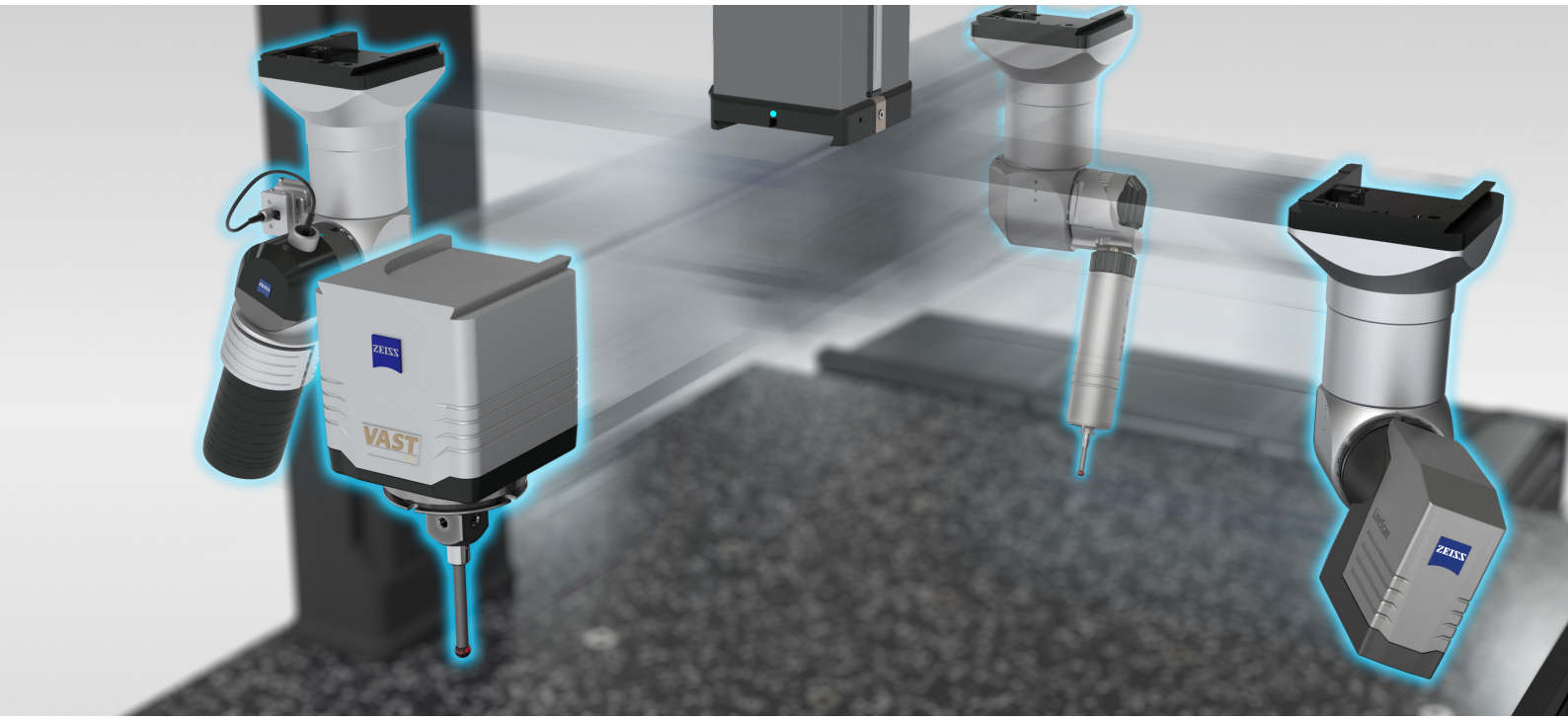
Prepared for all challenges - today and tomorrow

ZEISS CONTURA



ZEISS CONTURA with mass technology

ZEISS

Seeing beyond

ZEISS CONTURA with mass technology:
Versatility in focus

When it comes to maximum precision, coordinate measuring machines are an indispensable tool in industrial applications. To date, they have mainly been used for tactile measurement. In recent years, the need for and use of optical sensors is becoming increasingly significant. There are many reasons for this: the technical advancements being experienced in many sectors requires increasingly complex parts, digitalization and Industry 4.0 are changing manufacturing processes and thus also quality assurance, customers have higher quality and efficiency demands in general nowadays. Many companies are therefore expressing the need for an all-round solution, i.e. tactile and optical measurement on a coordinate measuring machine.
Already in its fifth generation, the ZEISS CONTURA is equipped with mass technology (multi-application sensor system) as standard. This enables tactile and optical measurement on a single machine. The multisensor platform means ZEISS CONTURA is compatible with a variety of sensors from the ZEISS portfolio: sensors on the continuous articulating unit, star styluses or long styluses, optical or tactile, scanning or with single point measurement. Thanks to mass technology from ZEISS, the user acquires maximum flexibility.

