Baumer

Sensor Solutions
Motion Control
Vision Technologies

Application report:

New Solutions Thanks to Dot-Shaped and Linear Scanning

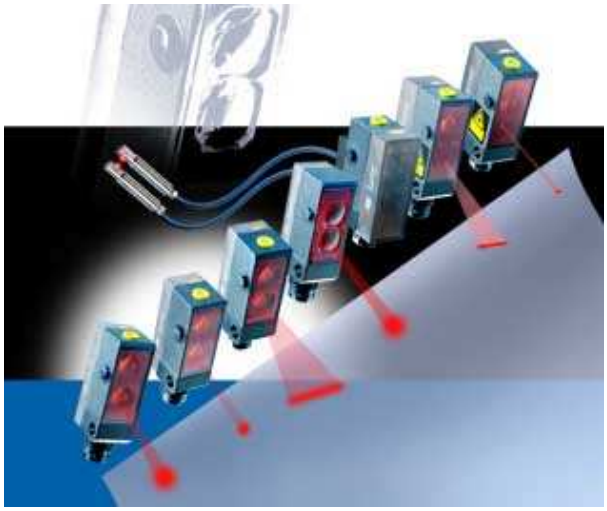

Figure 1: New product overview

Baumer's successful Series 10 with its broad selection of high performance red light sensors and high precision laser sensors has now been expanded to include several extremely interesting versions offering special beam shapes and a miniaturized fiber optic sensor. These new tools allow even the most difficult recognition and detection problems in, for example, handling equipment, PCB manufacturing machinery, document processing equipment or the pharmaceutical packaging industry to be easily solved.

Precise Recognition Through Optimal Light Beam and Background Suppression

The employment of various LEDs for diffuse sensors with background suppression allows Baumer to offer its customers the optimal sensor for their specific application. When it comes to precise detection, the shape and size of the light dot hitting the object plays a decisive role. If the task involves the highly precise positioning of objects or the reliable detection of the smallest components, a sensor using a laser beam is employed. Thanks to the laser diodes' small light exit and their high quality optics, the focal point of the beam diameter is a mere 0.2 mm. Objects can thus be positioned with corresponding accuracy.

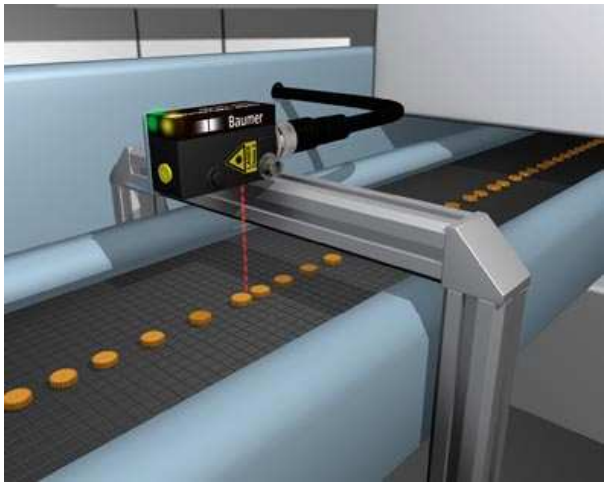

Figure 2: Reliable detection of small components on a conveyor belt using a laser sensor

The bond wire attached to the side of the point-source LED together with precision optics now also allow nearly laser-equivalent beams to be generated from red light sensors (beam diameter at the focal point: 2 mm). With this, these red light sensors offer a distinct improvement in precision over conventional LED red light sensors with approaches from the side. Where the aim is to reliably detect larger objects, a standard red light LED is still preferable.

Series 10 with	Beam diameter at focus
Standard red light LED	4 mm
Point source LED	2 mm
Red light laser	0.2 mm

Table 1: A comparison of beam diameters

What all three types of sensors have in common is highly efficient background suppression. Diffuse sensors with background suppression are currently the most popular sensors for reliably and precisely detecting objects, regardless of their color or surface features. The more efficiently the sensor is able to differentiate between the background and the components being detected, the more universally it can be employed.
Diffuse sensors with background suppression not only analyze the intensity of the incoming light, but also the angle of incidence of light reflected

off the object. In turn, this angle is determined solely by the distance between the object and the sensor (T1 or T2). A position-sensitive receiver element then evaluates the position (R1, R2).

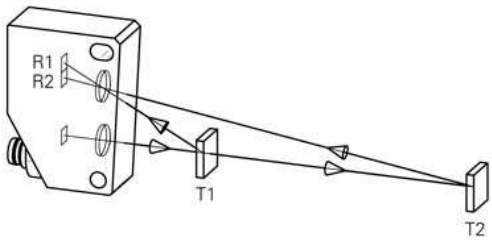

Figure 3: The principle of background suppression

While the switch point of a standard diffuse sensor is extremely dependent on the degree to which the object reflects or does not reflect light, a diffuse sensor employing background suppression is able to reduce this dependence to a minimum. Recognition is still possible even if there is dust on the lens, as this merely affects the intensity of the received light, not the position on the receiver diodes.

The switch point is adjusted by mechanically moving the lens. This allows both the focal range and the blind region to be optimized for the adjusted sensing distance. In turn this means a smaller blind region and the smallest possible black-and-white shift for short switching distances resulting in more precise detection.

Although sensors with adjustable range ability offer excellent flexibility, the market also demands sensors with a fixed range. These avoid incorrect adjustments on the part of machine operators or allow the adjustment effort during installation to be reduced. Baumer has also implemented the technology required for highly efficient background suppression in three new diffuse sensors with defined scanning distances (30, 50 and 80 mm).

