ATOS Capsule

Quality control with highest resolution

gom
a ZEISS company

Optical 3D Metrology

For Industrial Use

Optical 3D coordinate measuring machines capture detailed and easily interpretable quality information in a short measuring time. They provide fully automated full-field deviations between the actual 3D coordinates and the CAD data. As this measuring data contains all the object information, in addition to the surface deviations from the CAD, the software also automatically derives detailed information such as GD&T, trimming or hole positions.

GOM's measuring systems ensure the dimensional quality in particular of sheet metal, casting and plastics products in the automotive, aerospace or consumer goods industries. They form the basis for the optimization of production and machine parameters as part of a value-added measuring procedure.

Measuring Room and Production

In the measuring room, the measurement technician creates the measuring programs and the evaluation templates offline on the computer in a CAD-like environment for a wide range of different parts. After the scanning process, the evaluation templates are filled with the full-field 3D coordinates and the reports are generated.

In the production department, the measurement takes place directly on site. There is no need to carry the object to a measuring room. Robustness, measuring speed and compensation for temperature fluctuations are convincing factors of the scanners, enabling traceable results to be captured even under harsh conditions.

ATOS Capsule

Optical Precision Measuring Machine with Highest Resolution

The ATOS Capsule is an optical precision measuring machine for full-field digitizing of contoured part geometries. The fringe projection system of the ATOS series is used for production quality assurance of small to medium-sized parts and excels by its high precision when scanning fine details. ATOS Capsule is used, for example, for first article inspection of gears, turbine blades and wheels as well as medical parts.

Due to its housing design, the ATOS Capsule provides process stability for automated applications. Made of aluminum, the precisely manufactured unibody housing ensures maximum stiffness and precise measuring results for industrial use. Optics and electronics are protected against dust and splashing water. For this purpose, the lenses are protected by a cover, integrating a thin non-reflecting glass pane. In addition, the sensor electronics are hermetically sealed and the cooling takes place via external cooling fins along the housing. Industrial ports increase process reliability and ensure an interference-free data transfer.

ATOS Capsule in Use

In the standardized measuring machine ATOS ScanBox, ATOS Capsule is used for fully automated measuring and inspection of contoured parts. The ATOS ScanBox is a complete optical 3D measuring machine that was developed by GOM for an efficient quality control in production and manufacturing processes. Various measuring systems are available for different part sizes and applications.

Used in the ATOS ScanBox of series 4, ATOS Capsule serves as a mobile and therefore flexible measuring system for small parts. In the ATOS ScanBox models of series 5 and 6, ATOS Capsule can be extended with a Plus Box photogrammetry add-on. Thus, bigger components or several parts can be measured simultaneously.

Manually, ATOS Capsule is used with a studio stand or a desk stand. For the semi-automatic use, a 3-axis Motorization Kit, including a lift module for the sensor and a Tilt and Swivel Unit for the fixture, is available.

Technical Data

Two versions of ATOS Capsule are available with different levels of detail. The system captures 8 or 12 million points per scan. The dimensions of the sensor, its low weight and the short working distance simplify its application in practice. The measuring areas of this sensor can be changed easily, covering a range of different part sizes.

Measuring Volumes	MV40	MV70	MV120	MV200	MV320
Measuring area [mm]	40 × 30	70 × 50	120 × 80	200 × 140	320 × 240
Working distance [mm]*	290	290	290	290	290
Dimensions [mm]	Approx. 310 × 240 × 150	Approx. 310 × 220 × 150			
Housing *	—	Dustproof, splashproof			
Sensor types	8 or 12 million points per scan				
Weight	Approx. 7 kg				
Operating temperature	+5 °C to +35 °C (non-condensing)				

* The measuring volume MV40 is operated without camera cover.

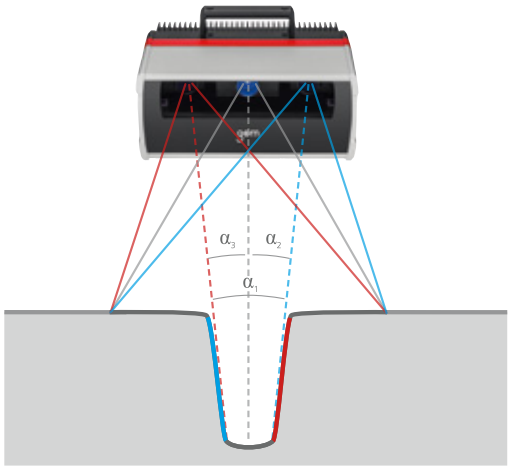
ATOS Technology

High Tech in Robust Machines

The accuracy of optical measuring systems is not due to expensive and high-maintenance precision mechanics but is rather based on state-of-the-art optoelectronics, precise image processing and mathematical algorithms. Thanks to their proven measuring technology, the ATOS systems have established themselves as the preferred measuring system in almost all industries.

