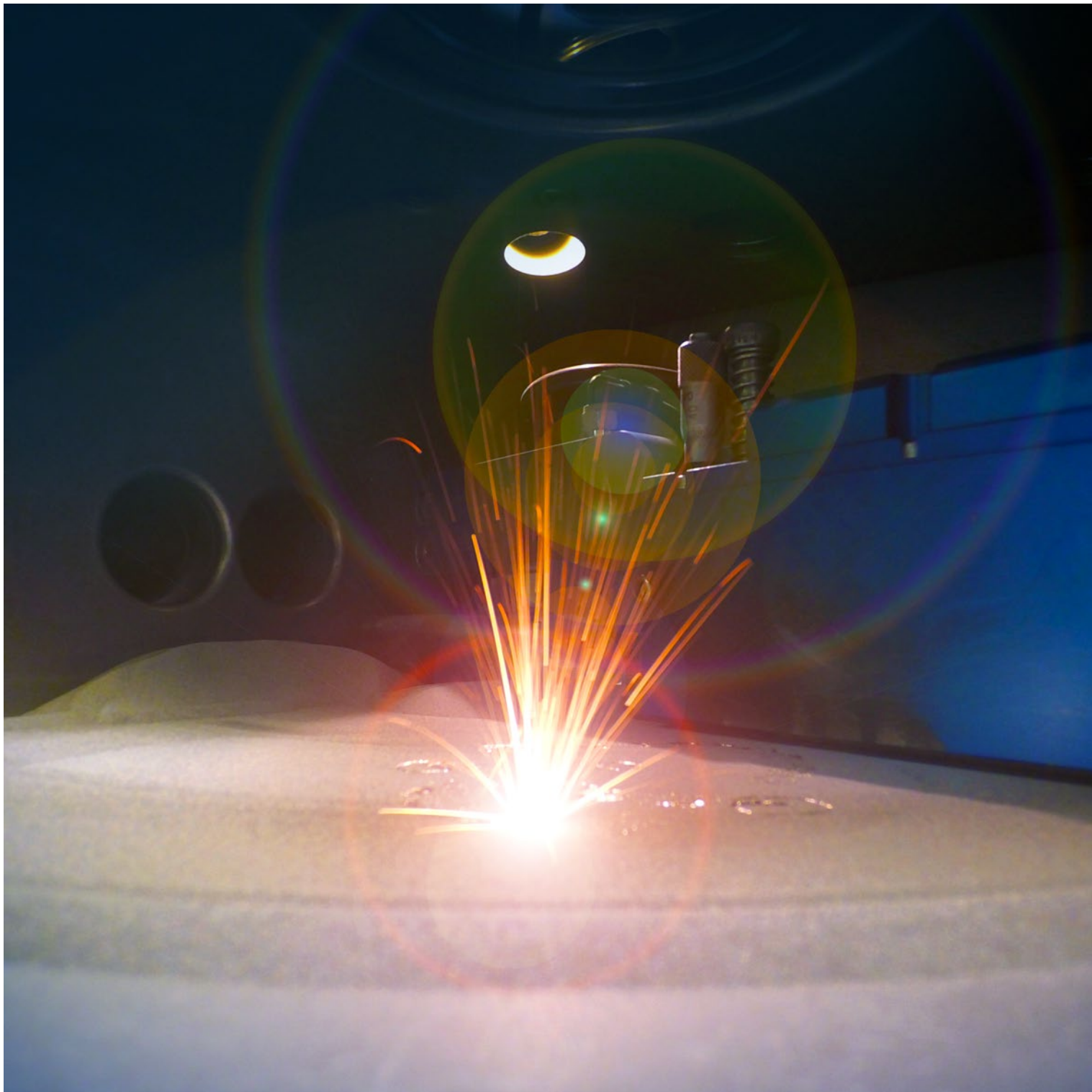


# Sensors & Applications

## Welding Automation



More Precision



Maximum productivity along with consistent quality are required in automated welding processes. In spot welding, additive manufacturing procedures and robot welding, all process steps are clocked and carried out with the highest precision. This increases the need for sensors that perform path planning, distance control and quality inspections.

