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The right technology for every measuring task

3D measurement service with multisensor technology and computed tomography

Werth Messtechnik GmbH

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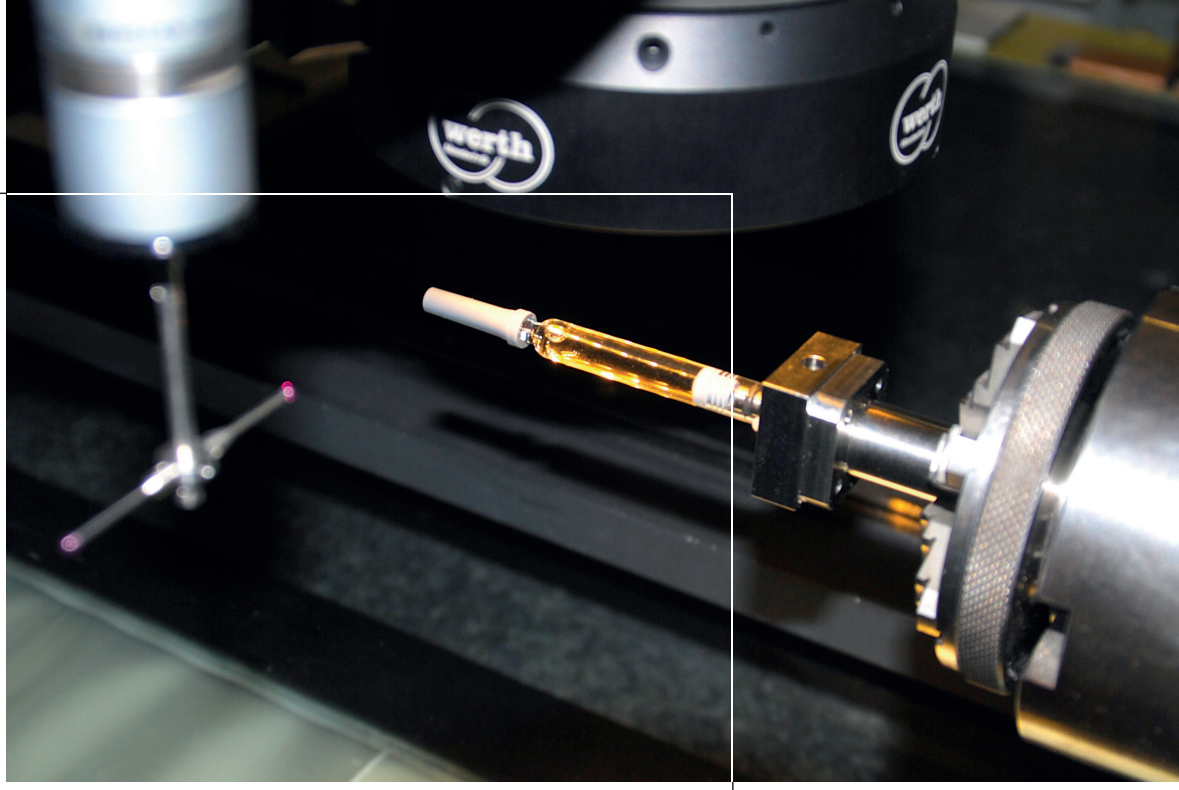

At Scopecheck FB DZ, after tactile 3D alignment, the position of the stopper, the markings, and the shoulder of the syringe are measured with the image processing sensor Image: Messtronik

3D measurement service with multisensor technology and computed tomography

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"As a measurement service provider, we have to deliver accurate and reproducible results in a short time," says Jörg Weißer, President of Messtronik. "Ideally, with a complete report on the functionality of the workpiece, in which problem areas are already marked. Many customers turn to us time and again. In such cases, we have all the data in view to solve problems and keep the processes running."

Until a few years ago, the measurement service provider from St. Georgen used manual measuring equipment in addition to measuring instruments with optics, probes, and computed tomography (CT). Today, the requirements have increased immensely due to area-based measuring with computer-aided evaluation. Weißer and his brother are keeping up with the times, making home office workplaces possible and have only hired engineers in recent years: "Due to increasing standardization, requirements are changing rapidly. Unfortunately, when creating the drawing, the designer usually does not take the later measurement into account, so that the measurement technician very often has to think in terms of the entire process and is forced to keep his knowledge up to date."

As early as 1986, company founder (and father of the Weißer brothers) Gerd Weißer, purchased a measuring projector Optimus G, their first machine from Werth Messtechnik. Later, a Scopecheck MB was added as a 3D coordinate measuring machine with image processing and conventional probe. For example, injection molding workpieces with many small details or gears with module 0.08 are measured optically.

