Color Sensor
colorSENSOR

Sensor system for food and recipe control

In the food industry, the exact composition of the ingredients is of high importance in the production of gelatin, syrup, brittle or chocolate. Whether the quantity of ingredients is right can be determined by the color of the product. In chocolate production, the chocolate mass is conched after mixing the ingredients. This gives the cocoa mass its typical creamy consistency. During conching, cocoa butter is also added to adjust the fat content of the chocolate. To achieve the perfect mixing ratio here, the colorSENSOR CFO color sensor from Micro-Epsilon continuously measures and checks the color of the chocolate mass during this process.

The measuring system used consists of the colorSENSOR CFO200 controller and the CFS4-K34-BOA reflex sensor. The sensor measures at a distance of 120 mm from the top and at an angle of 20 degrees to the center of the agitator. In this process, the correct mixing ratio between cocoa liquor and cocoa butter is checked, which is shown by a change in brown tone and gloss. The sensor is vibration and food resistant, so no cocoa mass can penetrate. The controller evaluates the sensor signal with a repeatability of $\Delta E < 0.5$ and outputs the measurement signal with a data rate of 20 Hz. The data is output via Ethernet interface directly to a PLC control system for further evaluation of the color values. Inline monitoring of the color shade allows the composition of the cocoa mass to be corrected directly via the additive proportions, so that food losses are reduced to a minimum.

The smart, accurate colorSENSORs from Micro-Epsilon impress with their high color accuracy and repeatability. They are ideal for 100% inline inspection in food production, as they precisely detect even the slightest color differences and enable immediate intervention during ongoing operation. Up to 320 colors can be taught in 254 color groups.

Operation is intuitive via the web interface. The attractive sensor system for food and recipe control (art. no. 10235602) consists of the CFO200 controller and the CFS4-K34-BOA sensor. This combination impresses both by the high accuracy and the attractive price-performance ratio.

Requirements for the measurement system
- Measuring rate 1 kHz
- Repeatability $\Delta E \leq 0.5$
- Working distance 120 mm
- Min. target size: 22 mm
- Data output with 20 Hz
- Temperature resistance up to 90 °C

Ambient conditions
- Constant ambient light
- Production environment
- Hot spraying chocolate mass (90 °C)

System design
- Controller: colorSENSOR CFO200
- Reflex sensor: CFS4-K34-BOA-2400-T250-VS

Advantages
- Inline measurement with high precision on a wide range of foods
- Multi-teach function and formation of color groups
- Modern, user-friendly web interface
- High color precision and repeatability
- Simple and fast integration of the system even in existing plants

---

Micro-Epsilon Eltrotec GmbH   A member of micro-epsilon group

Tel. 07161 / 98 872-300 | www.micro-epsilon.com | eltrotec@micro-epsilon.de | Modifications reserved

| Model	CFS4-K34-BOA-2400-T250-VS	
Sensor type		Reflex sensor
Working distance [1]		120 mm
Measurement spot diameter [1]		22 mm
Light spot diameter [1]		23 mm
Measurement geometry		0°:0°
Min. target size (flat)		Ø 22 mm
Minimum curvature radius of target (curved)		220 mm
Sensitivity	Distance [1] [2]	< 0.3 ΔE / mm
	Tilt angle [1] [2]	< 0.3 ΔE / °
	Ambient light [1] [2]	< 0.3 ΔE / 1,000 lx
Permissible ambient light [1] [2]		< 4,800 lx
Max. tilt angle [1] [2]		±45°
Connector		Integrated axial fiber optic cable with corrugated ring hose and steel braid (BOA) sheath, length 2.4 m
Mounting		FA (M18x1)
Temperature range	Storage / Operation	Sensor head: -40 … +250 °C; Cable: -50 … +600 °C
Air humidity		20 … 60 % r.H. (non-condensing)
Protection class (DIN EN 60529)		IP53
Material		Aluminum black anodized, glass, glass fiber bundle with corrugated ring tube and steel braiding (BOA)
Weight		290 g
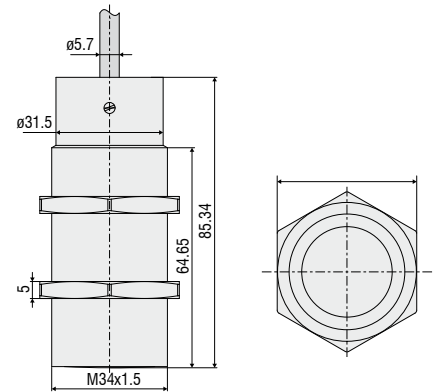
The specified data apply to a white, diffuse reflecting surface (zenith white reference)
1) In combination with colorSENSOR CFO200 and a repeatability of ΔE ≤ 0.3
2) Valid for optimal working distance

