Precision & Accuracy

and small footprint to save shop space

TomoScope XS Line

Small footprint, big capablities - Best in class X-ray computed tomography machines

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The all in one measurement software, provides fast inspection with high reliability.

Headquarters in Giessen, Gemany

OUR HISTORY

After studying mechanical engineering and obtaining a doctorate (Dr.-Ing. at the Technical University of Berlin (today TU Berlin) , Dr.-Ing. Siegfried Werth founded the company Werth Apparate und Maschinen in 1951 . Werth Messtechnik GmbH later emerged from this company.

In 1955, Dr.-Ing. Siegfried Werth designed the first desk-type profile projector, which was significantly lighter and more compact than conventional column-type models. The optical beam path was integrated into the housing with the help of mirrors. As a result, a new standard for ergonomics and precision was set.

At the end of the 1970s, Siegfried Werth developed the first optical sensor for measuring projectors. The Werth probe eye is a punctiform fiber sensor for use in the transmitted light method, i.e. on the shadow image of the workpiece. When driving over the workpiece edge, the edge position is automatically detected based on the light-dark transition. In connection with a CNC control, this sensor enabled the automation of optical measuring devices for the first time in 1980.

In 1987, Werth Messtechnik presented the first multi-sensor coordinate measuring machine with image processing and an integrated laser distance sensor under the name Inspector®. With the introduction of the VideoCheck® product line, Werth again did pioneering work in the 1990s with the introduction of digital image processing in industrial coordinate measuring technology.

In 2005, TomoScope® was introduced. It was the first X-ray computed tomography machine developed for coordinate metrology. Since then, Werth has led the way to apply this powerful technology.

In 2017, Werth introduced TomoScope ® XS, the first machine in the XS line. This compact and inexpensive TomoScope ® offers the advantages of proven technology in XS format. The X-ray tube in monoblock design with transmission target combines measurement that is five times faster than conventional systems with low maintenance costs. The popularity of the XS also led to the development of XS Plus in 2019, and XS FOV / 500 in 2020. Today, the XS line is widely used in various industries, and the demand continues to grow.

Dr. -Ing. Siegfried Werth

Dr. -Ing. Siegfried Werth with desk projectors and measuring devices at the Hanover Fair, 1955.

TomoScope® XS FOV / 500

The entry-level unit for industrial computed tomography (CT) for small workpieces

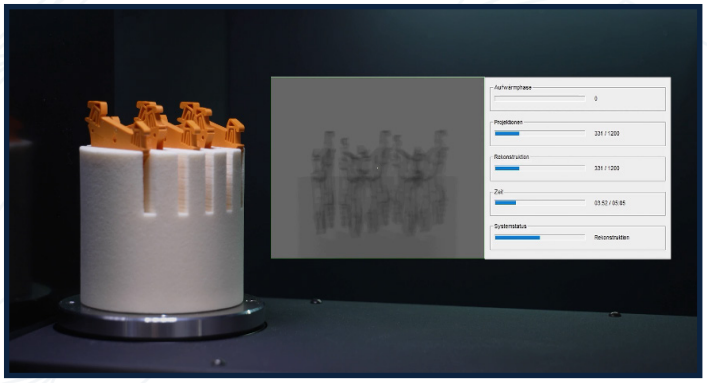
Specifications

X-ray Source	FOV	FOV 500
Tube Type	Closed Macro-focus	
Target Options	Transmission	Reflection
Max. Voltage	130kV	160kV
Max. Power	80W	500W

X-Ray Detector	FOV	FOV 500
Surface Area	2.36 x 2.08 in² [60 x53 mm²] 5.5 x 4.3 in² [140 x110 mm²]	5.5 x 4.3 in² [140 x110 mm²] 11.2 x 8.8 in² [287 x223 mm²]
Pixel Count	1200 x 1060 2800 x 2200	2800 x 2200 5800 x 4500
Center Distance	50 µm	50 µm to 75 µm

Maximum Permissible Error [MPE]	
Laboratory Conditions	P: 5 µm E: (5 + L/75) µm SD[3]: (4 + L/100) µm
Standard Conditions	P: 7.5 µm E: (7.5 + L/150) µm

