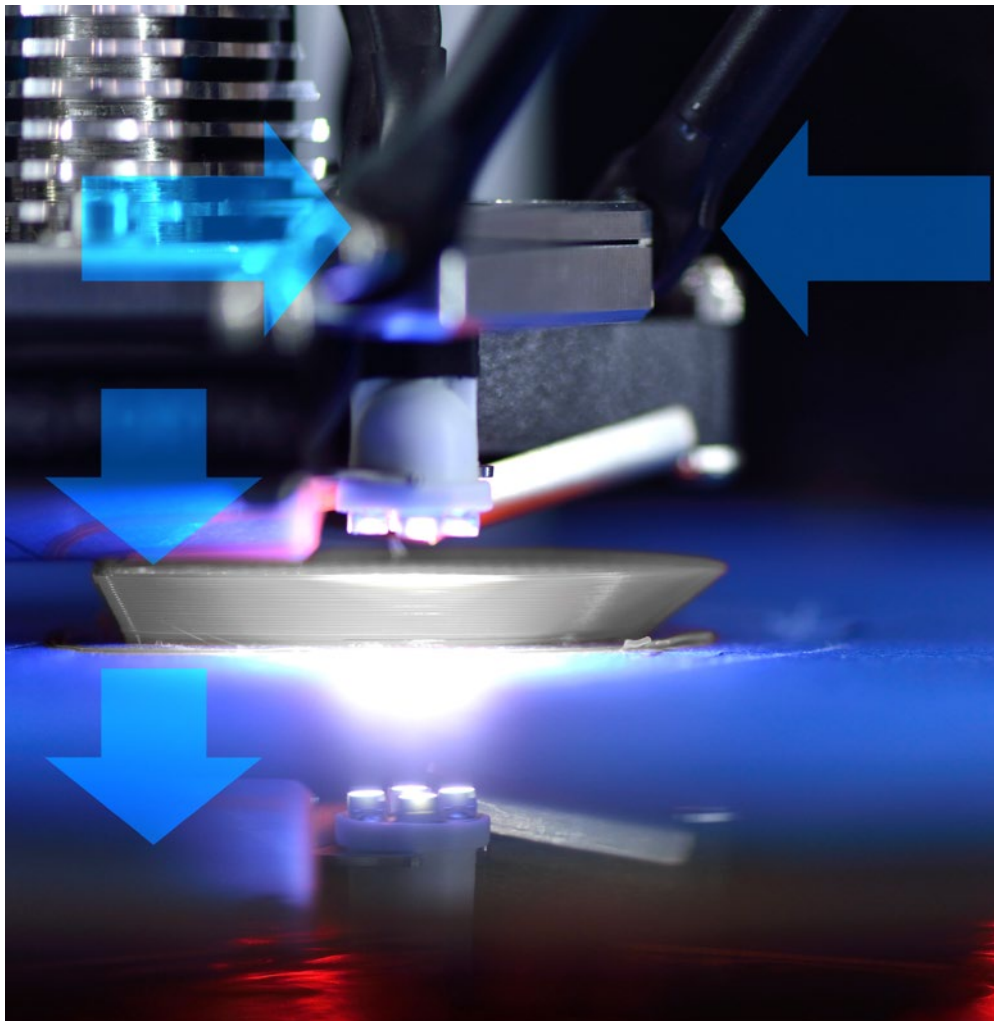
