



## Volume scanning technology

# Innovation with a family tradition

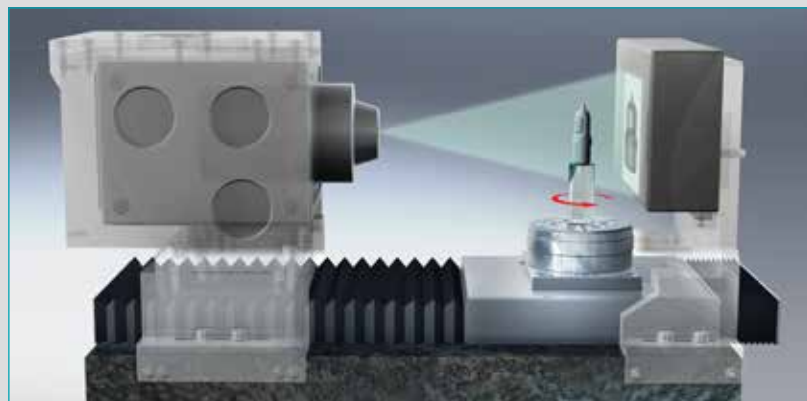
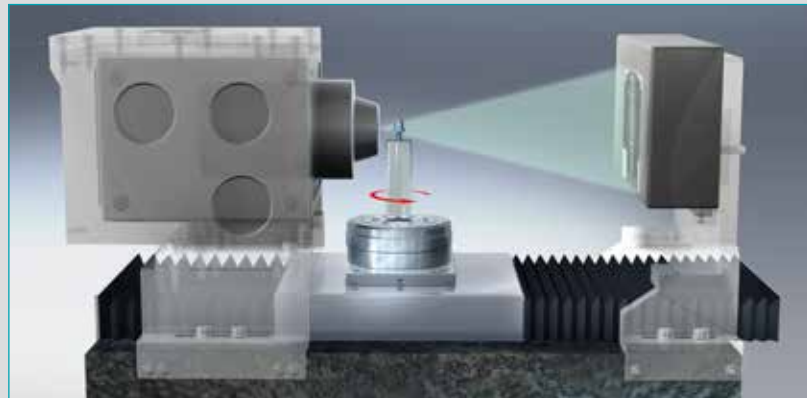
Founded in 1968, the family-owned, WENZEL Metrology Group is one of the world's leading providers of high-precision coordinate and gear measurement technology along with industry leading measurement software. When it comes to innovation, WENZEL products continuously set unrivalled standards, that are characterised

by manufacturing quality and high precision. Through the acquisition of WENZEL Volumetrik in 2008, the WENZEL Group has extended its product portfolio into the sector of industrial computed tomography (CT). WENZEL Volumetrik is a leading innovator among CT manufacturers and specifically provides powerful and precise

devices for carrying out non-contact, non-destructive three dimensional measurements and testing of both internal and external structures of objects. This makes the volume scanning technology from Volumetrik the perfect addition to the coordinate measurement technology from the WENZEL Group.

## What is volume scanning technology?

Computed tomography has been used since the 1970s for medical applications. They constitute a further development of classic X-ray technology. While radiography X-ray devices reproduce two-dimensional radiographic images of objects, the computed tomography volume scanning technology from WENZEL generates three dimensional volume data. Its deployment in the industrial sector is relatively recent. The technology of the WENZEL computed tomography is adapted to industrial applications, so that internal and external structures of components can be captured completely. The pictures on the right side clarify the operating principle of the exaCT<sup>®</sup>S. The component is rotated in the path of the X-ray beam and a three-dimensional model is reconstructed from a number of two-dimensional projections. Small parts will be measured close to the X-ray source and larger parts close to the detector. Through the use of magnification of small parts it is possible to resolve even the smallest details of parts.



## Compact, precise and low-maintenance

If the name WENZEL appears on a new type of measuring machine, this stands for innovation, quality and service. The new exaCT<sup>®</sup>S combines decades of experience in measurement technology and extraordinary quality of WENZEL along with the advanced expertise in CT development from WENZEL Volumetrik. With a new modular system design concept and with innovative

sensor technology, WENZEL Volumetrik now produces a range of CT device variants that permits adaptation to different customer requirements.

The result is the exaCT<sup>®</sup>S, an appealing desktop-CT with a compact construction that is more powerful, precise and with very low-maintenance, compared to devices from other manufacturers.

