

WENZEL GT SERIES

TOP CLASS GEAR METROLOGY



THE NEW BENCHMARK
IN 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 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. WENZEL have brought numerous innovative solutions into the market in recent years so as to offer our customers the right products. In addition to the product, we also supply you with turnkey solutions. This makes us experts in flexible 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 by investing in the outstanding quality of our machines and offering 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, key elements in the new development. The new GT series works with our standard controller WPC and is used with completely new software from WENZEL. Our goal for the GT series is to provide gear measuring technology that grows together with universal measuring technology and is tactile and optical.



About WENZEL

Founded in 1968, today WENZEL is 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



Our Headquarters

Wiesthal, Germany

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

OUR APPLICATIONS



OUR PRODUCT LINES

OUR FOCUS INDUSTRIES

Measurement technology has been our profession since 1968, and over the years WENZEL has come to stand for the highest quality standards and reliability, while continuing to evolve and keep a clear vision of the future.

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, WENZEL's new GT series gear measuring devices 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, as well as measurement and analysis of involute gears using coordinate measuring machines. Users can take advantage of the extensive capabilities of the powerful WM | Quartis measuring software, without needing additional training.

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
Agricultural machinery
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. It is suitable for small gears and rotationally symmetrical components, from the automotive industry to toothed workpieces and shafts used in commercial vehicles, railroad transmissions, and construction and agricultural machinery, as well as the measurement of marine gears. For easy loading of the gear measuring device, they are equipped with a tailstock. Using the tailstock,

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. WENZEL, therefore, supports and provides solutions to a wide variety of industries including the automotive and energy industries, materials handling, agriculture-machinery, the aerospace industry, and mechanical & plant engineering.

AEROSPACE

In aerospace, the technical requirements of gears include high efficiency, low noise emission, and high durability. These requirements are fundamental and the measurement of these parts need reliable and precise gear measuring machines. Furthermore, the software has to allow for easy and meticulous documentation of measuring results according to certified standards. The GT series offers this combination of hardware and software.



INDUSTRIAL VEHICLES & GEAR BOXES

Gearboxes in commercial vehicles are exposed to extreme mechanic and environmental conditions. In order to guarantee high durability, the complex components have to be measured exactly and be documented in a traceable manner. Besides the measurement of gears, the measurement of geometrical references and their evaluation concerning accuracy in size, form, and position is of great importance. All these measuring tasks can be solved with a GT.



WIND ENERGY

Gearboxes in modern wind turbines are subjected to extreme cyclic loads. Together with the low speeds of a wind turbine, even smallest breakouts on the gear flank can be enough to cause expensive gear damage. Therefore, wind turbines require a reliable and highly accurate choice of gearbox.



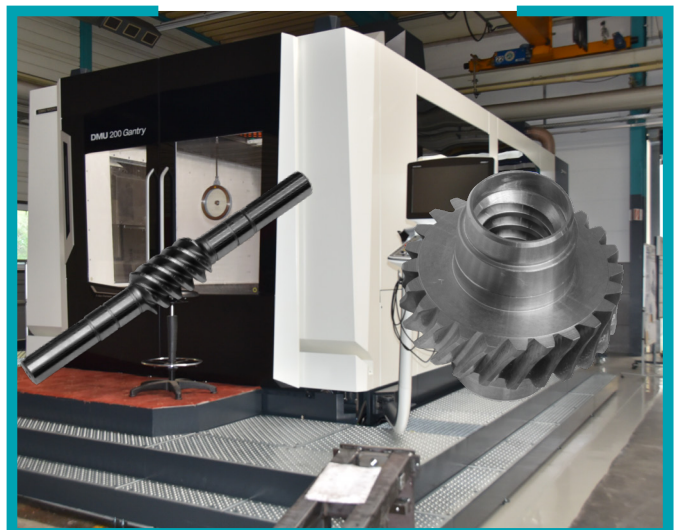
AUTOMOTIVE INDUSTRY

In the construction of modern gearboxes, high efficiency, low noise emission, and weight reduction for high durability are a 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, ensuring resource saving and efficient measuring procedures.