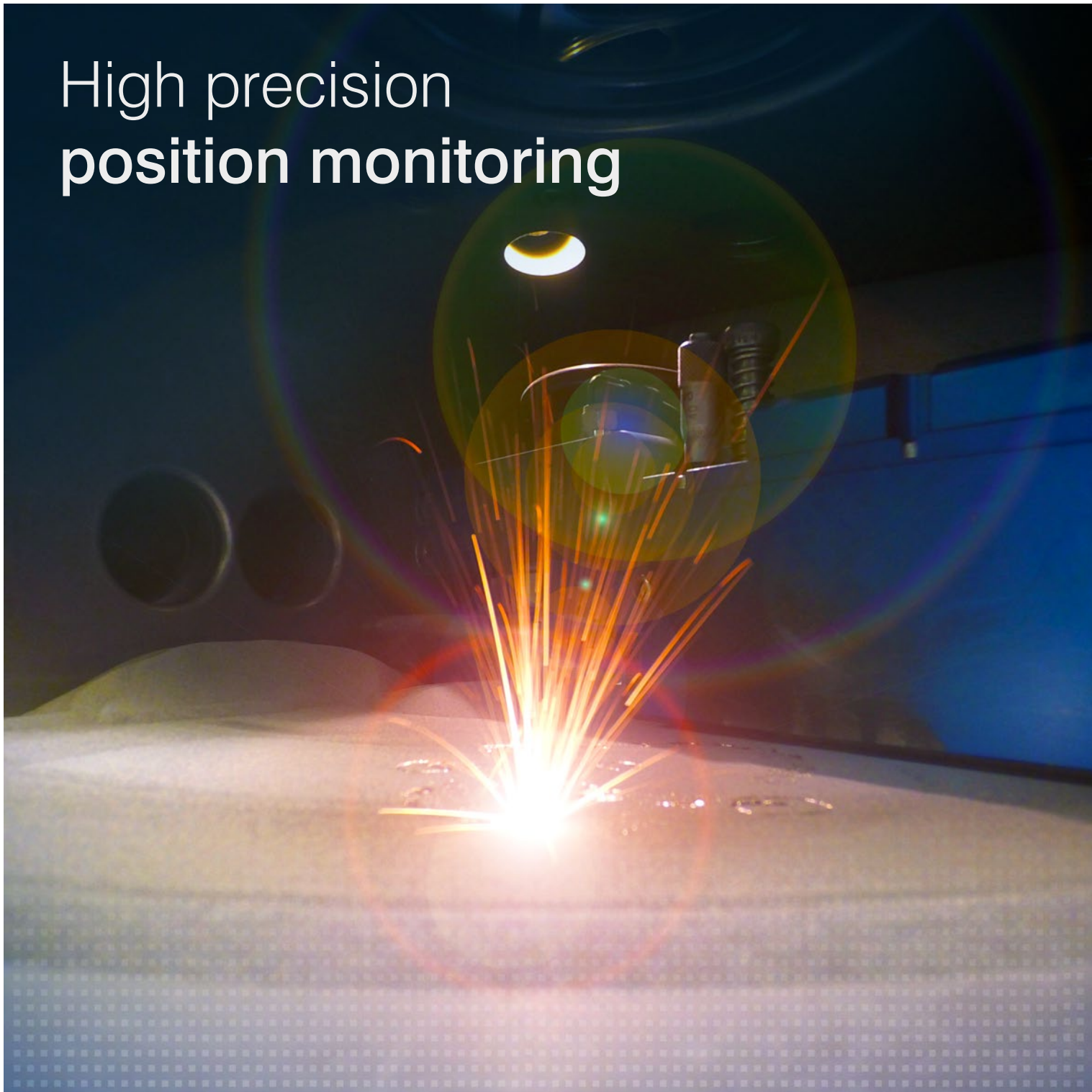


