



MORE LIGHT

Opticline – Optical Shaft Metrology

Fast and precise quality assurance
in the production environment thanks
to optical measuring systems.

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.



Our Opticline measuring solutions present a wide range of evaluation options and numerous areas of application for measuring shaft-type workpieces. Thanks to the fast, optical non-contact measuring principle, measurements are performed with an extremely high level of flexibility, repeatability and accuracy.

Successfully implemented solutions worldwide

- Turned and precision turned parts
- Components used in the automotive industry such as electric motors, drive trains, steering parts and turbochargers
- Blanks and pressed parts for metal processing
- High-precision workpieces used in medical technology such as implants, bone screws and tools
- Jets and injection technology
- Components used in the bearings industry
- Turbines and emergency power units
- Parts used in the textile and printing industries
- Applications in the aerospace industry
- Pneumatic and hydraulic parts, such as pumps
- Various electric motors, e.g. for fans, household appliances, positioning and drive systems

Dimensional measurement

- Length
- Diameter
- Radius
- Angle

Thread measurement

- Dimension
- Form

Form measurement

- Straightness
- Roundness
- Cylinder form
- Conicity
- Flatness

Profile forms

- Free form
- Tolerance range

Position measurement

- Radial run-out/total radial run-out
- Axial run-out/total axial run-out
- Straightness
- Symmetry
- Parallelism
- Concentricity
- Coaxiality
- Perpendicularity

Please scan for detailed Opticline information



Rapid and precise quality assurance directly in the production process

Opticline solutions are the result of our extensive expertise in optical and tactile shaft measuring technology. Our technologically innovative and pioneering systems have been impressing a broad range of users around the world for over 25 years.



Networked measuring systems to support flexible production: Smart Factory

For production that is largely self-organized, we offer integrated systems that can be seamlessly incorporated into the production process. Recorded measuring values are forwarded directly to the processing machine so that the production process can be corrected in real time.

- Automated processes
- Accurate measurements
- Reliable measurement processes
- Flexible use
- Fast measuring times



Precise and fast – Innovative measuring systems

- Complete measurements in seconds
- High-resolution and μm precise
- Automatic measurement runs
- Integrated tactile probing system (option)
- High-precision headstock for improved form measurement capability (option)

Flexible and versatile – Simple workpiece change

- Tailstock with convenient functions for quick vertical adjustment and engaging
- Flexible clamping device attachment via Morse taper
- Open enclosure for fast loading
- Minimum set-up times

Ideal for production – Robust hardware and software

- Camera with IP52 protection
- Enclosure with thermal insulation
- Intelligent functions for compensating negative environmental influences
- Integrated roller shutter (optional)
- Integrated measuring computer (optional)

Durable and reliable –

Long-term gauging component capability

- Intelligent, automatic monitoring of the measuring system
- Integrated, automatic temperature compensation
- No setting master needed for daily use

Safe and simple – Optimized for use in production

- Ergonomic design
- Optimized for operator-controlled inspections
- Light barriers for maximum safety
- Results display visible from a distance

Intuitive and easy to understand –

Operating and evaluation software

- Fast test plan generation
- Numerous tools and wizards
- Clear representation of results
- Easy mapping of complex test characteristics and tasks
- Quick and easy program change
- Very little training required

Opticline CS. Flexible, optical measuring systems for quality assurance on turned parts



Opticline CS305 for cost-effective measurement of turned parts



Fast worker self-control directly in the production environment



Door or light barrier protects the operator and ensures reliable measurements



Simple clamping of the workpiece between tips

Opticline CS series shaft measuring systems have been designed for production-related applications and offer a high degree of measuring performance and absolute precision from 2 μm in an extremely compact design. They are available at an attractive price and are ideal for operator-independent workpiece checking within the production environment.

System features

- Universal measuring instrument for dimensions, form, position, etc.
- Simple, fast and precise
- Compact design and simple operation
- Traceable quality control
- Sophisticated technology at an attractive price
- Supports flexible production processes
- Simple operation and programming
- Numerous analysis functions
- Simple workpiece changes
- Flexible measuring instrument for a variety of parts
- Reliable measuring processes and clear measurement results
- Statistics-oriented, informative reporting

Measuring capacity	CS155	CS305	CS308	CS314	CS608	CS614
Max. diameter [mm]	50	50	80	140	80	140
Length [mm]	150	300	300	300	600	600

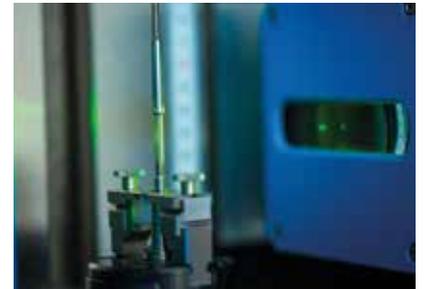
Opticline C. Compact and robust systems for long-term gauge repeatability and reproducibility



Opticline C914 with optional, mobile gauge enclosure for flexible use in production



Simple, convenient starting of measurements for fast and reproducible measuring results



Workpiece-specific clamping devices for measuring small and very small parts



Integrated light barrier to protect operators in accordance with international safety standards



Simple operation of the measuring machine thanks to fast tailstock adjustment

Opticline C series shaft measuring systems offer maximum gauge repeatability and reproducibility from 1 μm . With different configurations, such as a high-precision C-axis or multi-sensor system, the performance capability can be customized to suit your requirements. The instruments thus offer the highest level of flexibility, accuracy and stability.

System features

- Optimum precision properties in μm delivering measurements within seconds
- An individual camera offers bidirectional measurement for workpiece diameters of up to 80 mm
- Scaling of the optical system for measuring diameters of up to 140 mm without loss of resolution or quality
- Special tailstock and headstock design for rapid workpiece changes and maximum precision
- Simple and automatic workpiece alignment
- Real-time processing and fastest possible data transfer
- Self-monitoring functions for reliable use in production
- Low-maintenance, robust measuring system including camera with IP52 protection

Product variants and options

- Tactile probing system T3D or TSP for measuring additional lengths and form test characteristics
- High-precision headstock for higher form gauge repeatability and reproducibility and improved rotational measurements
- Integrated measuring and evaluation computer
- Roller shutter to protect against negative environmental influences
- Pneumatic clamping solutions for greater flexibility and workpiece variety
- Table racks for practical loading at working height and additional storage space

Measuring capacity	C203	C305	C308	C314	C605	C608	C614	C908	C914	C1214
Max. diameter [mm]	30	50	80	140	50	80	140	80	140	140
Length [mm]	250	300	300	300	600	600	600	900	900	1200

Opticline C1000. User-independent measurement of large shafts



Opticline C1023 with safety light barrier and roller shutter



Optional tactile probing system BTS for concentric lengths and axial run-outs



Opticline C1023-75AE: Measuring crank shafts with specially optimized camera system, high-precision C-axis and high-resolution measuring system for demanding measurements

The shaft measuring systems of the Opticline C1000 series offer you an ideal combination of precision, suitability for production, ergonomics and operator friendliness.

System features

- Fast and reliable results for large and heavy workpieces
- Fast loading and unloading of different workpieces combined with maximum operator safety through a light barrier
- Protected from negative environmental influence by closed and lockable housing with integrated motor-driven roller shutters
- Elaborate design for high demands on production suitability: air-conditioned cabinet for power electronics and measuring computers, height adjustable operating panel with TFT screen and a lockable cabinet with drawers for printer, tools and accessories
- Easy to set up and use thanks to simple tailstock positioning via a digital position indicator

Measuring capacity	C1014	C1023	C1023-75AE
Max. diameter [mm]	140	230	230
Length [mm]	1000	1000	1000
Workpiece weight [N]	400	400	750

Opticline CA. Flexible and automated shaft measurement in production



Example integration of Opticline CA618 with robots and loading station



Opticline VMS305 for measuring engine valves; integrated in a production line

Thanks to their special open machine concept, the high-precision Opticline CA systems are ideal for PLC measuring stations with manual loading and automated production.

System features

- Outstanding precision characteristics and flexible in use, including for future workpieces and measuring tasks
- Ideal production suitability and reliability through long-term gauging component capability
- High-precision rotational axis with outstanding form measurement ability
- Automatic tailstock with a long stroke on precision guides
- Quick, easy and accurate workpiece clamping via a motorized tailstock
- Ideally suited for automated measuring of turned parts of different branches of industry and manufacturing
- Optional tactile measurement of length and axial run-out

Customized solutions for flexible use

- Horizontal or vertical system design
- Project-specific housing solutions
- Various options for automated loading and clamping
- Various interfaces for machine integration and control
- Flexible integration into automated production processes
- Ideal accessibility for manual and automatic loading
- Active temperature control and compensation
- Simultaneous control of several production systems by a single operator
- Free software interfaces safeguard results and allow tool compensation for upstream processing machines
- Special systems for fully automatic measurement of valves or crankshafts

Measuring capacity	VMS305	CA305	CA310	CA314	CA605	CA610	CA614	CA614-AE	CA618	CA618-AE
Max. diameter [mm]	50	50	100	140	50	100	140	140	180	180
Length [mm]	300	300	300	300	600	600	600	600	580	580

Opticline AMV. Professionals for concatenated use in production



Opticline AMV923V with robot loading in a vertical design



Opticline AMV923H for concatenated post-process work sequence measurement in a horizontal design

These Opticline AMV measuring systems designed specifically for concatenated use in production are available in horizontal and vertical designs depending on your requirements. They are ideal for the automated handling of large workpieces.

System features

- Short measuring times for complex workpiece geometry
- Concatenated use in production; the integrated PLC connects to the superordinate loading system
- Fast correction of one or more processing machines with the help of intelligent software for tool correction

Product variants

- Horizontal or vertical system design
- Customer-specific enclosures
- Various safety devices to protect the workers and the workpiece

Measuring capacity	AMV923H	AMV923V
Max. diameter [mm]	230	230
Length [mm]	805	830

Opticline WMS. Precision for particularly large and heavy workpieces

The machine design of the optical measuring systems Opticline WMS enables them to handle above-average workpiece sizes weighing up to 120 kg.



Opticline WMS1023 in a vertical design

System features

- Top resolution and measurement accuracy across the entire range thanks to a unique, cascaded camera system for workpieces with diameters of up to 320 mm
- Adaptation to your integration requirements: horizontal or vertical design
- Split-second measurements, even with very large workpieces
- Available for operator self-inspection and fully-automated use



Use in production, loading a crank shaft with operator self-inspection



Opticline WMS1332 in a horizontal design

Measuring capacity	WMS1023	WMS1332
Max. diameter [mm]	230	320
Length [mm]	1000	1300

Multi-sensor technology for additional evaluation possibilities

Optionally, the shaft measuring systems of the Opticline product family can be extended with a tactile probing system. Tactile measurements can be seamlessly integrated into the optical measurement run and, depending on the design, are suitable for specific applications, such as measurements of axial run-out, grooves or bores. These additional evaluation possibilities add to the quality information within one single measurement run and offer higher flexibility.



