WAVELINE
Roughness and Contour Metrology
Metrology from Jenoptik for your quality control

We deliver solutions that help you optimize your manufacturing process regarding qualitative and economic objectives.

We are one of the leading international specialists in high-precision, tactile and non-tactile production metrology.
Our services range from complete solutions for different measuring tasks such as the inspection of surface and form as well as determining dimensions, throughout every phase of the production process including final inspection or in the metrology lab.

Our decades of experience in tactile, optical and pneumatic measurement combined with our global sales and service support network brings us close to you, our customers, enabling us to provide optimal support as a reliable partner.

Our team is looking forward to your inquiry!

Jenoptik – Sharing Excellence

Surface roughness measurement on a wide range of surfaces

Ground surfaces  Turned surfaces  Honed surfaces

Lasered surfaces  Textured surfaces
State-of-the-art roughness and contour measurement

WAVELINE measuring systems offer you extensive evaluation possibilities for surface measurement – also possible in combination, depending on the system.

**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 angles
- Area of blowholes
- Radius
- Laser honing structures

**Wide range of evaluation possibilities in contour measurement**
Get better measurements

... with versatility
Whether mobile or stationary, manual or automated, for simple or complex measuring tasks — we supply you with measuring systems that are tailored to your needs.

... in day-to-day operations
Our robust and high-precision solutions provide absolutely precise results in environments close to production. Our systems are easy to operate thanks to an intuitive software interface.

... with flexibility
The WAVELINE systems can be optimally configured to suit a wide range of requirements as needed, with exchangeable probe arms and a comprehensive range of accessories. As a result, these systems are also suitable for different measuring tasks on flexible production lines.

... with professional metrology
WAVELINE solutions are the direct result of decades of experience and extensive expertise. They stand out from other products on the market thanks to measurements performed in accordance with international standards, simple operation, and professional evaluation of the measured values.

... with modern technology
Mobile WAVELINE solutions feature wireless Bluetooth® technology allowing an almost limitless range of applications. In contour measurement, digital probing systems ensure reliable measurement results without analog limitations.

... with innovative probing systems
Thanks to intelligent probing systems, the correct measuring conditions are automatically set for contour measurements. It is also possible to measure with dual tip probe arms for top/bottom measurements.
Tailored to your needs

You have the choice. 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.

<table>
<thead>
<tr>
<th>Systems</th>
<th>Short description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>W5, W10 and W20</td>
<td>Mobile roughness measuring instruments</td>
<td>6 – 11</td>
</tr>
<tr>
<td>EVOVIS mobile</td>
<td>Control and evaluation software for mobile roughness measuring systems</td>
<td>12 – 13</td>
</tr>
<tr>
<td>T8000 and C8000</td>
<td>Stationary roughness and/or contour measurement with separate probing systems</td>
<td>16 – 23</td>
</tr>
<tr>
<td>surfscan and nanoscan</td>
<td>Combined roughness and contour measurement with one probing system</td>
<td>24 – 27</td>
</tr>
<tr>
<td>EVOVIS</td>
<td>Control and evaluation software for stationary surface measuring systems</td>
<td>28 – 33</td>
</tr>
<tr>
<td>POU, waveslide, wavemove</td>
<td>Individual solutions for production related roughness and contour measurement</td>
<td>44 – 47</td>
</tr>
<tr>
<td>toposcan</td>
<td>Surface inspection in cylinder bores</td>
<td>48 – 49</td>
</tr>
<tr>
<td>TOPOWIN</td>
<td>Control and evaluation software for surface inspection</td>
<td>50 – 51</td>
</tr>
</tbody>
</table>
Small but powerful – portable, reliable roughness measurement

HOMMEL-ETAMIC W5 with optional printer HOMMEL-ETAMIC P5

Highlights HOMMEL-ETAMIC W5

• Portable and battery-supplied
• Compact and light in design
• Easy, intuitive handling with click wheel and graphical user interface
• Features Bluetooth® technology for wireless data transfer and printing
• USB port with Windows-compatible data format and battery charging function
• No calibration necessary
• Battery capacity for up to 800 measurements
• Easily exchangeable probes
• Storage capacity for 5 measuring programs with measuring conditions
• Optional printer P5 for documentation of the measurement results on the spot
**Mobile measurement**
- Universal roughness measuring instrument for use on the production line, on machine tools or in incoming goods inspection
- Ideal for measurements on big workpieces
- Measurement in all possible measuring positions, including on perpendicular surfaces or overhead

**Precise workpiece support, even on small shafts**
- Secure positioning and stable workpiece support on precisely ground support shafts on the underside of the measuring device
- Vee-block rest for small shafts with a diameter of 10 mm and above for reliable centering on the correct measuring position; can also be used as probe protection for bores with a diameter of 12 mm and above

**Exchangeable probes**
- Probes for a range of different measuring tasks
- Probe cover to protect probe from damaging
- Measurement position lighting to view the exact measurement position

**Tolerance evaluation**
- Colored display of measurement results depending on the tolerance evaluation
- Assessment of measurement results at a glance

**Log created directly on site: optional P5 printer**
- Compact thermal printer with Bluetooth® technology
- Long battery life for mobile measurement documentation
- Paper easy to insert thanks to the Easy Paper Loading function
- Measuring conditions, parameters, tolerance evaluation, roughness profile and Abbott curve can be printed off individually or in combination depending on the measurement program

<table>
<thead>
<tr>
<th>Model</th>
<th>Probe</th>
<th>Parameters</th>
<th>Printer</th>
<th>Transverse probing</th>
<th>Profile/material ratio</th>
<th>Tolerance</th>
<th>Statistics</th>
<th>Measuring programs</th>
<th>Roughness standard</th>
</tr>
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<tbody>
<tr>
<td>W5</td>
<td>with skid</td>
<td>23</td>
<td>optional</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>5</td>
<td>optional</td>
</tr>
</tbody>
</table>
Flexible, precise roughness measurement without boundaries

Highlights HOMMEL-ETAMIC W10

- Mobile and battery-supplied, with cable-free traverse unit
- Usable as stationary instrument
- Modern, intuitive operation via color touchscreen
- Wireless data transfer via Bluetooth® interface
- Measurement of all common roughness parameters according to international standards
- Integrated printer for documentation of the measurement results on the spot
- Easy changing of the skid probes
- Immediate verification of the W10 via the integrated roughness standard
- Integrated barrel jack for traverse unit
- Storage capacity for 7 measuring programs
**Integrated, exchangeable roughness standard**
- Safely stored in the basic unit
- Immediate verification of the measuring instrument on site
- Stable measurement configuration
- Measuring program specifically for verification of the measuring instrument with predefined nominal values

**Transverse probing**
- 90° tilting of the probe for measurements in grooves and incisions or between collars
- Probing of the surface transversely to the traverse direction without complex conversion

**Integrated rest and barrel jack**
- Secure storage of the traverse unit
- Protection of the probe
- Continuous operational readiness of the traverse unit thanks to the automatic battery charging function

**Measurement in all positions**
- Measurement of small workpieces in overhead position
- Contact to the workpiece is made by precisely polished shafts on the bottom side of the traverse unit
- 3-point support on the back side of the traverse unit for secure positioning when measuring perpendicular surfaces

**Integrated height adjustment**
- Extendable tripod legs for adjusting the traverse unit to the height of small workpieces
- Easily adaptable to the desired measuring position

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<tr>
<td>W10</td>
<td>with skid</td>
<td>40</td>
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<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>7</td>
<td>integrated</td>
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</table>
Mobile roughness, waviness and profile measurement in production

Highlights HOMMEL-ETAMIC W20

- Modern, intuitive operation via color touchscreen
- Skidless probing system for measurement of all common roughness, waviness and profile parameters according to international standards
- Compact and easy to operate
- Integrated printer for immediate documentation
- 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
- Automatic probe positioning to avoid unnecessary adjustments
Traverse unit for skidless measurement
- Integrated start button enables one-handed user control
- High-precision linear guide
- Variable measurement speed
- Software assisted alignment of the reference plane
- Measurement in all positions (also overhead)
- For all our skidless probes

Motorized lowering of the probe
- Automatic positioning of the stylus tip on the workpiece surface and setting of the preselected measuring range
- Automatic lifting of the stylus tip at the end of the measurement to avoid accidental damage during mobile use

Mobile reference plane measurements
- High-precision roughness, waviness and profile measurement in mobile operation
- Performs reference plane measurements and determines the unfiltered P as well as W parameters
- Suitable for measurement of sealing surfaces

Context sensitive operation via touchscreen
- Function keys for the 4 basic functions
- Extensive possibilities for tolerance evaluation
- Fast and comfortable input of additional data via touchscreen
- Clear display of the measurement results
- Results display: parameters, profile view, interactive Abbott curve, extensive statistics functions

Integrated thermal printer
- For documentation of the measurement results on the spot
- Easy-Paper-Loading function
- Printing of measurement results with tolerance evaluation, profiles, Abbott curve, additional information, statistics

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<th>Roughness standard</th>
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<tbody>
<tr>
<td>W20</td>
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<td>68</td>
<td>integrated</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>7</td>
<td>integrated</td>
</tr>
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</table>
EVOVIS mobile: professional evaluation and simple 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.