Simple sensor switch
With ZEISS mass technology, when the sensors are operated on the continuous articulating unit, they are switched automatically. This applies to all optical sensors as well as the ZEISS VAST XXT and XDT tactile sensors. During the sensor switch, the continuous articulating unit aligns itself in a 90° position, with the sensor pointing downwards. The continuous articulating unit then moves to a free place in the sensor magazine which is usually attached to the reverse end of the measuring stage, pushes the safety flap back, moves downwards into a groove and releases the magnetic locking mechanism in order to unlock the sensor. The new sensor is picked up in a similar way: the continuous articulating unit moves backwards and opens the safety flap, moves downwards and picks up the sensor magnetically. On the plate holding the sensor, there are three cylinder-shaped rollers which ensure that the counterpart is precisely positioned on the sensor.

Therefore, even after frequent switches, the sensor is reproducibly situated at the correct point. The measurement uncertainty is not increased by any significant extent due to the sensor bracket. Users do not need to worry that the accuracy may get out of hand if the sensor is switched repeatedly. Due to the high repetition accuracy during the sensor switch, it is not necessary to recalibrate the sensor after the switch has been carried out. Since the automatic exchange itself takes only a few seconds, ZEISS mass technology means an enormous boost in productivity – and thus time and cost savings.
The continuous articulating unit itself, as well as tactile probes from the ZEISS VAST XT gold series, are attached to the ZEISS CONTURA by means of a dovetail mechanism. This is a groove which the counterpart on the sensor or on the continuous articulating unit is pushed into and which, due to its shape and precise processing, does not allow any leeway whatsoever. Handling is easy too: the measuring technician loosens a screw

Step 1: Loosening the screw

Step 2: Simple sensor removal thanks to dovetail mechanism

Step 3: Easy handling when inserting the sensor

and pulls the sensor or the continuous articulating unit out of the groove and inserts the new sensor. The sensor switch is completed within seconds. However, a repeated calibration is crucial during a sensor switch and is especially useful when using an active tactile sensor such as ZEISS VAST XT gold which offers high measuring accuracy, short measurement times and long stylus lengths. All other sensors – passive, tactile as well as optical – are ideally operated on the continuous articulating unit – with all the advantages of the automatic sensor switch of ZEISS mass technology.

Optical measuring procedures

Optical measuring procedures are particularly interesting in parts with complex shapes if the user is required to record the surface quickly. This is useful in production in order to safeguard the quality of process steps, such as casting metal blanks or after grinding, in order to obtain a quick comparison between the current and target values of the CAD file. Optical sensors are also ideal for reverse engineering, i.e. in order to generate CAD data from a prototype. Optical measurement procedures are often faster than tactile procedures and nonetheless sufficiently accurate. For sensitive parts which may not be touched, there is no alternative to optical sensors.
Various optical sensors can be more suitable depending on the application:

■ Chromatic-confocal white light sensor: This type of sensor is used in the area of application of workpieces with sensitive, soft, reflective or low-contrast surfaces. It records the surface of sensitive parts which may not be touched - where tactile styluses are obviously excluded. This sensor even detects transparent painted surfaces above underlying metallic layers and is suitable for transparent layers with various refractive indices. For this purpose, the sensor uses white light which includes all wavelengths of the visible spectrum. Even strongly reflective surfaces such as glossy metal parts either in automotive and engineering or knee implants do not need to be sprayed with a contrast medium, which other optical measurement methods usually require.
ZEISS offers such a pioneering chromatic confocal white light sensor: DotScan. Mobilizing light: the sensor can be rotated and swiveled in 2.5° steps so that it is always optimally aligned towards the surface. In conjunction with the optional rotary stage, it is suited, for example, to the quality control of parts with complex shapes as well as glass surfaces. The underlying principle is direct reflection: the light which is reflected onto the optimally reflective surface has to be returned to the objective lens. If the surface, which is hit by the visible light, has angles greater than 30°, there is no direct reflection back into the objective lens of the ZEISS DotScan. Therefore, an acceptance angle of +-30° is referred to here also. Thus, parts with more pronounced curving can also be scanned using the ZEISS DotScan's 1 mm variant. ZEISS DotScan is available in three variants for the ten, three and one millimeter measuring ranges.

