



MORE LIGHT

Waveline – Roughness and Contour Metrology

Mobile and stationary systems for  
efficient, automatable measurements  
in the metrology lab or in production.

# Your partner for measuring solutions

The Light & Production Division of Jenoptik is a global specialist in the optimization of manufacturing processes.

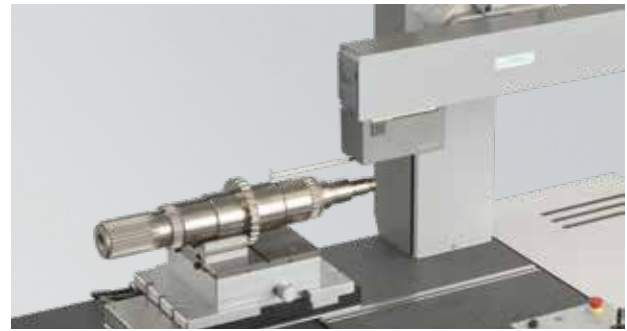
Our many years of experience and know-how in the field of industrial measurement technology and optical inspection, modern laser-based material processing and highly flexible robot-based automation enable us to develop tailor-made manufacturing solutions for our customers in automotive, aerospace, healthcare and other manufacturing industries.

As an experienced and reliable partner for high-precision, tactile and non-tactile production metrology, we support you with our global sales and services network.

Depending on the requirements, our tactile, pneumatic and optical measuring systems take on a wide range of tasks for the inspection of surface and form as well as the determination of dimensions, throughout every phase of the production process including final inspection or in the metrology lab. Our systems provide you with precise measured data within the shortest time frames.



Mobile roughness measurement



Stationary roughness & contour measurement

Surface inspection

Waveline measuring systems offer you extensive evaluation possibilities for surface measurement. Our product range consists of mobile surface measuring instruments, stationary measuring systems for manual and automated roughness, contour, topography or twist measurement, combined systems for roughness and contour measurements, as well as measuring instruments for cylinder bores. We also offer measuring stations tailored to meeting your specific measuring requirements.

## Tactile roughness measurement

- Roughness parameters
- Core roughness parameters
- Profile parameters
- Waviness parameters
- Motif parameters
- JIS parameters
- Topography evaluation
- Dominant waviness
- Twist parameters

## Tactile contour measurement

- Angle
- Radius
- Distance
- Parallelism
- Crowning
- Gothic arcs
- Edge geometries
- Line profile
- Threads
- Diameter

## Optical surface inspection

- Crosshatch angle
- Area of blowholes
- Radius
- Laser honing structures

Please scan for detailed Waveline information



# Waveline W5. Portable, reliable roughness measurement



Mobile measurement in production



Precise workpiece support



Exchangeable probes



Tolerance evaluation at a glance



Waveline W5 with optional printer Waveline P5

## System features

- Portable and battery-supplied
- Compact and light in design
- Easy, intuitive handling with click wheel and graphical user interface
- No calibration necessary
- Easily exchangeable probes
- USB port with Windows-compatible data format and battery charging function
- Features *Bluetooth*® technology for wireless data transfer and printing
- Battery capacity for up to 800 measurements
- Storage capacity for 5 measuring programs with measuring conditions
- Optional printer P5 with *Bluetooth*® technology for documentation of the measurement results on the spot
- Tolerance evaluation at a glance for immediate assessment of the measurement results
- Precise workpiece support, even on small shafts
- Measurement in all possible measuring positions, including on perpendicular surfaces and overhead

Model	Probe	Parameters	Printer	Traverse probing	Profile/material ratio	Tolerance	Statistics	Measuring programs	Roughness standard
W5	with skid	23	optional	no	no	yes	no	5	optional