Micro-Epsilon offers a wide portfolio of robust sensors for welding automation which impress in harsh environments and with high precision. Their high precision and high measuring rates enable the sensors to increase the performance of various welding processes.



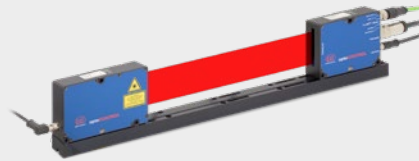
### **optoNCDT 1900**

Compact laser triangulation displacement sensor for non-contact displacement and distance measurements

Highest immunity to ambient light in its class

High accuracy and high measuring rate

Compact design and easy installation



### **optoCONTROL**

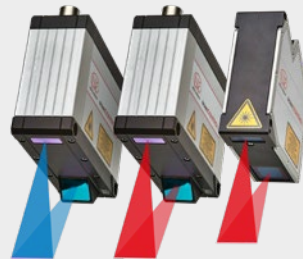
Laser micrometer for precise applications

Measuring ranges up to 95 mm, distances up to 2 m

Detection of edges, gaps, positions and diameters

High accuracy and measuring rate

Integrated controller



### **scanCONTROL**

High-end laser scanner for high precision 2D/3D 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**

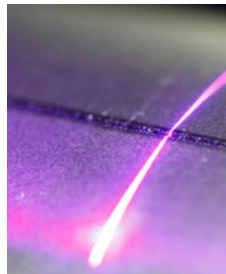
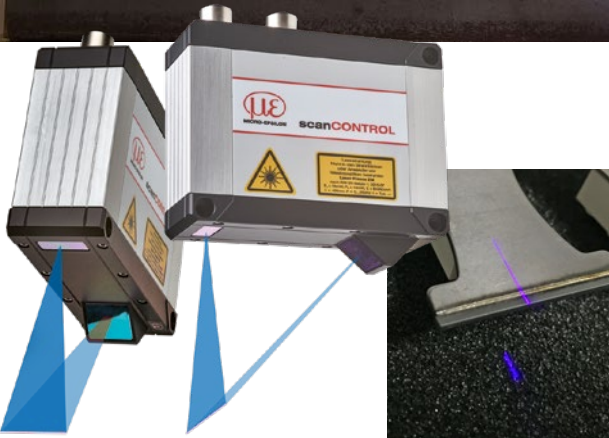
Sensors for color recognition in industry and automation

Ideal for integration into processing lines due to high measuring rates

High accuracy

Robust and suitable for industrial applications

# Path planning



## scanCONTROL Blue Laser Technology

Laser profile scanners from Micro-Epsilon are among the highest performing profile sensors with respect to accuracy and measuring rate. These scanners with blue laser line are used in particularly demanding applications and impress with their high signal stability. The Blue Laser Technology from Micro-Epsilon for measurement tasks on red-hot glowing objects is patent-protected.



### 3D scan of components before laser cladding

With laser cladding, the component surface is melted by a laser beam and joined to form a new, pore-free layer by the addition of a powdered filler material. Prior to laser processing, the components are scanned with a scanCONTROL laser scanner from several directions. The core task of the scanners is the detection of free forms as well as the recognition of form deviations. Regardless of the reflection properties of the material, the scanners provide stable measurement values. The raw data is transferred directly to the customer software, assembled into a 3D model and used for the path planning of the laser welding head. The welding nozzle is then placed at the correct distance from the surface and guided along the calculated path.

