

## Technical Report

# Laser distance measurement for all surfaces. Strengths and weaknesses of point, line, and multi-spot distance sensing.

Historically, laser distance sensing has only been possible through point distance measurement. While precise, this technology has its weaknesses. Using other methods allows the same precision when measuring targets suboptimal for point distance measurement.

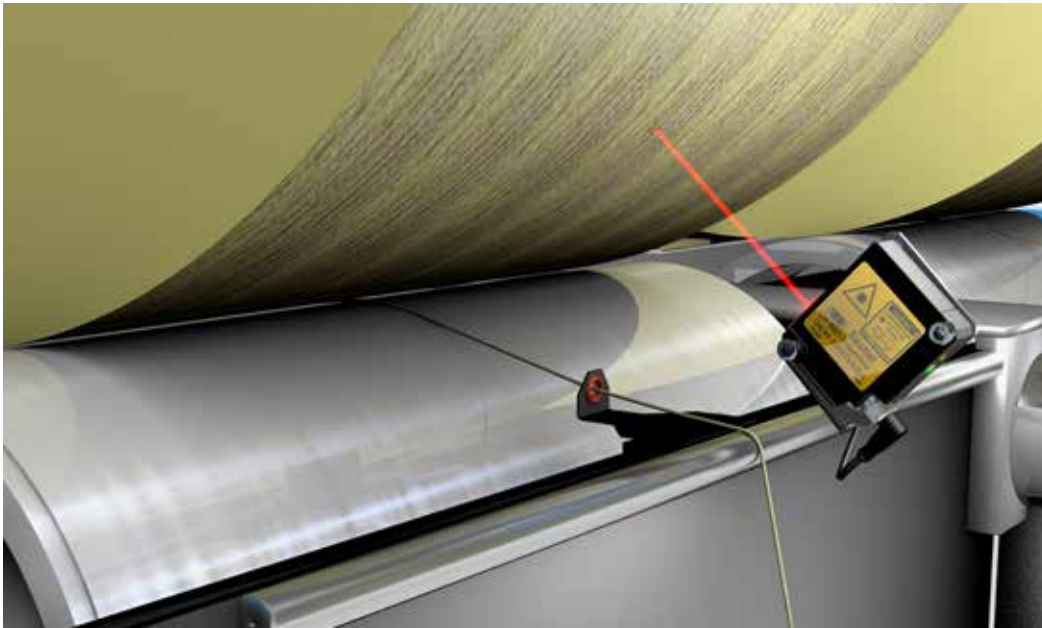
### Laser line vs. traditional spot laser distance measurement

Laser sensors perform a variety of measurement feats including detection, counting, guiding and triggering of far, near, moving and stationary objects. They've grown up substantially from previous generations and deliver the requisite depth and breadth of product line as well as sensing reliability that just wasn't possible before. In the past, spot laser distance measurement was the go-to solution, despite less than consistent and reliable results. Some applications require a small spot for high-resolution measurement, while others require

a larger diameter spot for averaging rough surfaces, or for eye safety concerns. A small, focused laser spot will help to resolve tiny features on a target's surface. A large spot will reflect off larger areas which may contain features at several different heights. Spot laser sensor measurements rely heavily on environmental conditions for accuracy. If there is dust in the environment, recognition of a moving target, for example, is particularly difficult. Sensor accuracy is also affected by temperature and ambient light, while others struggle to report an accurate liquid level measurement. Inaccurate measurements are at times a result of color



Laser point sensor for precise measurement of timepiece internal components.



Laser line sensing is best used on rough surfaces which would excessively scatter a point sensor.

– as in detecting a black object on a white conveyor from a reasonable distance, or involve material finish or texture, such as shiny surfaces that reflect more light than matte white surfaces, or coarse and fuzzy materials that reflect less light than flat surfaces. The lightest and darkest materials represent the greatest consistency challenges. It isn't just the amount of light a surface reflects, it's also the way in which light is reflected that inhibit performance. Should anything intrude on the beam itself, inaccuracy and equipment damage may result. Finally over time, repeatability, which is low for very fast sample rates, may worsen as long-term drift in components, combined with temperature changes affect sensor output.

#### Advantages of laser line distance measurements

The use of laser line distance measurement provides many benefits, including:

- A very high measuring rate
- Flexible field of view
- High-performance signal processing unit
- Trigger and synchronize capabilities

Laser-line sensors triangulation for two-dimensional acquisition of profiles on a variety of target surfaces, and when the object is in motion the sensor generates a 3D representation of the object. The system projects a laser line onto the target object / surface to be measured. Laser line distance measurements are both accurate and reliable, no matter the surface. As legacy systems give way to

more robust laser solutions for demanding environments there are multiple possibilities of lasers with features specific to the target application.