MACHINE & PLANT ENGINEERING

The requirements in machine and plant engineering are as diverse as their applications. They range from the measurement of small gears (module 0.3 mm), to the measurement of high accuracy gears and the geometrical evaluation of pump housing. The measurement of large bevel gears used in ship propulsion is also 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.



GT Series

WENZEL GT SERIES

TOP CLASS GEAR METROLOGY





THE NEW WENZEL GT SERIES

TOP CLASS GEAR METROLOGY

WENZEL GT 300

The GT 300 was specifically developed for the measurement and analysis of smaller gears and rotational symmetrical parts used in the automotive industry. Additionally, 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 and automotive industries, as well as their supplier industries. It allows for 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 using this gear measuring machine within a measuring range of 650 to 800 mm.



WENZEL GT 650

Due to the maximum measurable diameter of 650 mm, the GT 650 is especially well suited for the analysis of geared parts and shafts used in commercial vehicles, rail transmissions, as well as 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

When engine components for aviation or smaller marine gear units need to be measured, the GT 900 is the ideal gear measuring machine. It is equipped with a movable tailstock, allowing the measuring machine to be easily loaded. When using the tailstock, parts with a maximum diameter of 900 mm can be measured. The GT of this size is standardly equipped with active damping, assuring high precision measurements of big parts, even during production.

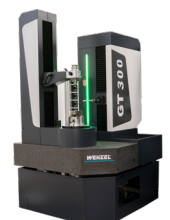


WENZEL GT 1200

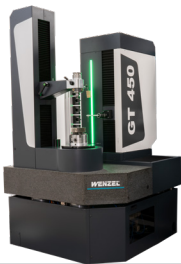
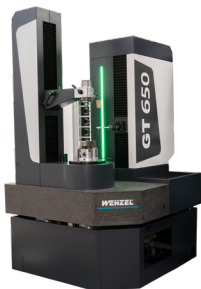
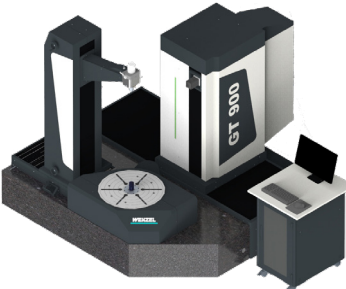
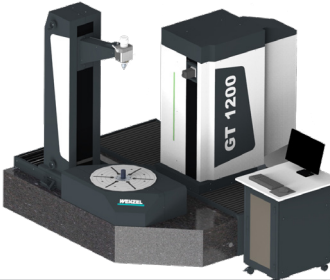
Components for large-scale machines from the machinery and plant engineering field need a suitable gear measuring machine, which is the GT 1200. It is the largest measuring machine of the GT series and is equipped with a movable tailstock. This makes loading easy of large and heavy parts. When using 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 ensures reliable measurement procedures.



Max. Workpiece Diameter [mm]	300
Measuring range* X- Axis [mm]	400
Measuring range* Y- Axis [mm]	225
Measuring range* Z- Axis [mm]	500/650
Allowable workpiece weight [kg]	50/400
ISO 10360 Specification	
Single Probing deviation P_{FTU}^* MPE [μm]	1,8
Repeatability span R_0 , MPL [μm]	1,8
Length measurement deviation E_0 , MPE / E_{150}^* MPE [μm]	$1,8 + L/350$
Length measurement deviation E_{0X}^* MPE / E_{0Y}^* MPE / E_{0Z}	$1,3 + L/400$
Temperature Ranges and Gradients	
VDI/VDE 2612 Bl. 1 and 2	2613
Net weight Machine [~kg]**	1560 - 1740
Machine dimensions [mm]	
Length [mm]	1183
Width [mm]	1079
Height [mm]***	1843/1993
Height [mm] depending on counterholder	1962/2212
Counterholder	650/900
We reserve the right to make changes to the design and scope of delivery as well as to further technical developments. *Measuring ranges depend on the respective machine configuration. **Weight depending on machine configuration. ***Height without counter support, depending on Z-column	



