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COVER STORY

Highly Accurate Quality Assurance

Werth Multisensor Machine Used for Electromobility and Transmission Parts at VW

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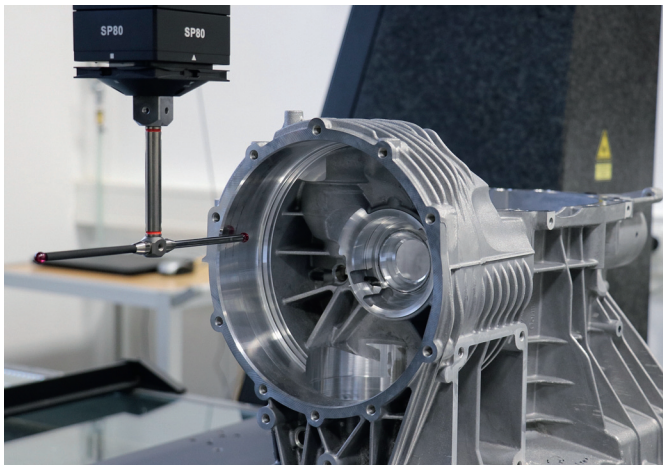
The increasing emergence of electromobility has led to an increased variety of measurement tasks in the pilot production center of the VW plant in Kassel. For two years now, measurement technicians have used a Video Check DZ HA 3D coordinate measuring machine from Werth to handle these requirements as efficiently as possible.

The core business of the Volkswagen plant in Kassel, Germany, which has around 16,000 employees, is transmission manufacturing. About one-third of the workforce is engaged in this field and ensures that over 15,000 transmissions per day, or about 3.7 million per year, in 16 different variants, are shipped throughout the company. Because this location is a lead plant for the transmission business segment, Volkswagen has a high level of development expertise here, along with a pilot production center where prototypes of newly developed transmissions are built.



The SP80 scanning measurement probe is ideally suited for plunging into a transmission housing and taking measurements there.

The project group that was intensively involved in the selection of the 3D multisensor coordinate measuring machine includes (from left) Normen Hitsch, Hans-Werner Scholz, Ulrich Schneider, Peter Rubik, Jens Kaul, and Markus Hartmann (right). With them is Werth Sales Manager Detlef Ferger (second from right), celebrating the successful project.

The Video Check DZ HA 3D coordinate measuring machine has since been proven effective at VW. With a specified maximum permissible error MPE E of (0.5 + L/600) µm, it is highly accurate. Its measuring volume of 1130 mm x 2000 mm x 800 mm and various optical and tactile sensors, which we can use on two independent Z-axes, cover a wide range of applications.

Images: Werth

The pilot production center is part of the transmission business segment, where production processes are devised for transmissions and for hybrid and electric drives. Metrology planner Ulrich Schneider is a member of this department. His area of responsibility includes all metrological equipment, needed for manufacturing transmissions for combustion and electric engines, from plug gages to coordinate measuring machines.

As automotive drive technology changes, the requirements for metrological equipment in the pilot production center have risen in recent years, as Schneider reports: „As E-mobility takes on an increasing role, we have had to expand our equipment so that our pilot production measurement lab stays up to date."

The lab falls within the purview of Normen Hitsch, who is the foreman responsible for the pilot production measurement lab. With his team of 15 employees, he takes on measurement tasks primarily for the development department, but also for production, quality assurance, and planning. "We mostly measure transmission components and elements for electric motors at this time. These workpieces vary greatly, from ball bearing components in the millimeter range to axles, shafts, rotor and stator punchings, and entire transmission housings."

This means that employees and equipment need a great deal of flexibility. To achieve this, VW is expanding the existing laboratory, adding a second lab, and investing in a large 3D multisensor coordinate measuring machine to add to the existing thirteen different measuring machines.

A project team consisting of Schneider as the planner, the measurement technicians on Hitsch's team, and a project manager for the structural building components, has been working on the appropriate selection since 2013. "Our specification defines the three main requirements: high precision, a large measuring volume, and the ability to use a variety of sensor systems," explains Schneider. "The details cover existing measurement tasks as well as future requirements to be met."