Probing system T3D for Opticline C series

New probing system T3D

- Tactile probing system for various 3D measurements
- Now also allows the measurement of grooves, positions and references as well as in holes and in blind holes
- Multi-sensor solution for increased efficiency and cost reduction with just one measuring system



Probing system BTS for Opticline C1000, AMV and WMS



Probing system TSP for Opticline C and CA series

Data and temperature acquisition with external sensors

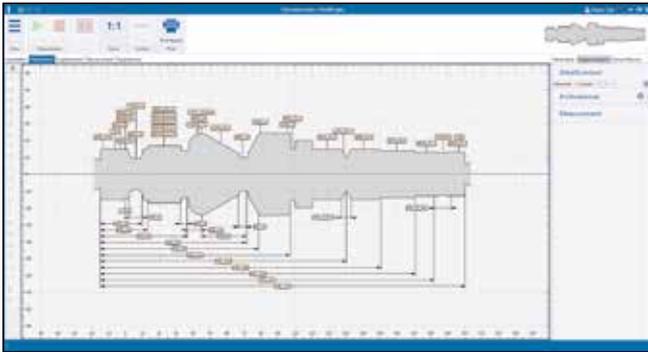


Barcode scanner for test plan selection and data input



Workpiece temperature detection

Tolaris Optic. Operating and evaluation software for precise results in seconds



User interface: optimized view for operators

User-friendly, intuitive operation

- Display and operating controls adapted to the requirement profiles of test plan designers and operators
- Wizards for easy creation of test plans and setting of test characteristics
- Clear presentation and subsequent processing of measurement results
- “Live” mode for direct feedback when creating test plans
- Scan of the part contour in different views

Optimized measuring runs

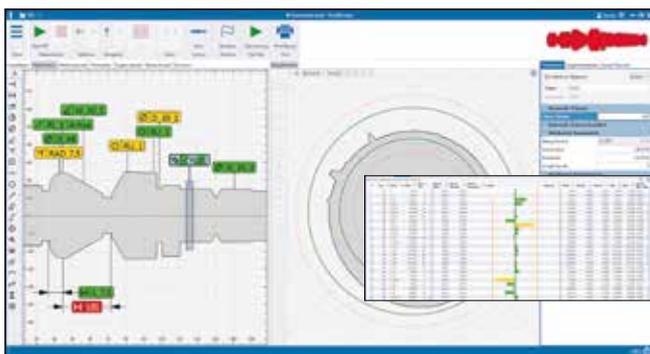
- Easy selection of new characteristics by clicking with the cursor; workpiece contour definition in accordance with drawing specifications
- Scanning and evaluation of workpiece contours in the shortest possible time
- Fast combination of any measurement functions in one test plan
- Fully automated measurement process with results displayed within seconds



Setting of test characteristics

Reliable analysis of measurement results

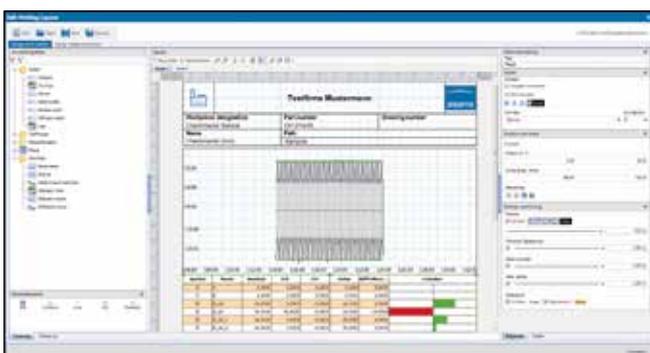
- Various views for displaying measurement values on screen
- Extensive analysis functions
- Customizable documentation of measurement values
- Various export options for subsequent data processing or documentation
- Database tool for convenient saving and managing of measurement results
- Fast and reliable analysis and interpretation of measurement results by the operator
- Comprehensive and practice-oriented result tracing



Results display with detailed contour, results list

Documented quality and seamless integration

- Automated reporting
- Storage and management of measurement results
- Analysis tools for result tracing
- Certified interfaces (Q-DAS, AQDEF)
- Software interfaces via CSV and Script
- Connection of additional, external gauging components via interface box



Report and template editor

Formline – Form metrology

Innovative measuring systems for unequivocal measurement of form and positional tolerances



Precise metrology for efficient quality control

As a leading manufacturer of metrology systems, HOMMEL ETAMIC offers a broad portfolio of measurement solutions for industrial manufacturing processes. Our high-precision technologies include pneumatic, tactile or optical measurement of roughness, contour, form and dimensions, as well as optical inspection of machined surfaces. Comprehensive services such as consulting, training, DAkkS-DKD calibration and service, including long-term maintenance contracts, round off our worldwide range of metrology services for quality assurance in industrial manufacturing.

Our measuring systems ensure the quality of the workpiece throughout the entire production process and provide precise measurement data in the shortest possible time. Automatic measuring technologies enhance overall productivity during production through efficiently designed inspection solutions – whether inline or offline, or using spot checks through 100 % inspection of all manufactured workpieces.

We provide you with solutions for a wide range of tasks in form measurement – from the fully automatic CNC measuring station for all form and positional tolerances to combined form and roughness measuring systems to solutions for large and heavy shafts.

Typical applications

- Bearing rings
- Gear shafts
- Rotor shafts
- Brake disks
- Spindles
- Screws
- Prostheses
- Hydraulic and pneumatic components
- Pistons
- Crankshafts
- Camshafts
- And many more

Form tolerances

- Roundness
- Straightness
- Flatness
- Cylinder form

Run-out tolerances

- Radial run-out
- Axial run-out
- Total radial run-out
- Total axial run-out

Position tolerances

- Parallelism
- Perpendicularity
- Angularity
- Coaxiality, concentricity

Specific parameters

- Conicity
- Position deviation
- Length
- Thickness and thickness deviation
- Stroke radius
- Crowning
- Angle deviation
- FFT analysis and synthesis
- Twist
- Roughness (linear and polar)
- Dominant roundness waviness
- Polar and line form
- Cam form
- Vibration velocity
- Angular sector evaluation
- Laminar jump
- Piston evaluation



Formline F900. Highly efficient solution for form, roughness and twist measurements



Formline F900 with 550 mm column and vibration-damped instrument table



Motorized tilt and rotation module



Magnetic coupling



Double-tipped probe system

Highlights

- Time saving thanks to very fast, fully automatic centering and leveling and CNC controlled measuring axes
- Flexible use with free probe system in C, Z and R direction for form, roughness, waviness and twist measurement in a single clamping operation
- Heights of vertical measuring axis: 350, 550 or 900 mm
- Vibration-damped instrument table with container for PC and system electronics
- Magnetic probe arm coupling for fast changing of the probe arm and protection in case of collisions
- Flexible access to external/internal measurement positions:
 - + fully automatic probe positioning by CNC controlled tilt and rotation module
 - + fully automatic, freely adjustable probe force and reversible scanning direction

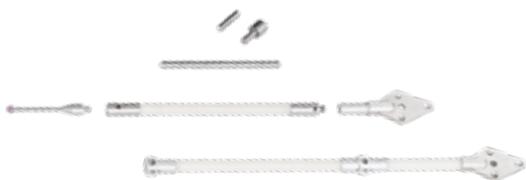
System features

- Highly accurate air bearing rotary table with outstanding rigidity for consistently high precision
- High resolution with 0.1 μm in the R/Z axis and 360,000 points in the C axis
- Integrated linear scale and active level control
- CNC controlled motorized tilt and rotation module for fully automatic measurements
- Double-tipped probe system can be switched from form to roughness during the CNC run
- For roughness measurement, the probing force can be programmed in any position of the probe arm in accordance with standards
- Axes with high resolution and very low interference
- Automatic zenith alignment of the probe arm through 3-ball system

Formline F900. Accessories for a variety of measuring tasks

We offer you a wide range of accessories to adjust the system to different workpieces and measuring tasks. We can also provide you with specially manufactured accessories for specific tasks.

Probe arm set FTM



With the flexible probe arm set for the configuration of probe arms, you can cover the most common measuring tasks. Other probe arms and probes are available on request.
Art. 1002 9224

Chucks

With three, six or eight hardened clamping jaws for secure clamping of the workpieces on the rotary table. Other chucks are available on request.

Chuck FX70

Chuck range
Internal 18–62 mm
External 2–68 mm
Art. 232 036



Chuck FX100

Chuck range
Internal 28–95 mm
External 2–95 mm
Art. 232 357



Chuck FX150

Chuck range
Internal 46–140 mm
External 2–140 mm
Art. 232 359



Roundness standard FN111

Made of ceramic. For inspecting the radial roundness deviation of the rotational axis.

With factory calibration certificate

Art. 521 799

With DAkkS-DKD calibration certificate

Art. 532 529



Magnification standard FN101

For inspecting the amplification of the probing system.

With factory calibration certificate

Art. 521 809

With DAkkS-DKD calibration certificate

Art. 532 528



Roughness standard RNDX2 with standard holder

For inspecting the roughness measurement with the Z and R axis. In the FNR standard holder for one or two geometry standards of type RNDH or RNDX.

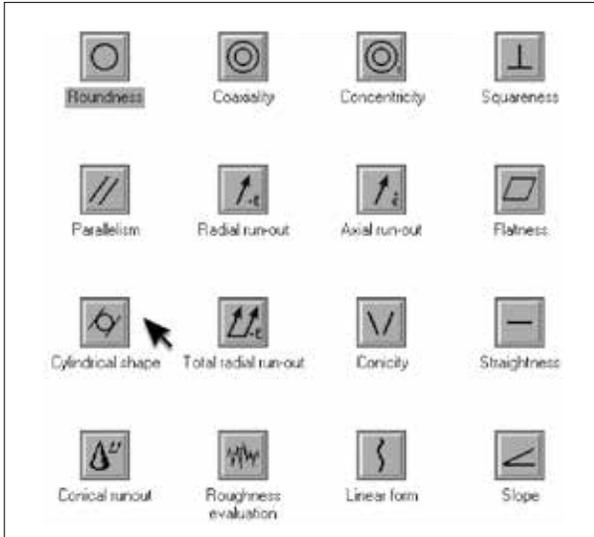
Scope of delivery:

- Standard holder
- RNDX2 standards
- Factory calibration certificate

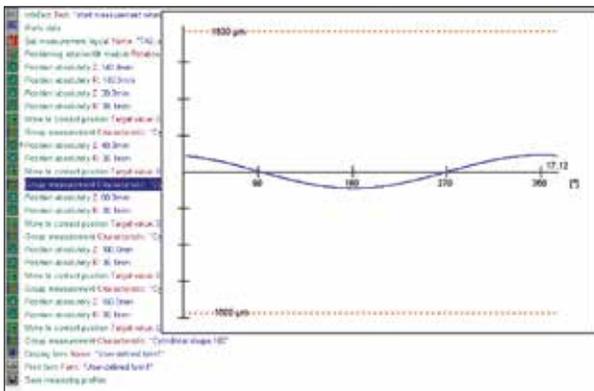
Art. 1003 4205



Turbo Form. Software with clear user guidance for reliable measurement evaluation



Test plan creation



Automated alignment and measuring run



Results report for form and roughness measurement

The graphical, function-oriented user interface of Turbo Form ensures simple operation, even when performing complex measurement tasks.

System features

- User-friendly interface with clear icons
- Simple definition of measurement positions/axis references
- Direct transfer of positions via teach-in
- Simple CNC programming using pictograms
- Fully automatic alignment and measurement
- Comprehensive profile analysis and complete documentation of the measurement results
- Clear program flow
- Evaluation in accordance with standards
- Convenient test plan management
- Fast evaluation algorithms for prompt results
- Fourier analysis for detection of recurring profile parts
- Results display in 3D diagrams
- User-defined presentation of measuring reports
- Automatic saving of PDF reports

Automatic measurement runs: CNC

- User-independent, reproducible results
- Aligned workpiece is automatically measured at the measuring positions defined in the test plan
- Created in the teach-in mode or via offline license

Software options

- Line form
- Angular sector
- Fourier synthesis
- Cone
- qs-STAT® interface
- ASCII export interface
- Piston measurement
- Brake disk measurements
- Dominant roundness waviness
- PDF export component
- Profile operations
- Evaluation of common roughness, waviness and profile parameters in accordance with standards
- Twist measurement according to MBN 31007-07 standard with TwistLive® quick analysis method

Formline F900. Twist measurement according to MBN 31007-07

Twist refers to periodic structures which are comparable with the course of a thread. Magnified many times, it is visible as a micro-grinding structure. Twist structures at the sealing surfaces of shafts occur during grinding and impair the sealing function between the shaft and the sealing ring.

The most important properties of these structures can be determined with a 3D evaluation of the surface. The contact zone of the shaft is measured as a 3D area with a roughness stylus tip over a series of envelope line profiles. This allows a graphic representation of the twist structure as well as calculation of the twist parameters according to MBN 31007-07.

Twist parameters

- Number of threads DG
- Twist depth Dt [μm]
- Period length DP [mm]
- Feed cross section DF [μm^2]
- Feed cross section per revolution DFu [$\mu\text{m}^2/\text{U}$]
- Contact length in percent DLu [%]
- Twist angle DW [°]

Twist standards

For inspecting the accuracy of the measuring system. Calibrated parameters: Dt, DP, DG and DW. Set consisting of two standards with 10 threads and 30 threads. With factory calibration certificate. Art. 521 799

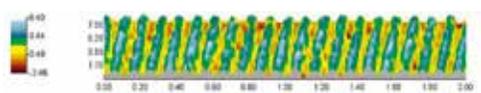


Patented TwistLive® analysis method

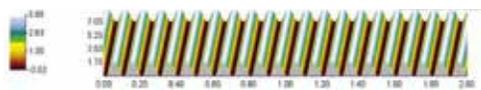
With this standard-compliant analysis method for all Formline F900 systems, the normal measurement time may be reduced by 75 %. During the measuring progress, a results forecast of the twist parameters is already possible – live!

The measured value recording for the twist measurement requires 72 profiles. The TwistLive® fast analysis method, which is based on the 36° and 360° profile principle, includes a specially developed evaluation method to shorten the measuring time.

The resulting twist structure is updated after each structure is updated and the twist parameters are calculated. The required measuring time is thus typically reduced from 15 - 20 minutes to approx. 5 minutes per topography.



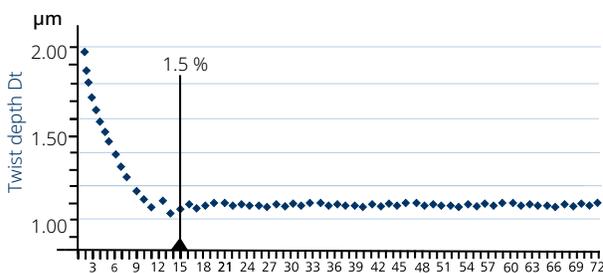
Display of unfiltered primary surface structure



Display of twist structure in detailed scaling



Display of original profile (green) and twist profile (blue)



TwistLive®

Standard measuring time 72 measurements

Example measurement of the twist depth Dt. After 12 measurements, the final value is stable within 1.5 % and the measurement is ended after only approx. 5 minutes.

