SPECTRO Series

SPECTRO-3-FIO-UV/BL-MSM-ANA

- **Color and identity control** of different luminescent colors
- Detection of visible light (as of blue) of objects that fluoresce under UV light
- Various UV reflective fiber optics and optical frontends to choose from
- Working distance (measurement range) typ. 10 mm ... 100 mm (depends on the fiber optics and optical frontend used)
- L*a*b* , L*C*h* , L*u*v*, L*u'v' and xyY evaluation (CIE standard)
- Super-bright UV-LED, 365 nm, UG11 black glass filter (AC- or DC-operation can be switched)
- Up to 3 colors can be taught
- Insensitive to outside light (can be used with fluorescent materials in AC mode)
- Scan frequency max. 90 kHz (in DC-operation)
- Switching frequency typ. 60 kHz
- 3 analog outputs to output color values to PLC (0V ... +10V or 4mA...20mA)
- 2 digital outputs to output taught colors (0V/+24V)
- TEACH via PC or external input (IN0 (0V/+24V)
- Various evaluation algorithms can be activated
- "BEST HIT" mode ("human color assessment")
- Averaging can be activated (from 1 up to over 32000 values)
- Parameterizable via Windows® software, scope function
- Temperature compensated
- 3-color filter detector (true color detector: "human color perception")
- RS232 interface (USB, Ethernet, or Profinet adapters available)
- Integrated cooling devices for protection against overheating of the sensor



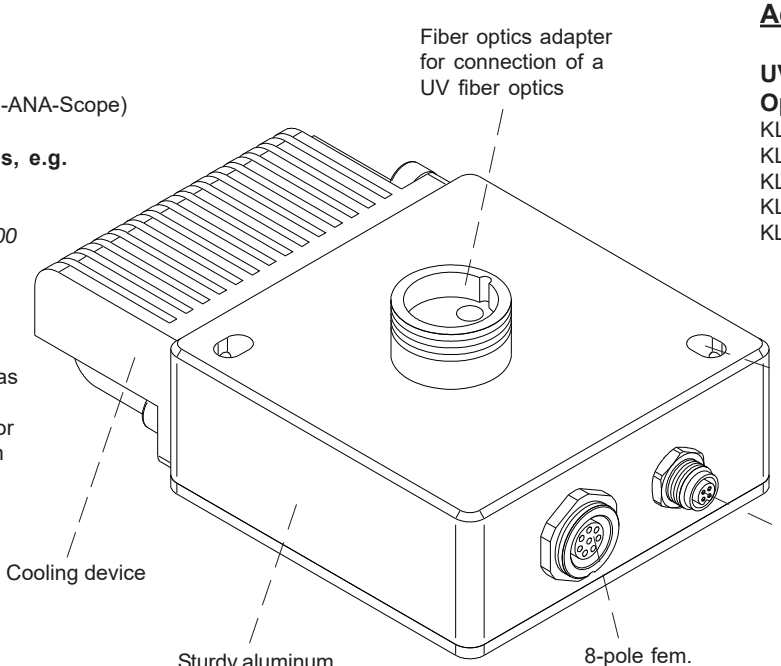
Design

Product name:

SPECTRO-3-FIO-UV/BL-MSM-ANA
(incl. Windows® software SPECTRO3-MSM-ANA-Scope)

Suitable UV reflected-light fiber optics, e.g.
R-S-A3.0-(3.0)-(*length**)-22°-UV
R-S-R2.1-(6x1)-(*length**)-22°-UV
**length(mm) = 600, 1200, 2000, 3000, 5000*
(please order fiber optics separately)

UV/BL:
The transmitter operates in the ultraviolett range, whereas the receiver is sensitive as of the blue range. This sensor type in reflective operation therefore is suitable for the detection of fluorescent objects which by way of UV excitation can be caused to emit light.



