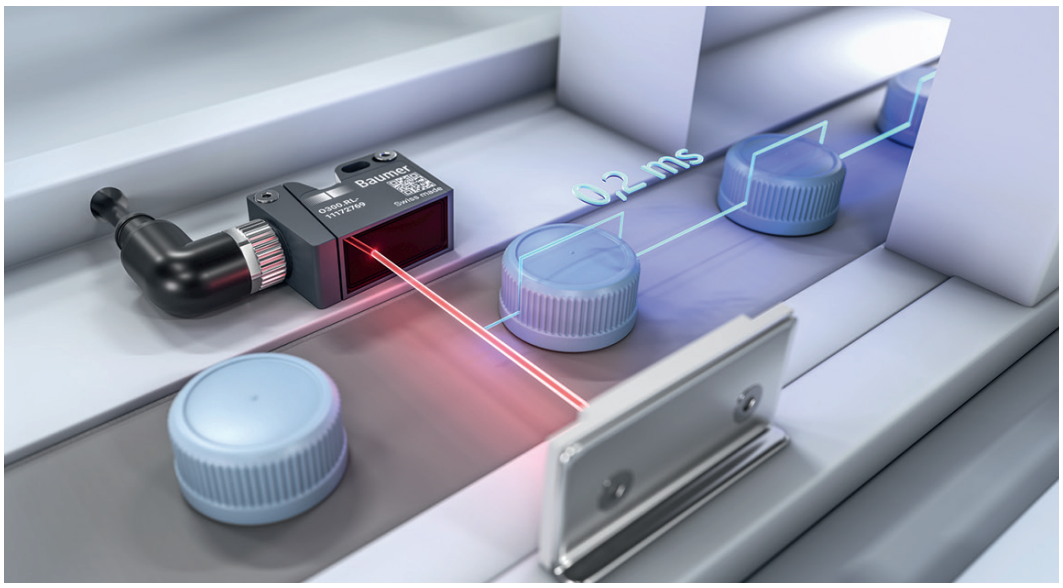
Baumer
Passion for Sensors



Optical sensors are true all-rounders

Most of the time, sensors do their job hidden away in the background. This is one of the reasons why the technology behind the sensor is not always obvious. Baumer Product Manager Markus Imbach and Bernhard Furrer, Head of Business Unit Position Sensors, explain the performance capabilities of present-day optical sensors.

Bernhard Furrer, Head of Business Unit Position Sensors and Markus Imbach, Product Manager at Baumer (f.l.)

What is the position of optical sensors in factory automation, compared to other sensor types? Are they frequently used?

Furrer: Sensors operating on the optical principle play a key role in factory automation. Optoelectronic sensing includes a big sensor variety, from simple photoelectric sensors on to distance-measuring sensors, imaging smart vision sensors and cameras. Already in view of their large variety, photoelectric sensors and photoelectric proximity switches are at the forefront in factory automation. Due to their variety, photoelectric sensors and photoelectric proximity switches play a key role in factory automation.

For which tasks in automation are optical sensors the first choice?

Imbach: Virtually any, since they are true all-rounders. Using different sensing principles, optical sensors enable fast and extremely reliable non-contact detection of objects or their positions at a considerable distance to the sensor. Optical sensors will also detect very precisely distances between sensor and object. Our optical sensors feature large sensing ranges in miniature designs, allow for precise parameterization and operate extremely reliably. That is why they are so flexible in use. Of course, there are challenges associated with their use.

What particular challenges are these?

Imbach: Challenges are mainly object properties, local prevailing conditions like space, potential mutual interference of optical sensors or interfering light. This is even more complicated by demanding environmental conditions in terms of soiling, hygiene or temperature, as well as processing speed and requirements on detection precision.

«Smart sensors like the O200 are the key in modern concepts..»
Bernhard Furrer, Head of Business Unit Position Sensors

In your opinion, what is most important when selecting an optical sensor?

Imbach: First the question: What will be the sensor task? What is to be detected at which point and at which precision? These are the essential factors to determine the best suited sensing principle, i.e. photoelectric sensors or photoelectric proximity switches in their multi-faceted diversity regarding light source and beam geometry.

Another important point is the object material. Is it transparent or opaque? Next, consider the surface property and object geometry. The detection of a drill tip places different demands on the sensor technology than that of a printed circuit board. These points should always be clarified first since they are basic for deciding on the appropriate sensing principle in the next step.

