

Sensors & Applications Automotive Production



More Precision



Sensors for car manufacturing

Sensors and measurement technology are an indispensable aid in modern automotive production. From the pressing plant to the assembly line and road tests, sensors are used to control assembly processes, monitor supplier parts and for quality assurance purposes.

Micro-Epsilon's instrumentation portfolio provides innovative solutions for measuring distance, thickness, color, temperature and surfaces in almost every stage of the process.



scanCONTROL 29xx

High-end automation scanner for high precision profile measurements

Inline measurement of gaps, profiles, steps, angles

Red or blue laser line versions

Measurement on numerous surfaces, including reflecting and mat



colorCONTROL ACS

Sensors for color measurement of shiny and reflecting surfaces

Ideal for integration into processing lines due to high measuring rates

High accuracy

Different sensors for shiny, structured & curved objects



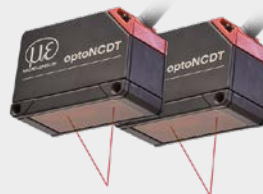
thermoIMAGER / thermoMETER

Thermal imaging cameras and infrared pyrometers for non-contact temperature measurement

Fast and precise temperature measurement

Real-time process monitoring and system control

Compact design & extensive range of interfaces



optoNCDT 1420

Compact laser triangulation displacement sensor for high speed, precision measurements

Non-contact displacement and distance measurements from 10 mm to 500 mm

High accuracy

High measuring rate for dynamic measurements

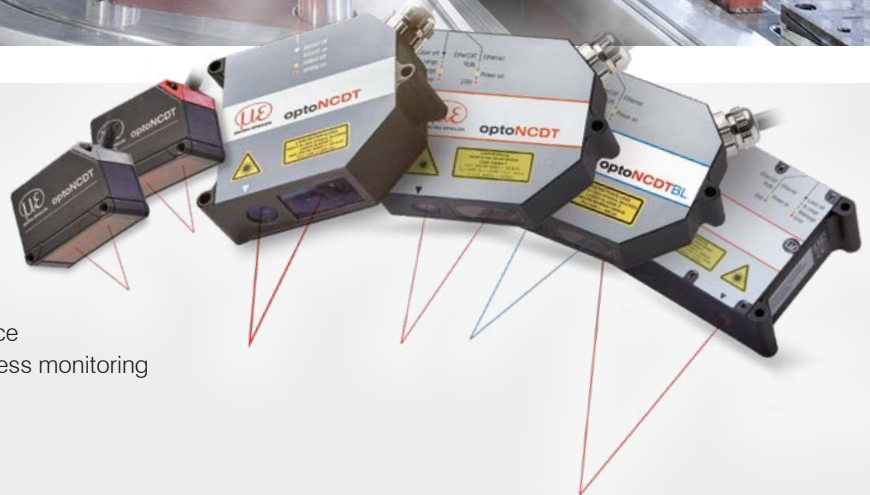
Compact design and easy to install

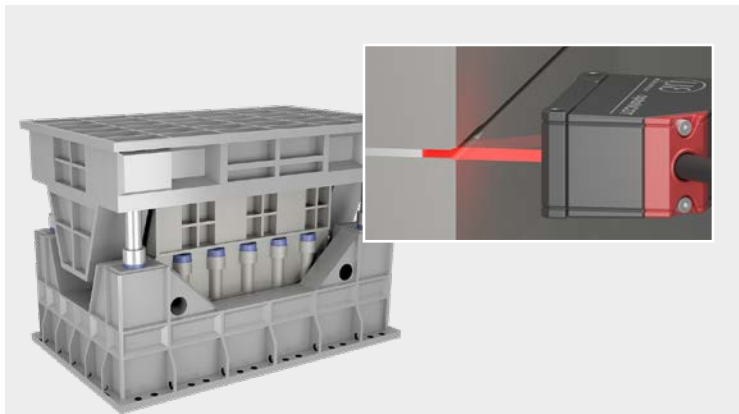
Foundry & Pressing plant



optoNCDT

- Laser triangulation sensors with measuring ranges up to 1000 mm
- Precise measurement from a safe distance
- High measuring rate for high speed process monitoring
- High accuracy





Monitoring sheet metal infeed during pressing

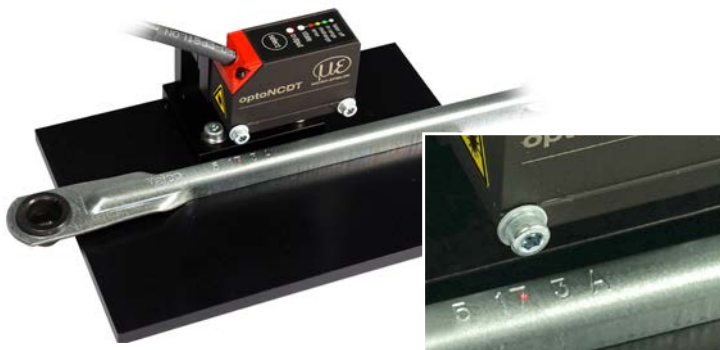
During forming in the pressing plant, the presence detection and the detection of the exact sheet metal position are required. Therefore, laser triangulation sensors measure on the sheet between the dies. The challenge here is to achieve high measurement accuracy in tight spaces despite oil mist, vibrations and shocks. Since the measuring gap is very small, the diameter of the laser must be correspondingly low.