■ Triangulation laser: suitable for the fast recording and inspection of freeform surfaces such as those required by casting tools or castings, bent sheets or plastic covers also require non-tactile measurement. The sensor moves above the part at a distance of a few centimeters and projects a line with laser light, which is thrown back from the surface into a sensor chip. Based on the angle, the sensor determines the distance from the part and therefore its surface shape. Each time the light is projected, the sensor determines hundreds of points in a line.
The maximum possible number of points with ZEISS LineScan is 700,000 measurement points per second. This refers to the number of rough points which are then calculated to provide actual measurement points in the software. Thus, point clouds which fully record the complex surfaces of even larger parts can be created in just a few minutes. This is not possible with tactile sensors. They can provide only a small number of measurement points in this timeframe and therefore say less about the shape and dimensional accuracy of a whole surface. Based on the point cloud, the ZEISS CALYPSO software calculates a chromatic representation using the CAD target data record as a comparison. On this basis, the measurement technician immediately detects where exactly there is an excess (red) or a shortage (blue).

■ 2D camera sensor: for very small or two-dimensional parts such as circuit boards or flat parts made of sheet metal, rubber or plastic that cannot be measured using contact means because it may result in deformation of their surfaces, the ZEISS ViScan 2D rotatable camera sensor is the ideal solution. A ring light made of LEDs on the objective lens illuminates the part, the light is thrown back into the objective lens and illuminates an image sensor – just like in a camera for taking photographs. Transmitted light LED illumination in the form of a mobile stage can also be chosen if necessary. The transmitted light variant with long-life LED illumination is helpful when bridge-type CMMs with continuous articulating unit are also used for taking difficult measurements on low-contrast measuring objects such as punched components or printed circuit boards. Strictly speaking, ZEISS ViScan is a 2.5D camera sensor, since it is also capable of recording height-related information thanks to the Autofocus function. ZEISS ViScan features various objective lenses, enabling increased flexibility in the working distance, area being recorded and accuracy.
The continuous articulating unit allows for the sensor to be ideally oriented in a vertical position to the workpiece surface. This prevents the image from becoming distorted and the measurement result therefore being falsified.

Tactile measuring procedures

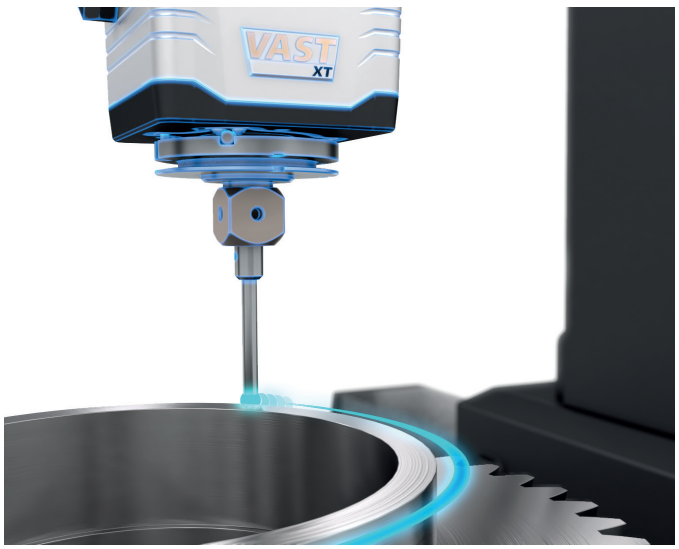
Tactile sensors are the right choice if very high accuracies are needed as well as a high degree of flexibility regarding the contact angle and the shape of the inspected parts. The part's surface is scanned point by point either as a single point measurement or by scanning. Single point measurement comes into question when searching for the absolute or relative position of quality-related points, such as the distances between individual levels or between points which were contacted in self-centered mode. On the other hand, the scanning tactile measurement is useful if the contour of surfaces has to be recorded quickly without dropping the stylus. Also, tactile measurement is often required in order to determine where parts are located prior to carrying out a measurement using optical sensors. For example, this is used internally at ZEISS for lenses with applications in illumination systems for semiconductor manufacturing technology. The position is determined using contact, the actual measurement of the sensitive lens is then carried out using optical means.
Various tactile sensors are suitable depending on the application:

