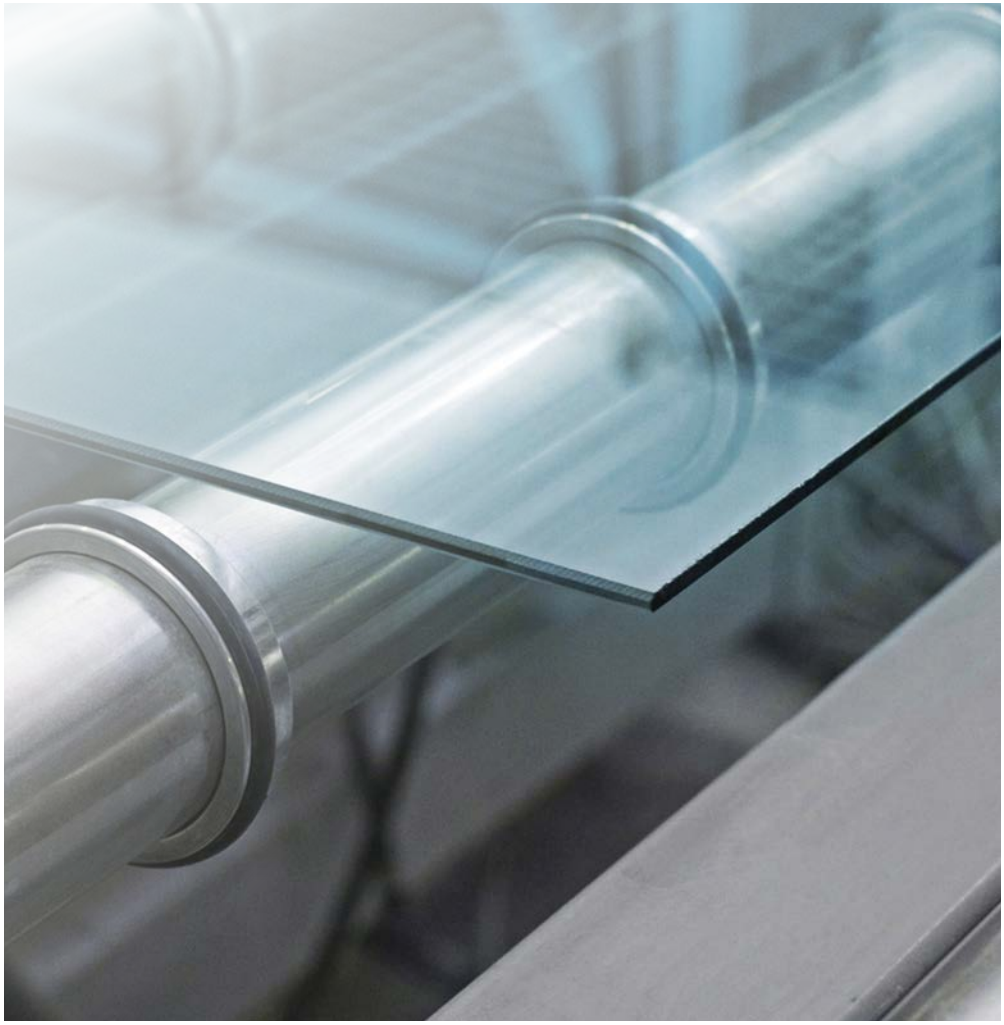
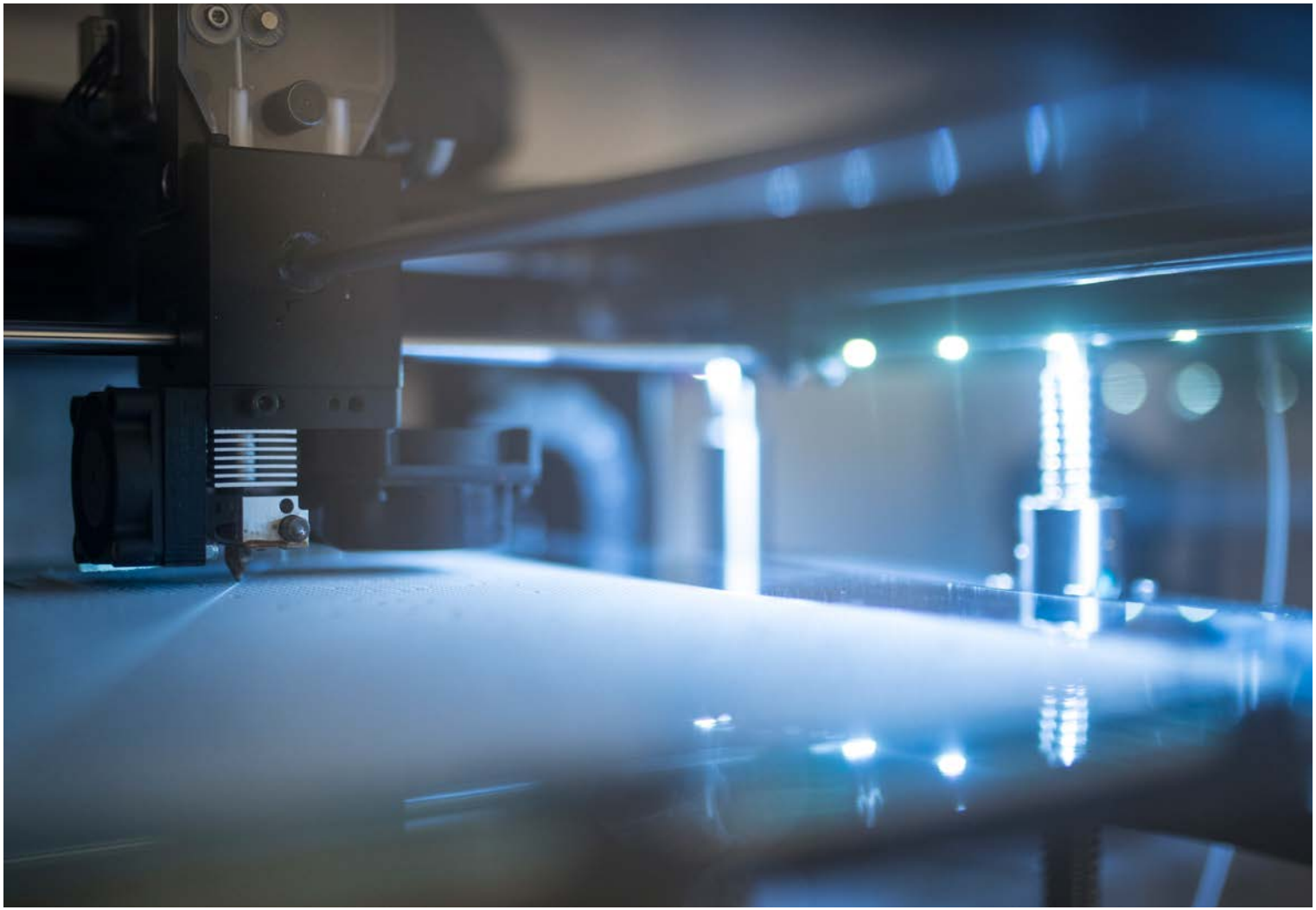
Sensors and measuring systems for glass production and processing

