

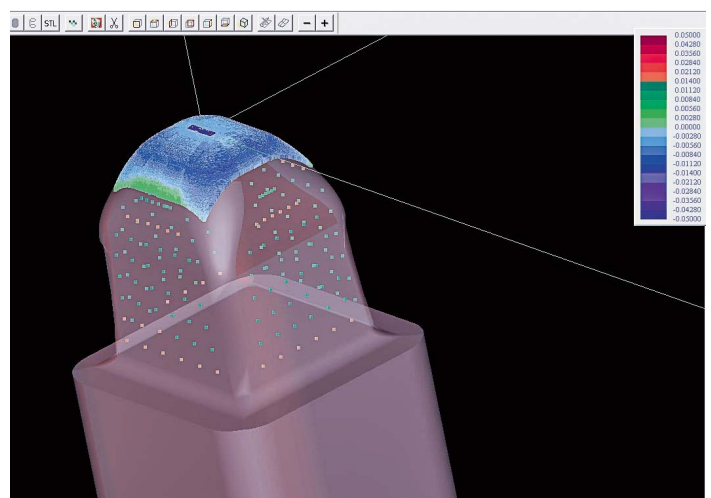
Multisensors in Quality Assurance at Kleiner Stanztechnik

When Optical Sensors Work Hand in Hand

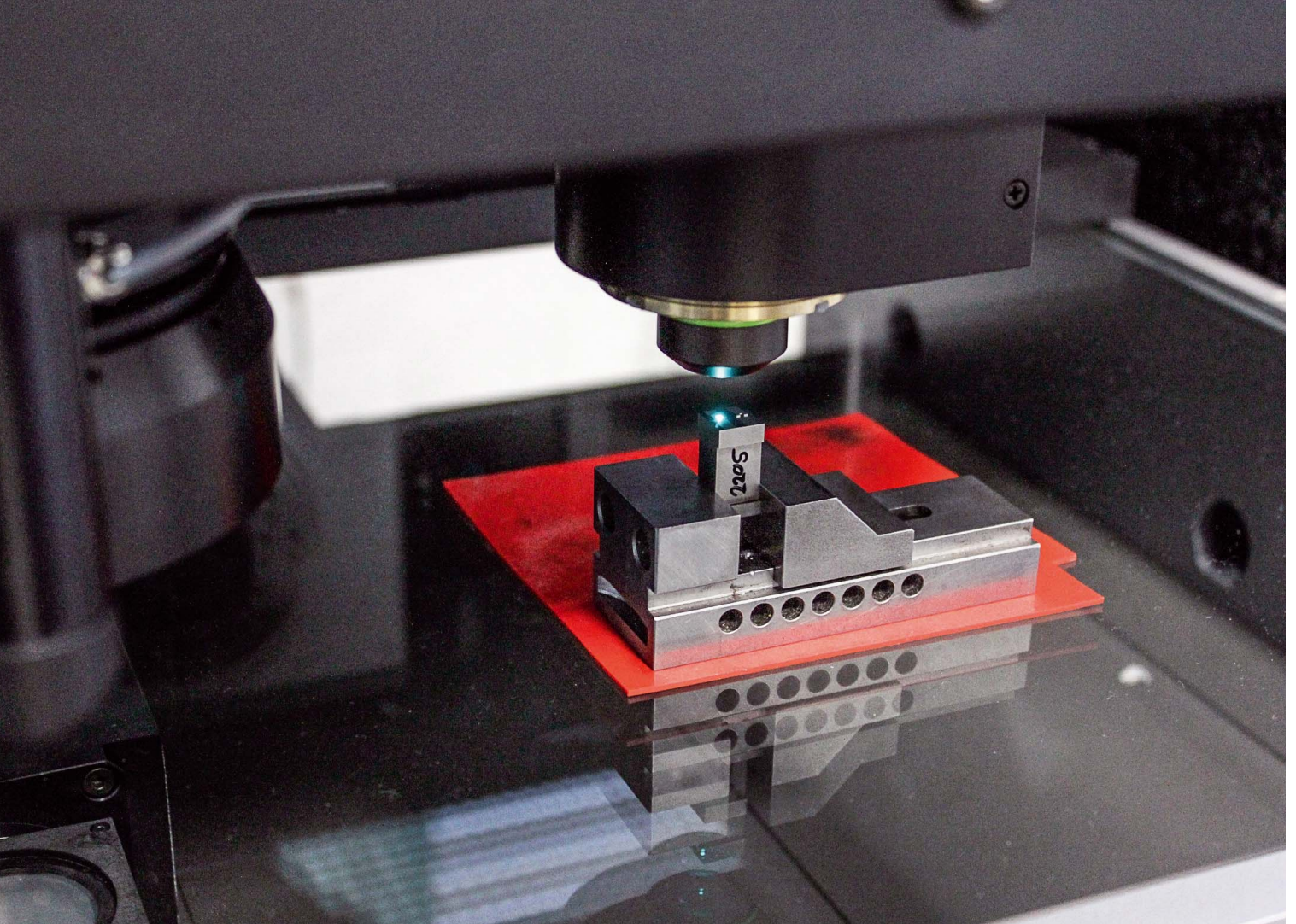
Kleiner Stanztechnik designs and manufactures their own tools that they need to produce precision stamped parts. This makes a significant difference in the quality of the components produced. The high precision Werth Video Check HA multisensor measuring machine—using different optical sensors selected to match the measurement task—provides precise measurement results for the three-dimensional shape of the tools and components.

