

WENZEL GT SERIES

TOP CLASS GEAR METROLOGY



WENZEL – INNOVATION MEETS TRADITION



DR. HEIKE WENZEL AND PROF. DR. HEIKO WENZEL-SCHINZER

The WENZEL Group GmbH & Co. KG is a leading Manufacturer of innovative measuring technology solutions. The success of the largest family-run company in the industry is based on German quality, technology, flexibility and strong partnerships.

Founded in 1968, the name WENZEL stands today primarily for the highest precision, reliability and technological competence.

In recent years, measurement technology has changed a lot. The measuring tasks are performed in production as well as in the measuring room. In addition to high precision tactile measurement, optical sensors as well as new technologies such as computed tomography have found their place in metrology. We as WENZEL have brought numerous innovative solutions onto the market in recent years so as to offer our customers the right products. In addition to the product itself, we also supply you with turnkey solutions. This makes us flexible experts for innovative measurement solutions.

MANAGEMENT OF THE WENZEL GROUP

With our product range we are able to support all your measuring needs. As a family business, we strive to achieve long-term partnerships with our customers and for this we invest in the outstanding quality of our machines and offer you excellent service.

Our new GT series is based on our successful tradition in the development and production of specialized gear measuring machines. We have improved many, decisive details in the new development. The new GT series works with our standard controller WPC and is used with a completely new software from WENZEL. With the GT series we set standards: gear measuring technology grows together with universal measuring technology: tactile and optical!



About WENZEL

Founded in 1968, WENZEL is today the largest family-run measurement technology manufacturer.

More than 10,000 machines installed worldwide



WENZEL Worldwide

More than 600 employees worldwide

Subsidiaries & representatives in more than 50 countries



Unser Headquarters

Wiesthal, Germany

Total area: 54.000 m²
of which buildings: 15.500 m²
air-conditioned: 5.000 m²



Measurement technology has been our profession since 1968 and over the years developed WENZEL to stand for the highest quality standards and reliability - without forgetting that to continue to exist, one has to keep a clear vision of the future in one's eyes at all times.

WENZEL offers innovative solutions for the measurement of gears and rotationally symmetrical workpieces, which we present in this brochure. To meet the high accuracy requirements in gear measuring technology precisely, easily and quickly, the gear measuring devices of the new GT series from WENZEL

have been designed. The GT series is characterized by excellent working ergonomics, simple operation and extensive measuring and analysis options. Also of high importance is the sophisticated software concept. WM | Gear, together with the WM | Gear Analyzer is the innovative software package for data acquisition, measurement and analysis of involute gears with coordinate measuring machines. Users can take advantage of the extensive capabilities of the proven and powerful WM | Quartis measuring software without additional training effort.

**BUSINESS AREAS
OF OUR CUSTOMERS**

- Quality assurance**
- Manufacturing**
- Development**
- Surface testing**
- Prototyping**
- Initial sampling**
- Reverse Engineering**
- R & D**
- ... and many more**

**OUR
CORE INDUSTRIES**

- Automotive industry**
- Railroad gearboxes**
- Energy industry**
- Conveyor technology**
- Industrial gear units**
- Agriculture**
- Aerospace industry**
- Mechanical & plant engineering**
- Commercial vehicles**
- Wind power**
- ...and many more**

WENZEL GT SERIES

APPLICATIONS & INDUSTRIES

The GT series offers the right solution for your measuring task: for small gears and rotationally symmetrical components, e.g. from the automotive industry, through toothed workpieces and shafts used, for example, in commercial vehicles, railroad transmissions or construction and agricultural machinery, to the measurement of marine gears.

For easy loading of the gear measuring device, they are equipped with a counter holder. Using the counterholder, diameters of up to

1,200 mm can be measured. Flat components whose measurement does not require a counter holder can even be measured precisely up to a diameter of 1,600 mm.

Thus, WENZEL supports a wide variety of industries and provides solutions for the automotive and energy industries, materials handling, agriculture, the aerospace industry and mechanical & plant engineering.

AEROSPACE

In aerospace the technical requirements on gears concern high efficiency, low noise emission and high durability. These requirements are fundamental. The measurement of these parts needs reliable and precise gear measuring machines. Furthermore the software has to allow an easy and gapless documentation of measuring results according to certified standards. This combination of hard- and software offers the GT series.



