

Application report:

Precise detection of the smallest objects with ultrasonic sensors

Miniaturization has been progressing for years – particularly electronic components are becoming smaller and smaller. With the new Series 09 ultrasonic sensors Baumer rises to the challenge of monitoring the production of these shrinking components reliably and ensuring the requested quality. Wherever the smallest objects or liquid levels have to be detected, the new ultrasonic sensors can be applied. They reliably detect even glossy and transparent materials.

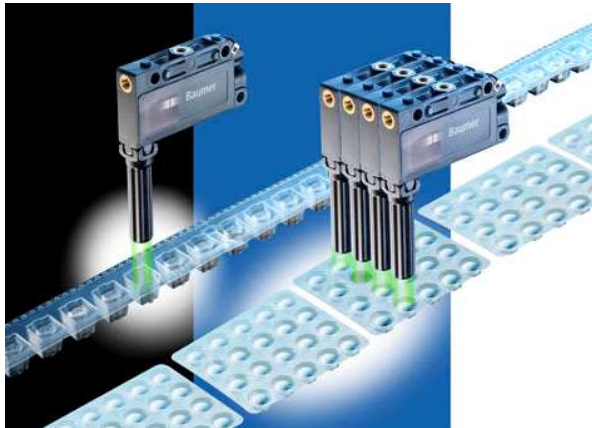


Figure 1: Series 09 Baumer sensors monitor the presence of tablets and electronic components in the packaging process

The development of the personal computer and the cell phone shows the trend of the past years towards a clear reduction in size. Particularly for these technical products smaller components have to be manufactured. The printed circuit boards that are employed have to be assembled with increasing precision in order to comply with the requested performance and size. The very small SMD components used for PCB equipping are mostly packaged in blister belts that are inserted into the feeder of the pick-and-place machine. During the packaging process of these components in the manufacturing plant their presence in the blister belts has to be checked. (Figure 1) Only after this is ensured can the belts be welded up and delivered to the customers. Precisely working sensors are needed for this task. They ensure that the pick-and-place

machine can work properly without grasping at nothing.

The most important sensor features demanded by manufacturers and users are a high measuring speed as well as independence of transparency, color, and reflection. There is also little space to check the tiny components. The cavities of the blister belts sometimes are very narrow, but the sensor nonetheless has to detect any discrepancy as quickly as possible. Additionally it must be able to identify any components, regardless of their texture and appearance. Baumer's new Series 09 ultrasonic sensors offer a very good solution for this task.

Advantages of the new Series 09 ultrasonic sensors

Ultrasonic sensors are based on the principle of measuring sound's time of flight through the air. Ultrasonic waves that are not audible to the human ear are emitted by the sensor, reflected by an object and again received by the sensor. As a result, the sensors operate completely contact-free. Especially in the lab several advantages result from this operating mode, as neither the medium to be analyzed nor the sensor are contaminated during the measurement. Additionally, an ultrasonic sensor is particularly resistant to humidity and dust, which makes it constantly reliable. In contrast to photoelectric sensors it does not work with light but with acoustic waves. Therefore, it can detect a variety of different media reliably – independent of their transparency and color. Neither high-gloss surfaces, highly transparent objects nor the texture of the medium influence the measurement.

Conventionally operating ultrasonic sensors send out conical acoustic waves. As a result, their spot size is too big for measuring into openings of less than 10 mm in diameter. To avoid these limitations, the sensor specialist Baumer has developed the new Series 09 in close co-operation with its customers. These ultrasonic sensors are equipped with a special beam columnator that concentrates the acoustic waves,

which allows for the sensor to measure even into very small openings. Apart from the described filling of blister packages with electronic components or pharmaceutical products, this feature is advantageous for the detection of wafers of photovoltaic cells through small openings. Depending on the preferred installation, the sensors are available with the columnator on the short or long side. The nozzle is removable and exchangeable, which facilitates the cleaning and maintenance of the sensor. The new sensor family can be used in a wide range of applications to detect objects liquids in containers of any size.



Figure 2: Detection of small pipette tips in the laboratory with ultrasonic sensors

Fast and flexible

The minimum response time of the Series 09 ultrasonic sensors amounts to only 7 ms. Thanks to the housing width of only 9 mm, the sensors can be cascaded in a confined space. By this means, sensors that are arranged in-line can scan a large surface or several openings in one single cycle. This reduces the scanning time considerably and is, for example, useful for the presence check of tablets. At the same time the sensors achieve a very high resolution and repeat accuracy of up to 0.1 mm.

Various possibilities for installation provide great flexibility for the sensors' insertion into automation systems. Depending on the requirements, the sensors are installed vertically or horizontally and can be fixed from above, the side or from below with a single screw, which makes the installation

simple and efficient. The sensors are available with RS232, analog, or digital interface, the new communications standard IO-Link and cable as well as flylead connectors. Thus, an easy connection to a multitude of controls is guaranteed and exchange of data, condition information, and configuration parameters is possible. These features ensure a high degree of control over the process.



Figure 3: Ultrasonic sensors with beam columnator on the short and long side as well as cable or flylead connectors

Applicable also for level detection

Thanks to the versatile ultrasonic technology, the sensors can perform many other tasks besides the detection of the smallest objects: To save the consumers of cosmetic products unpleasant surprises after the purchase, the sensors inspect levels of mascara, creams or the like during the packaging process. Additionally, they assure that contact lenses are packaged according to the hygienic standards by detecting reliably the level of the saline solution in the blister package. When capsules are to be filled and packaged the ultrasonic sensors can check the presence of the capsule halves as well as detect the fill level within.

Furthermore, they are employed in laboratory automation. They detect the fill levels in the cavities of micro containers. Due to the special concentration of the beam waves, they are able to measure into the openings which sometimes only measure 3 mm in diameter. The sensors check whether the quantities are sufficient for the analysis and whether too much liquid has been filled into the wells respectively. Thus, waste and wrong analytical results can be held at a minimum.

Résumé

Nowadays, everything is optimized for profitability. Therefore, speed and precision are obligatory for a good automation solution. With their short response times and possible cascading the Series 09 ultrasonic sensors contribute to the operating efficiency of the automation systems. They detect the smallest objects reliably – even when they are glossy or transparent – and operate with a very high resolution. Consequently, they ensure a high quality. Thanks to the diversity of possible applications and their precision, the sensors stand for flexibility and reliability.