Highlights HOMMEL-ETAMIC EVOVIS mobile
• Clear, user-friendly operating structure
• Remote operation of W5, W10 and W20
• 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 with PDF printout
• 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
• Optional: qs-STAT® data export interface (description page 31)
• Optional: evaluation of dominant waviness according to VDA 2007 (description page 33)
Free design of print forms
- Log editor for free positioning and processing of the contents from the test plan
- Customization of log templates
- Part data can be provided for the measurement and displayed in the log
- For displaying on screen, for storing as a PDF file and for printing out
- Multiprint log for documentation of several measurements on one page

Defined test plan types
- Online measurement with remote operation and control of the measuring instrument
- Importing of raw profiles stored on the mobile measuring instrument for further evaluation and logging
- Importing and display of the measurement results (parameters) stored on the mobile measuring instrument for logging

Evaluation display
- Numerous options for adjusting the display
- Parameters, result values, tolerances, tolerance violations as a value or bar chart
Height stands and accessories

**Height stand HS300**
Turns the mobile measuring instrument into a stationary measuring configuration. 300 mm height measuring stand with ±180° tilting device for precise positioning of the roughness probe on the workpiece surface.

- HS300  Art.no. 1004 7611
- Adapter W5, W10  Art.no. 1004 9843
- Adapter W20  Art.no. 1005 1747
- Tilting device for W5, W10  Art.no. 1005 1140

**Printer paper**
Set of 10 rolls of thermal paper for P5, W10 and W20. Paper width 57 mm, paper length approx. 11 m.
Art.no. 256 016

**Probe stop for W5 and W10**
Adjustable pendulum stroke limitation of the roughness probe.
Art.no. 1006 8896

**Roller adapter for W5 and W10**
For simple and reliable roughness measurement directly on roller surfaces. Adjustable for roller diameters 100-180 mm and 180-500 mm.
Art.no. 1005 5622

**Magnetic holder for W5 and W10**
Enables magnetic fixing of the measuring device/traverse unit on the workpiece surface.
Art.no. 1006 8578

**Measuring station**
Granite plate with T-groove 400 x 280 mm; height measuring range 300 mm with tilting device ±180°.
Art.no. 999 011

More accessories such as probe extensions, measuring tables and vee-blocks on pages 40 and 42.
Long-term stable skid probes

All skidded probes have a robust housing and a reliable connector. They are calibrated straight from the factory and provide long term stability thanks to a dual spool system in the inductive converter.

**T1E one skid probe**
- For measurement on flat surfaces, on shafts and in bores.
- Skid radius lengthwise/transverse: 30/1.95 mm
- Measuring range: 100 µm
- With 2 µm/90° stylus tip: Art.no. 240 005
- With 5 µm/90° stylus tip: Art.no. 240 000
- Oil resistant with 2 µm/90° stylus tip: Art.no. 1000 8327
- Oil resistant with 5 µm/90° stylus tip: Art.no. 240 008

**TKO 50 one skid probe**
- Offset skid for bores from 2 mm diameter.
- Skid radius lengthwise/transverse: 30/0.925 mm
- Measuring range: 50 µm
- With 2 µm/90° stylus tip: Art.no. 224 444
- With 5 µm/90° stylus tip: Art.no. M0435 023

**T1E one skid probe with transverse skid**
- For length and transverse measurement on flat surfaces, on shafts and in bores.
- Skid radius lengthwise/transverse: 30/30 mm
- Measuring range: 100 µm
- With 2 µm/90° stylus tip: Art.no. 1002 0277
- With 5 µm/90° stylus tip: Art.no. 240 022

**T3E one skid probe**
- With large measuring range for very rough surfaces.
- Skid radius lengthwise/transverse: 30/1.95 mm
- Measuring range: 300 µm
- With 5 µm/90° stylus tip: Art.no. 243 961

**TKPK 100 two skid probe**
- For measurement on cold-rolled sheets (EN 10049).
- Wear-reduced skids with DLC coating.
- Skid radius lengthwise/transverse: 50/3 mm
- Measuring range: 100 µm
- With 5 µm/90° stylus tip: Art.no. 235 730

**T1K one skid probe**
- For measurement on concave and convex surfaces.
- Skid radius lengthwise/transverse: 0.2/3.95 mm
- Skid depth: 3 mm
- Measuring range: 100 µm
- With 2 µm/60° stylus tip: Art.no. 257 413
- With 5 µm/90° stylus tip: Art.no. 256 504

**Dimensioning in drawings in mm.**
Universally applicable roughness measuring system

The PC-based T8000 R measuring instruments are designed for demanding tasks in professional roughness metrology. Each one meets international standards and can be used both in production and in the metrology lab. Its state of the art design allows varying expansion levels of the measuring station configuration and offers upgrade possibilities for both topography and contour measurement.

**Highlights HOMMEL-ETAMIC T8000 R**
- High-precision traverse unit for skidless measurement
- Modular structure
- PC-based evaluation unit
- Robust Gauss filter according to ISO/TS 16610-31
- Many special parameters from the automotive industry
HOMMEL-ETAMIC T8000 R system features

- Calculation of all common roughness, waviness and profile parameters
- Continuous further development of the software with regard to new standards/changes in standards
- Traverse length 120 mm for roughness and waviness measurement
- Suitable for measurement positions with difficult access thanks to the positioning accuracy of the drive bar
- Stable and robust motorized measuring column for automatic probe positioning
- Universally usable roughness probe with exchangeable probe arms for different measuring tasks and special applications
- User friendly software with individual measuring programs and clearly arranged operating structure

The probe can be swiveled 90° for measurements on recessed surfaces or between collars. The surface is scanned perpendicular to the traversing direction without complex conversion.

The roughness probe is attached either to the drive bar or underneath the traverse unit. This guarantees maximum flexibility for use in a wide range of measuring tasks.

<table>
<thead>
<tr>
<th>Model</th>
<th>Vert. measuring range*</th>
<th>Min. resolution*</th>
<th>Measuring range/ hor. resolution</th>
<th>Vertical travel</th>
<th>Granite plate</th>
<th>Topography option</th>
<th>Twist option</th>
<th>Contour option</th>
</tr>
</thead>
<tbody>
<tr>
<td>T8000 R120-400</td>
<td>±300 or ±600 µm</td>
<td>1 nm or 2 nm</td>
<td>120 mm/0.1 µm</td>
<td>400 mm</td>
<td>780 x 500 mm</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>T8000 R120-800</td>
<td>±300 or ±600 µm</td>
<td>1 nm or 2 nm</td>
<td>120 mm/0.1 µm</td>
<td>800 mm</td>
<td>1000 x 500 mm</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

* Smallest measuring range and depending on roughness probe
Compact and precise contour measuring systems

Our contour measuring systems are equipped with digital, high-resolution linear scales in the Z and X direction so that they are free of negative, analog variables.

The C8000 digital contour measuring stations boast an optimum price/performance ratio and are designed for high-precision contour measurement.

Highlights HOMMEL-ETAMIC C8000 digital
- Maximum vertical measurement range: 60 mm
- Interactive control of the measuring station
- High level of continuous measuring accuracy thanks to digital measuring system
- Powerful analysis software
- Processing of several profiles
The C8000 digital contour measuring stations feature a modern, digital measuring system. The resolution remains high throughout the entire measuring cycle and provides maximum repeatability and measurement accuracy even with critical contour features.

- Motorized probe arm lift and stroke limitation
- Quick release fastener for simple probe arm change
- Manual probing force adjustment
- Automatic measurement runs

**HOMMEL-ETAMIC C8000 digital system features**

- Vertical measuring range/resolution: 60 mm/50 nm
- wavecontour™ digital probing system with digital linear scales in the Z and X-axis
- Large measuring volume
- Wizard for easy system calibration
- Wide range of easy-to-replace probe arms for various applications
- Compact measuring station configuration for all standard contour measuring tasks

<table>
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<th>Model</th>
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<th>Measuring range/ horizontal resolution</th>
<th>Vertical travel</th>
<th>Granite plate</th>
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<tr>
<td>C8000-400 digital</td>
<td>60 mm</td>
<td>50 nm</td>
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<td>no</td>
<td>no</td>
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</table>

Contour measuring systems that can be upgraded to additional roughness measurement

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<tr>
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<td>400 mm</td>
<td>780 x 500 mm</td>
<td>no</td>
<td>yes</td>
<td>yes*</td>
<td>yes*</td>
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<tr>
<td>T8000 C200-800 digital</td>
<td>60 mm</td>
<td>50 nm</td>
<td>200 mm/0.01 µm</td>
<td>800 mm</td>
<td>1000 x 500 mm</td>
<td>no</td>
<td>yes</td>
<td>yes*</td>
<td>yes*</td>
</tr>
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</table>

* In conjunction with the optional roughness measurement
The C8000 digiscan contour measuring systems provide state-of-the-art technology, assuring safety in the design of the test processes, as well as ease of operation and fully reliable measuring results.

Thanks to intelligent probe arms, the contour probe system detects which probe arm is installed and automatically loads the correct system measuring conditions. This helps prevent operational errors from occurring.