# Waveline W10. Flexible, precise roughness measurement without boundaries



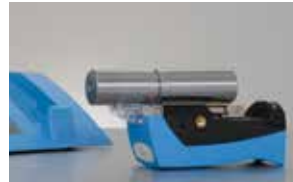
Waveline W10



Transverse probing



Integrated roughness standard



Measurement in overhead position



Height adjustment of traverse unit

## System features

- Mobile and battery-supplied, with cable-free traverse unit
- Usable as stationary instrument
- Measurement of all common roughness parameters according to international standards
- Modern, intuitive operation via color touchscreen
- Integrated rest and barrel jack for secure storage and continuous operational readiness of the traverse unit
- Immediate verification of the measuring system via the integrated roughness standard
- Easy changing of the skid probes
- Wireless data transfer via *Bluetooth*® interface
- Integrated printer for documentation of the measurement results on the spot
- Storage capacity for 7 measuring programs
- Measuring program specifically for verification of the measuring instrument with predefined nominal values
- 90° tilting of the probe for measurements in grooves and incisions or between collars
- Transverse probing without conversion
- Measurement of small workpieces in overhead position
- Contact to the workpiece via precisely polished shafts
- 3-point support on the traverse unit for secure positioning when measuring perpendicular surfaces
- Extendable tripod legs for height adjustment

Model	Probe	Parameters	Printer	Traverse probing	Profile/material ratio	Tolerance	Statistics	Measuring programs	Roughness standard
W10	with skid	40	integrated	yes	yes	yes	yes	7	integrated

# Waveline W20. Mobile roughness, waviness and profile measurement in production



Waveline W20



Motorized lowering of the probe



Mobile reference plane measurement



Context sensitive operation



Integrated thermal printer


## System features

- Compact and easy to operate
- Modern, intuitive operation via color touchscreen
- Function keys for the 4 basic functions
- Extensive possibilities for tolerance evaluation
- Clear display of the measurement results
- Simple measuring sequence thanks to the motorized lowering of the probe on the workpiece surface
- Skidless probe system for measurement of all common roughness, waviness and profile parameters
- Immediate verification of the measuring instrument thanks to the integrated roughness standard
- Easily exchangeable probes for skidless measurements
- 7 measuring programs plus 1 specifically for verification of the device
- Integrated start button on the traverse unit for one-handed user control
- High-precision linear guide, variable measurement speed and software assisted alignment of the reference plane
- Measurement in all positions, also overhead
- Suitable for measurement of sealing surfaces
- Integrated thermal printer for immediate documentation
- Easy-Paper-Loading function

Model	Probe	Parameters	Printer	Traverse probing	Profile/material ratio	Tolerance	Statistics	Measuring programs	Roughness standard
W20	skidless	68	integrated	no	yes	yes	yes	7	integrated

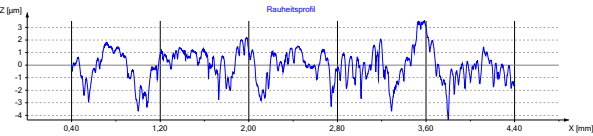
# Evovis Mobile. Simple evaluation and operation of mobile measuring instruments

The optional Evovis Mobile software is specifically designed for operation with mobile measuring instruments. In online mode, the mobile measuring instrument is directly controlled by the software and turns into a stationary measuring station. In offline mode, the locally measured parameters and profile data saved in the measuring instrument are transferred and evaluated on the PC.

Kunde <b>Jenoptik</b>	Werkstück <b>W32-AC33</b>	
Auftrag <b>A-42BE</b>	Zeichnungsnummer <b>Z-12344</b>	
Prüfer <b>Schmidt</b>	Seriennummer <b>S122</b>	
Bemerkung		

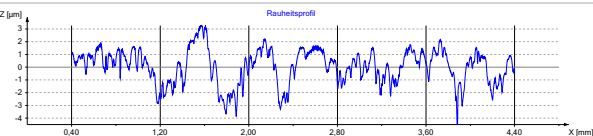
Rauheit 1 [Profilsatz 1]			
Ra	µm	0,00	11,50
Rz	µm	0,00	15,80
Rmax	µm	0,00	14,00



