SPECTRO-3 - The new color sensor series of Sensor Instruments

Download Presseinfo

With the **SPECTRO-3 series** there now is a **family of color sensors** that have been specifically designed for "true-color" detection ("human visual reception") and high switching frequency. The sensors can be used both in AC and in DC operation with integrated or externally controlled light source.

With the included SPECTRO3-Scope Windows® software illumination can also be turned off (OFF mode) with a simple mouse-click - which also allows the detection of the L*u*v* color value of self-luminous objects such as LEDs, automobile tail lights, fluorescent lamps, or e.g. the color of flames. Up to 31 colors can be output through the 5 digital outputs, the typ. maximum switching frequency is 30 kHz. Apart from a white-light source, a high-performance UV lights source also is available and allows color detection and differentiation of fluorescent colors without any problems. Different front-ends make it possible to implement operating distances of almost 0 through to approx. 500 mm, with detection areas of a diameter of 0.5 mm to 100 mm. The use of optical fibres (approx. 50 different versions) allows applications in Ex areas (zone 0). Apart from the optical fibre types (**FIO group**) there also are the types of the **DIL group** (diffuser), which primarily are used for applications where the gloss effect of the objects to be inspected has to be suppressed. For objects with an extremely high gloss, however, it is recommended to use the **POL group** (polarisation filter), while the **FCL group** is especially used for applications requiring a differentiation between glossy and diffuse objects. If the application requires a color detection of small objects, the suitable sensors are of the **FIO group** or of the **COF group** (transmitter and receiver optics arranged cofocally), which allow a reliable detection of smallest objects at a distance of 30 mm or 50 mm, respectively.

Extensive range of optical fibres for the new SPECTRO-3-FIO series

Download Presseinfo

62 different optical fibre sensor head versions are now available for the new SPECTRO-3-FIO color sensor series. Optical fibre cross-sections range from Ø 0.6 mm to Ø 10 mm, or 3 mm x 0.5 mm up to 88 mm x 0.15 mm.

Light is emitted at the front side either axially or at an angle of 90°. The micro-fibres are available in different lengths and are provided in sturdy, industry-type quality. For the most important sensor head versions there also are front-ends that allow a larger distance from the object with a smaller light spot size (up to 150 mm). Furthermore, the color sensor can be operated with the **external light sources SI-ELS and SI-ELS-UV**, which for example allows the detection of color marks or fluorescent color marks.

Color checking of structured and inhomogeneous surfaces

Download Presseinfo

With many objects requiring color checking an inhomogeneous surface causes problems in color determination. A structured surface, for example, leads to gloss rate fluctuations that cause difficulties for conventional color sensors because depending on the gloss rate the color is sometimes detected more intensively and sometimes less intensively, and the actual color that depends on the respective gloss rate of the surface, is brightened or "softened" by direct reflection. With the **SPECTRO-3-50-DIL color sensor**, diffuse illumination considerably reduces this gloss effect.

Furthermore, optical averaging of structural fluctuations is performed with the help of the large measuring range (measuring spot typ. 20 mm at a distance of 50 mm), and the color is thus reliably detected.

The true-color color detector ("human color perception") and the evaluation software ("human color assessment") furthermore guarantee that even smallest color differences of different objects are reliably detected.

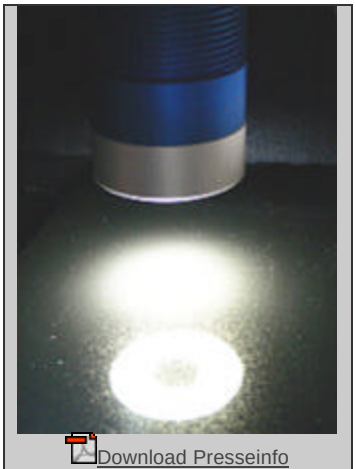
Reliable and fast color detection at a large distance

Download Presseinfo

The **SPECTRO-3-FCL series** now also allows color detection at a large distance. Depending on the version and on the object, a distance of up to 500 mm can be realised. The sensor is equipped with super-bright white-light LEDs and a so-called true-color chip that perceives colors like the human eye. Up to 31 colors an be taught. During operation the sensor determines the color reference that comes closest to the current color sample ("human color interpretation").