MICRO-EPSILON



More Precision



Sensors and measuring systems for glass production

Modern glass production is increasingly determined by maximum efficiency. Therefore, rapid access to fundamental process variables is required in order to ensure fast control of the process. With products such as container glass, flat glass or special glasses, tight manufacturing tolerances must be adhered to while maintaining the shortest possible cycle times.

Due to the high degree of integration as well as the high accuracy and measurement speed, sensors from Micro-Epsilon are used in the glass industry for different measurement tasks: robust eddy current sensors are integrated into machines in order to detect machine movements while optical sensors monitor glass products in processing lines. Typical measured parameters include displacement, position, thickness, color and temperature.

confocalDT 2421 / 2422

Confocal chromatic sensors for distance and thickness measurements

- One-sided thickness measurement of transparent materials
- Synchronous 2-channel measurement with max. measuring rate
- Best price/performance ratio in its class

colorCONTROL ACS

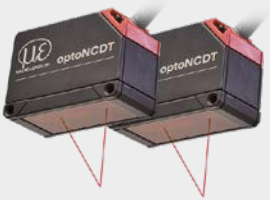
Sensors for color measurement of transparent materials

- 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

- 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 with large measuring ranges from 10mm to 500mm
- High accuracy
- High measuring rate for dynamic measurements
- Compact design and easy to install