Sensors & Applications
Additive Manufacturing / 3D Printing



More Precision

High precision position monitoring





Monitoring the tilted squeegee

Capacitive displacement sensors monitor the position of the squeegee. Two synchronized sensors measure with high resolution both ends of the squeegee to provide exact statements about its tilt angle. This is to ensure that the powder bed has been pulled off evenly.

Sensor: *capaNCDT 6200*



capaNCDT 6200

- Capacitive multi-channel measuring system for machine position monitoring
- Displacement and distance measurements down to the nanometer with measuring ranges from 0.05 to 10 mm
- High frequency response for dynamic measurements
- Ideal for long-term measurements
- Multi-channel controller for synchronous detection of multiple measuring positions



eddyNCDT 3005

- Miniature eddy current measuring system, ideal for integration into plant and machinery
- Non-contact displacement and distance measurements with measuring ranges from 1 to 6 mm
- High accuracy and high frequency response
- Pressure-resistant versions up to 2000 bar, resistant to oil, dust & dirt



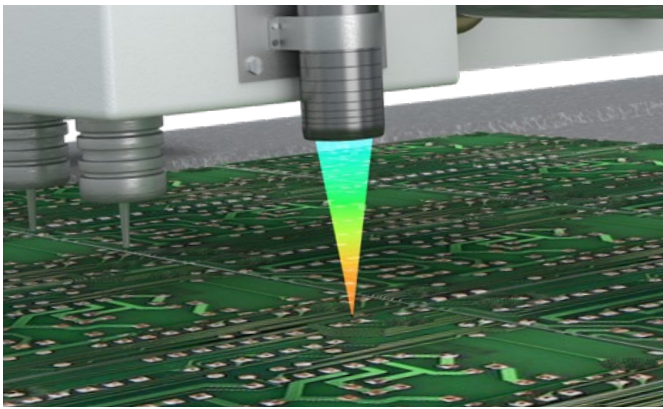
Orientation and positioning of the building platform

With selective laser sintering, the building platform is lowered after each melting cycle by a defined value which corresponds to the required Z resolution. Inductive displacement sensors based on eddy currents monitor this building platform in order to allow the print head to be aligned in parallel.

Sensor: *eddyNCDT 3005*

Position monitoring of printing processes

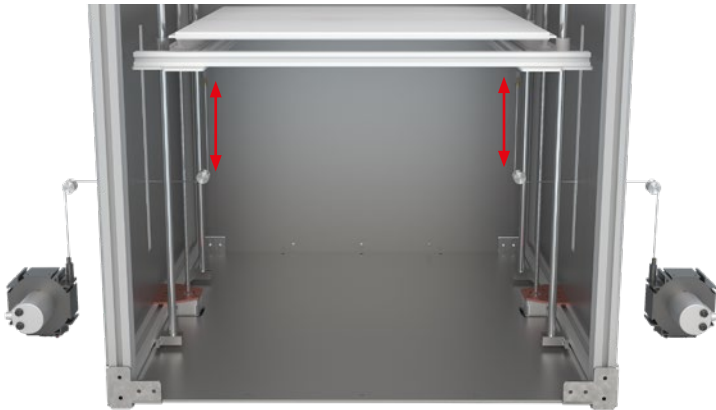




High precision sensors for print head tracking

Precise positioning of the print head is particularly necessary for 3D printing of complex components as well as for PCB printing. Confocal sensors are used to check positioning with submicrometer accuracy. These record the distance with the highest precision and at the same time a high measuring rate. This also allows dynamic pressure processes to be controlled.

