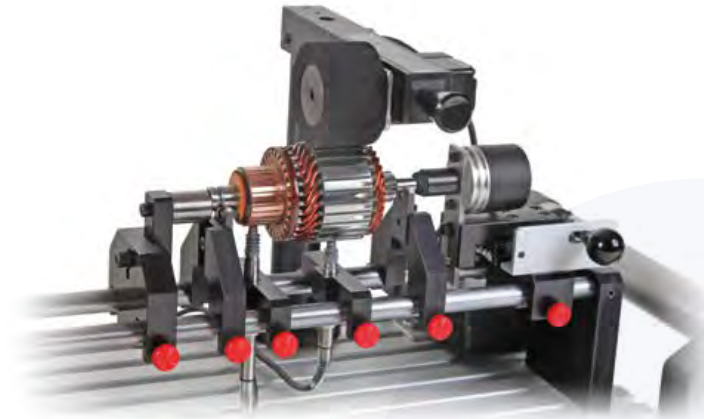
Software „kommutator.info“

Special features of the measuring system:

- Robust, can be also used in the production environment
- Flexible, ergonomic operation
- Integration of almost all popular calculation algorithms of geometric dimensions
- Data transfer interface and integration of external systems, for example roughness tester
- Numerical and graphical view of results
- Graphical display of tolerance violations
- Linear, polar or combined representation
- SPC evaluation
- CAQ data export
- Results viewable as a list
- User management
- Status display of control inputs and outputs
- Communication with the PLC control unit of production lines
- Typical cycle times including evaluation < 2 s

Evaluation of parameters:

- Bar to bar difference
- Delta bar to bar
- Bar to bar difference of laminated Commutator
- Segment form deviation
- Commutator runout
- Commutator roundness
- Commutator diameter
- Concentricity to shaft/worm
- Runout of laminated commutators
- Shaft roundness
- Shaft diameter
- Angular offset to disc pack
- Pack concentricity
- Runout of laminated disc packs
- Disk pack diameter
- Welding nose



Commutator testing system

Special measurement technologie

Do your needs require an individual solution?

No problem! From auxiliary devices to automatic testing machines with special software, we find the right solution with the help of our customised solutions.



Part holder with ZS-60 and Y positioning unit

T&S-customer service



Assistance when it matters

It's great when everything is running smoothly. However, if problems do arise, we offer customised solutions!

It's not enough for us to deliver technically outstanding products, our service know-how and customer support is first-class too.

Additionally, we place special importance on robustness and longevity when developing products. T&S is dedicated to the principle of technology "Made in Germany" and mainly cooperates with local partners and suppliers. This not only assures quality but in particular warrants short delivery and turnaround times.

After-sales service

We are available for support and advice and will use our combined practical know-how gained from more than 28 years of experience and several thousand of delivered systems across the world. You can reach us by phone or email during our business hours. If required, our technicians will come to your site personally.

What you can expect from us

- A friendly, helpful and competent service team
- Project management by our technical sales
- T&S in-house repair service with transport organization
- Technical customer service for on-site repairs
- Maintenance contracts with schedule monitoring by us
- User and follow-up training at T&S or at your site
- Free-of-charge technical customer service over the phone and by email
- Loan equipment to cover repair times where possible
- Global customer service
- Tracing arm repair service
- Free software updates



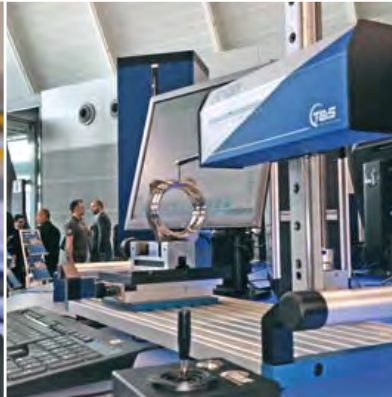
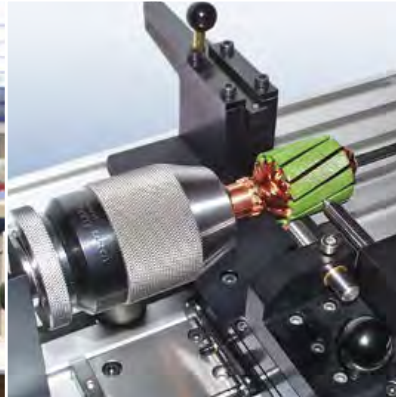
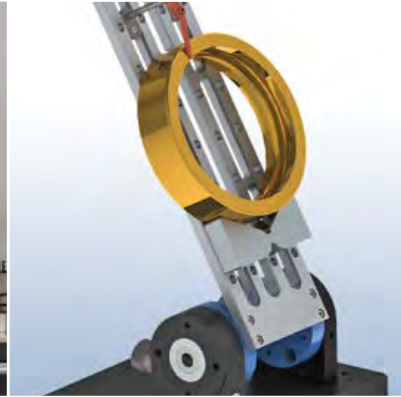
ISO 9001:2008-certification
Certified by
TÜV Rheinland Cert GmbH

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