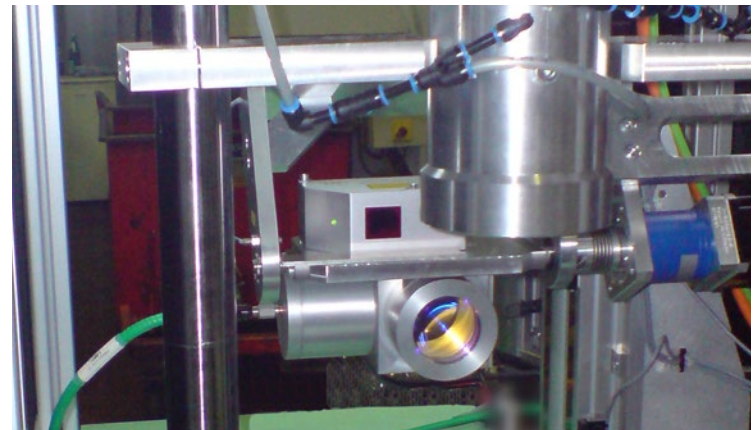
*Sensor: scanCONTROL*



### Completely automatic 3D repair welding

scanCONTROL laser scanners are used for repair welding of large parts in order to determine the welding track and the robot path. First, the surface of the defective area is scanned by a laser scanner, which is guided over the surface by a robot. The 3D data of the worn area together with the position data of the robot are generated. The measuring points determined are inserted into the CAD target model of the component. Therefore, the difference in volume between the high resolution measurement values and the target contour is obtained. Based on this difference, the required welding track is calculated and then transmitted to the robot control.