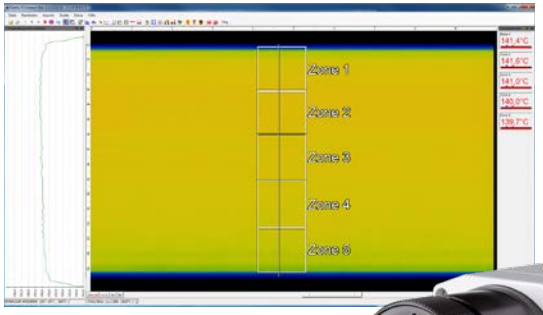
Flat **glass**

Temperature measurement of float glass

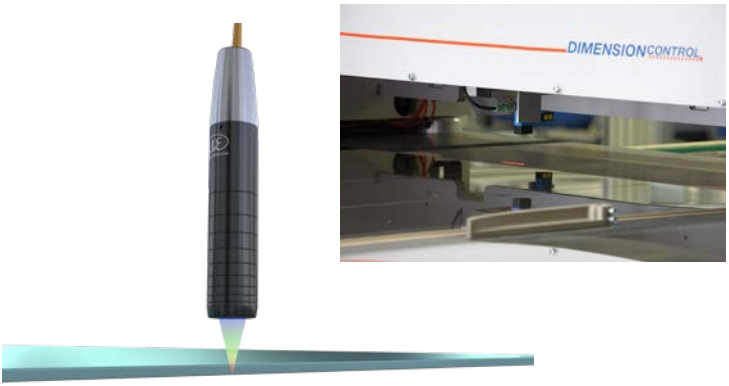
After the tin bath, flat glass has a temperature of approx. 600°C. At the transition to the cooling zone and in the other subsequent cooling zones, thermoIMAGER infrared cameras are used for temperature inspection. Infrared cameras enable non-contact temperature monitoring of the cooling process from a safe distance.

Line scan camera

Thanks to the TIM Connect Software, the thermoIMAGER cameras can also be used as line scan cameras. The software enables the user to choose any line from the detector array and to position it. This line acts as a line scanner and provides the temperature information line by line. As additional information, the user is provided with a complete thermal image. Due to the line scan feature, it is also possible to measure the glass temperature through the smallest of openings.



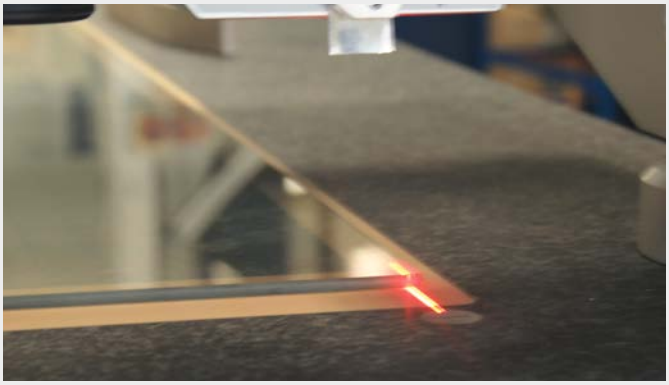
Software settings for the line scan process



Thickness measurement of displays and flat glass

For the production of display glass, glass sheets with a homogeneous thickness profile are required. For thickness measurement tasks, confocal chromatic sensors from Micro-Epsilon are used. These detect the thickness from one side without touching the target. Due to their high measuring rate, the sensors are also applied in high speed processes.

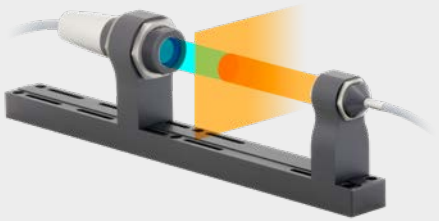
Sensor: confocalDT



Edge measurement of glass

In many handling processes, precise positioning of glass sheets is required. The position of the sheets is determined via the detection of the glass edges. Laser profile sensors from Micro-Epsilon measure the edge position at several points and transmit this information to the control system.

