# Оптические 3D-датчики и измерительные приборы AIMax twin и AIMax twin UV, AIMax cloud II, 3D сканеры ATOS Q, системы измерения для повышения производительности в прессовом цехе ABIS III, мобильные измерительные станции ScanCobot, ABISV20

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**Беларусь** +(375)257-127-884
**Узбекистан** +998(71)205-18-59
**Киргизия** +996(312)96-26-47

эл.почта: zsf@nt-rt.ru || сайт: https://zeiss.nt-rt.ru/

INLINE MEASUREMENT TECHNOLOGY

# ZEISS AIMax

## Measurement of complex geometric features

The ZEISS AIMax digital optical 3D sensor was specially developed for robot-based inline process monitoring. The system combines three measuring principles that enable the measurement of geometric features such as holes or bolts with maximum robustness and attributive feature recognition.

- **Unique combination of three measuring principles in one sensor**
- **Patented method for bolt measurements**
- **Flexible lighting control for optimum scene illumination**

Complex geometric featuresAreas of applicationZEISS INDIVolkswagen customer testimonial

## Three measuring principles

ZEISS AIMax combines three measuring principles in one sensor: Gray value image processing, multi-line triangulation and the patented shadow evaluation, especially for pin and bolt measurements. The flexible lighting control enables optimum scene illumination, such as individually switchable segment lighting and lighting combinations for ideal contrasting of features that are difficult to measure.

## Areas of application

The sensor is used for testing assembly and welding processes as well as for inline measurement technology in car body construction, sheet metal processing and for structural components. In addition, gap and flush measurements are possible in the body shell and during final assembly. ZEISS AIMax can also be used for position detection and positioning tasks (parts, car bodies) and for robot-based coordinate measuring technology in general.

## Visualization of the measurement results

The measurement results are visualized directly after the measurement in the connected ZEISS INDI software. Feature extraction based on multi-line triangulation, gray value image processing and patented shadow evaluation is instantaneous and can be used for statistical evaluations and Q-stop functionalities.

The data from the inline stations helps to optimize the production processes in the plant. If we see on the photos that there is adhesive in the hole, we simply send the photo to the person responsible and they optimize the adhesive supply, which avoids rework.

**Werner Steinert**Head of PWQ-3/1 QA analysis/measurement, Volkswagen Wrzesnia

INLINE MEASUREMENT TECHNOLOGY

# ZEISS AIMax twin & ZEISS AIMax twin UV

## 100% detection of gaps and flushes

The double-head sensors inspect gap and flush values on every vehicle produced in the production line. ZEISS AIMax twin measures geometric gap and flush dimensions on metallic and painted surfaces. ZEISS AIMax twin UV also enables the reliable inspection of gap and flush on non-cooperative and transparent surfaces such as glass or plastic. The continuous control of all necessary gaps and flush fits - from the overall body to the finished vehicle - guarantees that the parts fit together perfectly.

- **Short control loops thanks to automated detection**
- **Measurement of geometric gaps on metallic, painted, non-cooperative and transparent surfaces**
- **Inline inspection guarantees optimum fitting accuracy of the installed parts**

Flush & GapZEISS AIMax twinZEISS AIMax twin UV

## Significance of gap & flush for the automotive industry

The early detection of gaps and flushness is intended to prevent subsequent, very time-consuming and cost-intensive reworking. The cross-trade inline functional inspections not only guarantee a perfect optical appearance, but also ensure the tightness of the vehicle and correct door closing forces. This has an impact on the customer's subsequent driving experience in terms of driving and wind noise.

## ZEISS AIMax twin

ZEISS AIMax twin can - thanks to the double-head sensor technology - capture and evaluate the gap geometrically from two directions by looking directly into it. The result: an even more precise inspection with more data and information that can be fed back into the process.

## ZEISS AIMax twin UV

A large number of gaps and flush lines on the vehicle are located in relevant visual zones and are often created by adjacent parts with various surface materials such as glass, plastic, chrome and rubber seals. As a result, the inspection of customer-relevant gap and flush values is becoming increasingly important. The ZEISS AIMax twin UV is used for measuring and inspection on various non-cooperative materials.


# ZEISS AIMax cloud II

High-speed sensor for measuring
complex features in the production line

Seeing beyond


# Index

# 100% measurements with maximum speed

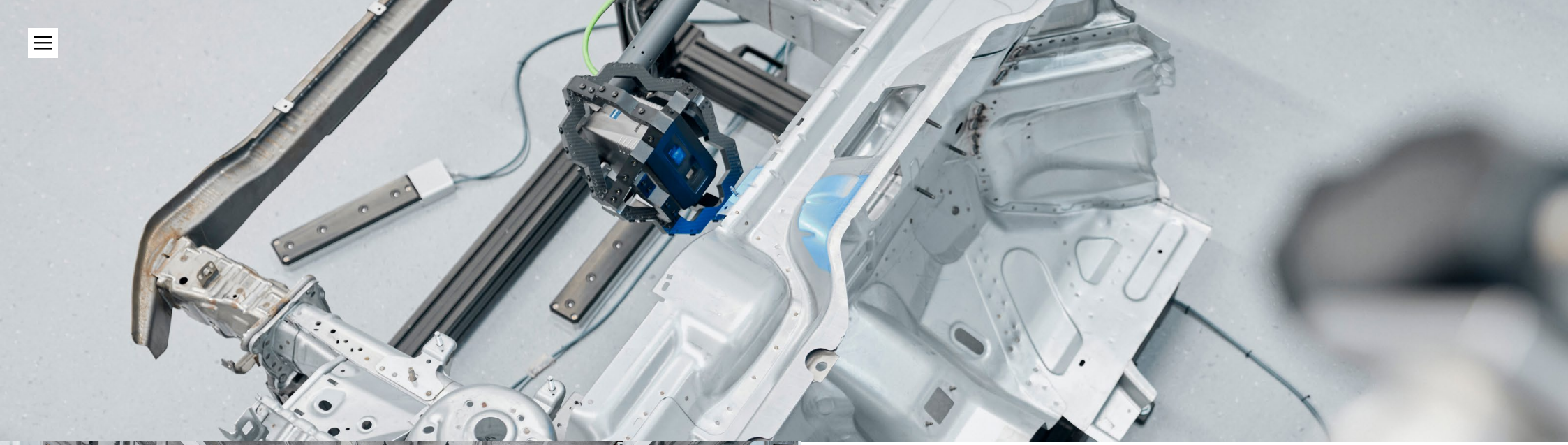
ZEISS AIMax cloud II optical 3D sensor was specially developed for quickly measuring features in the production line that are easy to evaluate. Using its projection technology and high 3D resolution, the sensor generates a very dense point cloud and measures complex car body specific features such as rivets, bending edges, surface points, or T-pins with just one image. This robot-guided inline measuring system is ideal for the sheet metal processing industry and car body construction, allowing for fast 100% measurements in short cycle times from individual parts to the entire car body.

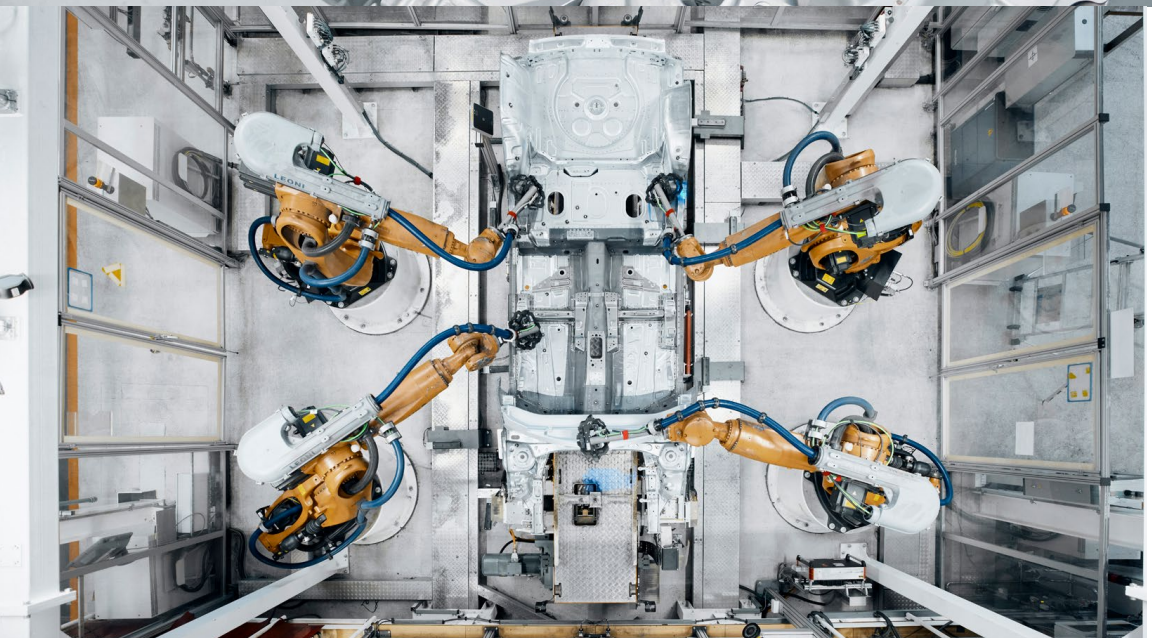
Due to its compact design, all measuring points in the production line are easily accessible. The measurement setup is quick and intuitive, and the result is visualized immediately after the measurement.


