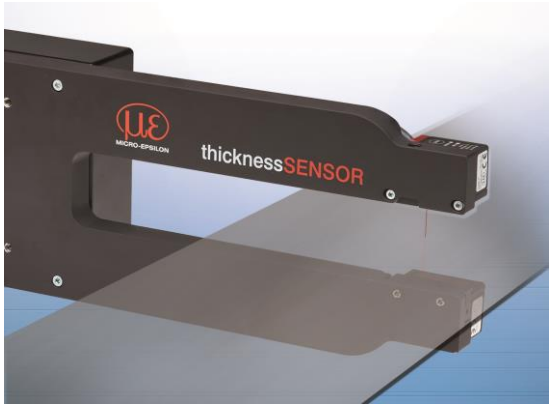
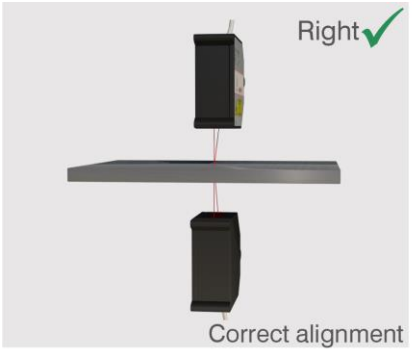


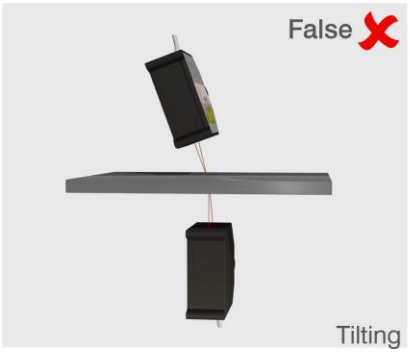
Thickness Measurement with Laser Displacement Sensors

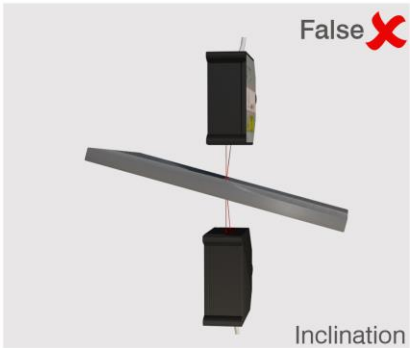
Laser displacement sensors are often used for measuring distance, movement and dimensions. If the measured values from two sensors are evaluated together, the thickness of an object can be determined from this. However, in order to achieve a precise statement of the target thickness from the combined signals of two sensors, there are a number of factors that need to be taken into account.

Alignment of the laser sensors

Special attention must be paid to the alignment of the two sensors installed opposite each other. No misalignment, tilting or inclination in relation to the target is permitted for the sensors. Example: For a misalignment of 1mm and an inclination of 2°, there is an error of 35µm; in the case of 10mm target thickness this increases to 41µm.





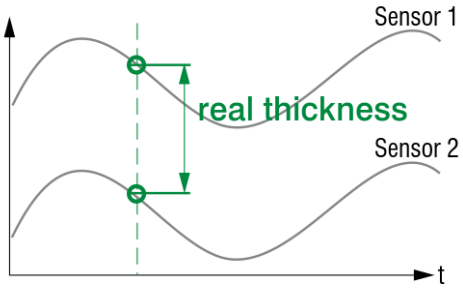


Synchronisation

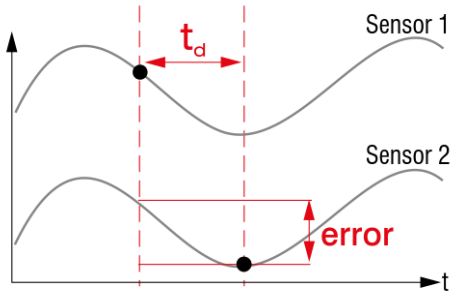
In order to avoid interference due to movement of the target, both sensors must be synchronised so that they perform the measurement at the same time at the exact opposite point of the target. If synchronisation doesn‘t occur defective measured data is produced. For example, micro-vibrations of the measuring object can occur if measurements are taken at different times, resulting in an error being output.

Example: For a time-delayed measurement of 1ms, a deviation of 125µm is produced (assuming 1mm vibration at 20Hz).

