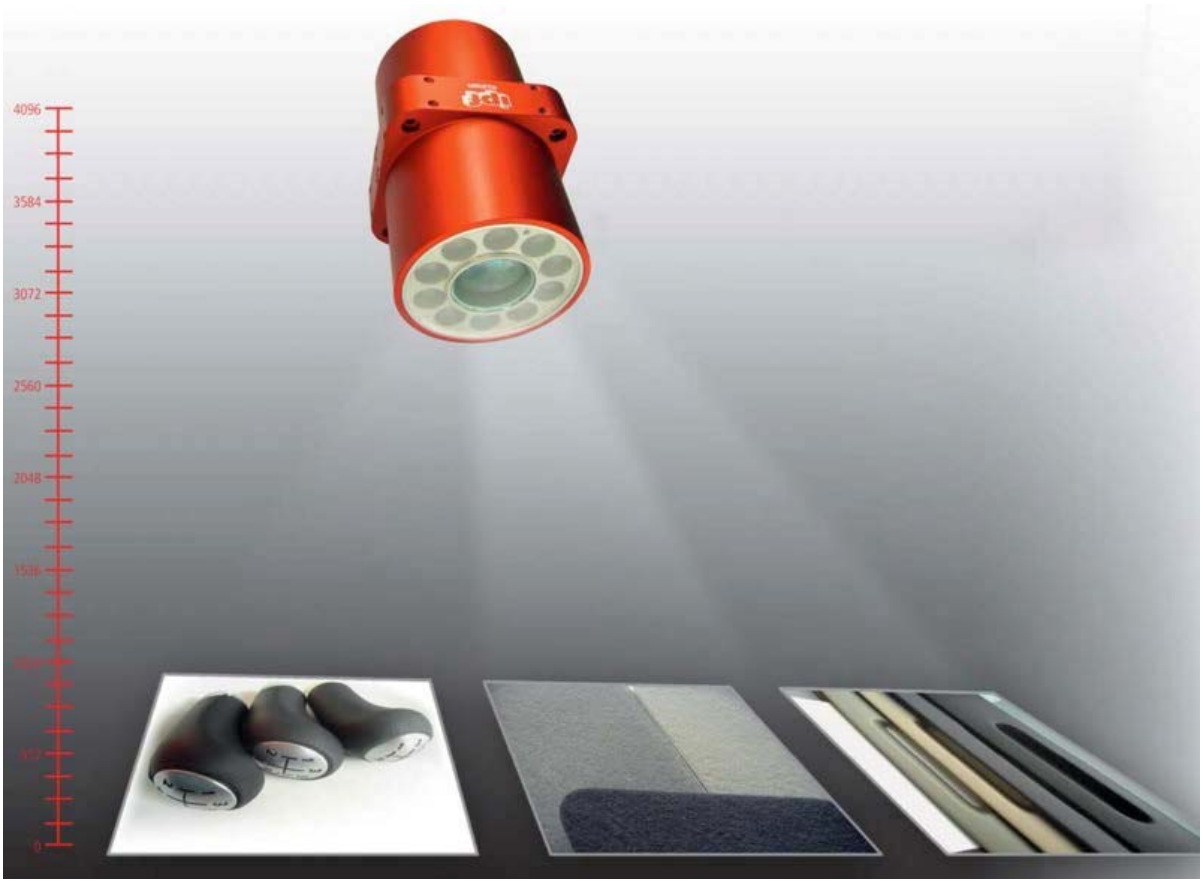
An eye on the grey
The ability to recognize over 4,000 gradations

When monitoring colored objects in production processes, the task at hand is rarely about selecting well-defined colors. It is more often the subtle nuances which are regarded as the key quality criterion - especially when recognizing different shades of grey.



A look inside a car is enough to get an idea of how many different shades of grey are combined in the materials that are used, from inner linings, leather imitation textiles through to mounting clips. Although some grey tones are indistinguishable to the naked eye even with very good lighting conditions, it is their shades that ensure an appealing interior (Fig. 1-3).



Fig. 1-3

For the car industry and its suppliers, it is especially important to check such components and their materials during the manufacturing process down to their exact shade of grey. Color sensors such as those in the OF 35 and OF 70 (fig. 4) series from ipf electronic have, among others things, been developed for this task. By a programmable teach-in function, they can also detect colors as well as shades of grey.

Fig. 4

Grey and its facets

In order to check a wide range of different shades of grey levels reliably, a high resolution is crucial. With their 12 bit resolution, the sensors can detect over 4000 different shades of grey on a scale from 0 (black) to 4096 (white).

