MICRO-EPSILON

More Precision

colorCONTROL ACS7000 // Inline color measuring system

- Inline color measurement

- Non-contact operation

- Measurement accuracy is
 ΔE ≤ 0.08 (sample-related)

- Measurement frequency from
 25Hz to 2000Hz

- Ethernet/EtherCAT, RS422, Digital I/O

- Web browser operation

▸ Light source: adjustable standard illuminant and observer
▸ Color spaces (adjustable) : XYZ; L*a*b*; L* u* v*; L*c*h
▸ Color recognition from a taught reference list
▸ White/black reference comparison
 (via browser and buttons on the device)
▸ Inline quality assurance and continuous documentation
▸ Optional measuring heads for different technical surfaces

The colorCONTROL ACS7000 inline color measuring system recognizes colors not just by comparing them to reference values, but also by using their coordinates in the respective color space to ensure unique identification. Due to its very high measurement speeds, the color-CONTROL ACS7000 is suitable for applications where colors and shades have to be inspected on-the-fly and to very high accuracies. Due to the extremely high measurement accuracy, the system is also applied in laboratories.

Measuring principle
The spectral procedure is the most accurate method of color measurement. First, the sample is illuminated with a homogeneous white LED light. The spectrum of the reflected light is then calculated with a white reference. Then the coordinates in the CIE-XYZ color system are determined for all wavelengths of visible light (390 to 780 nm) and output in the desired color space. The controller takes into account different observation conditions such as the type of light (illuminant) and standard observer.

Function
Three operating modes are possible with the colorCONTROL ACS7000: In the first mode, the color distance ΔE is measured for reference. The system operates with up to 15 taught values. The second mode determines and outputs the reflectivity spectrum of the sample. The third mode determines color coordinates and displays these in the desired color space. For quality inspection purposes, a trend analysis can be performed over any time period via L*a*b*; XYZ or L*c*h color values.

All modes support measurement speeds up to 2 kHz. Operation and display are performed via a web interface. Light/dark correction can also be carried out via buttons on the controller or through the user interface. Ethernet/EtherCAT, RS422 and digital I/Os are available for data output.

Controller, colorCONTROL ACS7000

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Article number	11104174
Spectral measuring range	390 – 780nm
Measuring range reflectivity	0 - 200 %R
Output values	L*a*b*, L*u*v*, L*c*h°, XYZ, ΔE, spectrum
Illuminants	A, C, D65, D50, D75, E, F4, F7, F11, Off
Standard observer	2°, 10°
Distance models for color recognition	Sphere (ΔE), cylinder (ΔL*, Δa*b*), box (ΔL*, Δa*, Δb*), with individual tolerance parameters for every color taught
Color resolution	0.01 ΔE
Spectral resolution	5nm
Measurement frequency	25 - 2000Hz (internal spectrum, signal averaging and data reduction are possible)
Temperature stability	<0.1 ΔE/°C
Light source	LED, 390 - 780nm
Reproducibility of the measurements of a device [1]	<0.03 (mean); <0.08 (max) ΔE
Housing dimensions	210 x 120 x 90mm (W x H x D)
Weight	1.8kg
Protection class	IP40
Operating temperature	0°C to 45°C
Storage temperature	-20°C to 70°C
Inputs / Outputs	4 color detection switching outputs (4 individual colors or 15 colors binary or {ΔE, ΔL* Δa*, Δb*} for one color) 1 Switching output, synchronization 1 Switching input, synchronization 1 Switching output, measurement error
Interfaces	Ethernet/EtherCAT (DHCP-enabled) RS422 (USB via RS422 adapter is possible)
Connection for fiber optics	Illumination: 7mm ferrule with M18 cap (union) nut (analogous to MICRO-EPSILON Eltrotec Fasop system) Measurement: DIN fiber connector
Connection cables	To power supply: Art. No. 11234222 / to PLC: Art. No. 11234223 / to synchronization: Art. No. 11234091 / to PC: Art. No. 11294232 (Ethernet/EtherCAT); 11234224 or 11234230 (RS422)
Additional data processing	Internal calculation of spectral characteristics, color valence calculations, color space transformations, ΔE calculations, and tolerance settings of the upper and lower thresholds for the color values
Connection to software	Control and configuration via integrated Web server or via terminal with commands Visualization of spectral characteristics and temporal sequence of the color values and color differences
Power supply	24 VDC +/- 15 % 1000mA
Service life of the light source	>20,000 h when operated at 25°C

