Baumer
Passion for Sensors

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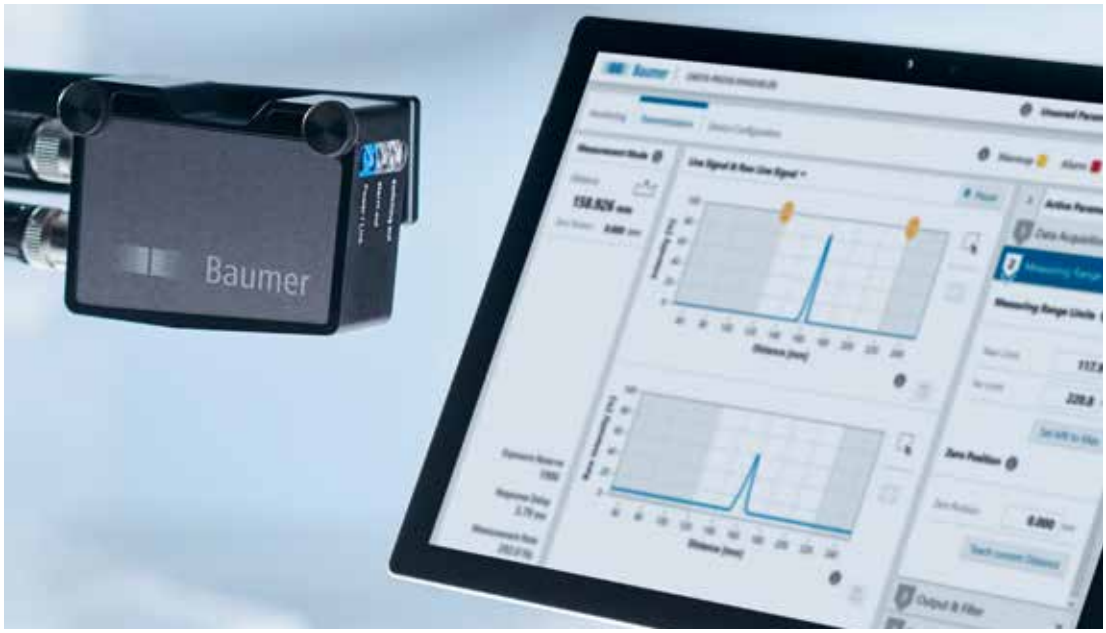
Technical Report

The right choice can be so easy

5 steps on how to find the right laser distance sensor for best-in-class measurement performance even on demanding surfaces.



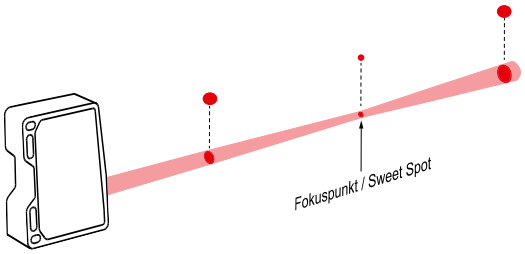
Modern laser distance sensors offer intuitive setting options via a platform-independent web interface

Within automated production processes, laser distance sensors like the Baumer OM70 sensors provide non-contact measurements to significantly increase process efficiency. They enable fast and highly accurate distance measurement of objects for reliable inline quality control tasks; provide distance values for high-precision positioning of objects or y-axis positioning of a robot arm, or measure the thickness for double layer control. In particular, triangulation-based laser distance sensors offer a nearly surface independent solution with highest precision. Compared to mechanical or tactile solutions, the measurement is contact-free, which prevents both wear and tear of the measuring equipment and avoids damage to the product. Criteria such as measuring range, focus, beam shape, object surface, as well as usability play an important role when choosing the right sensor.

1. Highest precision for every application – choose measuring range and focus

In general, it is recommended to mount the sensor as close to the object to be measured as possible, since the precision of triangulation-based sensors decreases with increasing distance to the measuring object. This will allow you to select the sensor with the smallest possible measuring range, and in turn, provide you with the best possible precision.

Such a sensor projects a laser spot onto an object. The reflected light falls onto a receiving element at a certain angle which depends on the distance of the object to the sensor. Based on the position of the light spot on the receiver element, the required distance to the object can then be calculated directly in the sensor. The further an object is away from the sensor, the less the position of the light spot on the receiver is affected by a variation in the object distance. That is the reason for the reduced precision of a triangulation-based sensor.