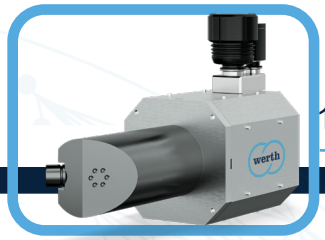
L = measuring length in mm comparable to ISO 10360 and VDI/ VDE 2617
See the Werth final testing guideline for more details



System	
Width	51.2 in [1300 mm]
Depth	26.5 in [674 mm]
Height	53.9 in [1370 mm]
Weight	1940 lbs [880 kg]
Voltage	230 V (115 V) ±10%
Frequency	50 - 60 Hz
Power	2000 VA
Air Pressure	5.5 - 10 bar
Air Consumption	3000 Nl/h
Humidity	40% - 70%
Air Contamination	0.05 mg/m³
Tempurature	50 - 95 °F [10 - 35 °C]
Operating System	Microsoft Windows

Inspection	FOV	FOV 500
Max. Sample Weight	22 lbs [10 kg]	
Max. Diameter “in the image”	Ø = 2.0 in [51 mm] Ø = 4.7 in [120 mm]	Ø = 4.7 in [120 mm] Ø = 7.6 in [192 mm]
Max. Length “in the image”	L = 1.8 in [45 mm] L = 3.7 in [93 mm]	L = 3.7 in [93 mm] L = 5.7 in [145 mm]
Max. Diameter Raster	**Not availble in FOV**	Ø = 7.9 in [201 mm] Ø = 11 in [280 mm]
Max. Length Raster	**Not availble in FOV**	L = 3.7 in [94 mm] L = 4.4 in [112 mm]
Max. Distance Source to Detector	19.7 in [500 mm]	

Specifications vary depending on machine configurations, operating conditions, and calibration



160kv Reflection Tube [FOV 500]

130kv Transmission Tube [FOV]

OnTheFly® CT

In contrast to conventional start & stop tomography, OnTheFly-CT Function continuously rotates the workpiece while voxel volume is being reconstructed. Patented method “Adds” images instead of amplifying to optimize Signal-to-Noise ratio. This Method reduces measurement times by up to 90% over conventional approach, while causing 0% reduction in scanning quality.

*Availiable on all XS machines

Maintenance Free

Reduce downtime and operating costs with our maintenance free mono-block tube.

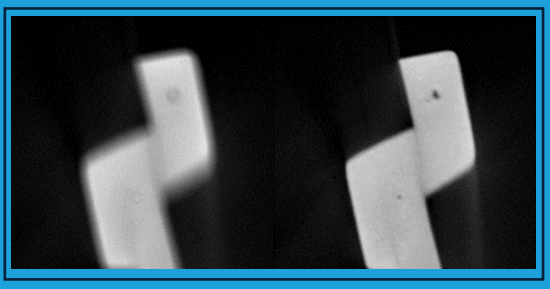
Measure Fast

No moving axes enable fast measurement with high resolution and power.

Compact Design

Save space with the incredibly small footprint and integrated controls.

Reflection tube VS Transmission tube



Measurement with similar power (80 Watt) and voxel size (24.8 µm)

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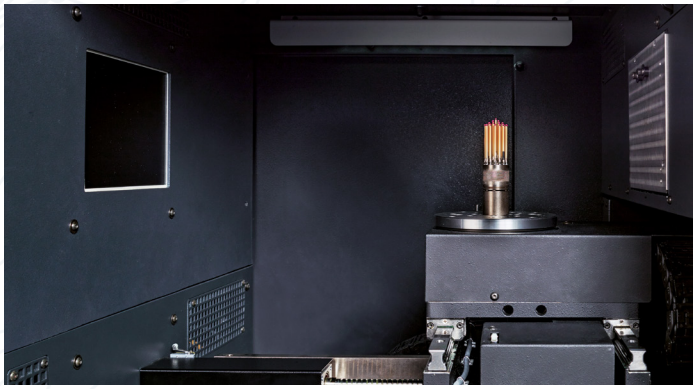
TomoScope® XS

The entry-level device in industrial computed tomography (CT) for highly accurate measurement of small workpieces

Specifications



X-ray Source

Tube Type	Open Monoblock
Target Options	Transmission Target
Max. Voltage	160kV (130kV)
Max. Power	80W