GT300

450	650	900	1200
535	710	930	1200
300	400	500	650
650/800	650/800	850/1000/1500	1000/1500
50/400	500	1500	3000/6000
2,0	2,0	2,7	2,9
2,0	2,0	2,7	1,8
2,0 + L/350	2,0 + L/350	2,7 + L/350	2,9 + L/350
1,5 + L/400	1,5 + L/400	2,2 + L/400	2,4 + L/400
18°C – 22°C ; 1 K/h; 1 K/m 2 K/d			
Class 1			
1580 - 1770	1610 - 1800	9020 - 9560	9710 - 10250
1378	1678	2302	2677
1229	1429	2902	3202
1993/2143	1993/2143	2250 (for Z 850 mm)	2400 (for Z 1000 mm)
1962/2212/2512	2212/2512	2372/2672/3072	2672/3072
650/900/1200	900/1200	900/1200/1600	1200/1600
			
GT450	GT650	GT900	GT1200

WENZEL GT SERIES

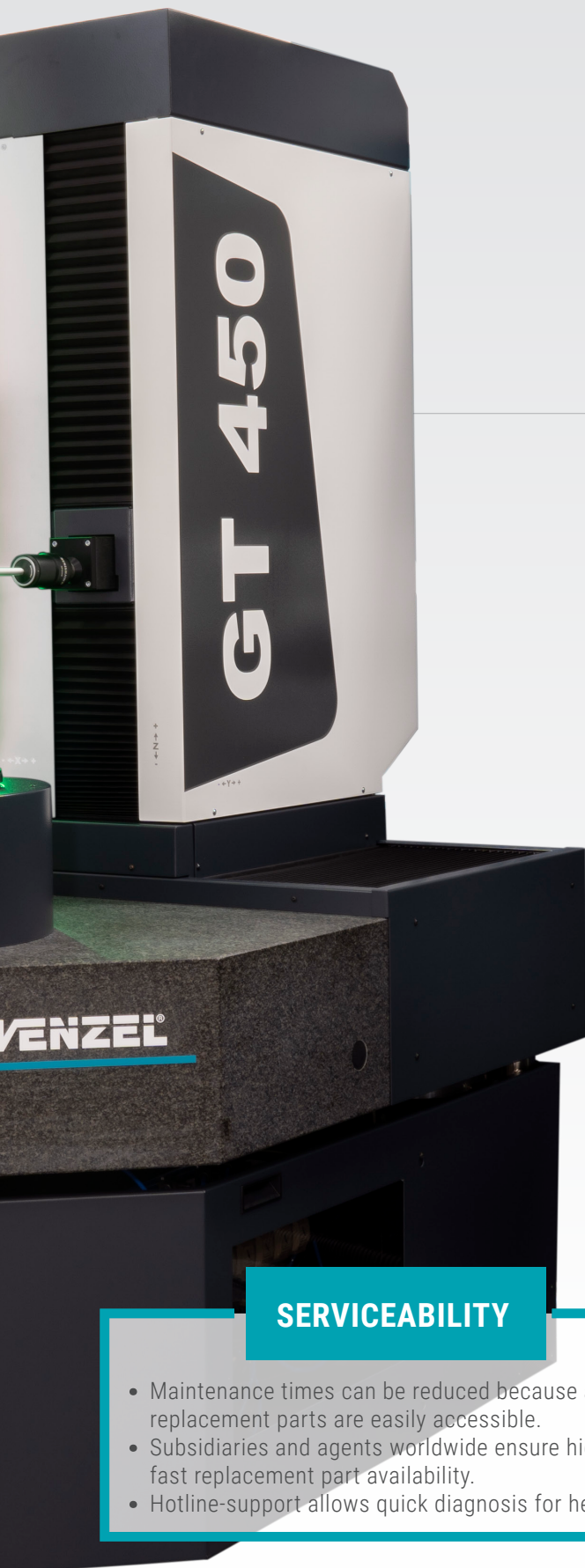
HIGHLIGHTS

PRECISION

- For the highest precision, air bearings are used in all axes.
- The baseplate and guides of the linear axes are made of granite, ensuring 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, depending on the size and configuration of the GT, ensuring a very high accuracy.
- High-resolution scales provide accurate positioning and precise results.