*Sensor: scanCONTROL*

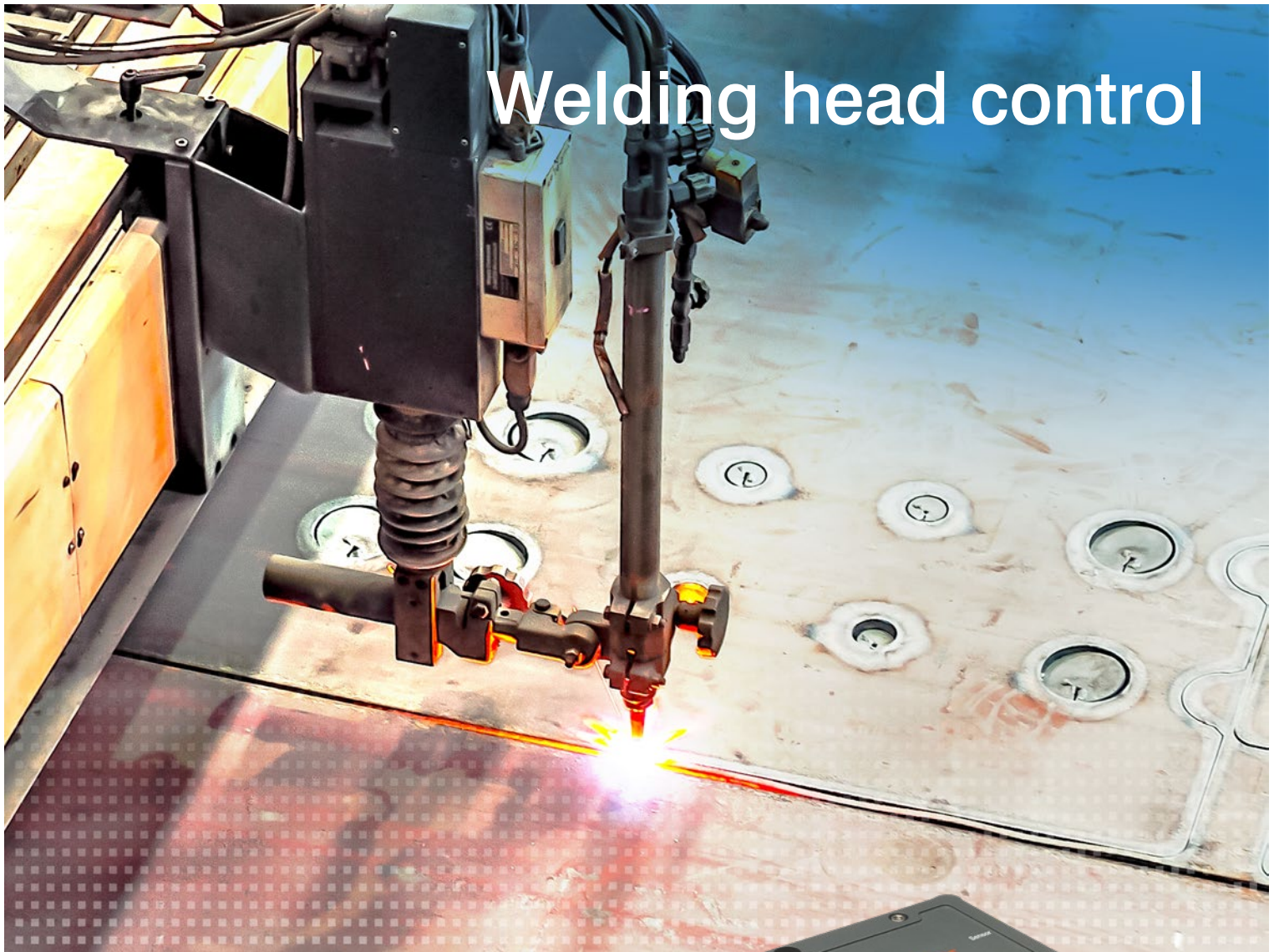


### Calculation of welded paths on gas valves

The position of the welding head relative to the welded seam is a decisive factor in the quality of automated welding processes. Even minor deviations can affect the welding result and lead to manual rework or rejection of the component. scanCONTROL profile sensors are used for profile measurements and provide precise profile information of the seam, even on difficult surfaces. The calculated paths eliminate deviations from the component tolerance in such a way that the welding head is positioned over the desired seam at all times.

*Sensor: scanCONTROL*

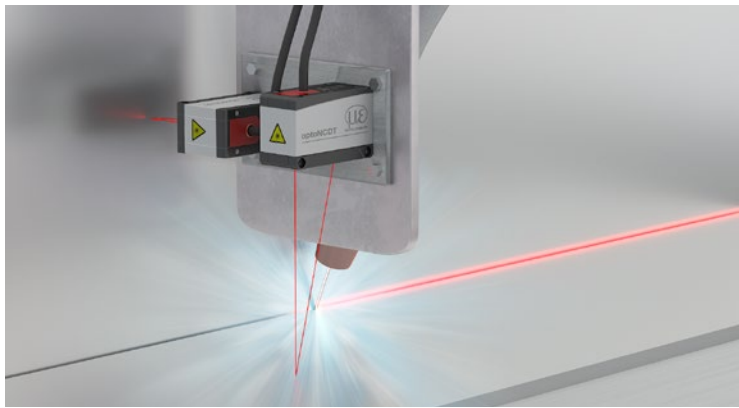
# Welding head control



## eddyNCDT 3060

- Inductive sensors (eddy current) for high precision measurements of displacement, distance & position
- High frequency response for dynamic measurements
- Temperature resistance for harsh ambient conditions
- Pressure-resistant versions up to 2000 bar, resistant to oil, dust & dirt
- Compact sensors for integration into confined spaces

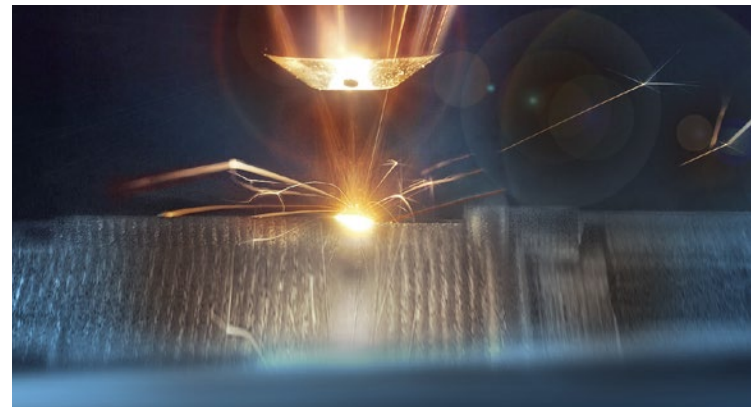




### Distance control with fully automatic laser welding

In fully automatic welding units, welding head positioning is crucial for the quality of the welded joint. In order to position the welding head at the correct distance, optoNCDT 1900 laser sensors are used. These measure the distance from the steel plates with high accuracy and dynamics. As they offer the highest insensitivity to ambient light in their class, the laser sensors are ideal for the distance control of welding heads.