Highlights HOMMEL-ETAMIC C8000 digiscan
- Vertical measurement range: 60 or 90 mm
- Electronic probe arm detection using RFID technology
- Optional top/bottom probing as well as diameter and thread measurement
- Reliable measurement of small geometric features
- Extensive analysis functions
HOMMEL-ETAMIC C8000 digiscan system features

- Vertical measuring range/resolution: 60 or 90 mm/50 or 75 nm
- wavecontour™ digiscan probing system with automatic probe arm detection
- The use of RFID technology eliminates the need to manage probe arms manually
- Motorized probe arm lifting/lowering
- Adjustable stroke limit
- Automatic measuring and evaluation
- Processing of several profiles
- Probe arms can be quickly replaced for different measuring tasks

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<td>C8000-400 digiscan</td>
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<td>50/75 nm</td>
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<td>400 mm</td>
<td>780 x 500 mm</td>
<td>yes</td>
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<td>no</td>
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Contour measuring systems that can be upgraded to additional roughness measurement

| T8000 C120-400 digiscan | 60/90 mm | 50/75 nm | 120 mm/0.1 µm | 400 mm | 780 x 500 mm | yes | yes | yes* | yes* |
| T8000 C200-800 digiscan | 60/90 mm | 50/75 nm | 200 mm/0.01 µm | 800 mm | 1000 x 500 mm | yes | yes | yes* | yes* |

* In conjunction with the optional roughness measurement
Combined roughness and contour measuring systems

The optimum combination for roughness and contour measurement is provided by the intelligent integration of both measurement systems. Roughness and contour are evaluated by two separate probing systems. The drive bar positions the roughness probe even in difficult to access measuring positions. The contour probe is easy to change and can be operated parallel to the roughness probe if necessary.

**Highlights HOMMEL-ETAMIC T8000 RC**
- Universal roughness and contour measuring system
- Easily interchangeable probing systems
- Roughness measurement over the whole traverse length
- Automatic measuring runs with motorized lowering/lifting of the probe
- Attachment of the roughness probe either to the drive bar or underneath the traverse unit
The T8000 RC digiscan offers a large measuring stroke for complex contour measurements. Probe arms with magnetic holder are easy to replace and allow flexible extension of the vertical measuring range.

HOMMEL-ETAMIC T8000 RC system features

- Uniform user interface for roughness and contour evaluations
- Calculation of all common roughness, waviness and profile parameters
- Evaluation of geometric characteristics such as distances, angles and radii
- Traverse length 120 mm for roughness, waviness and contour measurements
- Evaluation of roughness and contour characteristics in one measurement log

- Traverse unit with high guiding accuracy and digital glass scale for exact measurement results
- Stable and robust motorized measuring column for automatic probe positioning
- Digital probing systems for contour measurement: wavecontour™ digital with quick fastener or wavecontour™ digiscan with magnetic holder for fast and secure changing of the probe arms

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<td>R: 1 or 2 nm C: 50 nm</td>
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<td>780 x 500 mm</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>T8000 RC120-800 digiscan</td>
<td>R: ±300 or ±600 µm C: 60/90 mm</td>
<td>R: 1 or 2 nm C: 50/75 nm</td>
<td>120 mm/0.1 µm</td>
<td>800 mm</td>
<td>1000 x 500 mm</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

* R = roughness, C = contour
High resolution roughness and contour measurement in one run

Roughness and contours are recorded simultaneously with a high-resolution, digital probing system. As a result, this measuring system provides the optimal solution for demanding measuring applications in the metrology lab and in production. The geometric characteristics and roughness parameters are evaluated in one run. With its extraordinary price/performance ratio, this system offers application possibilities that are usually only covered by much more complex laboratory systems.

Highlights HOMMEL-ETAMIC surfscan
- Time-saving thanks to simultaneous measurement of roughness and contour
- Highest repeatability even for critical measuring tasks
- Time-consuming alignment of the reference plane is no longer necessary when measuring roughness
- RFID technology for automatic detection of the probe arms and setting of the correct measuring parameters
HOMMEL-ETAMIC surfscan system features

- Universal measuring station for quality control in production or in the metrology lab
- Modular system design for individual configurations
- Intuitive, easy-to-use software for integrated evaluation of roughness and contour features in a customizable measurement log
- Only one probing system for roughness and contour
- Roughness measurement on inclined or curved surfaces with a resolution of 6 nm in the 6 mm measuring range
- The wide measuring range means there is no need to align the probing system with the workpiece surface
- Magnetic probe arm holder for fast and secure changing of the probe arms
- Extensive software functions for the evaluation of roughness and contour
- Can be extended with other probing systems, e.g. to enlarge the contour measuring range with the wavcontour™ digital/digiscan probing systems or with roughness probes for specific roughness measurement tasks

<table>
<thead>
<tr>
<th>Model</th>
<th>Vert. measuring range</th>
<th>Min. resolution</th>
<th>Measuring range/hor. resolution</th>
<th>Vertical travel</th>
<th>Granite plate</th>
<th>Topography option</th>
<th>Twist option</th>
</tr>
</thead>
<tbody>
<tr>
<td>surfscan 120-400</td>
<td>6 or 12 mm</td>
<td>6 or 12 nm</td>
<td>120 mm/0.1 µm</td>
<td>400 mm</td>
<td>780 x 500 mm</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>surfscan 120-800</td>
<td>6 or 12 mm</td>
<td>6 or 12 nm</td>
<td>120 mm/0.1 µm</td>
<td>800 mm</td>
<td>1000 x 500 mm</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

Precision probe arm positioning allows automatic measurement runs to be performed even on small workpieces and in small bores.

Probe arms are quick and easy to replace thanks to magnetic mounting points. Additionally, probe arm installation is automatically detected using RFID technology and assigned to the correct measuring task by the software.

The large measuring stroke and wide range of probe arms for specific measurement tasks open up a variety of application possibilities.
Simultaneous roughness and contour measurement in the nanometer range

The nanoscan 855 offers two measuring systems in one, ensuring universal, flexible use for all measurement tasks in the field of surface measuring technology – saving time and money.

With its high resolution, large presence and highly accurate straightness guide, this exceptionally precise measuring system is suitable for the finest of surface roughness features as well as for determining micro-geometric features or contours with a large presence.

Highlights HOMMEL-ETAMIC nanoscan 855

- RFID technology with
  - automatic setting of probe force and measuring conditions
  - automatic assignment of probe arms to each measuring task
- Highly precise probe positioning
- Top/bottom or inner/outer measurement
- Thread measurement with automatic evaluation
**HOMMEL-ETAMIC nanoscan 855 system features**

- Ultra-precision, opto-mechanical measuring system with high resolution and large measuring range for measurements on curved or inclined surfaces
- Ergonomic measuring station design with integrated granite plate and active level regulation
- Automatic measuring runs thanks to fast, CNC-controlled measuring axes for highest productivity
- New evaluation possibilities: top/bottom measurement, inside diameters, parallelism and angularity of geometric elements from several profiles
- Topography measurement with optional Y-axis and large measuring stroke as well as high resolution
- Easy calibration method with only one sphere standard and an automatic calibration measuring run
- Precise, magnetic probe arm holder for fast and secure changing of probe arms; insertion either in „down“ or „up“ probing direction
- Extensive range of probe arms for a large range of measuring tasks
- Optional cover for reducing environmental influences

<table>
<thead>
<tr>
<th>Model</th>
<th>Vert. measuring range*</th>
<th>Min. resolution*</th>
<th>Measuring range/ hor. resolution</th>
<th>Vertical travel</th>
<th>Granite plate</th>
<th>Topography option</th>
</tr>
</thead>
<tbody>
<tr>
<td>nanoscan 855</td>
<td>24 or 48 mm</td>
<td>0.6/1.2 nm</td>
<td>200 mm/0.01 µm</td>
<td>550 mm</td>
<td>850 x 600 mm</td>
<td>yes</td>
</tr>
</tbody>
</table>
EVOVIS software is easy to use and offers a standardized interface for roughness and contour measurement, regardless of the configuration of the device.

Simple icons, supported by comprehensive help functions, allow the operator to use the efficient measurement and evaluation tools according to their own requirements.

In the workpiece-specific test plan, several measuring tasks can be summarized using different measuring conditions, ensuring that all of the features to be checked remain in one overview and are documented in the same log.

**Highlights HOMMEL-ETAMIC EVOVIS for roughness measurement and evaluation**

- Interactive profile analysis functions for evaluating surface parameters
- Evaluation of the measurement results in accordance with tolerance specifics displayed in a compact form
- Measuring station control: all of the information in one view, reliable operation of all manual and automatic functions
- Individual test plan creation
- Wizard for selecting the measuring conditions
- All common roughness and waviness parameters in accordance with ISO 4287 and other ISO and national standards (DIN, JIS, Motif, etc.)
- Robust Gaussian filter in accordance with ISO/TS 16610-31
- Optionally can be extended to include function-oriented parameters such as dominant waviness (VDA 2007), twist parameters (MBN 31007-07) and other factory standard-specific parameters
- Open design of the print log
- Electronic archiving of logs with PDF printout and automatic save function
EVOVIS is the quick and reliable way to evaluate geometric features of workpieces, such as radii, angles or distances.

Additional evaluation tools are offered by the line profile deviation with variable tolerance range, the comparison option with stored nominal profiles, as well as the automatic evaluation of complex geometric elements such as Gothic arcs or workpiece edges.

Precision fitting methods, various options for forming help elements, and definition options for the coordinate origin also enable complex evaluations to be performed.