INDUSTRIAL VEHICLES & GEAR BOXES

Gear boxes of commercial vehicles are exposed to extreme mechanic and climatic conditions. However to guarantee a high durability the complex component parts have to be measured exactly and be traceable documented. Besides the measurement of gears, the measurement of geometrical references and their evaluation concerning accuracy to size and form and position is of great importance. All these measuring tasks can be solved with a GT.



WIND ENERGY

Gearboxes of modern wind turbines are subjected to extremely high loads. In conjunction with the low speeds of a wind turbine, even microscopic breakouts on the gear flank are enough to cause expensive gear damage. Therefore, reliable and highly accurate initial sampling for gearboxes in wind turbines is essential.



AUTOMOTIVE INDUSTRY

In construction of modern gear boxes high efficiency, low noise emission and weight reduction at highest durability are at very high priority. Precise and reliable measuring systems in quality assurance are essential. Because of its ease of use a GT can easily be integrated into production for resource saving and efficient measuring procedures



MACHINE & PLANT ENGINEERING

The requirements in machine and plant engineering are as manifold as their applications. They reach from the measurement of small gears (module 0.3 mm) up to the measurement of high accuracy gears and geometrical evaluation of pump housing. But also the measurement of large bevel gears as they are used in ship propulsion is part of this spectrum. To fulfill these diverse requirements a measuring system with high accuracy and high flexibility is essential. The GT series offers exactly this precision and flexibility.



WENZEL GT SERIES

TOP CLASS GEAR METROLOGY



THE NEW WENZEL GT SERIES

TOP CLASS GEAR METROLOGY

WENZEL GT 300

The GT 300 was especially developed for the measurement and analysis of smaller gears and rotational symmetrical parts from the automotive industry. Optionally the GT 300 can be equipped with a tailstock for measurements between centers.



WENZEL GT 450

The GT 450 gear measuring machine is typically used in the aerospace, automotive and their supplier industries. It allows the precise analysis of gears and rotationally symmetrical parts up to a diameter of 450 mm. Equipped with a tailstock, shafts with a maximum length of 650, 900 or 1200 mm can be measured on this gear measuring machine within a measuring range of 650 or 800 mm.



WENZEL GT 650

Due to the maximum measurable diameter of 650 mm, the GT 650 is especially well suitable for the analysis of geared parts and shafts used in commercial vehicles, rail transmissions or construction and agricultural machinery. In the standard version of this gear measuring machine, face widths of up to 650 or optionally even 800 mm can be measured.



WENZEL GT 900

Whenever engine components for aviation or smaller marine gear units need to be measured, GT 900 is the ideal gear measuring machine. It is equipped with a movable tailstock. Therefore the measuring machine can be loaded easily. Using the tailstock parts with a maximum diameter of 900 mm can be measured. The GT of this size is equipped with active damping by standard. This assures high precision measurements of big parts even close to production.



WENZEL GT 1200

Components for large scale machines from the field of machinery and plant engineering need a suitable gear measuring machine, the GT 1200. It is the largest measuring machine of the GT series and is equipped with a movable tailstock. This makes an easy loading with large and heavy parts possible. When using the tailstock parts with a maximum diameter of 1200 mm can be measured. The GT 1200 does not need a separate foundation. Active damping absorbs vibrations and assures reliable measurement procedures.



WENZEL GT SERIES

HIGHLIGHTS

PRECISION

- For highest precision air bearings are used in all axes.
- Baseplate and guides of the linear axes are made of granite; this ensures an identical thermal behavior of the complete measuring system.
- The standard WENZEL controller WPC guarantees an excellent 4-axis measuring performance and machine correction in real time.
- The rotary table is either pneumatic or hydraulic for very high accuracy, depending on the size and configuration of the GT.
- High-resolution scales provide accurate positioning and precise results.

ERGONOMICS

- The open construction and the radial movable tailstock of the GT 900 and GT 1200 allows an easy and uncomplicated loading.
- The simple operator interface and graphical input of the parameterized software make the creation of complex measuring programs and significant measurement reports quick and easy.
- The optimized ergonomics make the comfortable and secure operation of the gear measuring machine possible.
- Because of its compact construction and small footprint the GT can be easily integrated into the manufacturing area.



DURABILITY

- The massive base of the WGT is made of granite and provides the highest level of stability.
- All axes are protected against oil and dust by covers
- The air bearing technology in combination with the impala granite is absolutely wear-free and stands for long-life cycle concerning material and accuracy.
- The modular system concept of the GT allows the adaption to changing requirements and offers security of investment for the future.
- The exclusive use of high-quality components guarantees long machine operating times

SERVICEABILITY

- Maintenance times can be reduced as all replacement parts are easy to access.
- Subsidiaries and agents worldwide ensure high and fast replacement part availability.
- Hotline-support allows quick diagnosis for help.