Formline F900. Application examples and technical data

Application examples Formline F900

Thanks to the extensive range of accessories, the F900 systems are suitable for a wide variety of measuring tasks. If required, we can develop a system that is specially tailored to your requirements.



Combined form and roughness measurement



Form measurement in small, deep bores



Measurement on a gear shaft

Technical data

Model	F900-350	F900-550	F900-900
Measuring range Distance C/Z axis, max. interfering edge radius Max. test diameter Max. measuring height	370 (420 ¹⁾) mm 430 (530 ¹⁾) mm 350 mm	370 (420 ¹⁾) mm 430 (530 ¹⁾) mm 550 mm	370 (420 ¹⁾) mm 430 (530 ¹⁾) mm 900 mm
Rotation axis (C axis) Table diameter Workpiece alignment Roundness deviation (radial) $\mu\text{m} + \mu\text{m}/\text{mm}$ measuring height ²⁾ Run-out deviation (axial) $\mu\text{m} + \mu\text{m}/\text{mm}$ radius ²⁾ Centering range Leveling range Measuring and positioning speed Bearing Max. charge		330 mm automatic 0.02 $\mu\text{m} + H \cdot 0.0005 \mu\text{m}$ 0.03 $\mu\text{m} + R \cdot 0.0005 \mu\text{m}$ $\pm 5 \text{ mm}$ $\pm 1^\circ$ 0.2 – 15 1/min. air 1000 N	
Vertical axis (Z axis) Measuring distance Straightness deviation/100 mm Straightness deviation/measuring distance Parallel C-Z/measuring distance Measuring and positioning speed Collision protection	350 mm 0.15 μm 0.3 μm 0.5 μm 0.2 – 50 mm/s yes	550 mm 0.15 μm 0.45 μm 0.8 μm 0.2 – 50 mm/s yes	900 mm 0.25 μm 1.5 μm 2.5 μm 0.2 – 50 mm/s yes
Horizontal axis (R axis) Measuring distance Straightness deviation/100 mm Straightness deviation/measuring distance Squareness C-R Measuring and positioning speed		240 mm 0.25 μm 0.5 μm 0.8 μm 0.2 – 50 mm/s	
Dimensions Length Width Height	1425 mm 800 mm 1620 mm	1425 mm 800 mm 1820 mm	1425 mm 800 mm 2170 mm
Weight Measuring system	685 kg	700 kg	720 kg

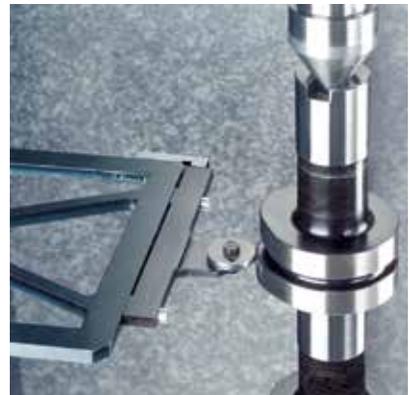
Formline CFM3010. Comprehensive competence for large and heavy shafts



Formline CFM3010 with evaluation unit



Flat measuring follower for crankshafts



Round measuring follower for camshafts

Highlights

- Secure measurement results thanks to air-bearing, lateral force-stable measuring head, including precise FFT analysis
- Excellent basic accuracy thanks to high-resolution measurement systems
- Robust construction with vibration decoupling for use in the measuring room or in production
- Optimized CNC runs in conjunction with high measurement and travel speeds
- Fast measurement value recording
- Can be used flexibly for a variety of workpieces
- **Typical applications:** crankshafts, camshafts, transmission shafts, rotor shafts, and many more

System features

- Gaging component capability: measuring accuracy with repeatability of up to 0.3 μm
- Distance between tips: 1250 (1500) mm
- Wear-free air bearing measuring slides
- Interpolated axis positioning
- Capable evaluation software Tolaris Shaft for camshafts and crankshafts
- Element-oriented programming concept
- Offline programming license
- PTB-certified cam form evaluation algorithms
- Extensive range of accessories such as followers and drivers for different measuring tasks

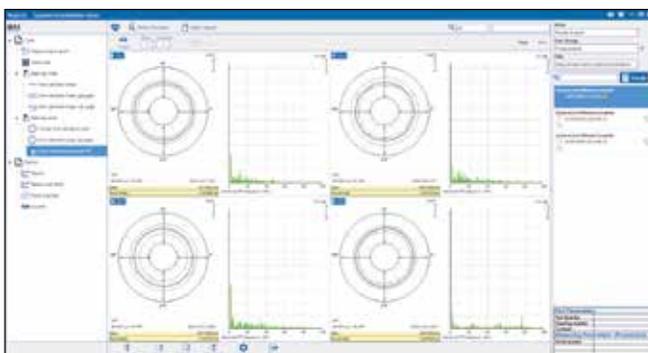
Tolaris Shaft. Modern evaluation software for reliable process control



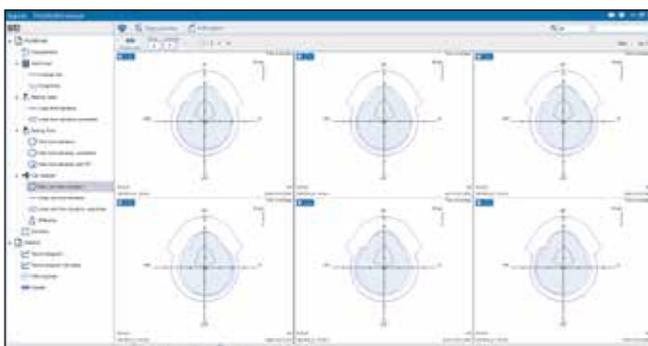
Workpiece displays together with characteristics



Management of workpiece-specific accessories



Polar diagram bearing with FFT



Polar diagram cam form

The Tolaris Shaft evaluation software for the CFM3010 crankshaft and camshaft measuring machine is easy to use and takes all key aspects for controlling and optimizing modern production processes for crankshafts and camshafts into account.

System features

- Optimized for the measurement and evaluation of crankshafts and camshafts
- Standardized displays to make it easy to familiarize yourself with the software and use it reliably
- Extensive toleration functions
- Clear profile graphics
- Simple print form creation
- Control charts
- Extensive data exports to correct machine tools
- Measuring process and accessories management
- User management
- FFT tolerance zone management
- Offline programming
- Scope for expansion to include specific evaluation functions

Simple and comfortable use

- Self-explanatory dialogues to support recurring tasks
- Feature-oriented programming with schematic representation of the workpiece with measuring positions
- Simple machine control and CNC programming for automated measuring sequences
- Accessories management for easy organization of clamping equipment and measuring elements for specific workpieces

Options for specific measuring tasks

- qs-STAT® interface
- Wavinesses such as chatter marks or dominant roundness waviness
- Cam form
- Classification (for final inspection systems)

Formline CFM3010. Application-related accessories & technical data

Workpiece drivers for Formline CFM3010

Universal standard workpiece drivers for the measurement of all common workpiece types.
Application-specific drivers are also available.



Universal driver for cam shafts, gear shafts and crank shafts



Workpiece-specific axial driver for cam shafts and crank shafts for angle indexing in axial bores



Workpiece-specific radial driver for cam shafts for angle indexing in grooves

Technical data

Model	CFM3010
Measuring range Distance C/Z axis, max. interfering edge radius ²⁾ Max. test diameter Max. measuring height Max. traverse distance radial	162 mm 300 mm 1250 (1500 ¹⁾) mm 210 mm
Rotation axis (C axis) Face plate Workpiece alignment Measuring and positioning speed Bearing Max. charge Traversing speed Resolution Positioning accuracy Accuracy Run-out accuracy of the roller bearing Measuring point distance	196 mm tips 0.5 – 50 1/min. mechanical 1500 N 0.5 – 50 1/min. 0.00005° 0.1° ±0.00028 0.25 µm 0.1 / 0.2 / 0.5 / 1
Vertical axis (Z axis) Travel distance Measuring distance Collision protection Positioning error/measuring distance Measuring and positioning speed Resolution of the Z scale Accuracy	1290 (1590 ¹⁾) mm 1250 (1500 ¹⁾) mm yes 0.02 mm 1 – 200 mm/s 0.1 µm ±3 µm
Straightness axis (X axis) Measuring distance Resolution Accuracy Setting range of the measurement force	210 mm 0.02 µm ±0.2 µm 1, 2, 3 and 4 N
Travel in X direction (resolution probing system) Measuring and positioning speed Resolution radial Resolution axial	1 – 80 mm/s 0.02 µm 0.1 µm
Dimensions [L x W x H]	1240 x 1360 x 2450 (2700 ¹⁾) mm
Weight measuring system	3100 (3500 ¹⁾) kg

¹⁾ On request. | ²⁾ Standard flat measuring follower, length 43 mm.

All-round support. Ensuring your productivity thanks to a comprehensive range of services

We not only provide you with innovative and high-precision measuring systems, but also the appropriate services – from the initial inquiry to the individual customer service package. From our wide range of services, we will put together an individual package for you that is perfectly tailored to your requirements.

Service | Preventive & reactive services

- **Application consulting:** Start-up support, measuring program generation, application studies
- **Maintenance & repairs:** Remote service (teleservice), maintenance & repairs of measuring systems, repairs (technical service)
- **Upgrades & retrofit:** Optimization, retrofitting & extension, software updates & upgrades
- **Spare parts:** Probe replacement and spare parts service
- **Other services:** Relocation service, financing

Training | Good training & safe operation

- Training courses on the basics, operation and programming
- At our premises or at your site
- Standard or individual training courses
- Small groups for optimal learning success
- Qualified instructors with practical experience
- **Webinars:** Practice-oriented and location-independent training on specific topics

DAkKS-accredited DKD calibration laboratory



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-insulated and air-conditioned calibration laboratory (D-K-15030-01-00) is accredited by the Deutsche Akkreditierungsstelle GmbH (DAkKS) according to ISO / IEC 17025. Here we calibrate your standards. 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 simple factory calibration certificates (e.g. for cam standards) or factory 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, form deviation, contour, contact stylus instruments and shaft measuring systems. Within this scope we issue DAkKS-DKD calibration certificates for e.g.:

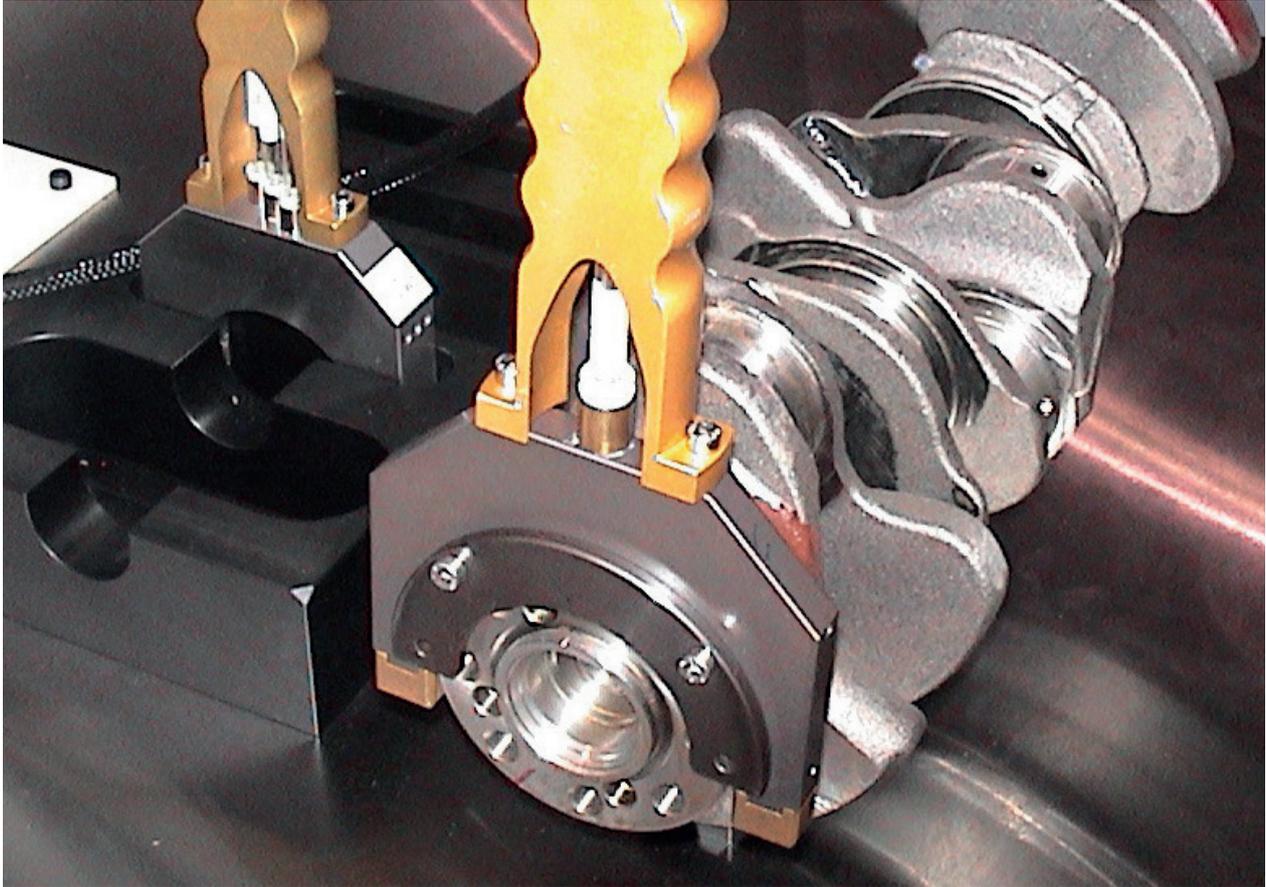
- form standards
- contour standards
- roughness standards

DAkKS-DKD calibration certificate for form standards

Calibration is carried out on our DKD measuring station in an air-conditioned, vibration-insulated measuring room with a rotating spindle system with measuring Z axis.