Sensor: *optoNCDT 1420*

Surface inspection of car body components

In modern stamping lines, automotive body shell parts are produced in a cycle time of just a few seconds. Here, automatic recognition and analysis of any deformations or discontinuities are crucial. Because of the different fouling, material tolerances or variations, unwanted shape defects such as pimples, bumps, dents and neckings may appear. surfaceCONTROL 3D inspection systems inspect the surface of car body components in a few seconds and enable the detection and assessment of local defects.

System: *surfaceCONTROL*



Monitoring embossment depth

In embossing machines, car body IDs are punched into the vehicle frame. The embossment depth must be to a defined tolerance range. In order to position the embossing tool, laser triangulation sensors from Micro-Epsilon measure the distance between the embossing tool and the component. After the embossment is finished, the sensor measures the profile of the embossment and ensures that all characters are embossed to the required depth.

Sensor: *optoNCDT 1420*

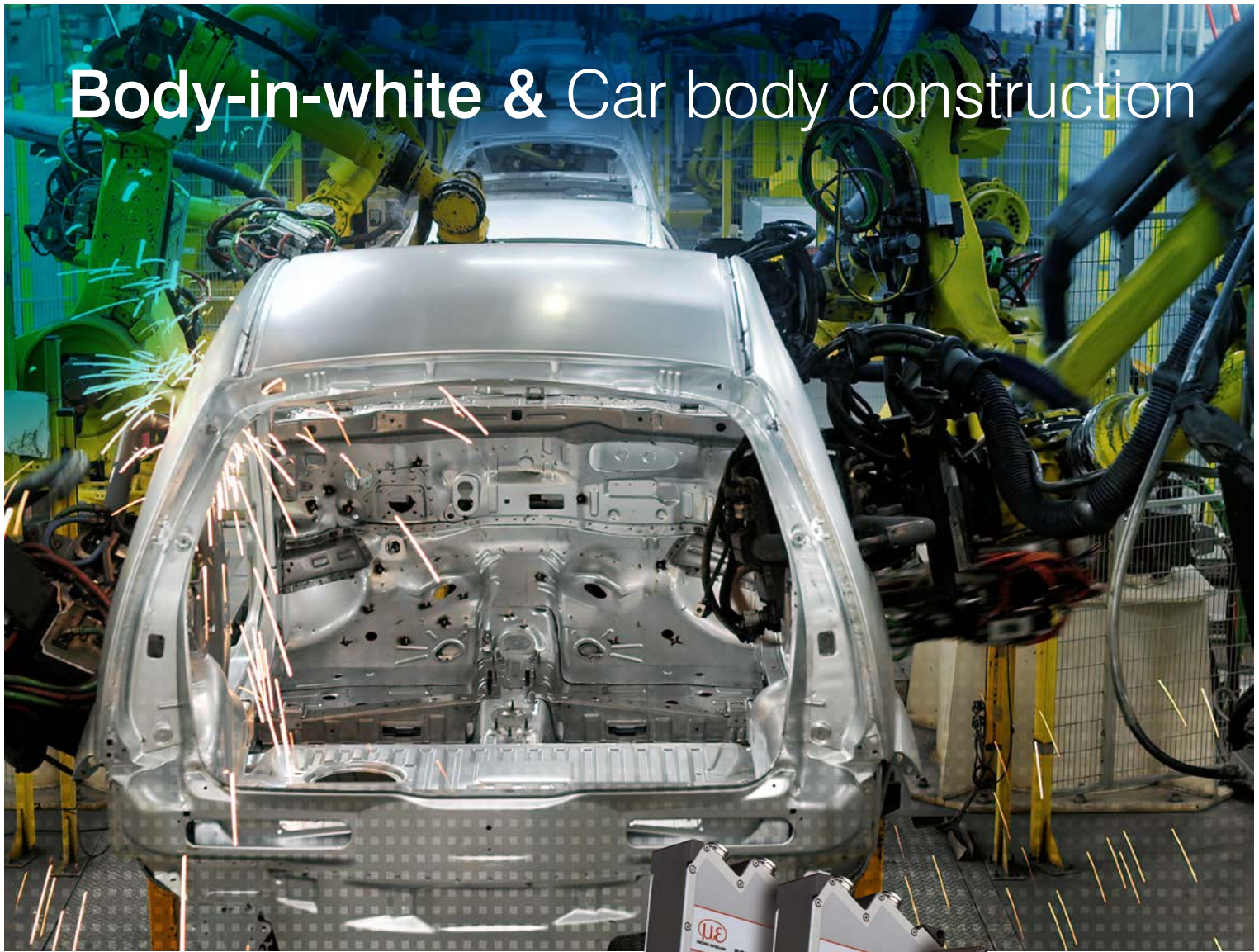
Gap measurement in aluminum die casting processes

In aluminum die casting, liquid aluminum is poured into molds under high pressure and at high speeds. The high pressure acts on the closed mold and pushes it apart, which is why splinters and burrs can occur during casting. In order to measure the pressure-induced movement of the molds, eddy current sensors measure the change in distance. These robust sensors provide reliable measurement results despite high temperatures, ambient pressure and a dirty measuring gap.