Auswertebedingungen	Af:	Aus	Taststrecke:	4,80 mm
Ac:	0,80 mm	Xz linear 1	Geschwindigkeit:	0,50 mm/s

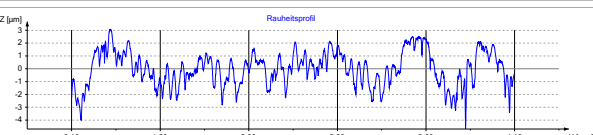
Rauheit 1 [Profilsatz 2]			
Ra	µm	0,00	11,50
Rz	µm	0,00	15,80
Rmax	µm	0,00	14,00



Auswertebedingungen	Af:	Aus	Taststrecke:	4,80 mm
Ac:	0,80 mm	Xz linear 1	Geschwindigkeit:	0,50 mm/s

Rauheit 1 [Profilsatz 3]			
Ra	µm	0,00	11,50
Rz	µm	0,00	15,80
Rmax	µm	0,00	14,00

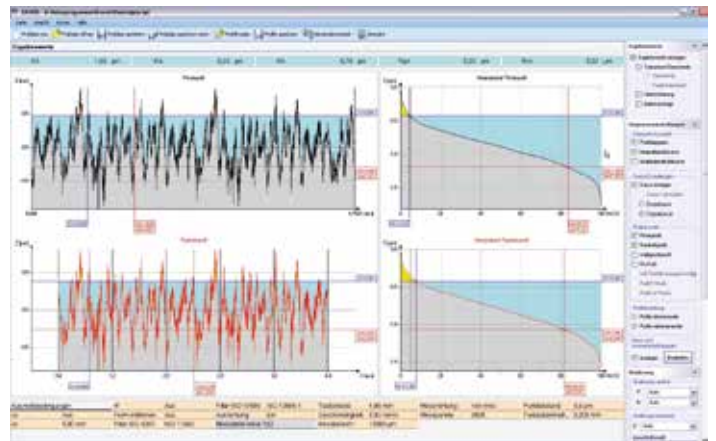


Auswertebedingungen	Af:	Aus	Taststrecke:	4,80 mm
Ac:	0,80 mm	Xz linear 1	Geschwindigkeit:	0,50 mm/s

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Multiprint log



Interactive profile analysis



Measurement and evaluation in online mode

## System features

- Clear, user-friendly operating structure
- Remote operation of W5, W10 and W20
- All common roughness and waviness parameters in accordance with ISO 4287 and other ISO and national standards (ASME, DIN, JIS, Motif, etc.)
- Continuous further development of the software in line with new standards/changes in standards
- Individual test plan creation
- Integrated help with the parameters
- Wizard for selecting the measuring conditions
- Import and subsequent processing of profiles and parameters
- Open design of the print log
- Electronic archiving of reports via PDF printout
- Optional qs-STAT® data export interface
- Optional evaluation of dominant waviness according to VDA 2007

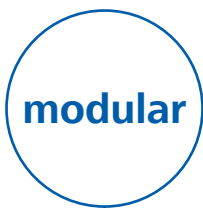
# Waveline W800/W900. Modern system concept for optimum flexibility and precision



Owing to a standardized system concept and state-of-the-art probe systems, the W800/W900 measuring systems provide optimum flexibility in day-to-day measurement tasks.

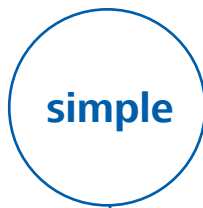
All measuring station configurations are modular in design, meaning they can easily be expanded at a later date. Thanks to our W800/W900 systems, you can measure surfaces in exactly the right way for your individual infrastructure and your specific measurement requirements.

The measuring systems are easy to use and also offer a variety of analysis options thanks to the Evovis measurement and evaluation software.