[1] Medium or maximum color distance ΔE of 1000 successive measurements of the color value (mean) of a light gray reference tile (R = 61%), measured with sensor FCS-T-ACS1-30/0-50-1200 at 200Hz and maximum illumination brightness
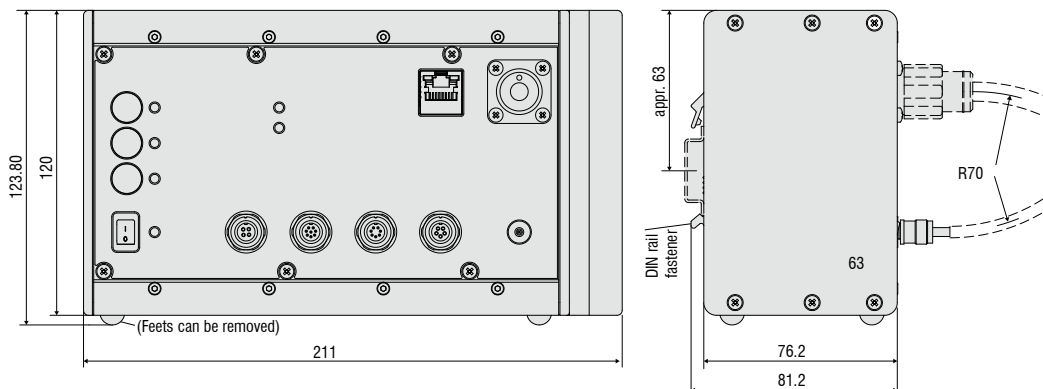
Spectrum and color location in user interface
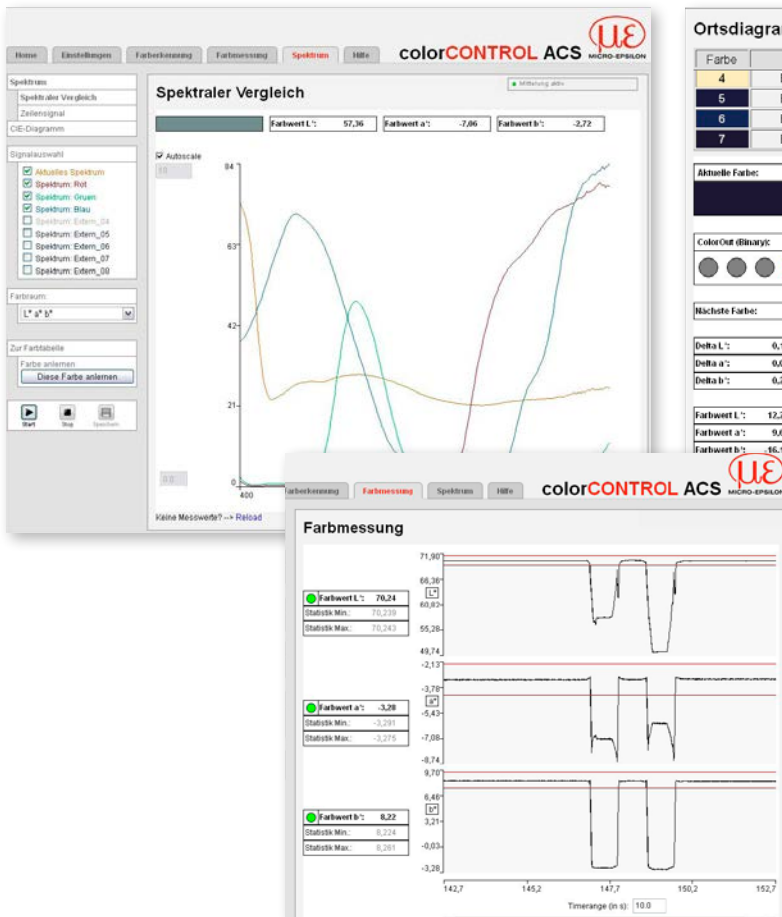
Depiction of color values in the color space
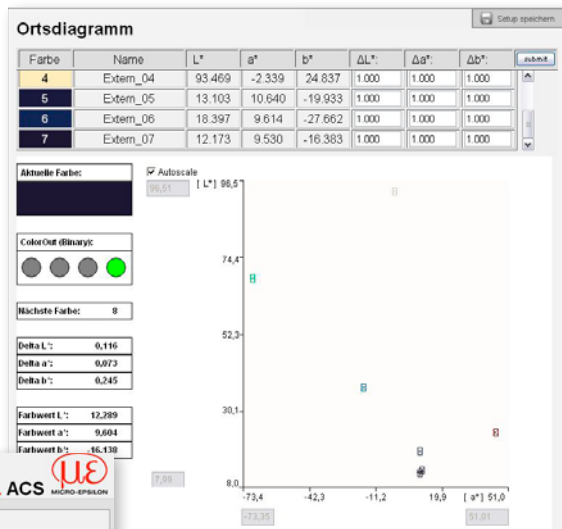
Measurements of XYZ, L*a*b*, L*u*v*,
L*c*h shown over time

