Baumer
Passion for Sensors

Technical Report

A case for Time of Flight: difficult surfaces reliably detected

In assembly & handling, photoelectric sensors are a proven standard solution for object detection. Particular surfaces, however, are a demanding challenge for photoelectric proximity switches. This technical report describes Baumer sensor solutions that would reliably detect even structured, shiny and highly light-absorbing surfaces – even from a long distance.

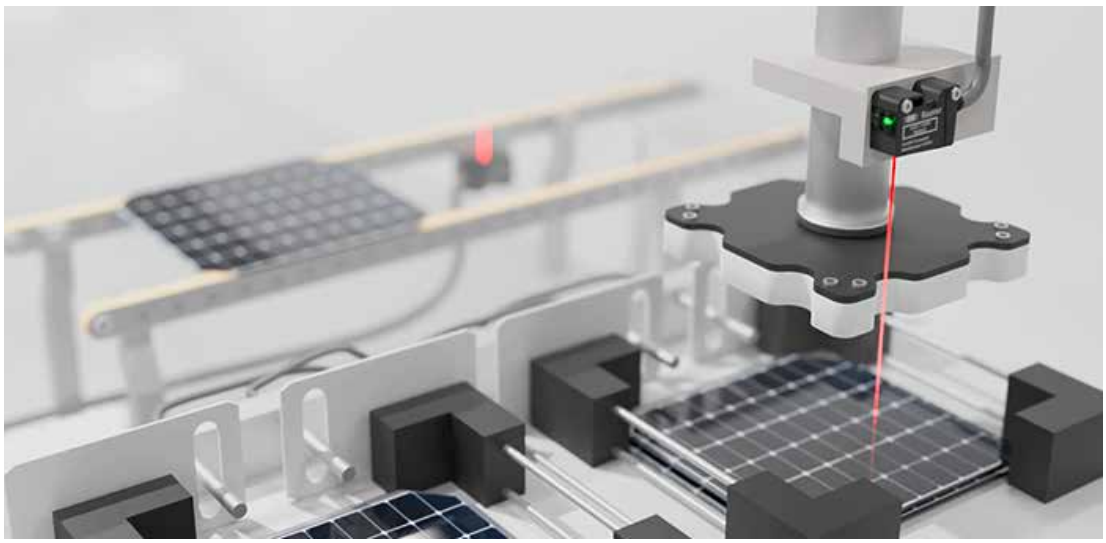


Figure 1

Figure 1: Baumer OT300 / OT500 sensors with laser light beam master accurate positioning tasks even for low-reflecting objects like wafers with anti-reflective coating.

Does the object reflect enough light? This is the crucial question in object detection with photoelectric sensors. There is a wide variety of challenging applications with low-reflective objects. Alternating high-gloss and matte car lacquer paintings in the automotive industry for example, and a multifaceted color palette between black and white. Different component geometries and sensor mounting positions make it even worse. Photoelectric sensors with background suppression face difficult tasks in the assembly and handling of solar cells and wafers in the semiconductor industry. Things get even more complex with severely varying degrees of remission during manufacture, like in tire production: frequently changing surface properties from tread to tire design on to vulcanization the final tire shape. Here, surfaces vary between high-gloss, smooth to the matte tire tread.

If light reflection is insufficient

Diffuse reflection sensors receive the light emitted by the sensor and remitted by the object. Different colors have different degrees of reflectance, depending on the wavelength of the light source used. Deep black or angled objects can be easily detected if they are close to the sensor. An increasing distance between sensor and object entails a rapidly decreasing share of light received. Such objects simply reflect too little light for reliable signal evaluation. In other words, physical properties such as object remission, absorption, and transmission make it difficult for the sensors to convert the light beams into electrical signals.

Reliable object detection by Time of Flight

Such challenging surfaces call for a particular sensing technology: the time-of-flight principle (ToF). In this

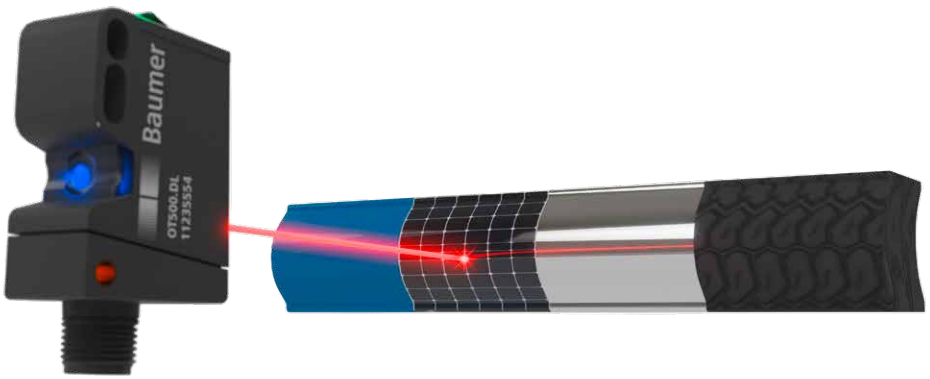
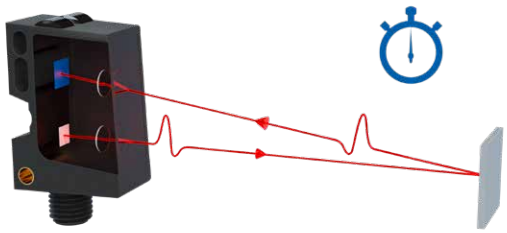


Figure 2

Figure 2: Optical sensors with extra plus in reliability even on challenging objects: Whether shiny or painted surfaces, reflective wafers, mirror-like materials or structured, deep-black tires. The Baumer OT300 / OT500 photoelectric sensors and photoelectric proximity switches ensure reliable object detection at all times.

detection method, the amount of reflected light plays a minor role only. In ToF measurements, the decisive factor is the light's runtime to the object and back. This time measured by the sensor is used to determine the distance to the object. In practice, a laser light



source acting as transmitter is emitting a signal package reflected by the object and registered by the receiver. The sensor evaluates both runtime and/or phase shift and converts them into distance values. Time-of-flight technology allows for precise and long-distance detection of objects with demanding surfaces properties.

Figure 3: What is the runtime of the transmitted light to the object and back? Time of Flight sensors measure this runtime for determining the distance to the object. In contrast to other sensor technologies, the amount of reflected light plays a minor role.

Ranges up to 2.6 m

The Baumer OT300 / OT500 sensor families ensure reliable detection of demanding surfaces within a measuring range up to 2.6 m. When used correctly, such powerful sensors minimize the risk of machine downtime caused by detection errors and this way ensure prerequisite conditions for maximum system uptime. Individual application and environmental conditions require tailor-made sensor solutions. This is where the broad performance spectrum offered by Baumer photoelectric proximity switches pays off. The OT300 / OT500 product family further add to the toolbox of the O200 / O300 / O500 photoelectric proximity switches with max. 2.6 m detection range in extremely compact designs.

More information at
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