Gageline AG300

Air tooling for uninterrupted and interrupted shaft diameters



System features

- Easy and convenient operation
- Measurement in one, two or three planes for measuring of out-of-roundness, conicity and cylindricity
- Static or dynamic measurements
- High reliability and quality with a repeat accuracy below 0.25 μm
- Mounted or mobile operation
- Simple calibration using a master of known dimensions
- Adaptation of air jet length and position according to the requirements
- Use with displays (e. g. Pneumatic) or measuring computers (e. g. Vega)
- Standard or customized air tooling

Advantages of the pneumatic measuring principle

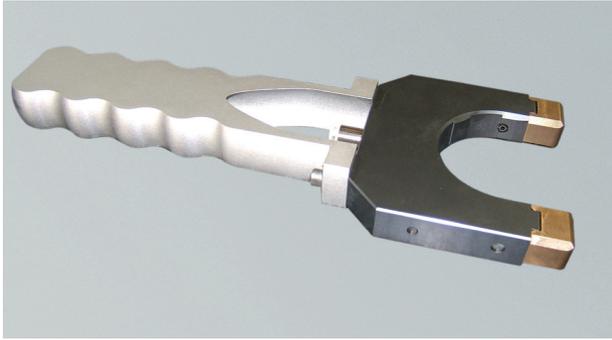
- Non-contact measurement
- High sensitivity and accuracy
- Extremely robust and dirt resistant, therefore suitable for measurement in harsh workshop conditions
- Self-cleaning of measured surfaces
- Short response times

Universal application

- Manual measurement in production lines
- Semi-automatic or automatic measuring stations
- Quality lab (subgroups or 100 % monitoring)
- Manual air tooling with handle or on base

Gageline AG300

Air tooling for shaft diameters



Standard air snap gauge with handle for mobile measurements



Standard air snap gauge AG300 on base

Measuring range (Standard air snap gauge with 2 jets #2)

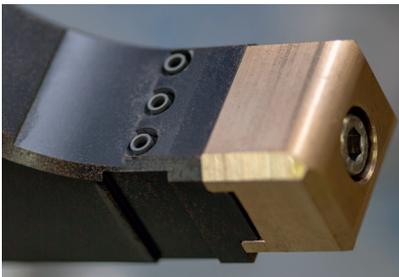
Air snap gauge	Diameter [mm]	Min. measuring range [mm]	Max. measuring range [mm]
Manual	$15 < \varnothing N \leq 105$	0.040 (± 0.020)	0.120 (± 0.060)
On base	$9 < \varnothing N \leq 45$	0.040 (± 0.020)	0.120 (± 0.060)

Precision and performance

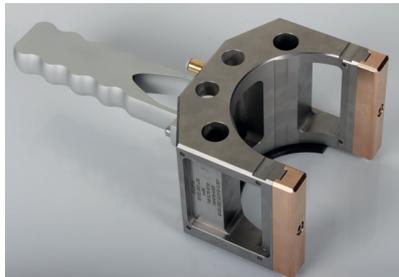
Measuring range [mm]	Precision	Accuracy GR&R type 2	Accuracy CMC
0.040 (± 0.020)	< 0.0005	< 10 %	4
0.080 (± 0.040)	< 0.0010	< 10 %	4
0.120 (± 0.060)	< 0.0015	< 10 %	4

Versatile application

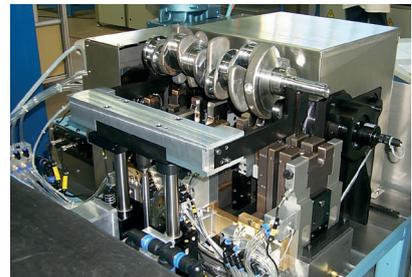
Air snap gauges are used for a wide range of applications, such as measuring main and crankpin bearings on crankshafts, camshaft journals or bearing seats on drive shafts. In addition to our range of standard air snap gauges, we also develop and manufacture part-specific air tooling.



Air snap gauge AG313 with two jets on three measuring planes



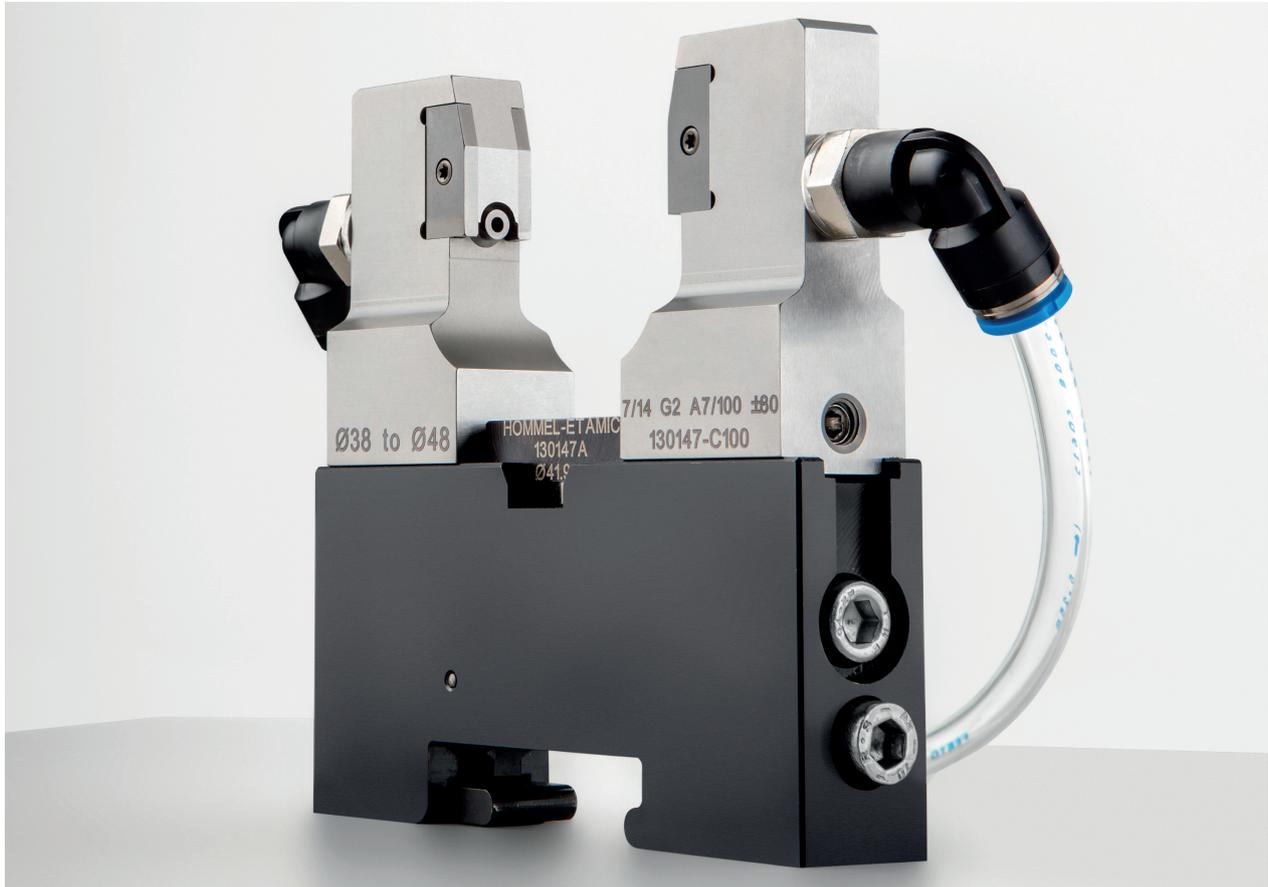
Special manual air snap gauge with handle for mobile use



Automated measuring station for crankshafts with 12 air snap gauges

Gageline AG380

Flexible air snap gauge for outer diameters



System features

- Pneumatic measurement, highly flexible adjustment to different workpiece diameters
- Large diameter range
- Quick clamping system, simple handling
- Suitable for prototyping as well as small and large batch production
- Simple upgrading of existing systems to AG380 possible

Advantages of the pneumatic measuring principle

- Non-contact measurement
- High sensitivity and accuracy
- Extremely robust and dirt resistant, therefore suitable for measurement in harsh workshop conditions
- Self-cleaning of measured surfaces

HOMMEL  **ETAMIC**

A member of the JENOPTIK Group



MORE LIGHT

Gageline – Dimensional Metrology

Precision quality control at every
stage of the production process.

Your partner for custom designed solutions

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

By working with our global team you benefit from our extensive experience and capabilities for a wide range of applications:

- Automation solutions for the manufacturing environment with machine integration, process automation and material handling systems
- Advanced 3D laser-based manufacturing solutions for perforation, cutting and welding of plastics, metals, and sensitive materials such as leather
- Industrial measurement technology and inspection utilizing optical, pneumatic, and tactile technologies

Our metrology products and services offer solutions for the most demanding measuring tasks.

As a reliable partner for high-precision, tactile and non-tactile production metrology, we support you with a global sales and service network capable of designing and developing cutting edge custom metrology solutions.

We work with you to determine the ideal quality control solution designed to meet your specific manufacturing requirements. Whether in the lab, or on the production floor, our tactile, pneumatic, and optical measuring solutions are capable of inspecting a complete range of dimensional part features throughout every phase of the production process.

Gageline. Dimensional metrology in every production stage



Pneumatic metrology



Tactile metrology

Gageline solutions are flexible and take into account any special requirements of the measurement task, required automation, part handling, and even the machine layout. We offer standard and custom designed solutions for any application, capable of providing real-time quality control data anywhere in your production process.

Gageline product range

- Manual measuring gages
- Semi-automatic measuring stations
- Fully automated measuring machines
- Tactile and pneumatic sensors
- Displays and measuring computers

Applications

- In-line and off-line
- Pre- or post-process
- Final inspection
- Metrology lab
- Statistical process control (SPC)
- 100 percent control
- Sample measurements

Additional tasks

- Weighing
- Classification
- Signing
- Sorting
- Optical surface inspection

Custom metrology solutions for any industry

Gageline provides you with solutions for high-precision dimensional measurement in almost any environment, regardless of processes, cycle times, or specific production related requirements like temperature or cleanliness. Our custom solutions offer a high level of specialization and reliability to our customers in medical, aerospace, and automotive manufacturing as well as other mobility industries.

Industries and application examples

Automotive

- Connecting rods
- Injector components
- Gear components
- E-motor components



Mechanical Engineering

- Bearings
- Pump housings
- Rotor shafts
- Sockets

Medical

- Femoral top prostheses
- Femoral pivot prostheses
- Tibial prostheses
- Glass tubes



Aerospace

- Driving shafts
- Bevel gears
- Hydraulic components
- Turbine components

Heavy Duty Trucks

- Cylinder heads
- Cylinder blocks
- Shafts
- Differential carriers



Recreational Vehicles

- Brake disks
- Pump bodies
- Gearbox housings
- Valve bodies

Heavy Equipment

- Hydraulics
- Transmissions
- Brake cylinders
- Turbo chargers



Railroad

- Gears
- Housings
- Shafts
- Centering plates

Dimensional characteristics measured with Gageline solutions

	Straightness
	Roundness
	Flatness
	Cylindricity
	Parallelism

	Perpendicularity
	Angularity
	Coaxiality
	Radial/axial run-out
	Total radial/axial run-out

	Diameter (inner/outer)
	Conicity
	Location
	Length
	Profile form

From simple measuring stations to fully automated solutions

Gageline offers dimensional measuring solutions that can be integrated into your production processes. The degree of automation and the technology used depends mainly on the production requirements and the measuring task.