X-Ray Detector

Surface Area	65 x 53 mm² 223 x 185 mm²
Pixel Count	984 x 984 2800 x 2200
Center Distance	50-130 µm

Maximum Permissible Error [MPE]

Laboratory Conditions	P: 4.5 µm E: (4.5 + L/75) µm SD[3)]: (3.5 + L/100) µm
Standard Conditions	P: 7.5 µm E: (7.5 + L/150) µm

L = measuring length in mm comparable to ISO 10360 and VDI/VDE 2617
See the Werth final testing guideline for more details

System

Width	51.2 in [1300 mm]
Depth	22.9 in [583 mm]
Height	53.9 in [1370 mm]
Weight	1940 lbs [880 kg]
Voltage	230 V (115 V) ±10%
Frequency	50 - 60 Hz
Power	2000 VA
Air Pressure	5.5 - 10 bar
Air Consumption	3000 Nl/h
Humidity	40% - 70%
Air Contamination	0.05 mg/m³
Tempurature	50 - 95 °F [10 - 35 °C]
Operating System	Microsoft Windows

Inspection

Max. Sample Weight	22 lbs [10 kg]
Max. Diameter “in the image”	Ø = 2.0 in [51 mm] to Ø = 7.0 in [177 mm]
Max. Length “in the image”	L = 1.8 in [45 mm] to L = 5.9 in [149 mm]
Max. Diameter Raster	Ø = 3.8 in [97 mm] to Ø = 10.9 in [205 mm]
Max. Length Raster	L = 1.8 in [45 mm] to L = 5.9 in [149 mm]
Max. Distance Source to Detector	19.7 in [500mm]

Specifications vary depending on machine configurations, operating conditions, and calibration

160kv Open Monoblock Transmission Tube *

Benefits of Werth transmission tube -

- Open monoblock design allows tube components to be service/replaced
- Reliable tube technology & longlife components provides 12 months of maintenance free filament, signifi-cantly reduces operating cost
- Max resolution @ 2 µm*
  *Subject to usage

Added air bearing rotary axis allows moving the workpiece closer to the X-ray tube, providing higher resolution scans.

High Precision

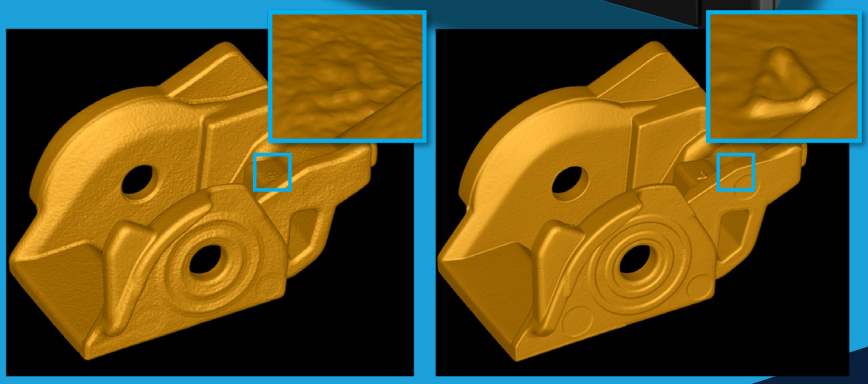
Extremely precise air bearing rotary axis for low measurement uncertainty.

Fast Measurements

Measure faster with OnTheFly and high resolution via transmission tube.

Compact Design

Save space with the incredibly small footprint and integrated controls.



Reflection Tube Vs. Transmission Tube

Transmission tube can scan up to 5 times faster with higher structural resolution in comparison to reflection tubes

TomoScope® XS Plus

Industrial computed tomography (CT) for measurements of medium-sized workpieces

Specifications

X-ray Source

Tube Type	Open Monoblock
Target Options	Transmission Target
Max. Voltage	200 kV [160kV] [130kV]
Max. Power	80W

X-Ray Detector

Surface Area	60 x 57.5 mm^2 233 x 190 mm^2
Pixel Count	984 x 1024 2800 x 2304

Maximum Permissible Error [MPE]

Laboratory Conditions	P: 4.5 µm E: (4.5 + L/75) µm SD[3]: (4 + L/100) µm
Standard Conditions	P: 7.5 µm E: (7.5 + L/[1]50) µm

