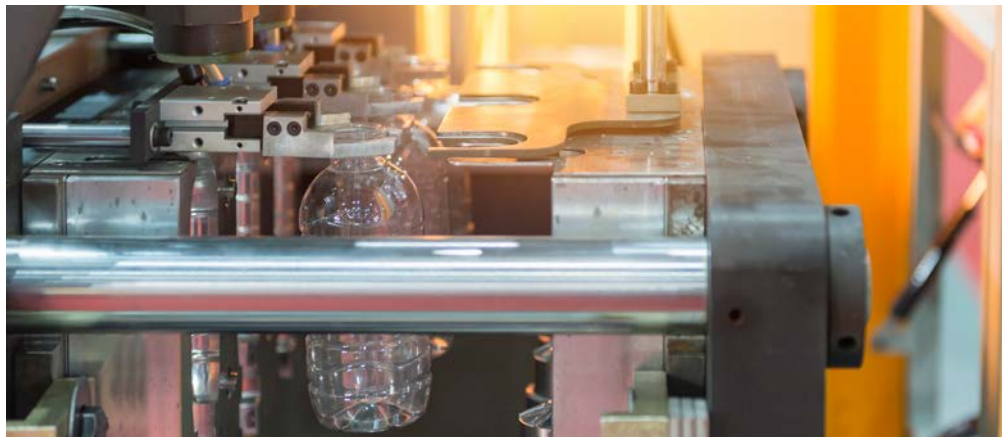
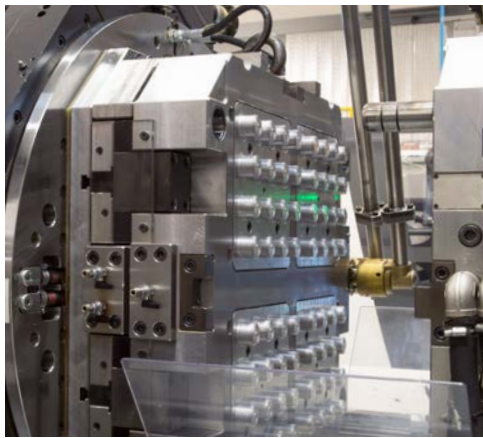
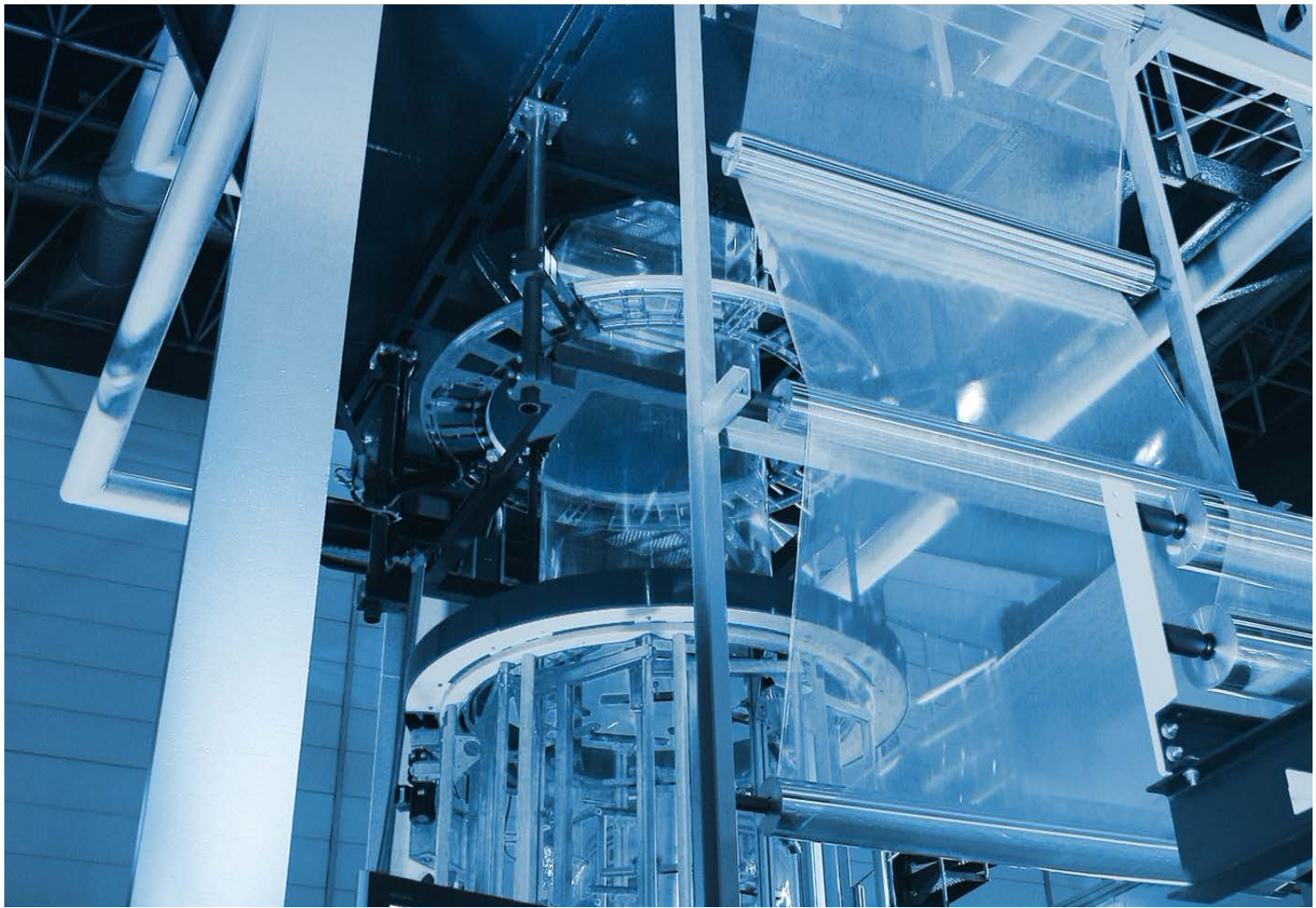