#### The Baumer Laser Distance Sensor Family

Baumer offers a unique portfolio of laser distance-measurement sensors that features a wide variety of performance classes. Whether the target is a small object or a particularly difficult or demanding surface, Baumer distance sensors are ideal for any application based on the availability of three separate beam principles:

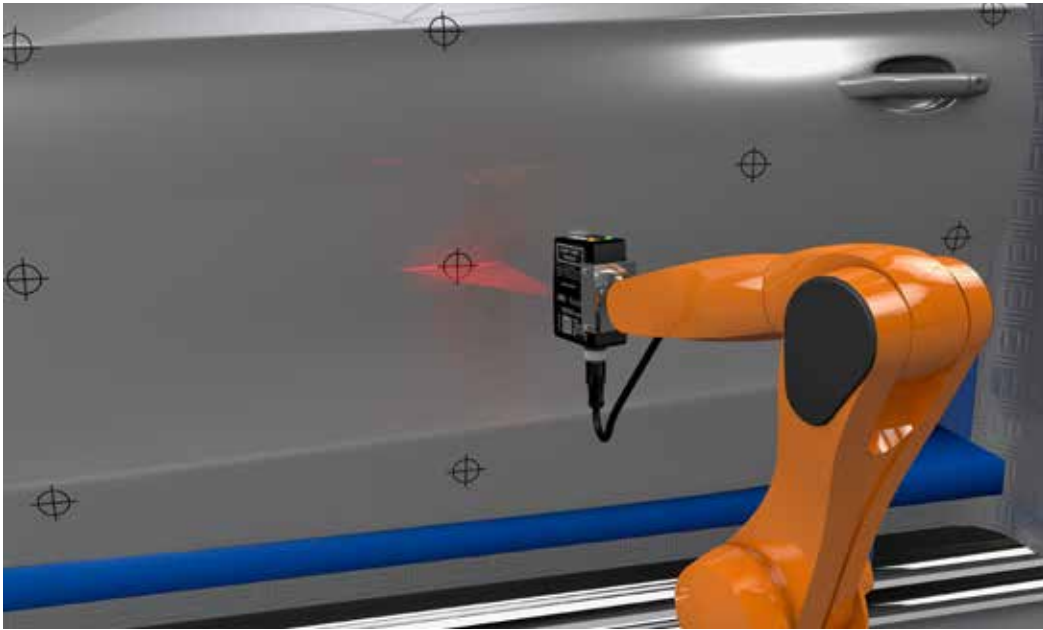
- Laser point
- Laser line
- Multi-spot

#### Laser Point Sensors

The Baumer laser point solution provides precise measurements for applications like quality control in watch production. Two laser point options include the Series 12, representing the smallest laser distance sensor – but an extremely fast one, with a programmable measuring range to 120 mm. In comparison, the Series 250/260 provides time-of-flight measurement and is used for large measuring ranges up to 13 m. It is the most compact laser point sensor of its class.

#### Laser Line Sensors

Baumer laser line sensors offer precise measurements even on rough surfaces, for example, the measurement of roll diameters to determine yarn



For glossy and coarse surfaces, multi-point sensing uses multiple measurements per second to give accurate results.

length. Three sensors target either laser point or laser line measurements. For example, the Series 21 provides the highest precision for measuring ranges to 1.000 mm. It features very high-resolution and linearity for demanding measurement applications and has an adjustable measuring range. The Series 20 laser point or laser line sensor is used for a variety of applications and features a programmable measuring range to 1.000 mm. It has highly robust variants, for example its wash-down design. Series 13 features a programmable measuring range to 550 mm and is offered in a very compact housing and targets a variety of applications.

#### Baumer multi-spot

Although traditional spot laser solutions were often problematic, the multi-spot solution effectively and reliably targets non-homogeneous glossy and extremely coarse surfaces, as can be seen in the quality inspection process for metal objects. For example, the Baumer OM70 features a multi-spot beam, and is factory-calibrated for rapid startup. It offers high ambient light immunity and accurate, repeatable measurement results without external software or elaborate conversion formulas. The innovative multi-spot measuring principle is based on the light section method whereby up to 600 measured values of an object are recorded and the distance is calculated based on intelligent analysis. The sensor performs 500 distance measurements per second at a resolution of up to 2  $\mu\text{m}$  (0.008 % of the measuring range). Unlike early or tradition-

al spot measurement, the multi-spot solution provides extremely stable measurement results and a unique optical laser distance measurement solution. It is used in a variety of testing and measurement applications, especially those with glossy objects in quality inspection or for the optimal positioning of grinding disks with extremely coarse surfaces. There are currently many laser distance measurement choices. Consider Baumer's laser solutions when upgrading your legacy system or adding greater laser capabilities for your manufacturing processes. Baumer assists its customers in making informed choices when selecting sensors for their application needs. Subscribe to the Baumer newsletter to stay abreast of new products, how-to assistance and more.



AUTHOR

**Jeremy Jones**  
Marketing  
Communications,  
Baumer Ltd., USA

**Baumer**  
Passion for Sensors

Baumer Group  
Phone +41 (0)52 728 1122  
sales@baumer.com  
www.baumer.com