# Areas of application

In the automotive industry, ZEISS AIMax cloud II measures car body specific features such as bolts, hole patterns, or rivets. The inline measuring system also supports users in testing of assembly and welding processes. Furthermore, the sensor enables the measurement of characteristic design lines.

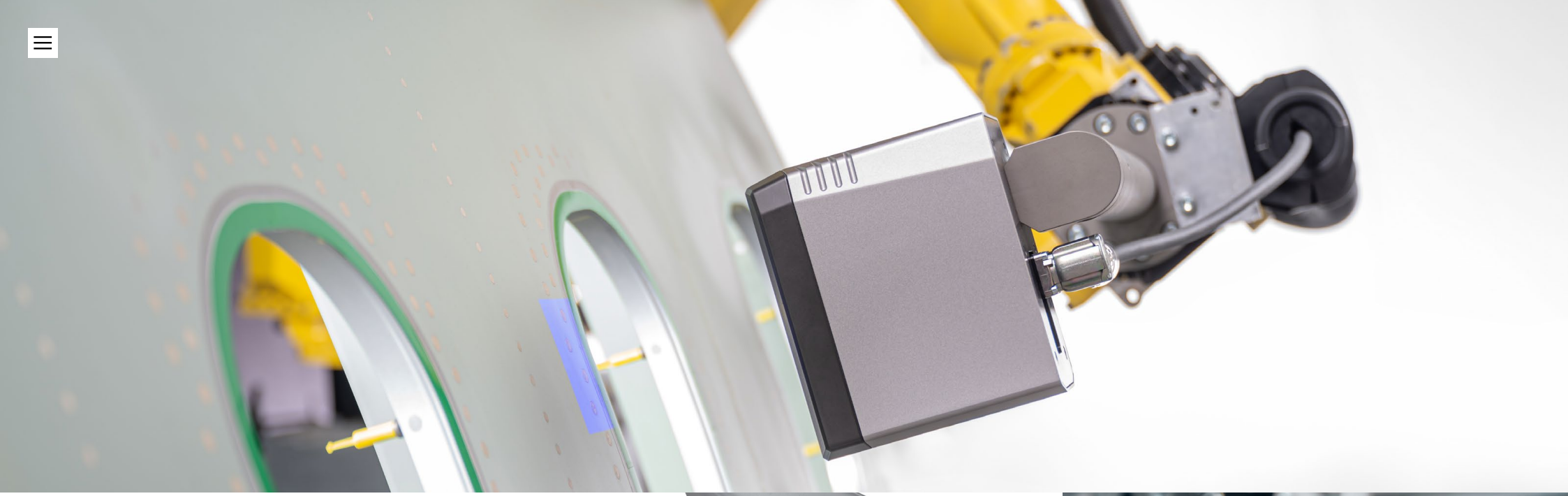
Another application is the aerospace industry: the sensor can efficiently and quickly measure specific features such as rivets or important functional dimensions on aircraft fuselages, wings, vertical stabilizers, and aircraft doors.





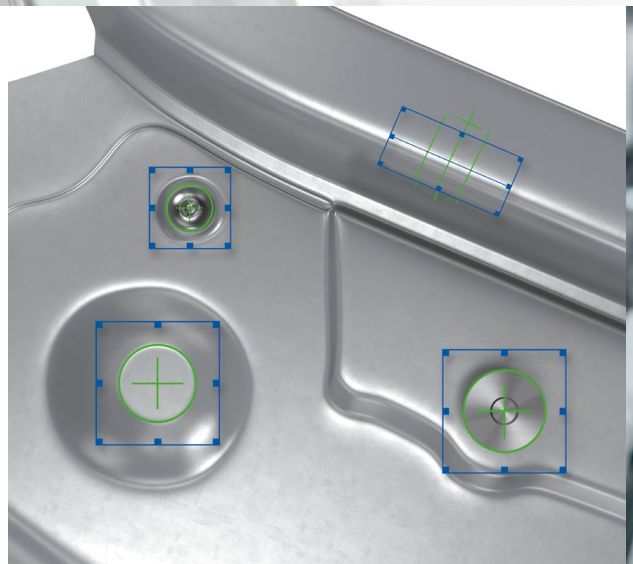
# Correlation-free and metrologically traceable inline metrology

ZEISS AIMax cloud II can also be used in the metrologically traceable inline measuring system ZEISS AICell trace. Providing reliable and meaningful measurement and inspection data, this technology has the required accuracy from the first part. As a result, correlation measurements in the measuring room are no longer necessary.



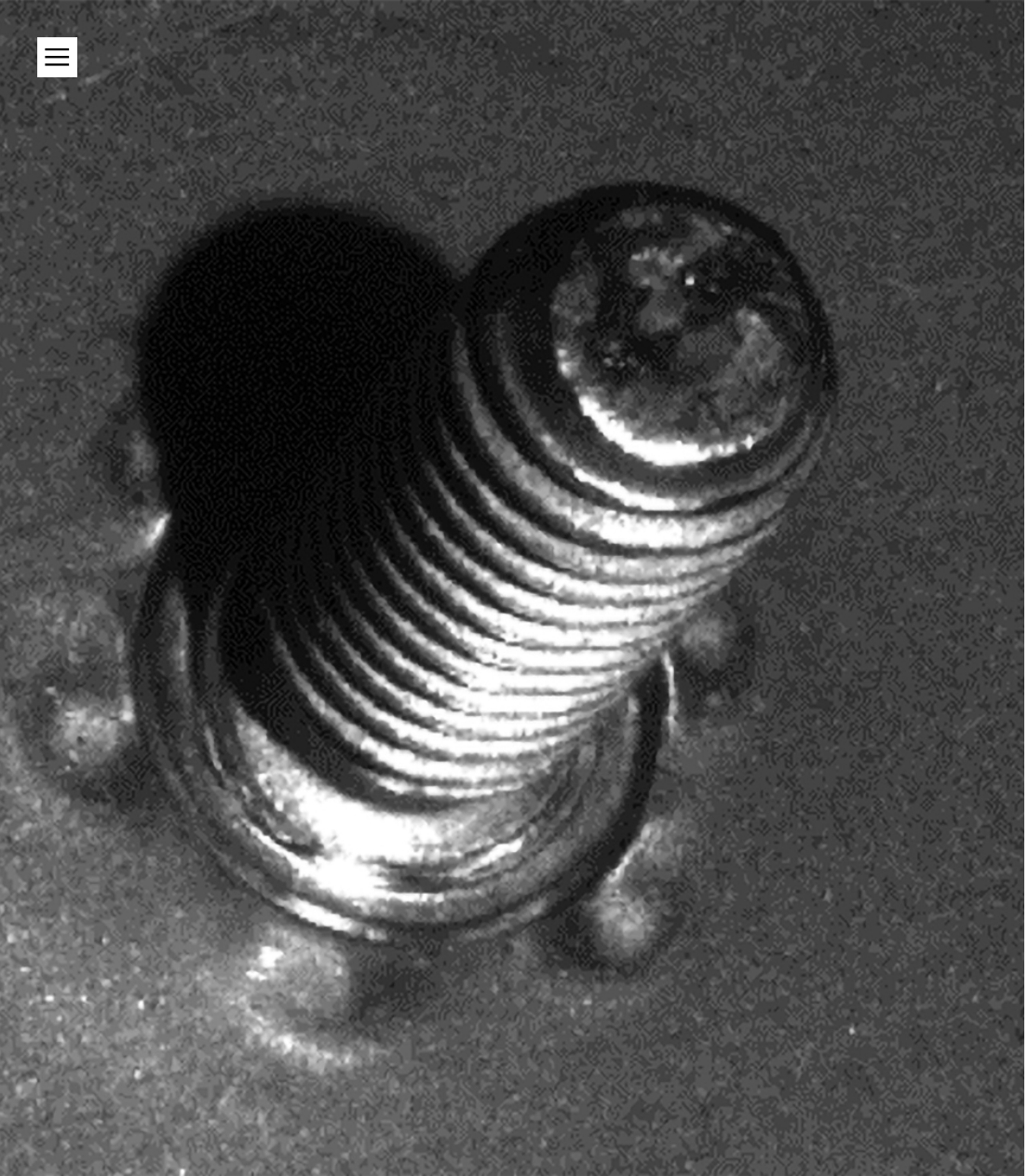
# Feature measurement

- Dimensional accuracy of the car body geometry
- Position of a welding nut behind sheet metal
- Rivets
- Ball pins
- Position of ISOFIX anchors
- Correct bolt position
- Hole pattern position
- Bending edges



# The advantages at a glance

- Quick creation of dense point clouds using structured illumination
- DLP® technology optimized for inline use
- Intuitive and fast setup of feature extraction
- Enhanced robustness compared to standard image processing through feature extraction in the point cloud
- Ability to measure and test even the most minor features thanks to high 3D resolution
- Simultaneous analysis of multiple features in one sensor position
- Measurement of individual parts up to complete car bodies



# Visualization of the measurement results in ZEISS INDI

The measurement results are visualized directly after the measurement in the connected ZEISS INDI software. Feature extraction in the point cloud can be set up quickly and is user-friendly. The software can also be used to perform statistical evaluations and configure the measurement plan.

Furthermore, the images of the affected measuring points can be accessed and analyzed for a targeted and fast root cause analysis.