L = measuring length in mm comparable to ISO 10360 and VDI/VDE 2617
See the Werth final testing guideline for more details

System

Width	59.6 in [1515 mm]
Depth	32.7 in [830 mm]
Height	58.5 in [1485 mm]
Weight	3087 lbs [1400 kg]
Voltage	230 V (115 V) ±10%
Frequency	50 - 60 Hz
Power	2000 VA
Air Pressure	5.5 - 10 bar
Air Consumption	3000 Nl/h
Humidity	40% - 70%
Air Contamination	0.05 mg/m^3
Tempurature	50 - 95 °F [10 - 35 °C]
Operating System	Microsoft Windows

Inspection

Max. Sample Weight	22 lbs [10 kg]
Max. Diameter “in the image”	Ø = 2.0 in [50 mm] to Ø = 7.0 in [177 mm]
Max. Length “in the image”	L = 1.9 in [48 mm] to L = 6.3 in [161 mm]
Max. Diameter Raster	Ø = 3.7 in [95 mm] to Ø = 11.4 in [289 mm]
Max. Length Raster	L = 13.5 in [343 mm] to L = 18.0 in [456 mm]
Max. Distance Source to Detector	19.7 in [500mm]

Specifications vary depending on machine configurations, operating conditions, and calibration

200kv Open Monoblock Transmission Tube *

The integration of a workpiece changing system enables the automatic feeding of several workpieces within the measuring volume. Simply load all workpieces in one setting, and no additional radiation protection are required and it provides a cost-effective alternative to robot loading.

High Precision

Extremely precise air bearing rotary axis for low measurement uncertainty.

Fast Measurements

Measure faster with OnTheFly and high resolution via transmission tube.

Compact Design

Save space with the incredibly small footprint and integrated controls.

A major upgrade from the TomoScope XS, TomoScope XS Plus offers the same characteristics but with double the measuring range because of moveable X and Y axes (Raster-Tomography in horizontal and vertical direction). Unlike traditional image stitching, Werth patented RasterScanning captures X-ray images of various workpiece areas sequentially, and the workpiece volume is reconstructed from the images at various rotational positions. The patented sub-voxeling process is used to calculate the measurement points at the material transitions. This process allows larger workpieces of up to 450 mm in length to be measured. Alternatively, smaller objects can be captured at high resolution individually or multiple objects simultaneously with reduced measurement time. The measurement result provides complete workpiece volumes at almost any desired resolution in all coordinate axes (up to 60 billion voxels).

Also with the capability of equipping a 200kv transmission tube, the TomoScope XS plus is able to capture denser, wider materials.

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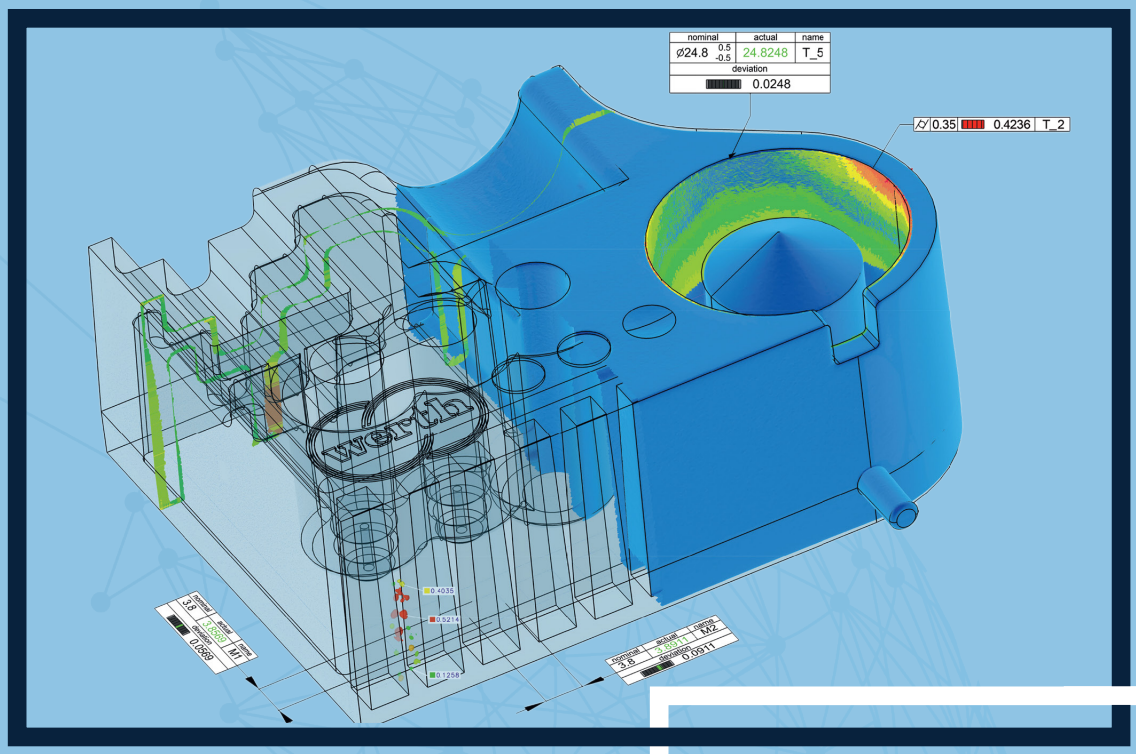
TomoScope® XS machines are lightweight and maneuverable, you can even transport them by passenger elevator.