### SAFETY INCLUDED

The new exaCT<sup>®</sup> desktop-CT is a fully protected device based on the strict legal requirements of the German X-ray Directive and DIN 54113. Its use is non-hazardous for the operator.

There is also no danger from components that have been exposed to X-ray.

Simply exaCT

## Computed tomography on the desk

The compact desktop CT exaCT<sup>®</sup>S is the ideal solution for the volume measurement of small components. It is compact in size and provides maximum performance in a minimum space. The high resolution allows a detailed analysis of small components ranging from micro measurements to micro

material testing. The modular design concept of exaCT S makes it possible to customize the system to suite customer requirements. These are primarily differentiated by the X-ray source, the detector and by the component sizes that can be

measured. What connects all exaCT<sup>®</sup>S versions is the compact design, the sophisticated ergonomics and the idea of combining more performance and flexibility with a smaller footprint.

# exaCT<sup>®</sup>S



### FLEXIBLE PERFORMANCE\*

Various different device variants can be realized

WORK PIECE DIMENSIONS:		MECHANICS:	
Maximum scan diameter	35 mm - 75 mm	Linear guide ways	Granite based with high precision linear guideways
Maximum scan height (depending on the component diameter)	25 mm - 45 mm	Turntable bearings	Roller bearing or Air bearing
<b>DETECTOR:</b>		Position measuring systems	High-resolution optical precision measuring systems
Number of pixels	1 Megapixels - 3 Megapixels	Voxel resolution (detail detectability)	5 µm - 40 µm
Pixel size	20 µm - 75 µm	Calibration and monitoring	Calibration and test artifact acc. to VDI/VDE 2630 (draft)
AD conversion	16 bit	Radiation protection	Full radiation protection chamber
<b>X-RAY SOURCE:</b>		Setup	Table top installation
Maximum acceleration voltage	80 kV - 130 kV	Maintenance accesses	Front
Power	10 W - 90 W		
Cooling	air (integrated)		

\* The technical data can lie between the minimum and maximum values, depending on customer requirements. Technical changes reserved.

## Product advantages

# Superior point by point

The new desktop-CT exaCT® S has an innovative system concept. WENZEL Volumetrik has systematically concentrated on the specific needs of the user. The result is a device that is not only partially superior, but point by point to comparable devices.

The exaCT® S is a modular system concept with exceptional system stability and can be perfectly integrated into existing measurement rooms. The compact size of the system associated with precision mechanics, of our own production, and the inno-

vative detector technology are the foundation for the systems excellent stability. Also integrated: software, service, consultation and training.

### ■ Low footprint tabletop installation with high performance

The small desktop-CT is easy to integrate in a wide range of working environments. This saves expensive production floor space. Access to the rear and to the sides is not required which means the exaCT S can be installed space saving. The exaCT® S also provides higher performance with smaller equipment dimensions than comparable products from other manufacturers.

### ■ Perfect operating ergonomics

Not only is the design of the exaCT® S attractive, but also the superior ergonomics are a major benefit. Everything is designed in such a way that the exaCT® S is easy to operate while providing a perfect overview. Just how the perfect CT workplace of the future should be!

### ■ High level of proprietary manufacture

There is a large amount of proprietary manufacturing from WENZEL. For the exaCT® S, this means: all of the installed components are perfectly matched to one another, the software has proven its performance in practice. Logical consequence: the need for servicing the system and the time and effort required for training are low.

### ■ X-ray source stable and maintenance-free

The X-ray source in the exaCT® S is characterised by its special stability. It is maintenance-free.