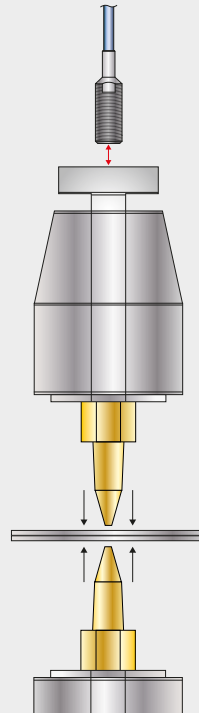
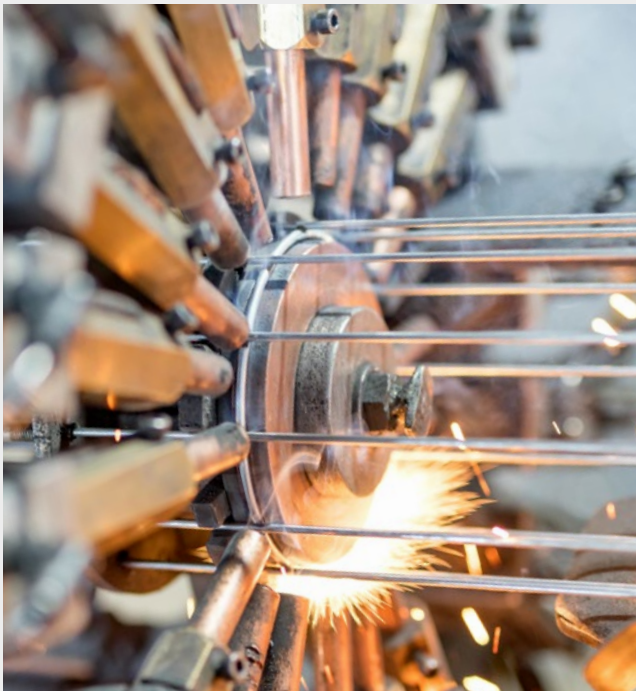
Sensor: *optoNCDT 1900*



### Focal point control in additive manufacturing

With additive manufacturing methods such as selective metal melting, the focal point control of the laser is crucial for the process speed and the quality. In order to determine the distance between the print head and the powder surface and to control the laser focal point, optoNCDT 1900 laser sensors are used. Their high measuring rate and repeatability enable fast and reliable distance measurements regardless of the respective alloy.

Sensor: *optoNCDT 1900*



### Displacement measurement of electrodes in resistance welding

In resistance welding processes, various parameters have to be monitored. In automatic welding machines eddy current sensors from Micro-Epsilon ensure high quality welded joints while measuring the travel of the electrodes. The non-contact displacement sensors detect the axial displacement which is influenced by thermal and mechanical factors. These robust sensors are insensitive to welding currents, vibrations and fluctuating temperatures. Therefore, they also operate reliably under harsh environmental conditions. High resolution and frequency response allow for the electrode position to be dynamically controlled while enabling repeatable quality of the welding joints.

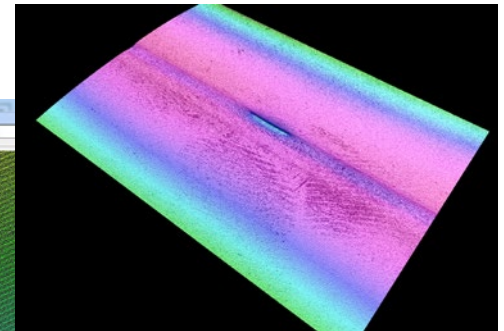
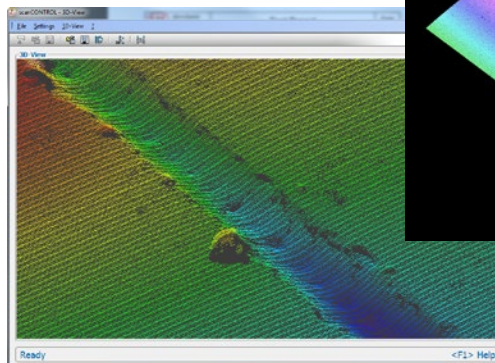
Sensor: *eddyNCDT 3060*