Accessories: (p. 8-10)

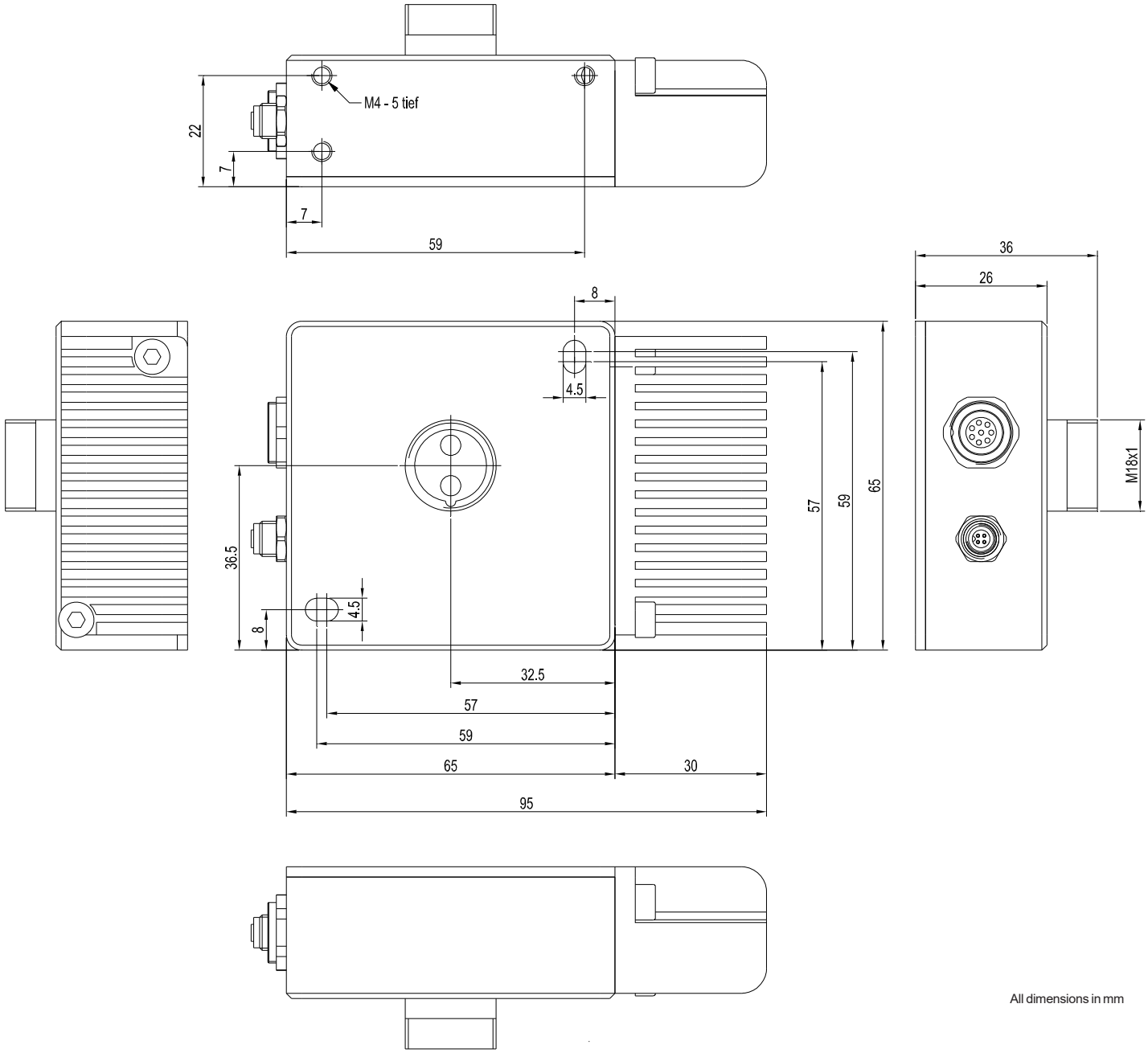
UV fiber optics
Optical frontends, e.g.
KL-9-A3.0
KL-8-R2.1
KL-M12-XL-A3.0
KL-M34-XL-A3.0
KL-M34-XL-R2.1