Applications:
- Inline measurement in production lines, all industries: plastics, wood, paper, glass, films, injection molding, textiles and medicine
- Color measurement of interior parts
- Inspection of car paint

Advantages:
- Continuous process measurement to ensure consistent product quality
- Direct influence on the production process is possible
- Reduction of production cost
- Waste reduction

Inline measurement of the color gradient of glass, Plexiglas®, PET and PVC films and paper

Measurement of the zinc strip color in production

Interior and attachment parts in the automotive industry

colorCONTROL ACS accessories

| Art. no.	Description	suitable for
11234694	White standard 30mm Zenith	colorSENSOR and colorCONTROL
11234695	White standard 30mm Zenith	colorSENSOR and colorCONTROL
11234696	White standard 5x5cm Zenith	colorSENSOR and colorCONTROL
11234697	White standard 5x5cm Zenith calibrated	colorSENSOR and colorCONTROL
11234222	CAB-M9-4P-St-ge;2m-PUR;open	colorCONTROL ACS7000 (power)
11234225	CAB-M9-4P-St-ge;5m-PUR;open	colorCONTROL ACS7000 (power)
11234091	CAB-M9-8P-St-ge;2m-PUR;open	colorCONTROL ACS7000 (digital I/O, Sync.)
11234099	CAB-M9-8P-St-ge;5m-PUR;open	colorCONTROL ACS7000 (digital I/O, Sync.)
11234223	CAB-M9-7P-St-ge;2m-PUR;open	colorCONTROL ACS7000 (Color Out)
11234226	CAB-M9-7P-St-ge;5m-PUR;open	colorCONTROL ACS7000 (Color Out)
11294232	CAB-RJ45-Eth; 2m-PVC-Cat5e; RJ45-Eth	colorCONTROL ACS7000 (Ether-net/-CAT)
11293257	CAB-RJ45-Eth; 5m-PVC-Cat5e; RJ45-Eth	colorCONTROL ACS7000 (Ether-net/-CAT)
11294277	CAB-RJ45-Eth-Cross; 3m-PVC-Cat5e; RJ45-Eth	colorCONTROL ACS7000 (Ether-net/-CAT)
11293258	CAB-RJ45-Eth-Cross; 5m-PVC-Cat5e; RJ45-Eth	colorCONTROL ACS7000 (Ether-net/-CAT)
11234224	CAB-M9-5P-co-straight; 2m-PVC-RS422; open ends	colorCONTROL ACS7000 (RS422)
11234227	CAB-M9-5P-co-straight; 5m-PVC-RS422; open ends	colorCONTROL ACS7000 (RS422)
11234230	CAB-M9-5P-co-straight; 2m-PVC-RS422; Sub-D-15P-co-straight	colorCONTROL ACS7000 (IF2008)
11234231	CAB-M9-5P-co-straight; 5m-PVC-RS422; Sub-D-15P-co-straight	colorCONTROL ACS7000 (IF2008)
2213017	IF2008 Interface card RS422 / PCI-card	colorCONTROL ACS7000 (RS422/PC)
2213025	IF2001/USB 1-channel RS422/USB converter	colorCONTROL ACS7000
10824338	FCS-ACS1-30/0 adapter tactile	FCS-X-ACS1-30/0-50-XXXX
10824424	FCS-ACS adapter TT-TR	all ACS sensor heads (connection illumination into receiving fibers)
10824804	FCS-ACS3 90° Aufsatz	FCS-X-ACS3 TT and TR
10824414	FCS-ACS3-200 mounting rail	FCS-X-ACS3
10824423	FCS-ACS3 mounting adapter 50mm	FCS-ACS3-200 mounting rail
10824422	FCS-ACS3 mounting adapter 150mm	FCS-ACS3-200 mounting rail
10824708	FCS-ACS1/ILD1420 adapter plate angled	FCS-X-ACS1 distance readjustment with ILD1420
10824709	FCS-ACS2/ILD1420 adapter plate angled	FCS-X-ACS2 distance readjustment with ILD1420
10824710	FCS-ACS2/ILD1420 adapter plate angled	FCS-X-ACS2 distance readjustment with ILD1420
2420065	PS2030 power supply 24V/24W/ 1A; 2m-PVC; terminal-2P-co-fm-straight	CAB-M9-4P-co-straight; Xm-PUR; open ends (power)