Exact fitting measuring systems to solve your measuring task

- Two performance classes: W800 and W900
- Modular probe systems
- Modular CNC axes
- Modular software



Simple operation, low training requirements, expandable at any time

- Simple change of probe systems and probe arms
- Automatic recognition of the probe arms
- Calibration with a few mouse clicks or optionally automatically



Flexible for roughness, contour, topography and twist

- Compatible with future hardware and software upgrades
- Automatable measuring runs
- Standard interfaces



Probe systems with highest precision

- High-resolution probe systems for smallest tolerances
- Nanoscan probe system with opto-mechanical measuring principle
- Compensation of the form deviation of the probe tip

# Waveline W800. Modular concept for 100-percent accuracy of fit



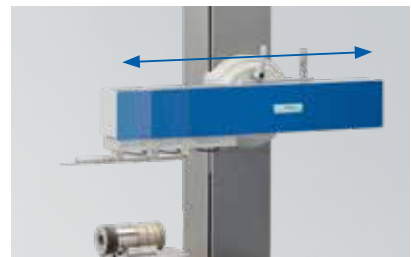
Waveline W812C Digiscan with 500 mm measuring column and 120 mm traverse unit



Quick-change adapter QCA



Probe arms with magnetic coupling



Optimal accessibility of measuring positions

## System features

- Easy-to-use measuring system
- Modern, high-resolution probe system
- High measurement quality thanks to stable mechanics
- Sophisticated probe arm technology
- Unique traverse unit concept for optimum access to measuring positions
- Probe arms with magnetic coupling for fast and easy probe arm change over
- All contour probe arms equipped with an RFID chip for simplified calibration and automatic configuration
- Quick-change adapter QCA enables quick probe system changeover with minimum retooling time and automatic configuration feature
- Horizontal motion of the probe system occurs via the traverse unit enclosure, meaning the probe arm is always in front of the traverse unit
- Control panel for easy, direct operation of the most important measuring and control functions as well as emergency stop function with restart at interrupted axis position
- The modular concept enables subsequent expansion of the measuring system

Model	W800R	W800C Digiscan	W800RC Digiscan	W800RC Surfscan	W800RC Nanoscan
Traverse unit [mm]	120 or 200	120 or 200	120 or 200	120 or 200	120 or 200
Measuring column [mm]	500 or 800	500 or 800	500 or 800	500 or 800	500 or 800
Granite plate [mm]	700x520 or 1000x520	700x520 or 1000x520	700x520 or 1000x520	700x520 or 1000x520	700x520 or 1000x520



# Waveline W900. Fast measuring axes for high-end performance



Waveline W920RC with 500 mm measuring column and 200 mm traverse unit



Dual operation of two probe systems



Motorized tilt unit



Additional measuring and positioning axes

## System features

- Fast measurement technology
- Highly flexible, dynamic measurement
- Excellent measuring accuracy in combination with Nanoscan probe system
- Dual operation of two probe systems; a roughness probe system can also be installed on the front of the traverse unit; also suitable for optional rotary module
- Optional motorized tilt unit for precise adjustment of the tilt angle and automatic alignment of the probe to the workpiece level
- Extensive options for automated, CNC-controlled measurement runs
- Measuring Z-column with linear scale at a resolution of 0.1  $\mu\text{m}$  for measurement of vertical distances outside the Z measuring range of the probe; requires probe arm with double probe tip
- Additional motorized Y-axis or X-Y-axis combination for automatic zenith search, topography measurement and workpiece positioning
- Optional rotational axis for roughness measurement on cylindrical workpieces in circumferential and axial direction

Model	W900R	W900C Digiscan	W900RC Digiscan	W900RC Surfscan	W900RC Nanoscan
Traverse unit [mm]	120 or 200	120 or 200	120 or 200	120 or 200	120 or 200
Measuring column [mm]	500 or 800	500 or 800	500 or 800	500 or 800	500 or 800
Granite plate [mm]	700x520 or 1000x520	700x520 or 1000x520	700x520 or 1000x520	700x520 or 1000x520	700x520 or 1000x520

# Probe systems with quick-change adapter QCA. For optimum configuration of your measuring system

Probe systems with quick-change adapter QCA allow quick and simple system changeovers to accommodate new measurement tasks and thus guarantee reproducible measurement results.