Microstamped components, springs, snap panels and even populated stamped mesh parts - Kleiner GmbH, headquartered in Pforzheim, specializes in these precision stamped components which are used in many industries such as automotive, plastics, electrical, medical and electronics. The company orients itself to the needs of its customers with the motto: „Quality is what the customer wants.“ Because the quality of manufactured components is largely determined by the precision of the tooling and because quality does not happen by chance, the certified punched component specialist has set up a high performance tool shop and advance quality planning.

Jürgen Fässler has been part of the advance quality planning team since 2006. In addition to an education as a toolmaker, he collected over 20 years of wide-ranging experience in metrology and test engineering. He explains: „We serve as an interface between quality assurance and the departments that are in contact with customers. My duties include supporting quality related issues for new projects from customer coordination to series producti-



The embossing die is later measured using the Nano Focus Probe. The results are shown as color code deviations from the CAD model.



on launch.“ This also includes planning, designing, and selecting measurement and testing equipment.

He is particularly keen on this task when it affects the tool shop. Metrology plays a critical role there, as he explains: „We want to detect any deviations from the specifications as early as possible, and not just once the tool is online and ready to be run. Therefore, we check the shape of electrode, punch and die inserts very carefully while they are being manufactured.“

This is exactly the reason why Kleiner invested in a high precision 3D multisensor measuring machine.

Multisensor Technology for Complex Three Dimensional Measurement Tasks

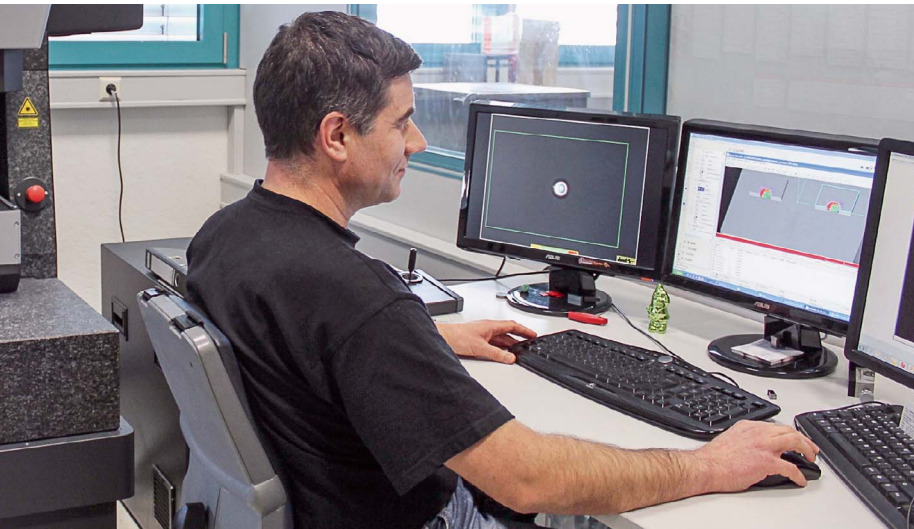
The responsible team searched over a year for a suitable solution, had test measurements made, performed analyses and compared various models in terms of flexibility, precision, and operator interface software. „At Werth Messtechnik we finally found what we needed for our tasks in the tool shop with the VideoCheck HA 3D multisensor coordinate measuring machine. Above all, the precision and variety of sensors that can be used make it possible to perform our often complex three dimensional measurement tasks flexibly,“ Fässler explains. „We find the optical Nano Focus Probe NFP and Werth Fiber Probe WFP, which work hand in hand, to be especially useful. They make it possible to very carefully measure three dimensional surfaces of small punches, dies and die inserts as well as EDM electrodes in a single process step within a short time. Sensors offered by other providers cannot keep up.“

