

Application report:

Position on a knife edge – Measure to the size of a hair

The edges of paper webs can be controlled with even more precision, the positions of wires can be determined more exactly or the width of a plastic section can be measured at the output of an extruder with more accuracy, using PosCon and ParCon, the new generation of line sensors from Baumer.



Fig. 1 ParCon and PosCon, the new generation of line sensors

The idea

A sensor that can detect objects or their edges laterally with respect to the sensor is needed in applications such as the measurement of cloth widths, the control of the correct position of threads or wires, the positioning of packaging foils using edges. The sensor should be capable of reliably detecting both high-gloss metal plates and transparent foils. High demands are also placed on the measuring frequency because object speeds of 2,5 m/s are standard in many industries. Another characteristic, crucial for the success of such a sensor, is resolution. This has a decisive influence on the quality of the end product.

The engineering solution

When web edges, object widths or thicknesses need to be detected, the tasks can usually be described by searching for the presence or absence of an object along a specific measuring line.

In the line sensors from Baumer, an IR LED illuminates a reflective foil that then returns the transmitted light. For the sensor, the object to be detected then appears dark in front of a very light background. On a diode line used as the receiving ele-

ment, some of the diodes receive a lot of light while another part receives almost no light. A microcontroller integrated into the sensor reads the diode line pixel by pixel and searches for the light/dark transitions in the image, these occur at the edges of the object. The microcontroller stores the positions of the edges found in this way and, at the end of the read cycle, calculates the value selected in "Measuring type". The value, determined digitally, is output as an analog value (4...20 mA) by way of a D/A converter.

The high reflectivity of the foil used allows for very short exposure times and even white paper appears as a dark object. The foil is fixed behind the object on a carrier or mounted in the form of a reflector. The selected principle of a retro-reflective sensor has the advantage that both glossy and transparent objects can be reliably detected.

The optics of both the PosCon and the ParCon line sensors are constructed differently.

The PosCon has an expanding measuring field. This provides very large measuring ranges of up to 875 mm and distances to the object of up to 1400 mm. The expanding measuring field results in the situation that the object appears larger or smaller depending upon the distance to the sensor.

The ParCon, on the other hand, has a parallel measuring field. In this way, an object appears to be the same size over the entire measuring range, regardless of whether it moves toward the sensor or away from it. The measuring range is 24 mm and the distance to the object may be up to 40 mm.

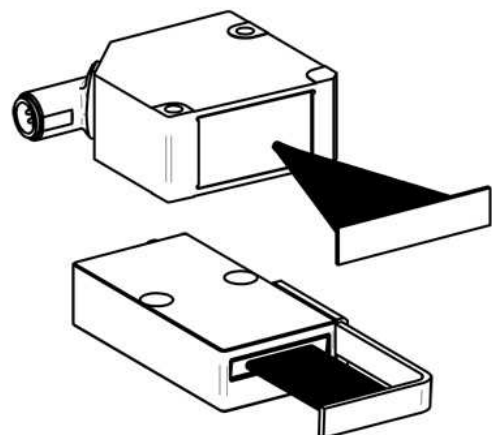


Fig. 2 PosCon has an expanding beam, ParCon has a parallel beam

The most diverse measuring potential – The simplest operation

A sensor should be simple to operate. It should be easy to set up without a PC or similar aids. If there is something to be adjusted, it should be easy to do this. Both line sensors satisfy these wishes. Despite their sophisticated technology, they can be set simply and quickly using the integrated keypad. A PC with additional software or a special adjustment adapter is not necessary. The *PosCon* has a serial RS 485 interface where the user can access the measuring result as a digital value using his machine control system. Optionally, the user can program the measuring type, tolerance limits, etc., by way of this interface.

In both sensors, the processing electronics were integrated into the compact sensor housing so that no additional devices are necessary. The processing electronics allows different measuring results to be output:

- The measurement of an edge position within the measuring range (the first edge seen from the beginning of the measuring range or the first edge seen from the end of the measuring range)
- The measurement of the center position of an object
- The measurement of an object width (distance from the extreme left edge to the extreme right edge or the sum of all dark areas)
- The *PosCon* also has two teachable switching thresholds and corresponding switching outputs. In operation, these may be used as limits.
- A switching version of the *ParCon* detects objects based on their width and can thus be used as a high-speed counter.

Countless applications

The three different measuring types (edge position, object width, center position of an object) solve numerous applications in many industries.

Web edge control

One of the most frequent applications of line sensors is web edge control. In this application, the edge position, for example, of a transparent packaging foil, is to be checked and immediately corrected for the smallest shifts so that the foil can be wrapped exactly around the product. To do this, it is necessary to know the precise position to then shift the foil in the correct direction. Similar applications are found in the paper industry (paper webs), the textile industry (cloth) and in the manufacture of metallic

and plastic foils or conveyor belts. The term edge positioning is also used for positioning sheets of paper in printing machines, sheet metal or plastic panels on laser-cutting machines or punch presses using the edges of the object.



Fig. 3 The edge position of a packaging foil is monitored by a *PosCon*.