### Highlights HOMMEL-ETAMIC EVOVIS for contour measurement and evaluation

- Intelligent measuring station control
- Individual test plan creation
- Processing of several profiles/features in one test plan
- Icon-based contour features for quick test plan creation
- Help elements such as references, points, lines or co-ordinate systems
- Automatic alignment functions of the measured profile
- Automatic evaluation run with clear workflow
- Powerful zoom functions
- Automatically generated results table
- Graphic representation of line profile deviations with variable tolerance range
- Morphological filter
- Evaluation of complex geometric elements such as Gothic arcs or edge geometries
- Open design of print logs
- Electronic archiving of logs with PDF printout and automatic save function
EVOVIS supports innovative, combined, measurement systems and enables the integrated evaluation of roughness and contour characteristics.

The evaluation of roughness parameters can be determined interactively anywhere in the contour profile. The roughness profile can also be shown graphically.

Additionally the roughness and contour characteristics can be displayed in a table and can also be evaluated statistically.

Highlights HOMMEL-ETAMIC EVOVIS for combined roughness and contour measuring systems

- Interactive roughness evaluation on the contour profile
- Roughness evaluation on straight lines, inclines and radii segments
- Individual definition of evaluation length and filter setting for the roughness evaluation
- Retrospective roughness evaluation possible on measured profiles

Individual design of print logs:

- dimensions and roughness parameters evaluated simultaneously
Software options for EVOVIS

**Automatic runs: CNC control**

A CNC measuring run needs a lot less time than a manual measurement sequence and supplies operator-independent, reproducible results.

This option allows complex CNC runs and evaluations to be programmed quickly and easily. The run commands are selected via mouse click and the necessary parameters are automatically set. The created program run is displayed clearly in a graphic workflow.

**qs-STAT® data export interface**

The data export interface supports the Q-DAS ASCII transfer format for the exchange of quality information via Q-DAS software modules. Predefined parameter sets and the possible use of predefined catalogs simplify set-up of the data interface.

The interface is certified by Q-DAS according to AQDEF specifications (Automotive Quality Data Exchange Format).
Topography evaluation: option for roughness measurement

HOMMEL MAP 3D topography analysis software offers extensive evaluation possibilities for profile and surface data. Both the T8000 and the nanoscan can be upgraded for topography measurement. A „Y“ positioner is necessary in addition to the software (see page 42).

Highlights HOMMEL-ETAMIC HOMMEL MAP
• Intuitive structure of the analysis documents
• Pre-processing of the measured data: alignment, filtering and form removal
• Automatic recalculation after changing evaluation steps
• Extensive online help
• Standards for evaluation of 2D parameters
• ISO/TS 25178 standard for 3D parameters (only HOMMEL MAP expert and premium)
• Extensive metrological and scientific filter possibilities
• Extensive graphic and analytical studies

Depending on the requirements, HOMMEL MAP 3D evaluation software is available in three different versions each one adding greater capabilities than the last.

HOMMEL MAP basic
• Document management
• Interactive studies of 3D objects
• 2D parameters according to ISO 4287
• Distance measurement, step height evaluation

HOMMEL MAP expert
basic functions plus
• Evaluation of profile series
• Rk parameters, Motif parameters, 2D parameters automotive
• 3D parameters
• Joining of multiple profiles
• FFT analysis, frequency spectrum and autocorrelation
• Morphological filtering on 3D objects
• Difference between two surfaces

HOMMEL MAP premium
expert functions plus
• Extensive studies of surface series
• Studies on binary surfaces (grains)
• Multilayer surfaces
Other options for roughness measurement

**Dominant waviness according to VDA 2007**

The primary profile is checked for dominant waviness. The evaluation method automatically recognizes any existing periodic characteristics, extracts the waviness profile (WD profile) and derives the parameters WDSm, WDt and WDc.

The following functional behavior can be tested, for example, with the dominant waviness analysis:
- Static tightness
- Dynamic tightness
- Noise emission
- Avoidance of increased wear or malfunctions
- Pre-processing conditions

**Twist evaluation according to MBN 31 007-07**

Twist structures at sealing surfaces occur during the machining process and impair the sealing function between the shaft and the sealing ring. The most important properties of these surface structures are measured three-dimensionally and the parameters relevant to the tightness determined:

- Number of threads \( DG \)
- Twist depth \( Dt \) [µm]
- Period length \( DP \) [mm]
- Feed cross section \( DF \) [µm²]
- Feed cross section per revolution \( DFu \) [µm²/r]
- Contact length \( DLu \) [%]
- Twist angle \( \gamma \) [°]

**TwistLive® analysis method (patented)**

With this modern analysis method the normal measurement time may be reduced by up to 75%. During the measuring process, a results forecast of the twist parameters is already possible — live!

For twist measurement, the optional rotary traverse unit (see page 41) is required.
Probe sets for roughness parameters

The TKU probe sets are versatile to use because they replace up to three conventional standard probes and therefore offer a low-cost alternative. The probe sets can be extended at any time with additional probe arms.

**The probe sets contain**

- Basic probe, skid (TKU 300/600 only), probe protection
- TS1 probe arms for bores
- TS2 probe arm (TKU 300/600 only)
- TS1T probe arm for grooves
- TS1D probe arm for collars and faces

**TKU 100 probe set ±100 µm**

- With 2 µm stylus tip  Art.no. 256 658
- With 5 µm stylus tip  Art.no. 256 500

**TKU 300/600 probe set ±300/600 µm**

- With 2 µm stylus tip  Art.no. 256 657
- With 5 µm stylus tip  Art.no. 230 450

**TS1 or TS2 probe arm**

For bores from 4 or 5 mm diameter; max. horizontal tracing depth 33 or 78 mm.

- TS1 with 2 µm/90° stylus tip  Art.no. 240 805
- TS1 with 5 µm/90° stylus tip  Art.no. 230 475
- TS2 with 2 µm/90° stylus tip  Art.no. 240 156
- TS2 with 5 µm/90° stylus tip  Art.no. 230 480

**TS1T probe arm**

For grooves with max. vertical/horizontal tracing depth of 10/33 mm.

- With 2 µm/90° stylus tip  Art.no. 256 624
- With 5 µm/90° stylus tip  Art.no. 231 289

**TS1D probe arm**

For collars, directly on end faces and bores from 5 mm diameter; distance from end face to probing point 0.2 mm; max. horizontal tracing depth 33 mm.

- With 2 µm/60° stylus tip  Art.no. 240 160
- With 5 µm/60° stylus tip  Art.no. 231 291

Dimensioning in drawings in mm. Pages 34 – 39 excerpt from our extensive range of available probes and probe arms. Additional models on demand.
Probe sets with magnetic adapter

The TKU 300 TSM probe arm set includes a magnetic adapter with 3-point support for fast and easy change out of the probe arms. In case of collision, the probe arm detaches itself from the roughness probe and thus prevents damage of the probe arm or roughness probe. The included probe arms cover the most common roughness measuring tasks.

**The probe set contains**
- Basic probe with magnetic adapter
- TSM1 probe arm for bores
- TSM1T probe arm for grooves
- TSM1D probe arm for collars and faces

**TKU 300 TSM probe set ±300 µm**
- With 2 µm/90° stylus tip Art.no. 1005 9997
- With 5 µm/90° stylus tip Art.no. 1006 5082

**TSM1 probe arm**
For bores from 4 mm diameter; max. horizontal tracing depth 33 mm.
- With 2 µm/90° stylus tip Art.no. 1006 0616
- With 5 µm/90° stylus tip Art.no. 1005 4119

**TSM1T probe arm**
For grooves with max. vertical/horizontal tracing depth of 10/33 mm.
- With 2 µm/90° stylus tip Art.no. 1006 0617
- With 5 µm/90° stylus tip Art.no. 1006 5084

**TSM1D probe arm**
For collars, directly on end faces and bores from 5 mm diameter; distance from end face to probing point 0.2 mm; max. horizontal tracing depth 33 mm.
- With 2 µm/60° stylus tip Art.no. 1006 0618
- With 5 µm/60° stylus tip Art.no. 1006 5085

Dimensining in drawings in mm.
Skidless probes for roughness, waviness and profile

With a measuring range of ±300 or ±100 µm and precise ruby bearings, the TKL probes are particularly well suited for fine roughness measurements. The probes are factory calibrated and provide long-term stability thanks to their dual spool system in the inductive converter.