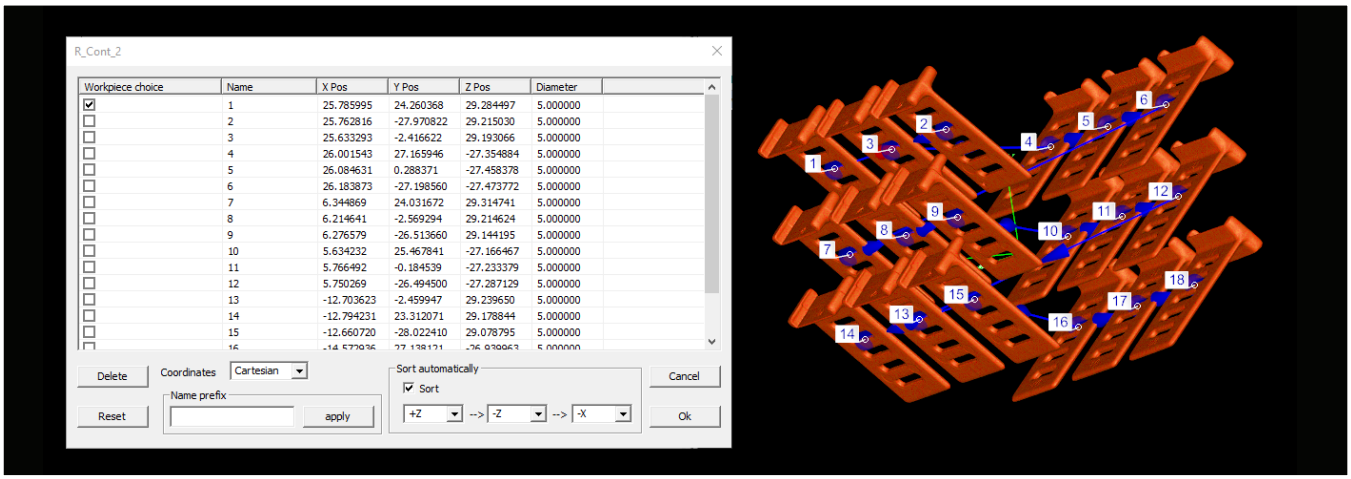


One software for ALL

Fully customizable modular software structure, so you only pay for what you need.

With 40+ years of experience, WinWerth® is probably the most powerful, and only coordinate measuring software that combines all functions for controlling coordinate measuring machines with optical and tactile sensors, as well as computed tomography and the corresponding data evaluation. For example, CAD models, voxel volumes, point clouds, measurement and calculation elements, geometrical characteristics, color-coded deviation plots and video images can be displayed in several views simultaneously. Measurements can be made on volume sections with the image processing software; layers of any thickness can also be displayed and, for example, bond wires can be measured. The transfer functions, e.g. for spreading certain grey scale ranges for a more detailed representation, can be saved and called up again. All functions are also available for CNC measurement sequences.