WM | GEAR & GEAR ANALYZER

THE ALL-ROUNDER FOR GEAR MEASUREMENT

WM | Gear, together with WM | Gear Analyzer, is the innovative software package for data acquisition, measurement and evaluation of involute gears on CMMs. Operators may use extensive possibilities of WM | Quartis (e.g. probe management, probe

calibration, determination of workpiece coordinate system and rotary table axis) without additional training effort. Communication between WM | Gear and WM | Gear Analyzer is based on open GDE-Standard (VDI / VDE Guideline 2610).

ANWENDUNGS- GEBIETE



Spur and helical gears with involute profile, internal and external gears and bevel gears.



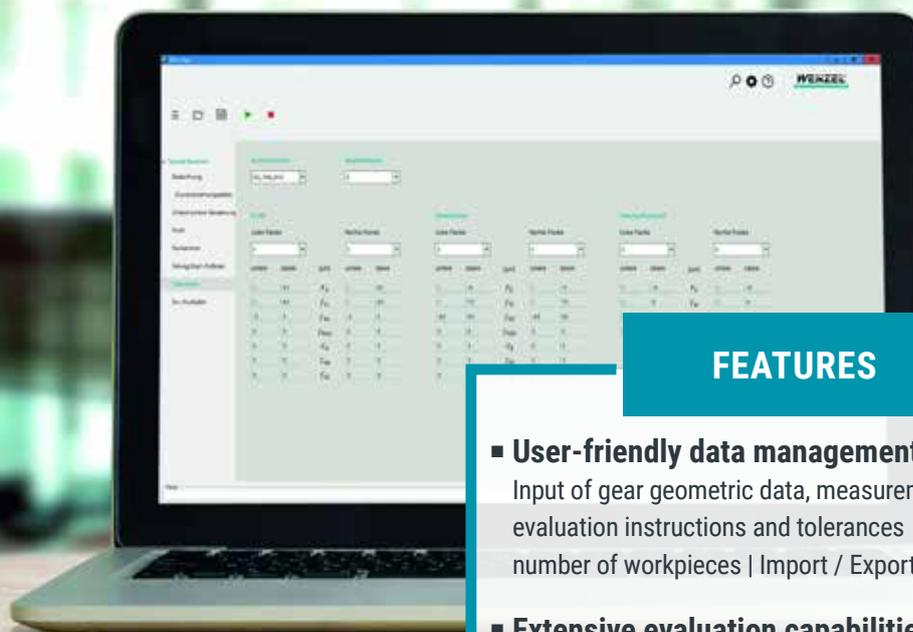
HIGHLIGHTS

Profile inspection

Extensive parameterization of measuring tasks. All common profile characteristics can be determined. Profile testing on any number of teeth possible. Multiple profile checks on one tooth. Profile modifications may be selected separately for each measuring position (profile crowning, tip- / root relief, profile slope modification, K-chart, design profile).

Lead inspection

Extensive parameterization of measuring tasks. All common lead characteristics can be determined. Lead testing on any number of teeth possible. Multiple lead checks on one tooth. Lead modifications may be selected separately for each measuring position (lead crowning, end reliefs, lead slope modification, K-chart, design lead).



FEATURES

- User-friendly data management**
 Input of gear geometric data, measurement tasks, evaluation instructions and tolerances | Unlimited number of workpieces | Import / Export of gear data
- Extensive evaluation capabilities**
 Support of accredited standards | Free tolerances for each characteristic possible | Transparent numerical filter configuration | Company standards possible on request
- Interactiv measurement diagram**
 Magnification automatic / fix | Dilation automatic / fix | mm / inch switching | Subsequent modification of measurement sheet form | Temporary switching of presentation language | PDF file archiving of measurement results
- High flexibility**
 Fully automatic measurement sequence | Evaluation and presentation parameters may be modified subsequently | Manufacturer-independent evaluation of measurement data available in valid GDE-format

Division inspection & absolute dimensions



PITCH AND RUNOUT INSPECTION

Extensive parameterization of measuring tasks. All common pitch / runout characteristics can be determined. Up to three pitch tests at different tooth positions can be determined.