**TKL 300L probe**
Standard probe for measurements of R, W and P profiles on plain surfaces, shafts and in bores from 4 mm.
- Measuring range: ±300 µm
- Max. horizontal tracing depth: 30 mm
- With 2 µm/90° stylus tip: Art.no. 1000 4132
- With 5 µm/90° stylus tip: Art.no. 243 588

**TKL 100/5 probe**
For measurements in small bores from 1 mm.
- Measuring range: ±100 µm
- Max. horizontal tracing depth: 5 mm
- With 2 µm/90° stylus tip: Art.no. 233 280
- With 5 µm/90° stylus tip: Art.no. M0 435 035

**TKLT 100/17 probe**
For measurements in grooves or on recessed surfaces.
- Measuring range: ±100 µm
- Vertical/horizontal tracing depth: 13/17 mm
- With 2 µm/90° stylus tip: Art.no. 552 726
- With 5 µm/90° stylus tip: Art.no. 224 835

**TKLQ 100/17 probe**
With specific bearing for transverse measurements, e.g. in grooves or between collars.
- Measuring range: ±100 µm
- Max. horizontal tracing depth: 17 mm
- With 2 µm/90° stylus tip: Art.no. 231 207
- With 5 µm/90° stylus tip: Art.no. 1004 4932

Dimensioning in drawings in mm.
wavecontour™ digital probe arms for contour measurement

**TA-60 probe arm with carbide tip**
For profile recording on very fine to coarse structures.
- Probe arm: Art.no. 243 700
- Carbide stylus tip: Art.no. 232 586

**TA-60 probe arm with ruby ball**
For measurements on radii or when mechanical pre-filtering is desired.
- Probe arm: Art.no. 256 497
- Ruby ball stylus tip: Art.no. IM02 4743
- Adapter stylus tip: Art.no. 230 695

**TA-60 probe arm for transverse measurements**
Inner profile, e.g. internal gears, are made accessible by the transverse arm of 32.5 mm.
- Probe arm: Art.no. 256 785
- Stylus tip: Art.no. 284 039

**TA-60 probe arm for bores**
With a maximum tracing depth of 35.8 mm.
For bores from 4.5 mm diameter.
- Probe arm: Art.no. 256 565
- Stylus tip: Art.no. M0 445 036
- Bores from 4 mm: Art.no. 1000 2710

**Stylus tips with ruby ball**
- Adapter M2 for stylus tip: Art.no. 230 695
- Stylus tip extension: Art.no. IM05 1212
- Stylus tip 0.25 mm: Art.no. IM05 1342
- Stylus tip 0.5 mm: Art.no. IM02 4743
- Stylus tip 1 mm: Art.no. IM05 1208
- Stylus tip 1.5 mm: Art.no. IM06 3935

Dimensioning in drawings in mm.
wavecontour™ digiscan contour probe arms with magnetic coupling

TD-60 standard probe arm
With carbide tip for profile recording on very fine to coarse structures or with ruby ball for measurements on radii or if mechanical prefiltering is required.

- Carbide probe arm: Art.no. 1005 7599
- Carbide stylus tip: Art.no. 1005 3157
- Ruby ball probe arm: Art.no. 1005 7670
- Ruby ball stylus tip: Art.no. 1005 0760

TD-90 probe arm at 1.5 times the length
For 90 mm measuring range.

- Carbide probe arm: Art.no. 1005 7685
- Carbide stylus tip: Art.no. 1005 3157
- Ruby ball probe arm: Art.no. 1006 2155
- Ruby ball stylus tip: Art.no. 230 695

TD-60 probe arm for bores
Max. horizontal tracing depth 150 mm.
For bores from 12 mm.

- Probe arm: Art.no. 1005 2855
- Stylus tip: Art.no. 244 799
- Max. horizontal tracing depth: 39 mm.
For bores from 7 mm.
- Probe arm: Art.no. 1005 8268

TD-60 dual-tip probe arms
For inner/outer measurement or top/bottom measuring.

- T5 carbide probe arm: Art.no. 1005 8278
- Stylus tip: Art.no. 1005 4412
- T10 carbide probe arm: Art.no. 1005 8293
- Stylus tip: Art.no. 1005 4413
- T12 ruby ball probe arm: Art.no. 1005 7699
- Stylus tip: Art.no. 1005 5974

Dimensioning in drawings in mm.
Probe arms for combined roughness and contour measurement

**WCN1 probe arm**
With diamond tip for bores from 6.5 mm diameter.
Max. horizontal tracing depth 60 mm
With 2 µm/60° stylus tip Art.no. 1005 5687

**WCN1 probe arm for bores**
With carbide tip for measurement of fine contours in bores.
Max. vert./hor. tracing depth 4,5/60 mm
With 20 µm/22° stylus tip Art.no. 1005 6630

**WCN1 probe arm with dual-tip**
With carbide dual-tip.
Max. vert./hor. tracing depth 5/60 mm
With 20 µm/22° stylus tip Art.no 1005 5890
With diamond dual-tip.
Max. vert./hor. tracing depth 10/60 mm
With 2 µm/60° stylus tip Art.no. 1004 6152

**WCNT1 probe arm**
With diamond tip for measurement in grooves or on recessed surfaces.
Max. horizontal tracing depth 13/60 mm
With 2 µm/60° stylus tip Art.no. 1005 5688

**WCN1T probe arm**
With carbide tip.
Max. vertical tracing depth 25 mm
With 20 µm/15° stylus tip Art.no. 1006 6658
Max. vertical tracing depth 13 mm
With 20 µm/15° stylus tip Art.no. 553 734
With ruby ball.
Max. vertical tracing depth 7 mm
With ruby ball Ø 0.5 mm Art.no. 1002 6503

Dimensioning in drawings in mm.
Accessories for adapting the probing system to the measuring task

**PHZ skid probe holder**
For holding skid probes because the skid of the probe must adapt to the form deviation of a surface. The skid therefore forms the reference plane for the roughness measurement. All roughness parameters are measured with skid probes.

Art.no. 240 211

**FHZ skidless probe holder**
To hold skidless probes so that the stylus tip can measure the form deviations correctly. Skidless probes are used to determine roughness, waviness and form deviations.

Art.no. 240 215

**FHZ rotatable skidless probe holder**
Rotatable by 360° in steps of 15°.
For measurements overhead and on vertical surfaces.

Art.no. 244 891

**AZZ probe extensions**
Also suitable for mobile roughness measuring devices.

55 mm  Art.no. M0 435 041
100 mm  Art.no. M0 435 042
150 mm  Art.no. M0 435 043
200 mm  Art.no. M0 435 044

**HAA holder**
Twist-protected holder for fixed alignment of the roughness probe.

HAA150  Art.no. M0 435 127
**Probe adapter**
Enables the operation of roughness probes under the traverse unit, alternatively to position on the drive bar.
Art.no. 240 754

**Rotary traverse unit waverotor™**
For roughness measurements on cylindrical workpieces in circumferential direction. Workpiece held by chuck or optional clamping jaws.
Art.no. 999 061

**wavecontrol™ basic control panel**
For convenient one-handed user control of the measuring system. Function keys for the most frequent operating functions; joystick for fine control of the axis movements; emergency stop switch close at hand.
Art.no. 1002 5181

**GTR instrument table**
With integrated granite plate on passive damping elements; undercabinet for accommodating the PC, printer and measuring instrument electronics. Max. load 300 kg.
GTR4 for 780 x 500 mm granite plate Art. no. 235 626
GTR5 for 1000 x 500 mm granite plate Art. no. 239 303

**Damping elements with active level regulation**
Optional for benchtop or instrument tables. For 780 x 500 or 1000 x 500 mm granite plates. Regulates the horizontal alignment of the granite plate; automatic and independent of the workpiece weight.
LC-25 for GTR4 Art. no. 1003 8970
LC-50 for GTR5 Art. no. 1003 8509
LC-25 benchtop version for 780 x 500 mm granite plate Art. no. 240 785
Accessories for holding of workpieces

**Measuring tables**
For holding and positioning workpieces. Two coordinates adjustable ± 12.5 mm; rotatable: ± 5° around the vertical axis.

- **MT1:** 160 x 160 mm support area
  - XYO axis  Art. no. M0 435 276
  - XY axis  Art. no. M0 435 273

- **MT2:** 100 x 100 mm support area
  - XYO axis  Art. no. M0 435 278

**Vee-block**
Four different sized, finely ground vees ensure a holding range of shafts and round workpieces with diameters between 1 and 150 mm.
Art. no. M0 435 084

**Y positioner**
With motor drive for recording of topographies or for automatic positioning transversely to the probing direction. Load capacity approx. 30 kg. Guiding accuracy approx. 5 µm. Max. trace width 50 mm. Smallest step size 2.0 µm, optional with manual fine adjustment in X/Y-direction with a manual adjustment way of 25 mm.

- **Y-positioner**  Art. no. 1005 2547
- **Y-positioner with fine adjustment**  Art. no. 1005 2599

**Parallel vices**
Two small pairs of vees in the clamping jaws enable clamping of right-angled and cylindrical workpieces in horizontal or vertical position.

- **M32**  Art. no. IM05 0968
- **M50**  Art. no. IM05 0965

With flexible foot:
- **M32/GF32**  Art. no. IM05 0966
- **M50/GF50**  Art. no. IM05 0963

**Angle vise**
Completely precision ground. Angle adjustment in two axes with Nonius scale and screw for fine adjustment. Horizontal swivel range 360°, vertical swivel range ±60°. Jaw width 70 mm, clamping range 80 mm.
Art. no. 1002 7036
Permanent measuring accuracy

The accuracy can change unnoticed due to constant use and associated wear. The device must therefore be calibrated regularly using measurement calibration standards, as meaningful and accurate results can only be generated if the measuring instruments are calibrated accordingly.

**Surface inspection standards**
To check surface measuring systems with the profile method:
- **Depth setting standard** in polished glass with grooves of differing depths for determining the vertical amplification and the repeatability
- **Geometry standard** in glass or nickel (hard or extra hard coating) with uniform groove profile for checking the entire measurement system
- **Roughness standard** in steel with irregular surface profile replicated from practice for checking the entire measuring system

**KN8 contour standard**
Compliant with VDI/VDE Directive 2629.
Measurement features: radii, angles, horizontal and vertical distances
Vertical measuring range: 4.5 mm/7.5 mm
Horizontal measuring range: max. 82 mm
Including holder and DAkkS-DKD calibration certificate.
Art. no. 1000 1678

**Twist standards**
For verification of twist measuring systems.
Calibrated parameters: Dt, DP, DG and Dy.
Including test report.
Art. no. 1001 6265

**DAkkS-DKD calibration laboratory**
At our EN ISO/IEC 17025 accredited, vibration-free and air-conditioned DAkks-DKD calibration laboratory we conduct fundamental and application based research and perform calibration processes on your standards.