Also, for CT/X-ray measurement evaluations, there are new functions such as 3D wall thickness measurement and automatic burr detection with color-coded deviation plot and analysis markers. Missing features in an assembly can also be automatically identified by comparison with a master part STL or CAD model.

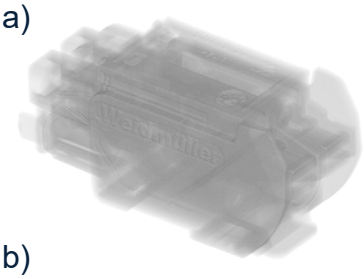


Multiple parts measurement & automated workpiece separation

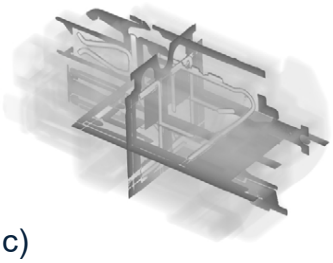
WinWerth® enables coordinate measuring machines with X-ray tomography to measure several workpieces simultaneously in one shot, so that the measuring time per workpiece is greatly reduced to just a few seconds.

- Automatic separation of the total measuring point cloud into individual measuring point clouds using the “workpiece separation” software function. The workpiece separation can also be processed in offline stations.
- The automatic assignment of small objects such as voids or chips to the respective workpiece significantly improves non-dimensional inspection tasks.
- In the overview display of the 3D graphic and in the measurement report, the status of the individual workpieces can be seen at a glance by means of the color marking.
- Combining several workpieces into a group enables the evaluation of workpieces or groups of workpieces.

a)

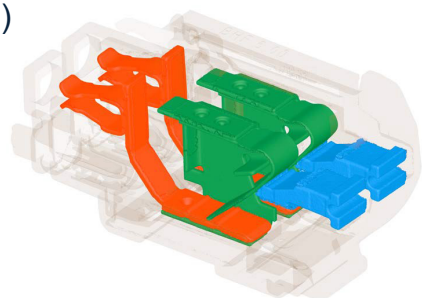


b)



c)

d)



a) Volume of a connector
b) Volume sections
c) Point cloud of the plastic enclosure
d) Point clouds of the different metal components

MultiMaterialScan

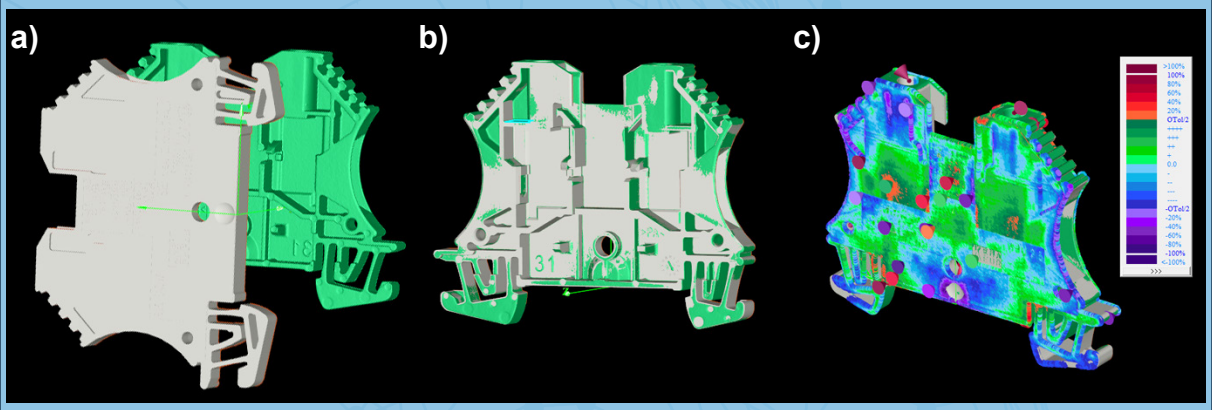
The WinWerth® MultiMaterialScan enables automatic, sub-voxel accurate calculation of separate STL point clouds per material from CT volume data, for example for plastic and metal components of connectors.