ERGONOMICS

- The open construction and radial movable tailstock of the GT 900 and GT 1200 allows for easy and simple loading.
- The simple operator interface and graphical input of the parameterized software makes the creation of complex measuring programs and large 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 easily be integrated into the manufacturing area.



DURABILITY

- The solid 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-proof and ensure a long-life cycle of the material as well as accuracy.
- The modular system concept of the GT allows for easy adaption to changing requirements and offers security for your investment in the future.
- The exclusive use of high-quality components guarantees long machine operating times

SERVICEABILITY

- Maintenance times can be reduced because all replacement parts are easily accessible.
- 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

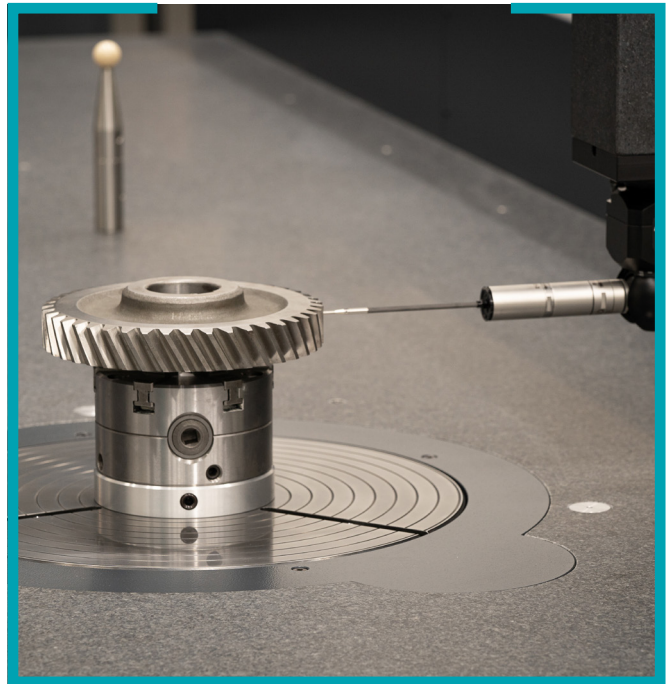
WM | Gear, together with WM | Gear Analyzer, is the innovative software package for data acquisition, measurement and evaluation of involute gears on CMMs. Operators may use extensive possibilities of WM | Quartis (e.g. probe management, probe

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).

