ATOS 5 · ATOS 5X

Industrial 3D Metrology with High-Speed Technology

Optical 3D Metrology

For Industrial Use

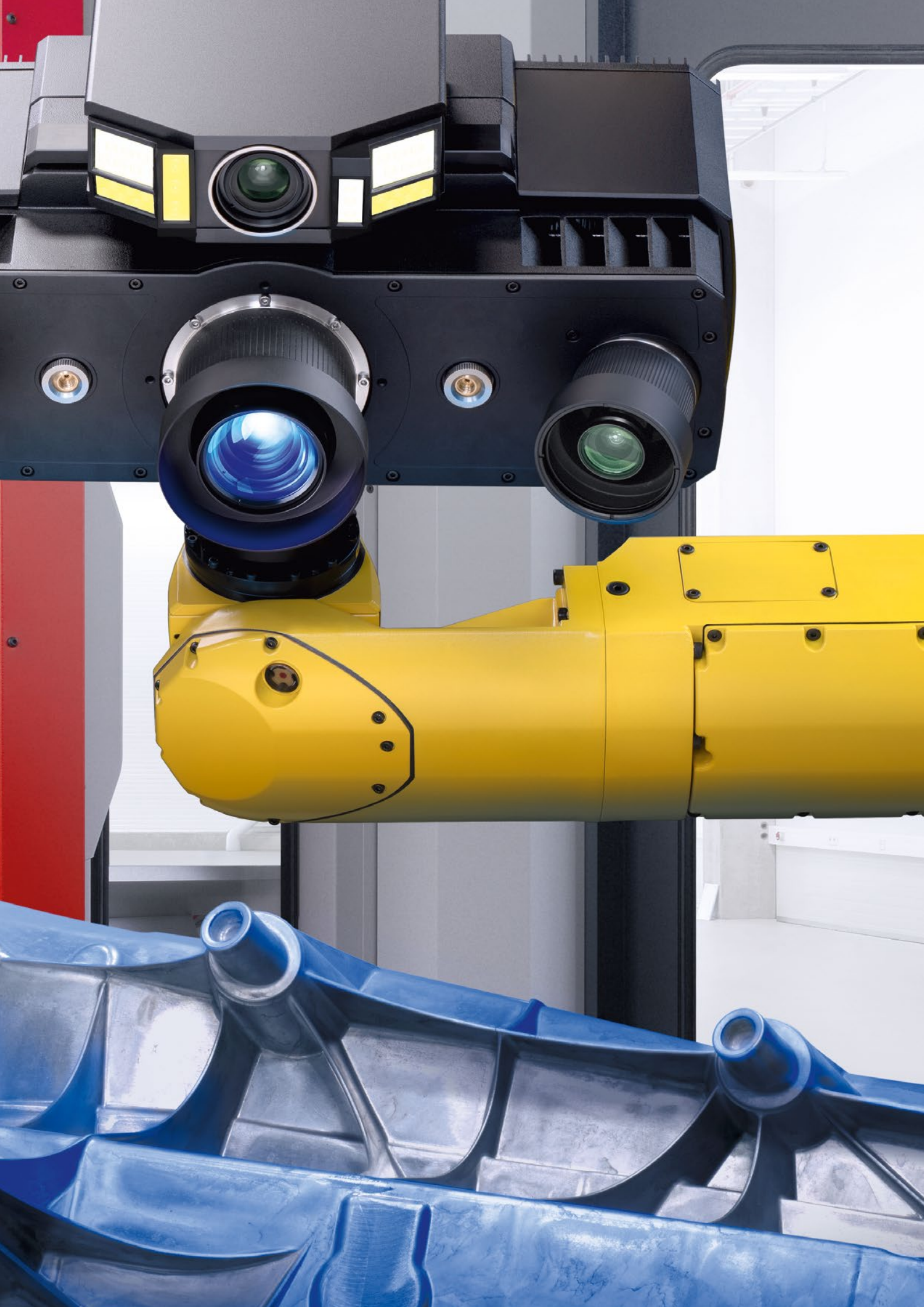
Optical 3D coordinate measuring machines capture detailed and easily interpretable quality information in a short measuring time. They provide fully automated full-field deviations between the actual 3D coordinates and the CAD data. As this measuring data contains all the object information, in addition 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 5 and ATOS 5X

High-Speed Scanner with Highest Data Quality

The two 3D scanners ATOS 5 and ATOS 5X are high-resolution optical digitizers, which quickly provide precise three-dimensional measuring data for optimizing design and manufacturing processes.