# Sensors & Applications

## Plastics Industry



More Precision

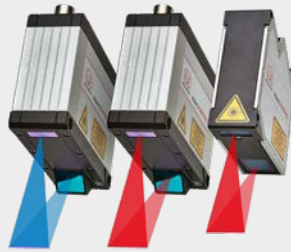




## Sensors and measuring systems for plastics production

Miniaturization and increased production speeds together with rising economic efficiency are the determining factors in the production and processing of plastics. Quality, function and touch-screen communications of the final product require reliable measurement and inspection procedures in every manufacturing stage.

Compact and high speed sensors ensure highest reliability in almost any area where high precision is expected - from machine monitoring to fully automatic quality control of the final product.



### scanCONTROL

High-end laser scanner for  
high precision profile measurements

Inline measurement of gaps, profiles, steps, angles

Red or blue laser line versions

Measurement on numerous surfaces,  
also reflecting and matt



### colorSENSOR CFO100 & CFO200

Sensors for color recognition in industry  
and automation

Ideal for integration into processing lines  
due to high measuring rates

High accuracy

Robust and suitable for industrial applications



### thermoIMAGER / thermoMETER

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

Pyrometers for temperature monitoring of thin plastics

Real-time process monitoring and system control

Compact design & extensive range of interfaces



### thicknessCONTROL

Turnkey measuring systems for thickness  
measurement of films and plates

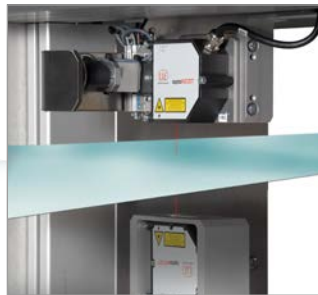
Measurement of thickness and thickness profile

No consequential costs for radiation protection  
due to isotope and X-ray free measuring principle

Easy integration into processing lines

Film thickness from 30  $\mu\text{m}$  to 6 mm

# Thickness & geometry measurements



## Two-sided thickness measurement

With band-shaped films and sheets, it is sensible to carry out a two-sided thickness measurement. Two displacement sensors are arranged opposite to one another in order to detect the material thickness. This measurement arrangement is particularly suitable for high speed measurements and fluttering materials. Micro-Epsilon offers both sensors and turnkey systems for two-sided thickness measurement.