Sensor: *eddyNCDT*



Body-in-white & Car body construction



scanCONTROL

- Compact laser scanner with integrated controller
- High profile frequency for dynamic measurements
- Synchronization enables multi-scanner applications
- Various measuring ranges
- Blue Laser sensors for high precision measurements





Robot positioning in seam welding

In order to permanently protect weld seams against the ingress of moisture, the weld is sealed to the roof rail. At the point where the side frame is connected to the roof panel, a robot automatically applies the seal. In order to detect the weld seam, a laser sensor from Micro-Epsilon is used. The distance measurement enables pre-positioning of the robot.

Sensor: *optoNCDT 1750*



Position detection of the car body

For automated processing of car bodies, an exact determination of the position relative to the processing tool is necessary (drilling, punching, fitting, subassemblies). Laser triangulation sensors are used for high precision distance measurements on metallic surfaces.

Sensor: *optoNCDT 1750*



Non-contact monitoring of the welding temperature

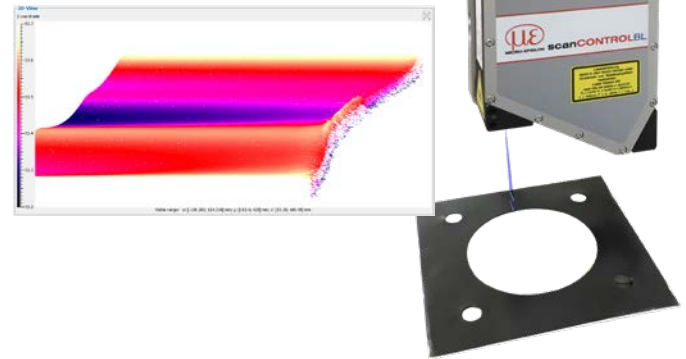
In car body manufacture, welding is carried out using fully automatic welding robots. In order to ensure optimal welded joints, temperature measurement is monitored during welding using non-contact temperature sensors. Therefore, stable welding processes are achieved which are sensitive to the material.

Sensor: *thermoMETER CT*

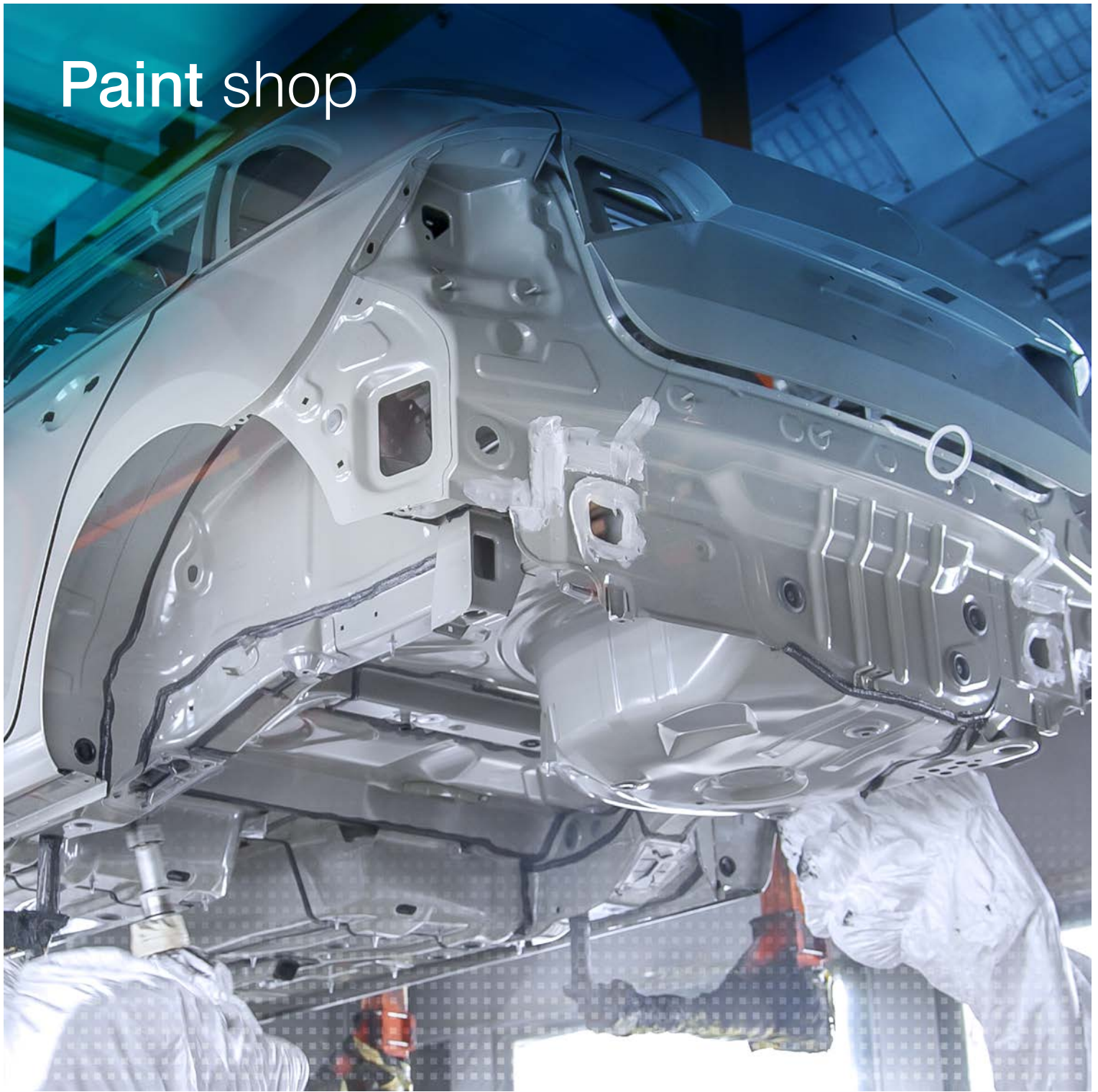
Inline burr detection on sheet edges in body manufacture