Teaching either can be performed under Windows® with the supplied SPECTRO3-Scope software, through the INØ pin, or with the TEACH button that is integrated at the sensor housing. Color scanning is performed with a scanning frequency of up to 40 kHz, the switching frequency of the sensor is 30 kHz. The sensor unit is integrated in an M34 aluminium housing, the optics unit is protected by a scratch-proof glass cover, which makes the sensor suitable for rough industrial use.

High-speed color sensor with integrated gloss suppression



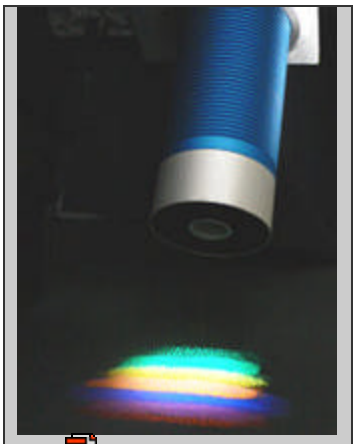
Download Presseinfo

Color inspection of glossy objects primarily depends on correct illumination. For example, when directed light is used, i.e. light that is directed onto the object at a certain angle, the color detector apart from the actual object color also receives influences due to direct reflection of the transmitter light depending on the gloss rate of the object. The actual object color thus is distorted due to the influence of direct reflection, the colors become smoother, red for example is recognised as pink, blue as bright blue, etc.

With the **color sensors** of the **SPECTRO-3-DIL series** the effect of direct reflection is considerably suppressed by using diffuse light, colors are detected much more clearly, and a reliable color differentiation of differently colored glossy

objects is thus possible. Up to 31 color references can be stored in the sensor, and the sensor determines the color reference that comes closest to the current color sample. A true-color chip is used as color detector ("human color perception"). Inspection is performed at a scanning rate of 40 kHz and a switching frequency of the digital outputs (5 outputs) of 30 kHz. With its compact M34 aluminium housing and the glass cover of the transmitter and receiver optics the SPECTRO-3 color sensor is excellently suited for rough industrial use.

High-speed color detection of fluorescent objects



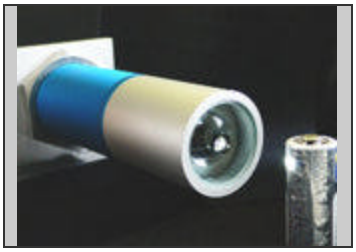
Download Presseinfo

Conventional luminescence sensors that are available on the market are able to detect whether there is a fluorescent object, but they utterly fail when they should perform color differentiation of such objects! With the luminescence color sensors of the **SPECTRO-3-UV series** there now are sensors that apart from brightness differentiation (grey scale evaluation) also can perform color differentiation. Up to 31 different fluorescent objects can be stored in the sensor's color memory. The color information is provided via 5 digital outputs, a serial interface also is available.

Teaching of the fluorescent objects can be performed either under Windows® with the included SPECTRO3-Scope software, with the TEACH button that is integrated at the sensor, or through digital input INØ. With its compact (M34 housing) and sturdy design the sensor is excellently suited for rough industrial use.

The 40 kHz scanning frequency and the 30 kHz switching frequency also guarantee a reliable detection and recognition of fast-moving fluorescent markings.

High-speed color detection of small objects at a great distance



The confocal sensors of the **SPECTRO-3-COF series** project white-light spots with a diameter of approx. 1 mm to 5 mm or with dimensions of 4 mm x 0.7 mm onto the object to

Download Presseinfo

be detected. The transmitter optics unit is located at the centre of the receiver optics unit, which results in a highly compact design. This allows a reliable, high-precision, and high-speed detection of small objects such as e.g. color markings or wires at a great distance.

The color sensor features 5 digital outputs; teaching of up to 31 colors can be performed with the included SPECTRO3-Scope Windows® software, with a Teach-button at the sensor housing or with a Teach-input for external teaching. With a scanning frequency of 40 kHz and a switching frequency of 30 kHz the color mark detector definitely ranks among the faster systems. Reliable color differentiation on the one hand is guaranteed by the so-called true-color detector (human color perception), and on the other hand by a special evaluation algorithm. The color that is currently placed under the sensor is compared with the color references (up to 31) that are stored in the color memory. Similar to human evaluation the color sensor software first performs a pre-selection of references (possible candidates) whose tolerance range includes the current color. From the possible reference colors it then selects the one color that is closest to the current color (direct comparison). Only this process allows the detection even of smallest color differences (to ?E=0.3).