■ Passive scanning with continuous articulating unit: tactile measurements in difficult areas, for instance inside diagonal openings, require sensors which are compact and can be swiveled laterally. Nevertheless, users do not want to do without the scanning functionality. The solid and light ZEISS VAST XXT sensor is especially suited to this. This is a passive scanning sensor which can record the shape of a part within a short measurement time. Thanks to its compact design, it is suitable for the continuous articulating unit, which increases flexibility. With three modules, ZEISS VAST XXT covers the standard stylus length range for this sensor design, lateral styluses are possible up to 65 millimeters.

■ Passive single point with continuous articulating unit: if no surface shapes are scanned, but instead individual points have to be recorded with a high degree of accuracy, ZEISS XDT is the right choice. This sensor is also suited to the continuous articulating unit and can be rotated towards the measurement object. It works with sliding averaging, whereby each measurement point is made up of at least a hundred single point measurements – a big plus for operational safety and accuracy.

■ Active scanning: the preferred areas of application for these sensors are shape and position measurement, curves and freeform measurement as well as reverse engineering. These sensors meet the highest demands in terms of measurement accuracy and speed. The applications range from plastic machined parts to brake components, crankshafts and engine blocks. An active scanning tactile sensor has measuring force coils which go into preliminary deflection. This has several advantages: the active regulation means the stylus traces even surfaces with complicated shapes in scanning mode without losing the contact. Particularly if there are large deviations from the target dimension, due to its active regulation, ZEISS VAST XT gold excels as the perfect tactile sensor. A passive sensor without this regulation only traces a nominal path, but is unable to actively regulate itself if there are any deviations. The measuring force of ZEISS VAST XT gold can be set at between 50 and 1000 mN and remain constant. In conjunction with ZEISS VAST navigator and the ZEISS CALYPSO software, the active measuring force regulation offers the highest scanning speeds. This also applies to styluses with lengths of up to 500 mm and weights of up to 500 g, which ZEISS VAST XT gold can also carry.

■ Active scanning compact and with rotation: ZEISS VAST XTR gold is another variant which is based on VAST XT gold. "R" is for rotation here, as the sensor has an integrated rotation axis. Thus, the recording of the stylus can be rotated in 15° steps and positioned at the correct angle to the part at all times. The probe proves its strengths on a wide range of workpieces. These include parts with many features and angular positions such as those on gear housings for helicopters and locomotives.



ZEISS VAST XTR gold is also suitable for rotationally symmetric workpieces such as ventilation gears or turbines. Thanks to the rotary axis, the probe also reaches internal gears that until now could only be measured using complex multi-stylus systems. The sensor is also ideal for very large and heavy parts, for example in shipbuilding and in the wind power industry, for which there are no suitable rotary stages with the required load-bearing capacity and accuracy.

ZEISS mass technology as part of a wide-ranging measuring platform

Sensors are only one aspect of ZEISS mass technology, however. The platform comprises the coordinate measuring machine as a "body" which collaborates optimally with the replaceable tactile and optical sensors – the "sensory organs" – and a controller as "nerves". In this analogy, the role of the "brain" is played by ZEISS CALYPSO – the comprehensive yet user-friendly measuring and evaluation software. ZEISS CALYPSO measures standard geometries easily, quickly and reliably. It can be programmed simply by clicking on the required characteristics such as dimensions, positional tolerances or deviations in shape. The reporting is carried out by ZEISS PiWeb, which is included in the delivery scope of ZEISS CALYPSO.

Equipped for the future with ZEISS CONTURA

With its wide range of new innovations and ZEISS mass technology, ZEISS CONTURA is the machine of choice in its class. This also applies to users who have not been required to carry out optical measurement to date. The demand for measurement tasks in which tactile and optical sensors are jointly used is set to rise more and more in the future.
The fifth generation of ZEISS CONTURA is a safe investment in the future. It saves time and operating costs without compromising on reliable, precise measurement results.

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Digital Version CZ-I/2020