

MORE LIGHT

Formline – Form Metrology

Innovative measuring systems
for unequivocal measurement of
form and positional tolerances.

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.



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 position tolerances to combined form and roughness measuring systems to solutions for special crankshaft and camshaft measurements or form measurements in cylinder bores.

Typical applications

- Bearing rings
- Gear shafts
- Electro shafts
- Brake disks
- Hydraulic and pneumatic components
- Pistons
- Cylinder blocks
- 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



Please scan for detailed Formline information

Specific parameter

- Conicity
- Position deviation
- Length
- Thickness and thickness deviation
- Stroke radius
- Crowning
- Angle deviation
- Waviness analysis
- Twist
- Roughness
- Dominant roundness waviness
- Polar and line form
- Cam form

Formline F435/F455. Fully automatic measuring of all form and positional tolerances



Formline F435, ergonomic measuring station



Formline F435, desktop device



Measurement of roughness and form with double-tipped probing system



Special measuring station for specific tasks in brake disk measurement



Motorized tilt and rotation module MDS for fully automatic measurement runs (option)

Highlights

- Automatic centering and leveling of the workpiece and CNC controlled measuring axes for high degree of automation
- Easy CNC programming and workpiece-specific measurement documentation
- Capable evaluation software for determination of all form and positional tolerances
- For demanding measuring tasks in series production or for frequently changing tasks in the metrology lab
- Optional roughness, waviness and twist measurement with free probing system in Z-direction
- Optional evaluation of dominant roundness waviness

System features

- Highly accurate air bearing rotary table (Ø 250 mm) with automatic centering and leveling of the workpiece
- Three motorized measuring axes
- Vertical measuring axis with a measurement range of either 350 mm or 550 mm
- Motorized tilt and rotation module MDS or tilt arm FS1 for perfect probe positioning, even on complex workpieces
- Magnetic coupling for fast probe arm changes and collision protection
- Available as compact desktop device or integrated into an ergonomic measuring station with damping

Model	Workpiece weight	Distance C/Z axis	ø measurable	Measuring height	Centering/leveling	Measuring axes	Option Roughness
F435/F455 Form	40 kg	325 mm	430 mm	350/550 mm	automatic	C, Z, R	no
F435/F455 Roughness	40 kg	325 mm	430 mm	350/550 mm	automatic	C, Z, R	yes, Z axis



Formline Roundscan. Highly efficient solution for combined form and roughness measurements



Formline Roundscan 555 with optional printer container



Height-adjustable evaluation unit



MDS4 with double-tipped probing system



Form measurement in deep, narrow bores



Integrated probe arm rest

Highlights

- Time saving thanks to very fast, fully automatic centering and leveling and CNC controlled measuring axes
- Flexible use with free probing system in C, Z and R direction for form, roughness, waviness and twist measurement in a single clamping operation
- Ergonomically optimized design for convenient standing or sitting operation with height-adjustable, tiltable evaluation unit, lockable cabinets, integrated probe arm rest and control panel for key operations
- 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

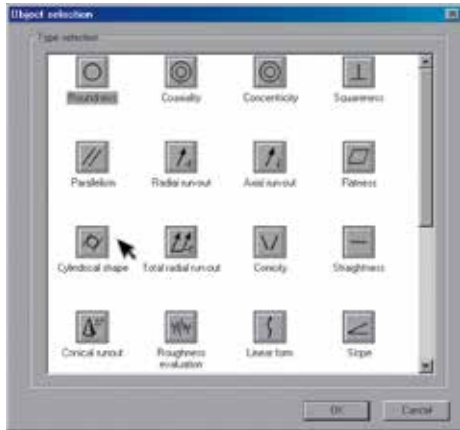
- Highly accurate air bearing rotary table with impressive rigidity for consistently high precision
- High resolution with 0.1 μm in the R/Z axis and 720,000 points in the C axis
- Integrated linear scale and active level control
- Heights of vertical measuring axis: 350, 550 or 900 mm
- CNC controlled motorized tilt and rotation module MDS4 for fully automatic measurements
- Double-tipped probing system can be switched from form to roughness during the CNC run
- Magnetic probe arm coupling for fast changing of the probe arm and protection in case of collisions
- Only very low basic interference of the measuring axes, even at maximum resolution