Gageline solutions are robust and precise thanks to "plug-and-play" technologies that can be used as stand-alone control devices, or integrated into manual, semi-automatic, or fully automated measuring solutions that deliver scalability and evolve with your processes.

Dynamic measurements as well as statistical process control (SPC) insure part quality through interlinked measuring machines that are integrated into the production line.

The following pages show examples of Gageline applications ranging from simple, manual measuring stations, to fully automated measuring machines, all capable of being seamlessly integrated into your production processes.

Simple, cost-effective measuring chain



Manual table-top gage for inner diameters

Simple manual measuring stations consist of three basic components: a measurement display, a pneumatic or tactile measuring device, and a master (standard). These gages are inexpensive, easy to use, do not require prior knowledge and deliver immediate measurement results.

Customer requirements

- Workpiece: ball joint pickle fork separator
- Measurement of two inner diameters
- Post-process, 100 percent control operation

Gageline solution with air tooling

- Mounting on table
- 2 Pneumatic digital comparators
- 1 air spindle with 2 levels for the 2 diameters and elongated jets to take into account the surface finish
- 2 standards according to DIN 2250 B (Min/Max)

Special features

- Immediate display of measurement results
- Ease-of-use
- Portability



Air spindle with two elongated jets

Expandable bench gage measuring system



Manual bench gage for shafts

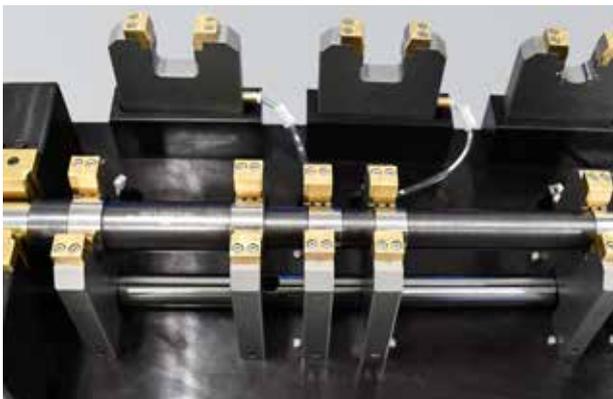
Measuring stations similar to these are normally placed close to the production line and can be used for taking sample measurements, or for final inspection. Workpiece loading/unloading, measuring and mastering are completed manually by the operator.

Customer requirements

- Workpieces: Drive shafts of a ten-speed gearbox
- 3 shaft types
- Multiple O.D. sizes ranging from 23 to 39 mm
- Tolerance range from $\pm 7 \mu\text{m}$ to $\pm 13 \mu\text{m}$

Gageline solution with air tooling and tactile sensors

- Fully adjustable table top fixture
- Multi-sensor compact bench gage
- Carbide vee for precision part positioning
- 10 interchangeable air snap measuring devices
- 1 special tactile snap measuring device for the $\pm 13 \mu\text{m}$ tolerance range
- 2 mastering standards according to DIN 2250 B (Min/Max)



Adjustable fixture using air snap gages

Special features

- Adjustable fixture for multiple part lengths
- Interchangeable/replaceable non-contact air snap gages
- Dual pneumatic and tactile technologies for management of different tolerance ranges
- Manual air saver
- Compact measuring station

Bench gage table top system



Manual measuring station for cylinder heads



Valvescan air spindle for bores

Manual measuring systems range from very simple solutions, to more complex systems that integrate dozens of different measuring devices. This is the case with cylinder head inspection with hand-held air tooling for example.

Customer requirements

- Workpiece: 2 different off-road vehicle cylinder heads which are bulky, difficult to handle and have small margins of tolerance
- Ergonomic measuring station
- Reliable measuring results
- Part features:
 - I.D. of exhaust guides, intakes and bores
 - Roundness and concentricity
 - Seat angle
 - Radial run-out of the valve seats

Gageline solution with air tooling

Bench style gaging station utilizing multiple manually operated pneumatic devices that allow the operator to fully inspect a cylinder head.

- 3 pneumatic Valvescan gages mounted on balancers (2 for intake and exhaust and 1 for the exhaust)
- 3 air gages for seat angle control and seal control
- 3 air gages for valve seat control
- 2 DIN 2250 B Min/Max standards

Special features

- Dynamic measurements
- Non-contact pneumatic measurements
- Precision air to electronic converters
- Retractable overhead reels for ergonomic workstation

Semi-automatic I.D. and O.D. solutions



Compact pneumatic measuring station Gageline SG500

SG semi-automatic solutions are capable of static and dynamic measurements for inner and outer diameters on cylindrical workpieces.

These types of systems are suitable for:

- I.D. and O.D. checks on different levels
- Dynamic measurements for I.D. or O.D. workpieces (profile evaluation)
- Scan/Match between mated workpieces
- Conicity

Customer requirements

- Workpieces: valve body and valve shaft
- Measurement of valve body I.D.
- Measurement of valve shaft O.D.
- Automated measuring sequence
- Deviation check between mated workpieces

Gageline solution with air tooling

Table top style gaging station utilizing two semi-automatic pneumatic devices that both measure and „match fit“ valve bodies and valve shafts.

- Valve body I.D. inspection on multiple levels
- Valve shaft O.D. inspection on multiple levels
- Manual load, with automatic measuring runs
- Synchronous recording of measured values and position in Z (using CANopen motion controller)
- DIN 2550 B Min/Max standards

Special features

- IP65 protection for use on the shop floor
- Easy test plan control
- Automated measurement sequences
- High linearity due to precision high pressure pneumo-electronic transducer
- Fast measurement cycles



Inner diameter measurement



Outer diameter measurement

Semi-automatic measuring stations



Semi-automatic measuring station for seat rails



Part-specific tactile measurement

Semi-automatic measuring stations are capable of managing a high number of measurements thanks to cutting edge metrology software, fully automated sequencing and extremely capable hardware. Part loading and unloading can be completed manually, or automated through conveyor, robot, or other automatic part handling technologies. Customer specifications play a large part in determining the which one is utilized.

Customer requirements

- Workpieces: seat rails
- Dimensional measurement of:
 - Profiles
 - Bearing rolling zones
 - Lock interface
- Measurement conditions:
 - Cycle time <1 minute
 - Manual operator load
 - Manufacturing environment
 - Check of 40 essential dimensions, more than 120 in total
 - Different rail lengths
 - Measurement of first batch parts

Gageline solution with tactile sensors

- Semi-automatic, off-line tactile measuring solution
- ZDB inductive pencil sensors with XP206 measuring blocks
- PS100 measuring communication modules
- CANopen communication protocol
- Sirius measuring computer with Jenoptik measuring software
- Part compensation management
- Mastering standards based on part design (Min/Max)

Special features

- Robust system technology
- Industry 4.0 machine communication
- Mastering standards based on series production part
- Fast measuring times with >120 measurements per minute

Fully automated turnkey solutions



Automated in-line measuring station for gears



Robot loading

Fully automated “off-line” measuring solutions utilize tactile and pneumatic technologies, in combination with automated part handling capabilities, and are typically integrated parallel to the manufacturing line.

The pneumatic and/or tactile sensors are engineered to rigorous specifications and are placed according to customer part tolerance requirements. Jenoptik software manages the test plans, piloting of the part and/or sensors, and if required ensures part classification and sorting.

Customer requirements

- Workpieces: Hybrid powertrain gears
- 100 percent high speed production control
- Measurement of dimensional part features of the pinion and conformity of pinion teeth
- 4 different types of fixed gears
- 6 types of mobile gears
- >50 different controls
- Sorting of defective gears
- <30 s cycle time

Gageline solution with tactile sensors

- 100 percent automated production control
- Optical management of gear diversity
- Dynamic measurement of center distance and roundness
- Detection of shocks on the teeth
- Sorting and storage of defective gears
- Automatic calibration of control stations
- Loading, unloading, and handling of parts by 6-axis robot
- Automatic measurement program selection
- Gear heights tolerance 100 μm , R&R <10
- Diameter tolerance <10 μm

Special features

- Fully automatic
- Detection of defective gears
- Automated part sorting and classification
- Identification and sorting of defective parts
- Integration of optical sensors

Fully automatic in-line measuring machine



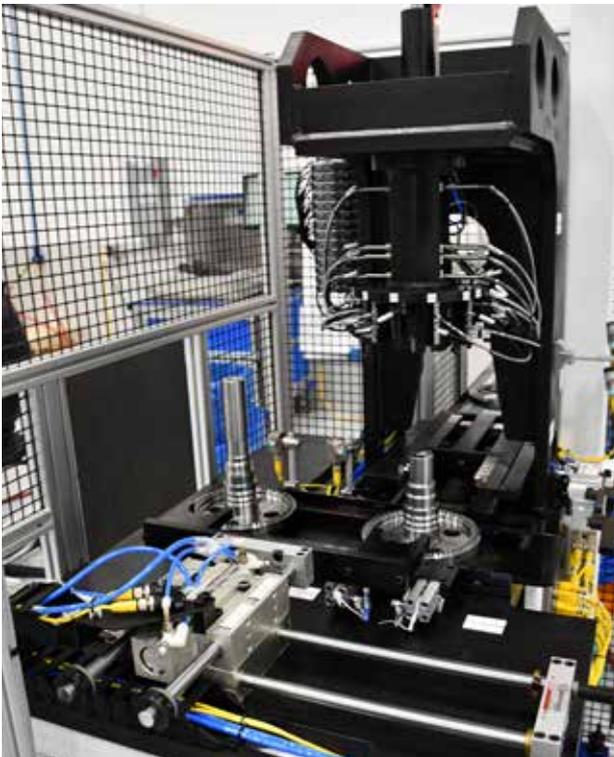
Automatic bench gage for transmission shafts

Automatic measuring stations deliver user-independent, reproducible results. Robot-loading of the workpiece guarantees fast and precise positioning. Automatic measuring runs produce results within the given cycle times and allow for fast evaluation.

These stations are conceived in a project process in order to guarantee perfect implementation into the customer's production line.

Customer requirements

- Workpiece: output transmission shaft
- 19 dimensions to control for each part
- Automatic in-line post-process measuring gage
- 2 different shaft types (short and long)
- Cycle time: 50 s per part (part load/unload included)



Diversity managed automatically

Gageline solution with tactile sensors

- Fully automatic in-line inspection station with ZDB probes
- Implementation of 2 stations: one for gaging and one for sorting
- Integrated conveyor linking the 2 stations
- Sorting station
- Measuring computer with full SPC capability and qS-STAT® certified interface
- HMI integrated into measuring computer
- Certified mean standard for short part, with adaptor for long part, and protective storage box
- Manual calibration mode
- Built-in changeover between long and short part type

Special features

- Sorting function of defect parts
- Unique measuring station managing diversity
- Plug & Work station

A wide range of components to create customized measuring solutions

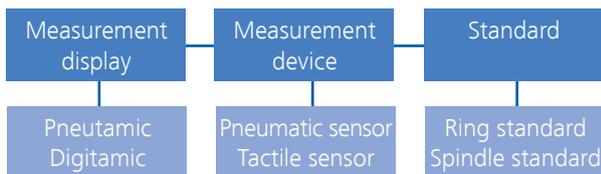
Jenoptik dimensional metrology checks diameters, lengths, distances, shape, and position of your workpieces either with tactile or pneumatic sensors depending on measuring task and process-integration. The robustness and precision of our measuring solutions are the result of the know-how we have acquired over several decades. This experience can be found in our standard modules developed in-house and which equip our customers' simplest „at-line“ manual measurement gages as well as their complex measuring machines, integrated into the most efficient production lines.

Pneumatic measurement convinces with a very high resolution. It is extremely robust and insensitive to dirt, making it perfect for use under tough manufacturing conditions. Our pneumatic process meets the high standards of DIN 2271.

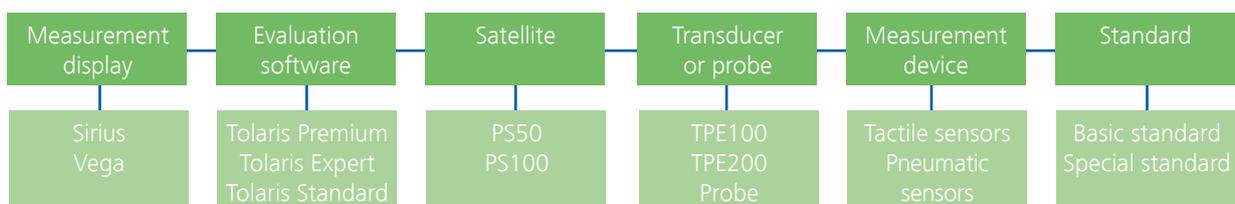
Tactile measurement uses contacting probes that record the measured values extremely quickly. Typically, tactile probes are used in multi-point measurement technology where the individual measured values must be recorded quickly in order to maintain a short cycle time.