Conventional algorithms allow automatic and sufficiently accurate determination of surface points without prior information about the workpiece (e.g., CAD model or STL point cloud of a master part) only for measuring objects made of one material. With the new WinWerth® MultiMaterialScan, a separate measuring point cloud is now automatically calculated for each material, even for measuring objects consisting of several materials that attenuate very differently. Typical applications are, for example, plastic-molded assemblies such as connectors or pump heads with corresponding integrated metallic components.

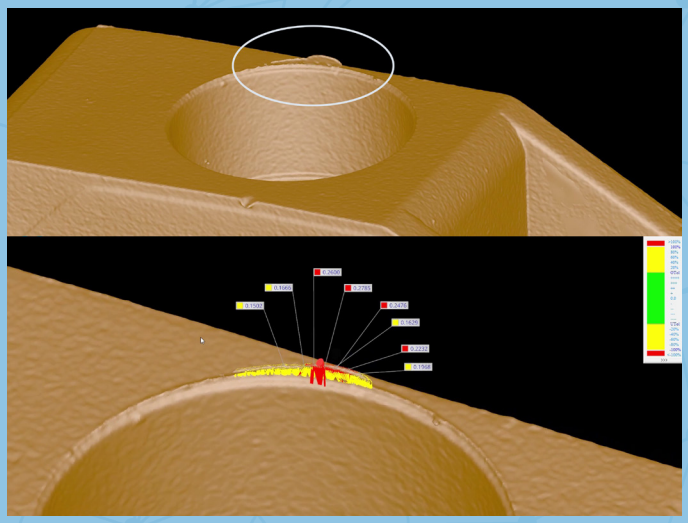
The materials to be considered by the algorithm can be defined by the operator through simply setting measurement windows in the volume section. The gray values contained in the measurement windows are automatically assigned to the respective material. This assignment can be tested and, if necessary, adjusted by means of a preview with colored marking of the materials.

Measurement with CAD data

In order to illustrate the deviation of the workpiece geometry from the nominal values, a comparison to the CAD model with a color-coded display of the deviations is available in WinWerth®. This procedure is absolutely necessary for the inspection of free-form surfaces. For measurement, the area of interest is scanned or captured as a point cloud. WinWerth® then compares the measured values with the CAD model. The result is documented in each case by vectorial or color-coded representation of the deviations to the CAD model. This evaluation can be carried out as part of the measurement sequence on the machine or in offline mode at a separate evaluation station. The colors of the measurement points illustrate the deviation between target and actual.



a): Unaligned STL(Green) and CAD(Gray); b): Fitted STL and CAD; c): Comparison to CAD with color-coded deviation.



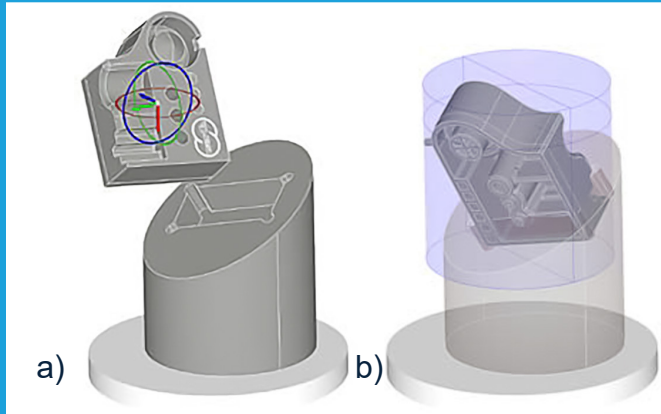
Automatic Burr Detection

In addition to Measurement with CAD Data, another special CAD model feature of WinWerth® is the automatic detection and measurement of burrs or chips during the measurement sequence. The example photo to the left, is a color-coded deviation plot of the burr and the maximum burr length. The deviation display optionally shows only those points where the burr length exceeds the tolerance limits. The burr length along the entire burr can also be displayed numerically via analysis markers. For example, every 0.5 mm a flag is set that contains the maximum local burr length.