*Measuring system: thicknessCONTROL*



### One-sided thickness measurement of films

In its sensor housing, the combiSENSOR combines an eddy current displacement sensor and a capacitive displacement sensor. This unique sensor concept enables one-sided thickness measurement of electrically non-conductive materials on metallic objects. Its field of application is the thickness measurement of plastic film or of plastic coating on metal plates. The sensor is connected to the controller via a cable, which processes and calculates the signals in order to output these via interfaces.

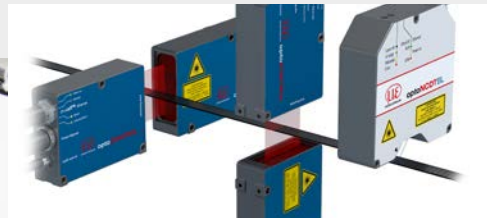
*Sensor: combiSENSOR*



### Thickness profile measurement of strips and plates

The thicknessCONTROL measuring system is used for thickness measurement of plates and strip materials. Depending on the measurement task and materials, the head is equipped with different sensors that measure in a fixed track or in a traversing method. Comprehensive software packages and interfaces enable measurement, evaluation and recording of readings.

*Measuring system: thicknessCONTROL*



### Geometrical monitoring of cable ties

The "width" and "height" of the cable tie strap, as well as the "tooth pitch" are monitored constantly during the production of cable ties. The measurement is performed using two optical precision micrometers and a laser displacement sensor which are attached behind the extruder. The laser micrometers are positioned horizontally and vertically respectively while measuring the height and width of the strip. The laser sensor detects the tooth pitch from above. The sensors provide reliable and reproducible measurement results and accelerate the production process while minimizing the rejects.

*Sensor: optoCONTROL 2520 / optoNCDT 2300-2DR*



# Color measurement



## color**SENSOR** CFO100 / CFO200

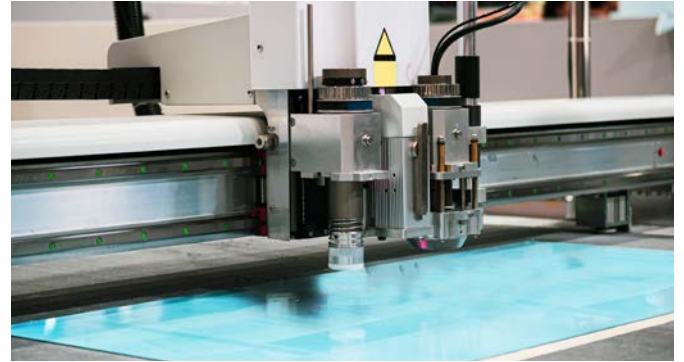
- High measurement speed for dynamic processes
- Large color memory for different test batches
- High color accuracy
- High measuring rate, ideal for quality assurance and documentation in the processing line



### Inline color monitoring of plastic bottles

Plastic bottles are frequently manufactured in different shapes and sizes. In this respect, color homogeneity is indispensable particularly with brand products. Due to different bottle shapes, distance-dependent color deviations occur which must be compensated for by the color sensor. Therefore, colorSENSOR CFO200 sensors are used as they offer a multi-teach function combined with a high measuring rate and color accuracy. With more than 320 colors in 256 color groups, different production batches and variants can be detected reliably.

*Sensor: Circular sensor CFS2, colorSENSOR CFO200*



### Inspection of polycarbonate sheets

The production of polycarbonate sheets involves inline color monitoring. The measuring principle applied with these transparent sheets is based on the transmitted light principle using colorSENSOR CFO200 sensors. The sensors detect color deviations from taught reference colors. If deviations occur, the plastic mixture is adapted accordingly. With its high light intensity, the CFO200 is also suitable for semi-transparent objects. The CFS3 transmission sensor used enables measurement of different material strengths with only one channel.

*Sensor: CFS3 transmission sensor, colorSENSOR CFO200*



### Color recognition in component sorting tasks

Particularly with automated mounting, components must be sorted according to their color. The colorSENSOR CFO is ideally suited for these high production speeds. Adjustable colors and tolerances enable high flexibility.