# Quality assurance

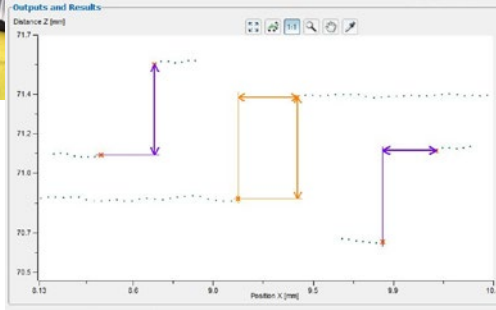
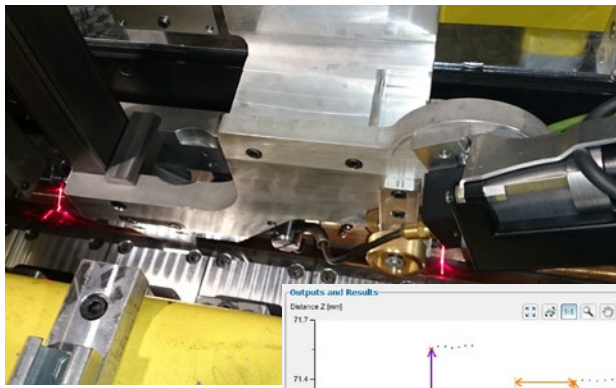


## 3D Inspection of weld seams using laser scanners

Laser scanners from Micro-Epsilon are used for quality assurance and the documentation of weld seams. Their high resolution enables the scanners to detect three-dimensional shapes and the finest of details and structures. The 3D View software allows quick and easy visualization of the evaluated readings. Moreover, multiple interfaces can be used in order to integrate the scanner in common image processing environments.







### Sheet edge measurement with laser welding

Automated robotic welding cells monitor the quality of pipes with longitudinal welding on the basis of several points. On the one hand, the edge position must be known along the sheet edge length while also ensuring the optimal alignment of the sheet edge.

Laser scanners from Micro-Epsilon which process several measurement programs in the integrated controller are used for monitoring. The scanCONTROL SMART sensors require no additional controller, which considerably simplifies the installation procedure.

*Sensor: scanCONTROL SMART*



### Measurement of cooling time in welding units

The documentation of welding parameters such as cooling time is achieved using high performance pyrometers from Micro-Epsilon. These short-wave temperature sensors enable precise measurements of metallic surfaces. The pyrometers are equipped with a double laser sighting in order to view the exact measurement spot position. The recording of the cooling time is performed between freely adjustable limit values. Depending on the model, different measurement distances and measurement spot sizes are available.

*Sensor: thermoMETER CTLaser M2*



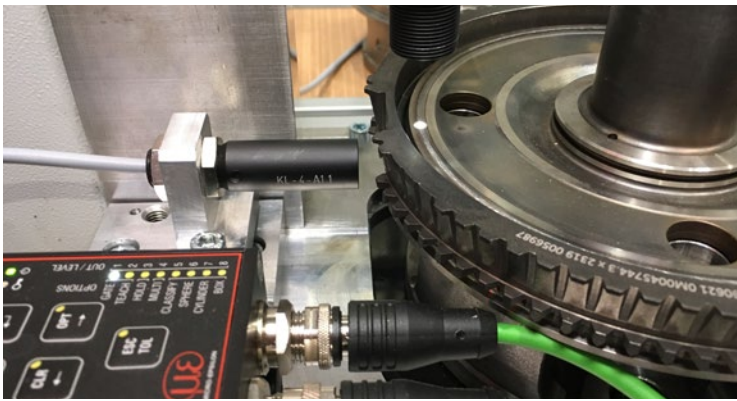
### Weld seam tracking for pipeline inspection

For the maintenance of pipelines, the inspection of the outer weld seam is a decisive criterion. For this purpose, the pipes are inspected in a test station under extreme climatic conditions. In order to automate the inspection process, the test facility is positioned precisely over the seam. The laser scanner detects the position of the weld seam and outputs this to the control system which readjusts the test unit. The laser scanner automatically adapts the exposure time to surface changes (e.g. moisture, dirt or corrosion).