This ensures direct tracing of the gaging components to the Federal Physical-Technical Institute (PTB, Physikalisch-Technische Bundesanstalt) and guarantees measurements and calibrations at the highest technical standard for measuring.

If a standard cannot be calibrated, a new one can be obtained directly from any of our manufacturing facilities. Simple factory calibration certificates and test reports for non-accredited parameters are also available. We also carry out capability tests for demanding measurement tasks.

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

**DAkkS-DKD calibration certificates**
- for roughness standards
- for contour standards
- for form standards
- for cam shaft standards
Manual surface finish measurement right where you need it

Point of Use metrology equipment is tailored for roughness measurements, on a wide variety of workpieces, utilizing application specific designs. These systems deliver safe and repeatable positioning of the measuring devices, at pre-defined measurement locations, even for hard to access areas. As an example, Point of Use bore gages (B30) are designed with an adjustable depth ring that allows positioning of the probe at pre-determined depths.

Measurement in bores

The HOMMEL-ETAMIC B30 measures roughness in bores, using customized I.D. tooling with built in wireless surface testers.

Measurement on plane surfaces

The HOMMEL-ETAMIC T30 is designed to measure roughness on a wide variety of plane surfaces using pre-made templates to accurately position the traverse unit on the workpiece.

Measurement on shafts

The HOMMEL-ETAMIC S30 is intended for shaft measurement, using unique “scissoring” technology to accurately position the wireless traverse unit.

Highlights HOMMEL-ETAMIC POU

• Secure and accurate positioning of the traverse unit on the workpiece
• Repeatable measurement results due to template positioning
• Unique “scissoring” technology for shaft type workpieces

• Skidded or skidless probing systems
• Included roughness standards for measuring system verification
• Ideal for work pieces such as engine blocks, cylinder heads, valve bodies or housings, as well as crank shafts, cam shafts and connecting rods
Individual, semi-automatic production measuring stations

HOMMEL-ETAMIC waveslide measuring stations are individually tailored to suit specific measurement tasks. They are based on proven T8000 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.

The HOMMEL-ETAMIC waveslide measures roughness on shaft-type or cubic workpieces that are positioned manually via a measuring table with air slides.

**Highlights HOMMEL-ETAMIC waveslide**
- 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
Time-saving measurement in production: fully automated measuring systems

The HOMMEL-ETAMIC wavemove measuring stations allow individual, CNC-controlled, fully automated roughness and contour measurements to be performed directly on the production line. These stations are based on the T8000 platform and are enhanced with CNC axes and workpiece fixtures specific to the part. This enables them to perform complex measuring tasks on cubic or wave-shaped workpieces in a fully automated process.

Highlights HOMMEL-ETAMIC wavemove

- 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
The calibration of the measurement system is automated via integrated roughness and contour standards.

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

**Application example: HOMMEL-ETAMIC wavemove for crank shafts**

- Fully automated measurement of roughness and twist on crank shaft bearings
- Optional contour measurement, e.g. of groove radii
- Workpiece held between tips using carrier disk and tailstock
- System check via integrated roughness and contour standards
- Automated axes for:
  - X/Y-axis travel movement of the measuring column
  - Vertical positioning of the traverse unit (Z-axis)
  - Rotary drive for rotation of the crank shaft
  - Motorized tilt unit for the traverse unit
  - Optional: CNC-controlled rotation module for lateral probing or measurement in the overhead position

**Application example: HOMMEL-ETAMIC wavemove for cubic workpieces**

- Fully automated measurement of roughness and contour on cylinder heads and blocks
- Workpiece-specific fixing device with optional workpiece carrier detection
- Various fixing devices enable flexible use for different workpieces
- Twist and tilt axis for workpiece positioning
- Extensive safety devices for monitoring the workpiece
- Optional light curtain to protect operating personnel
Surface inspection system for cylinder bores

The toposcan is the ideal inspection system for fast, precise, and reliable testing of finely machined (e.g. honed) surfaces of cylinder bores during motor production as well as development and tests.

Optical testing of surface structure characteristics and tactile measurement of surface roughness is carried out using a compact measuring probe.

Highlights HOMMEL-ETAMIC toposcan
- Mobile use thanks to its light weight
- Ergonomic design for comfortable operation
- Easy adaptation to different bore diameters
- High optical zoom, up to 210 times for finest structures
- Automatic determination of crosshatch angle
The toposcan OR150 offers a lighting unit and a roughness probe for determining all relevant surface characteristics. The roughness standard allows for immediate verification of the measuring system. The centering plate is adapted to the diameter of the cylinder bore.

Thanks to the ergonomic design of the control elements, operation of the toposcan system is easy and secure. The mobile workstation simplifies its flexible use in the production environment.

**HOMMEL-ETAMIC toposcan at a glance**

- All important functions, such as motorized axial positioning, zoom and focus setting as well as lighting regulation, are carried out using the computer
- Basic model for optical testing and advanced model for additional tactile roughness measurement
- Immediate display of the cylinder bore surface on the computer screen

- Manual radial probe positioning
- Complete evaluation of the cylinder surface thanks to optical inspection and roughness measurement at any position
- Mobile workstation for easy transport in the production environment
- For cylinder bores from 60 mm diameter

<table>
<thead>
<tr>
<th>Model</th>
<th>Diameter*</th>
<th>Measurement height</th>
<th>Scan-/measuring mode</th>
<th>Roughness measurement</th>
<th>Tabletop model</th>
<th>Workstation model</th>
</tr>
</thead>
<tbody>
<tr>
<td>toposcan O150 or O210</td>
<td>60-110 mm</td>
<td>150 or 210 mm</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>toposcan OR150 or OR210</td>
<td>60-110 mm</td>
<td>150 or 210 mm</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

* Further diameters on demand
Control and evaluation software for toposcan

The user-friendly TOPOWIN software can be operated intuitively and offers a standardized interface for optical surface inspection and roughness measurement.

**Highlights HOMMEL-ETAMIC TOPOWIN**

- Clear, well-arranged user interface
- Optical inspection with zoom microscope
- High optical zoom, 30 to 210 times
- Imaging of a plateau-honed surface
- Display of finest structures of new surfaces
- High inspection rates and user-independent results thanks to automated measuring runs
- Immediate display of the roughness profile and the results of the preset characteristics
- Local correlation of optical inspection and tactile roughness measurement
- Continuous development of the software in regards to new standards
Simple documentation

The numerical and graphical output of the roughness parameters and the profiles can be combined with the image evaluations in one report to provide compact and informative documentation. Documentation can either be archived as a printout or a PDF file.

qs-STAT® data export interface (optional)

The data export interface supports the Q-DAS ASCII transfer format for the exchange of quality information via Q-DAS software modules. Predefined parameter sets and the possible use of predefined catalogs simplify set-up of the data interface. The interface is certified by Q-DAS according to AQDEF specifications (Automotive Quality Data Exchange Format).

Laser pocket structures: measurement and evaluation of laser-structured surfaces (optional)

In combustion engines, grooves can be cut into the upper reverse area of the piston with a laser to reduce wear rates, which creates a higher oil pressure volume for improved lubrication of the piston rings. This software module makes it easy to determine the geometric dimensions of the laser pocket structures. A measuring assistant guides the user through the measuring process.

Automatic runs: CNC control (optional)

Automatic positioning at preselected inspection heights, which are then used to automatically carry out a sequence of several cross hatch angles or roughness measurements.
Technical data stationary roughness and/or contour measuring systems (pages 16 – 27)

### Characteristics roughness measurement with EOVIS (page 28)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range/resolution</td>
<td>±8 μm/1 mm; ±16 μm/2 mm; ±80 μm/10 mm; ±400 μm/50 mm</td>
</tr>
<tr>
<td>Metric system</td>
<td>μm/μinch selectable</td>
</tr>
<tr>
<td>Filter: cut-offs</td>
<td>0.080/250.8/2.5/8 [mm], selectable in -2 to +1 cut-off steps, variable from 0.001 – 0.001 steps</td>
</tr>
<tr>
<td>EN ISO 11562, part 1</td>
<td>Gauss (M1) digital filter [mm], cut-offs 0.080/0.250/0.8/2.5/8</td>
</tr>
<tr>
<td>EN ISO 13656-1</td>
<td>2-fold Gauss (M2) Rx parameters, cut-offs 0.080/0.250/0.8/2.5/8</td>
</tr>
<tr>
<td>ISO/TS 16610-31</td>
<td>robust Gauss filter; cut-offs 0.080/0.250/0.8/2.5/8</td>
</tr>
<tr>
<td>ISO/TS 11610-21</td>
<td>linear Gauss filter</td>
</tr>
<tr>
<td>ISO/TS 16610-22</td>
<td>linear Split filter</td>
</tr>
<tr>
<td>ISO 3274/11562</td>
<td>short-wave cut-off A, selectable in μc or manually</td>
</tr>
<tr>
<td>Measurement speed vt</td>
<td>1.2 – 15/50 μm/s, variable from 0.1 – 2 m/s in 0.1 steps</td>
</tr>
<tr>
<td>Traverse length lt</td>
<td>0.48/1.5/4.8/15/48 mm or variable from 0.1 – 120/200 mm (depending on traverse unit)</td>
</tr>
<tr>
<td>Evaluation length ln</td>
<td>0.4/1.5/25/4/12.5/40 mm or variable cut-offs</td>
</tr>
<tr>
<td>Cut-off [mm]</td>
<td>0.080/0.250/8/2.5/8</td>
</tr>
</tbody>
</table>