The performance of the ATOS 5 and ATOS 5X systems is very impressive, particularly when measuring glossy surfaces, fine structures, and edges. The ATOS technology significantly reduces the number of individual scans and accelerates overall measuring procedures.

ATOS 5 and ATOS 5X in Use

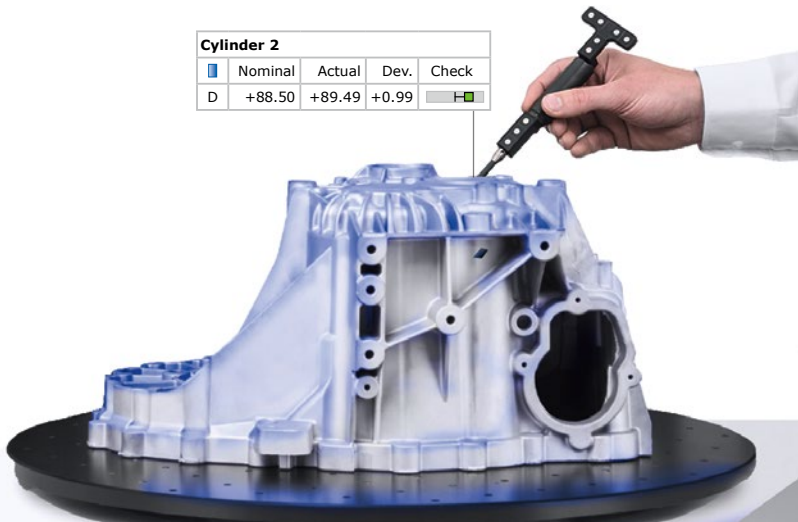
The systems are used in many industries for the measurement of parts, such as sheet metals, tools and dies, turbine blades, prototypes and injection-molded and pressure die-cast parts. They are based on state-of-the-art camera sensors and innovative measuring and projection technology.

Manually, ATOS 5 and ATOS 5X are used with a studio stand or a tripod. For the semi-automatic use, a 3-axis Motorization Kit, consisting of a lift module for the sensor and a Tilt and Swivel Unit for the fixture, is available. Mobile rotation tables enable simple automated measurement of small to medium objects.

In the standardized ATOS ScanBox measuring machine, ATOS 5 and ATOS 5X are used for automated measuring and inspection of parts. ATOS ScanBox is a complete optical measuring machine that was developed by GOM for an efficient quality control in production and manufacturing processes. In the ATOS ScanBox models as of series 5, the ATOS 5 and ATOS 5X sensors can be extended with a Plus Box photogrammetry add-on.

Optical and Tactile Measurement

The GOM Touch Probe combines full-field ATOS measurements with tactile 3D measurements. This enables point-based measurements of areas that are difficult to access optically, measurements of regular geometries, the direct comparison against CAD data, fast measurement of single points and online alignment.



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.

High Measuring Speed

ATOS sensors provide full-field 3D coordinates for each individual measurement. Within a few seconds, up to 12 million independent measuring points are captured per scan. This is made possible by the low noise level of the Blue Light Equalizer. As a result, the measuring data is characterized by very high detailed reproduction, thereby enabling very small component features to be measured.