Pin assignment

CAB-M9-5P-co-straight; Xm-PVC-RS422; open ends
(art.no.: 11234224; 11234227)
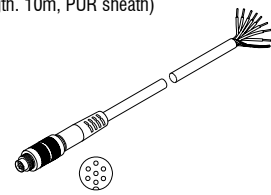Connection cable RS422
(max. length 5m, PVC sheath)
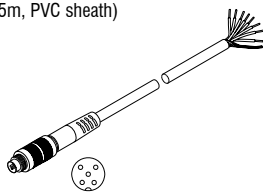
Pin	Color	ACS7000	15 PIN IF2008	10 PIN IF2001
1	white	TX	3	3
2	brown	/TX	4	4
3	green	/RX	2	2
4	yellow	RX	1	1
5	gray	GND RS422 (DC isolated)	15	9

CAB-M9-8P-co-straight; Xm-PUR; open ends
(art.no.: 11234091; 11234098)
Connection cable to power/PLC or digital I/O
(max. length. 10m, PUR sheath)
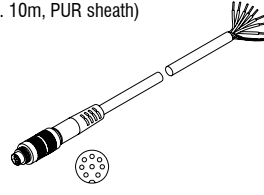
Pin	Color	ACS7000
1	white	Error
2	brown	GND Error
3	green	Sync. OUT
4	yellow	GND Sync. OUT
5	gray	Sync. IN
6	pink	GND Sync. IN
7	blue	LLL/ HLL
8	red	LLL/ HLL

CAB-M9-7P-co-straight; Xm-PUR; open ends
(art.no.: 11234223; 11234226)
Connection cable color OUT
(max. length. 10m, PUR sheath)

Pin	Color	ACS7000
1	white	OUT0
2	brown	OUT1
3	green	OUT2
4	yellow	OUT3
5	gray	GND
6	pink	n. c.
7	blue	n. c.

CAB-M9-4P-co-straight; Xm-PUR; open ends
(art.no.: 11234222; 11234225)
Connection cable Power
(max. length. 10m, PUR sheath)
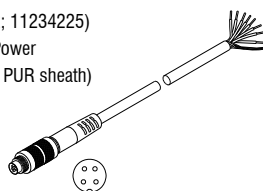
Pin	Color	ACS7000
1	white	n. c.
2	brown	+24V DC (±15%)
3	black	n. c.
4	blue	GND (0V)

High performance sensors made by Micro-Epsilon

Sensors and systems for displacement and position

Sensors and measurement devices for non-contact temperature measurement

2D/3D profile sensors (laser scanner)

Optical micrometers, fiber optic sensors and fiber optics

Color recognition sensors, LED analyzers and color inline spectrometer

Measurement and inspection systems

MICRO-EPSILON