APPLICATION AREAS



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



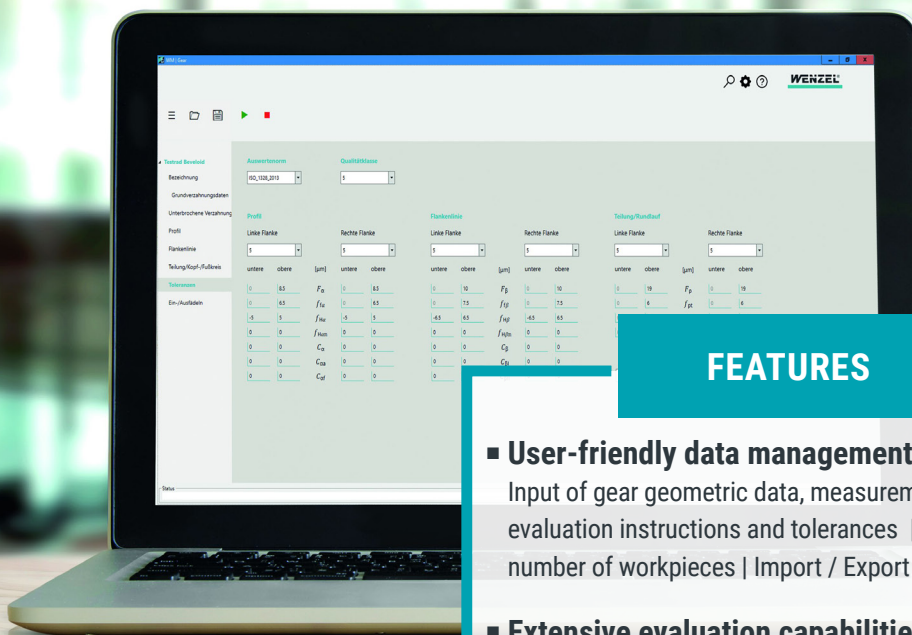
HIGHLIGHTS

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

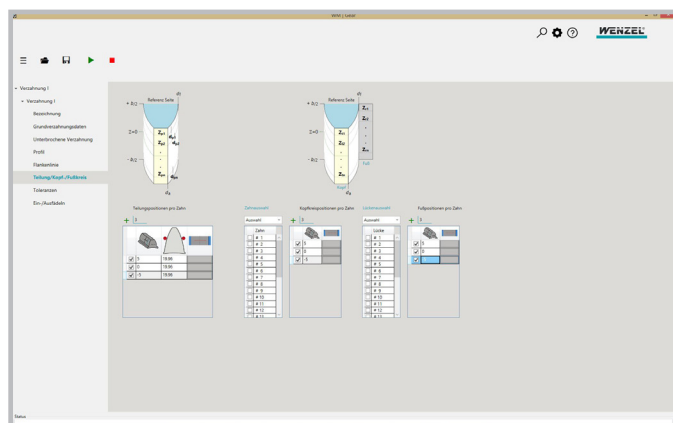
■ Interactive measurement diagram

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.

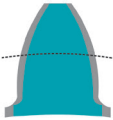
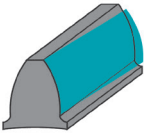
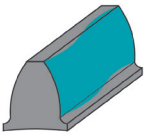
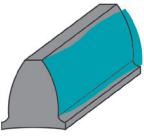
DETERMINATION OF ABSOLUTE DIMENSIONS

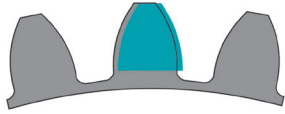
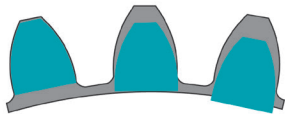
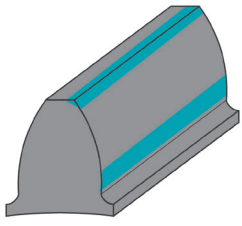
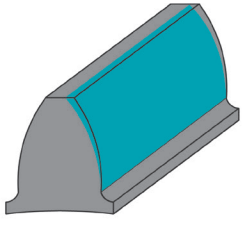
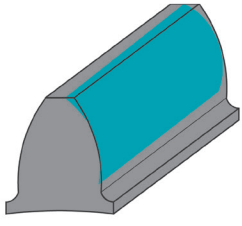
The following characteristics may be determined by up to three different tooth positions:

- 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  Tooth thickness deviation	The tooth thickness s_t results from the difference between the actual and nominal tooth thickness.
	$f_{H\alpha}$  Profile slope deviation	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.
	$f_{f\alpha}$  Profile form deviation	The profile form deviation $f_{f\alpha}$ is derived from the deviation of the actual to the nominal form without the angular influence.
	F_α  Total profile deviation	The total profile deviation F_α is derived from the superposition of the profile slope deviation and the profile form deviation.
Profile		
Lead	$f_{H\beta}$  Helix slope deviation	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.
	$f_{f\beta}$  Helix form deviation	The helix form deviation $f_{f\beta}$ is derived from the deviation of the actual to the nominal form without the angular influence.
	F_β  Total helix deviation	The total helix deviation F_β is derived from the superposition of the helix slope deviation and the helix form deviation.

Quality Parameters of Gears	
Pitch	f_p  Single pitch error
	F_p  Total pitch error
Runout	F_r  Runout error
Tooth Flank Modification	
Profile Corrections	c_a  Tip and root relief
	c_f  Profile angle modification
	c_α  Profile crown height

WENZEL®

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.