*Sensor: CFS4 reflection sensor, colorSENSOR CFO*

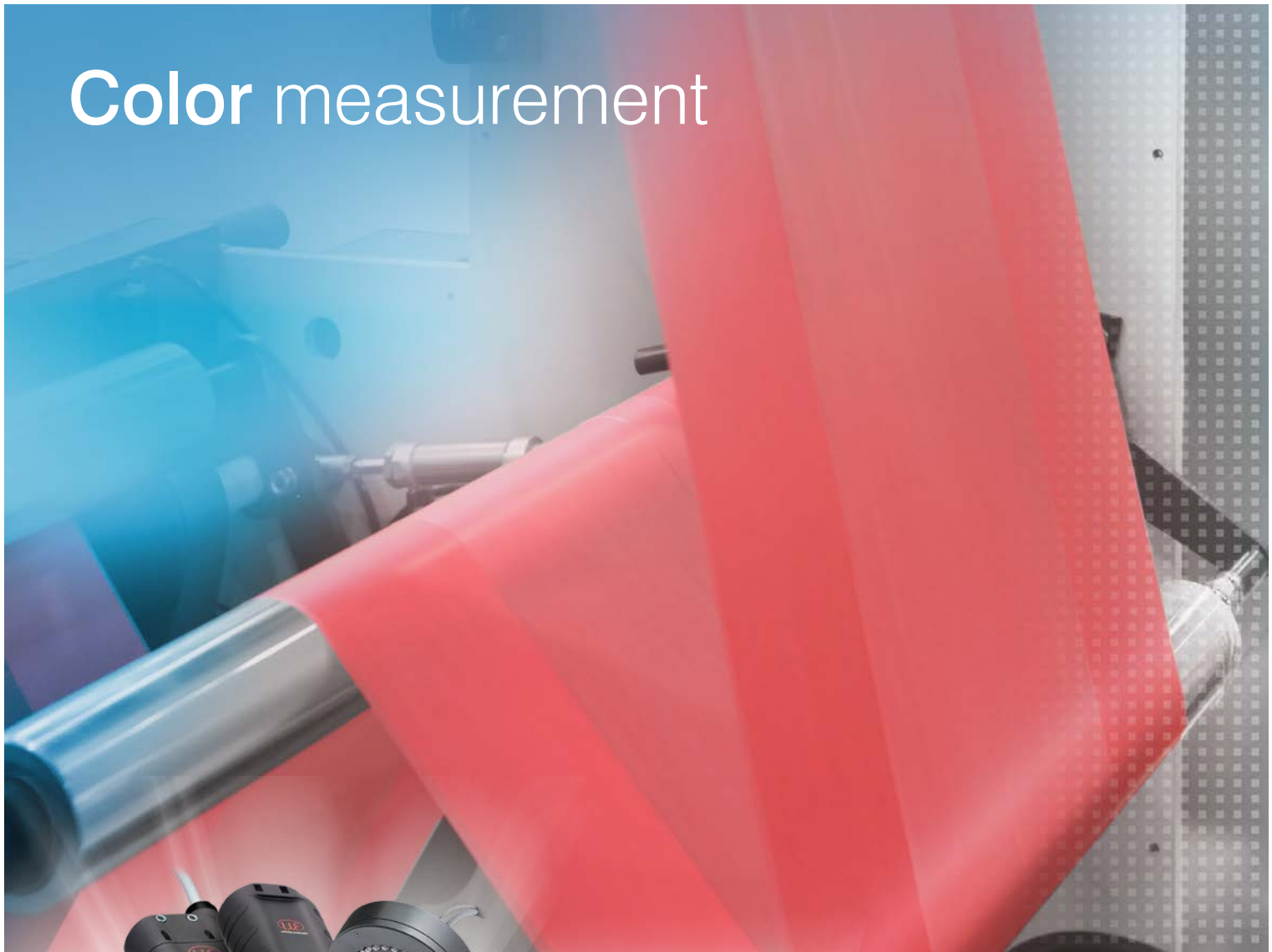


### Color measurement of plastic profiles

With order production of plastic profiles, the colorSENSOR CFO200 monitors the color directly after its extrusion. Depending on the production order, reference colors are taught in advance in the sensor and customer-specific tolerances are defined. The sensor's large color memory enables reliable testing of opaque colors, (semi-) transparent and fully colored profiles.