For Jörg Weißer, the Werth fiber probe is an alternative for micro gears, which are too small for conventional tactile sensors: "Really, a great product. The future means even more speed and accuracy – and the workpieces will be even smaller. Unfortunately, we don't have one yet, but we definitely will." First, the Werth Zoom with Multiring, also patented, was retrofitted to measure workpieces with edge transitions that are difficult to detect. In combination with the variable working distance, the angle-adjustable 8-segment ring light enables defined shadow formation for reliable measurement of uncooperative workpieces.

However, for the complete optical measurement of injection molded parts, different clampings are usually required; or a probe is additionally used if only a few geometric properties can be determined. Injection burr dimensions are also often in demand, because only a few micrometers decide whether a hose connection, for example, becomes tight or not. Here, resolution is the top priority and a stylus tip with a diameter of 5 mm cannot be used. Messtronik has a wide range of tactile sensors with stylus tip diameters from 0.3 mm to 26 mm. Small styli are critical in the application and therefore wear products, and some orders consume two or three.

Products of the machining industry are also measured tactilely. "Undercuts and grooves are inaccessible to many sensors, but if they were made with cutting tools, they can also be reached by conventional touch probes," says Weißer. "The disadvantage of tactile measurements is the time required, both for creating the measuring program and for the measurement itself."

Efficiency through multi-sensor technology

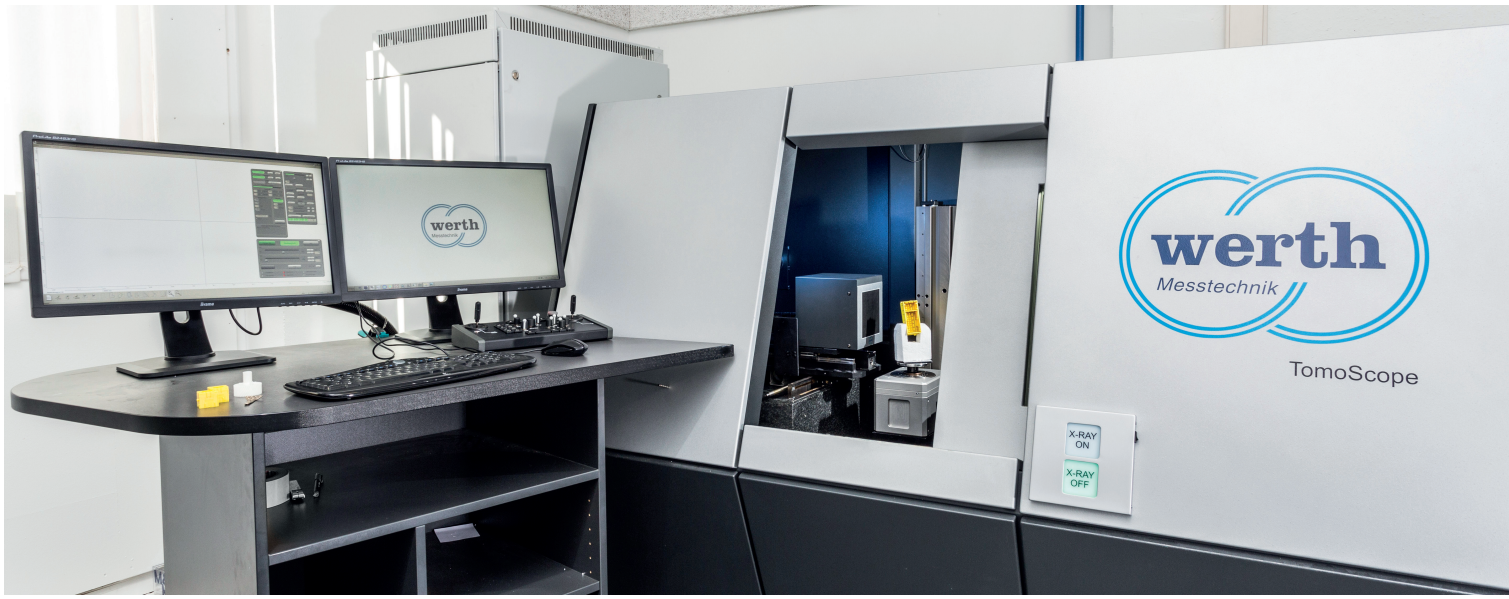
With the increasing demands of technology, the number of pure 2D workpieces is decreasing. The trend is toward greater integration, with more and more functions being mapped in one workpiece. The production machines are correspondingly complex. "In the past, different employees manufactured the workpiece in several work steps. Today, it is clamped on a 5-axis machine that takes over all the work steps," explains Weißer. "The measuring technology has to react to this, for example with multisensor coordinate measuring machines with which the workpiece can be completely measured without reclamping."