Simple measuring chains for manual gages



Advanced measuring chains for more complex measuring stations and machines



The following pages provide an overview of the individual measuring components used for simple and complex measuring solutions.

Pneumatic measuring components

A pioneer in pneumatic, non-contact measurement technology, Jenoptik is world-renowned specialist with more than 70 years of experience. Pneumatic metrology uses air jets in combination with air to electronic converters to create a high pressure air circuit that allows sub-micron measurement of precision parts.

Our pneumatic technology is capable of measuring a variety of part features, including I.D., O.D., roundness, cylindricity, parallelism, conicity and even distances between axes.

Our high pressure technology delivers absolute precision even in extremely dirty manufacturing environments.

Advantages of Jenoptik pneumatic metrology

- Extremely high precision (<0.1 μm)
- Unparalleled repeatability (<0.05 μm)
- Robust and resistant to wear
- Non-contact
- High pressure (self-cleans parts)

Standard air tooling

Standardized air tooling uses precision pneumatic air jets for I.D. and O.D. measurements. These can be used in a variety of applications, including manual hand gages, table top bench systems, and semi-automatic off-line gages.



Air spindles AG100¹⁾



Air rings AG200

Functional diameter	3 < ØN < 150 mm
Measuring range	Maxi = 0.160 mm*
Precision	0.00025 to 0.004**
GR&R type 2	< 10 %
Capabilities (CMC)	2 to 4*

Functional diameter	3 < ØN < 150 mm
Measuring range	Maxi = 0.120 mm*
Precision	0.00025 to 0.002**
GR&R type 2	< 10 %
Capabilities (CMC)	2 to 4*

¹⁾In special supply for air spindles, the dimensions of the parts to be measured can range from 1 mm up to 600 mm.



Air snap gages AG300



Flexible air snap gages AG380

Functional diameter	9 < ØN < 105 mm
Measuring range	Maxi = 0.040 mm*
Precision	0.0005 to 0.0015**
GR&R type 2	< 10 %
Capabilities (CMC)	4

Functional diameter	14 < ØN < 150 mm
Measuring range	Maxi = 0.160 mm*
Precision	0.00025 to 0.002**
GR&R type 2	< 10 %
Capabilities (CMC)	on demand

*Max = 0.060 mm for 3<ØN<6 mm
**depending on measuring range

Pneumatic measuring components

Customer engineered air tooling

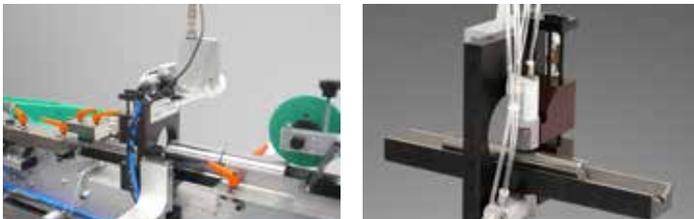
Custom manufactured air tooling uses part specific engineered pneumatic circuits for inspecting a full range of dimensional and geometric part features, as well as form and positional measurements. Custom solutions can be used in a variety of applications and can utilize a variety of additional features such as part level adjusts, part vees, annular air jets, multiple measurement circuits, and much more.

AG250 air ring with annular jet



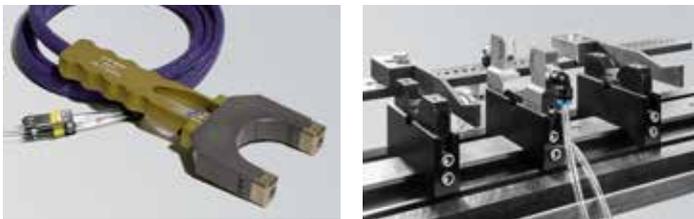
O.D. air ring with annular air jet for 360° continuous part measurement and high resolution.

AG280 air ring with standard jets for centerless grinding machines



Dynamic centerless measurements with high-speed data acquisition and high sampling frequency. Optional configurations include multi-jet air circuits, annular air circuits, and fully adjustable tooling for measuring different part sizes.

Air snap gage with three measuring planes



Snap gages can be designed with multiple air jets. In this example, 6 air jets form 3 individual diameter measurement circuits used to calculate a variety of part features like diameter, taper, etc.

Multi-jet air spindles



Small and large diameter multi-jet air spindles used for measuring a variety of applications. Left is a large diameter air spindle for crankshaft bearings, as-well-as the world's smallest air spindle (1 mm) for measuring small injector bore components.

Pneumatic measuring components

Pneumo-electronic transducers

Pneumo-electronic transducers convert air pressure from the pneumatic measurement circuit into an analog or digital CANopen signal. This signal is then processed by our metrology software for data acquisition, visual display and even machine compensation.



TPE200



TPE100



TPE99

Conversion	pneumatic-digital	pneumatic-digital or analog	pneumatic-analog
Operating temperature	0 °C to +60 °C	0 °C to +60 °C	+5 °C to 50 °C
Power supply	12–24 VDC	12–24 VDC	15–24 VAC
Pressure of air supply	3 ±0.5 bar	3 ±0.5 bar	3 ±0.5 bar
Pressure in front of air gauge	1.5 to 2.3 bar	1.5 to 2.3 bar	1.5 to 2.3 bar
Protection grade	IP67	IP67	IP65
Connector	CAN bus M8 (4 pins)	M12 CANopen or 4–20 mA (8 pins)	4–20 mA
Measuring noise*	≤0.1 µm	≤0.1 µm	≤0.1 µm
Response time*	15 ms	NA	50 ms
Linearity*	0.4 % full scale	up to 0.4 % full scale	0.5 % full scale

*Characteristics determined according to standard DIN 2271

Large choice of standards



Pneumatic measurement operates off a comparison based concept. The system is engineered to measure a specific range, part sized standards are used to calibrate the system and then actual parts are measured and “compared” to the calibrated standard.

We maintain a large range of standards in stock, which allows us to conceptualize, engineer, build and test pneumatic systems quickly and efficiently.

Standards for air tooling

Tactile measurement components

Tactile measurement technologies offer excellent quality, reliability, and robustness. Tactile sensors are particularly suited for large tolerance ranges of >120 µm and for workpieces with distinctive roughness characteristics.

Inductive sensors ZDB (LVDT*)

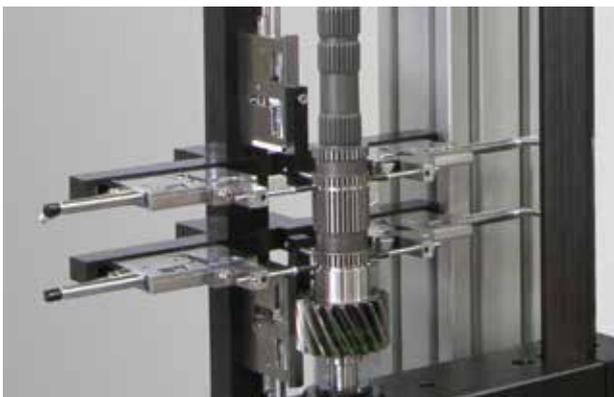


	Straight LVDT sensor	Straight LVDT sensor with pneumatic lifting	Straight LVDT sensor with pneumatic push
Measuring range	±0.3 mm to ±10 mm	±1 mm to ±5 mm	±1 mm to ±5 mm
Measuring force	0.7 N	0.6 N	0.35–0.85 N at 0.4 bar 1.9–2.5 N at 1 bar
Non-repeatability (precision)	<15 or <30 µm (depending on type)	<15 µm	<15 µm
Operating temperature	-10 °C to +80 °C	+5 °C to +80 °C	+5 °C to +80 °C
Protection grade	IP65	IP65	IP65

	Mini LVDT sensor	Straight LVDT sensor with floating core
Measuring range	±0.25 mm to ±1 mm	±1 mm to ±2.5 mm
Measuring force	0.7 N	NA
Non-repeatability (precision)	<15 µm	<15 µm
Operating temperature	+5 °C to +80 °C	-10 °C to +80 °C
Protection grade	IP65	IP65

* LVDT = Linear Variable Differential Transformer: inductive sensors with electrical transducer for measuring linear positions

Measuring blocks



Measuring system with several measuring blocks

XP style measuring blocks enable precise sensor positioning and allow for an extended stroke range.



- Fully stainless steel and Viton valve
- Stroke from 1 to 11 mm depending on type
- Clamping for all types of sensors
- Interchangeable thrust spring and low measuring force
- Lifetime up to 20 million cycles
- Constant measuring pressure
- Mechanical protection of the sensor

Data processing of dimensional measurements

Digital comparators

The Pneutamic and Digitamic are electronic comparators used to visually display information from a pneumatic or tactile measurement circuit. Easy to use, they do not require any adjustment and can be used by operators without any particular expertise in metrology.

- Up to 5 measurement programs
- Wide range of available sensors
- Reliable and durable
- Shop floor hardened
- Static or dynamic measurements available
- Easy to install/use
- Up to 8 linkable in a series



Pneutamic



Digitamic

Probe satellites

Probe satellites function as a receiver for pneumo-electronic transducers, or LVDT tactile sensors. Each measurement circuit is attached to one channel on the probe satellite, which corresponds to an assigned I.D. in the evaluation software.

The PS50/100 probe satellites can perform dynamic or static dimensional measurements, with the option of connecting to a large variety of either Jenoptik, or other commercially available sensors.



PS100



PS50

Ethernet	Switch 100 Mbps	Switch 100 Mbps
Power supply	24 VDC \pm 20%	24 VDC \pm 20 %
Protection grade	IP54	IP54
Operating temperature	0 °C to +45 °C, relative humidity max. 80 %	0 °C to +45 °C, relative humidity max. 80 %
Dimensions	295 x 150 x 65 mm [W x D x H]	195 x 150 x 65 mm [W x D x H]
Weight	2.2 to 2.7 kg (depending on type)	0.8 to 1.0 kg (depending on type)
Number of types	10	8
Number of entries	16	4
Types of entries	LVDT, HBT, 4–20 mA, \pm 10 V, opto, incremental, relay	LVDT, HBT, 4–20 mA, \pm 10 V, opto, incremental, relay

Measuring computers for control and evaluation of dimensional measurements

Sirius and Vega industrial computers can be combined with Tolaris Premium and Tolaris Expert evaluation software, to offer flexible solutions that help control your production processes.

Advantages

- Suitable for harsh production environments
- Ultra-simple user interface with touchscreens
- Flexible USB and Ethernet interfaces
- Profibus / Profinet or CANbus / CANopen
- Compatible with both Jenoptik and other commercially available probe satellites



Sirius

Touchscreen	18.5" TFT LCD, 1920x1080 pixel, Full HD touch
Processor	Intel Atom QuadCore E3845 1.9 GHz
DRAM	8 GB DDR3
Memory	128 GB SSD SATA
Operating system	Windows 10 IoT
Interfaces	2 x COM (RS232), 2 USB 2.0, 1 USB 3.0, 1 DP
Power supply	115/230 VAC
Options	Profibus, Profinet, CAN bus/CANopen, Ethernet
Dimensions	533.5 x 354.5 x 81.55 mm [L x H x D]
Protection grade	IP69 on the front panel, IP66 on other faces
Weight	15 kg
Certifications	CE, CCC compatible

Sirius shown with Tolaris Premium main screen



Vega

Touchscreen	10.4" TFT, GA 1024x768 pixel, resistive touch
Processor	Intel Atom x7-E3950 Quad Core 2.0 GHz
DRAM	8 GB DDR3
Memory	120 GB SSD
Operating system	Windows 10 IoT
Interfaces	1x COM 1 (RS232), 4x USB
Power supply	12-24 VDC
Options	Profibus, Profinet, CAN bus/CANopen
Dimensions	270 x 217 x 64 mm [L x H x D]
Protection grade	IP65 on the front panel
Weight	2 kg
Certifications	CE

Vega shown with Tolaris Expert main screen



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.