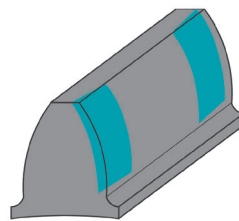
Tip relief C_a and root relief C_r are an intended additional removal of material in profile direction at the tip and/or root area.

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.

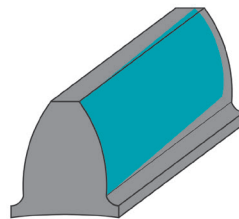
Tooth Flank Modification

WENZEL®

 $C_{\beta s}$ $C_{n\beta s}$ 

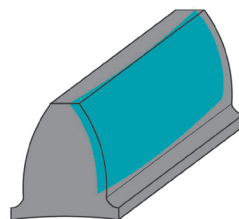
End relief reference side
End relief non-reference side

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.

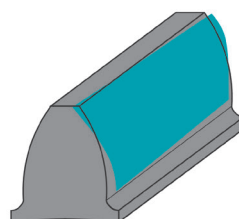
 C_β 

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.

Helix Corrections

Profile and Helix

 $R_{fH\alpha}$ $R_{fH\beta}$ 

Profile twist
Helix twist

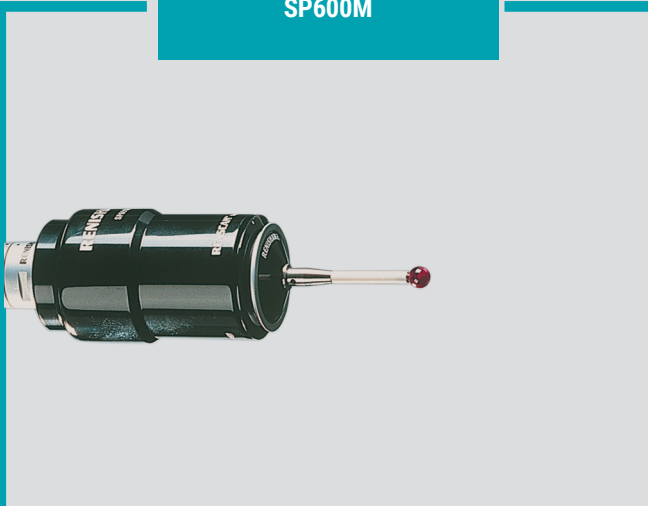
Due to targeted corrections, production influences or heat treat distortion, teeth can have a twist.

$R_{fH\alpha}$ 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 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, like 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

TECHNOLOGY AND SUPPORT

WENZEL GEAR SOLUTIONS IN DETAIL

Reliable results on the shop floor

Active damping

Optionally, the GT series machines can be 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.

Robust and efficient

Measuring systems from WENZEL are not only robust, but also characterized by high dynamics and productivity, having a small footprint and good accessibility, which makes them ideally suited for the harsher, often cramped conditions in series monitoring or automation.

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 and retrofitting through telephone support or with the innovative and simple WENZEL Online Service (WOS) - the internet-based remote diagnosis and maintenance service. Detailed information can be found in our service brochure.

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 very small, compensable length errors.

INNOVATION MEETS TRADITION

The WENZEL Group is one of the leading suppliers in the field of industrial metrology and styling solutions. WENZEL's product portfolio includes coordinate and gear measuring machines with tactile and optical sensors, multi-sensor systems, optical high speed scanning and 3D X-ray measuring technology based on computer tomography. In addition to these systems WENZEL also offers comprehensive metrology software, which is used by many thousands of users for the measurement and analysis of parts. WENZEL's measuring solutions

are used in various industries, including the automotive sector, aerospace, power generation and medical devices. Our solutions also support reverse engineering, inspection, and analysis for a variety of fields including power generation, vehicle electrification, and additive manufacturing. Over the years WENZEL has installed more than 12,000 machines worldwide. Subsidiaries and agencies in more than 50 countries support the sales and ensure the after sales service for our customers. The WENZEL Group employs more than 500 people worldwide.



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