The Scopecheck MB is equipped with a rotary axis, so that even rotationally symmetrical workpieces such as shafts or flanges can be measured with multisensor technology. When selecting the sensor technology, the type of geometry must be taken into account precisely. For example, the probe is needed to measure axial runout. If different sensors achieve the accuracy required for the workpiece tolerances, the fastest one is usually chosen. On flanges, for example, the screw holes are measured with the image processing sensor. Sometimes, however, a lower measuring speed must be accepted in favor of process reliability. Weißer specifies: "In addition to the technology, our expert knowledge is also in demand. This begins with the measurement of diameters: A circular measurement alone usually does not say much and is not viable. The condition of the workpiece is only recorded after alignment with the appropriate measuring strategy."

Today, the workpieces are to be recorded over an area, individual measuring points are no longer sufficient. If, for example, the position of the metal pins on assembled connectors has to be measured in relation to the contact surface, preferably with graphic display, a multi-point measurement with optical sensors or CT is necessary. In the future, this will enable the most complete raw data possible to be recorded, which will only be evaluated if necessary. In the event of an error, the raw data can be used to show that everything was fine at the time the product was sold. An alternative for area-based optical measurements is the highly accurate Chromatic Focus Line Sensor (CFL), which measures largely independent of the surface due to the chromatic measuring principle. Therefore, the workpiece preparation that is usually necessary for alternative methods can be omitted. In the case of large surfaces, however, the more precise measurement takes more time due to the relatively small field of view of the sensor.

When it comes to the complete detection of the workpiece, computed tomography goes one step further: Due to the ability of X-rays to penetrate matter, a complete volume model of the workpiece including internal geometries can be calculated. For this purpose, the workpiece is rotated between the X-ray source and the detector and radiographic images are recorded in different rotational positions. Weißer looked at computer tomographs at the Control exhibition at an early stage, but for a long time his question about the measurement data was only answered that the machines were used exclusively for image acquisition and analysis. He remembers: "In 2005, the Werth Tomoscope 200 came along, and at that time I was not yet familiar with coordinate measuring technology with CT. But I knew that Werth produced the best equipment, so I invested. In retrospect, I should have purchased additional machines earlier."

The rapid progress in the CT field makes rapid adaptation necessary. In 2011 Jörg Weißer replaced the Tomoscope 200 with a current machine of the same series. In 2016 he then invested in a Tomoscope XL NC. This machine has a measuring range of 1200 mm x 700 mm and is equipped with a 300 kV X-ray source. The addition of a 450 kV X-ray source is planned. With such an X-ray tube whole car seats and engine blocks can be radiographed. "The Tomoscope XL NC is an investment in the future, the necessary size is available. Components such as a detector with higher resolution or a computer with greater computing power can be retrofitted according to the current state of the art," explains Weißer.



Messtronik uses several multisensor and computed tomography coordinate measuring machines from Werth, including the Tomoscope S CT machine. Image: Messtronik

Fast measurements with On-The-Fly-CT

Messtronik works a lot with CT. The operation is simple: Only a few parameters have to be selected and you don't need to think long about alignment and measurement strategy. With the new On-The-Fly CT, fast measurements are also possible, as dead times for positioning the workpiece are saved by continuously rotating the rotary axis. In addition, several workpieces can be measured simultaneously. The desired geometric properties are later determined offline at a workstation remote from the machine.

"Up until now, only parts of the workpiece were measured and from this the condition of the entire workpiece was deduced. The result of a CT measurement, on the other hand, is a complete point cloud of the workpiece that will be available for further evaluation in the future," adds Weißer. "However, high-resolution measurements of many small details result in a very large amount of data, so we use conventional sensors in such cases."

A typical application of this sensor is injection molding. Some companies use the same tools for this around the clock, which are only parked once a year for cleaning. To test their stability, samples of the manufactured components are taken every two hours. At Messtronik, several hundred such workpieces are often measured.

In addition to his employees and the equipment, Weißer also relies on the measuring software to open up new areas of application. For injection molding and additive manufacturing, Winwerth Formcorrect determines the exact workpiece geometry by largely automatic correction of the CAD model. The high density of measuring points from the CT measurement enables a high resolution of the correction, and with the precision and the feedback accuracy of the measurement results, good product quality is achieved. Jörg Weißer: "In the future, we will supply not only the measurement report but also the measuring point cloud of the workpiece and the corrected CAD model. The Werth machines have confirmed my principle of only buying the best." ■

Web Note

For more details *on Messtronik's use of the TomoScope XL NC, watch this Video: www.messtronik.de/sensor*