As a light source, the sensors have integrated white light LEDs which are synchronized using 30 kHz. This modulation is necessary so that the sensor element can eliminate external and/or disturbing light sources during the measurements. Highly reflective parts represent another classic problem with optical sensors, e.g. painted exterior mirrors, door handles or sensors integrated into the bumper bar.

Such surfaces act like mirrors, thus making the receiver optics interpret the reflection of the own light source as a measurement signal without corrective measures. Polarizing filters provide a solution for this problem by providing better information about the colors. In addition, the sensor is configured so that it dynamically adjusts the light intensity of the integrated light source to the reflection behavior of the object surface.
The application of color sensors in grey scale detection is not limited solely to the automobile industry. The ceramic industry can also improve its production processes, e.g. by checking tile blanks continuously instead of taking the usual samples. Even the tile blanks have to have a specific color or a grey value in order to achieve the correct color in the final product.

If quality control takes place by sampling, it is often not possible to determine the exact point in time when a deviation to the actual value occurred. As such, substantial quantities of scrap are produced. On the other hand, color sensors represent a way of providing a continuous quality check and allow for immediate corrective measures to take place.
Up to 31 grey reference values can be stored by means of a teach-in process. If several products have to be checked with different shades of grey, this can be done without much effort with a single sensor. At the same time, a configuration tool makes special functions (fig. 5) possible: The possible matches to the reference values are shown for each measurement. Based on the results, the project engineer can decide which tolerance range is appropriate for the reference values. The function of the sensors is not only based comparing the measured data with the static reference values, but also dynamically updating the reference values depending of the measured data.

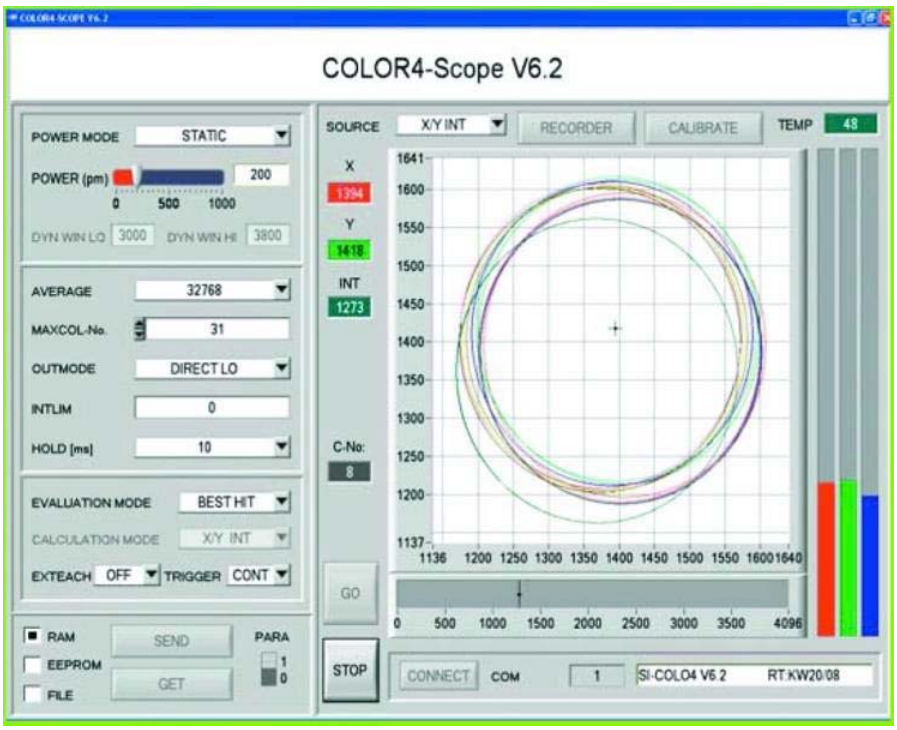


Fig. 5

A typical application of these functions can be found in the plastics industry, e.g. in the processing of granules for the manufacture of housings or panels for TVs or PCs and cellular phone cases. Here, it is possible to easily change the grey values of the granules during processing. The reason: In the injection molding process, the grey scale gradient does not affect the color of the finished product - at least, as long as it is within certain limits. This tolerance range must be monitored. Although the grey values in the granules exhibit slight variations, the color of the finished product corresponds to a specific shade of grey.

If necessary, the predefined shades of grey can be summarized in groups. This feature helps in the sorting of parts, e.g. in the separation of gravel into grades. To date, sorting into various colors and shades of grey took place manually and involved a lot of work. Color sensors enable the automation of this process. In so doing, many reference values concerning the color gradient of the gravel are learnt and combined into a single group of varieties.

These examples show just how diverse the applications of sensors with high resolution / additional features in detecting shades of grey are - and may also be in the future.