In order to avoid waste in downstream production steps, it is crucial to recognize burrs inline as early as possible. The scanCONTROL laser profile sensor is guided over different parts on a robot in order to detect burrs reliably. Thanks to its compact design and high point resolution, the profile sensor can also be used to measure small burrs.

Sensor: *scanCONTROL 2910-10/BL*



Paint shop





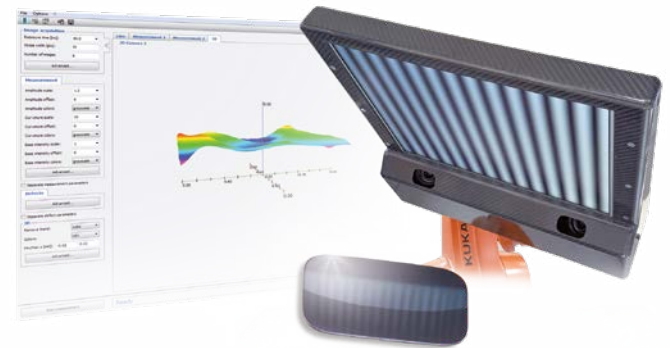
Surface inspection of painted car bodies

Particularly with shiny surfaces, a faultless production process is expected in order to lend a sophisticated visual appearance to the final product. For fully automatic defect detection on car bodies and attachments, the reflectCONTROL inspection system is used. The system projects a striped pattern onto the surface. Deviations caused by any defects are recorded using two cameras and evaluated via software.

Inspection system: reflectCONTROL Automotive

reflectCONTROL

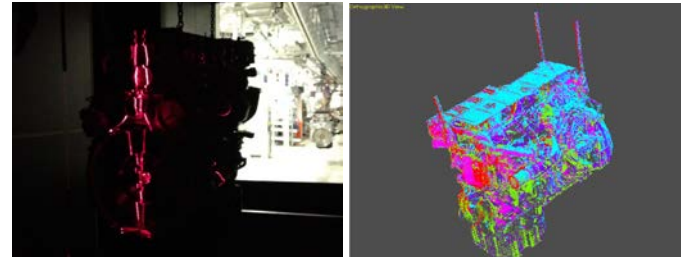
- Automated surface inspection
- Defect recognition on shiny components
- High speed and high resolution
- Proven technology for offline inspection and integration into processing lines
- Reproducible defect detection and documentation



Surface inspection of attachments

Similar to a painted chassis, attachments must also have a high surface quality. For surface inspection of shiny parts, the reflectCONTROL inspection system is used. For complex shapes, inspection can be carried out using a robot.

