

As clear as crystal: Accurate sorting according to type, even with minimal differences in color. The use of flexible color sensors in automated bottle cleaning

The human eye is an extremely powerful organ. Overall, a person can differentiate around 20 million colors. However, this is only limited, as eyes easily become tired, especially if subtle variations of color have to be detected over a long period of time. On the other hand, color sensors work without becoming tired and as such, they ensure long-term stability. Through the integration of special features, they are also superior to human color perception.

The 'Spülo' company in Enkirch at the Moselle river is a specialist in the rinsing of wine bottles. Since 1984, it has offered this service for winemakers and wineries. On average, Spülo cleans 50,000 bottles a day. After cleaning, all the bottles have to be sorted according to their specific color (brown, transparent, blue and/or three different shades of green) so that they can go back to be refilled.

Burrs and drops of water cause problems

Some time ago, Wolfgang Immich-Spier, the Managing Director of Spülo, was looking for an efficient sensor solution capable of enabling a reliable selection of bottles according to type.

This system should be capable of not just identifying the obvious bottle colors such as brown, blue and transparent, but also the three shades of green which are close to each other. Special challenges in connection with this: Burrs in the glass, different glass thicknesses as well as bottles which are wet with many (or a few) drops of water. These variations cause refraction effects and as such make the detection of the glass color significantly more difficult.

Wolfgang Immich-Spier then discovered what he was looking for with ipf electronic gmbh. Together with Spülo, ipf was able to master this challenge with one of the most flexible color sensors.

All-rounder for the True-Color-Detection

The OF34 color sensor family has been specifically developed for recognizing slight color differences. The sensors (insensitive to external light) either work continuously or they are started by a trigger signal. After teaching in the reference values and setting the tolerances, the recognized color is available at the five digital outputs as a binary code. This way, up to 31 reference colors can be learned and stored in the sensor.

Apart from the reliable detection of objects e.g. bottles at Spülo, another highlight is the opportunity to check the brightness and light color among primary light sources such as LEDs, halogen lamps or

bulbs (in the automotive sector). In addition, device alternatives are equipped with a UV light source which are in a position to check fluorescent markings (colors).

On account of the sensor heads (front ends) that are possible, the devices enable operating distances of almost 0mm to 500mm in detection areas with diameters of 0.5 to approx. 100mm.

A flexible solution for special requirements

As a sensor solution, for optical fibers made of fiberglass, Spülo employs an embodiment in ipf electronic's OF34 (Fig.1) series. Together with the corresponding optical fibers, these devices are exceptionally flexible, and especially suited for special requirements e.g. bottle cleaning in Enkirch.



Fig. 1

With the fiber optic sensor used at the bottle cleaning company, the distance between the transmitter with a M18 front end and the middle of the bottle is around 50 mm. In addition, the distance between the receiver with a M34 front end and the middle of the bottle is approx. 150 mm. As a transmission light source, the sensor integrates a pulsed, very bright white light LED. By making a comparison of the transmitter pulse frequency with the receiver signal frequency, the influence of external light is eliminated, as only same frequency signals are used for the evaluation. With the maximum possible sampling frequency of 30kHz, the belt speed of 2m per minute occurring in the cleaning plant is no problem.

Assessment software masters minimal differences in color

The special characteristic about the solution at the Spülo company does not just lie in the sensory mechanics which are specifically adapted to the application but in particular, in the specific software for the sensors to assess the receiver signals internally.

Automatic trigger function

For reliable triggering of the sensor system, the bottle neck is selected as a checking point. In order to avoid influences which occur as a result of the trigger point shifts of external trigger sensors in the different glass color shades, this system can automatically trigger and/or start the measuring sequence. The assessment is always started by the system when a bottle neck runs through the detection range of the fiber optic sensor and automatically finishes when the bottle leaves the range.

Securely recognizing glass color

At the same time, the receiver signals are assessed by the sensor in the so-called 'best hit mode' in which the measured values are compared with the entries in a reference/teach value table and the 'best hit' is emitted as a result.

On its own however, this assessment technique cannot detect the various possible variations of a bottle type (with/without burrs in the glass, different glass thicknesses, bottles which are wet with many (or few) drops of water) in a reliable way for production purposes.

For this reason, different states have been taught into the sensor for each bottle design as possible reference scenarios and summarized in so-called color groups. As such, a color group represents a selection of different bottle designs. As long as there is a correspondence between the measured value and the reference value of a color group, always the same color correlation is emitted by the sensor. This allows for deviations in a bottle type to be compensated for and guarantees the secure recognition of the glass color.

Secure selection by type makes it quicker

Using the ipf electronic system (Fig. 2), the Spülo company can now ensure the selection of the bottles by type in an automated cleaning process of the plant. This eliminates the time-consuming and expensive, as well as partly inaccurate manual sorting of the bottles. Apart from this, the 'empties' which are highly sought after by bottle fillers can be supplied much quicker, especially in the summer months.



Fig. 2