How do optical sensors detect transparent objects? One can look through them, right?

Imbach: That is problem number one in sensing towards transparent materials: light goes through unhindered, and it hardly reflects either. However, the little light reflecting at the object surface must be detected by the sensor. We therefore try to explore limits in the laws of physics by developing systems that ensure reliable object detection at extremely dim light.

For this reason we have developed a specialized optical sensor portfolio to meet the varied industry requirements in the detection of transparent objects like glass bottles or plastic trays. This includes optics and light sources as well as algorithms for the detection of transparent objects.

Repeatedly we spoke about sensing principles. Can you give us an idea what is meant exactly?

Furrer: There are different principles, from through-beam sensors to photoelectric sensors with reflector on to diffuse sensors utilizing object-remitted light. In recent years, diffuse sensors have taken a leading position thanks to their capability of detecting nearly any object with high precision within a precisely parameterized range. Transmitter (LED or laser) and receiver are accommodated in the same housing. The emitted light is remitted by the object; little of the reflected light hits the sensor's receiver and is converted into an electrical signal. Besides sufficient amount of light, the downstream evaluation device will determine the object distance towards the sensor and this way identify unambiguously whether it is the target object.

Present-day sensors operate on application-adapted transmitters and receivers, powerful microcontrollers and ASICs, altogether form a kind of "sensor engine" and in parallel communicate with controller and data processing unit. Here, Baumer has been deploying for years already own developed and continuously enhanced high-performance ASICs.

What else, besides object properties, must users consider?

Furrer: First of all, the sensor position, process speed and precision requirements. Another aspect is the mechanical machine interface, meaning sensor mount and the way it is aligned towards the object, as well as electrical interfaces. Today, another important aspect is fast and flexible adaptation during object change, as required in modular or batch size 1 production. All these factors must be considered in sensor selection.

Machines and plants often integrate a large number of sensors. In other words, they must ensure reliable operation for a long time and, best case, inform the operator early on when they need cleaning or detection is getting worse for some other reason. Present-day sensors like the Baumer sensors are capable to communicate with the automation world of machines and installations via standardized IO-Link interface. Last but not least, sensor solutions must meet the customers' economic requirements.

To what extent does extraneous light impair optical sensor systems?

Imbach: Optical sensors can be interfered by artificial light, sunlight and sensors in the near vicinity. But also LED lighting in shop floors or at machinery can cause interference, since LEDs operate in a spectrum up to 150 kHz and thus use the same or higher frequency as optical sensors. Therefore, reliable operation under ambient light conditions call for clever interaction of optics, electronics and algorithms.

Baumer always emphasizes the ease in installation of its sensors. Are sensors of other brands more complicated in mounting?

Imbach: It is not a matter of our sensors being quicker installed than those of other manufacturers. But what is special with our sensors and makes them standing out from competitive products is the tested and consistently aligned light beam. User work is eased by adding our 3D CAD data an optical axis which eliminates a big design-in effort. In addition, users can be sure the light beam will exactly follow the planned path.

Furrer: The optical axis is referenced to the mounting point, which is not only an advantage in sensor installation. Sensors do not squint, so when being exchanged you can be sure that objects will be detected at exactly the same point as before. This will considerably reduce downtime of machinery and installations.

«The optical axis considerably simplifies design-in.» Markus Imbach, Produkt Manager

Your sensors feature IO-Link interface as standard. What is it for?

Imbach: IO-Link turns binary switches into smart information providers and this way is the key to modern production concepts like "batch size 1" or "modular production". Via this bi-directional interface, sensors are quickly and easily adapted to new tasks which provides users with additional freedom and flexibility.

Furrer: Data delivered by a state-of-the-art sensor can be used for many purposes, e.g. for process optimization or for measuring the exploited capacity of machinery and systems. Smart sensors are key in clever concepts.

Finally, let's talk briefly about research and development. What are the topics or questions driving Baumer?

Imbach: Miniaturization is a topic we will focus on in the years to come. Space is scarce and there will be less and less installation space.

Furrer: We see great opportunities in signal processing and communication to provide our customers with even more high-performing sensors. Another application field is data-evaluating sensors making own decisions based on their evaluations.

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