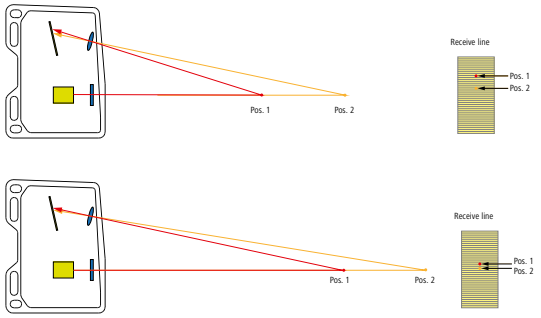
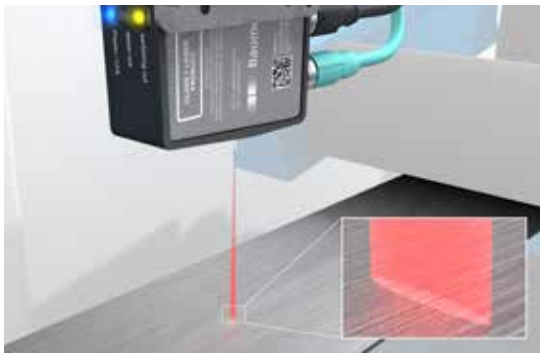
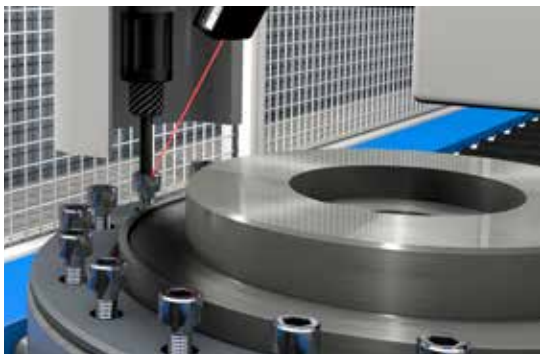


Illustration of the beam path with focus point for a laser distance sensor based on triangulation. The best local repeatability and thus precision is achieved at the focus point.

Comparison of signal changes at short or long distances: the shorter the measuring range, the larger the changes on the receive line

As any number of design considerations may prevent an optimal positioning of the sensor, we recommend using a sensor which provides a sweet spot within its measurement range. To optimize the performance of the laser triangulation sensor, measurements should always be performed in the focus (or sweet spot) of the laser beam. The minimum diameter of the light spot minimizes interfering optical effects and thus ensures the best repeatability and precision of the measurement result.





Different beam shapes for different surfaces: Laser-line beam shape for structured surfaces, focused laser point for high-precision positioning tasks

Different beam shapes for different surfaces: focused laser point for high-precision positioning

2. Measurement stability on any object with the right beam shape

In many cases, the portfolio of laser distance sensors includes both point and line beam shapes, which can be chosen depending on the type of application. Distance sensors with a fine laser-line beam shape provide an averaged measurement value over the structure of the surface of the target and therefore offer a clear advantage in terms of measurement stability when measuring metals, wood, rough or structured surfaces. Sensors with a laser spot beam, on the other hand, provide a precise measurement even on the smallest objects such as electronic components or enable the exact positioning of components thanks to their extremely small and focused light spot.

3. No additional expense for protective devices – laser class 1 and 2

Most laser distance sensors provide reliable results by automatically adapting the exposure conditions to the optical characteristics of the target, and thus manage to stay within laser class 1 specification. The laser radiation of laser class 1 sensors may achieve a maximum power <25.5 µW at a wavelength between 400 nm ... 700 nm and is therefore harmless to the human eye. The sensors can be mounted easily and quickly without necessitating additional protective measures. For this reason they are the preferred choice in industrial applications. Nevertheless, sensors with laser class 2, which emit a higher level of average power, are needed as well: They facilitate reliable measurements even with extremely dark materials, such as matt rubber conveyor belts, where a large proportion of the light is absorbed. The consequence is that only a small amount of light is reflected to the sensor's receiving element. If sensors with laser class 1 were used in such cases, the exposure time required to produce a reliable signal would be significantly increased. In turn, this would reduce the measuring speed and the entire measuring cycle would be considerably longer. In this case, the higher output power of a laser class 2 sensor enables short measuring cycles.

4. Interfaces and connectivity – from analog to digital

In order to extract the maximum amount of information from the recorded measured values, they must be passed on to the different levels of the automation pyramid. For a long time, the availability of an analog reference value via the analog output of the sensor or serial protocols such as RS 485 has been sufficient. However, the advancing development of Industry 4.0 offers an unprecedented opportunity for factory automation. In turn, this places much higher demands on the capability of critical components like sensors to network between the levels of the automation pyramid. For this reason, Industrial Ethernet-based protocols are also offered for efficient integration into the network infrastructure of a modern factory. The appropriate communication protocol can be selected according to the specific requirements.

Industrial Ethernet based protocols offer many advantages for the user. Digital interfaces offer added value, particularly with regard to reliable, flexible production processes. For example, the parameterization of the sensor can be carried out during operation via an integrated web server or the interface itself. In addition, high transmission rates allow the transmission of additional secondary data in addition to the distance values, for example to support predictive maintenance processes.

5. Solve challenging measuring applications simply – the impact of usability

In addition to the technical selection criteria described above, the simple operability of the sensors is of great importance. Laser distance sensors with a web interface are an efficient solution in this case. They allow quick and easy adjustments of the sensors without additional software; all you need is a standard web browser. Thanks to the graphical visualization of the measurement signal and the possibility of limiting the measuring range of the Baumer OM70 high-performance sensors via the web interface even reliable measurements on transparent products or the identification and suppression of interfering signals can be achieved extremely easy. The integrated monitoring function allows a live analysis of the measurement results. This enables fast and immediate problem solving both during initial testing of the application and later during service or maintenance.

Standardized interfaces guarantee fast integration into existing automation systems
Figure

Conclusion

There is not the one laser distance sensor that is suitable for all applications but a number of factors that influence the selection. For this reason, Baumer offers the most comprehensive portfolio of high-performance laser distance sensors on the market with the OM70 product line. If offers a variety of settings, beam shapes, measuring ranges and laser classes to optimally solve specific applications.

Further information:
www.baumer.com/OM70

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