Assured Measuring Data Quality

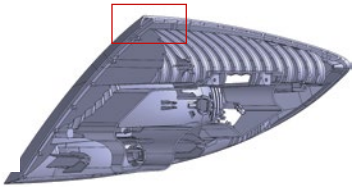
An ATOS sensor is a self-monitoring system. The software of the sensors is continuously monitoring the calibration status, the transformation accuracy as well as environmental changes and part movements in order to ensure the quality of the measuring data.

Blue Light Equalizer

GOM's projection technology works with narrow-band, blue light, which means that interfering ambient light can be filtered out during image acquisition. In addition, ATOS 5 is equipped with a Blue Light Equalizer, which increases the brightness of the light source by a factor of 1.5 and transmits uniform, non-coherent, speckle-free light to the projection unit. The Blue Light Equalizer of ATOS 5 is so powerful that even on unconventional surfaces short measuring times can be achieved and the precise coverage of complex geometries is possible.

Laser Light Compressor

The light processing of the ATOS 5X is extended by a Laser Light Compressor, which bundles several laser elements to generate an extremely bright light source on the basis of laser light. The light, which is up to eight times brighter, is particularly resistant to ambient light influences and enables measuring areas of up to 1,000 mm and extremely short exposure times. This reduces the number of required scans, simplifies the measuring setup and shortens the measuring time.



Headlamp 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.

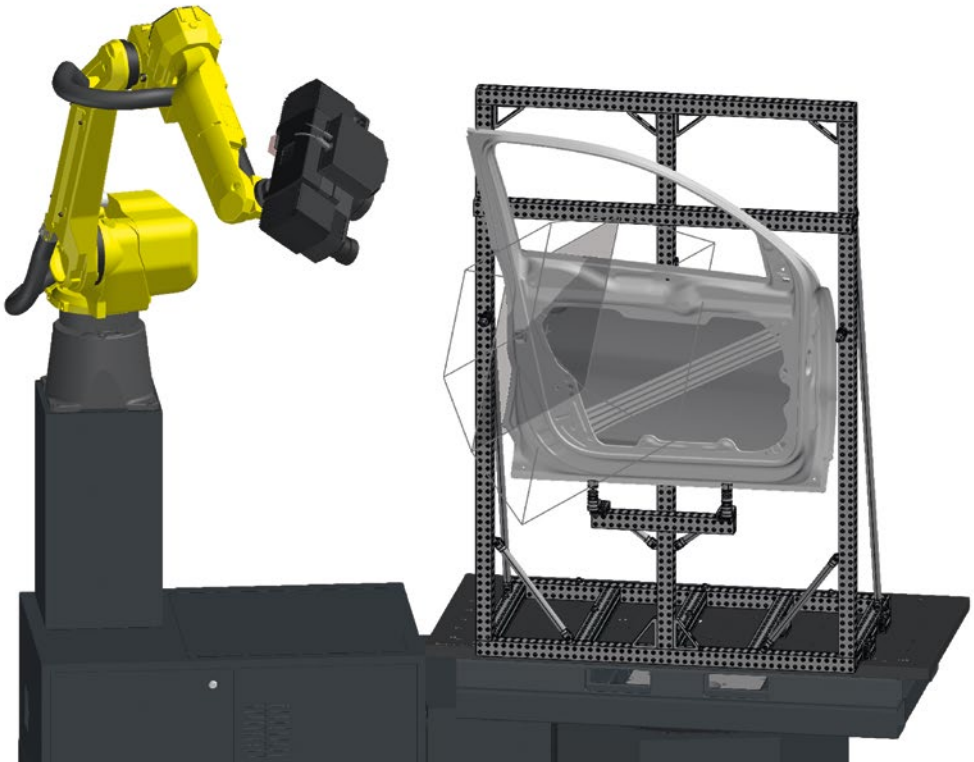
Inspection planning – The CAD data set is imported together with the associated measurement plan. The inspection features stored there are automatically assigned to the inspection characteristics from the measurement plan. The measuring report can also be prepared offline in advance. The actual measuring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



High-Speed 3D Scanner

Technical Data

The ATOS 5 and ATOS 5X systems capture up to 2×12 million coordinate points during scanning. This means that the precision, resolution, and measuring area size can be freely defined. This also permits very high resolution in small, detailed components as well as very rapid digitizing of large components.