Inspection system: reflectCONTROL Automation

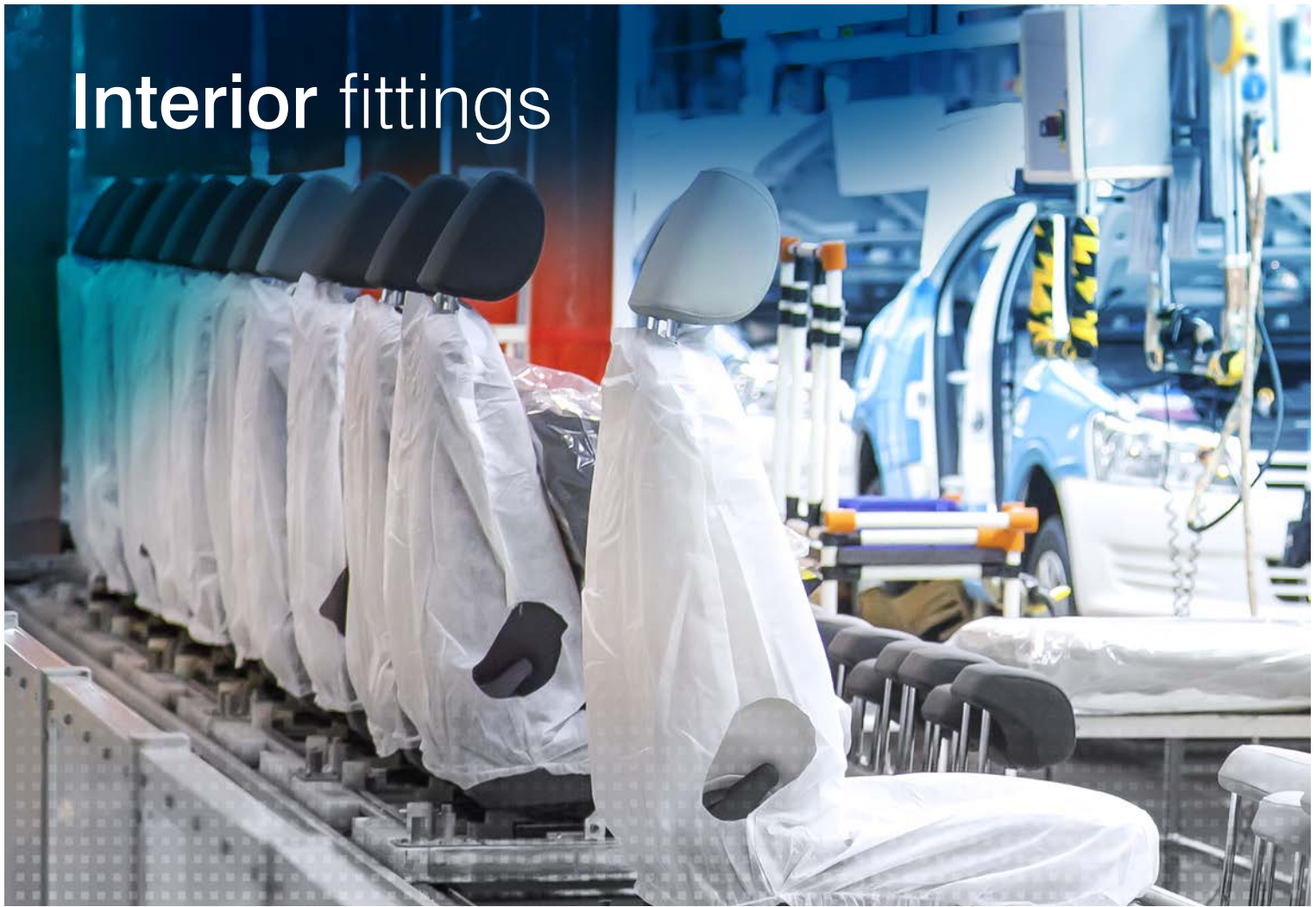


Robot track planning lot size 1

In order to enable robot-assisted cleaning and painting despite the large number of variants, the engines are guided through a scanner booth prior to treatment, which is integrated into the conveyor line. There, Atensor laser scanners detect the external shape of the engine and convert this into a 3D surface model. Based on this model, individual cleaning and painting programs are generated and transmitted to the robots on request.

Inspection system: Atensor lot size 1

Interior fittings



surfaceCONTROL

- Measurement & inspection of diffuse reflecting measurement objects
- Continuous process monitoring
- Detection of different shape defects
- Clear definition of the failure criteria in supplier relations
- Objective evaluation of the deviations
- Less working steps, reduced reconditioning and reject costs
- Optical error marking on the component with back projection





Detecting surface defects

As well as the visual requirements, instrumentation panels must also fulfill functional and security requirements. Often the passenger airbag has a predetermined breaking line, which is generated using a laser. This „weak point“ ensures the safe opening of the airbag at the predetermined breaking line. Sink marks may appear, which can be recognized under certain light conditions. In order to recognize these defects, surfaceCONTROL inspection systems are used, which enable rapid, objective evaluations to be made of the characteristics of any shape deviations, both on grained and smooth surfaces.

Inspection system: surfaceCONTROL



Gap monitoring in car interiors

Car interiors present a number of gaps, for example, between the single cockpit elements such as the center console or door trim. During final assembly, profile scanners from Micro-Epsilon are used in order to inspect the homogeneity of the gap sizes in the car interior.

Sensor: scanCONTROL



Stitching position of airbags

The aesthetic requirements placed on the cockpit, seats, interior trim and steering wheel are particularly important for airbags. While assembly gaps cannot be measured prior to installation, like many other elements of a car, the airbag stitching can be inspected during production using a scanCONTROL laser profile sensor. The scanner is guided over the stitching using a robot in order to detect the seam contour. In this way, several parameters can be evaluated simultaneously.

Sensor: scanCONTROL



Color recognition of seams in automotive interiors

In the assembly line of a well-known German car manufacturer, interior parts are distinguished on the basis of different seam colors. For fully automatic monitoring, colorSENSOR CFO sensors from Micro-Epsilon are used.

Sensor: colorSENSOR CFO

Exterior fittings



colorSENSOR / colorCONTROL

- Sensors for color recognition and color measurement
- Ideal for integration into processing lines due to high measuring rates
- High accuracy
- Continuous strip production
- Robust and suitable for industrial applications



Inspecting gaps in car trims

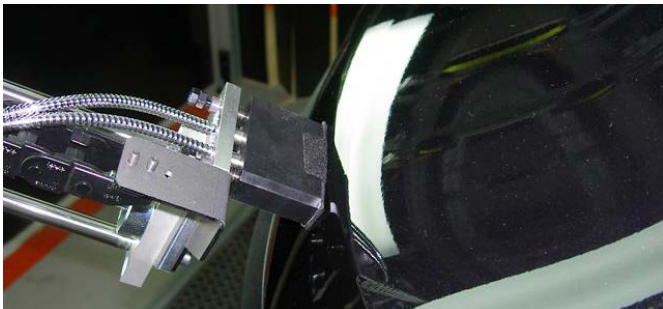
In high quality vehicles, the trim typically consists of different materials. This offers various design options but also many additional functions e.g. illumination using semi-transparent parts. Bonding or welding these elements requires precise handling, as parts that are only slightly misaligned can cause large deviations in the corresponding gap size. It is necessary to inspect all trims prior to delivery and to rework any defective parts. And this is where the scanCONTROL laser scanner comes in, which inspects gap sizes of the trims.