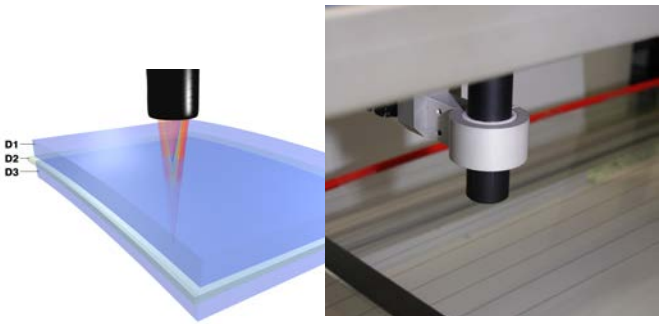
Measuring system: scanCONTROL



Color measurement of glass

The color of glass is the crucial and visually distinctive feature of many different glass products. This is particularly true with natural and recycled raw materials based on varying compositions, where continuous and objective control of the color effect is a decisive factor in consistent, homogeneous quality. Color sensors from Micro-Epsilon are used in order to inspect colors and shades of the glasses in the production process.

Sensor: colorCONTROL ACS-3



Gap monitoring of safety glass

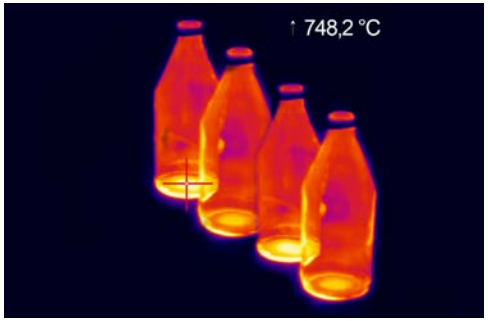
For quality control and process control during the production of safety glass, confocal chromatic displacement sensors with a multi-peak function are used. Confocal chromatic sensors from Micro-Epsilon enable thickness measurements to micron accuracy. The sensors detect up to 5 layers by evaluating 6 measurement values on the boundary areas. Therefore, the thickness of film, gap sizes, applied adhesives and coatings can be determined reliably.

Sensor: confocalDT

Container **glass**

confocalDT

- Confocal sensors for measuring displacement and thickness
- Small measurement spot size
- High repeatability
- For dynamic measurements



Hot-spot measurement in the glass bottle production

Non-contact temperature measurement when shaping container glass

In container glass production, the process relevant temperature must be inspected at different points. Non-contact temperature sensors are used during the shaping process that involves temperatures in excess of 500 °C. As the shaping process lasts for just a few seconds, the sensor response time is critical. During both the forming process of the parison and the final shaping process, the heat treatment of the glass can be influenced either by directly measuring the glass surface or by indirectly measuring the surface of the forming tool. At the end of the production process, the glass is tempered again to reduce the stress in the container. Therefore, the glass is heated again and then cooled for a period of up to 30 minutes in a cooling tunnel. When the containers leave the heating zone, the cooling process is monitored using non-contact temperature sensors.

Sensor: thermoMETER CTLaserGLASS

Thickness measurement of medical container glass

Consistent thickness of walls and bottom are vital quality factors in medical container glass. In order to determine the glass thickness of the bottom and the walls, confocal chromatic sensors from Micro-Epsilon are used. These sensors also measure thin glass. Thickness calibration enables varying distances between the sensor and the containers without influencing measurement accuracy.

