Sensors for production monitoring in the automotive industry
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

- 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
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

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 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

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

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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*

Surface inspection of attachments
Similarly 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*

**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

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

- 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. From a technical viewpoint it is often irrelevant if the width and height of a gap are constant. However, the interior is an area of the car that the customer sees first. The gapCONTROL profile scanner inspects the gaps of all parts in the car interior during final assembly.
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 µm within 0.5 ... 2.0 seconds, and evaluate these objectively. Even the slide marks of the bolt with a height of about 1 µm 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
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

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

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
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

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
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 1420
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