Triple Scan Principle

Precise fringe patterns are projected onto the surface of the object and are captured by two cameras based on the stereo camera principle. As the beam paths of both cameras and the projector are calibrated in advance, 3D coordinate points can be calculated from the three different ray intersections. This Triple Scan Principle offers advantages for measuring reflective surfaces and objects with indentations. The result is complete measuring data without holes or erratic points.



Blue Light Technology

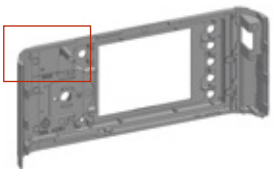
GOM's projection technology works with narrow-band blue light, which means that interfering ambient light during image acquisition can be filtered out. The light sources are so powerful that short measuring times can be achieved even on uncooperative surfaces. In addition, they have a life expectancy of well over 10,000 hours.

Assured Measuring Data Quality

An ATOS sensor is a self-monitoring system. The software of the sensors is continuously monitoring the calibration status, the transformation accuracy as well as environmental changes and part movements in order to ensure the quality of the measuring data.

High image resolution and measuring speed

The ATOS sensors return full-field distributed 3D coordinates for each individual measurement. Up to 12 million independent measuring points are captured within 1 to 2 seconds. The measuring data is characterized by very high detailed reproduction, thus also enabling very small component features to be measured.



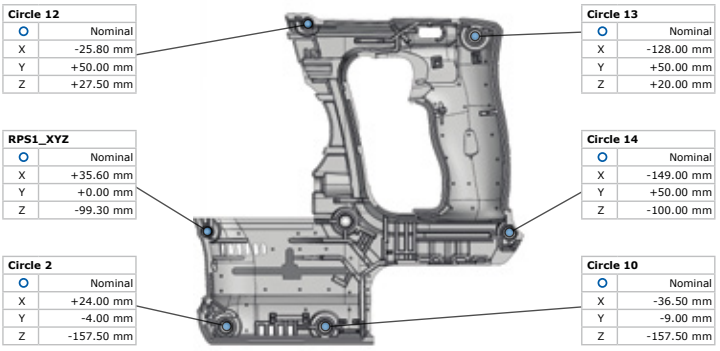
Camera housing

Workflow

ATOS Professional Software

Manual application – On a mobile stand, the ATOS sensor is positioned freely in front of the part. After each measurement, the sensor or the part is moved in order to measure those areas that were not covered by the previous scan. All individual measurements are automatically transformed into a common coordinate system and result in a complete 3D point cloud.

Automated application – The virtual measuring room (VMR) is the central control station and measurement planning software for all elements of the automated ATOS measuring cells. It offers the functional representation of a real measurement environment in a virtual simulation. Special robot know-how is not required during the whole process. All robot movements are simulated and checked for collision and accessibility before being performed in the actual environment. After that, the real measurement takes place in the same work environment.



Inspection planning – The CAD data set is imported together with the associated measurement plan. The inspection features stored there are automatically assigned to the inspection characteristics from the measurement plan. The measuring report can also be prepared offline in advance. The actual measuring results can be displayed after the measurement procedure.

Robot programming – The Auto Teaching function in the VMR calculates the required sensor positions for all inspection features and CAD surfaces. The subsequent path optimization improves the sequence of the positions in terms of runtime and collision avoidance. Thanks to Auto Teaching, the time required for creating reliable and runtime-optimized robot programs is kept to a minimum.

Burn-in – The measuring programs created offline are only "burned in" once in the ATOS ScanBox using an automated process. The robot moves to the measurement positions, where it defines the individual measurement parameters, for example, exposure times, on the real life component. Using a special procedure, the software automatically detects component mirroring and adapts the fringe projection in order to prevent measuring errors caused by mirroring.