	ATOS 5 (12M)	ATOS 5 (8M)	ATOS 5X
Light source	LED	LED	LD
Laser class	—	—	2 / 3B *
Measuring area [mm²]	170×140 – 1000×800	170×140 – 1000×800	320×250 – 1000×800
Working distance [mm]	880	880	880
Measuring points per scan	12 million	8 million	12 million
Dimensions [mm]	approx. 550×320×200	approx. 550×320×200	approx. 550×320×200
Temperature range	+5 °C to +35 °C, non-condensing		

* according to standard IEC 60825-1: In 2014, classified as a Class 2 laser in automated use and as a Class 3B laser in manual use (safety distance without safety goggles > 700 mm).

ATOS ScanBox with ATOS 5 and ATOS 5X

Four ATOS ScanBox models are available for a wide range of different applications. This allows small, complex components of up to 500 mm in size to be measured and two-sided measurements of larger and heavier components of up to 6,000 mm to be carried out. The modular structure of the ATOS ScanBox Series 7 and 8 enables a demand-oriented extension of the ATOS ScanBox both within the series as well as from series 7 to series 8.

	ATOS ScanBox 5108	ATOS ScanBox 5120
Dimensions [mm³]	2000×2550×2700	3300×3300×2700
Max. part size [mm]	Ø 800	Ø 2000
Max. part weight [kg]	300	500
Opening width [mm]	800	1400
Sensor compatibility	ATOS 5	ATOS 5

	ATOS ScanBox 6130	ATOS ScanBox 6135	ATOS ScanBox 6235
Dimensions [mm³]	4250 × 4250 × 2700	4500 × 4500 × 3026	7665 × 4500 × 3026
Max. part size [mm]	Ø 3000	Ø 3500	2× Ø 3500 mm
Max. part weight [kg]	2000	5000	2× 5000
Opening width [mm]	3100	2850	2850
Sensor compatibility	ATOS 5	ATOS 5, ATOS 5X	ATOS 5, ATOS 5X

	ATOS ScanBox 7160	ATOS ScanBox 7260
Dimensions [mm³]	4750×10150×3900	8750×10150×3900
Max. part size [mm]	6000×1250	6000×1250, rotation table working area up to Ø 3000
Max. part weight [kg]	unlimited	unlimited, rotation table working area up to 2000
Opening width [mm]	3050	3050, rotation table working area 3400
Sensor compatibility	ATOS 5, ATOS 5X	ATOS 5, ATOS 5X

	ATOS ScanBox 8160	ATOS ScanBox 8260	ATOS ScanBox 8360
Dimensions [mm³]	5750×10150×3900	9750×10150×3900	13750×10150×3900
Max. part size [mm]	6000×2500	6000×2500, rotation table working area up to Ø 3000	
Max. part weight [kg]	unlimited	unlimited, rotation table working area up to 2000	
Opening width [mm]	3050	3050, rotation table working area 3400	
Sensor compatibility	ATOS 5, ATOS 5X	ATOS 5, ATOS 5X	ATOS 5, ATOS 5X