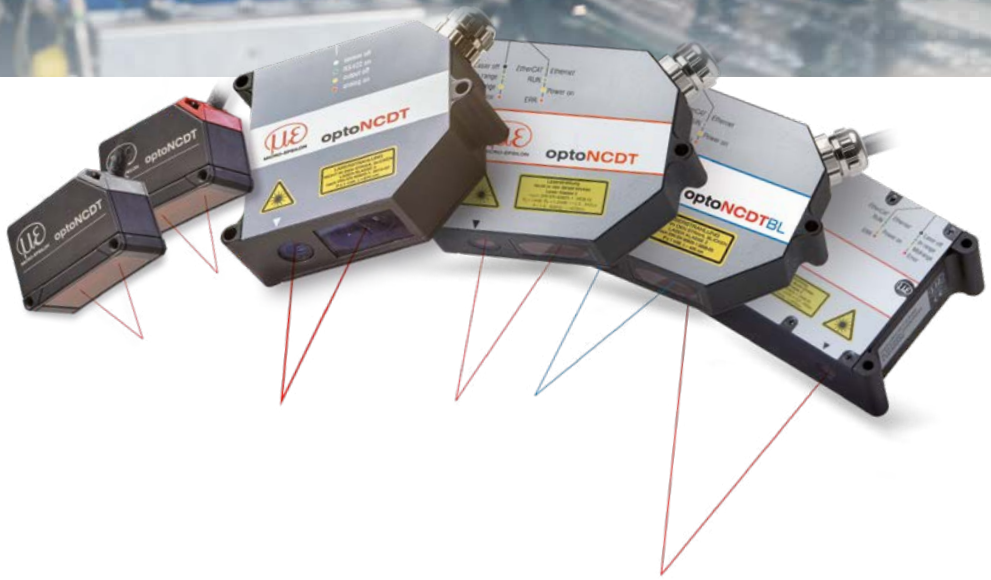
Sensor: confocalDT

Measuring the wall thickness and roundness of bottles

With the wall thickness and roundness measurements in star wheel inspection machines, a fast measuring rate is required in order to support the ongoing process. Micro-Epsilon's confocal chromatic measuring systems provide a high measuring rate and fast exposure time control. This also enables the measurement of thickness when the glass colors vary.

Sensor: confocalDT

Machine monitoring



Plunger measurement in IS machines

In hollow glass production, IS machines are used. This production environment is characterized by harsh ambient conditions such as vibration, steam and high temperatures. Micro-Epsilon has developed an inductive EDS displacement sensor, which is specially intended for 24-hour operation in IS machines to determine the exact plunger position. The robust sensor design compensates for temperature influences, including those caused by temperature gradients along the measuring range.

Sensor: induSENSOR EDS

Distance control of print heads for glass printing

When printing on materials such as glass and ceramics, very fine detailed structures are applied on the carrier material, which requires precise positioning of the print head.

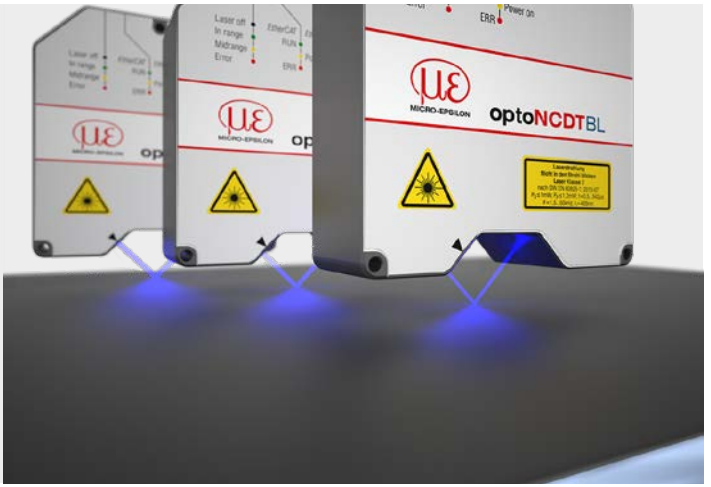
For distance measurements, optoNCDT 1420 laser triangulation sensors from Micro-Epsilon are used. With a measuring range of 10mm, these determine at various points in the print head the respective distance from the surface to be printed. The data obtained enables the determination of the edges and the surface tilt and therefore the exact positioning of the print head.

Sensor: optoNCDT 1420

Distance measurement on anti-reflective coated glass

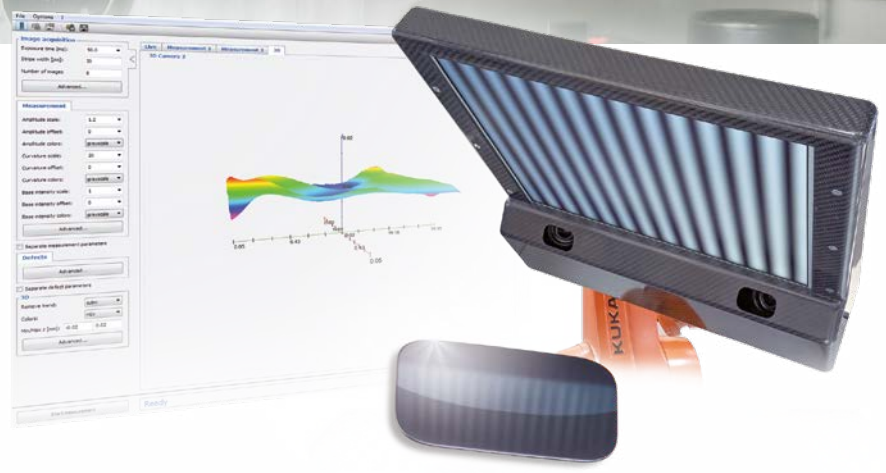
After the coating process, glass with anti-reflective coatings is inspected using laser-optical displacement sensors from Micro-Epsilon in order to determine undulations and torsion. The planarity of the coated glass surface is measured in several tracks. Based on the patented Blue Laser Technology, optoNCDT 2300-2DR sensors provide high measurement accuracies on coated glass surfaces.