Model	Workpiece weight	Distance C/Z axis	\varnothing measurable	Measuring height	Centering/leveling	Measuring axes	Option roughness
Roundscan 535/555/590	60 100 ¹⁾ kg	370 420 ¹⁾ mm	430 530 ¹⁾ mm	350/550/900 mm	automatic	C, Z, R, X, Y	yes, C, Z, R axes

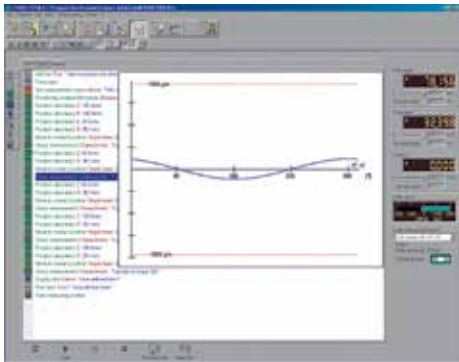


¹⁾ on request

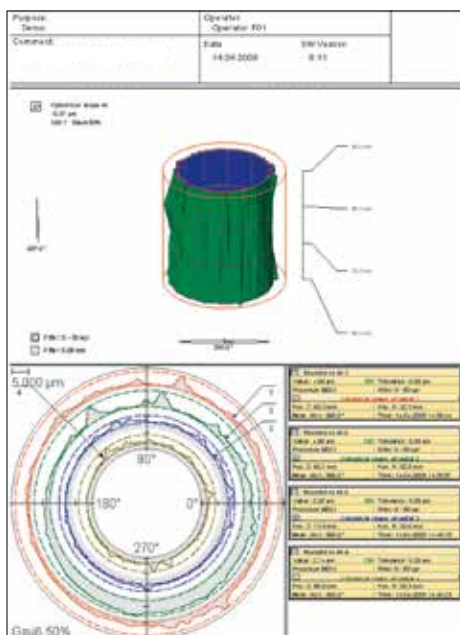
Turbo Form. Software with clear user guidance for reliable measurement evaluation



Test plan creation



Automated alignment and measuring run



Individual design of print forms

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

System features

- User-friendly interface with clear icons
- Simple definition of measurement positions and axis references
- Direct transfer of positions via teach-in
- Simple CNC programming using pictograms
- Fully automatic alignment and measurement of workpieces
- Comprehensive profile analysis and complete documentation of the measurement results
- Clear program flow
- Evaluation in accordance with standards
- Convenient test plan management
- User-defined presentation of measuring reports
- Numerous options for special applications
- Fast evaluation algorithms for prompt results
- CNC modules, Fourier analysis and 3D analyses included in the standard scope of delivery
- 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

Options for specific measuring tasks

- Line form
- Angular sector
- Fourier synthesis
- Cone
- qs-STAT® interface
- ASCII export interface
- Piston measurement
- Brake disk measurements
- Dominant roundness waviness

Turbo Form. Options for roughness, waviness, profile and twist measurement



Measurement report

Evaluation of roughness, waviness and profile

This optional module enables fast, simple calculation, evaluation and graphical representation of all standard roughness, profile and waviness parameters in accordance with DIN/EN/ISO/JIS standards.

- Simple, clear configuration of measurement conditions
- Individual combination of parameters
- A wide range of display options simplifies profile analysis
- Free and individual design of screen and print forms
- Clear display of all form, roughness or twist parameters in a characteristics table
- Key information visible at a glance via the tolerance output and the status display

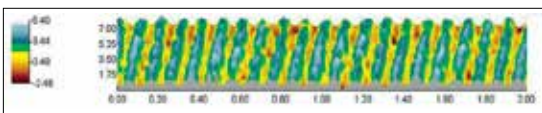


Twist measurement with a roughness stylus tip

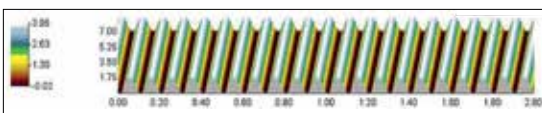
Twist measurement MBN 31007-07

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.