Linear Beam Permits Broad Surface Scanning

The market is constantly presenting applications where sensors with linear beams offer a better solution than a point-shaped or dot beam; for example, where an edge must be detected but is interrupted by recesses. If a point-shaped beam is employed to perform this task, the location of the recesses can never change, otherwise the sensor will need to be constantly readjusted with respect to the edge. This task can be performed much more efficiently with a linear beam running parallel to the edge. The beam's length ensures that at least some part of the beam always falls onto the edge being detected so that the object will always be precisely detected on the basis of the actual edge.

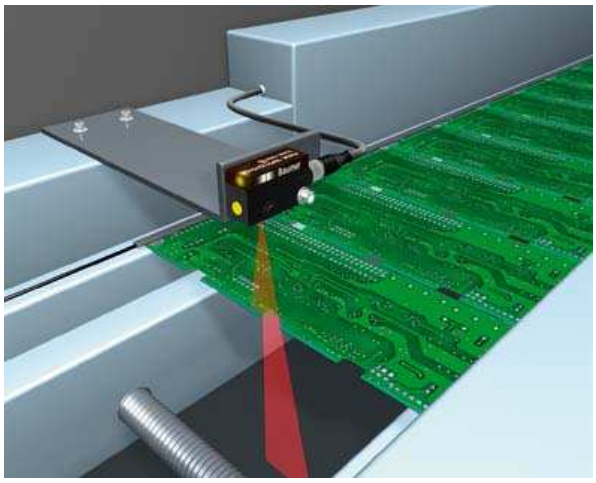

Figure 4: Thanks to the linear beam the edge of the PCB can be reliably detected, despite recesses

Linear beams are frequently created through the use of additional lenses. This, however, means that miniaturized sensors projecting linear beams cannot be offered. The process developed and patented by Baumer to generate linear beams is based on highly precise embossing technology whereby extremely fine lines are scribed onto the optics. This technique requires no additional space and can therefore also be employed for miniature designs such as those of the Series 10. In addition, it makes no difference whether the light source is a standard red light LED or a laser diode.

Sensor type	Beam width at 40 / 80 mm
Diffuse sensor with background suppression	20 / 48 mm
Laser diffuse sensor	3 / 12 mm

Table 2: Various beam widths

New Trend Among Fiber Optic Sensors

For the FVDK 10 – the smallest fiber optic sensor on the market – particular attention was given to uniting the most up-to-date sensor technology with the easiest possible use. Thanks to a new ASIC developed by Baumer, all standard market features can also be offered with the miniaturized Series 10 fiber optic sensors. Thus, for example,

up to three fiber optic sensors can be positioned directly adjacent to one another without any of them influencing the others and resulting in incorrect sensor switching. The yellow indicator LED shows whether the received signal is sufficiently strong and therefore whether the application will still continue to function reliably despite conditions which are somewhat less than optimal. The switching distance can be easily and precisely adjusted with the aid of a potentiometer.

Particularly beneficial features include the small dimensions and therefore the minimal weight (4g) of the fiber optic sensor. Where fiber optic sensors are employed on grippers or assembly heads they must frequently be dragline-compatible because the fiber optic sensor is simply too large to be mounted directly on the gripper. Further, the number of available dragline-compatible fiber optic sensors is very limited which, in turn, limits the available selection with regard to the most optimal sensor. The small, lightweight Series 10 fiber optic sensor can be installed on the gripper without any problem so that all plastic fiber optics available from Baumer can be employed.

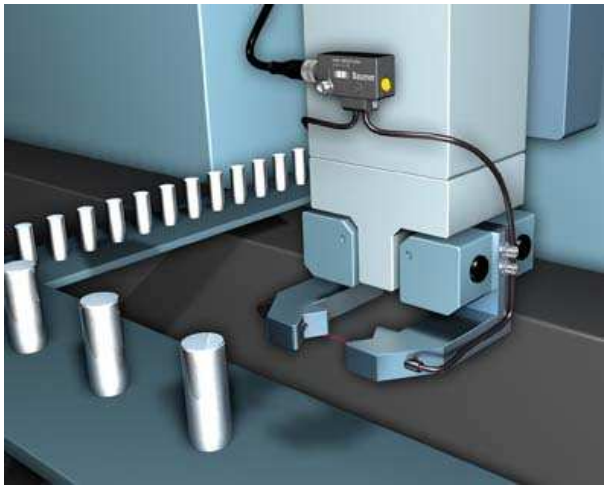

Figure 5: Even under conditions of limited space, fiber optic sensors are suitable for use in close proximity to the process in question

Unlimited Possibilities with a Single Housing Size

But not only optical sensors are available in the Series 10 housing. SONUS series ultrasonic sensors with either a switching or an analog output are also possible. With its shape and functionality, SONUS opens up entirely new application areas in the field of ultrasonic technology; for example, fill level measurement in miniature containers. In future, thanks to SONUS, measurements in this area will be possible regardless of the color or transparency of the media involved.

The new Series 10 sensors now present the customer with a very large and broad family of sensors. Standard sensors such as diffuse sensors, diffuse sensors with background suppression, diffuse sensors with polarization filters and through-beam sensors are available in both red light and laser light versions. Fiber optic sensors and ultrasonic sensors round out the product line. Thanks to special beam shapes, varying beam diameters, narrow sonic beam angles and a large array of different fiber optic heads, a wide variety of sophisticated applications can now be reliably processed with a single size.