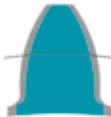
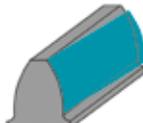
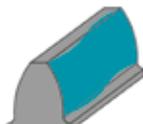
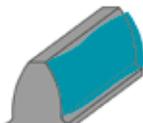
DETERMINATION OF ABSOLUTE DIMENSIONS

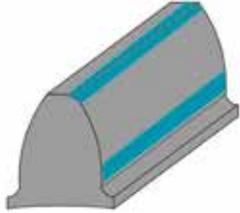
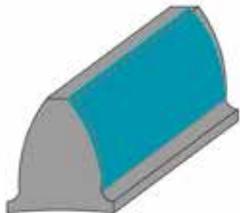
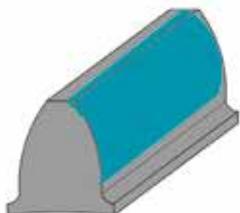
Following characteristics may be determined at up to three different tooth positions:

- Tip circle diameter
- Root circle diameter
- Dimension over one ball
- Dimension over two balls
- Dimension over one roll
- Dimension over two rolls
- Tooth span width
- Tooth thickness

GEARS

QUALITY PARAMETERS AND TOOTH FLANK MODIFICATION

Quality Parameters of Gears		WENZEL®
Tooth Thickness	s_t  <p>Tooth thickness deviation</p>	<p>The tooth thickness s_t results from the difference between the actual and nominal tooth thickness.</p>
	$f_{H\alpha}$  <p>Profile slope deviation</p>	<p>The profile slope deviation $f_{H\alpha}$ is derived from the deviation of the actual slope of the involute of a tooth flank and the nominal slope without influence of the form deviations.</p>
Profile	$f_{f\alpha}$  <p>Profile form deviation</p>	<p>The profile form deviation $f_{f\alpha}$ is derived from the deviation of the actual to the nominal form without the angular influence.</p>
	F_α  <p>Total profile deviation</p>	<p>The total profile deviation F_α is derived from the superposition of the profile slope deviation and the profile form deviation.</p>
Lead	$f_{H\beta}$  <p>Helix slope deviation</p>	<p>The helix slope deviation $f_{H\beta}$ is derived from the deviation of the actual slope of a lead trace to the nominal slope deviation without influence of form.</p>
	$f_{f\beta}$  <p>Helix form deviation</p>	<p>The helix form deviation $f_{f\beta}$ is derived from the deviation of the actual to the nominal form without the angular influence.</p>
	F_β  <p>Total helix deviation</p>	<p>The total helix deviation F_β is derived from the superposition of the helix slope deviation and the helix form deviation.</p>

Quality Parameters of Gears	
Pitch	f_p  <p>Single pitch error</p>
	F_p  <p>Total pitch error</p>
Runout	F_r  <p>Runout error</p>
Tooth Flank Modification	
Profile Corrections	C_a  <p>Tip and root relief</p>
	$C_{H\alpha}$  <p>Profile angle modification</p>
	C_α  <p>Profile crown height</p>



The single pitch error f_p is derived from the deviation of the actual and the nominal position of a single transverse pitch, separately evaluated for the left and right flank.

The total pitch error F_p results from continuous addition of the single pitch errors for left and right flanks.

The runout error F_r of a gearing is the radial position deviation of a stylus tip (ball) which is successively placed in all tooth gaps in such a manner that simultaneous contact is made with both the left and right flanks of each tooth gap at the center of the profile.

Mostly evaluated out of the pitch measurement.

Tip relief C_a and root relief C_r are an intended additional removal of material in profile direction at the tip and/or root area.

The profile angle modification $C_{H\alpha}$ is an intended angular deviation from the nominal pressure angle.

Profile crown height C_{α} is an intentional deviation of the theoretical form in the direction of the profile, so that the actual profile is curved towards the inside of the tooth.

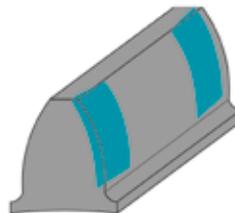
Tooth Flank Modification



Helix Corrections

$C_{\beta s}$

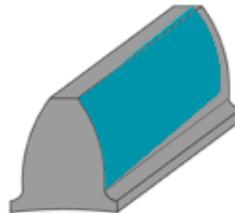
$C_{n\beta s}$



End relief reference side
End relief non-reference side

The amount of end relief on the reference side $C_{\beta s}$ and the amount of end relief on the non-reference side $C_{n\beta s}$ are specified as reduction of tooth-thickness at the reference side and/or non-reference side of the tooth flank.