Synchronisiation at thickness measurements of two sensors



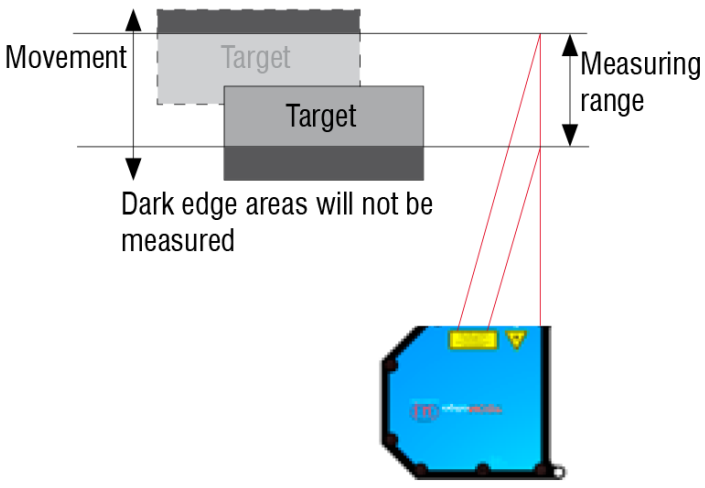
Genuine synchronisation during thickness measurement using two optoNCDT sensors with simultaneous data acquisition



Conventional laser sensor with usual time offset erroneous measurement

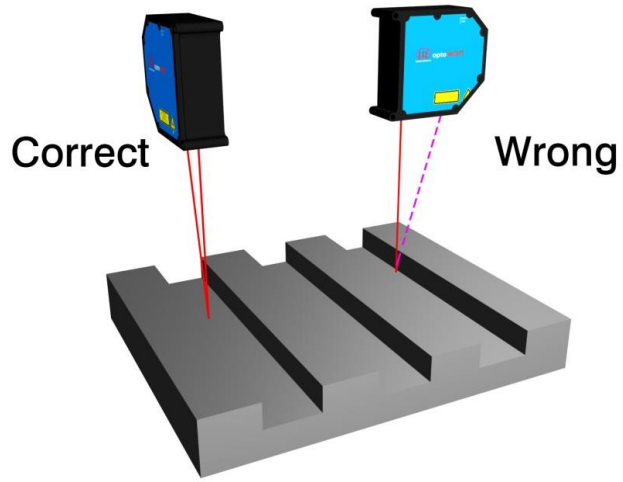
Positioning of the sensors / measurement range

Position, measurement range, thickness deviation and vibrations must be taken into account for the installation of the sensors. For correct measurements, the target must always be located within the measurement range. If the target is outside the measurement range, this can lead to faulty measurements. In particular, any special operating conditions such as Start, Stop or speed changes must be taken into account.



Arrangement of laser sensors

Laser sensors should not be installed until after specifying the running direction of the measuring object. In this way, higher accuracy and smaller deviation caused by the target surface are achieved. Shadowing of the beam path can also occur if the sensor is incorrectly installed.

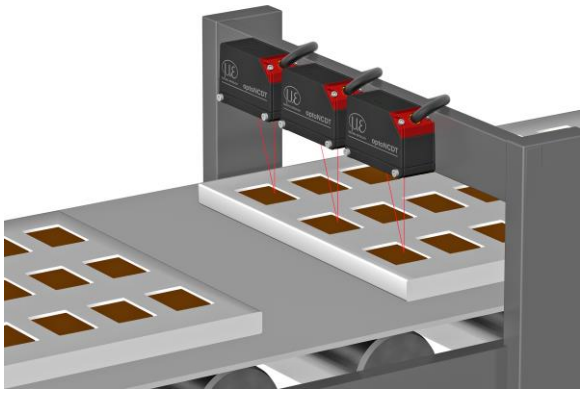


Mounting the sensors

All requirements for sensor positioning and alignment (see above) and a stable sensor assembly should be satisfied for the mounting of the sensor. The most secure, reliable mounting is achieved by using the recommended mounting accessories. In principle, mounting with an O-frame is more stable than with a C-frame.

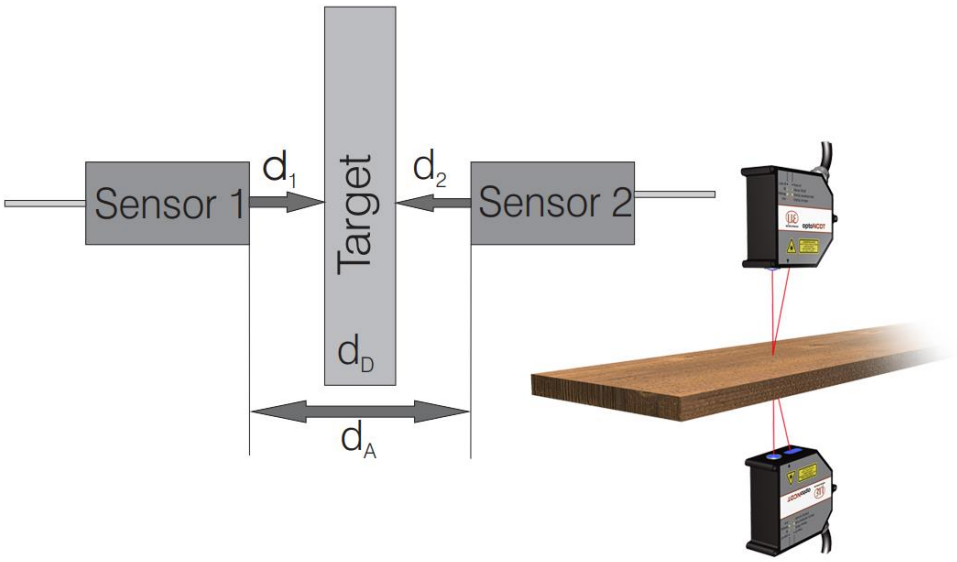
For thickness measurements, two sensor systems with the same or different measurement principles can be combined. These can be arranged on one or both sides of the target. Due to the use of two sensor systems, their non-linearities are added together.