*Sensor: Standard sensor CFS1, colorSENSOR CFO200*

# Color measurement



## colorCONTROL ACS

- Inline color measurement at the highest precision
- Optimized sensor models for different surfaces, e.g., reflecting, transparent, curved
- High measuring rate, ideal for quality assurance and documentation in the processing line



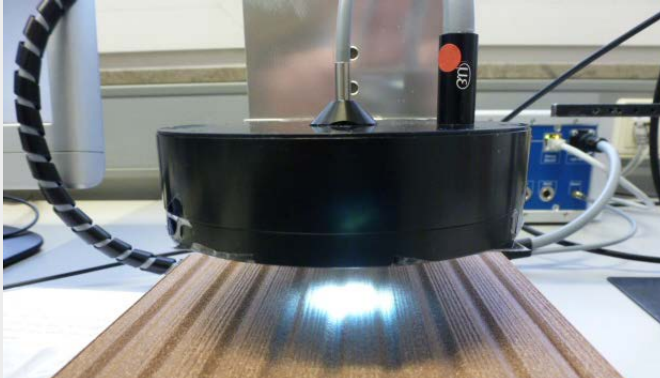


Photo: University Duisburg-Essen, Institute for Product Engineering,  
Chair for Construction and Plastics Machinery

### Inline color measurement of transparent films

As well as color fluctuations, streaks can occur during production. With translucent films it is possible to measure the color based on the transmitted light principle. The colorCONTROL ACS7000 measures the film color inline at high speed and at maximum precision.

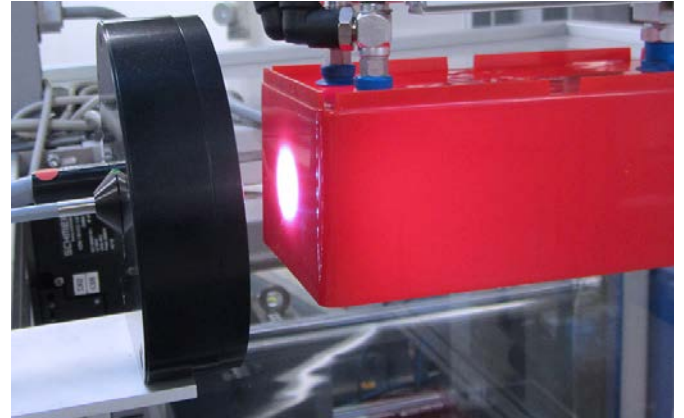
*Sensor: ACS3 transmission sensor, colorCONTROL ACS7000*



### Color measurement of floorboards

Plastic floorboards are made of colored granules and shaped in a deep-drawing process. Here, it must be ensured that the color of the floorboards is homogeneous and that there are no color differences. The inspection is carried out using the colorCONTROL ACS7000 spectral color measuring system and the ACS2 circular sensor (R45°c:0°). Absolute color measurement enables monitoring of the actual produced color shade and to recognize early any process-related defects.

*Sensor: ACS2 circular sensor, colorCONTROL ACS7000*



### Inline color measurement of injection-molded plastic parts

In plastics injection molding, color measurement can be performed only after the cooling process, as colors still can change. An empirically determined correlation between warm and cold pieces enables the ACS7000 to measure the color directly after the injection molding process and to determine any deviations early.

*Sensor: ACS2 circular sensor, colorCONTROL ACS7000*



### Inline detection of protective film on PVC window frames

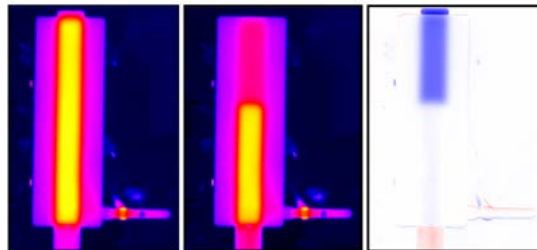
After their extrusion, a transparent protective film is applied onto the plastic profiles. The color shade of the plastics profile alters a little after the transparent film has been applied. Based on this color change, the colorCONTROL ACS7000 color measuring system recognizes if the film has been applied on the window frame. Its high measuring rate enables the color measuring system to be used inline.