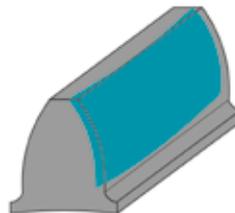
$C_{H\beta}$



Helix angle modification

The helix angle modification $C_{H\beta}$ is an intended angular deviation according to the nominal helix angle.

C_{β}



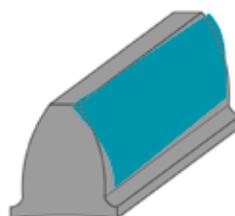
Helix crown height

Helix crown height C_{β} is an intentional deviation of the theoretical tooth flank form in the direction of the face width, so that the actual lead is curved towards the inside of the tooth.

Profile and Helix

$R_{fH\alpha}$

$R_{fH\beta}$



Profile twist
Helix twist

Due to targeted corrections, production influences or heat treat distortion, teeth can have a twist.

$R_{fH\alpha}$ describes the range of the profile twist.
 $R_{fH\beta}$ describes the range of the helix twist.

ACCESSORIES

PROBES AND CONTROLLERS

SP600M



The SP600M is a very reliable scanning probe with an excellent product life. The robust design of the probe withstands moderate collisions. With the corresponding changing rack system SCP600 it is possible to change automatically to different SH600 stylus holders within a measuring procedure. The SH600 stylus holders can be configured with styli in different size and length. The SP600M is used on all sizes of the new GT series.

SP80H



The GT 650, GT 900 and GT 1200 equipped with the passive scanning probe SP80H. This high accuracy scanning probe was especially designed to be mounted on a horizontal quill and is therefore very well suitable for the use on gear measuring machines. Using the SCP80 stylus change ports it is possible to automatically change between SH80 stylus holders with different styli configurations.



SP25M

Compact and versatile touch probe for scanning and triggering applications, which can be optionally configured to any machine size of the GT series.

WPC 2040 / 2050

Only a sophisticated control technology turns a gear measuring machine into an efficient CNC gear measuring machine. The WPC controller realizes the complete integration of the sensor technology into the control procedures. This guarantees an optimal 4-axis measurement and an accurate scanning performance. Continuous, fast and precise, the WPC controls every measurement.

- All measurement-relevant data, as position & touch probe data as well as temperature information are transmitted at high speed.

- The machine compensation is carried out in real-time and makes for precise machine movement.
- The wobble of the measured part is compensated in real-time, even during measurements of completely unknown curves.
- The controller is optimized for the use of scanning probes
- For technical support via remote maintenance access to the WPC can be permitted

TECHNOLOGIE AND SUPPORT

WENZEL GEAR SOLUTIONS IN DETAIL



Service and application support - We are at your side

Professional user training

Training is offered as individual training, group training and in seminar form. The training courses can be held on your premises or in our WENZEL training centers.

Qualified service team

Our service team is at your side with advice and support: For repair work, maintenance, retrofitting, telephone support or with the innovative and simple WENZEL Online Service (WOS) - the internet-based remote diagnosis and remote maintenance service. Detailed information can be found in our service brochure..



Reliable results on the store floor

Active damping

The GT series machines can be optionally equipped with active pneumatic vibration damping, which isolates the measuring device from external vibrations.

Temperature compensation

The GT machines can be equipped with automatic temperature compensation to compensate the thermal influences of the environment.



High resolution scales

Accurate positioning thanks to the optimal position measuring system technology

The GT Series is equipped with an incremental measuring system, which has very fine scale pitch, and excellent dirt immunity. This enables the best position stability and resolution at high speed. The high-precision and robust scale tapes have only very very small, compensable length errors.



Robust and efficient

Messsysteme von WENZEL sind nicht nur robust sondern zeichnen sich auch durch eine hohe Dynamik und Produktivität sowie geringen Platzbedarf und gute Zugänglichkeit aus, wodurch sie für die rauerer, oft beengten Verhältnisse in der Serienüberwachung oder Automation bestens geeignet sind.

INNOVATION MEETS TRADITION

The WENZEL Group is a market leader in innovative Metrology. WENZEL offers a comprehensive product portfolio in the fields of Coordinate Metrology, Computed Tomography and Optical High Speed Scanning. The technology of WENZEL is used in all industries, including the automotive sector, aeronautics, power generation and

medicine. WENZEL looks at today on an installed base of more than 10,000 machines worldwide. Subsidiaries and agencies in more than 50 countries support sales and provide after-sales service for our customers. The WENZEL Group today employs more than 600 people.



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