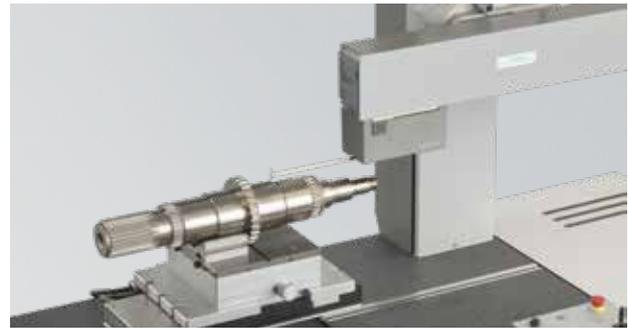
Our many years of experience and know-how in the field of industrial measurement technology and optical inspection, modern laser-based material processing and highly flexible robot-based automation enable us to develop tailor-made manufacturing solutions for our customers in automotive, aerospace, healthcare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

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 Jenoptik	Werkstück W32-AC33	
Auftrag A-42BE	Zeichnungsnummer Z-12344	
Prüfer Schmidt	Seriennummer S122	
Bemerkung		

Rauheit 1 [Profilsatz 1]				
Parameter	Einheit	Wert	Status	
Ra	µm	0,00	11,50	1,01
Rz	µm	0,00	15,80	5,95
Rmax	µm	0,00	14,00	7,50



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

Rauheit 1 [Profilsatz 2]				
Parameter	Einheit	Wert	Status	
Ra	µm	0,00	11,50	1,01
Rz	µm	0,00	15,80	5,95
Rmax	µm	0,00	14,00	7,50



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

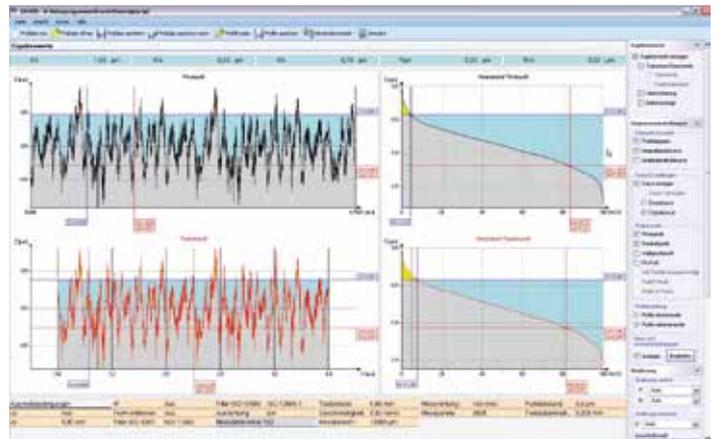
Rauheit 1 [Profilsatz 3]				
Parameter	Einheit	Wert	Status	
Ra	µm	0,00	11,50	1,01
Rz	µm	0,00	15,80	5,95
Rmax	µm	0,00	14,00	7,50



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.

modular

Exact fitting measuring systems to solve your measuring task

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

simple

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

Flexible for roughness, contour, topography and twist

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

precise

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



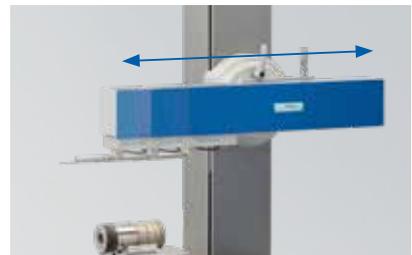
Waveline W812C Digiscan with 500 mm measuring column and 120 mm traverse unit



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				
Measuring column [mm]	500 or 800				
Granite plate [mm]	700x520 or 1000x520				

Waveline W900. Fast measuring axes for high-end performance



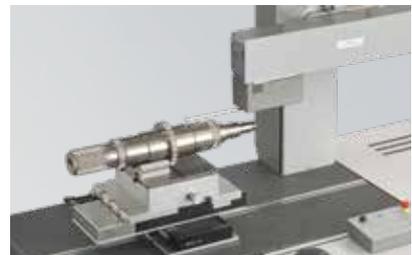
Waveline W920RC with 500 mm measuring column and 200 mm traverse unit



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 μm 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				
Measuring column [mm]	500 or 800				
Granite plate [mm]	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

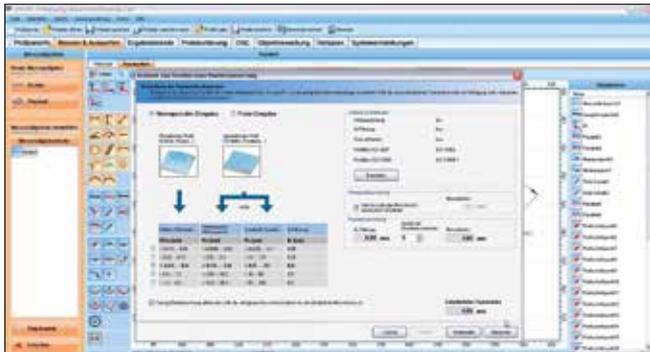


Measuring station control

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



Intuitive operation with numerous wizards

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



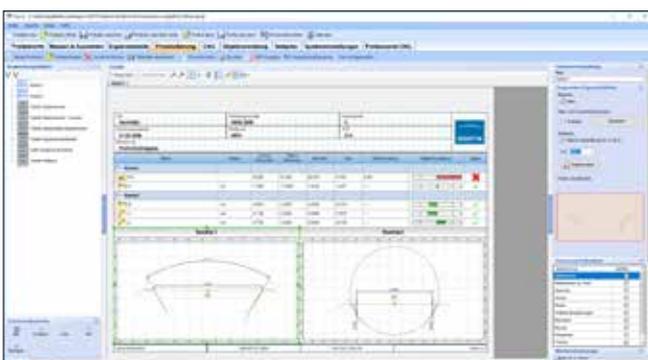
CNC editor for automated measuring runs

Option CNC Professional

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

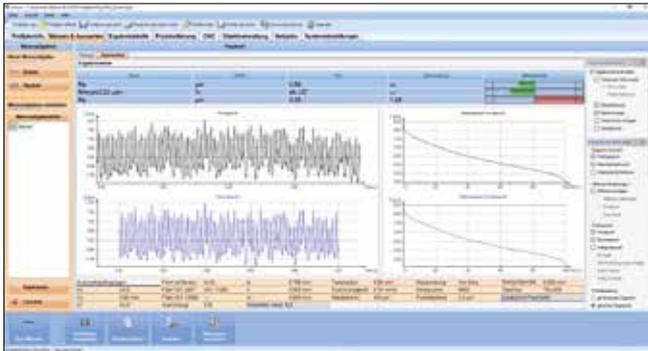
Documented quality

- 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



Report and template editor

Evovis. Software functions and options for specific measurement tasks



Roughness measurement with interactive profile evaluation

Roughness measurement and evaluation

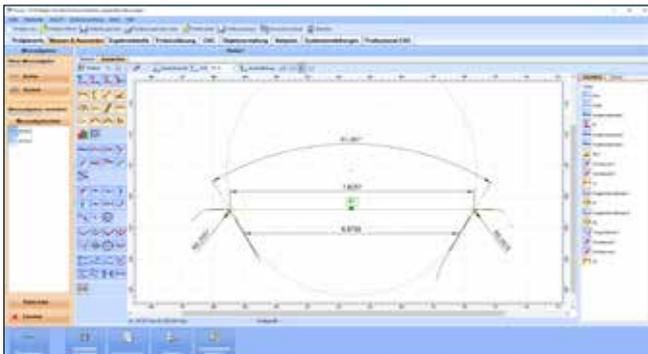
- Assistant for quick selection of roughness parameters and definition of the measurement conditions for safe processes and simple implementation of complex measurement tasks
- Interactive profile analysis functions for the evaluation of surface parameters
- Evaluation of the measurement results according 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

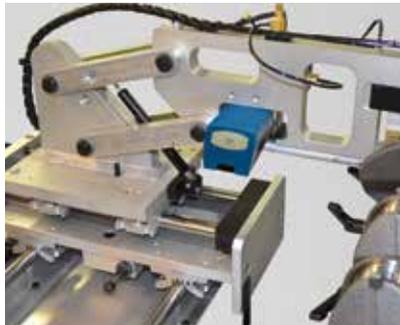
Options

- 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

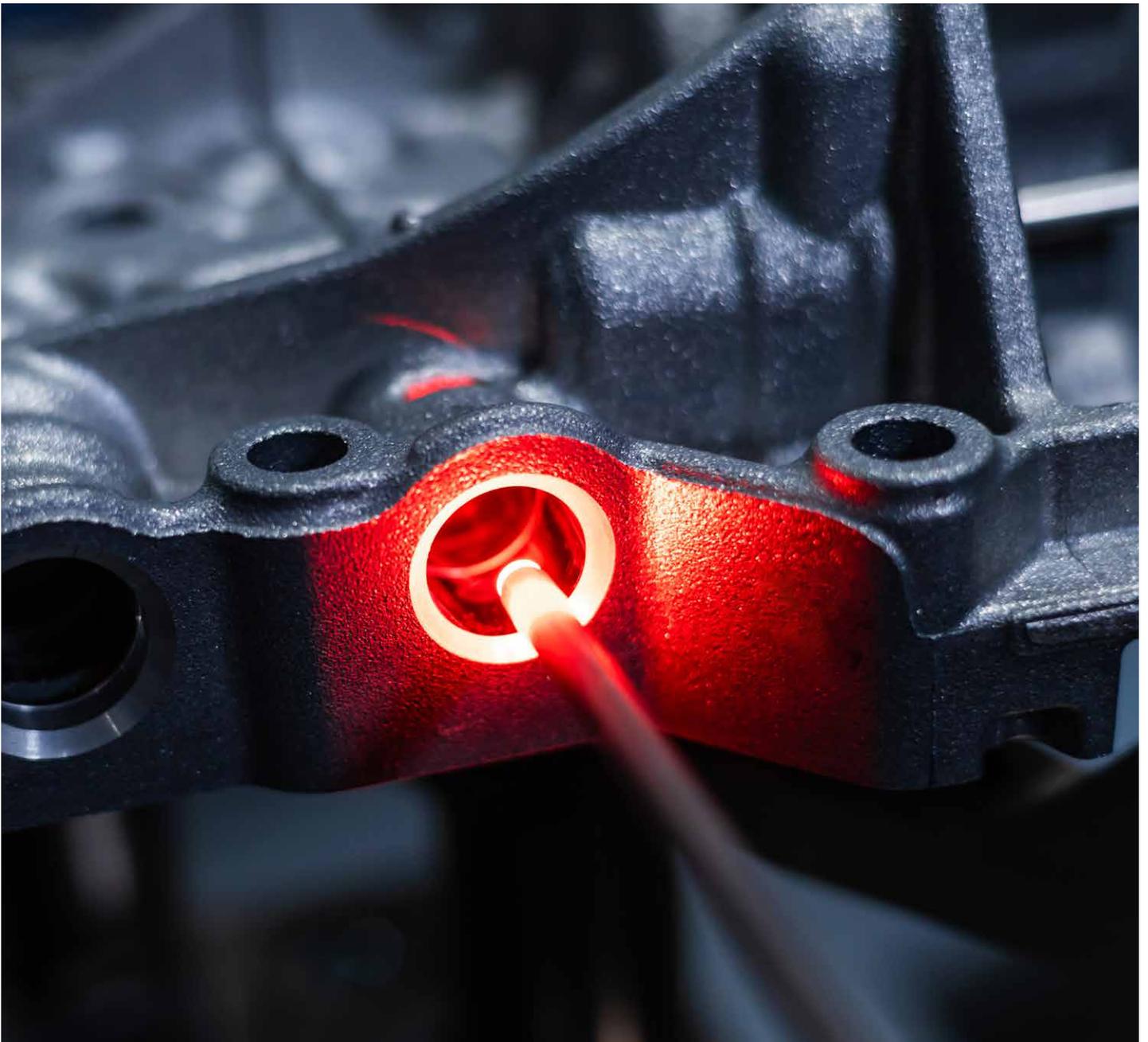
Compliant with VDI/VDE Directive 2629. Characteristics measured: radii, angles, horizontal and vertical distances.

Twist standards

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

Visionline – Optical surface inspection & profile measurement

Reliable and automated testing of technical surfaces



HOMMEL  **ETAMIC**

A member of the JENOPTIK Group

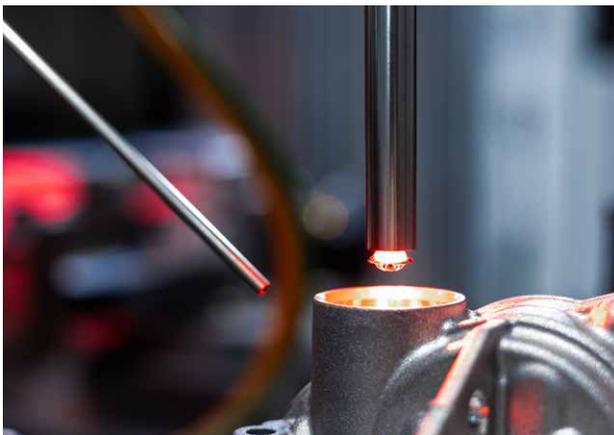
Precise metrology for efficient quality control

As a leading manufacturer of metrology systems, HOMMEL ETAMIC offers a broad portfolio of measurement solutions for industrial manufacturing processes. Our technologies include pneumatic measurement, tactile or optical measurement of roughness, contour, form and dimensional features, as well as optical inspection of machined surfaces.

Comprehensive services such as consulting, training, DAkkS-DKD calibration and service, including long-term maintenance contracts, round off our worldwide range of metrology services for quality assurance in industrial manufacturing.

Our measuring systems ensure the quality of the workpiece throughout the entire production process and provide precise measurement data in the shortest possible time.