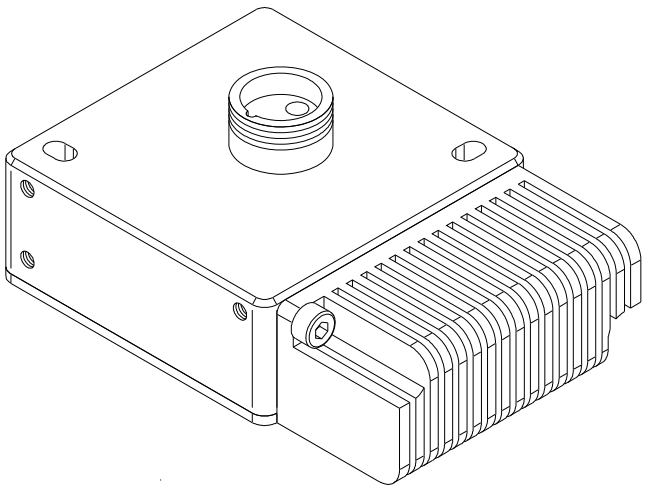
Technical Data

Type	SPECTRO-3-FIO-UV/BL-MSM-ANA
Voltage supply	+24VDC (± 10%), reverse polarity protected, overcurrent protected
Current consumption	< 160 mA
Max. switching current	100 mA, short circuit proof
Input digital (1x)	IN0 (Pin 3), digital (0V/+24V)
Outputs digital (2x)	OUT0, OUT1 (Pin 4 and 5): digital (0V/+24V), npn-/pnp-able (bright-/dark-switching, can be switched)
Outputs analog (3x)	OUT2, OUT3, OUT4 (Pin 6, 7, and 8): 0...+10V or 4...20mA (xyY, a*b*L*; u*v*L*, u'v'L*, C*h*L*, XYZ)
Interface	RS232 (an external USB and ETHERNET converter is available)
Pulse lengthening	0 ... 100 ms, adjustable via PC software
Averaging	max. 32768 values, adjustable via PC software
Scan frequency	LED operation, can be switched via PC software: AC operation: max. 25 kHz (depends on parameterization) DC operation: max. 90 kHz (depends on parameterization)
Switching frequency	typ. 60 kHz
Analog band width	max. 90 kHz (-3dB)
Transmitter (light source)	super-bright UV-LED, 365 nm
Transmitter control	can be switched via PC software: AC operation (LED MODE-AC), DC operation (LED MODE-DC)
Optical filter	Long pass filter, UG11 black glass filter
Object distance (working range)	typ. 10 mm ... 100 mm (depends on fiber optics and optical frontend used)
Receiver	3-color filter detector (TRUE COLOR detector, “human color perception“), color filter curves acc. to CIE 1931
Receiver gain setting	8 steps (AMP1 ... AMP8), adjustable via PC software
Ambient light	max. 5000 Lux
Size of light spot	depends on fiber optics and optical frontend used
Reproducibility	in the X, Y color range each 1 digit at 12-bit A/D conversion
Temperaturdrift X,Y	ΔX/ΔT; ΔY/ΔT typ. 0,2 digits/°C (< 0,01% / °C)
Measuring accuracy	typ. ΔE = 0.3
Resolution	ΔE >= 0.01 in case of color space L*u'v': Δu'v' = 0.001
Color space (resolution)	CIE L*a*b* , CIE L*C*h* , CIE L*u*v*, CIE L*u'v', and CIE xyY
Color memory capacity	non-volatile EEPROM with parameter sets for max. 3 colors
Housing dimensions	LxWxH approx. 95 mm x 65 mm x 36 mm (incl. fiber optics adapter M18x1, without flange connectors)
Housing material	aluminum, anodized in black
Enclosure rating	IP64
Connecting cables	to PLC: cab-las8/SPS or cab-las8/SPS-w to PC/RS232 interface: cab-las4/PC or cab-las4/PC-w to PC/USB interface: cab-4/USB or cab-4/USB-w to PC/Ethernet interface: cab-4/ETH to Profinet interface: cab-4-PNET
Type of connector	connection to PLC: 8-pole fem. connector (Binder 712), connection to PC: 4-pole fem. connector (Binder 707)
Operating temp. range	-20°C ... +55°C
Storage temperature range	-20°C ... +85°C
EMC test acc. to	DIN EN 60947-5-2 CE