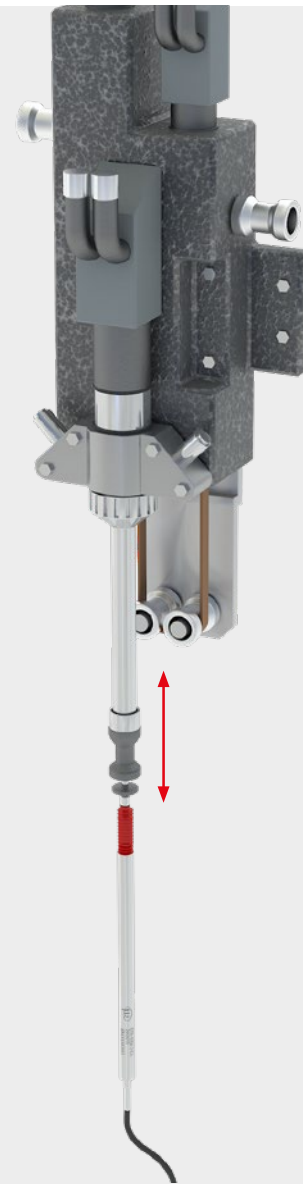
Sensor: confocalDT



Detection of platform tilt and position

Draw-wire displacement sensors are used to continuously check the tilting of girder platforms. The sensors are mounted outside the pressure chamber. The measuring wire is guided into the pressure chamber via deflection pulleys. Therefore, this design is also suitable for environments with high temperatures and dust formation. The compact sensors have large measuring ranges and can therefore detect the tilt even if the position of the platform varies.