### ■ Setup support: Video camera and laser markers

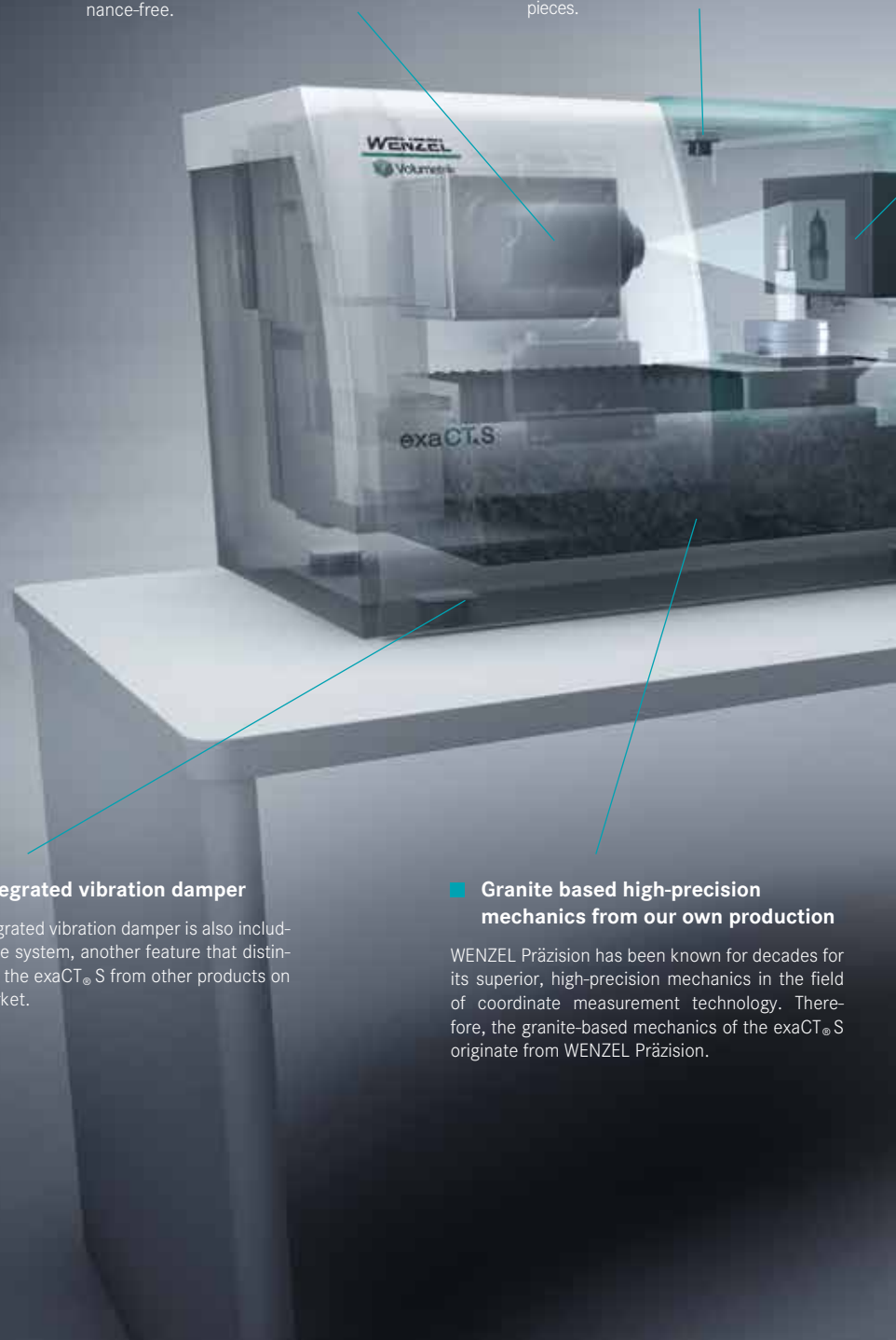
Integrated video cameras and laser markers are used for rapid and precise set-up of the workpieces.

### ■ Integrated vibration damper

An integrated vibration damper is also included in the system, another feature that distinguishes the exaCT® S from other products on the market.

### ■ Granite based high-precision mechanics from our own production

WENZEL Präzision has been known for decades for its superior, high-precision mechanics in the field of coordinate measurement technology. Therefore, the granite-based mechanics of the exaCT® S originate from WENZEL Präzision.



### ■ Industrial detector from our own development and production

The detector integrated in the exaCT<sup>®</sup> S is a proprietary development of WENZEL Volumetrik. It was specially optimised for metrological use in the industrial sector and provides excellent resolution, high dynamics and sensitivity – and hence a unique image quality.

### ■ Optimum price/performance ratio

The exaCT<sup>®</sup> S sets new benchmarks in terms of price/performance ratio. Therefore, computed tomography is now affordable, even for medium-sized companies.

### ■ Low-maintenance, high availability

The high manufacturing quality, the proven WENZEL mechanics and stable X-ray source lead to low maintenance and high availability. If still failure occurs, the global WENZEL service organisation is just around your corner.