Proven Partnership with Werth Messtechnik

The employees at Kleiner have long been familiar with Werth measuring machines. They are still very satisfied with their first measuring machine, a Werth Inspector, purchased in the 1990s. The OS department, which now has twelve employees, has therefore purchased additional Werth measuring machines over the years for measuring and inspecting components and tools. That includes a FlatScope, a ScopeCheck and two VideoCheck machines.

The new VideoCheck HA 400, with a measurement range of 400 mm x 400 mm x 200 mm, is located in the tool shop. The tolerances on tools and tool components are in the micron range; on the stamped components they are in the range of hundredths of millimeters. The precision of measurement (expressed as the measuring uncertainty) should always be an order of magnitude—but at least a factor of five—better than the feature's tolerance. To follow this rule and therefore provide meaningful measurement results to the manufacturing or development departments for corrective actions, Kleiner decided on the High Accuracy (HA) version of the Werth VideoCheck. It has a stable mechanical design made of granite with special air bearings, extremely high resolution scales, and design measures to prevent hysteresis. This allows measurement results with an uncertainty of less than one micron, with reproducibility of a few tenths of a micron. The measurement technicians at Kleiner decided on a package of various sensors to equip the machine. They chose the image processing sensor with integrated laser sensor as well as the Nano Focus Probe, NFP,

Measuring an embossing die with a Nano Focus Probe



Measurement technician Adrian Kaubert at work

and the patented Werth Fiber Probe, WFP. An additional rotary axis allows the workpiece to be rotated to any position.

Copper electrodes, punches, dies, embossing dies and inserts

The new high precision 3D metrology at Kleiner helps to optimize the quality of tools and production components.

Measuring and checking copper electrodes that are produced by high speed milling requires 20% of the capacity. They are used in the next process step, die sinking, to make the contours and impressions in carbide punches and die inserts. „We determine the dimensions of the additional material needed on the electrodes to set the cutting clearance during the die sinking process. The results are used in the die sinking step to determine the electrode position and deflection, so that the eroded shape fits when it is complete,“ explains measurement technician Adrian Kaubert, who operates the Video Check HA.

About 60% of the machine utilization is for punches and die inserts. If any rework die sinking is necessary, the required contours are determined here. Another 20% of the capacity is needed to check embossing punches and die inserts made of softer materials, which are milled on an HSC machine.

The Nano Focus Probe, NFP, and Werth Fiber Probe WFP are used for precise three dimensional measurements. The NFP is offered exclusively by Werth in coordinate measuring machines and for capturing the shape and fine features of microstructures over large areas on cutting edge radii on tools. Large areas can be measured using the machine axes to reposition the field of view,

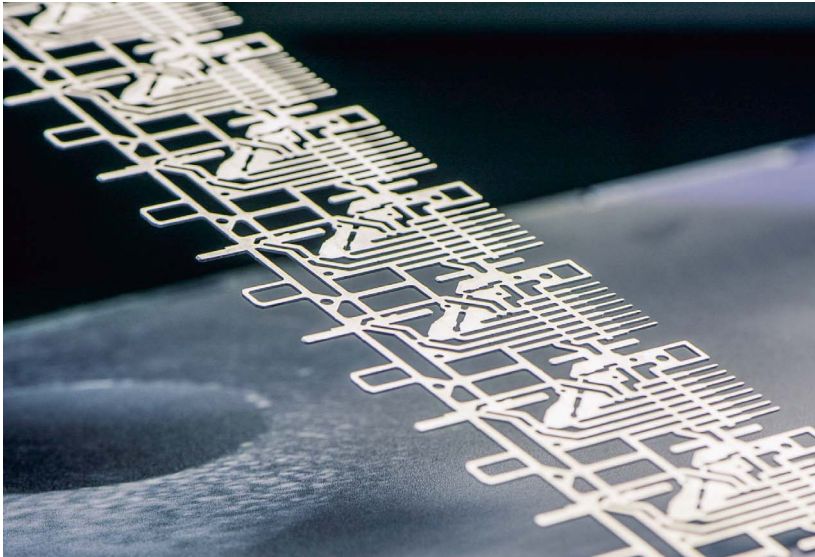


Jürgen Fässler (left) from advance quality planning at Kleiner discusses an example of the use of multisensors with Detlef Ferger, Sales Manager at Werth Messtechnik

which is only a few square millimeters in size. By combining multiple images with the precision of the coordinate measuring machine (Werth raster scanning), very large surfaces can be reliably and precisely measured, unlike the alternative stitching methods.