Dimensions



All dimensions in mm

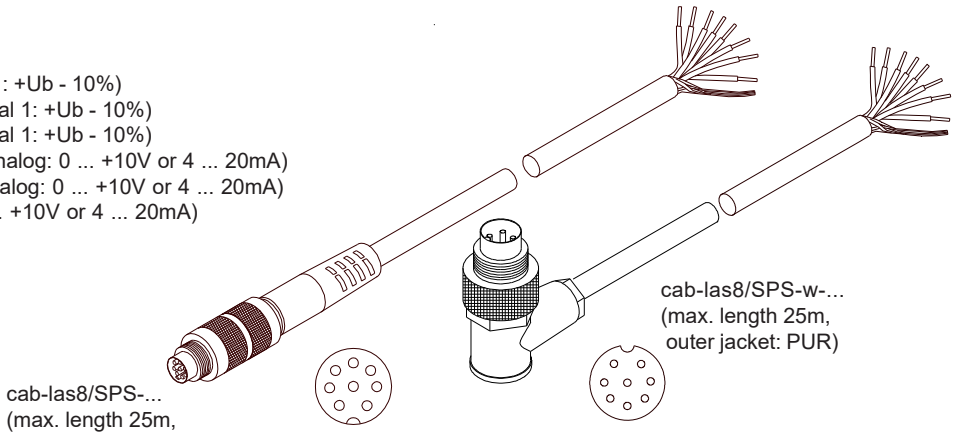


Connector Assignment

Connection to PLC:
8-pole fem. connector Binder series 712

Pin:	Color:	Assignment:
1	white	GND (0V)
2	brown	+24VDC (±10%)
3	green	IN0 (Digital 0: 0 … 1V, Digital 1: +Ub - 10%)
4	yellow	OUT0 (Digital 0: 0 … 1V, Digital 1: +Ub - 10%)
5	grey	OUT1 (Digital 0: 0 … 1V, Digital 1: +Ub - 10%)
6	pink or black	OUT2 X, x, a*, u*, u‘ or C* (Analog: 0 ... +10V or 4 ... 20mA)
7	blue	OUT3 Y, y, b*, v*, v‘ or h* (Analog: 0 ... +10V or 4 ... 20mA)
8	red	OUT4 Z, Y or L* (Analog: 0 ... +10V or 4 ... 20mA)

Connecting cable:
cab-las8/SPS-(length)
cab-las8/SPS-w-(length)
(standard length 2m)



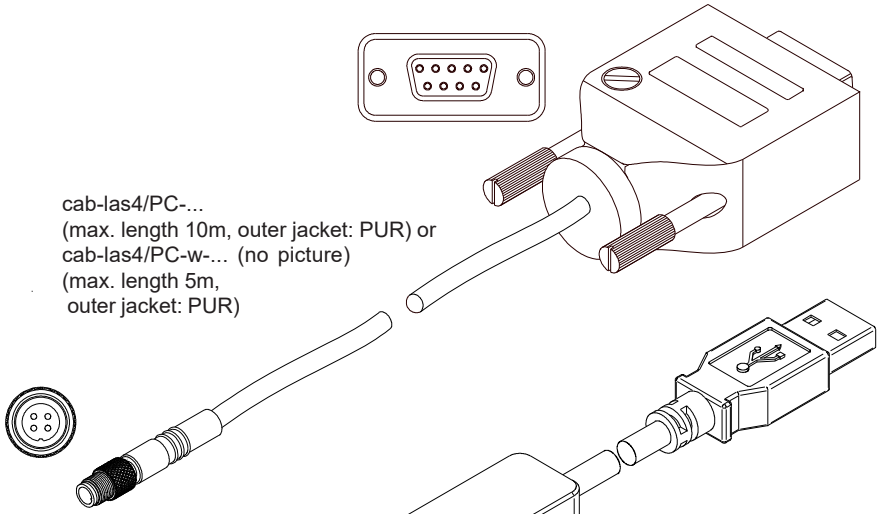
cab-las8/SPS-...
(max. length 25m,
outer jacket: PUR)

cab-las8/SPS-w-...
(max. length 25m,
outer jacket: PUR)