Display of unfiltered primary surface structure



Display of twist structure in detailed scaling



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

This allows a graphic representation of the twist structure as well as calculation of the twist parameters:

Number of threads DG, Twist depth Dt [µm], Period length DP [mm], Feed cross section DF [µm²], Feed cross section per revolution DFu [µm²/U], Contact length in percent DLU [%] and Twist angle Dy [°].

TwistLive® analysis method

With this modern analysis method for all Roundscan 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!

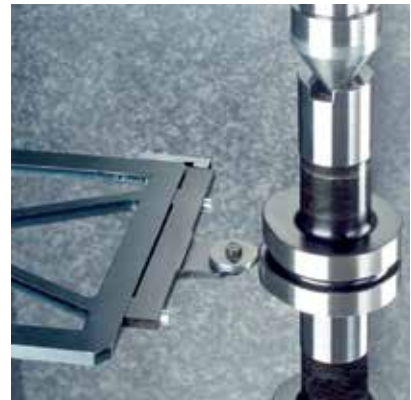
Formline CFM3010. Comprehensive competence for crankshafts, gear shafts and camshafts



Formline CFM3010



Flat measuring follower for crankshafts



Round measuring follower for camshafts

Highlights

- Secure measurement results, as there are no mechanical transverse forces
- Excellent basic accuracy thanks to high-resolution measurement systems
- Robust construction with vibration decoupling for use in the measuring room or in the laboratory
- Optimized CNC runs in conjunction with high measurement and travel speeds
- Can be used flexibly for a variety of workpieces

System features

- Gauging component capability: measuring accuracy with repeatability of up to 0.3 μm
- Distance between tips: 1250 or 1500 mm
- Fast measurement value recording
- Wear-free air bearing measuring slides
- Capable evaluation software Tolaris Shaft for camshafts and crankshafts
- Extensive range of accessories such as followers and drivers for different measuring tasks

Model	Workpiece weight	Test diameter	Measuring height
CFM3010	150 kg	300 mm	1250 1500 ¹⁾ mm



¹⁾ on request

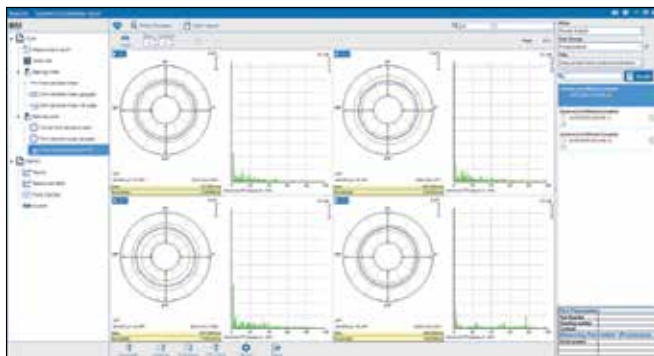
Tolaris Shaft. Modern evaluation software for reliable process control



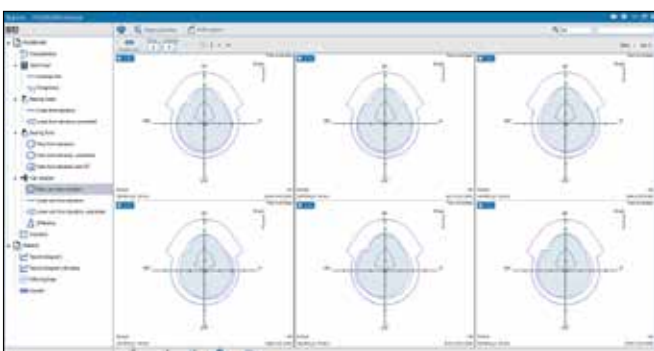
Workpiece displays together with characteristics



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 Incometer V. Flexible measuring systems for form and roundness in cylinder bores



Formline Incometer V



External plate for fixing the probe



Formline Incometer VS

The Incometer V measuring systems offer fast, reliable and highly accurate measurements for analytic examination of cylinder-piston configurations in engine block development.