Sensor: scanCONTROL

Surface inspection of exterior plastic parts

INB surfaceCONTROL systems recognize and evaluate the shape deviation on injection-molded parts and composite parts. These systems recognize relevant deviations from $5 \mu\text{m}$ within 0.5 ... 2.0 seconds, and evaluate these objectively. Even the slide marks of the bolt with a height of about $1 \mu\text{m}$ can be recognized.

Inspection system: surfaceCONTROL



Comparing colors of parking sensor and car body

Car attachments such as parking sensors are painted separately. However, the colors of these parts must be identical for assembly purposes. The colorSENSOR CFO sensor from Micro-Epsilon enables a direct color comparison between the parking sensor and the rear bumper.

Sensor: colorSENSOR CFO

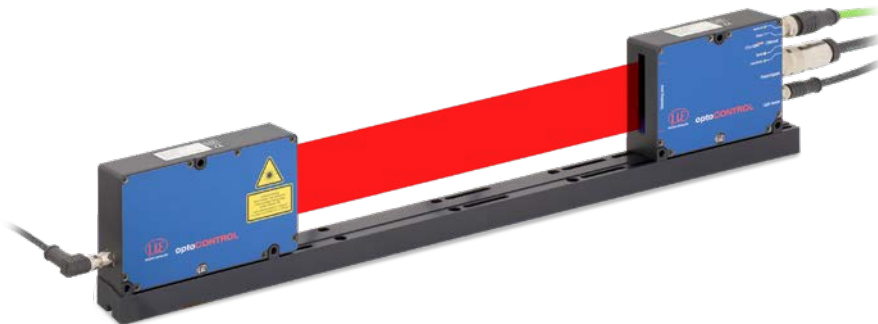
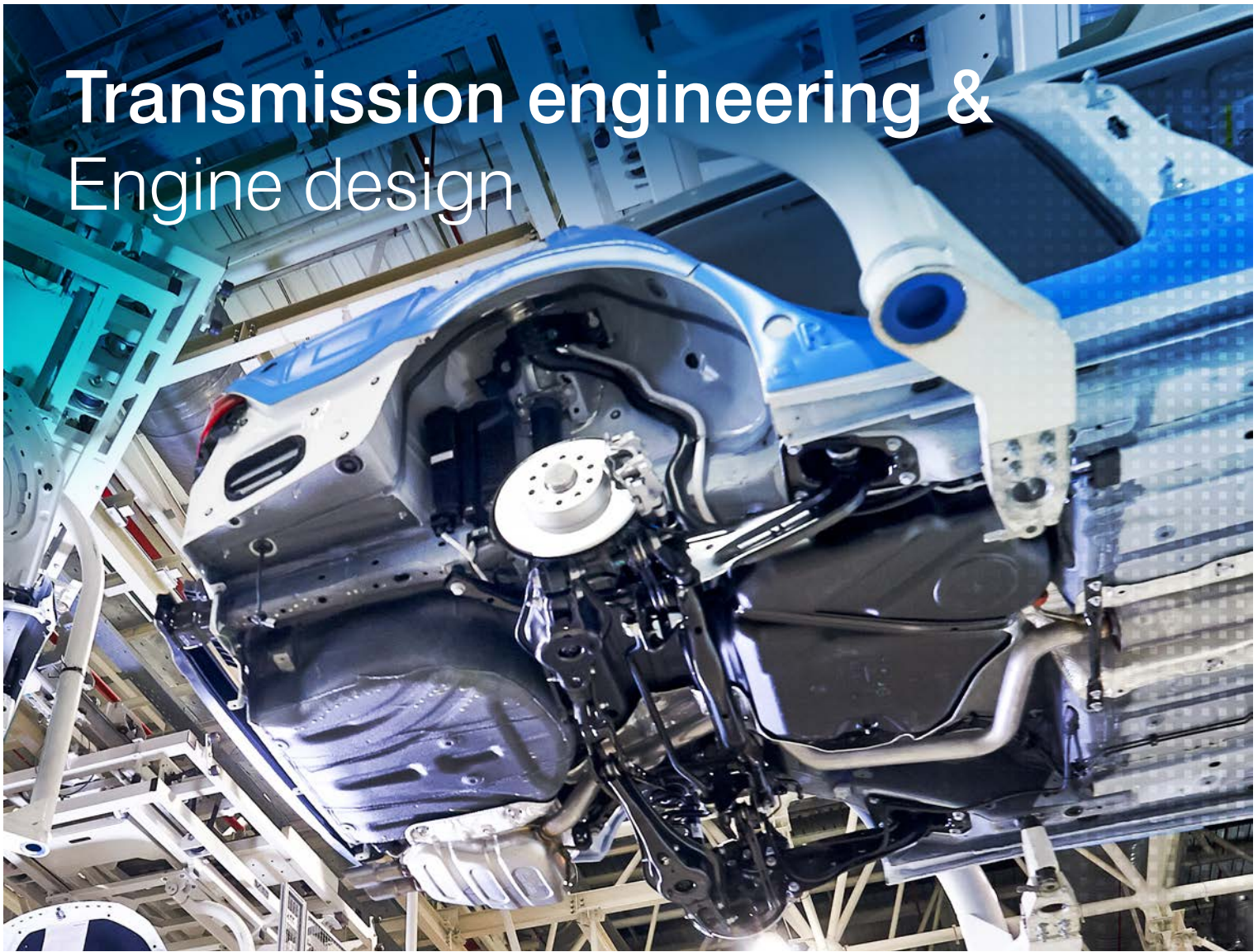