The software features of ZEISS INDI ensure efficiency gains, cost minimization, and increased productivity:

- Near-fault identification, incl. Q-Stop functionality
- Downstream evaluation of image files for targeted root cause analysis
- Evaluation of measurement curves and trends per measuring point
- Visualization of the generated point cloud
- Display/visualization of all measurement results on a part

# Technical data

| | |
|---|---|
| Camera | digital (USB3) |
| Camera technology | monochrome |
| Camera resolution | 2500 px x 2264 px |
| Illumination | DLP® projector in the range of 460 nm |
| Measuring distance | 163 mm |
| Measuring volume | 75 mm x 86 mm x 48 mm |
| Dimensions | 96 mm x 168 mm x 145 mm |
| Weight without tool | 3 kg |
| Temperature (compensated) | 10°C to 40°C |
| Image acquisition time | ~ 0,25 seconds / measuring position for typical features |

# ZEISS ScanCobot

Flexible. Efficient. Automated.

Seeing beyond

ZEISS ScanCobot

# Flexible. Efficient. Automated.

ZEISS ScanCobot is a mobile measuring station with a collaborative robot, a motorized rotation table and powerful software. Combined with the compact, high-precision ATOS sensor, the system is ideal for automated 3D measurements and, thanks to its small size, saves plenty on space. ZEISS ScanCobot can be moved directly to where the next measurement is needed.

The optical 3D sensor rapidly captures detailed information on the quality of small and medium-sized parts, which are placed on the motorized rotation table. To inspect the part completely, the ATOS sensor faces it from different directions. Measurement planning takes place fully automated in the virtual measuring room (VMR), a module of the inspection software ZEISS INSPECT.

## The advantages of the mobile measuring station at a glance


**ATOS Performance**

High-speed fringe projection

Fast data processing and high data throughput

Short exposure times, even with shiny and dark surfaces

**Collaborative robot**

Automated measurements

Reduced user interaction

Increased repeatability

**Motorized rotation table**

For small and medium-sized parts up to max. 50 kg

Max. part size 500 mm

Interaction with collaborative robot

**Mobile with low space requirement**

Easy and fast transfer to the next place of use

Small footprint

Reduced weight

**User-friendly inspection software**

Complete measurement process in the virtual measuring room (VMR)

Automated measurement and inspection processes

Automatic creation of scan positions through Smart Teach


# ZEISS ScanCobot

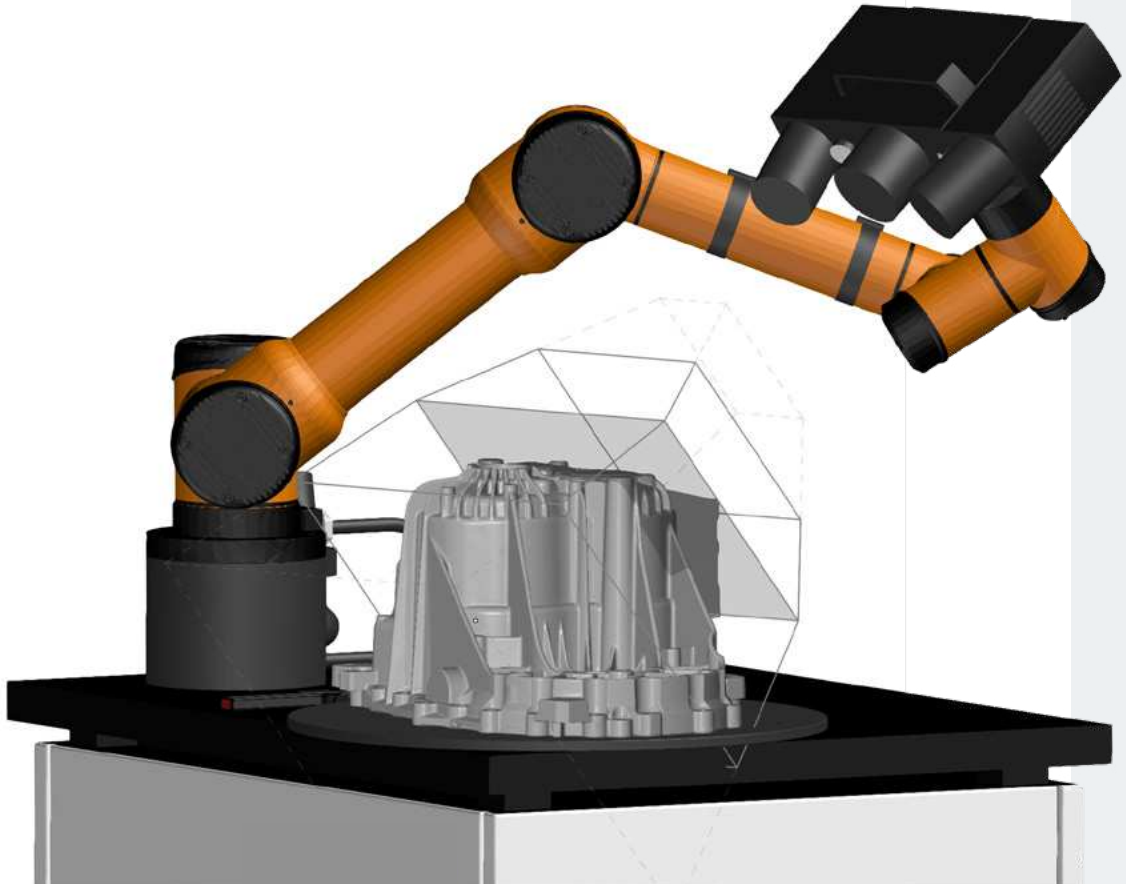
## speeds up product development processes

ZEISS ScanCobot makes prototyping quick and easy. It facilitates toolmaking and testing and speeds up preproduction. This, in turn, optimizes the quality control and assurance of the final product. Small and medium-sized parts can be measured efficiently to swiftly identify, analyze and correct quality issues.

## User-friendly inspection software and easy robot programming in the virtual measuring room (VMR)

As the central control and measurement planning software, the VMR reproduces the entire measuring procedure: measurement planning, digitizing and inspection. The CAD data set for the part being inspected is imported into the software ZEISS INSPECT together with the corresponding measurement plan. The software automatically computes the necessary sensor positions and robot paths.

If no CAD data is available, the software uses the part's geometry to generate evenly spaced measurement positions. This is followed by the measurement, inspection and analysis – fully automated. The user does not require any special robotics skills.



## Advantages for the entire workflow

**Process reliable and runtime-optimized**
Smart Teach functionality in the virtual measuring room simplifies the process of robot programming. Measurement positions are updated automatically, if the CAD or individual elements change.

**Burn-in process**
The created measuring program is integrated through an automated process. For this, the robot moves to the measurement positions and determines individual measurement parameters on the real part.

**Serial measurement**
The finished measurement programs can be used for additional component testing. Changes to the CAD data sets and inspection plan can be updated with a click of the mouse thanks to the software's parameter-based design.

**Reporting with one click**
Once inspection is complete, the results can be compiled into a custom report with photos, tables, diagrams, text and graphics.

ZEISS ScanCobot

# Created for a wide range of tasks

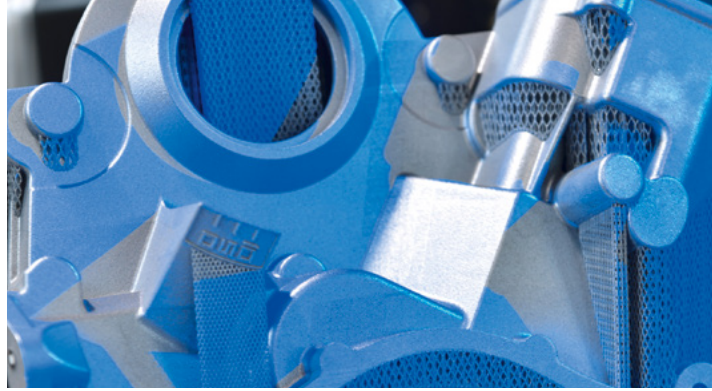
The ZEISS ScanCobot can be used in many industries for the efficient quality control of parts made of materials such as plastics, metal or cast iron.