Connection to PC:
4-pole fem. connector Binder Series 707

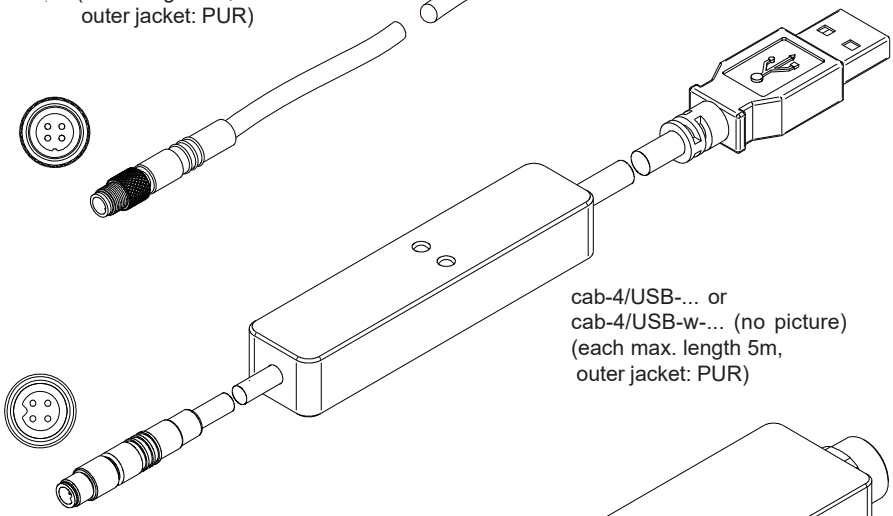
Pin:	Assignment:
1	+24VDC (+Ub, OUT)
2	GND (0V)
3	RxD
4	TxD

Connection via RS232 interface at the PC:
Connecting cable:
cab-las4/PC-(length)
cab-las4/PC-w-(length) (angle type 90°)
(standard length 2m)



cab-las4/PC-...
(max. length 10m, outer jacket: PUR) or
cab-las4/PC-w-... (no picture)
(max. length 5m,
outer jacket: PUR)

alternative:
Connection via USB interface at the PC:
USB converter (incl. driver software):
cab-4/USB-(length)
cab-4/USB-w-(length) (angle type 90°)
(standard length 2m)

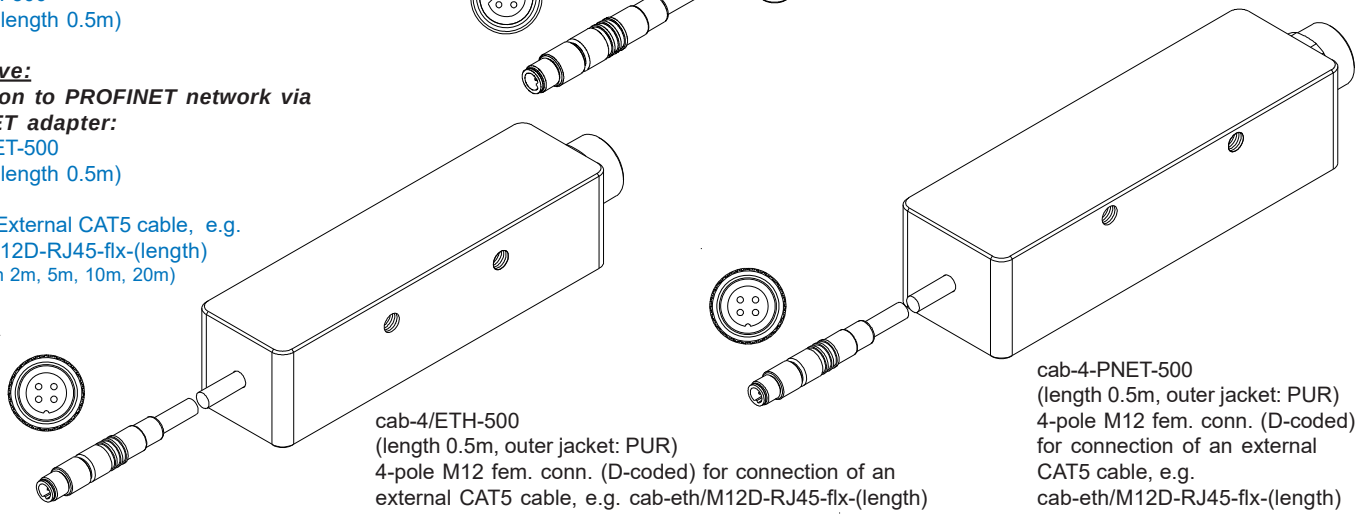


cab-4/USB-... or
cab-4/USB-w-... (no picture)
(each max. length 5m,
outer jacket: PUR)

alternative:
Connection to local network via Ethernet bus:
Ethernet converter (incl. software „SensorFinder“):
cab-4/ETH-500
(standard length 0.5m)

alternative:
Connection to PROFINET network via PROFINET adapter:
cab-4-PNET-500
(standard length 0.5m)