### Parameters EN ISO 4287-2010
- Roughness
- Profile
- Waviness

Core roughness parameters EN ISO 13656-2

<table>
<thead>
<tr>
<th>Roughness parameters</th>
<th>Rpk, Rvk, Mr1, Mr2, Vs, Rvk*, Rrk*, A1, A2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motif parameters EN ISO 12085</td>
<td>R, Rx, AR, Vr, Wx, AW, Wxe, NW</td>
</tr>
<tr>
<td>Roughness parameters JIS B-8001</td>
<td>Rz-iS</td>
</tr>
<tr>
<td>Roughness parameters EN 10049 and SEP 1941</td>
<td>Ra, Rpa, Wsa, Wca</td>
</tr>
<tr>
<td>Roughness parameters obsolete standards ISO 4287/1987, DIN 4762</td>
<td>Rmax, Rz, RSm, D, Da, Daq, Lq</td>
</tr>
<tr>
<td>Roughness parameters Daimler standard MBN 31 007</td>
<td>R32, R3p32, R3m2</td>
</tr>
<tr>
<td>Weariness parameters VDA 2007 (optional)</td>
<td>WDS, WDL, WDC</td>
</tr>
<tr>
<td>Twist parameters Daimler standard MBN 31 007-07 (optional)</td>
<td>DG, Di, DF, DFv, Dfu, Diu, Dy</td>
</tr>
</tbody>
</table>
Combined roughness and contour measurement

**Technical data**

**HOMMEL-ETAMiC**

| Diameter* | 60 – 110 mm | 60 – 110 mm |
| Axial measurement height | 150 / 210 mm | 150 / 210 mm |
| Optical zoom | 30 – 210 times (on the screen) | 30 – 210 times (on the screen) |
| Test zone (approx.) | 40 times: 5.1 x 3.8 mm; 100 times: 2.0 x 1.5 mm; 210 times: 0.9 x 0.7 mm | 40 times: 5.1 x 3.8 mm; 100 times: 2.0 x 1.5 mm; 210 times: 0.9 x 0.7 mm |
| Resolution CCD camera | 1360 (H) x 1024 (V) | 1360 (H) x 1024 (V) |
| Illumination | 18 LEDs individually switchable; 2 channel dimmable | 18 LEDs individually switchable; 2 channel dimmable |
| Axial position | motor-driven | motor-driven |
| Radial position | manual | manual |
| Focus adjustment | motor-driven | motor-driven |
| Operating modes | optical surface inspection | optical surface inspection |
| Optical evaluation | none angle; stroke reversal radius; spaces/width of grooves; detection of blow holes and pores; tolerance zone (angle); laser structure (optional) | none angle; stroke reversal radius; spaces/width of grooves; detection of blow holes and pores; tolerance zone (angle); laser structure (optional) |
| Roughness evaluation | Parameters EN ISO 4287 | – |
| Parameters EN ISO 13565-1, -2 | – | – |
| Parameters Motif EN ISO 12085 | – | – |
| ASME B46 | – | – |
| JIS B601 | – | – |
| EN 10049 | – | – |
| Daimler MBN 31007 | – | – |
| Probe | – | inductive skid probe TIE 5 µm/90° |
| Traverse length according to ISO/JS | – | 1.5/4.8/15 mm |
| Cut-off (ISO/JS) | – | 0.25/0.8/2.5 mm |
| Measurement speed ut | – | 0.15/0.5/1.5 mm/s; return speed 3 mm/s |
| Logging | axial height of view; set magnification; date/time; parts identification | axial height of view; set magnification; date/time; parts identification |
| Dimensions (L x W x H), weight | 110 x 90 x 640 mm, 5.2 kg* / 110 x 90 x 760 mm, 5.4 kg** | 110 x 90 x 640 mm, 5.5 kg* / 110 x 90 x 760 mm, 5.7 kg** |
| Workstation | 650 x 800 x 1180, 70 kg (with PC) | 650 x 800 x 1180, 70 kg (with PC) |

**surfscan 120-400 / surfscan 120-800**

| Roughness and contour combined | – |
| Parameters EN ISO 12085 | – |
| Parameters Motif EN ISO 12085 | – |
| ASME B46 | – |
| JIS B601 | – |
| EN 10049 | – |
| Daimler MBN 31007 | – |
| Probe | – |
| Traverse length according to ISO/JS | – |
| Cut-off (ISO/JS) | – |
| Measurement speed ut | – |
| Logging | – |
| Dimensions (L x W x H), weight | 110 x 90 x 640 mm, 5.2 kg* / 110 x 90 x 760 mm, 5.4 kg** | 110 x 90 x 640 mm, 5.5 kg* / 110 x 90 x 760 mm, 5.7 kg** |
| Workstation | 650 x 800 x 1180, 70 kg (with PC) | 650 x 800 x 1180, 70 kg (with PC) |

**HOMMEL-ETAMiC toposcan O150 / O210**

| Diameter* | 60 – 110 mm | 60 – 110 mm |
| Axial measurement height | 150 / 210 mm | 150 / 210 mm |
| Optical zoom | 30 – 210 times (on the screen) | 30 – 210 times (on the screen) |
| Test zone (approx.) | 40 times: 5.1 x 3.8 mm; 100 times: 2.0 x 1.5 mm; 210 times: 0.9 x 0.7 mm | 40 times: 5.1 x 3.8 mm; 100 times: 2.0 x 1.5 mm; 210 times: 0.9 x 0.7 mm |
| Resolution CCD camera | 1360 (H) x 1024 (V) | 1360 (H) x 1024 (V) |
| Illumination | 18 LEDs individually switchable; 2 channel dimmable | 18 LEDs individually switchable; 2 channel dimmable |
| Axial position | motor-driven | motor-driven |
| Radial position | manual | manual |
| Focus adjustment | motor-driven | motor-driven |
| Operating modes | optical surface inspection | optical surface inspection |
| Optical evaluation | none angle; stroke reversal radius; spaces/width of grooves; detection of blow holes and pores; tolerance zone (angle); laser structure (optional) | none angle; stroke reversal radius; spaces/width of grooves; detection of blow holes and pores; tolerance zone (angle); laser structure (optional) |
| Roughness evaluation | Parameters EN ISO 4287 | – |
| Parameters EN ISO 13565-1, -2 | – | – |
| Parameters Motif EN ISO 12085 | – | – |
| ASME B46 | – | – |
| JIS B601 | – | – |
| EN 10049 | – | – |
| Daimler MBN 31007 | – | – |
| Probe | – | inductive skid probe TIE 5 µm/90° |
| Traverse length according to ISO/JS | – | 1.5/4.8/15 mm |
| Cut-off (ISO/JS) | – | 0.25/0.8/2.5 mm |
| Measurement speed ut | – | 0.15/0.5/1.5 mm/s; return speed 3 mm/s |
| Logging | axial height of view; set magnification; date/time; parts identification | axial height of view; set magnification; date/time; parts identification |
| Dimensions (L x W x H), weight | 110 x 90 x 640 mm, 5.2 kg* / 110 x 90 x 760 mm, 5.4 kg** | 110 x 90 x 640 mm, 5.5 kg* / 110 x 90 x 760 mm, 5.7 kg** |
| Workstation | 650 x 800 x 1180, 70 kg (with PC) | 650 x 800 x 1180, 70 kg (with PC) |

**surfscan RC120-400 digiscan / surfscan RC120-800 digiscan**

| Roughness and contour combined | – |
| Parameters EN ISO 12085 | – |
| Parameters Motif EN ISO 12085 | – |
| ASME B46 | – |
| JIS B601 | – |
| EN 10049 | – |
| Daimler MBN 31007 | – |
| Probe | – |
| Traverse length according to ISO/JS | – | 1.5/4.8/15 mm |
| Cut-off (ISO/JS) | – | 0.25/0.8/2.5 mm |
| Measurement speed ut | – | 0.15/0.5/1.5 mm/s; return speed 3 mm/s |
| Logging | axial height of view; set magnification; date/time; parts identification | axial height of view; set magnification; date/time; parts identification |
| Dimensions (L x W x H), weight | 110 x 90 x 640 mm, 5.2 kg* / 110 x 90 x 760 mm, 5.4 kg** | 110 x 90 x 640 mm, 5.5 kg* / 110 x 90 x 760 mm, 5.7 kg** |
| Workstation | 650 x 800 x 1180, 70 kg (with PC) | 650 x 800 x 1180, 70 kg (with PC) |

**nanoscan 855**

| Roughness and contour combined | – |
| Parameters EN ISO 12085 | – |
| Parameters Motif EN ISO 12085 | – |
| ASME B46 | – |
| JIS B601 | – |
| EN 10049 | – |
| Daimler MBN 31007 | – |
| Probe | – |
| Traverse length according to ISO/JS | – | 1.5/4.8/15 mm |
| Cut-off (ISO/JS) | – | 0.25/0.8/2.5 mm |
| Measurement speed ut | – | 0.15/0.5/1.5 mm/s; return speed 3 mm/s |
| Logging | axial height of view; set magnification; date/time; parts identification | axial height of view; set magnification; date/time; parts identification |
| Dimensions (L x W x H), weight | 110 x 90 x 640 mm, 5.2 kg* / 110 x 90 x 760 mm, 5.4 kg** | 110 x 90 x 640 mm, 5.5 kg* / 110 x 90 x 760 mm, 5.7 kg** |
| Workstation | 650 x 800 x 1180, 70 kg (with PC) | 650 x 800 x 1180, 70 kg (with PC) |
### Technical data mobile roughness measuring systems (pages 6 – 11)

