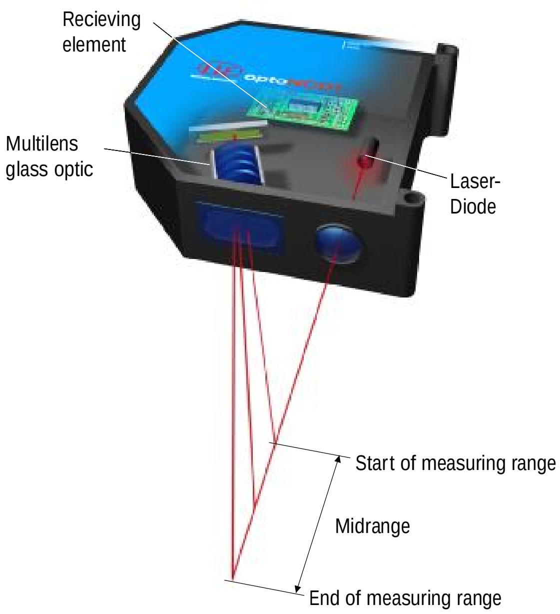
TechNote

Thickness measurement using CCD-Sensors

The determination of material thickness is critical for assessing the quality of web materials and individually packaged goods. As measurements often have to be made while the goods are moving, contact with sensitive or soft surfaces (ie. measuring object) is not permitted; only non-contact measuring methods can be considered for thickness measurement. Due to their excellent spatial resolution, material independence and high dynamic resolution, laser optical displacement sensors with CCD technology are best suited for these tasks.



A laser diode emits a laser beam, which is aimed at the target. The reflected ray of light is imaged via a lens either on a CCD / CMOS array or on a PSD element. The intensity of the reflected beam depends on the material of the measuring object. Therefore, the sensitivity is regulated when using analogue PSD sensors and the Series 1300 / 1401. The unique RTSC (Real Time Surface Compensation) circuit for the digital CCD sensors in the Series 1700 and 2200 regulates intensity changes instantaneously.

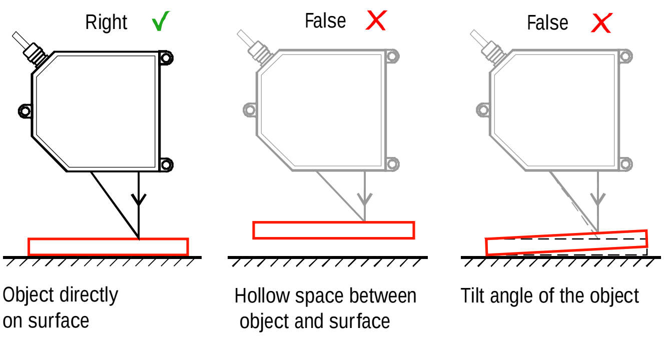
The distance from the object to the sensor is calculated from the position of the light spot on the receiver element. Depending on the version, the data is evaluated using the external or internal controller and output via various interfaces.

Advantages of the triangulation principle

- Small spot size
- Large base distances
- Large measuring ranges are possible
- Virtually material-independent

Thickness measurement with one sensor

The measurement object is passed over a support (e.g. roller). The distance between the support and the sensor is required as a reference distance for the subsequent thickness measurement. If there is an object in the measuring gap, its thickness is calculated from the difference between the reference distance and the current distance value.

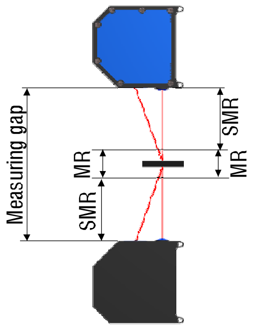


There are high requirements for the support and the conveyor because a hollow space between the support and measurement object or tilting of the measurement object in the measuring gap results in inaccurate measurements.

Thickness measurement with two sensors

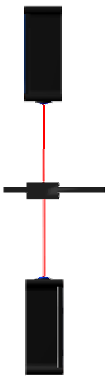
This elegant type of thickness measurement is carried out without any complex measurement object support. The basic advantage is that vibrations of the measurement object do not result in inaccurate measurements. The position tolerance of the measurement object is determined by the measuring gap width, start of measuring range (MBA) and measuring range (MB) of the laser sensor.

A reference object with known thickness must be positioned once in the measuring gap for the thickness measurement. The measuring gap width is decided together with the measured values of the two sensors. If there is an object in the measuring gap, its thickness is calculated from the difference between the measuring gap width and both the current distance values of the sensors.



Synchronous measured value recording

For an exact thickness result, it is critical that both the sensors record a measured value at the same time. A time delay for the measured value recording corresponds to a displacement of the target, i.e. the sensors are measuring at different places. Therefore, any calculations of the measured object thickness is only possible with limitations.

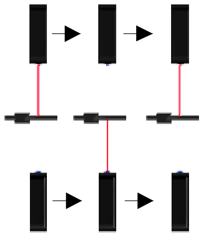


The synchronous measured value recording for the Micro-Epsilon laser sensors is achieved by synchronisation of the two sensors. This ensures that the sensors always perform the measurements at exactly the same time and position.
For the Series optoNCDT 1700 and 2200, the synchronisation can be achieved using hardware.

Micro-Epsilon also provides the IF2004 synchronisation software card. Using this card, an encoder or an incremental length or angle encoder can also be connected. The measured data is stored in a FIFO memory, in whichevaluations can be is stored.

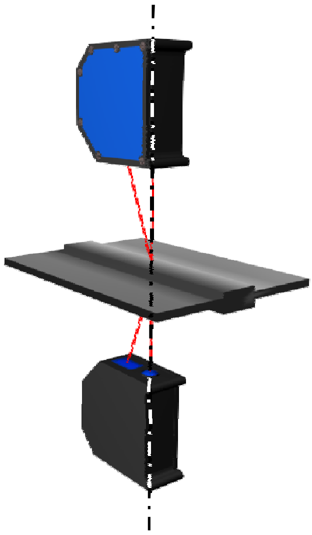
Alternating thickness measurement

For some transparent materials, it is necessary to select alternating modes for the thickness measurement. For example, 'milky' objects where the laser beam partially or completely penetrates the target. Here, the upper or lower beam is activated alternately, which prevents the laser beam of the lower sensor being interrupted during a measurement recording of the upper sensor.
In this case, movement of the measured object must be prevented, otherwise the problem outlined above will occur and both sensors measure at different points.



Note

Precise alignment of the sensors is very important. Otherwise, the problem mentioned above can occur with moving targets and an exact measurement is impossible.



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