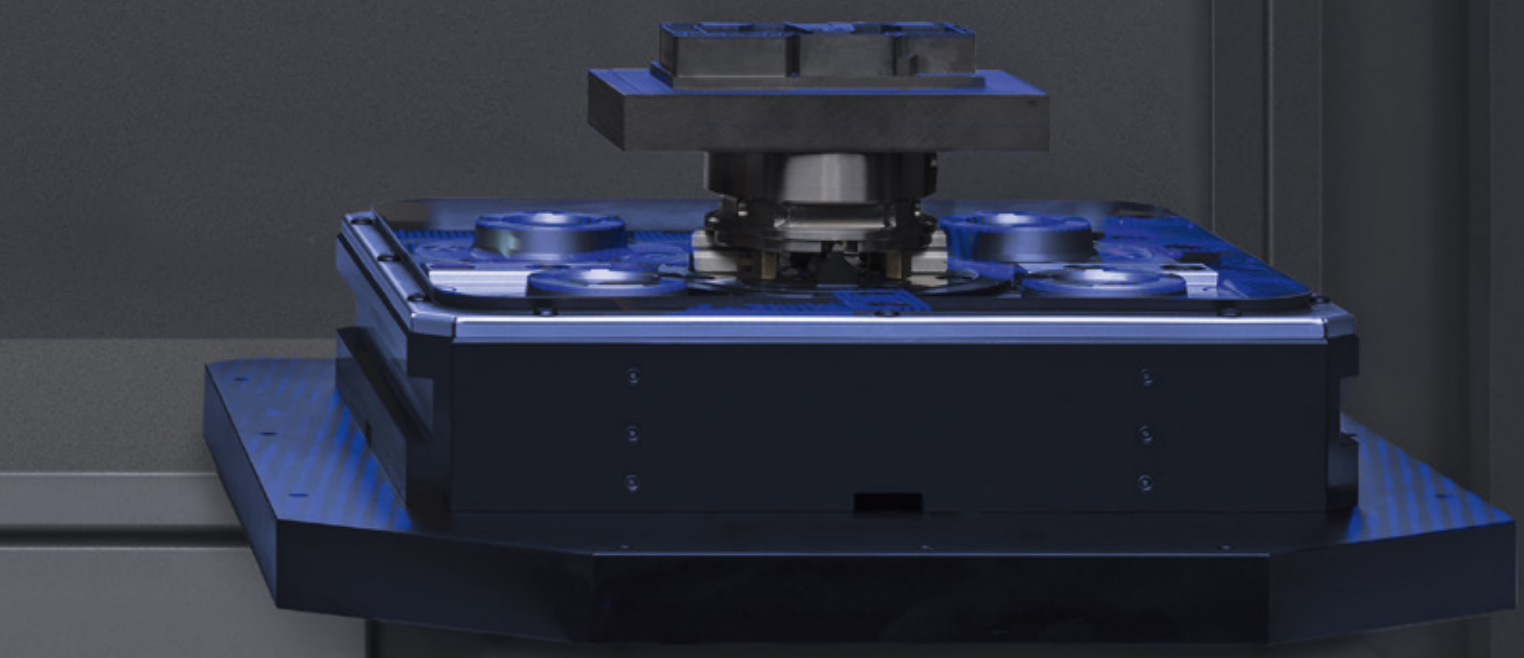
Series measurement – Ready-to-use measuring programs can be utilized for inspecting other components. The robot is fully controlled by the software and successively moves along the measurement positions. A check is carried out on each measurement as to whether the results meet the quality criteria. Changes to the data status of the CAD or the inspection plan can be quickly updated by the parameterized software.

Measurement evaluation – After data acquisition, the software calculates a polygon mesh of the surface of the component as well as the actual values of the inspection feature plan. This data is compared with the nominal data and is presented in a report. The measuring results are automatically saved in special export formats, for example, for databases for statistical quality control. The measuring procedure for different components can be performed fully automatically.

Automated 3D Metrology

ATOS ScanBox

The ATOS ScanBox is a complete optical measuring machine that was developed by GOM for an efficient quality control in production and manufacturing processes. The ATOS ScanBox has been installed several hundred times worldwide and is successfully used in a variety of industries. Eleven models are available for different part sizes and applications.



Standardized quality – The ATOS ScanBox is a standardized measuring machine which is certified in accordance with the Machinery Directive. There is no risk for the customer in terms of costs, performance or delivery date – in contrast to projected individual systems. Even before an order is placed, test measurements can be performed in an identically designed ATOS ScanBox to verify measuring equipment capability.

An ATOS ScanBox is usually supplied ex stock at short notice. Depending on the type, commissioning may take a few days for the small systems (series 5) and up to two weeks for the large systems (series 7 and 8). The entire kinematics is based on robust automation components instead of precision mechanics. The machines are hardly subject to any wear even under harsh ambient conditions and retain their full accuracy.

Plus Box – This add-on sensor, which is directly attached to the ATOS system, enables fully automated measuring of reference point markers with deviations of 3 µm to 30 µm. These reference point markers create a 3D volume, in which the detailed individual measurements of the ATOS sensors are transformed automatically. This is how the accuracy of the overarching photogrammetric measurement is achieved. Bigger components or multiple parts can be measured simultaneously.