Mobile 3D Metrology

On-Site Measurement Analyses

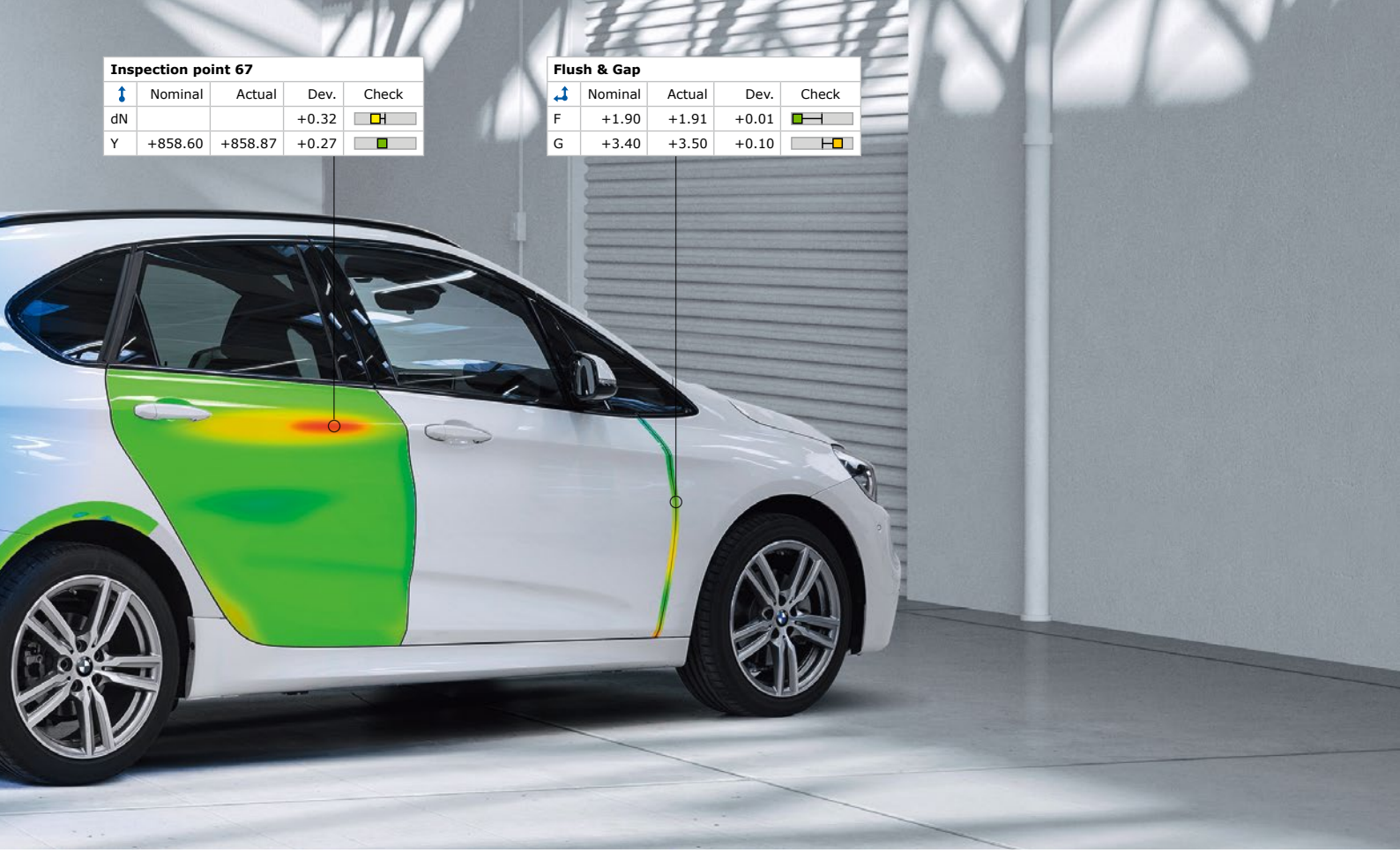
Businesses must inspect tools, systems and components even during ongoing production, so as to introduce corrections as quickly as possible. For this reason, mobile measuring systems are increasingly used as they can be used directly during the production process.

GOM provides mobile measuring systems that have been proven in practice due to their flexibility and precision. This way, errors which would otherwise only show up in the final product can be identified directly at the site where they occur. This also avoids a lengthy search for the source of the error.

Shop Floor Metrology

The right combination of hardware and software allows for safe integration of 3D metrology into production. The industrial housing is protected against dust and splash water.

Thanks to the interference-free data transfer via fiber optic cables, the independence of the surrounding system environment and the sensor-controlled monitoring of the calibration status, the systems can now be used in production. The sensors reach their maximum efficiency in the automated applications in the ATOS ScanBox series. ATOS 5X in combination with ATOS ScanBox Series 8, for example, accelerates the process by a factor of 4 when measuring and inspecting large and complex objects.