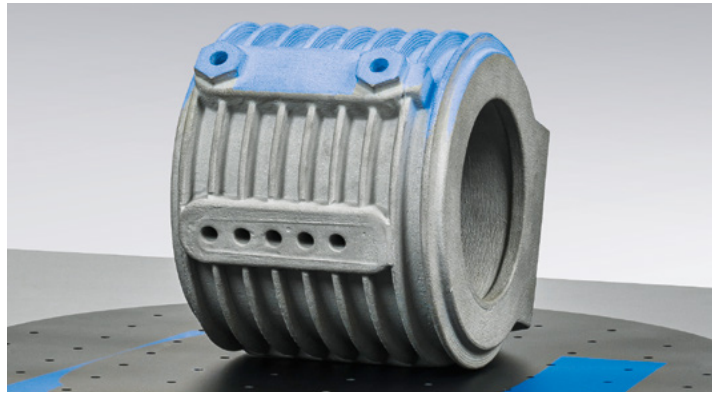
**Additive manufacturing**
Speed up product development and product launch with high-resolution polygon meshes (STL files) for 3D printing, milling, additive manufacturing and dimensional inspection

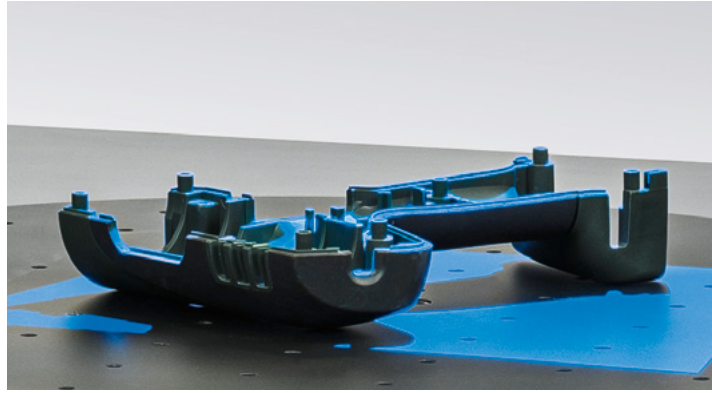
**Casting and forging**
Shorter measurement and inspection times in sand casting, die casting and investment casting as well as in the forging industry

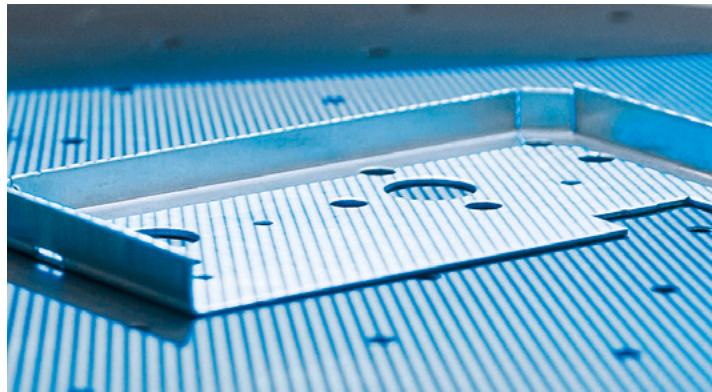
**Injection molding**
Optimization in all phases of injection molding, blow molding and thermoforming

**Metal forming**
Efficient quality control from toolmaking and testing, first article inspection and serial inspection to assembly









# Technical data

| | |
|---|---|
| Set-up area [mm] | 975 × 775 |
| Working height [mm] | 1,000 |
| Power supply | Standard, 100 – 240 V (1-phase, 16 A) |
| Sensor compatibility | ATOS Q 8M, ATOS Q 12M |
| Safety housing dimensions* [mm] | 1,650 × 1,650 × 2,340 |
| Doorway dimensions [mm] | 1,150 |
| Safety housing material | Steel and transparent plastic panels |

* The system can be equipped with a standardized safety housing to comply with market-specific safety regulations. The generous doorway allows the ZEISS ScanCobot to be easily placed inside the safety housing.

# ATOS technology

The ATOS sensors are fully tailored to the metrological requirements of industrial users and provide absolute, accurate and traceable measuring data even under harsh conditions. The 3D scanners operate with structured blue light for contactless measurement.

## Triple Scan Principle

The Triple Scan Principle ensures precise and complete measuring data, even with complex geometries and uncooperative surfaces. The sensor's two high-resolution cameras and projection unit deliver different views of an object in each individual measurement. To accomplish this, the projection unit projects a fine fringe pattern onto the part surface, which is captured by two cameras operating on the stereo camera principle and used by the software to generate the digital geometric twin. The stereo camera setup gives the system a built-in, sensor-controlled feature to monitor process reliability during measurement.

The software gives the user continuous feedback on the calibration status, the transformation accuracy of the individual measurements, changes in the environment and part movements.

## High measuring speed

With each scan, ATOS sensors deliver full-field 3D coordinates within seconds. Each individual measurement consists of up to 12 million independent measuring points. This is made possible by the low noise level of the Blue Light Equalizer. This increases the brightness of the light source by a factor of 1.5, allowing for short exposure times.

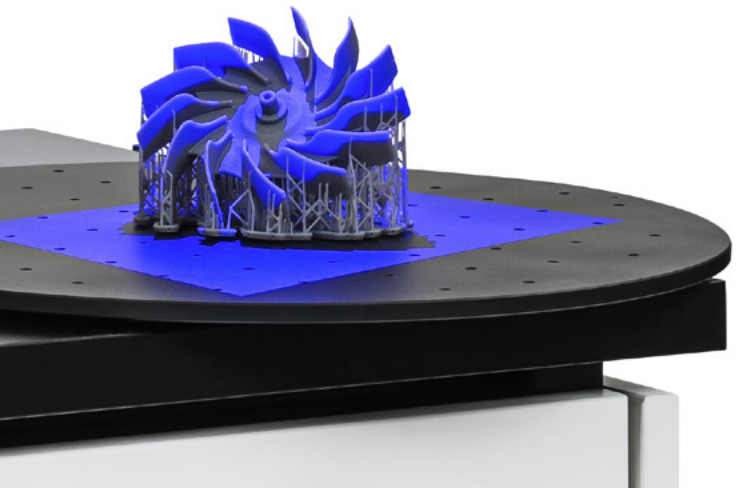
# ATOS Q

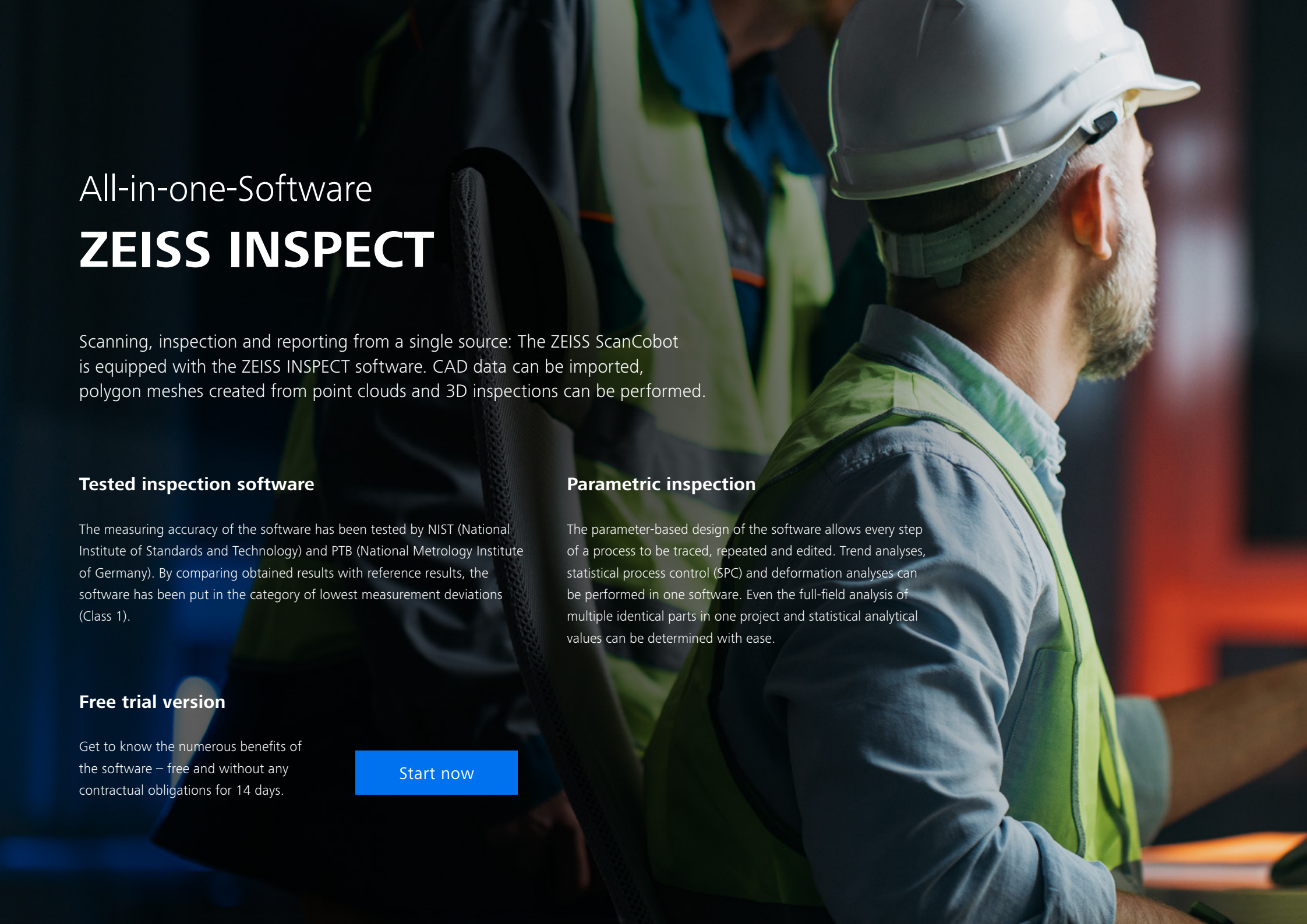
## High-speed 3D scanner with superior data quality

ATOS Q generates a complete measurement dataset in a short time from detailed full-field 3D coordinates. Instead of point-based or linear data, the system delivers full-field data about deviations between the actual 3D coordinates and the CAD data.