- All probe systems equipped with QCA interfaces
- Automatic setup after probe changeover
- Probe changeover without tools
- Precise, repeatable mechanical position
- Hot-plug-capable
- Future-proof

## TKU400 probe system with TAM probe arms: roughness measurement



- Universal roughness probe system
- Large measuring range
- Suitable for length and transverse measurements
- Easily exchangeable probe arms

## Digiscan probe system with TD probe arms: contour measurement



- Digital measuring system with high resolution
- Optional top/bottom measurement
- Probe arms with magnetic coupling and electronic detection
- Extensive range of probe arm solutions

## Surfscan probe system with WCN probe arms: roughness and contour measurement rolled into one



- Roughness measurement in the measuring range of 8 mm with a resolution of 3 nm
- Probe arms with magnetic coupling and electronic detection
- Optional top/bottom measurement

## Nanoscan probe system with WCN probe arms: roughness and contour measurement rolled into one



- Ultra-precise opto-mechanical probe system
- Wide measuring range with extremely high resolution
- Excellent roughness and contour measuring accuracy in conjunction with W900

Probe	Measuring range   Resolution			
	TKU400	Digiscan	Surfscan	Nanoscan
Standard length	±400 µm   1 nm	60 mm   10 nm	8 mm   3 nm	24 mm   0.3 nm
2-fold length	±800 µm   2 nm	90 mm   15 nm	16 mm   6 nm	48 mm   0.6 nm

# Evovis. Evaluation software for roughness and contour measurement with W800/W900



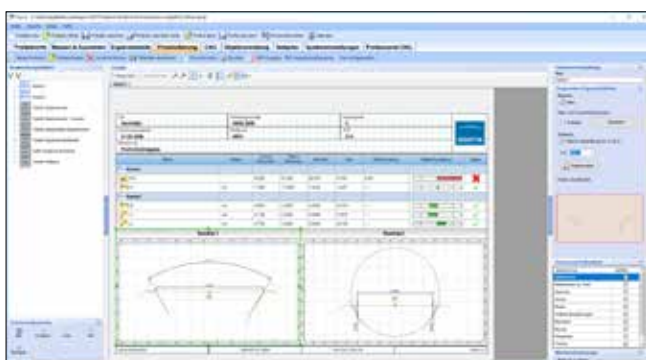
Measuring station control



Intuitive operation with numerous wizards



CNC editor for automated measuring runs



Report and template editor

Evovis, the measurement and evaluation software for roughness and contour measurement, offers a standardized user interface with easy-to-understand control logic and extensive support functions for designing individual measurement applications. Its applications range from simple measurements of a single characteristic to fully automated measurement applications within the Industry 4.0 environment.

## User-friendly, intuitive operation

- Modern user interface for safe operation with little training needed
- Central control with all frequently used operating and display functions in one view
- Measuring station control with live display
- Automatic system configuration when changing the probe system or probe arm
- Extensive statistical functions
- Interactive analysis and evaluation functions
- Central administration of all test characteristics
- Evaluation of roughness parameters in the contour profile
- Roughness and contour parameters summarized in a table for further statistical evaluation

## Optimized measurement runs: CNC editor

- Fast and easy programming of automated measurement and evaluation processes with a click of the mouse
- Clear representation in a graphic workflow
- Reduction of operator influences
- Comprehensive function library