Multisensor measuring technology has been proven in practice many times at VW

The project team used that specification to request bids from measuring machine manufacturers around the world. This was followed by extensive analyses of the quotations, on-site tests with challenging workpieces, and finally a decision. "With this measuring machine from Werth Messtechnik in Giessen, Germany, we had filtered out the right one for us from the short list of six providers," says Hitsch confidently. "The Video Check DZ HA 3D coordinate measuring machine that we installed in 2015 has proven itself many times over."

With a specified maximum permissible error MPE E of (0.5 + L/600) µm, it is highly accurate. Its measuring volume of 1130 mm x 2000 mm x 800 mm and various optical and tactile sensors, which can be used on two independent Z-axes, cover a greater range of applications than ever before. It is also possible to retrofit a third ram, if needed, in order to incorporate even more measurement options with additional sensors.

Currently four employees run the machine in doubles in a shift operation. Quality inspector Hans-Werner Scholz reports: “Traditional measurement, like we were familiar with on turned and machined parts, has changed with the new components for electromobility. We developed new measurement strategies in internal workshops as to how we can best capture the dimensions of stator and rotor packets, for example.”

Scholz and his three colleagues Markus Hartmann, Peter Rubik, and Jens Kaul—all quality inspectors certified by AUKOM (German apprenticeship program for metrologists)—appreciate the multisensor systems of the Video Check machine. They apply optical and tactile sensors as needed. They use the traditional image processing optical sensor , for example, to measure stator and rotor punchings and other flat workpieces, such as sealing rings, clutch plates, and other electronic components with high accuracy and without contact, using transmitted and incident light.

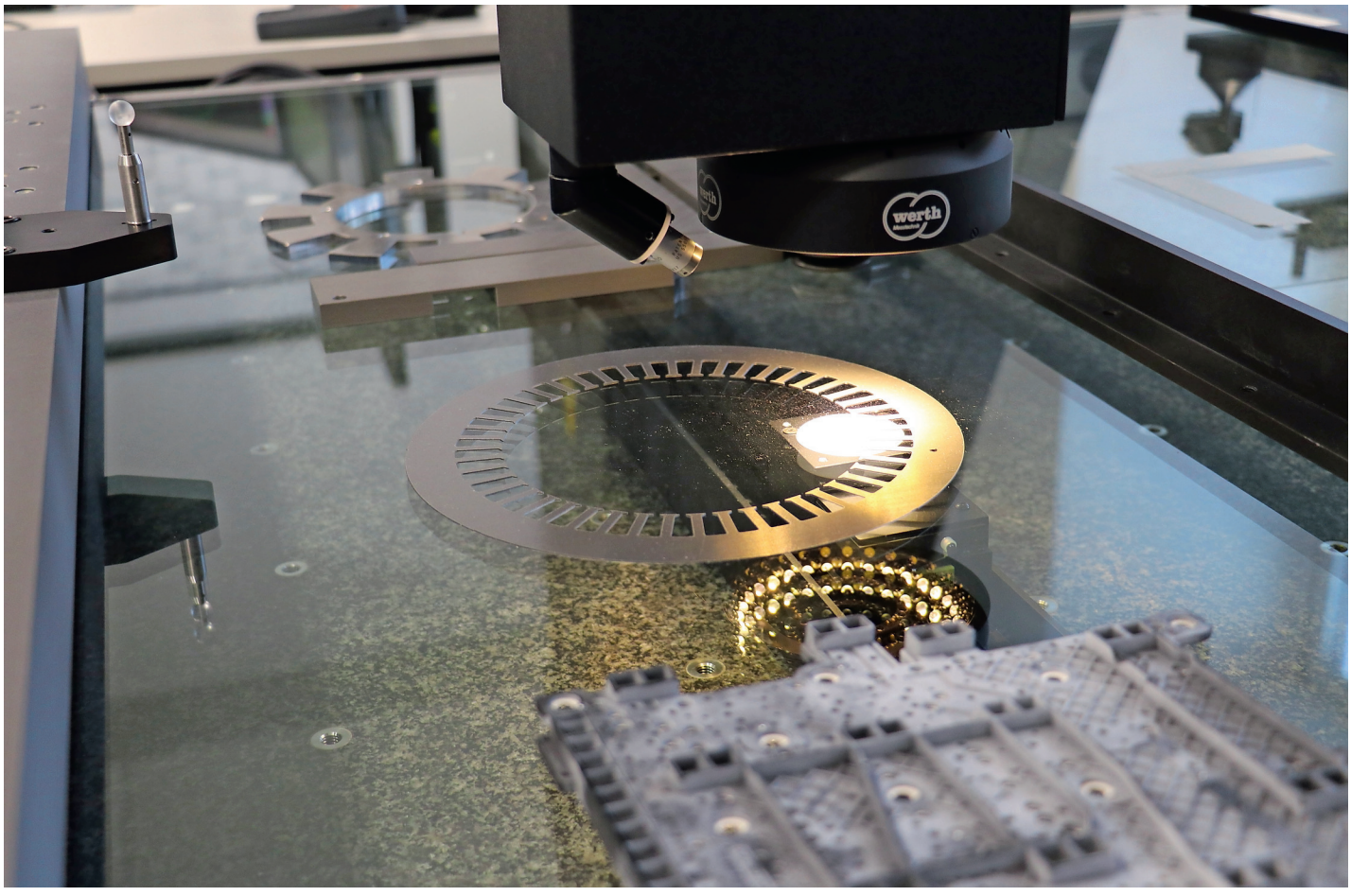
Another optical sensor that is available is the Werth Laser Probe (WLP), which they use to scan the workpiece surface. This can be used to measure workpiece flatness very quickly. “We can capture the waviness of steel plates for clutch modules,” explains Scholz, “and we are much faster than if we were to use tactile sensors.“ The WLP runs at a higher speed and greater point density than the tactile alternatives, with nearly the same accuracy.

