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 ∆E ≤ 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

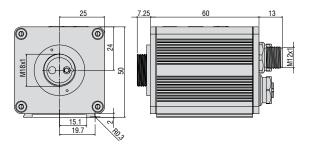
Model		CFS4-K34-BOA-2400-T250-VS
Sensor type		Reflex sensor
Working distance 1)		120 mm
Measurement spot diameter 1)		22 mm
Light spot diameter 1)		23 mm
Measurement geometry		0°:0°
Min. target size (flat)		Ø 22 mm
Minimum curvature radius of ta	arget (curved)	220 mm
	Distance 1) 2)	< 0.3 ΔE / mm
Sensitivity	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

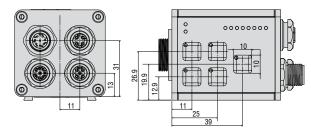
ø5.7	
ø31.5	
5 85.34	
64.65	
M34x1.5	

The specified data apply to a white, diffuse reflecting surface (zenith white reference) 1) In combination with colorSENSOR CFO200 and a repeatability of $\Delta E \leq 0.3$

²⁾ Valid for optimal working distance

Mounting Storage Temperature range Operation Air humidity Shock (DIN EN 60068-2-27) Vibration (DIN EN 60068-2-6) Protection class (DIN EN 60529) Material Weight Control and indicator elements Special features DIN rail assembly/screw connection via adapter -10 +85 °C 20 80 % r.H. (non-condensing) 20 80 % r.H. (non-condensing) 15 g / 6 ms in 3 axes in two directions, 1000 shocks each 2 g / 10 500 Hz in 3 axes, 10 cycles each Protection class (DIN EN 60529) Aluminum, black anodized Aluminum, black anodized Operation via keypad and web interface, visualization with 13 white LEDs Multi-color teach function, automatic adjustment of illumination brightness, measurement signal amplification and averaging depending on the measurement frequency,	Model		CFO200
Color difference AE ≤ 0.6 Spectral range Color spaces Syz, xyY, L*a*b*, L*u*v*, uVL* Illuminants D65 Standard observer Tolerance model Color memory Measuring rate Temperature stability Color memory Max. 320 colors in non-volatile EEPROM with parameter sets max. 30 kHz; standard 1 kHz (depending on the number of colors to learn and setting the averaging) Temperature stability Color memory Milte 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 Maximum power consumption Signal input Color RS232 (standard 9000 kBaud) ²⁰ , Ethernet, USB OUT0-OUT7 Push-Pull /NPN / PNP (color recognition, binary coding 254 color groups) Screw-on optical fiber via FA socket M18x1, length 1.3 m, min. bending radius 18 mm S-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 (power/PLC); 8-pin flange socket M12A (signal); 4-pin flange socket M12D (Ethernet DHC-capable; 5-pin flange socket M12A (power/PLC); 8-pin flange socket M12A (signal); 4-pin flange socket M12D (Ethernet DHC-capable; 5-pin flange socket M12A (power/PLC); 8-pin flange socket M12A (signal); 4-pin flange socket M12D (Ethernet DHC-capable; 5-pin flange socket M12A (signal); 4-pin flange socket M12D (Ethernet DHC-capable; 5-pin flange socket M12A (signal); 4-pin f	No. of measurement channels		1
Spectral range 400 680 nm Color spaces XYZ, xyY, L*a*b*, L*u*v*, uvL* Illuminants D65 Standard observer Tolerance model Classify; sphere (ΔΕ); cylinder (ΔL, Δab); box (ΔL, Δa, Δb) max. 320 colors in non-volatile EEPROM with parameter sets max. 30 kHz; standard 1 kHz (depending on the number of colors to learn and setting the averaging) Temperature stability < 0.1 % FSO / K 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 k Synchronization Synchronization is possible Supply voltage 18 28 VDC Maximum power consumption Signal input 4 (IN0-IN3); IN0 via keys; IN0-IN3 configurable via web interface (trigger, teach, delete, lock, calibration) Digital interface Switching output Color recognition, binary coding 254 color groups) Screw-on optical fiber via FA socket M18A1, length 1.3 m, min. bending radius 18 mm 8-pin flange socket M12A (USB) (PC/Ethernet DHC-capable; 5-pin flan	Repeatability 1)		$\Delta E \leq 0.3$
Color spaces	Color difference		$\Delta E \leq 0.6$
Standard observer Classify; sphere (ΔΕ); cylinder (ΔL, Δab); box (ΔL, Δa, Δb) max. 320 colors in non-volatile EEPROM with parameter sets max. 38 kHz; standard 1 kHz (depending on the number of colors to learn and setting the averaging) Classify; sphere (ΔΕ); cylinder (ΔL, Δab); box (ΔL, Δa, Δb) max. 320 colors in non-volatile EEPROM with parameter sets max. 30 kHz; standard 1 kHz (depending on the number of colors to learn and setting the averaging) Classify; sphere (ΔΕ); cylinder (ΔΕ); 750 nm); AC operation (Juminous flux at 1 kHz 220 lm) (adjustable or OFF for self-luminous switchable via software) Classify witchable or OFF for self-luminous switchable via software) Permissible ambient light max. 40,000 k Synchronization Synchronization is possible Synchronization Synchronization is possible Synchronization Synchronization is possible Synchronization Sync	Spectral range		400 680 nm
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Color memory max. 320 colors in non-volatile EEPROM with parameter sets max. 30 kHz; standard 1 kHz (depending on the number of colors to learn and setting the averaging) Temperature stability Color memory 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 Synchronization Synchronization is possible Synchronization is possible Synchronization is possible Synchronization is possible Maximum power consumption Signal input 4 (IN0-IN3): IN0 via keys; IN0-IN3 configurable via web interface (trigger, teach, delete, lock, calibration) RS232 (standard 9600 kBaud) ®, Ethernet, USB OUTO-OUT7 Push-Pull / NPN / PNP (color recognition, binary coding 254 color groups) screw-on optical fiber via FA socket M18x1, length 1.3 m, min. bending radius 18 mm 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 DHC-capable); 5-pin flange socket M12A (USB); 6-pin flange socket M12A (USB); 6-pi	Standard observer		2°