Monitoring object widths on extruders

The precise monitoring of object widths when extruding plastic sections, the fabrication of wires, cords, ropes or when cutting adhesive tapes, rubber belts and cloth straps allows the process to be precisely controlled thereby keeping tolerances within narrow limits. Here too, line sensors have become indispensable aids in monitoring and maintaining high quality.

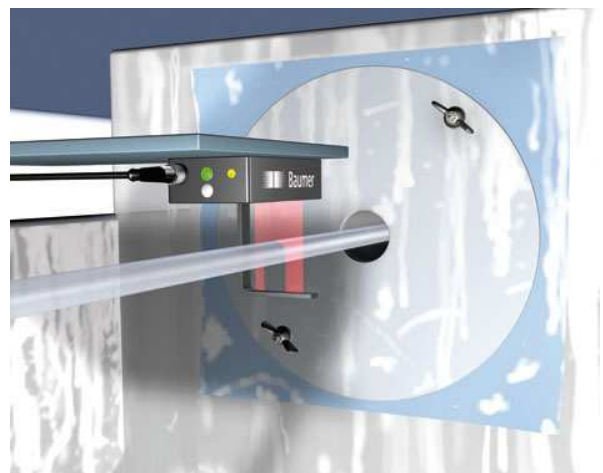


Fig. 4 The object width of a plastic section is monitored by a *ParCon* during extrusion.

Position control in an automatic crimping machine

If, for example, stranded wire is to be precisely centered on the appropriate crimp contact in an automatic crimping machine, enabling the wire to be cleanly inserted, then "Center position" is the right

measuring mode. If stranded wire, wires, cords or rubber sleeves are positioned using their center, the diameter is no longer important. Independent of whether the object is wider or narrower, the sensor always outputs the position of the longitudinal axis as the result.

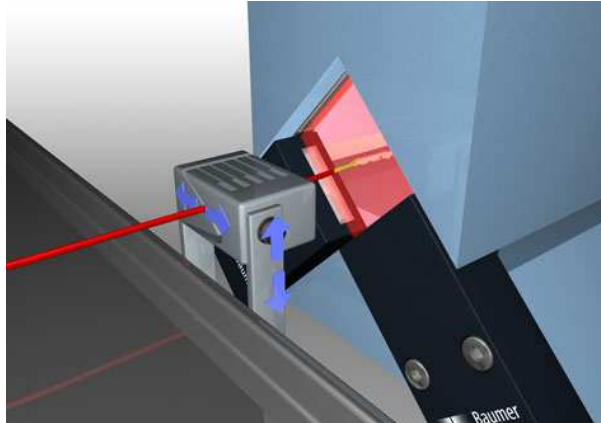


Fig. 5 With the measuring mode "Center position", stranded wire can be exactly centered on the suitable crimp contact independent of the diameter of the object.

Counting small parts

The ParCon with the switching output can be used to count small parts (pills, seeds, plastic parts). With this, it is possible to teach-in the minimum object size that must be detected and measured.

This means that smaller parts are suppressed and not counted. This sensor can also be used as a wire-break monitor for wire diameters as small as 0,5 mm.

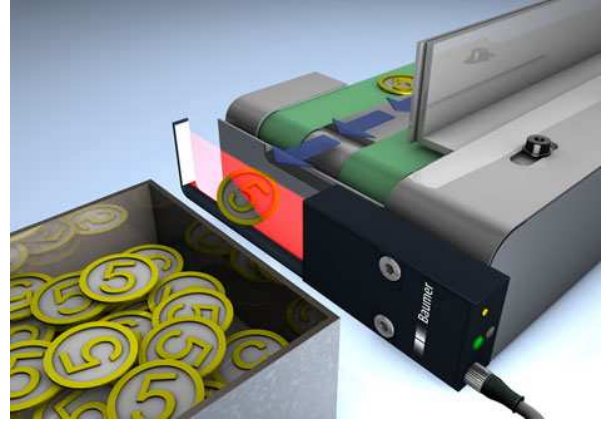


Fig. 6 The ParCon with the switching output is an ideal solution for counting small parts such as coins.

Line sensors – Profit for the future

Thanks to their unique design, precision and high measuring frequency, line sensors opened new possibilities for web edge control systems, positioning, measuring and counting tasks. Their simplicity in installation and operation helps to save costs. Line sensors have become indispensable in the handling and machinery industries, in measuring engineering and for positioning tasks.

	ZADM 023I – PosCon	ZADM 034I – ParCon	ZADM 034P – ParCon
Property	Large measuring field	Parallel beam	Parallel beam
Functions	Measurement of - Edge position - Object center position - Object width	Measurement of - Edge position - Object center position - Object width	Counting objects
Measuring fields	30 mm / 150 mm / 350 mm / 875 mm	24 mm	24 mm
Output	4...20 mA	4...20 mA	PNP switching output
Resolution	To 0,03 mm	To 0,05 mm	Smallest object > 0,5 mm
Additional functions	- RS485 - 2 programmable switching outputs - Alarm output - Programmable measuring range		Response time > 0,25 ms

Table 1 Line sensor version summary