ATOS Q is available in two different camera resolutions, 12 M and 8 M. The 3D scanners capture up to 2 × 12 million or 2 × 8 million coordinate points during scanning. The accuracy, resolution and the measuring area can be defined as desired. Five precision lenses are available, which cover measuring fields of different sizes: 100, 170, 270, 350, 500.

| | **ATOS Q 8M** | **ATOS Q 12M** |
|---|---|---|
| Light source | LED | LED |
| Measuring points per scan | 8 million | 12 million |
| Measuring area [mm²] | 100 × 70 – 500 × 370 | 100 × 70 – 500 × 370 |
| Point distance [mm] | 0.04 – 0.15 | 0.03 – 0.12 |
| Working distance [mm] | 490 | 490 |
| Weight | Approx. 4 kg | Approx. 4 kg |
| Dimensions | Approx. 340 mm × 240 mm × 83 mm | Approx. 340 mm × 240 mm × 83 mm |
| Cable length | 10 m fiber optic cable | 10 m fiber optic cable |
| Operating system | Windows 10 | Windows 10 |
| Measuring volumes | 100, 170, 270, 350, 500 | 100, 170, 270, 350, 500 |





All-in-one-Software

# ZEISS INSPECT

Scanning, inspection and reporting from a single source: The ZEISS ScanCobot is equipped with the ZEISS INSPECT software. CAD data can be imported, polygon meshes created from point clouds and 3D inspections can be performed.

## Tested inspection software

The measuring accuracy of the software has been tested by NIST (National Institute of Standards and Technology) and PTB (National Metrology Institute of Germany). By comparing obtained results with reference results, the software has been put in the category of lowest measurement deviations (Class 1).

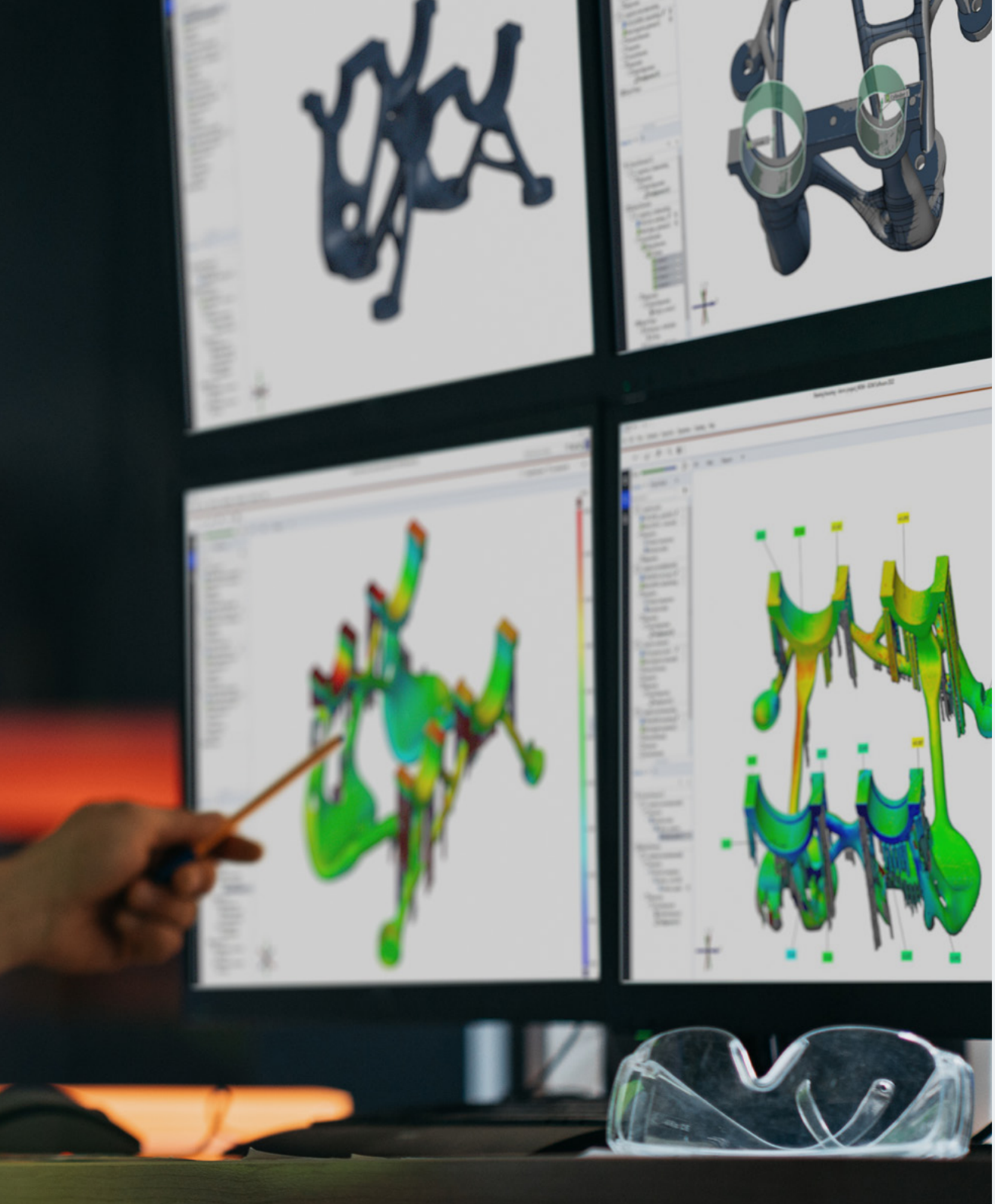
## Parametric inspection

The parameter-based design of the software allows every step of a process to be traced, repeated and edited. Trend analyses, statistical process control (SPC) and deformation analyses can be performed in one software. Even the full-field analysis of multiple identical parts in one project and statistical analytical values can be determined with ease.

## Free trial version

Get to know the numerous benefits of the software – free and without any contractual obligations for 14 days.

Start now



## Numerous CAD formats

Time can be saved by importing native CAD formats such as CATIA, NX, SOLIDWORKS and Pro/E into the software.

## Teaching by Doing

Thanks to continuous buffering, the desired inspection steps can be transferred to subsequent parts without any programming effort.

## Digital assembly

Digital and virtual assembly allows for control of the alignment of parts to one other and the accuracy of fit, regardless of where the parts were manufactured.

## Scripting

A command recorder saves all executed operations as a Python script, which can then be repeatedly applied or varied for other measurements.

ZEISS INSPECT supports the measuring and inspection process with detailed analytical and reporting functions. The results are easily and clearly compiled.

# ZEISS Industrial Quality Solutions

ZEISS Industrial Quality Solutions is a leading manufacturer of multidimensional metrology solutions. These include coordinate measuring machines, optical and multi-sensor systems, microscopy systems for industrial quality assurance as well as metrology software for the automotive, aircraft, mechanical engineering, plastics and medical technology industries. Innovative technologies such as 3D X-ray metrology for quality assurance complete the portfolio.

In addition, ZEISS Industrial Quality Solutions offers a broad global spectrum of customer services with ZEISS Quality Excellence Centers close to its customers. The company is headquartered in Oberkochen. Production and development sites outside Germany are located in Minneapolis in the USA, Shanghai, China and Bangalore, India.

ZEISS Industrial Quality Solutions is part of the Industrial Quality & Research segment.

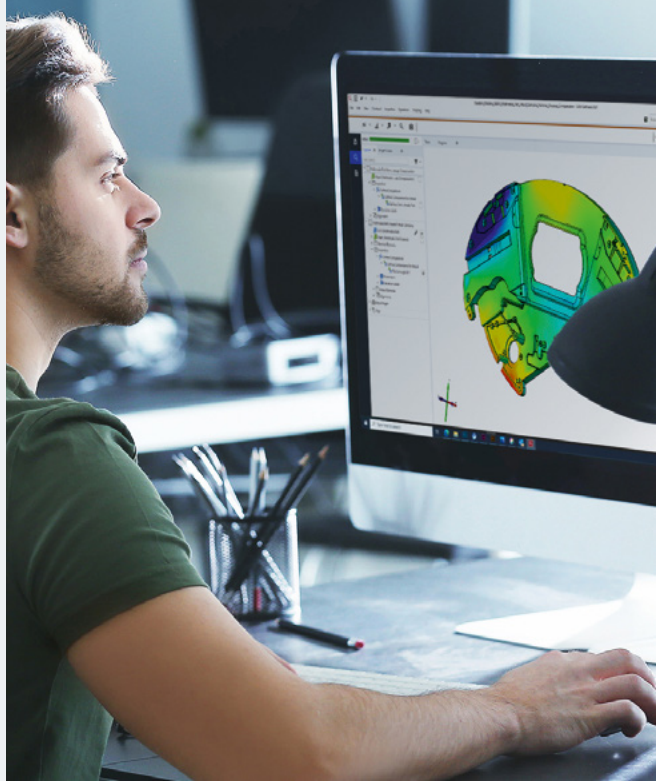
## Your holistic technology partner

Numerous services and training courses support you in your daily use of 3D measurement technology. Training courses and webinars help you to extend your knowledge about using the software and get to know more application fields for the measuring systems.

At conferences and application-based workshops, webinars and digital demos, ZEISS directly shares process and measurement technology know-how. In addition, support and services on a contractual basis are offered for all 3D measuring systems.