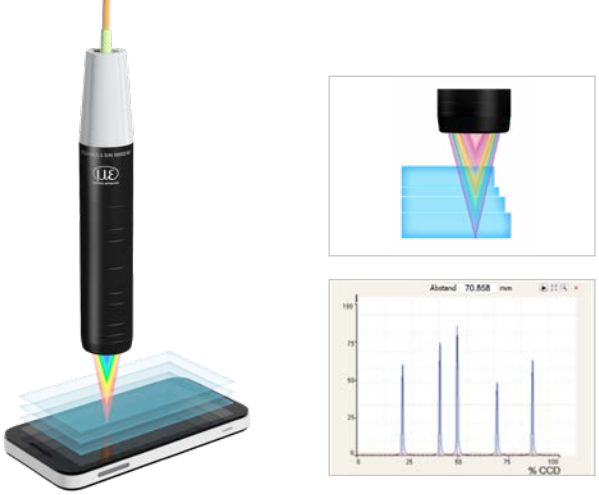
Sensor: optoNCDT 2300-2DR



Production control

of displays and optical glasses





Display assembly gap and thickness measurement of multilayer transparent material

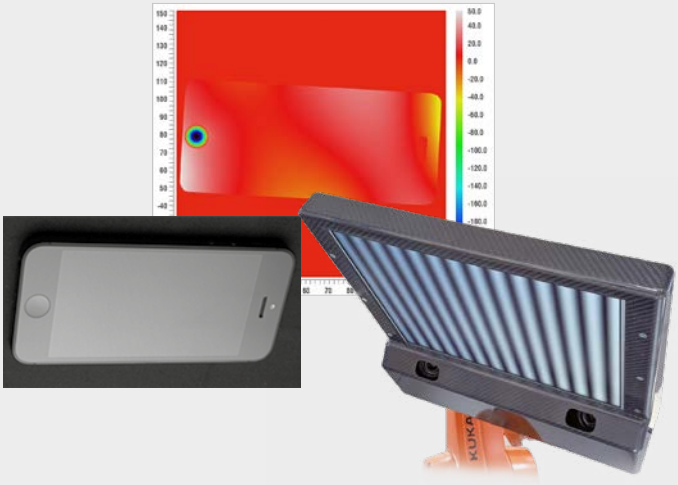
While smartphone display glasses are fed automatically into the line, a fast thickness measurement is carried out. With the single display glass layers presenting different refractive indices, several glass layers can be measured using only one confocal sensor.

Sensor: confocalDT

Camera auto focus measurement

Confocal sensors measure the distances between the auto focus lenses to provide the camera with the highest possible image quality.

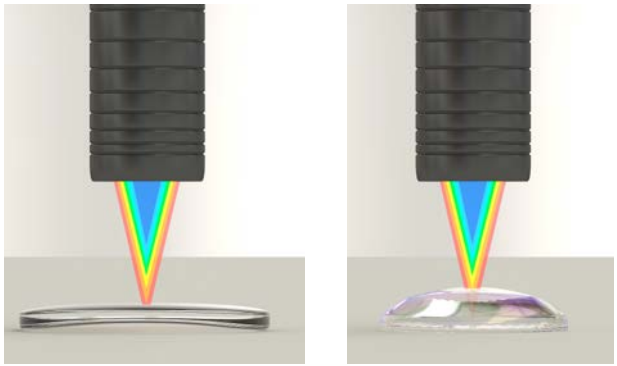
Sensor: confocalDT



Surface inspection of display glass

Fully-automatic defect detection on shiny surfaces is based on deflectometry systems. Extremely small inclusions or defects are detected reliably.

Sensor: reflectCONTROL



Curvature measurement of optical glass

In order to meet production tolerances, the contour of optical lenses such as eyeglass lenses or objectives is measured using confocal chromatic sensors. Based on the distance values, statements about the surface properties can also be made. Furthermore, the center thickness of the lens is determined. The sensors enable a large tilt angle which means they can also detect highly curved surfaces.

Sensor: confocalDT

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