Sensor: wireSENSOR MK

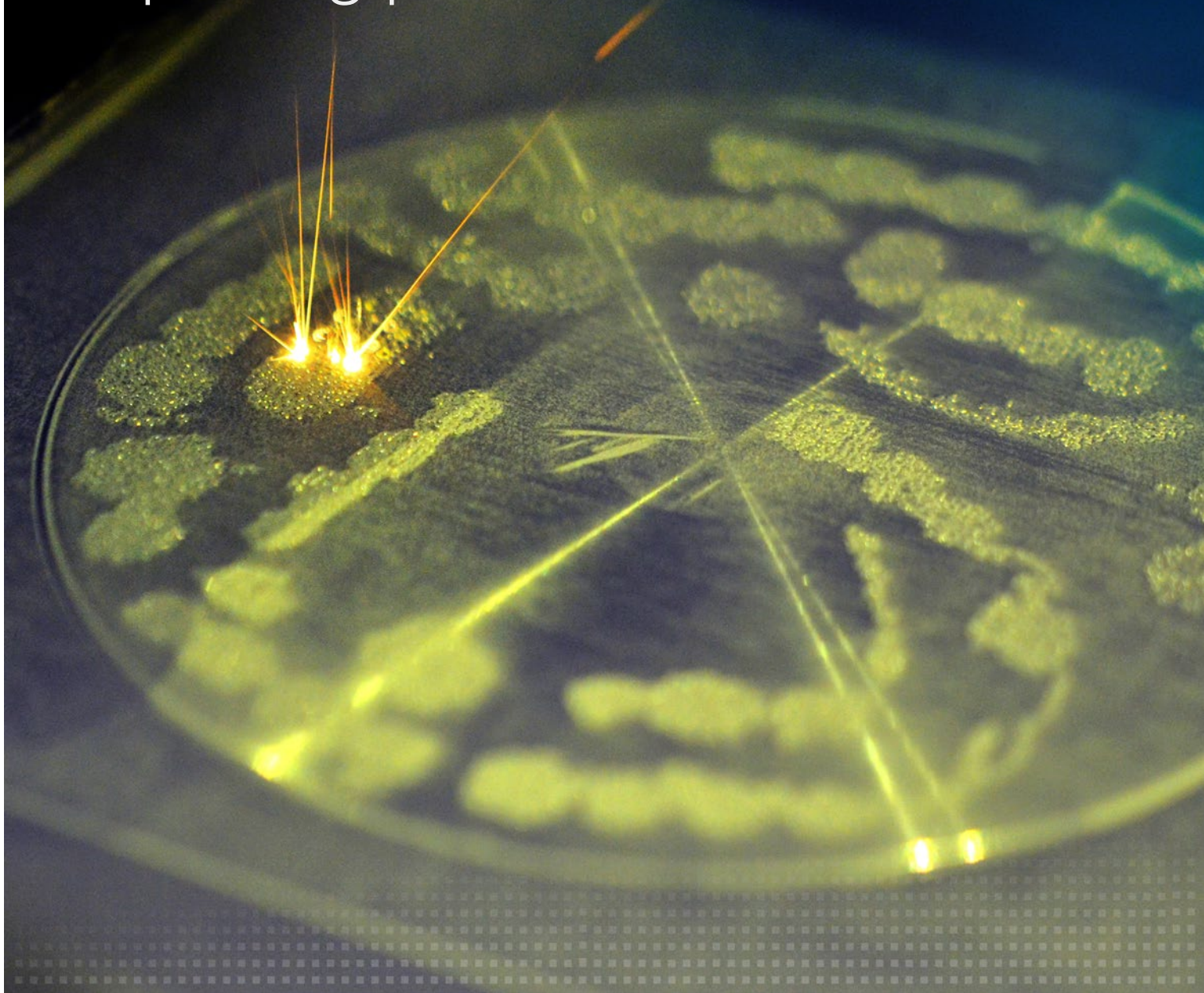


Print-head calibration in Z-axis direction

To obtain repeatable print results, the Z-axis position of print heads is calibrated fully automatically. For this purpose, the print head moves to a defined position and lowers in the Z-axis direction. An induSENSOR DTA probe records the Z-axis movement at high accuracy. The determined distance data is taught-in for regular calibration of the Z-axis position of the print head.

Sensor: induSENSOR DTA

Temperature monitoring of printing processes





Temperature monitoring of the powder bed in 3D printing

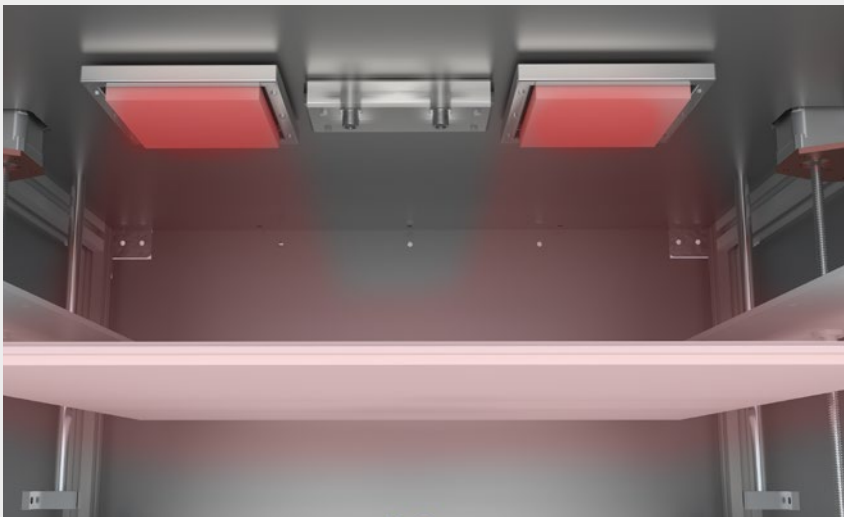
During laser sintering with CO₂ lasers, thermoMETER TIM thermal imaging cameras monitor the powder bed. The thermoMETER TIM thermal imaging cameras can be equipped with different lenses optimized for the respective measuring field. The high thermal sensitivity enables detection of the smallest temperature deviations. These high speed cameras also capture dynamic printing processes.

Thermal imager: thermoMAGER TIM

Heat distribution on 3D printed components

To check the heat distribution of the printed components, thermoMAGER thermal imaging cameras are used. These record the two-dimensional heat distribution from a safe distance and provide information on the stability of the joints and structures. The cameras can be used to monitor metal as well as plastic parts.

Thermal imager: thermoMAGER TIM

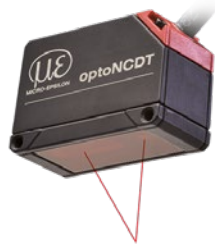


Temperature measurement of the powder bed and the carrier platform

In certain 3D printing processes, the powder bed is heated to ensure defined processing temperatures. Miniature thermoMETER CT pyrometers are used to monitor the temperatures. These are mounted on the top and record the temperature regardless of how far away the powder bed is. The sensors measure with high reliability even at high ambient temperatures in the installation space.