Simulation of the tomography process with WinWerth® TomoSim

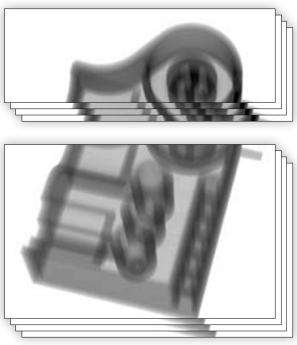
Until now, teaching volume-based evaluations was not possible without a real test measurement. With TomoSim, it is for the first time possible to simulate the tomography process offline in a coordinate measuring software using CAD data or a point cloud in STL format. The realistic simulation taking into account the set CT parameters enables the calculation of a volume including all essential artifacts. For example, a first article inspection program can be taught in parallel with the production of the first workpiece and the performance of other measurements on the machine using the WinWerth® measurement software at an offline workstation. TomoSim thus enables process acceleration and a reduction of downtimes, e.g., for TomoScope® machines in multi-shift operation.

In addition to a completed program creation and feasibility check in time for the completion of the first workpiece, the simulation of the tomography process allows testing and optimization of CT parameters. With the help of the simulated volume, significant artifacts, e.g., due to beam hardening or too few rotation steps, can be detected and, if necessary, an appropriate artifact correction can be selected. Also new is the complete offline programming of volume-based evaluations such as burr detection, void analysis, porosity analysis, text recognition, SurfaceScan Predefined or in volume sections.



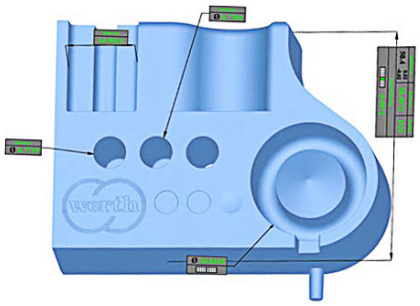
Representation of the rotary table with workpiece holder and workpiece a) as well as measuring range cylinder with Raster Tomography b), simulated by TomoSim

A simulation based on the CAD models or STL point clouds and the workpiece material is also possible for multiple measurements and the simultaneous measurement of different workpieces. The operation corresponds to that of a real measuring process. You select magnification, if necessary special measuring methods like the patented Multi-ROI-CT, and the CT parameters. After starting the simulation, the acquisition of the image stack is simulated and, as in a real measuring process, the volume is reconstructed in parallel.



Simulated intensity images in both raster positions

Volume with and without artifacts



Point cloud from corrected volume with dimensional evaluation

Computed tomography displaces conventional coordinate measuring machines

Until five years ago, accurate coordinate measuring machines with computed tomography were only available in the upper price segment. The compact machines of the TomoScope® XS family offer CT technology with high performance, high accuracy and at the price of tactile or multisensor coordinate measuring machines.

Before 2017, compact CT machines were only available with reflection target tubes in a closed design. Their large focal spot limited resolution and accuracy due to geometric blurring. Although the machines were relatively inexpensive, they incurred high maintenance costs. The limitation to acceptable focal spot sizes which were only achieved when the machine was operated at very low power, resulted in high exposure and thus measurement times. Standard-compliant specifications for assessing performance and for comparison with other machines were often lacking.

For large machines, transmission target tubes with up to 300 kV tube voltage enabled high resolution and accuracy. However, they were expensive to purchase and maintain, and because of their size and weight they were mainly used in specially designed measuring rooms.

Werth received many inquiries from customers who found the CT technology highly interesting, but could not economically justify the investment due to the high prices. This fact motivated the Werth development team to think in new directions. The prerequisite for the introduction of a new, more cost-effective machine was the new tube design that resulted from intensive development work. For the new TomoScope® XS, tube, generator and vacuum generation were combined in an open monoblock design. This design allows long maintenance intervals with a virtually unlimited service life, as spare and wear parts can be replaced during annual machine maintenance due to the open design. For the user, this results in short downtimes and low operating costs. Since the new machine has been equipped with a transmission tube, the focal spot size remains small even at high tube power. This is an important advantage of the TomoScope® XS, which thus allows fast measurements with high resolution.

The novel X-ray tube was combined with a compact and precise air-bearing rotary axis and a fast detector. In addition, small machine dimensions and a specification of the length measurement error in the lower micrometer range were crucial. Intelligent design solutions made it possible to offer the machine at about the same price level as conventional tactile or multisensor coordinate measuring machines.

Werth Inc.
8 Custom Drive
Old Saybrook, CT 06475
Phone: +1 (860) 399-2445
Email: sales@werthinc.com
www.werthinc.com

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