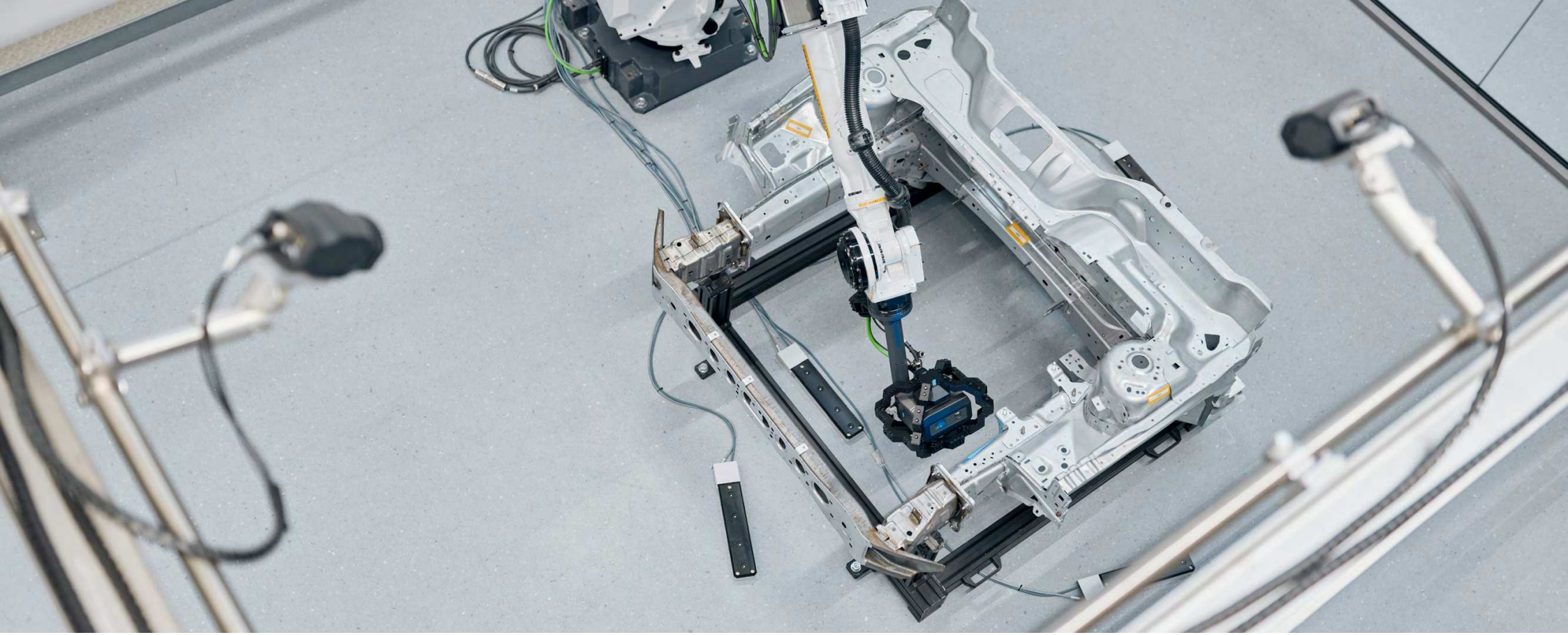
## Training

ZEISS training centers offer training and eLearning courses for all levels of expertise. The training courses follow an internationally standardized concept and are implemented by our certified partners in the corresponding national language. In addition to on-line training courses and scheduled courses in our training centers, customer-specific training courses on site are also available on request.



## Support and service

ZEISS provides support and services to assist you quickly and reliably if required. These are based on the following three pillars: Remote Assistance, Services and Contract Plans.



# ZEISS AICell trace

Process Monitoring and Metrologically
Traced Inline Metrology in One Cell

Seeing beyond

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# Integrated solution for more productivity and efficiency

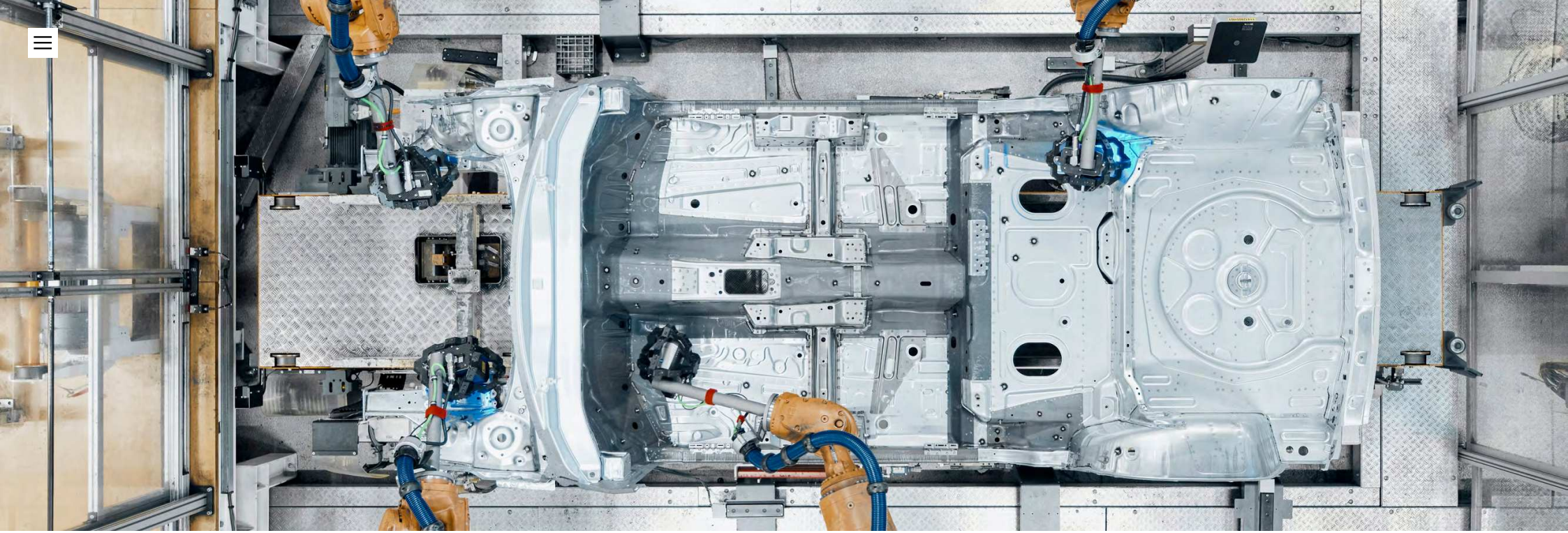
In car body manufacturing, there is an increasing demand for integrating metrological solutions directly into the production line.

The digital transformation of inline metrology reduces the workload of measuring rooms while significantly increasing the number of measured parts. Thus, the shop floor staff is able to immediately detect quality issues where they arise and to proactively manage the production process. ZEISS AICell trace correlation-free inline measuring cell allows for implementing this strategy: It combines process monitoring and metrologically traced inline metrology in one cell.

# Real-time process monitoring & traceable metrology in the production line

The ZEISS AICell trace correlation-free inline measuring cell enables both the real-time process monitoring of complex features and the support of the production ramp-up. The innovative tracking technology used in combination with the fast ZEISS AIMax cloud 3D sensor monitors the sensor position on the robot arm with high precision. The sensor generates highly dense point clouds and measures very complex features such as bolts, edges, holes, weld nuts behind sheet metal and rivets directly inline.

By using this technology, all relevant digital quality information is provided and all measuring points and functional dimensions relevant for continuous process monitoring are measured in cycle time. The complete measuring point plan can be realized through rolling measurements or pause programs.



## The benefits at a glance

- Correlation-free
- Reliable measuring results starting with the first part
- Use in the production environment including temperature fluctuations
- Robot-independent accuracy
- Measurement of single parts and entire car bodies directly inline
- Metrologically traceable serial measurements in the production line without manual effort – Reduced workload of the measuring room
- Prevention of logistical and handling overhead
- Significantly increased sample rate

## ZEISS AIMax cloud

The optical 3D sensor, which also includes a Q-Stop functionality, enables evaluating complex features within cycle time.

## Tracking Cameras

The tracking cameras measure both the exact sensor position and their own position, which can change due to temperature fluctuations.