*Sensor: scanCONTROL*

# Quality assurance





### Color sensors for the presence check of weld seams

When welding gear parts, the weld seam is automatically inspected for quality assurance purposes. Here, CFO100 color sensors are used which detect the entire seam while the component is rotating. As the weld seam has a different color than the surrounding materials, the presence of the seam can be reliably inspected. The multi-teach function enables teach-in of the color shades of the weld seam. If there is no seam, a switching signal is output.

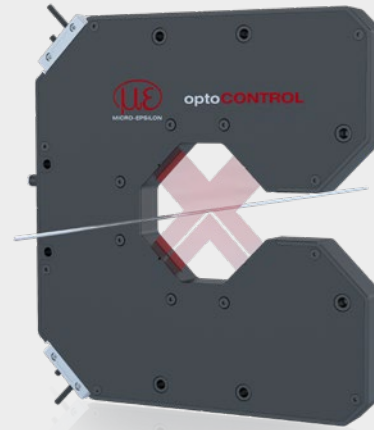
Sensor: colorSENSOR CFO100



### Optical weld seam inspection using industrial endoscopes

Rigid and video endoscopes are ideal for the inspection of weld seams in difficult-to-access places. This inspection can be performed before, during and after the welding process. Parameters such as wear, cleanliness, shape and surface are examined visually. For automatic evaluation, the endoscopes can also be integrated into image processing solutions.

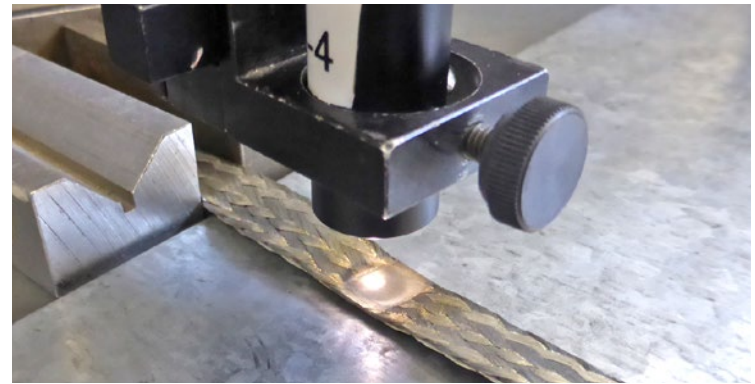
Industrial endoscopes from ELTROTEC



### Diameter measurement of welding wires

In order to monitor the thickness of welding wires, optical micrometers from Micro-Epsilon are used. The X-Frame measuring system continuously measures the wire diameter. Two laser micrometers detect the wire diameter with high resolution and measuring rate. The X-Frame enables the measurement of different wire thicknesses, and digital interfaces transmit the data to the control system.

Sensor: optoCONTROL 2520 / X-Frame



### Color sensors for automatic detection of weld spots

Brass strips are joined based on the spot welding method. CFO color sensors are used to automatically recognize the weld spots prior to further processing. The multi-teach function allows for the color shades of the shiny weld spots to be taught-in to color groups. When the sensor recognizes a weld spot, an output signal is output to the control system in order to initiate further processing.

Sensor: colorSENSOR CFO100

## Sensors and Systems from Micro-Epsilon



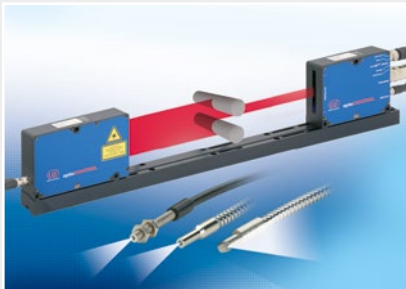
Sensors and systems for displacement, distance and position



Sensors and measurement devices for non-contact temperature measurement



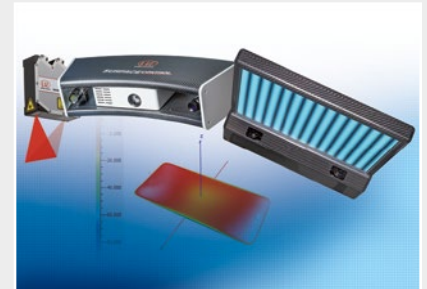
Measuring and inspection systems for metal strips, plastics and rubber



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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