Color inspection of glossy objects

Download Presseinfo

In practice, the reliable detection of the color of glossy objects usually is extremely difficult because the actual color information is mixed with direct reflection resulting from the gloss effect. A rich color thus is turned into a "soft" color, because the direct reflection of the color sensor's light source does not contain any color information. Red thus is recognised as pink, blue as bright blue, etc.

In the **SPECTRO-3-50-POL color sensor**, integrated polarisation filters prevent such direct reflection, the actual color thus can be clearly recognised and reliably detected. Parameterisation of the sensor is considerably facilitated by the included SPECTRO3-Scope Windows® software. This software provides various evaluation modes, teach

functions, and trigger possibilities. A detected color is output via 5 digital, npn- and pnp-capable outputs, and via a serial interface (RS232, USB and Ethernet). The switching frequency is approx. 30 kHz.

Human visual perception, only 1000 times faster

Download Presseinfo

The new SPECTRO-3-FIO series now also allows the detection of color marks with a scanning frequency of 40 kHz. With a high-power LED white light is fed into an optical fibre bundle, and via cross-section converter and attachment optics unit is projected onto the color mark to be detected as a light spot measuring 4 mm x 0.7 mm or 2 mm x 0.2 mm, or having a diameter of 0.5 mm. A part of the light impinging on the color mark is scattered back into the attachment optics unit and through the optical fibre bundle is directed onto the true-color detector that recognises the color of the object similar to human visual perception. With different attachment optics units, object distances of >0 mm up to approx. 200 mm can be realised. Due to the use of an optical fibre the color inspection system also can be used in Ex areas without any problems. Compressed-air attachment units can be provided as protection against excessive dirtying.

With a Windows® user interface the color sensor can be correspondingly parameterised via RS232, USB and ETHERNET. The software also provides various evaluation methods.

High-speed, high-precision color mark detection with the SPECTRO-3-FIO - also suitable for Ex areas

Download Presseinfo

The **SPECTRO-3-FIO** is a **color mark detector** that detects color like a human, but with a considerably higher frequency of approx. 40 kHz.

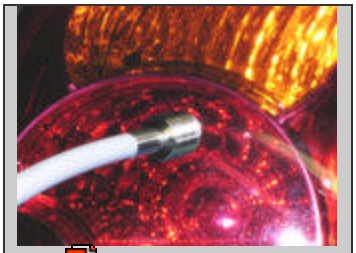
Through a special reflected-light optical fibre white light that is provided by a super-bright white-light LED is directed onto the color mark to be detected. Various optical fibres and attachment optics units are available to allow a highly precise color mark detection. At a distance of approx. 10 mm

from the object, the light spot thus may have a diameter of Ø 0.5 mm or dimensions of 2 mm x 0.2 mm or 4 mm x 0.7 mm. The light that is scattered back from the color mark towards the reflected-light optical fibre impinges on a so-called true-color detector that divides the light into a red, green, and blue component.

The controller that is integrated in the sensor then performs color calculation acc. to the L*a*b* method, and can select the suitable color from up to 31 stored color marks.

Due to the use of optical fibres the system also is suitable for Ex area applications, where for optical fibre lengths of more than 2 m the **external white-light source SPECTRO-3-ELS** is available.

Color measurement of self-luminous objects with the SPECTRO-3-FIO

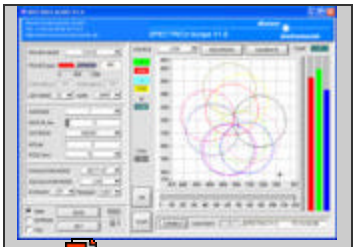


Download Presseinfo

With the **SPECTRO-3-FIO color sensor** there now is a system that ideally can measure different light sources similar to human visual perception. This is achieved by the "true-color detector" that is integrated in the sensor, and by corresponding software evaluation algorithms. The so-called L*,u*,v* value provides information about the brightness and about the red/green and yellow/blue color value of the light source. An extensive range of optical fibres and attachment optics units allows optimal matching of the sensor system to the respective light source. The required dynamic range is achieved by way of eight software-selectable gain stages. Optical attenuation filters are available for super-bright light sources.