*Sensor: Standard ACS1, colorCONTROL ACS7000*

# Non-contact temperature measurement



moldCONTROL thermal imaging camera  
at the traverse of a handling system



## Thermography for injection molding processes

moldCONTROL is a thermography solution for recognizing quality fluctuations in injection molding production. The compact, industrial thermal imaging camera captures a thermal image of the component directly after the injection molding process. The software compares the infrared images associated with the component (actual) to stored references (target). The identified temperature differences provide the basis for a good/bad decision reported back to the handling system.

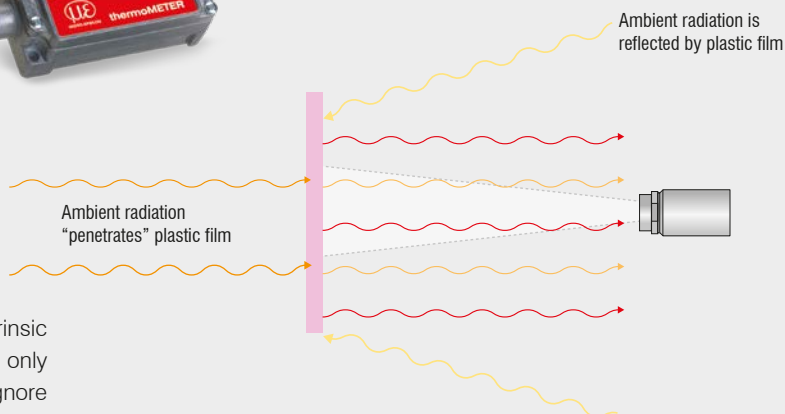
## Temperature measurement in the plastics industry

Micro-Epsilon offers a wide range of non-contact, infrared thermometers and thermal imagers, which enable precise temperature measurement. The infrared measuring devices are used in a wide range of applications:

- Extrusion of blown film, flat film and plates
- Thermoforming
- Laminating and embossing
- Injection molding
- Coating
- Plastics welding

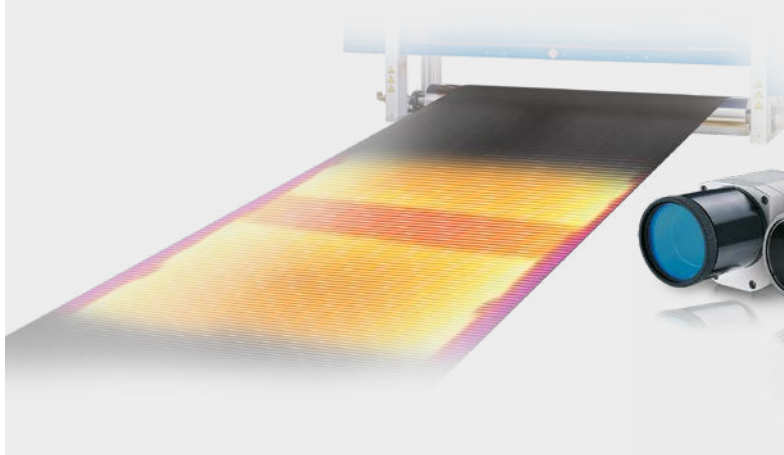


Infrared radiation also penetrates thin film and distorts the intrinsic radiation of the film. The infrared CT-P3 and CT-P7 pyrometers only detect the infrared radiation emitted by the plastic film and ignore the penetrated radiation. This is how high precision detection of the surface temperature is possible.



## Line scan feature for the detection of temperature profiles

In order to ensure homogeneity of high temperatures, e.g., in thermoforming and calendering processes, the line scan feature is used. The thermal imaging camera provides temperature profiles per line. This enables the evaluation of the temperature distribution across the entire production line.