High measuring speed – Compared to a traditional tactile coordinate measuring system, the ATOS ScanBox can reduce the measuring and inspection time for a component by more than half.

Space saving – All ATOS ScanBox models are characterized by their compact design. The measuring machines ATOS ScanBox 5108 and 5120 do not have to be anchored to the floor of the factory or on special measuring tables. They can easily be transported to the required place within a short period. All that is needed at the location is a power connection.

ATOS ScanBox BPS – GOM has developed ATOS ScanBox BPS to achieve even faster cycle times, for example, in electrode production. A batch processing system enables automated loading and unloading of the optical 3D coordinate measuring machine. For this reason, the ATOS ScanBox is extended by a handling system and a programmable logic controller. As the user does not have to place the individual parts, the time required for quality assurance is significantly shorter than before. Because the parts are marked, for example, with an RFID chip, the system independently detects which measuring program must be executed and which inspections are to be performed. Since user influences during measurement are excluded, process reliability is increased. ATOS ScanBox BPS ensures robust and repeatable measuring values for fast process control.

Evaluation and Measuring Reports

ATOS Professional Software

Certified Inspection Software

To ensure precise measuring accuracy, the GOM software packages have been tested and certified by the two institutes PTB and NIST. The accuracy of the inspection software is tested by comparing the results from the software with the reference results. The GOM software has been placed in category 1, the category with the smallest measurement deviations.

Nominal-actual comparison – The calculated polygon mesh describes freeform surfaces and standard geometries. These can be compared with the drawing or directly with the CAD data set with the help of a surface comparison. A 3D analysis of surfaces as well as a 2D analysis of sections or points can be implemented in the software. CAD-based generation of standard geometries such as lines, planes, circles or cylinders is also possible.

Curve-based inspection – Based on full-field digitized data, construction functions can be used for curves and their individual properties can be displayed. Edge curves can, for example, be captured, radii and design lines can be analyzed and spline curves can be created. In addition, curve-based inspection allows for gap and flush analyses.

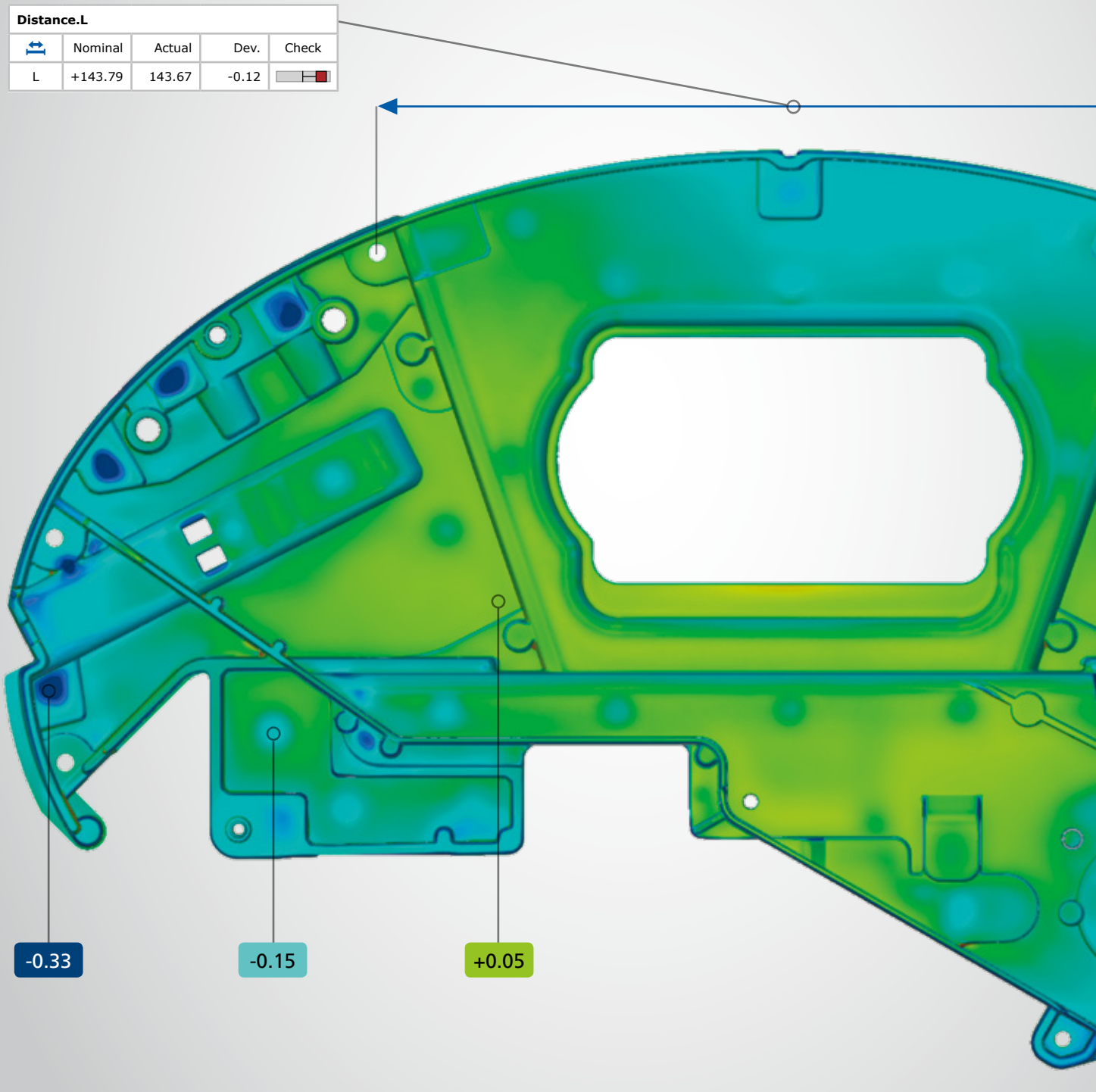
Alignment – The GOM 3D software contains all standard alignment functions. These include: RPS alignment, hierarchical alignment based on geometry elements, alignment in a local coordinate system, using reference points and various best-fit procedures such as global best-fit and local best-fit. Customers can also use their own specific alignments such as “Balanced beam” or “Equalized nested”, for example, for turbine blades.