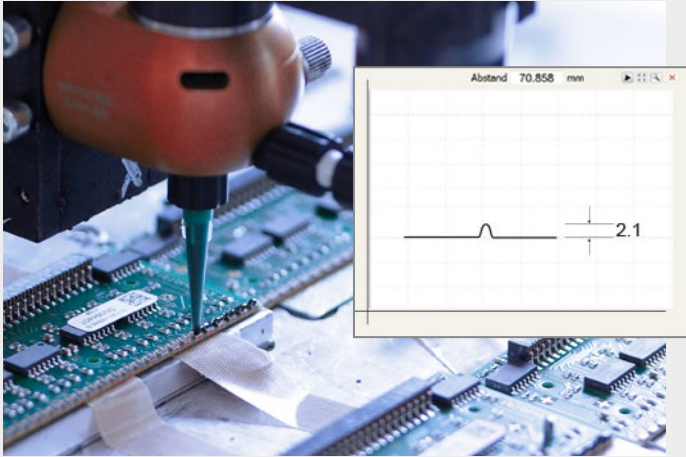
Sensor: thermoMETER CT

Distance control of print heads



optoNCDT 1420

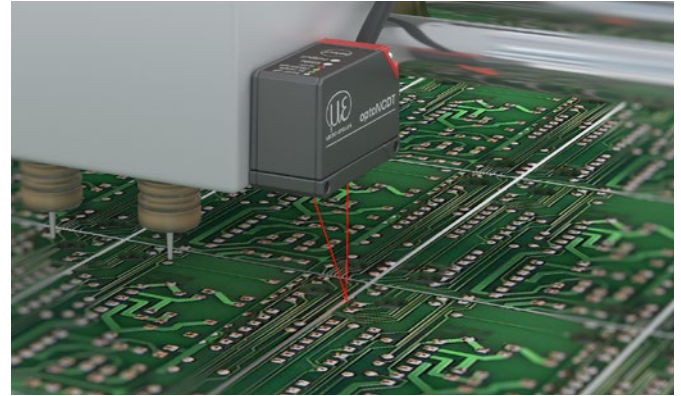
- Powerful laser displacement sensor for print head control
- Measuring rate of 4 kHz for precise and high speed measurements
- Measuring ranges: 10 mm - 500 mm
- Compact sensor design with integrated controller
- Robust and long-life design



Glue bead measurement in dispensing systems

After the reflow soldering process, glue is applied on some points to protect the circuit. The glue bead thickness is a critical factor that is reliably inspected using laser sensors.

Sensor: *optoNCDT 1420*



High-resolution fine positioning when printing PCBs

With printing, soldering and assembling processes of printed circuit boards, the exact height positioning of the print head is crucial for a flawless process. optoNCDT laser sensors enable precise positioning of the print head. Regardless of surface reflections, these sensors provide precise measurement results which are used to adjust the height and to detect the edges.