Measuring Large Objects

When inspecting bulky objects such as ships, industrial or wind power facilities, the greatest possible flexibility and mobility is required – which is why with the TRITOP system GOM is providing an additional 3D coordinate measuring machine that can be used completely cable-free and hand-guided. Combined with the ATOS 5, it is even possible to measure large objects of more than 30 meters in high resolution.

The portable optical TRITOP photogrammetry system determines the three-dimensional coordinates of object points precisely and independently of the environmental conditions. Based on this data, the system can also calculate three-dimensional displacements and deformations of objects and components.

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. For different part sizes and applications, ten models are available.

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.

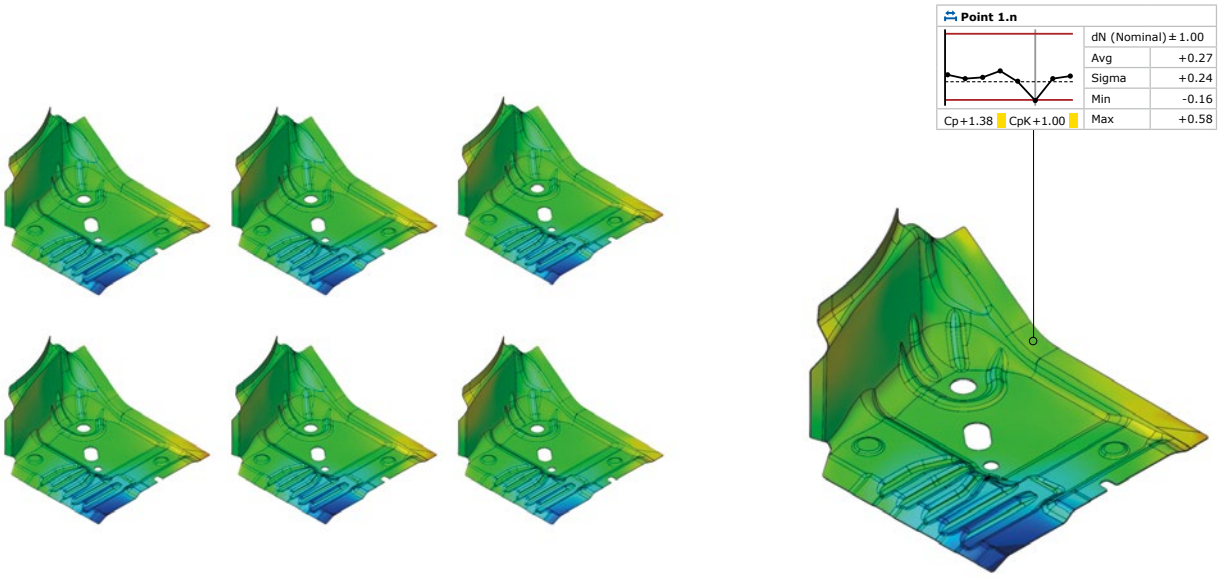
"Closed Loop" – With robot-based optical measuring machines, a robot moves an optical scanner over the component. The positioning accuracy of the robot is not sufficient for metrological tasks though. To transfer the measurements from all positions into the coordinate system, these must be defined with high precision. Using "Closed Loop" in the ATOS ScanBox systems, 3D coordinates of the characteristics of an object are determined photogrammetrically first without any interference from any ambient influences. In a second step – the actual scanning – based on the previously measured characteristics, the scanner determines its positions and transforms with high precision into a global coordinate system. A second measuring system for tracking the scanner is not needed.

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.

Evaluation and Measuring Reports

ATOS Professional VMR 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.