System features

- Flexible and mobile use during development and testing
- Resistant to vibrations, making it ideal for measurements during production
- Easily adapted to different cylinder dimensions thanks to the clamping mechanism
- The probe's self-adjustment eliminates time-consuming alignments
- Measurement with mounted cylinder head possible
- Compact, robust measuring probe
- Automatic correction of any eccentricities or inclined positions of the cylinder axes to the measuring probe via the software
- Measurement of cylinder distortion and isometrics
- Long-term testing: wear rates and cylinder distortion
- Measurement of temperature distortion
- Assistance for the dimensioning of piston rings
- Simple operation via Windows software with pre-defined measuring routines
- By changing measuring tips and clamping jaws, the probe easily adjusts to different diameters

Model	Application	Test diameter	Axial measuring range	Radial measuring range
Incometer V	Standard	65 – 155 mm	80 – 200 mm (depending on model)	±400 µm
Incometer V110	Flat V engines	65 – 155 mm	110 mm	±400 µm
Incometer VS120	Small engines	39 – 100 mm	120 mm	±500 µm



Formline Incometer P. Measuring systems for fast form measurements in cylinder bores



Formline Incometer P



Inserting of the probe



Fixing of the probe

The Incometer P measuring system delivers fast, reliable and highly accurate quality data during engine production – in the shortest form measuring times on the market.

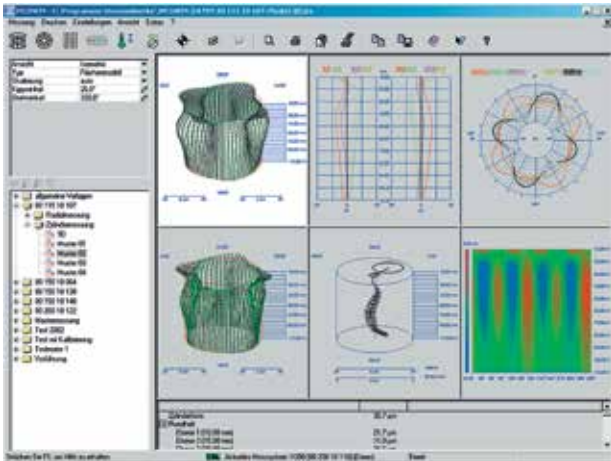
System features

- Fast measurement readiness, as no manual alignment is required
- Measurement of the cylinder bore in just a few seconds
- Fast adaptation to different bore diameters thanks to interchangeable measuring tips
- Ideally suited for flexible production lines
- Simple operation, even without previous experience
- Compact and robust design for mobile use during the production process
- Minimization of disruptive vibrations thanks to direct mechanical connection between the measuring probe and the workpiece
- Automatic correction of inclinations and eccentricities by the software
- Precision measurements of roundness and form in seconds during engine production
- Easy handling and fast measurement
- Choice of up to 7 sensors per measuring head

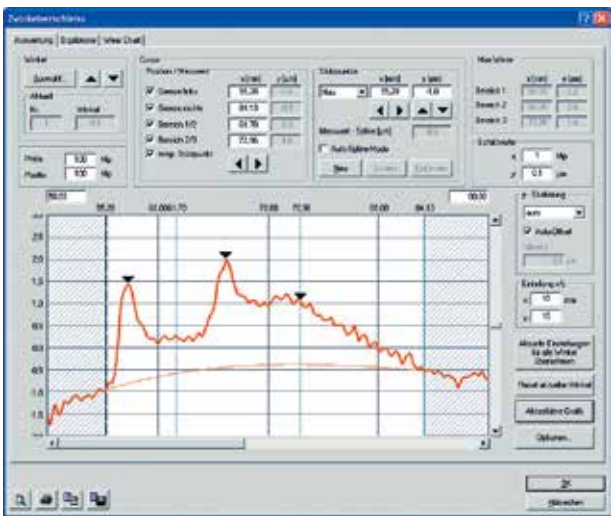
Model	Test diameter	Axial measuring range	Radial measuring range
Incometer P	60 – 110 mm	max. 300 mm	±500/1000 µm (depending on the diameter)