Automatic measuring technologies enhance overall productivity during production through efficiently designed inspection solutions – whether inline or offline, or using spot checks through 100 % inspection of all manufactured workpieces.



Inspecting inside bores



Inspecting plane surfaces

Our Visionline solutions provide you with a wide range of application options for reliable optical surface inspection in bores and on plane surfaces. The systems can be integrated into automated production processes, and deliver reproducible, robust results.

Surface inspection

- Cavities
- Pores
- Scratches
- Recesses
- Spalling
- Burrs

Innovative, optical inspection of various surfaces

Reliable test results

With Visionline solutions, the inspection process is automated and delivers operator-independent and reproducible results. This avoids the errors of a visual inspection and ensures that only really high-quality products are processed and delivered.

High quality products

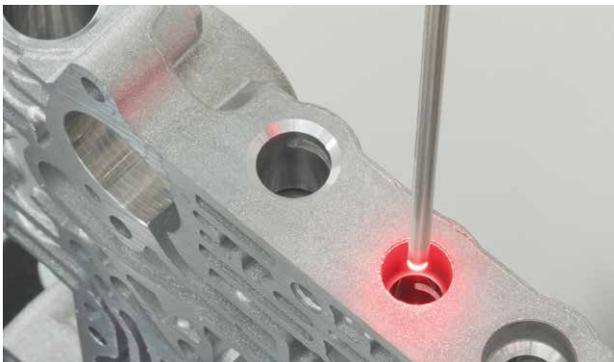
For an optimized quality assurance process, the test results are clearly documented and made available to the production line for further processing. Detailed displays make any defects visible and allow for immediate rectification. This increases the product quality and thus the satisfaction of your customers.

Optimized processes

The immediate inspection of all workpieces directly after the processing step allows statements about the manufacturing quality. The feedback of the test results into the production process helps to identify and remedy problems at an early stage.

Reduced inspection costs

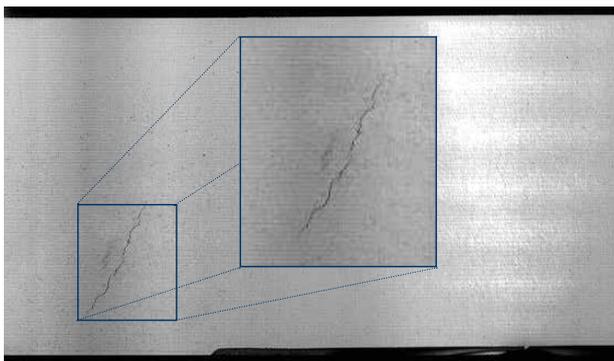
Automated 100 % inspection of technical surfaces saves you time and money. To speed up your inspection process, Visionline systems inspect surfaces in the shortest possible time and deliver objective results without operator influence.



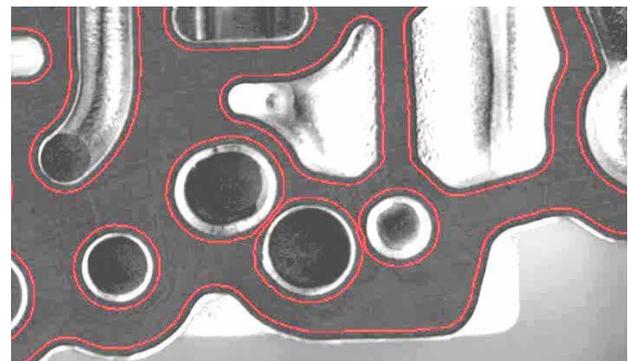
Optical surface inspection in bores (here: valve control plate)

Advantages of optical inspection

- Wear-free and reliable thanks to optical testing technology
- Fast inspection with short measuring cycles
- No retooling of the systems when changing workpieces
- Safety in case of misalignment of the workpiece thanks to collision protection
- 100 % control
- No operator influence
- Reduction of pseudo-errors and unrecognized defects (slippage)



Crack on a cylinder bore surface



Edge-accurate inspection thanks to adaptive dynamic masking

Visionline B5, B20 & B100. Optical inspection systems for reliable defects detection in bores



Inspection of small bore surfaces of a valve housing



Bore inspection of a truck motor block



Station with manual loading for small series or prototype production



Above-conveyor system for inline engines in large-scale production

The optical sensors enable precise inspection of bore surfaces and deliver high-resolution and distortion-free images of the surface in order to reliably detect defects within the required cycle time.

System features

- Latest CMOS image sensor technology and a 360° lens for reliable and automated inspection
- Objective test results without influence of the operator
- Detection of common surface defects such as cavities, pores, scratches, etc.
- Process-reliable differentiation of defects and residual dirt from drying
- Image pickup whilst in motion and within the required cycle time
- Large diameter ranges, therefore no conversion necessary when changing workpieces
- Head-on collision protection to avoid damage in case of workpiece misalignment

Modular system concept

- Offline with manual loading
- Inline with automated workpiece handling
- Flexible robot system
- Multiple sensors as well as combination with other sensors (e. g. F200S) in one system possible

Application examples

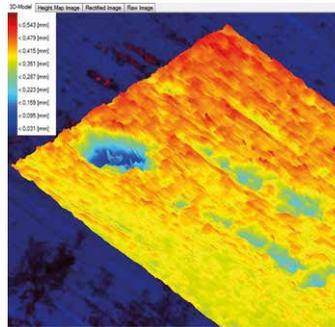
- Valve control plate
- Brake master cylinder
- Pump housing
- Con rod
- Cylinder liner, and many more

Model	B5	B20	B100
Test diameter	from 5 mm	from 14 mm	from 68 mm
Inspection depth	195 mm	240 mm	400 mm

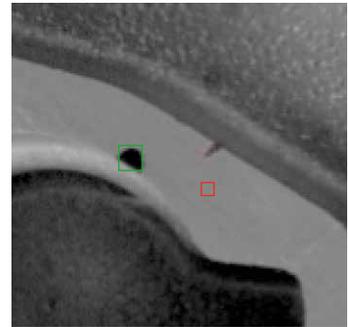
Visionline F100S, F200S & F400S. Optical systems for automatic inspection of plane surfaces



Plane surface inspection using an F sensor



Evaluation of surface defects



Red: edge flaw, green: contamination



Offline inspection station



Full inspection of cylinder bore and plane surface on the engine block

As a result of their fast speed, the F100S, F200S & F400S systems are used for full inspections of plane surfaces. Innovative camera and lighting technology and adaptive, dynamic masking are used to distinguish between genuine surface defects and contamination with a high level of process reliability.

System features

- Automatic inspection of plane faces
- Detect common surface defects such as cavities, pores, scratches, casting defects, etc.
- Image pickup whilst in motion and within the required cycle time (fly-over technology)
- Short inspection times thanks to a fast scan rate
- Adaptive, dynamic masking for reliable edge inspection
- Powerful 3D technology
- Offers a complete solution in conjunction with bore inspection sensors for full inspection of e.g. cubic parts
- Custom configurations for 2D inspection possible

Modular system concept

- Offline with manual loading
- Inline with automated workpiece handling
- Multiple sensors as well as combination with other sensors (e. g. B100) in one system possible

Application examples

- Crank case
- Cylinder head
- Gear housing
- Hydraulic block
- Motor housing
- Labyrinth plate
- Bipolar plate
- Valve control plate
- Shafts
- And many more

Model	F100S	F200S	F400S
Scan width	100 mm	200 mm	400 mm
Working distance	60 mm	60 mm	60 mm

Visionline V200. Optical bore inspection systems for automated detection of surface defects



Configuration example optical inspection system Visionline V205

Your advantages

- Reliable, reproducible and documented test results
- Wear-free and dependable thanks to optical testing technology
- Fast inspection with short cycles
- Easy retooling of the system when changing workpieces
- Safety in case of misalignment of the workpiece thanks to collision protection
- No operator influence
- Reduction of pseudo errors and unrecognized defects (slippage)

System features

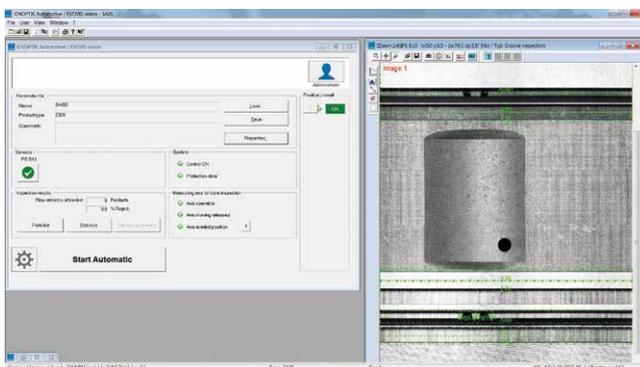
- Compact system with minimum space requirement
- Robust design for use in production environments
- Light barrier for safe operation
- Testing of bore diameters of different sizes
- Optional X and Y axes for precise workpiece positioning and automated inspection runs
- Proven technology with 360° optics
- Image pickup whilst in motion for fast results
- Head-on collision protection
- Connection to QDA systems possible

Robust detection of defects in bores

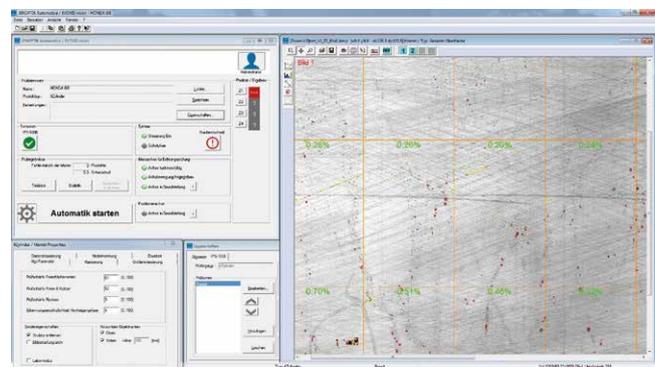
- Software Evovis Vision with live mode and numerous evaluation and analysis functions
- Precise inspection of bore surfaces
- High-resolution and distortion-free images of the surface
- Detection of common surface defects such as cavities, pores, scratches, etc.
- Process-reliable differentiation of defects and residual dirt from drying
- Adaptive, dynamic masking for reliable edge inspection

Evovis Vision. Software with clear user guidance for reliable inspection results

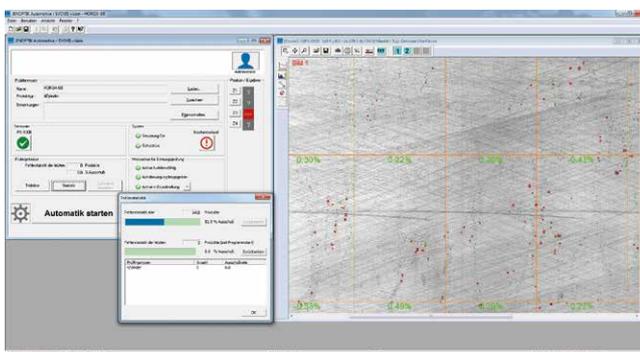
The graphical, function-oriented user interface of the Evovis Vision inspection and analysis software guarantees that you can operate the systems for bores or plane surfaces simply and accurately. Numerous functions and wizards simplify the use of the software. It takes just a few simple steps to tailor the inspection system to a specific workpiece. This means that Evovis Vision ensures full quality control of each workpiece in accordance with the specified cycle time of the production line.



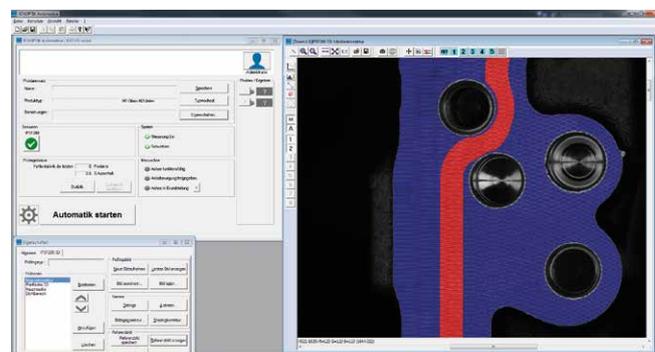
Defining inspection criteria and inspection zones



Automatic surface analysis



Statistical analysis using qs-STAT®



Adaptive, dynamic masking

System features

- Clear user interface and easy-to-understand icons
- Numerous wizards make it easy to create inspection plans
- Full evaluation and analysis functions for full quality control of manufactured parts
- Can be used for semi-automatic or fully automatic systems
- Interface to the line control system for integration in the production process control system
- Records and evaluates surface defects such as pores, scratches, cavities, etc.
- Evaluates regular and irregular structures
- Dimensions of cross bores, and chamfers
- Determines relevant inspection zones with individual classification
- Measures surfaces in the image plane, e.g. edges or bore diameters
- Clearly documented results and detailed representations
- Robust detection of defects through adaptive, dynamic masking