The physical principle of the NFP is confocal microscopy, which ultimately evaluates the intensity of reflected light from bright to dark. The measurement results can differ depending on the material of the measured object. Carbide has a light grained structure and therefore better reflectivity than very smooth materials. On carbide parts, flank surfaces with angles of around 80° can be measured. For high-gloss copper electrodes, the angle is much lower due to the different surface structure.

The measurement range can be flexibly adapted from a few tenths to several square millimeters by using various optics. This means that the punch surfaces at Kleiner in the range of about 2 mm x 3 mm are ideal for this measurement. As Kaubert confirms: „When we capture a punch surface with the NFP, we generate up to 55,000 points, which gives a very high pixel density.“ As the slope of the surface increases in the edge regions, particularly in the flanks that are perpendicular to the punch surface, the NFP cannot capture any measurement points due to the lack of reflection. This is where we see the benefits of multisensors.



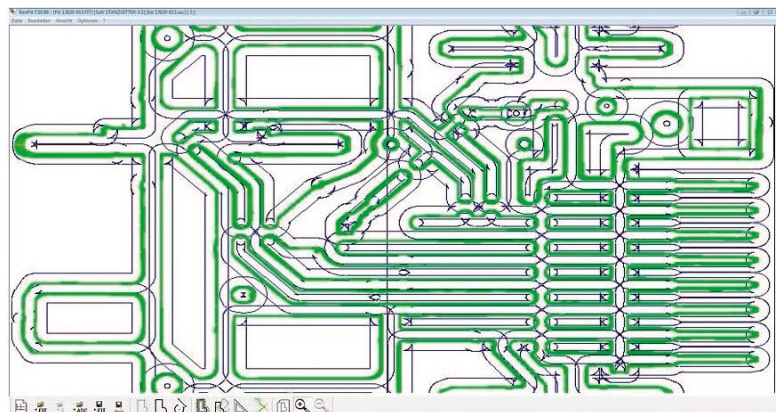
2D stamped parts are measured and compared with the CAD model.

Fiber Probe Can Even Measure Vertical Surfaces

To obtain data about the side flanks of the punches, the WFP takes over to capture measurement points. This patented microprobe consists of a glass fiber with a probe sphere on the end. The sphere diameter can be as small as 20 μm . In contrast to tactile measurement with a classical probe, the fiber probe operates on a tactile-optical basis. That is, the probe sphere is only there to make contact and its position is captured optically. Because it is attached to a glass fiber, the contact forces are minimal and the probing uncertainty is just a few tenths of a micron. As with a classical probe, the software calculates the corresponding measurement point on the workpiece surface based on the calibrated probe sphere radius.

The measurement points captured by the fiber probe supplement the surface data obtained by the Nano Focus Probe. This makes it possible to generate a complete picture of the quality of the component. All measurement data can be compared to the 3D CAD data using WinWerth measurement software. The contour deviations can be seen at a glance in a color coded deviation plot.

The rotary axis included on the Werth 3D VideoCheck provides additional measurement capabilities. The ability to perform rotary movements means that components can be scanned with the Nano Focus Sensor from



any angle. „We have used this many times with very good results. For these punches, however, it is not necessary, as a general rule, to have such high resolution on the flanks. With the Fiber Probe, I can capture the critical points quickly with sufficient resolution and high precision.“

As with every Werth coordinate measuring machine, the VideoCheck HA with integrated image processing sensor is also suitable for two-dimensional measurements. This capability is used at Kleiner whenever capacity is available and Kaubert can support his colleagues by measuring initial production parts.

The use of Werth multisensor technology with sensor data fusion from the WFP and Nano Focus Probe optical sensors has been completely justified and has had a positive effect on the development of precision punched component quality at Kleiner.