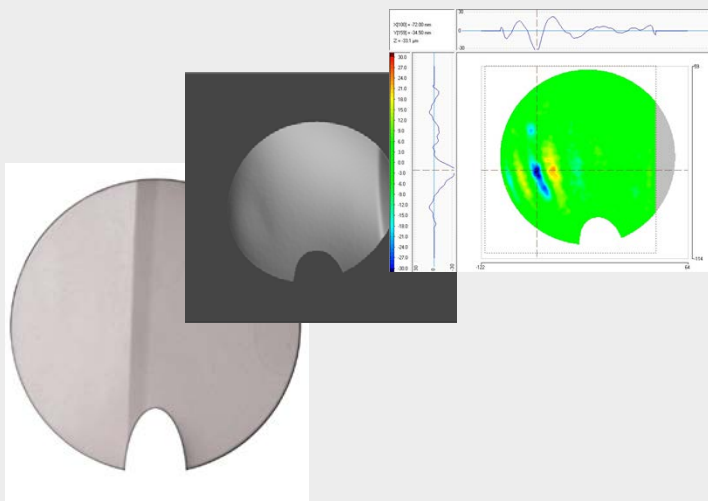
# Inspection of attachments



## 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





### Fuel filler flap inspection

One component that many automotive manufacturers and suppliers produce in plastic is the fuel filler cap. As fuel filler flaps are positioned in a prominent location, the surface must meet the high quality requirements. During production, small sink marks can appear on the visible side of the flap. These are only a few micrometers deep but visible to the human eye depending on the painting. The surfaceCONTROL is used for surface inspection of fuel filler flaps. Both in production monitoring and when inspecting incoming goods, the system reliably detects and evaluates the fuel filler flaps.

*Inspection system: surfaceCONTROL*



### Surface inspection of cockpit and dashboard

As well as the visual requirements, instrumentation panels also have to 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. They enable fast, objective evaluations of any shape deviations, both on grained and smooth surfaces.

*Inspection system: surfaceCONTROL*



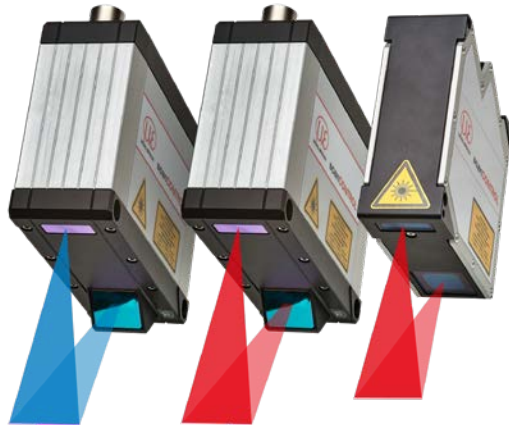
### Measurement of the sprayed skin thickness

Sprayed skins for vehicle dashboards and for airbag cladding are sprayed into a heated mold using a robot-guided nozzle. For safety reasons, extremely low tolerances are required for airbags. For this reason, the thickness of the sprayed skin must be inspected inline during the spraying process. The measurement is performed using a combination sensor (an eddy current displacement sensor and a laser displacement sensor) which is attached to the robot arm. The eddy current sensor measures the distance to the nickel-coated spray mold and has an opening in the center through which the laser sensor measures the distance to the sprayed skin. When subtracted, both signals provide the thickness of the sprayed skin.

*Sensor: optoNCDT / eddyNCDT*



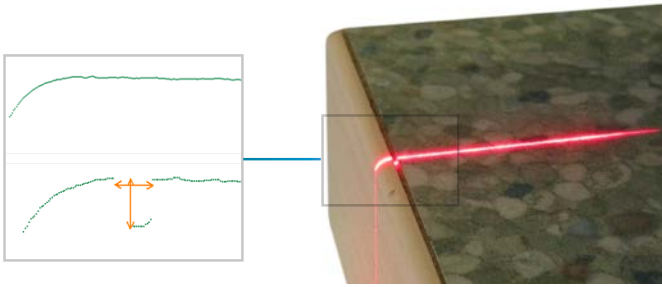
# Profile measurement



## scanCONTROL

- 2D/3D laser scanner
- High resolution profile measurement
- Ready for dynamic measurement tasks
- Compact with integrated controller
- Red laser and patented blue laser