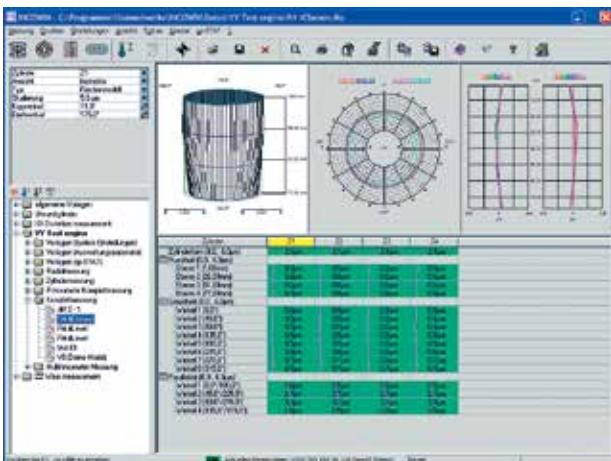
Incowin. Clearly structured evaluation and control software



Clearly arranged desktop



Option wear measurement



Option block measurement

The clearly structured Incowin software ensures that operating the measuring systems is easy, even with no previous experience. Once the measurements have been taken, all procedures, such as saving and printing the measurement results and statistically evaluating them, can be performed automatically.

System features

- Rapid set-up of all user-specific requirements
- Multiple display options for easy analysis of the measurement results
- Easy creation of new measuring programs
- Customization of screen and print forms
- Template language selectable independent from user language
- Optimal mobility with a notebook
- Clear and easy-to-understand user interface for intuitive operation
- Central data backup possible via network operation
- Extensive range of options for engine development and production
- Dynamic measurement
- Optional offline software for external evaluation and analysis of measuring data

Option for research and development

- Wear measurement in previously used cylinder bores
- Temperature distortion measurement in hot engines
- Fourier analysis for precise description of cylinder form
- Copy & Paste and data export to Windows applications
- Differentiation for analysis of distortion changes with different configurations of cylinder head, cylinder head seal and crankcase and for hot distortion evaluations
- Import of external data for analyzing and comparing

Options for production

- Block measurement and complete evaluation for measuring a complete crankcase and graphic display of the results in a single file
- Data transfer to qs-STAT® for process data analysis
- Determining the absolute diameter
- Advanced user administration with profiles
- Automatic functions for automated processes

Permanent measurement accuracy.



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.

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 certi-

ficates or test reports. We also carry out capability tests for demanding measurement tasks..

Our range of calibration services

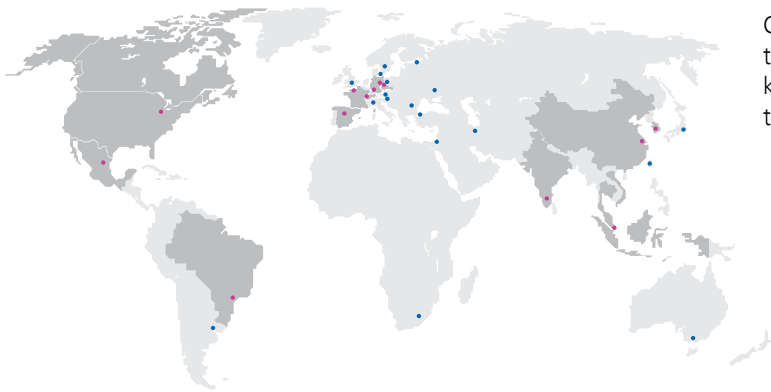
Our DAkkS accreditation includes the measurement of variables such as roughness, profile depth, roughness measurement instruments as well as roundness, straightness, parallelism and contour standards. Within this scope we offer DAkkS-DKD calibration certificates:

- for form standards
- for contour standards
- for 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. All common form characteristic values can be determined.

We support you worldwide.



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

Visit us on
YouTube.



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