Up to 31 light sources can be stored (taught) in the SPECTRO-3-FIO, the tolerance ranges for the individual taught color states can be preset with the software. The sensor provides the information about the detected color state by way of five digital outputs.

New SPECTRO3-Scope Windows® user interface for the SPECTRO-3 series



Download Presseinfo

The **SPECTRO3-Scope software** was developed specifically for the parameterisation and data monitoring of color sensors of the **SPECTRO-3 series**.

The software allows the selection of different illumination modes such as AC (modulated light), DC (constant light), Pulse (pulsed operation) or OFF (self-luminous object). In case of AC, DC, or PULSE mode the brightness of the light source can be set. In all four modes the gain of the color detector can be set in 8 stages.

The software furthermore allows the setting of a trigger type (external trigger, self-triggering, or continuous), the selection of various color evaluation methods x,y,INT, SiM (evaluation acc. to L*a*b*) and L*u*v* in case of self-luminous objects, and color modes (BEST HIT, FIRST HIT, MINIMAL DISTANCE, COL5).

With the color modes the current object color is compared with up to 31 references (that can be taught by the user) according to different criteria. Supposedly the most efficient and mostly used mode is the BEST HIT mode, which first selects the possible references from the stored color references (selection of candidates) and then performs an exact comparison with the candidate. The SPECTRO-3 sensor then selects the candidate that is closest to the current object color. Parameterisation furthermore is facilitated by extensive data monitoring, displaying both the raw data, the detected reference color, and the calculated values such as SiM, L*u*v*, xyINT in graphical and numerical form. Operation is further facilitated by a data recorder, a calibration function, and by teaching not only to single objects, but to a series of objects of the "same" color. The possibility of forming color groups that allows the combination of several taught colors on one switching output, also is worth mentioning.

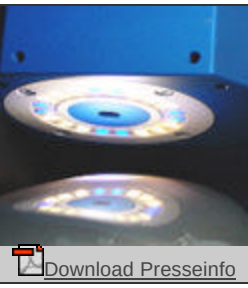
High-speed fluorescent color mark detection with the SPECTRO-3-FIO-UV

Download Presseinfo

With the **super-bright UV light source SI-ELS-UV** and the **SPECTRO-3-FIO-UV** evaluation unit there now is a color sensor system that not only performs high-speed detection of fluorescent color marks, but also is able to perform differentiation by fluorescent color and brightness. Objects are detected with a scanning frequency of typ. 40 kHz at a distance of approx. 12 mm between sensor head and object. Depending on the employed optical fibre and front-end the spot size may have a diameter of 0.7 mm or dimensions of 2 mm x 0.2 mm or 4 mm x 0.7 mm.

The included SPECTRO3-Scope Windows® operator software allows the teaching of up to 31 colors and the selection of various evaluation methods (L*, u*, v* or x, y, INT) and evaluation modes (BEST HIT, FIRST HIT, MINIMAL DISTANCE, SELFTRIGGER). Since the system uses reflected-light optical fibres, the detection of fluorescent marks also can be performed in Ex areas (zone 0) without any problems. Optical fibres of various lengths are available.

Insensitive to extraneous light, non-contacting, and high-speed inline color measurement



Download Presseinfo

L*a*b* inline color measurement according to the 45°/0° method under illumination similar to D65 with a true-color detector (color curves identical to the human eye) now is possible with the **SPECTRO-3-45°/0° color measuring system**.

Closeness to the D65 standard light curve is achieved by a combination of special white-light LEDs, blue-light LEDs, and optical filters. The use of LEDs furthermore allows light modulation, which prevents influences of extraneous light on the measuring result. The color sensor provides the color values in digital, serial form. The system furthermore features 5 digital outputs that allow the output of up to 31 stored colors (L*, a*, b* values). The distance between color measuring system and object is approx. 30 mm, the typical measuring range is 10 mm.