<table>
<thead>
<tr>
<th>Hommel-ETAMIC</th>
<th>W5</th>
<th>W10</th>
<th>W20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring principle</td>
<td>profile method, calibrated</td>
<td>profile method, calibrated</td>
<td>profile method, calibrated</td>
</tr>
<tr>
<td>Total deviation as per DIN 4772</td>
<td>class 1</td>
<td>class 1</td>
<td>class 1</td>
</tr>
<tr>
<td>Traverse unit</td>
<td>Integrated into basic unit</td>
<td>Integrated into basic unit</td>
<td>WAVELINE® 20</td>
</tr>
<tr>
<td>Suitable probes</td>
<td>360°</td>
<td>360°</td>
<td>20 mm</td>
</tr>
<tr>
<td>Tracing length</td>
<td>17 mm</td>
<td>17 mm</td>
<td>axial</td>
</tr>
<tr>
<td>Probing direction</td>
<td>360°</td>
<td>360°</td>
<td>over 360°</td>
</tr>
<tr>
<td>Probing range</td>
<td>integrated start button</td>
<td>integrated start button</td>
<td>integrated start button, inclination reference level</td>
</tr>
<tr>
<td>Control elements</td>
<td>T1E, 2 µm*90°</td>
<td>T1E, 2 µm*90°</td>
<td>TKL 300L, 2 µm*90°</td>
</tr>
<tr>
<td>Probe standards</td>
<td>x100 µm/6 mm*</td>
<td>x100 µm/6 mm*</td>
<td>x300 µm/12 mm*</td>
</tr>
<tr>
<td>Measuring range/resolution</td>
<td>0.150/5.1/1 mm/s</td>
<td>0.150/5.1/1 mm/s</td>
<td>0.150/5.1/1 mm/s</td>
</tr>
<tr>
<td>Sampling length</td>
<td>1 to 5 selectable</td>
<td>1 to n (max. traverse length)</td>
<td>1 to n (max. traverse length)</td>
</tr>
<tr>
<td>Filter</td>
<td>EN ISO 11562: Gauss filter</td>
<td>EN ISO 11562: Gauss filter</td>
<td>EN ISO 11562: Gauss filter</td>
</tr>
<tr>
<td>Roughness and profile parameters</td>
<td>40 parameters</td>
<td>40 parameters</td>
<td>68 parameters</td>
</tr>
<tr>
<td>EN ISO 4287</td>
<td>Ra, Rz, Rmax, Rm, Rmr(c), Rp</td>
<td>Ra, Rz, Rmax, Rm, Rmr(c), Rp</td>
<td>Ra, Rz, Rmax, Rm, Rmr(c), Rp</td>
</tr>
<tr>
<td>EN ISO 13565-1, -2</td>
<td>Rk, Rpk, Rk, M1, M2, A1, A2</td>
<td>Rk, Rpk, Rk, M1, M2, A1, A2</td>
<td>Rk, Rpk, Rk, M1, M2, A1, A2</td>
</tr>
<tr>
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<td>Rk, Rpk, Rk, M1, M2, A1, A2, Rk*, Rpk*, Vol.0001</td>
<td>Rk, Rpk, Rk, M1, M2, A1, A2, Rk*, Rpk*, Vol.0001</td>
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<tr>
<td>Geometry standard hard RND1H1</td>
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<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Geometry standard hard RND2H2</td>
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<td>–</td>
<td>–</td>
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<tr>
<td>Geometry standard hard RND1H3</td>
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<td>–</td>
</tr>
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<td>Geometry standard hard RND1X3</td>
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<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Geometry standard extra hard RNDX2</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Geometry standard extra hard RNDX3</td>
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<tr>
<td>Geometry standard glass</td>
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<tr>
<td>Geometry standard hard DIN I</td>
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<td>–</td>
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<tr>
<td>Geometry standard DIN II</td>
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</tr>
<tr>
<td>Depth setting standard</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Setting standard 3 grooves</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Setting depth standard EN9 (groove approx. 9 µm)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Cutting-off to EN ISO 4287/IS0 9601</td>
<td>0.250/8.2/5.5 mm</td>
<td>0.080/250.8/2.58 mm</td>
<td>0.080/250.8/2.58 mm</td>
</tr>
<tr>
<td>Display</td>
<td>2&quot; TFT color display</td>
<td>4.3&quot; TFT color display with touchscreen function</td>
<td>4.3&quot; TFT color display with touchscreen function</td>
</tr>
<tr>
<td>Interfaces</td>
<td>Bluetooth®, 8 points/mm, 384 points/line</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Battery (basic unit)</td>
<td>Lithium-ion battery, up to 800 measuring cycles</td>
<td>Lithium-ion battery, up to 800 measuring cycles</td>
<td>Lithium-ion battery, up to 800 measuring cycles</td>
</tr>
<tr>
<td>Dimensions (L x W x H), weight</td>
<td>approx. 50 x 63 x 128 mm, 270 g</td>
<td>approx. 227 x 70 x 98 mm, 275 g</td>
<td>approx. 227 x 70 x 98 mm, 1080 g</td>
</tr>
<tr>
<td>Printer</td>
<td>optional printer PS</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Printing method</td>
<td>static thermal print lines</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Paper roll</td>
<td>Ø = 31 mm</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Resolution</td>
<td>8 points/mm, 384 points</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Paper roll width</td>
<td>57 ±0.5 mm/48 mm</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Data memory (per measuring program)</td>
<td>max. 2000 measuring data records and 500 profile data records</td>
<td>max. 2000 measuring data records and 500 profile data records</td>
<td>max. 2000 measuring data records and 500 profile data records</td>
</tr>
<tr>
<td>Integrated</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Measurement principle</td>
<td>via basic unit</td>
<td>via basic unit</td>
<td>via basic unit</td>
</tr>
<tr>
<td>Cut-off standard</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Measuring range</td>
<td>0.150/5.1/1 mm/s</td>
<td>0.150/5.1/1 mm/s</td>
<td>0.150/5.1/1 mm/s</td>
</tr>
<tr>
<td>Display</td>
<td>2&quot; TFT color display</td>
<td>4.3&quot; TFT color display with touchscreen function</td>
<td>4.3&quot; TFT color display with touchscreen function</td>
</tr>
<tr>
<td>Interfaces</td>
<td>USB, Bluetooth® wireless technology</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Battery (basic unit)</td>
<td>Lithium-ion battery, up to 800 measuring cycles</td>
<td>Lithium-ion battery, up to 800 measuring cycles</td>
<td>Lithium-ion battery, up to 800 measuring cycles</td>
</tr>
<tr>
<td>Dimensions (L x W x H), weight</td>
<td>approx. 50 x 63 x 128 mm, 270 g</td>
<td>approx. 227 x 70 x 98 mm, 275 g</td>
<td>approx. 227 x 70 x 98 mm, 1080 g</td>
</tr>
<tr>
<td>Printer</td>
<td>optional printer PS</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Printing method</td>
<td>static thermal print lines</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Paper roll</td>
<td>Ø = 31 mm</td>
<td>–</td>
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<td>Resolution</td>
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<td>Paper roll width</td>
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<td>Data memory (per measuring program)</td>
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<td>max. 2000 measuring data records and 500 profile data records</td>
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### Description surface standards (page 43)

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<th>Standard</th>
<th>Ra</th>
<th>Rz</th>
<th>Rmax</th>
<th>Art. no.</th>
<th>With DAKKS-DKD calibration</th>
<th>Type EN ISO 5436-1</th>
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<td>approx. 1.15 µm</td>
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</tr>
</tbody>
</table>

* Depending on probe used
Excellent industrial metrology

**WAVELOLINE**
- Roughness and Contour Metrology
  Mobile, manual and automated measuring instruments for determining roughness, contour, topography and twist; combined systems for roughness and contour measurements; optical surface inspection for cylinder bores and customized solutions.

**FORMLINE**
- Form Metrology
  Manual and CNC-controlled systems for measuring form, position and twist, combined form and roughness instrumentation, form measurement systems for cylinder bores, spindle measuring machines, crank shaft and cam shaft measuring machines and workpiece-specific solutions.

**OPTICLINE**
- Optical Shaft Metrology
  Optical measuring systems for determining dimensions, form, position and geometric elements on concentric workpieces. Can be used offline, or as an automated SPC measuring station within the production chain and as a customized solution for workpiece-specific requirements.

**GAGELINE**
- Dimensional Metrology
  Pre-process, in-process and post-process measuring systems for measuring dimensions via tactile, pneumatic or optical technologies, including manual, semi and fully automatic systems, final inspection machines and individual in-line systems, plus systems for optical surface inspection.

**MOVOLINE**
- In-Process Metrology
  Digital measuring heads, control devices and accessories for tactile in-process measurements of diameter, position and length in machine tools, all aimed at controlling the machining process of machine tools.

**SERVICELINE**
- Services Worldwide
  Metrological services including training, application studies and start-up support, relocation services, production monitoring, (remote) services and calibration, repairs and spare parts/replacement service, measuring program generation and measurement process optimization.