Optional: External CAT5 cable, e.g.
cab-eth/M12D-RJ45-flx-(length)
(available in 2m, 5m, 10m, 20m)



cab-4/ETH-500
(length 0.5m, outer jacket: PUR)
4-pole M12 fem. conn. (D-coded) for connection of an external CAT5 cable, e.g. cab-eth/M12D-RJ45-flx-(length)

cab-4-PNET-500
(length 0.5m, outer jacket: PUR)
4-pole M12 fem. conn. (D-coded) for connection of an external CAT5 cable, e.g. cab-eth/M12D-RJ45-flx-(length)

Measuring Principle

Measuring principle of color sensors of SPECTRO-3-...-MSM-ANA Series:

The **SPECTRO-3-...-MSM-ANA** color sensor provides highly flexible signal acquisition. For example, the sensor can be operated in alternating-light mode (AC mode), which makes the sensor insensitive to extraneous light. It also can be set to constant-light mode (DC mode), which makes the sensor extremely fast. With the stepless adjustment of the integrated light source as well as the selectable gain of the receiver signal and an INTEGRAL function the sensor can be set to almost any surface.

When the integrated illumination of the **SPECTRO-3-FIO-UV/BL-MSM-ANA** color sensor is activated, the sensor detects the luminescence on the measurement object. A UVA LED with adjustable transmission power is used as the light source on the **SPECTRO-3-FIO-UV/BL-MSM-ANA** color sensor. An integrated triple receiver is used as the detector for the red, green, and blue components of the radiation converted from the measurement surface into the visible wavelength range.

The **SPECTRO-3-FIO-UV/BL-MSM-ANA** color sensor can be "taught" up to 3 colors. For each of these taught colors it is possible to set tolerances. Evaluation of the taught colors is performed either with the "FIRST HIT" or with the "BEST HIT" mode. With "FIRST HIT" the first hit in the teach table is output, and with "BEST HIT" the best hit in the teach table is output. Raw data are represented with 12 bit resolution..

Color detection operates either continuously or is initiated by an external PLC trigger signal.“The detected color is either available as binary code at the two digital outputs or can be output directly to the outputs if only up to 2 colors are to be detected. .

In addition to the 2 digital outputs there also are 3 analog outputs that either provide the red, green, and blue components or the calculated color coordinates in values of 0…+10V or 4…20mA.

Through input IN0 (green wire of the cab-las8/SPS cable) the color sensor can be taught up to 3 colors. For this purpose the corresponding parameter mode must be set with the software.

Parameters and measured values can be exchanged between the PC and the SPECTRO-3-FIO-UV/BL-MSM-ANA color sensor via the RS232 interface. All parameters for color detection can be stored in the non-volatile EEPROM of the **SPECTRO-3-FIO-UV/BL-MSM-ANA** color sensor via the RS232 serial interface. Once parameterization is complete, the color sensor continues to operate in STAND-ALONE mode with the current parameters without a PC.