Color control on the front spoiler

Before installing the front aprons, Micro-Epsilon color sensors check if the color of the attachment matches the body color. Different color groups can be defined to cover all coatings.

Sensor: colorSENSOR CFO

Transmission engineering & Engine design



optoCONTROL 2520

- Measuring ranges up to 98 mm
- Distance light source/receiver up to 2 m
- Measurement by laser or LED
- For high speed measurements
- Micrometer accurate measurements of diameter, gap and segment



Presence monitoring of bearing shells

Bearing shells are automatically pressed into the bearing cap for the connecting rod assembly on the drive shaft. The measurement task also involves checking whether the bearing shells are actually present in the bearing cap before assembling the connecting rod. Therefore, optoCONTROL optical micrometers are used to check for the presence and to detect the diameter of the bearing cap.

Sensor: *optoCONTROL*



Position monitoring during marriage

optoNCDT laser point sensors, for example, monitor the „marriage“ of the car body and the engine. Car body and engine, i.e. the entire drive train, are joined in so-called marriage lines. Laser triangulation sensors mounted on the device measure the distance between the car body and the engine in order to allow for the drive train to be placed precisely onto the car body.

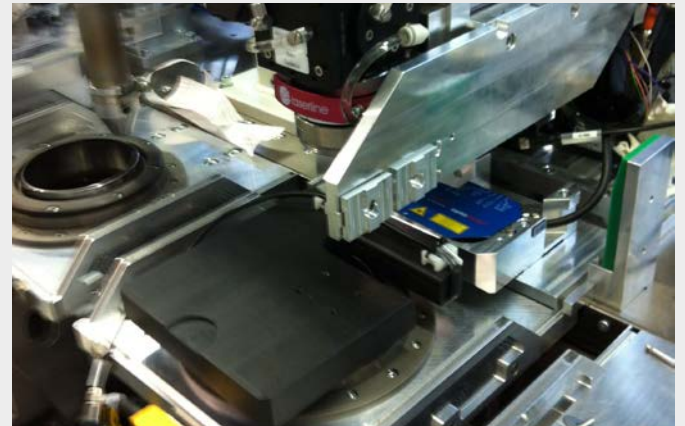
Sensor: *optoNCDT 1420*



Distinction of brake discs

In order to assign the correct brake disc to the respective car model, the discs are inspected using laser profile sensors prior to installation. The gap between the ventilation blades is used to recognize and classify the brake discs. The scanCONTROL laser scanners are used for 100 % inspection and subsequent sorting.

Sensor: *scanCONTROL*



Automatic positioning of synchronizer rings

When producing synchronizer rings, the front faces are deburred using a laser. In order to determine the exact position of the rings, Micro-Epsilon laser triangulation sensors detect the synchronizer rings.

Sensor: *optoNCDT 1750*

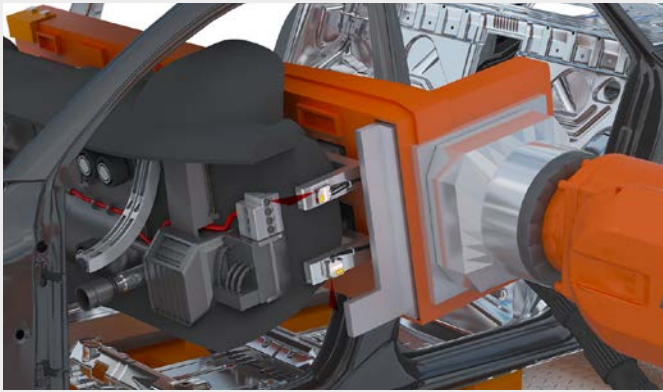
Vehicle assembly



optoNCDT 1750

- Powerful laser displacement sensor for industry & automation
- Measuring rate up to 7.5 kHz for precise and high speed measurements
- Measuring ranges: 2 mm - 750 mm
- Compact sensor design with integrated controller
- Robust and long-life design