Micro-stylus for ball bearing features that are difficult to access

The measurement technicians often use the patented Werth Fiber Probe (WFP) as well, which is considered a tactile-optical sensor. It consists of a glass fiber that can have a probe sphere with a diameter as small as 20 µm mounted on its end. Unlike a tactile measurement, the deflection is not transmitted to the machine electronics via the stylus. Instead, the position of the probe sphere is captured optically by the image processing sensor itself.

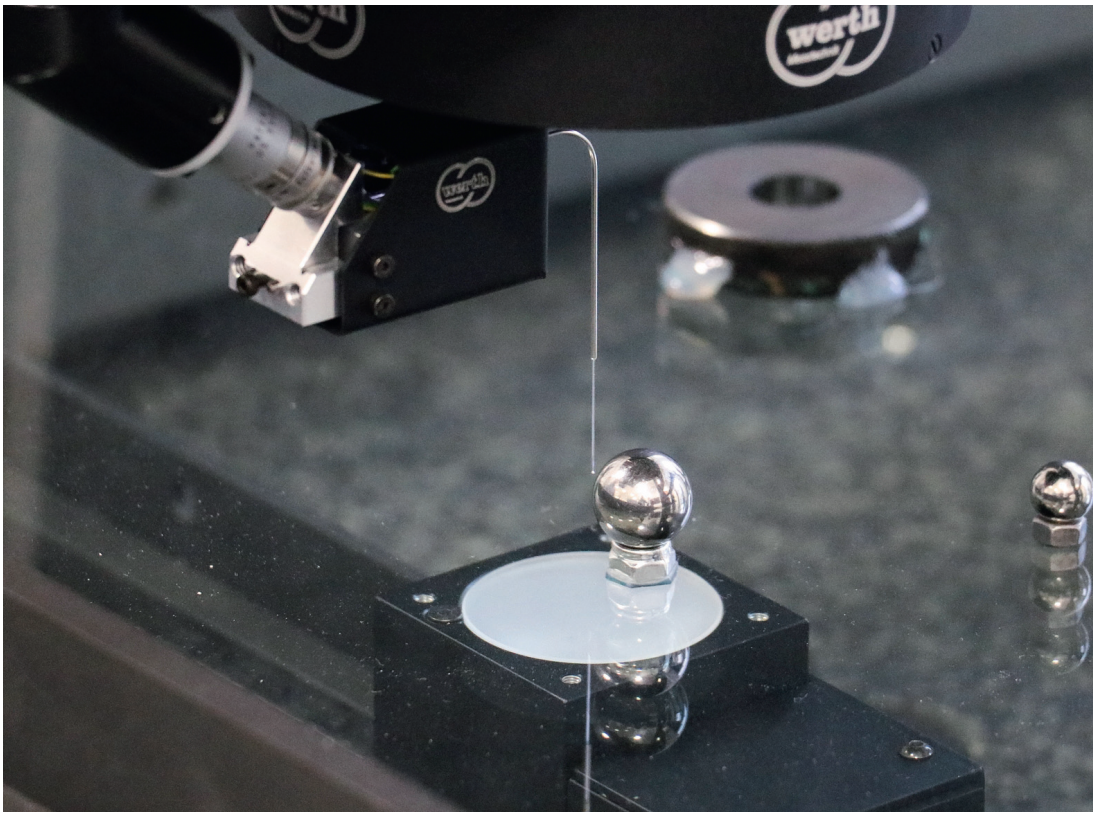
This makes the fiber probe extremely accurate as well as easy to use. The user can track the position of the probe sphere on the monitor, so it can easily be positioned at the desired measurement point. The team uses the WFP in the pilot production laboratory to measure steel balls from a supplier’s ball bearing. Quality inspector Scholz explains: “A single ball bearing is very difficult to clamp in a fixture. This is not even necessary for a fiber probe

The image processing sensor is used to measure stator punchings, rotor punchings, and contact plates, among other products.



measurement, as it is essentially a non-contact procedure, and the ball will not roll away."
The large machine is also used to measure very small workpieces. Due to its extremely delicate structure, the fiber probe is used for many other workpieces that cannot be measured with a purely tactile sensor due to holes that are too small and too deep, or small slots on engine assemblies.
The patented Werth Contour Probe (WCP) for measuring profiles and roughness also functions on a tactile-optical basis. "Because it actually contacts the workpiece with its tip, we do not use it for soft materials such as rubber, but rather for roughness measurements on non-machined surfaces such as forgings," says Scholz.