There are basically two different principles in measuring technology for determining the thickness of a work piece or material using displacement sensors.



Thickness measurement of confectionary, mounted as O-frame

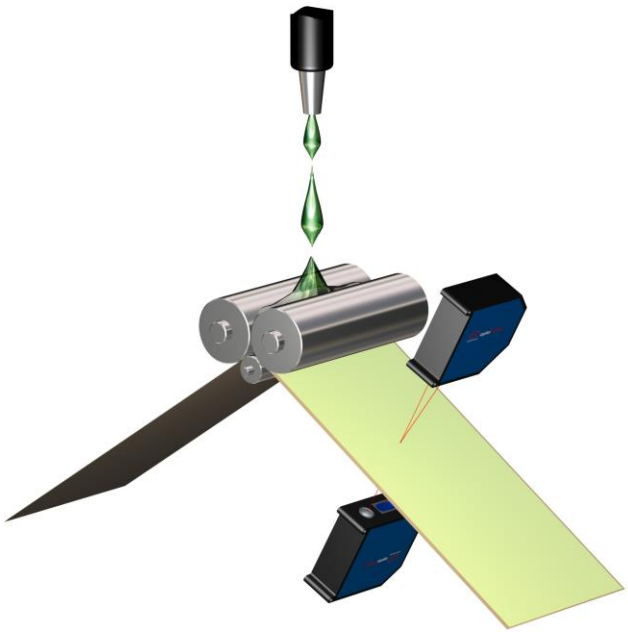
Two sided thickness measurement



Two sensors are placed at a known distance d_A on both sides of the measuring object (= target) which each measure the distance to the object. The distances d_1 and d_2 are subtracted from the sensor distance d_A in order to determine the thickness d_D of the target.

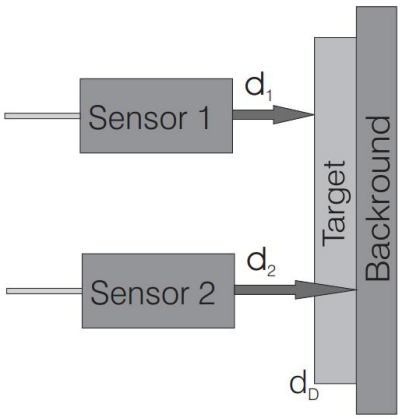
Formula: $d_D=d_A-(d_1+d_2)$

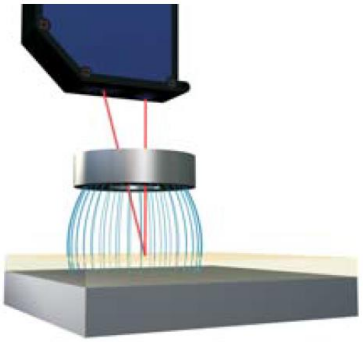
Measurement of thickness and warpage of credit cards



Thickness measurement of medical plasters

One-sided thickness measurement



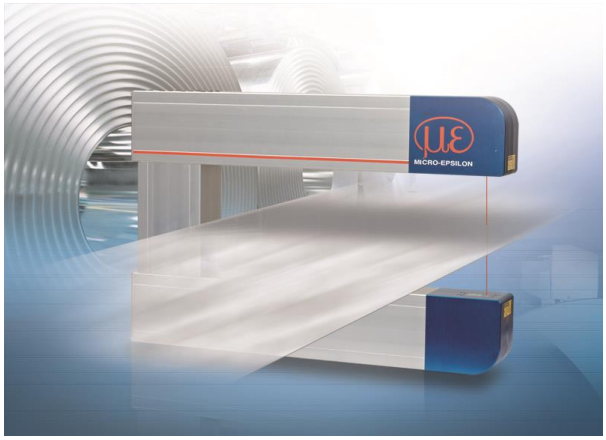


Two sensors are placed at the same distance d_1 from the measuring object on one side of the target. One sensor measures the distance d_2 to the background which is on the opposite side of the object. The thickness d_D of the target is calculated by subtracting the signals from one another.

Formula: $d_D=d_2-d_1$

Micro-Epsilon Inspection Systems

Micro-Epsilon offers complete turnkey solutions and inspection systems for the metals industry, including C-frame systems. Latest technologies are used for thickness, profile and surface measurements. Performance and quality, as well as reliability of products and services have made Micro-Epsilon one of the leading suppliers of inspection systems for optical thickness measurement used in the metals industry. Numerous, successful installations around the world in milling lines and processing lines rely on Micro-Epsilon inspection systems.



C-frame measuring metal thickness

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