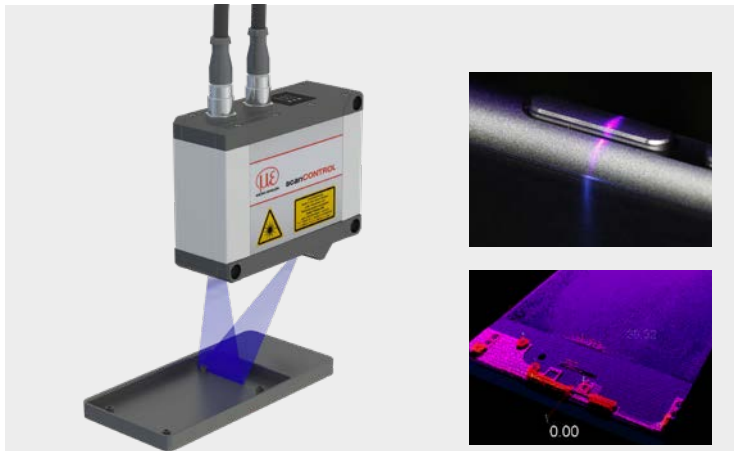
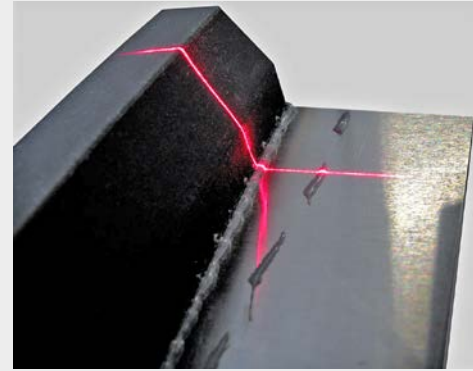


### Defect recognition on worktops

Foreign bodies, uneven distribution of the adhesive or unevenness when closing may produce open joints between the worktops and the sidebars. The scanCONTROL laser profile sensors check if there are open joints and detect their gap size.

### Inspection of protruding adhesive beading

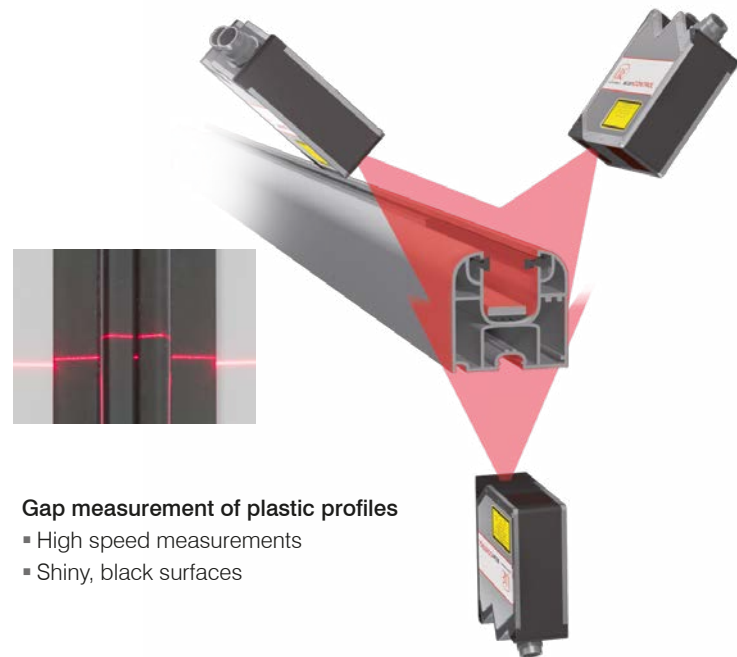
- Maximum height of protrusion is limited
- Adhesive drops on shiny surfaces are also recognized
- Inspection of liquid adhesive



### Dimensional measurement of extremely small, mechanical structures

While the plastic components are fed into the line, the laser scanner detects the dimensions of the smallest of structures. Deviations in the micrometer range are reliably measured using a Blue Laser Scanner.

Sensor: scanCONTROL BL



### Gap measurement of plastic profiles

- High speed measurements
- Shiny, black surfaces

## Sensors and Systems from Micro-Epsilon



Sensors and systems for displacement, distance and position



Sensors and measurement devices for non-contact temperature measurement



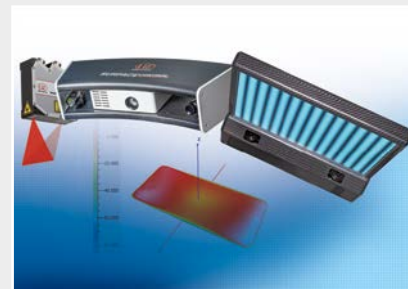
Measuring and inspection systems for metal strips, plastics and rubber



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



**SCIGATE AUTOMATION (S) PTE LTD**

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Business Hours: Monday - Friday 8:30AM - 6:15PM

## 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.



[www.micro-epsilon.com](http://www.micro-epsilon.com)