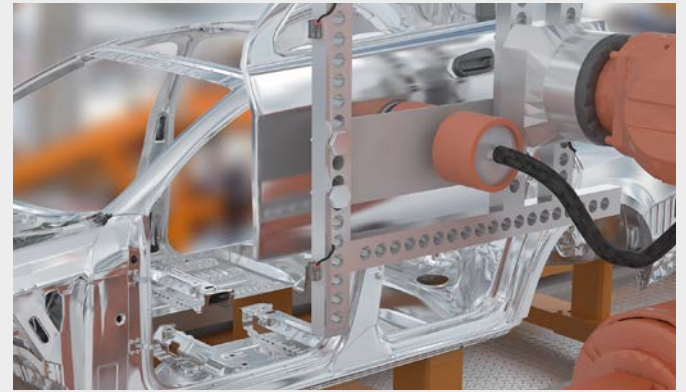




High accuracy cockpit positioning

During fully automatic installation into the vehicle, the cockpit must be positioned precisely. Therefore, a rectangular frame of metal struts with two grippers is mounted on the outsides on a robot arm. Four optoNCDT laser sensors monitor the correct orientation of the robot in the X, Y and Z axes. Robot-suitable sensors compensate for the various reflections caused by different paints while providing stable measurement values.

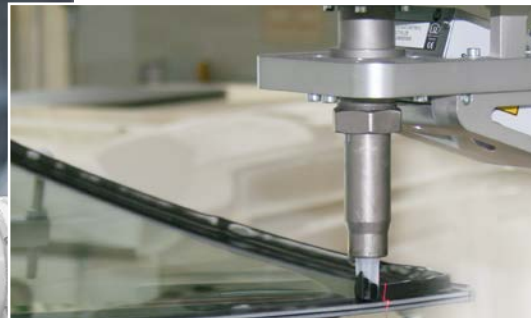
Sensor: optoNCDT 1420



Position detection of the car body

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Sensor: optoNCDT 1420



Inspection of the adhesive beading

When gluing glass panes in automotive production, it is important that the adhesive bead has a constant, uniform track. Therefore, a robot arm precisely tracks the adhesive bead using a scanCONTROL laser scanner. Based on the measurement data, the robot centers itself on the adhesive bead. The scanner measures the surface profile of the adhesive bead and transmits the measurement to the control system.

Sensor: scanCONTROL

Finish & Quality control

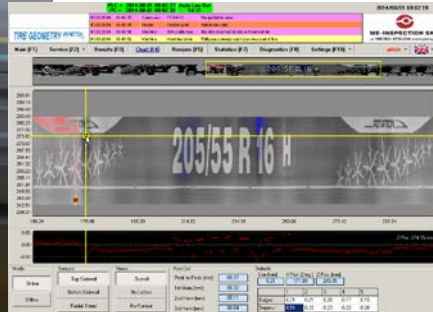




Tire geometry inspection

With the precise inspection of radial and axial run out, as well as bulges and constrictions on the tire, the dimensionCONTROL system makes an important contribution regarding quality during the production of the tire. Equipped with laser profile scanners, the inspection system measures the defect size (e.g. bulges, neckings) and evaluates the radial and lateral runout.

System: *dimensionCONTROL 8302.LLT/T*



Best-fit measurements in quality control

For quality control, laser scanners from Micro-Epsilon are used to check the final gap sizes and laser displacement sensors measure the flushness. The measurement is performed in different locations, for example on doors, windshields, rear windows and side windows as well as glass modules in the car roof and the panoramic roof. The laser sensors and profile scanners used offer a surface compensation feature which enables them to measure different surface types such as glass, paint and plastics.

Sensor: *scanCONTROL*



Color and intensity tests of vehicle lights

Color and intensity of vehicle lights must be reliably inspected prior to assembly and delivery. Homogeneous distribution of light should also be ensured with fluctuating LED batches. The colorCONTROL MFA is a special LED test system designed to inspect inaccessible and widely spaced test specimens. Optical fibers enable simultaneous measurement of up to 20 measuring points.

Sensor: *colorCONTROL MFA*



Sensors and Systems from Micro-Epsilon



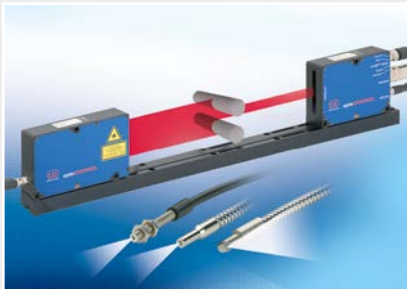
Sensors and systems for displacement, distance and position



Sensors and measurement devices for non-contact temperature measurement



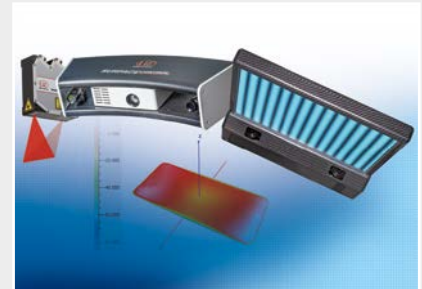
Measuring and inspection systems for metal strips, plastics and rubber



Optical micrometers and fiber optics, measuring and test amplifiers



Color recognition sensors, LED analyzers and inline color spectrometers



3D measurement technology for dimensional testing and surface inspection

More Precision

Whether it is for quality assurance, predictive maintenance, process and machine monitoring, automation or R&D – sensors from Micro-Epsilon make a vital contribution to the improvement of products and processes. High precision sensors and measuring systems solve measurement tasks in all core industries – from machine building to automated production lines and integrated OEM solutions.



MICRO-EPSILON

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