### ■ Integrated control cabinet

The electronics and control unit is fully integrated. Therefore no separate space consuming control cabinet is required.

### ■ Integrated and consistent operating concept

The ease of operation and high performance of the application software are further highlights of the new system. The exaCT<sup>®</sup> control data acquisition software was developed for optimised control of the computer tomograph and the exaCT<sup>®</sup> Volume reconstruction software for precise calculation of the 3D volume data.

All software modules are integrated in a consistent operating concept just like the proven WENZEL evaluation tools, Metrosoft QUARTIS and Knotenpunkt PointMaster.

### ■ Multifunctional signal lamp: Safety and surveillance during operation

The operating status of the exaCT<sup>®</sup> S is indicated by different colours of the signal lamp.



# Operating concept and fields of application of the exaCT®S

## Beautifully simple and well conceived

Above all, the performance and the user friendliness of the integrated application software ensure that the full extent of the innovative device concept of the exaCT® S is brought to bear. The exaCT® control data acquisition software for optimised control of the computer tomograph and the exaCT® Volume reconstruction soft-

ware for precise calculation of the volume data was developed by WENZEL Volumetrik. The evaluation software of the exaCT® has a direct link to the proven software products of Metrosoft QUARTIS from WENZEL Metromec and PointMaster from WENZEL Knotenpunkt. The applications for the exaCT® S are measurement and testing technology where 3D data

of complex inner structures are required. The tasks that can be performed with the exaCT®S are numerous and range from material analysis, through the testing of joining technology, right up to reverse engineering.

### CT control and reconstruction

You don't need to be a computed tomography specialist to operate the exaCT® S. Intuitive user guidance allows excellent measurements to be generated after a short training period. The exaCT® S thinks too: Measurement parameters are automatically optimised by the system. Specially developed for industrial use, the CT control unit and reconstruction software ensure high precision and high quality results. In contrast to other manufacturers, the entire image processing chain and 3D reconstruction are carried out with our own software. This allows the components to be optimised and finely matched to one another, thus achieving the high quality standards.

### Dimensional measurement

The decades of experience gained by WENZEL Metromec in 3-dimensional coordinate measurement technology is underlined in the key advantages that the Metrosoft QUARTIS measurement software also offers its users in the field of computed tomography:

- Non-destructive and non contact metrological evaluation of all contours and surfaces of a component as well as the internal structures of workpieces
- Clear, flexible and results-oriented user interface with proven construction and alignment functions
- Full functionality for evaluation of shape, position and dimension with simple display of the measurements in meaningful measurement reports
- Intuitive measurement programming for the automation of measurement sequences

### Nominal-to-actual comparison and reverse engineering

The PointMaster software from WENZEL Knotenpunkt is one of the world's best surface generation tools which can be used to generate and process exact free-form surfaces from CT data. PointMaster also fulfils important functions for CT evaluations:

- Can be used for reverse engineering
- Nominal-to-actual comparisons against 3D CAD models, display using colour rendering
- Innovative functions for iterative compensation of material shrinkage in injection and casting moulds

## FIELDS OF APPLICATION

### Measurement technology

#### Dimensional control

Measurement of standard part geometry and surfaces including form and tolerances

#### Wall thickness analysis

Color rendering of the wall thickness distribution of the component

#### Actual-to-nominal comparisons

Representation of the deviations from the CAD model or master component

#### Tool and component optimisation

Compensation of shrinkage and distortion

#### Development, rapid prototyping and reverse engineering

Generation of CAD models from scan data

### Testing technology

#### Material defect analyses

Non-destructive testing, e.g. voids, pores, cracks, etc.

#### Structural analyses

Visualisation of material and component structures

#### Assembly tests

Control of assembly results, function and failure analysis

#### Joining technology testing

Defect analysis for welding, soldering, gluing or riveting

#### Electronics testing

Inspection of solder and adhesive joints

## Applications

# One measurement – multiple evaluations

The strengths of the exaCT® S are revealed in the specific application. The possible applications are, however, too numerous to mention them all. For this reason we have shown examples of specific applications here to make our advantages clear. As with the exaCT® volume scanning technology, both

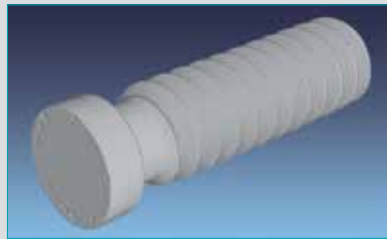
material and geometry data are present, so multiple evaluations can be carried out on the basis of a single measurement. Because of the non contact and non destructive measurement, components that are not suitable for other measurement techniques, such as

tactile or optical coordinate measurement machines can be examined. Fast and complete digitising of objects can be performed by scanning the overall geometry in a single measurement step.