Model	CFO200	
No. of measurement channels		1
Repeatability [1]		ΔE ≤ 0.3
Color difference		ΔE ≤ 0.6
Spectral range		400 … 680 nm
Color spaces		XYZ, xyY, L*a*b*, L*u*v*, u'v'L*
Illuminants		D65
Standard observer		2°
Tolerance model		Classify; sphere (ΔE); cylinder (ΔL, Δab); box (ΔL, Δa, Δb)
Color memory		max. 320 colors in non-volatile EEPROM with parameter sets
Measuring rate		max. 30 kHz; standard 1 kHz (depending on the number of colors to learn and setting the averaging)
Temperature stability		< 0.1 % FSO / K
Light source		White light LED (425 ... 750 nm); AC operation (luminous flux at 1 kHz 220 lm) (adjustable or OFF for self-luminous switchable via software)
Permissible ambient light		max. 40,000 lx
Synchronization		Synchronization is possible
Supply voltage		18 ... 28 VDC
Maximum power consumption		500 mA
Signal input		4 (IN0-IN3): IN0 via keys; IN0-IN3 configurable via web interface (trigger, teach, delete, lock, calibration)
Digital interface		RS232 (standard 9600 kBaud) [2], Ethernet, USB
Switching output		OUT0-OUT7 Push-Pull / NPN / PNP (color recognition, binary coding 254 color groups)
Connector	Optical	screw-on optical fiber via FA socket M18x1, length 1.3 m, min. bending radius 18 mm
	Electrical	8-pin flange plug M12A (power/PLC); 8-pin flange socket M12A (signal); 4-pin flange socket M12D (Ethernet DHC-capable; 5-pin flange socket M12A (USB) (PC/Ethernet DHCP-capable) Length 2 m
Mounting		DIN rail assembly/screw connection via adapter
Temperature range	Storage	-10 … +85 °C
	Operation	-10 … +55 °C
Air humidity		20 … 80 % r.H. (non-condensing)
Shock (DIN EN 60068-2-27)		15 g / 6 ms in 3 axes in two directions, 1000 shocks each
Vibration (DIN EN 60068-2-6)		2 g / 10 … 500 Hz in 3 axes, 10 cycles each
Protection class (DIN EN 60529)		IP65 (connected)
Material		Aluminum, black anodized
Weight		approx. 200 g
Control and indicator elements		Operation via keypad and web interface, visualization with 13 white LEDs
Special features		Multi-color teach function, automatic adjustment of illumination brightness, measurement signal amplification and averaging depending on the measurement frequency, adjustable hold time of > 30 µs
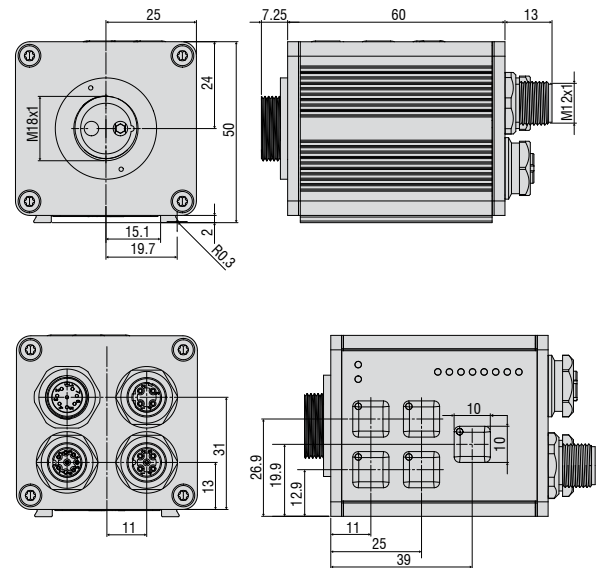
Dimensions:

Dimensions in mm, not to scale

FSO = Full Scale Output
1) Maximum color difference ΔE of 1000 consecutive measurements of the color value of a red and a dark gray (R= 5%) reference tile, measured with sensor CFS4-A20 at 1000 Hz and brightness adjustment to white standard (R= 95%)
2) Adjustable up to max. 115200 kBaud