Sensor: *optoNCDT 1420*

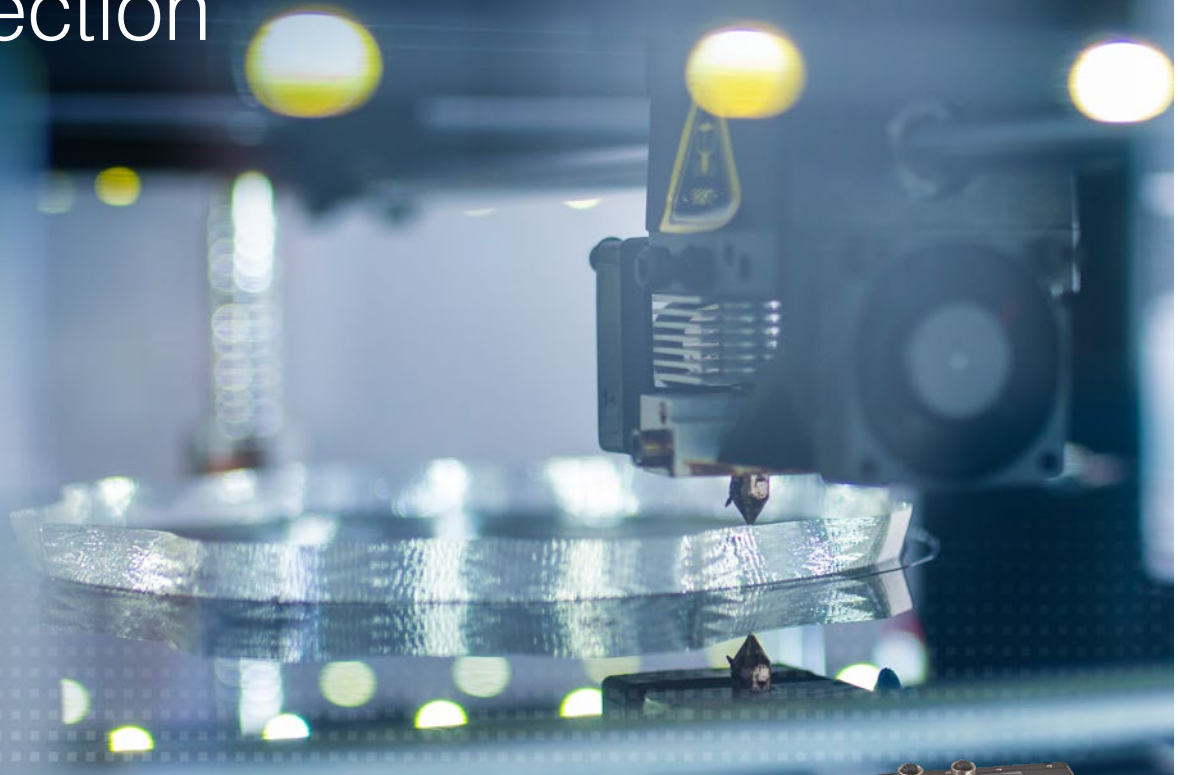
Print head positioning and focal point control

With printing processes, the exact height of the print head is a crucial factor for the quality of the final product. High-speed distance measurement against different material surfaces and reliable edge detection enable a fast readjustment process.