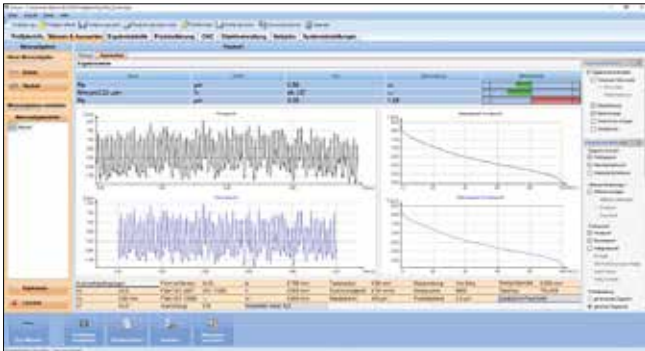
## Option CNC Professional

- Programming of complex, automated measuring processes with axis control, electronic workpiece identification, simplified user interface and automated data export

## Documented quality

- Individual, free design of test plans as well as display and print reports
- Easy design and management of templates
- Automatic, electronic archiving of the reports

# Evovis. Software functions and options for specific measurement tasks



Roughness measurement with interactive profile evaluation

## Roughness measurement and evaluation

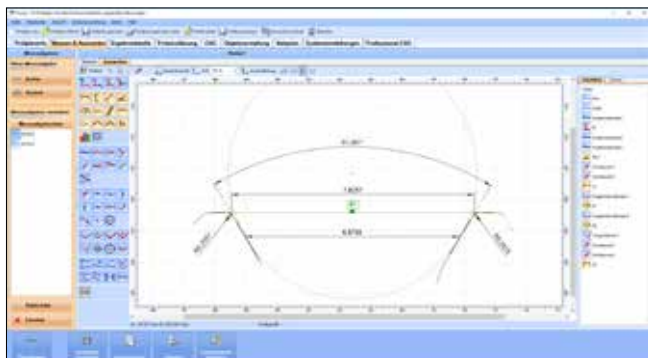
- Assistant for quick selection of roughness parameters and definition of the measurement conditions for safe processes and simple implementation of complex measurement tasks
- Interactive profile analysis functions for the evaluation of surface parameters
- Evaluation of the measurement results according to tolerance specifications with display in a compact form
- All globally standardized surface parameters for primary, roughness and waviness profiles
- Optionally expandable with function-oriented parameters



Contour evaluation

## Contour measurement and evaluation

- Contour evaluation with assessment of geometric dimensions, tolerancing of profiles and extensive functions for the assessment of line profile deviations
- Processing of several profiles/characteristics in one test plan
- Evaluation of complex geometric elements such as Gothic arcs or edge geometries
- Icon-based features for quick test plan creation
- Realization of complex applications thanks to precise fitting procedures and various auxiliary elements



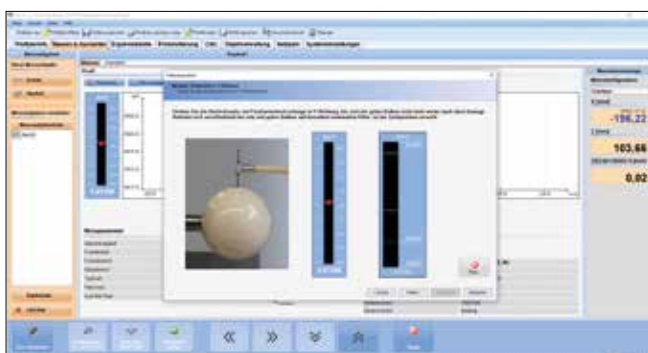
Multiple profile

## Evaluation of several profiles in one run

- Top/Bottom measurement
- Parallelism, angles and distance between several profiles

## Automated calibration (contour)

- Guided calibration process with recording of the history
- Automatic calibration in CNC mode
- Management of the calibration means