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Temperature stability	Color memory		max. 320 colors in non-volatile EEPROM with parameter sets
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 Synchronization Synchronization is possible Supply voltage Maximum power consumption Signal input 4 (IN0-IN3): IN0 via keys; IN0-IN3 configurable via web interface (trigger, teach, delete, lock, calibration) Permissible ambient light Synchronization is possible 8 4 (IN0-IN3): IN0 via keys; IN0-IN3 configurable via web interface (trigger, teach, delete, lock, calibration) Pigital interface Switching output Optical Optical Connector Electrical Optical Series on optical fiber via FA socket M18x1, length 1.3 m, min. bending radius 18 mm 8-pin flange plug M12A (power/PLC); 8-pin flange socket M12B (signal); 4-pin flange socket M12D (Ethernet DHC-capable; 5-pin flange socket M12A (usp) (PC/Ethernet DHC-capable) Length 2 n Mounting Mounting Storage Temperature range Operation Air humidity DIN rail assembly/screw connection via adapter -10 +85 °C -10 +85 °C -10 +85 °C Air humidity 20 80 % r.H. (non-condensing) Shock (DIN EN 60068-2-27) Vibration (DIN EN 60068-2-6) Protection class (DIN EN 60529) Material Aluminum, black anodized Weight Operation via keypad and web interface, visualization with 13 white LEDs Multi-color teach function, automatic adjustment of illumination brightness, measurement signal amplification and averaging depending on the measurement frequency,	,		
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Maximum power consumption 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 OUT0-OUT7 Push-Pull / NPN / PNP (color recognition, binary coding 254 color groups) Screw-on optical fiber via FA socket M18x1, length 1.3 m, min. bending radius 18 mm Connector Electrical 8-pin flange plug M12A (power/PLC); 8-pin flange socket M12A (signal); 4-pin flange socket M12D (Ethernet DHCP-capable; 5-pin flange socket M12A (USB) (PC/Ethernet DHCP-capable) Length 2 m Mounting DIN rail assembly/screw connection via adapter DIN rail assembly/screw connection via adapter -10 +85 °C Operation 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) Protection class (DIN EN 60529) Material Weight Operation Operation via keyspad and web interface, visualization with 13 white LEDs Multi-color teach function, automatic adjustment of illumination brightness, measurement signal amplification and averaging depending on the measurement frequency,	Synchronization		Synchronization is possible
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Length 1.3 m, min. bending radius 18 mm	Switching output		· · ·
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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) Protection class (DIN EN 60529) Material Weight Control and indicator elements Special features 15 g / 6 ms in 3 axes in two directions, 1000 shocks each 2 g / 10 500 Hz in 3 axes, 10 cycles each IP65 (connected) Aluminum, black anodized approx. 200 g Operation via keypad and web interface, visualization with 13 white LEDs Multi-color teach function, automatic adjustment of illumination brightness, measurement signal amplification and averaging depending on the measurement frequency,	iernperature range	Operation	-10 +55 °C
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Protection class (DIN EN 60529) Material Weight Control and indicator elements Special features Protection class (DIN EN 60529) IP65 (connected) Aluminum, black anodized approx. 200 g Operation via keypad and web interface, visualization with 13 white LEDs Multi-color teach function, automatic adjustment of illumination brightness, measurement signal amplification and averaging depending on the measurement frequency,	Shock (DIN EN 60068-2-27)		15 g / 6 ms in 3 axes in two directions, 1000 shocks each
Material Aluminum, black anodized Weight approx. 200 g Control and indicator elements Operation via keypad and web interface, visualization with 13 white LEDs Multi-color teach function, automatic adjustment of illumination brightness, measurement signal amplification and averaging depending on the measurement frequency,	Vibration (DIN EN 60068-2-6)		2 g / 10 500 Hz in 3 axes, 10 cycles each
Weight approx. 200 g Control and indicator Operation via keypad and web interface, visualization with 13 white LEDs Multi-color teach function, automatic adjustment of illumination brightness, measurement signal amplification and averaging depending on the measurement frequency,	Protection class (DIN EN 60529)		IP65 (connected)
Control and indicator Operation via keypad and web interface, elements visualization with 13 white LEDs Multi-color teach function, automatic adjustment of illumination brightness, measurement signal amplification and averaging depending on the measurement frequency,	Material		Aluminum, black anodized
elements visualization with 13 white LEDs Multi-color teach function, automatic adjustment of illumination brightness, measurement signal amplification and averaging depending on the measurement frequency,	Weight		approx. 200 g
Special features brightness, measurement signal amplification and averaging depending on the measurement frequency,			
adjustable hold time of $> 30 \mu \text{s}$	Special features		brightness, measurement signal amplification and averaging





Dimensions:

Dimensions in mm, not to scale

FSO = Full Scale Output

 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