Trend, SPC and deformation analysis – The parameter-based approach of the GOM software enables trend analysis for multiple evaluation, e.g. for statistical process control (SPC) or deformation analysis. As a result, several parts or stages within a single project can be evaluated in a full-field manner, and statistical analysis values such as Cp, Cpk, Pp, Ppk, Min, Max, Avg and Sigma can be determined.

GD&T analysis – In contrast to the pure dimension analysis, the GD&T analysis focuses on the functional aspect of the part. Corresponding GD&T elements are, for example, planarity, parallelism or cylindricity. Both, a standardized analysis of 2-point distances and of the maximum material requirement as well as the position tolerance in local datum and coordinate systems are possible.

Airfoil inspection – Special functions are available for the quality control of turbine blades, which can be used, for example, to inspect the profile mean line, profile chord line or profile thickness of turbine blades based on 2D sections. The profile centroid, profile radii and profile twists can also be calculated.

Reporting – The reporting module enables users to create result reports containing snapshots, images, tables, diagrams, text and graphics. The results can be visualized and edited in the user interface as well as exported to a PDF document. Templates are reusable and each scene saved in a report can be restored in the 3D window.



GOM

Precise Industrial 3D Metrology

GOM develops, produces and distributes software, machines and systems for industrial and automated 3D coordinate measuring technology and 3D testing based on innovative technologies. By continuously developing hardware and software, GOM sets new standards in industrial metrology.

Today, more than 17,000 system installations improve product quality and accelerate product development and manufacturing processes for international companies in the automotive, aerospace and consumer goods industries, their suppliers as well as many research institutes and universities.

Worldwide Competence

The worldwide GOM Metrology Network comprises more than 60 sites on five continents. The research and development, production, communication and administration departments are located at the headquarters in Braunschweig. In the research and development departments, engineers, mathematicians and scientists work on the measuring technology of the present and the future.

The certified partners of the network represent GOM worldwide. With more than 1,000 metrology experts, the GOM Metrology Network provides profound advice as well as professional support and service to operators on site in their local languages. At three GOM hubs in Europe, Asia and America, GOM service experts give advice to the partner network and global customers.

Holistic Technology Partner

Numerous services and training courses support the users with their daily work when using 3D measurement technology. Training courses and webinars deepen the knowledge about the software and show further application fields of the measuring systems.

The online portal provides instructions, tutorials and frequently asked questions and answers for the user. Furthermore, there is an application forum for exchanging ideas and supporting each other.

At conferences and application-based workshops, GOM directly shares knowledge on processes and measurement technology. The new GOM Care offer combines support and service for 3D measuring systems from GOM on a contractual basis.

GOM Care

With GOM Care, GOM offers fast and reliable customer support and services when necessary. The GOM Care support and services is based on three pillars: Remote Assistance, Services and Contract Plans.

GOM Training

The GOM training concept is based on practice-oriented training courses for different levels: basic and advanced training as well as expert courses. The modules can be combined and are based on each other.

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