in his view, the investment has already paid off with the improvements that have been achieved. "For some measurement tasks, such as the ball bearings, we never had a solution. Other measurements were possible, but they were only manual and therefore not very reproducible. Large workpieces did not fit on our previous coordinate measuring machine. The measured objects often had to be destroyed in order to be able to measure the interesting areas. These problems are now solved with the new 3D multisensor measuring machine, and we are well equipped for future measurement tasks as well."
Ulrich Schneider adds: "Multisensor systems qualify our machine not only for a variety of different components,



The team uses the WFP Werth Fiber Probe in the pilot production laboratory to inspect steel balls from a supplier's ball bearing.

Scanning probe SP80 can reach deeply buried measurement points in a workpiece

The optical sensors are complemented by two conventional tactile measurement systems. The SP80 scanning probe can reach measurement points that are deeply buried in a workpiece, because it can mount very long stylus inserts that are ideal for plunging into a transmission housing, for example, and taking measurements there. With the SP25, the Werth Video Check also has a stylus that can rotate and tilt at 7.5° intervals and can measure positions that are difficult to access, such as undercuts and lateral holes.
For foreman Normen Hitsch, the newest 3D coordinate measuring machine not only offers future potential, but but also for complex measurement tasks. For the encoder wheel of an electric motor, for example, we use several sensors in parallel: the laser as a surface sensor for flatness, the image processing sensor for the wings mounted on the workpiece, and the fiber probe for a very small, narrow groove."
The metrology planner points out that the measurement lab team has a very close working relationship with Werth. Discussions are held at regular intervals to promote future topics in the interest of both parties. "This is another very positive aspect of working together with Werth." ■

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