Calibration assistant

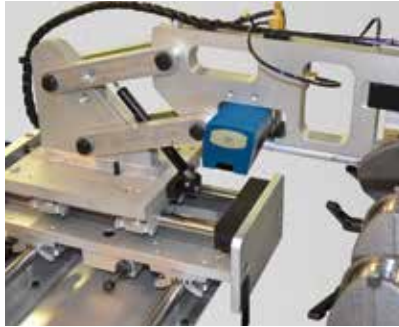
## Options

- qs-STAT® (Q-DAS ASCII transfer format): AQDEF-certified statistics export interface
- Dominant waviness according to VDA 2007
- TwistLive® twist evaluation in accordance with Daimler standard MBN 31 007-07 with additional quick analysis method and live display
- 3D topography evaluation

# Waveline POU und Waveslide. Manual and semi-automatic measuring devices and stations



Measurement in bores



Measurement on shafts



Measurement on plane surfaces

**POU (Point-of-Use) measuring devices** are used for roughness measurement on large workpieces and come with a workpiece-specific design. They are ideal for manual SPC control of roughness features in all stages of the production process and deliver safe and repeatable positioning of the measuring devices.

- Secure and accurate positioning of the traverse unit on the workpiece
- Repeatable measurement results due to template positioning
- Skidded or skidless probe systems
- Ideal for workpieces such as engine blocks, cylinder heads, valve bodies or housings, as well as crankshafts, cam shafts and connecting rods

**Waveslide measuring stations** are individually tailored to suit specific measurement tasks. They are based on proven system components and provide reliable, semi-automatic measurements in the manufacturing environment. The measuring systems are extremely robust and operate with high precision. The workpiece is positioned manually via guided air slides and the measuring process is fully automated.



- Simple, manual positioning of the workpiece via air slides
- For medium to large cubic or shaft-type workpieces
- Manual operation
- For roughness and contour measuring tasks

Waveslide measuring station with air slides for manual workpiece positioning

# Waveline Wavemove. Individual, fully automated measuring systems for use on the production line

Wavemove measuring stations allow individual, CNC-controlled, fully automated roughness and contour measurements to be performed directly on the production line. They are enhanced with CNC axes and workpiece fixtures specific to the part, enabling them to perform complex measuring tasks on cubic workpieces or shafts in a fully automated process.



The probe is swiveled by 90° for roughness measurements on pin bearings



Automated calibration of the measuring system via integrated standards

- Automated surface measurements for workpiece-specific applications
- High degree of automation
- Robust measuring stations suitable for production
- Transfer of the measurement results to programs such as qs-STAT®
- Flexible system concept for a wide range of applications
- Simple measurement program creation
- Up to eight independent CNC axes operating simultaneously
- Workpiece carrier with automatic identification of the workpiece
- Extensive safety equipment
- Advanced technology for a high degree of reliability



Fully automated Wavemove measuring station with workpiece-specific fixing device and light curtain

# Permanent measurement accuracy



Due to the constant use of measuring equipment and the associated wear and tear, the measuring accuracy can change unnoticed. Regular calibration of the device with the help of traceable standards is required, because only calibrated measuring devices ensure that meaningful and correct results are generated.

## DKD calibration laboratory

Our vibration-free and air-conditioned calibration laboratory (D-K-15030-01-00) is accredited by the Deutsche Akkreditierungsstelle GmbH (DAkkS) according to DIN EN ISO / IEC 17025.

Here we calibrate the standards you send us. This ensures direct tracing of the measuring equipment to the Physikalisch-Technische Bundesanstalt (PTB) and guarantees measurements and calibrations at the highest metrological level.

If a standard cannot be calibrated, a new one can be obtained from any of our facilities. For non-accredited parameters we deliver a simple factory calibration certificates or test reports. We also carry out capability tests for demanding measurement tasks.

## Our range of calibration services

Our DAkkS accreditation includes the measurement of variables such as roughness, profile depth, roughness measurement instruments as well as roundness, straightness, parallelism and contour standards. Within this scope we offer DAkkS-DKD calibration certificates:

- for roughness standards
- for contour standards
- for form standards

## Handbook Surface Texture – Theory and Practical Use

This handbook explains roughness parameters, describes the structure of surface measuring devices, supports the user in their use and makes it easier for the designer to specify surface parameters.