Sensor: *optoNCDT 1420*

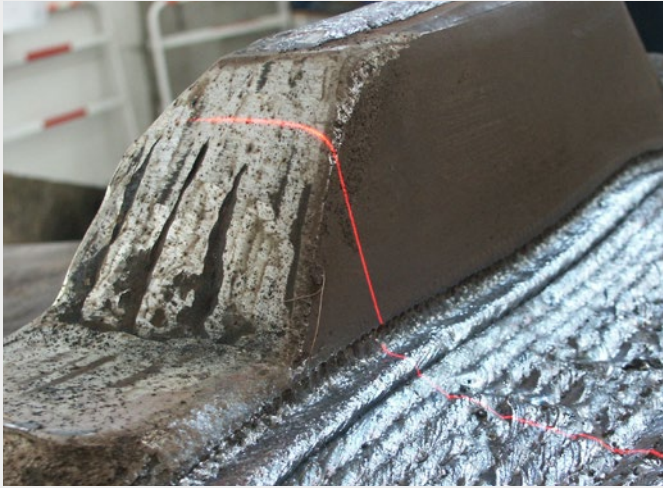


Quality monitoring & Inspection



scanCONTROL

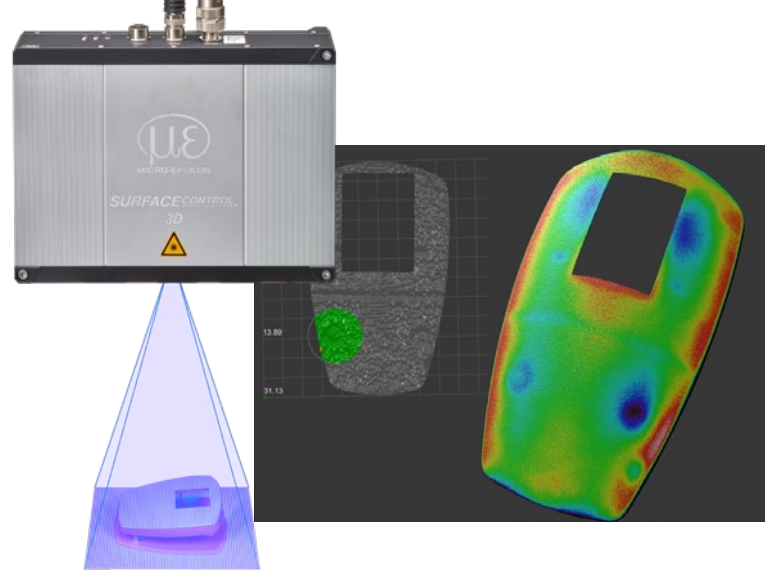
- Compact laser scanner with integrated controller
- High profile frequency for dynamic measurements
- Synchronization enables multi-scanner applications
- Various measuring ranges
- Blue Laser Technology for high precision measurement of various surfaces



Robot path calculation in repair welding processes

In order to calculate the robot path, scanCONTROL laser scanners determine the areas that need to be welded. Providing a high profile resolution and profile frequency, these laser scanners enable quick repairs.

Sensor: scanCONTROL 3060



High-precision 3D measurement in final inspection

To check the dimensional accuracy of printed components, surfaceCONTROL 3D sensors are used. These generate high-resolution snapshots of the components in a very short timeframe. The powerful 3DInspect software evaluates and outputs the point clouds.

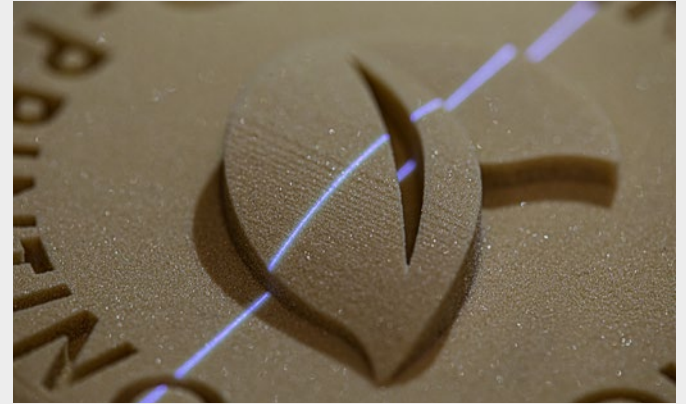
Sensor: surfaceCONTROL 3D



3D scan prior to laser cladding / laser deposition welding

Laser scanners from Micro-Epsilon are used to detect the contour during laser cladding. These scanners detect the exact contour of the object before the weld is deposited. The 3D data is used to exactly determine the guidance of the weld head.

Sensor: scanCONTROL 2900



CAD comparison of the printed component

In order to monitor their production quality, printed components are inspected using Blue Laser scanners. The components are moved past the scanners with a traversing unit. A 3D image is produced from the laser profiles and then compared with the CAD data.

Sensor: scanCONTROL 3060BL

Sensors and Systems from Micro-Epsilon



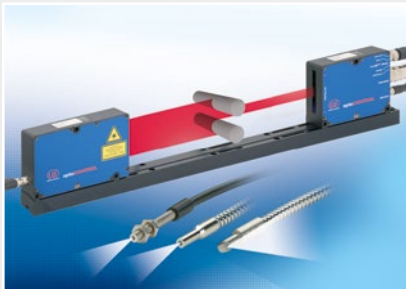
Sensors and systems for displacement, distance and position



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

www.micro-epsilon.com