## Carbon-Fiber Navigation Tool

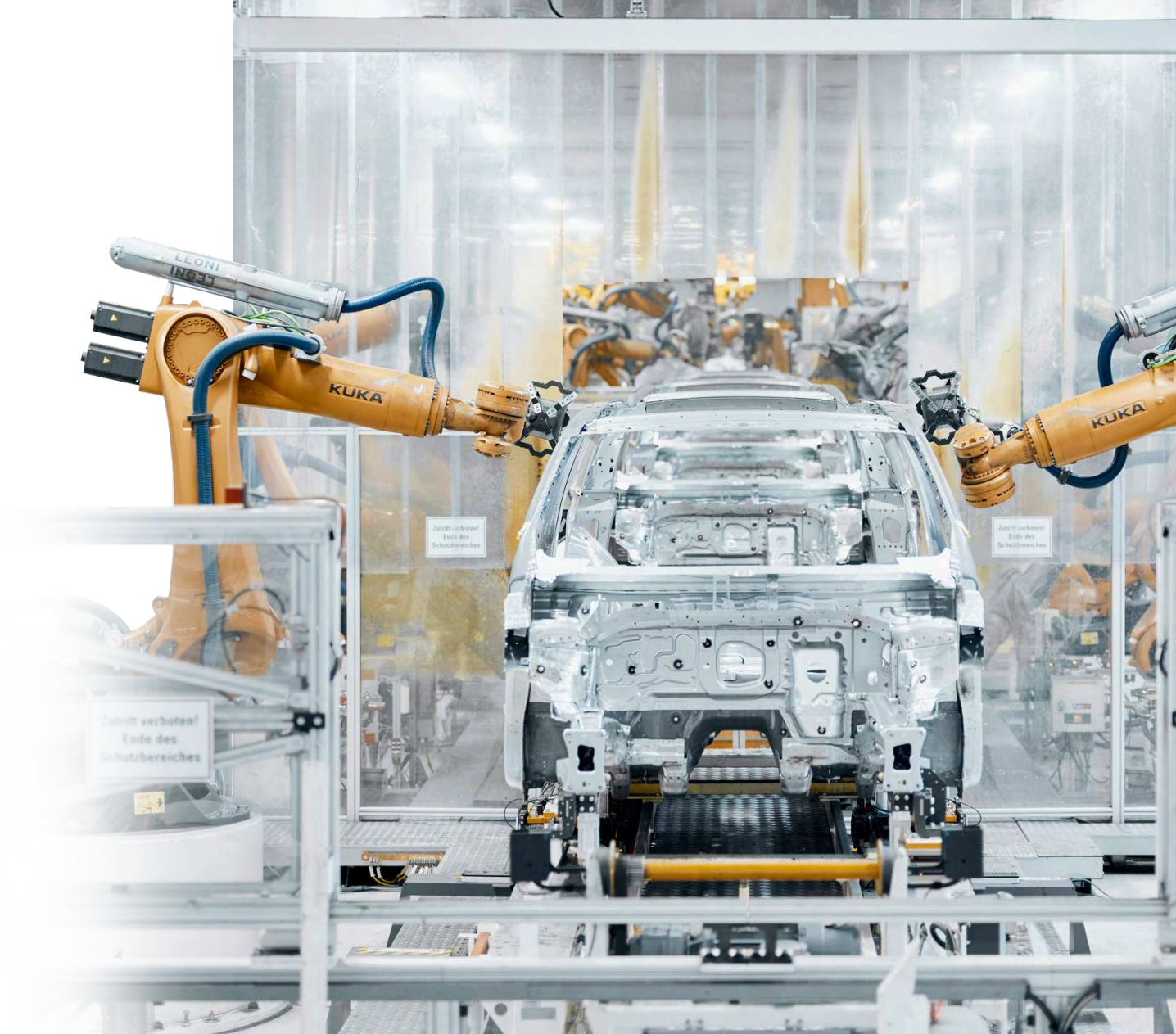
The LED tags are integrated into a carbon body, allowing for the precise determination of the 3D sensor location and position even in the industrial environment.

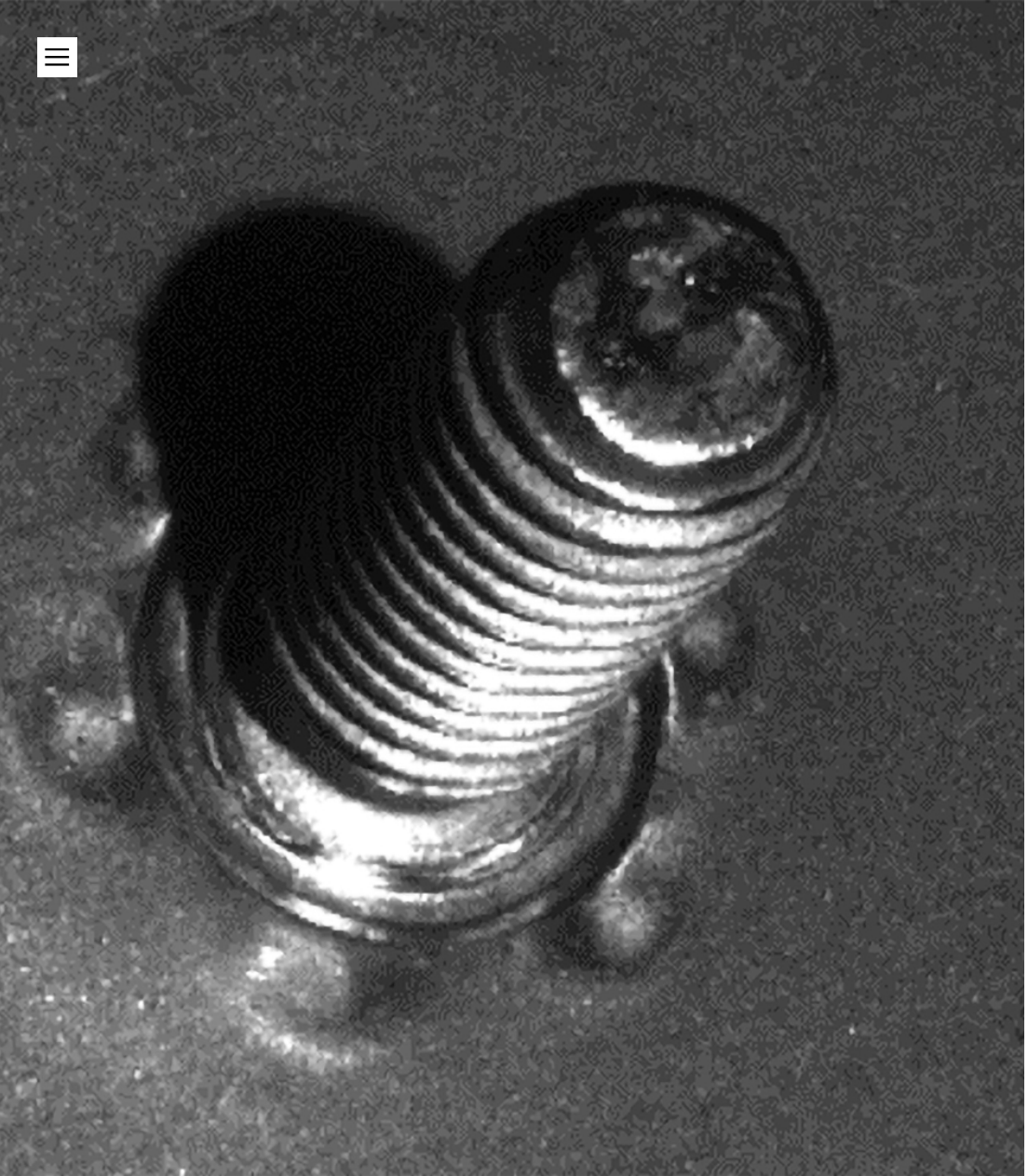
# ZEISS AICell trace

Components and functionality

# Applications

ZEISS AICell trace is the perfect solution for future-oriented body shops. Moreover, the system is also suited for implementation in other demanding industries such as aerospace or transport. Significant deviations of pre-defined features are fully inspected within the production cycle.





# Visualization of the measuring results

## ZEISS INDI

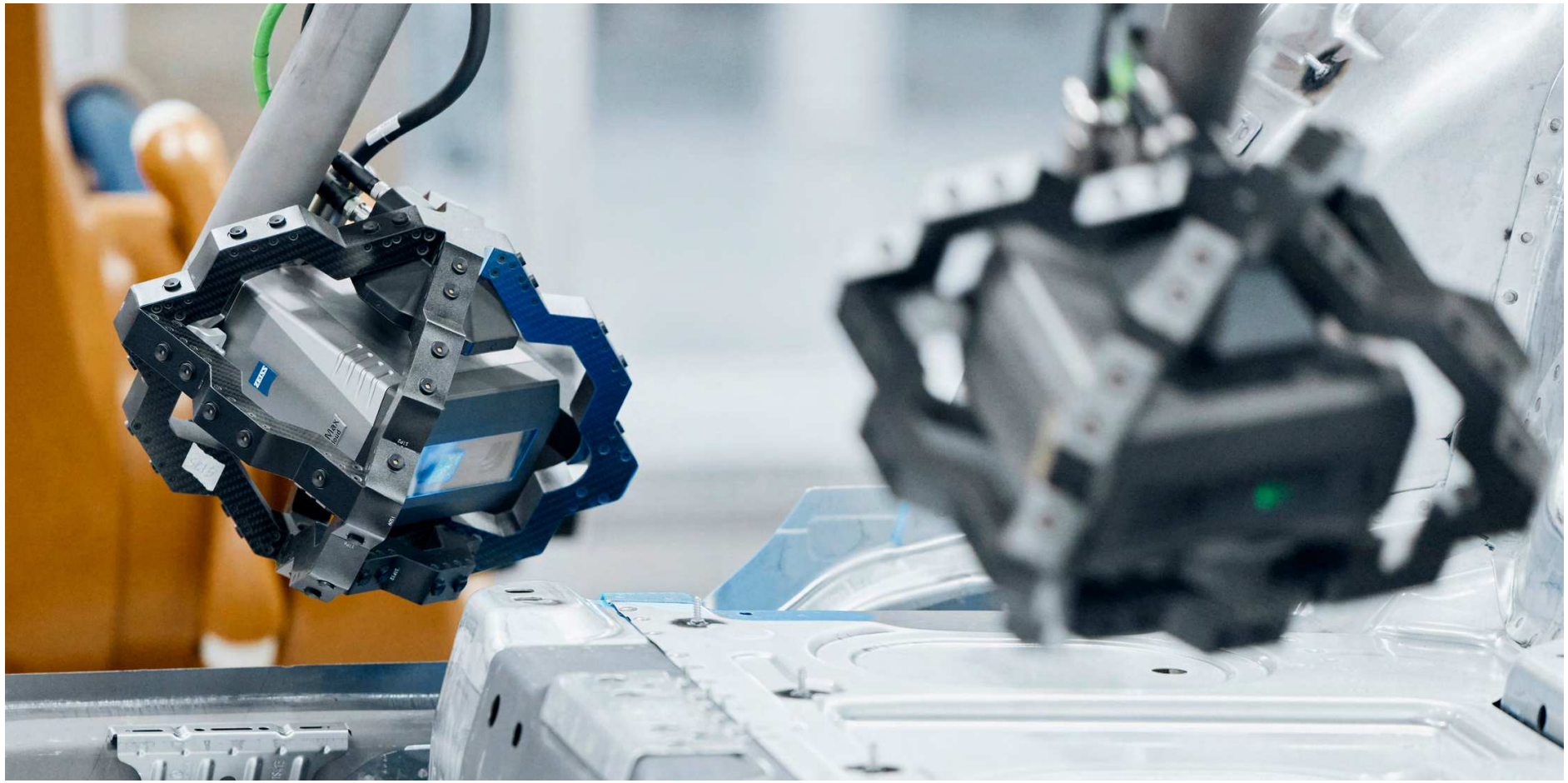
Measuring results are visualized in the incorporated ZEISS INDI software right after measurement. The extraction of features in the point cloud is both easy to configure and easy to use. The software also allows for further evaluating and configuring the measurement plan.