## Standards from Jenoptik



### Surface inspection standards

To check surface measuring systems with the profile method:

- **Depth setting standard** in polished glass for determining the vertical amplification and the repeatability
- **Geometry standard** in glass or nickel with uniform groove profile for checking the entire measuring system
- **Roughness standard** in steel with irregular surface profile for checking the entire measuring system

### Contour standard KN8

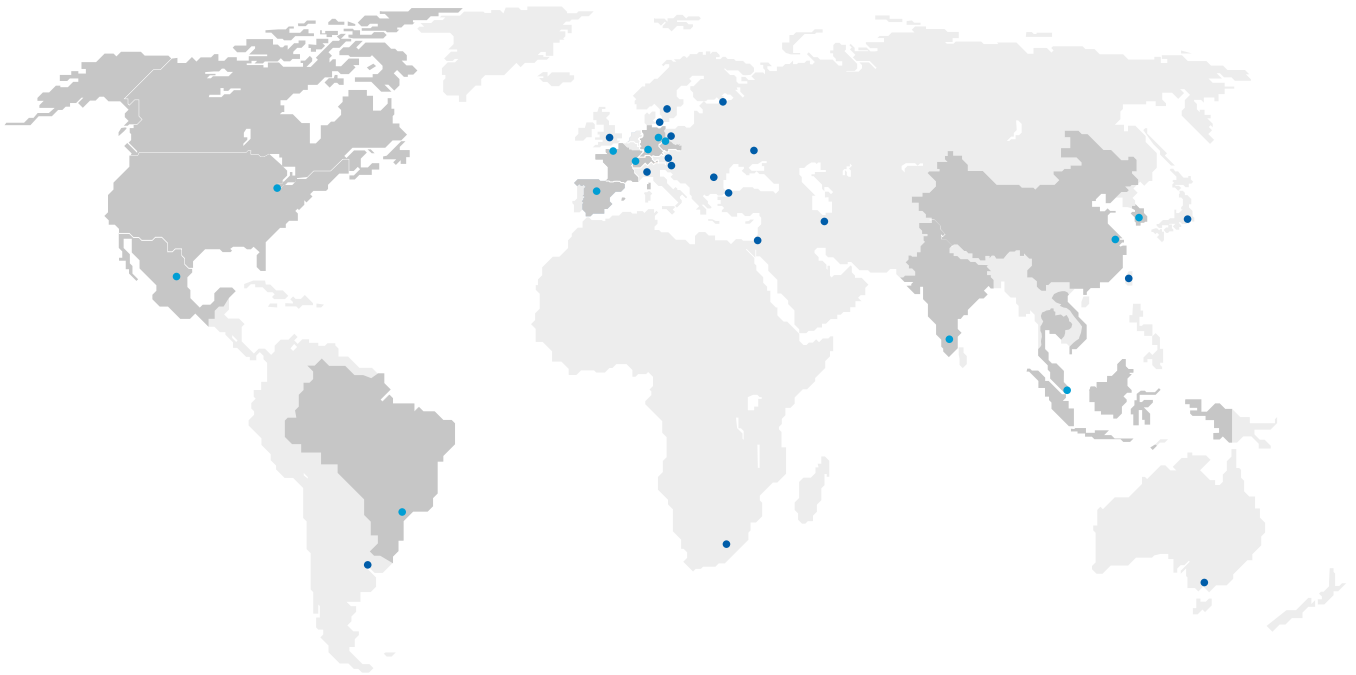
Compliant with VDI/VDE Directive 2629. Characteristics measured: radii, angles, horizontal and vertical distances.

### Twist standards

For verification of twist measuring systems. Calibrated parameters: Dt, DP, DG and Dy.

# We assist you worldwide.

Our qualified employees are available to assist you across the globe. We have subsidiaries and distribution partners in key industrial nations, meaning that we are always close by to offer you optimum support as a reliable partner.



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