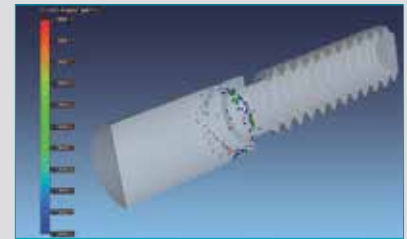
## Micro weld inspection on a brass component



Point welded brass pin



The virtual 3D cut reveals micro porosity in the welded joint

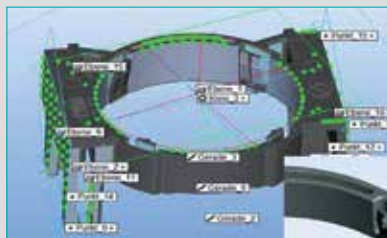


The 3D porosity analysis shows the size distribution of the pores. The diameter of the smallest pore is 20 µm

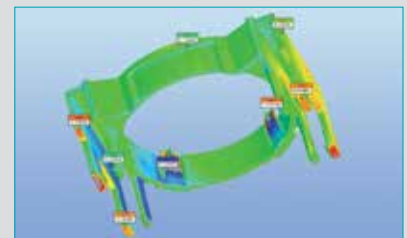
## Dimensional measurement on a plastic injection moulding part



Injection moulding part with complex internal structures

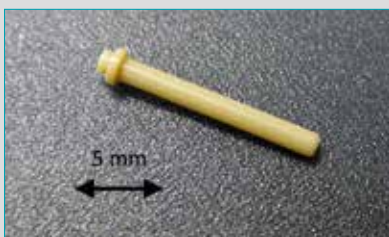


The measurement program includes inner and outer structures. For dimensional measurement, virtual probing points are taken.

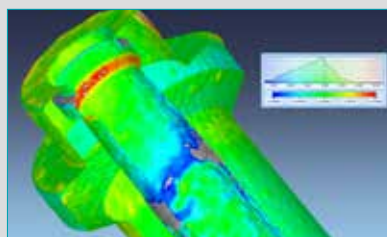


The nominal to actual comparison shows deviations between the manufactured part and the CAD model.

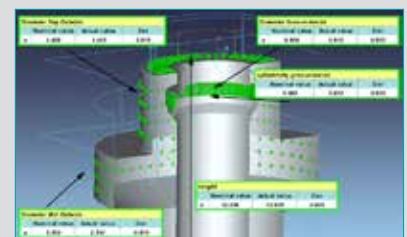
## Dimensional micro measurement on a plastic part



Plastic part with undercuts

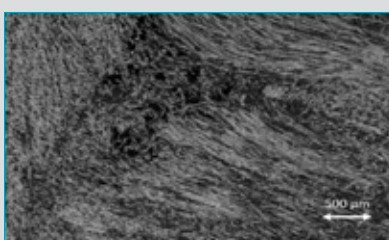


The colors make deviations between nominal and actual geometry visible. The histogram shows the distribution of the deviations.

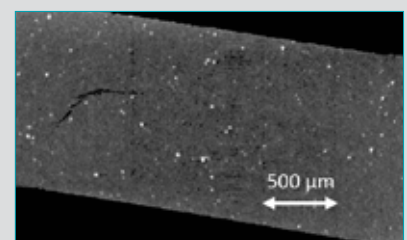
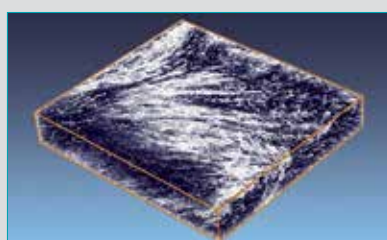


The measurement report shows the measured values of inner and outer features similar to a coordinate measuring machine

## Micro structure evaluation of composite components



GRP part: The 2D cut and 3D visualization makes visible the fiber orientation of the glass fibers. The diameter of the glass fibers is 10 µm



The 2D cut shows glass fibers and a micro crack with a gap width of 10 µm to 30 µm.