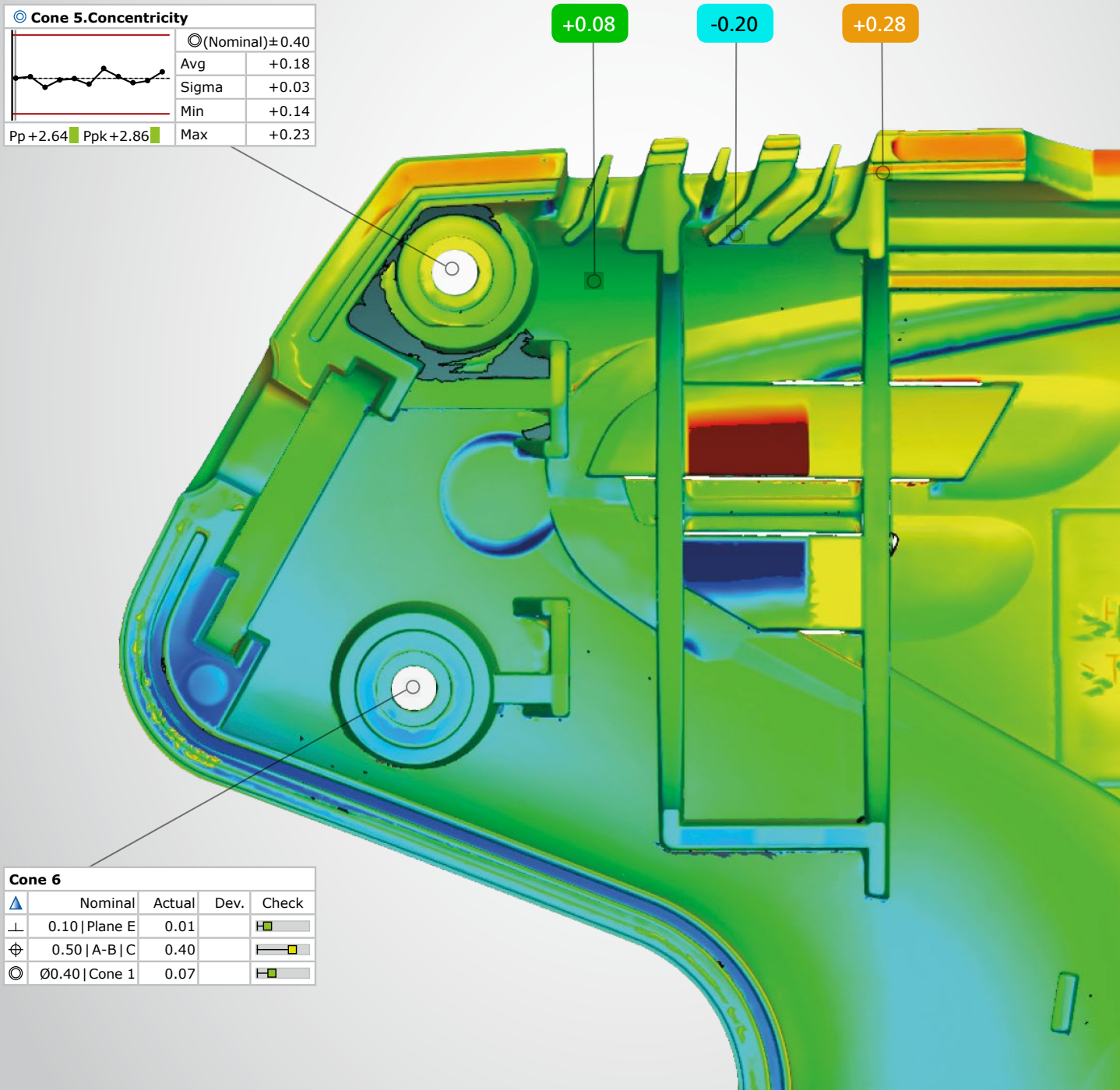
Alignment – The GOM 3D software contains all standard alignment functions. These include: RPS alignment, hierarchical alignment based on geometry elements, alignment in a local coordinate system, using reference points and various best-fit procedures such as global best-fit and local best-fit. Customers 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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