Moreover, images of the measuring points concerned can be accessed and analyzed for a target-oriented and fast root cause analysis.

The software functions of ZEISS AICell trace ensure efficiency and productivity increases while minimizing costs:

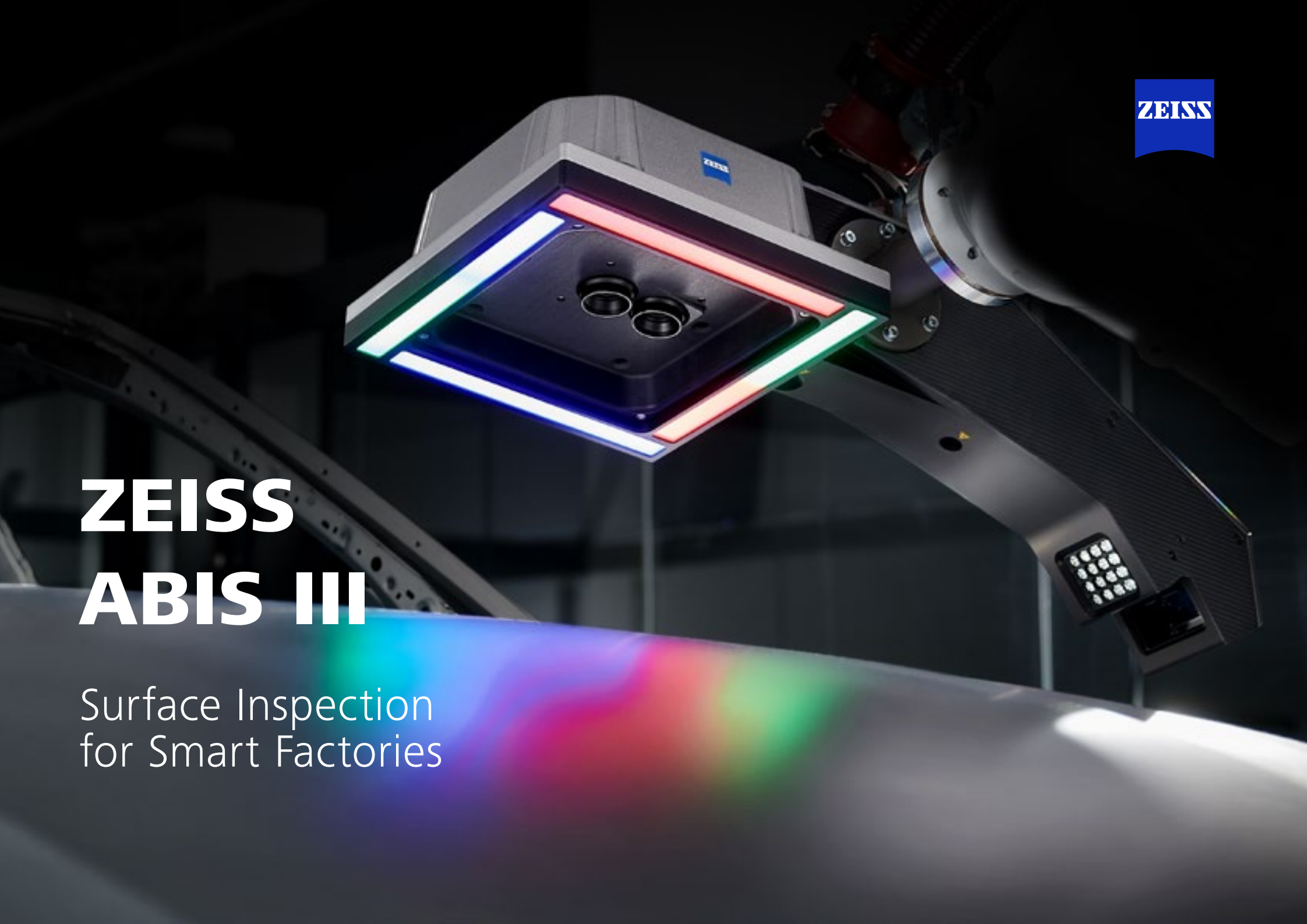
- Timely error detection including Q-Stop functionality
- Evaluation of image files for a target-oriented root cause analysis
- Evaluation of measuring procedures and trends by measuring point
- Visualization of the generated point cloud
- Visualization of all measuring results for a part

# Customer testimonial



# Technical data

| | |
|---|---|
| Camera | Digital (GigE) |
| Camera technology | Monochrome |
| Camera resolution | 2048 px × 2048 px |
| Illumination | DLP® projector in a range between 450 nm and 620 nm |
| Measuring distance | 165 mm |
| Measuring volume | 80 mm × 80 mm × 40 mm |
| Measuring time | < 0.5 seconds<br>Measurement position for typical features |
| Metrological traceability | Acceptance test DIN/ISO 10360 – 8 / 13 |



# ZEISS ABIS III

## Surface Inspection for Smart Factories

# Process Monitoring in Cycle Time

ZEISS ABIS III sensor combines high-speed inspection with a reliable detection of all relevant surface defects. The system inspects both moving and stationary parts reproducibly and highly precise during live production and within the cycle time.

The new surface inspection system continuously and automatically provides the database required for dedicated rework, quick surface analyses and efficient process optimizations.

# The advantages at a glance

- **Short Inspection Times**
  The system quickly and reliably detects all relevant surface defects and significantly reduces inspection times
- **Objective Evaluation**
  ZEISS ABIS III evaluates with constant reliability on the basis of digital limit sample – this ensures uniform standards
- **Easy Operation**
  The system is very easy to operate and forms the basis for proactive process control and a constantly high surface quality
- **Fatigue-Free Testing**
  ZEISS ABIS III works permanently, reliably, and fatigue-free

The patented Multi-Color-Light technology enables detecting the smallest types of defects such as scratches, dents, welding and adhesive residues. With the use of the sensor ZEISS ABIS III with an image capture frequency of up to 20 Hz and the fast detection rate, manual and subjective quality assurance processes become redundant. The resource-efficient system continuously and automatically provides the database required for dedicated rework, quick surface analyses and efficient process optimizations.

# Multi-Color-Light Technology

# Applications

ZEISS ABIS III is the ideal solution for both modern press shops and future-oriented body shops. The system can also be used in other demanding industries such as aerospace and transportation. Moreover, it is not only suited for inline but also for atline use in the production environment.

The uncompromising surface inspection system with the 100% principle guarantees the inspection of all produced parts – including the complete part surface and the detection of all relevant defect types.


# Software

# ZEISS ABIS V20

Possible surface defects of all metallic sheet metal and aluminum surfaces are processed and visualized in real time in the ZEISS ABIS V20 software. These include surface defects such as dents, sink marks, neckings, cracks, pressure marks and now also scratches as well as welding and adhesive residues.

This way, functions such as a Q-stop and digital quality details such as defect visualizations for scheduled rework are always available. They provide the basis for closed loop circuits and the precondition for implementing the Smart Process Control.

# Technical Data

| | |
|---|---|
| Number of cameras | 8 |
| Number of light sources | 200 |
| Measuring volume | 300 x 225 x 40 mm |
| Operating distance | 460 mm |
| Frame rate | Up to 20 Hz |
| Dimensions | 772 x 295 x 300 mm |
| Weight | 11,5 kg |

По вопросам продаж и поддержки обращайтесь:

Алматы (727)345-47-04
Ангарск (3955)60-70-56
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Ярославль (4852)69-52-93

**Россия** +7(495)268-04-70
**Казахстан** +7(727)345-47-04
**Беларусь** +(375)257-127-884
**Узбекистан** +998(71)205-18-59
**Киргизия** +996(312)96-26-47

эл.почта: zsf@nt-rt.ru || сайт: https://zeiss.nt-rt.ru/