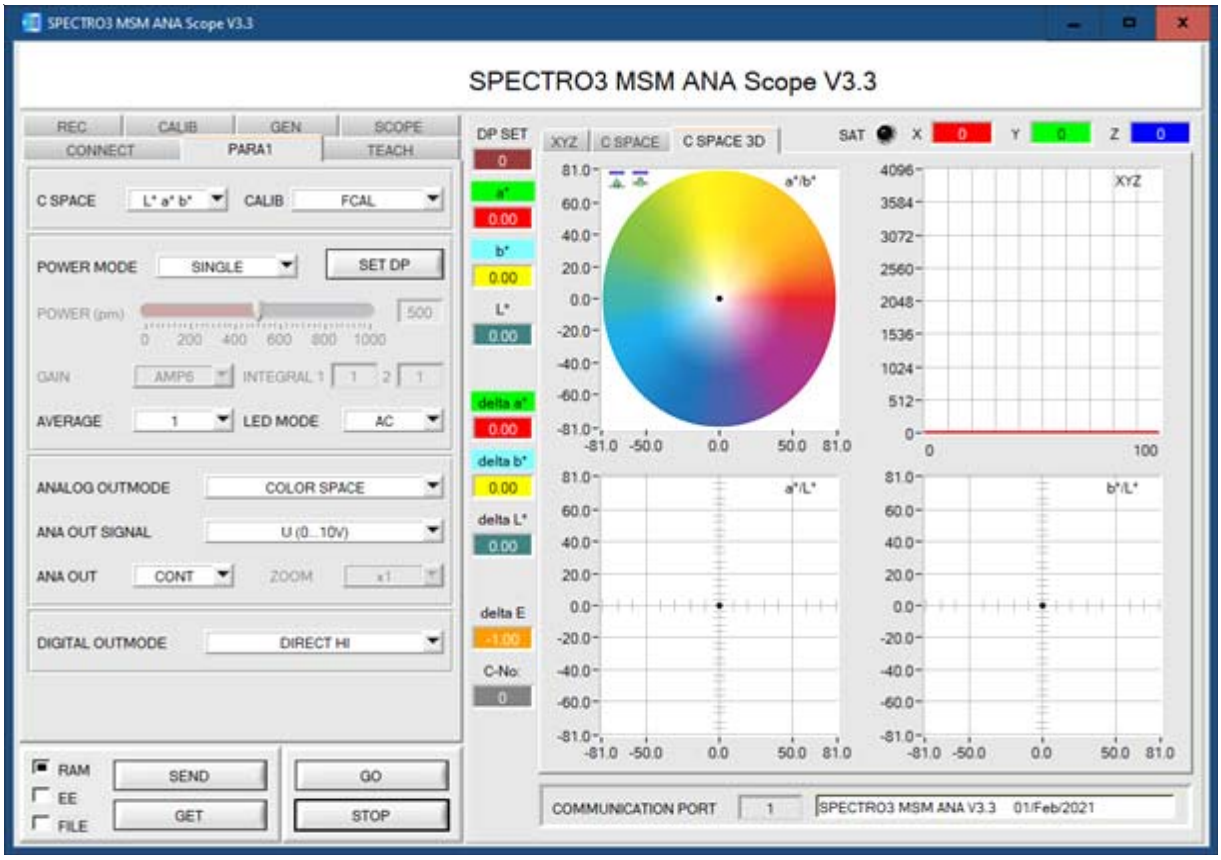
Possible firmware updates can be easily performed through the RS232 interface, even with the sensor system in installed condition. (a firmware update is performed via the software „FirmwareLoader").

Parameterization

Windows® user interface:

(The current software version is available for download on our website.)

The color sensor is parameterized under Windows® with the SPECTRO3-MSM-ANA-Scope software. The Windows® user interface facilitates the teach-in process at the color sensor and supports the operator in the task of adjustment and commissioning of the color sensor.



The RS232 interface (tab PARA1) is used for setting parameters such as e.g.:

- POWER MODE (SET DP): Light power of the LED (Set Double Parameter)
- LED MODE: Triggering of the internal light source (AC, DC)
- GAIN: Used for setting the gain of the receiver (AMP1 ... AMP8)
- AVERAGE: Averaging over a maximum of 32768 values. This function field is used for adjusting the number of scanning values (measurement values) over which the raw signal measured at the receiver is averaged. A higher AVERAGE default value reduces noise of the raw signals at the receiver unit and there will be a decrease of the maximal available switching frequency of the sensor
- INTEGRAL: This function field is used to set the number of scan values (measurement values) over which the raw signal measured at the receiver is summed up. This integral function allows the reliable detection even of extremely weak signals
- C SPACE: Selection of a color space ((L*a*b* , L*C*h* , L*u*v*, L*u‘v‘, or xyY) for the calculation of the color stimulus specification
- ANA LOG OUTMODE: Function to determine the signals that the sensor provides at its analog outputs (OUT2, OUT3, OUT4) (OFF, XYZ, COLOR SPACE, CS REF)
- EVALUATION MODE: BEST HIT or FIRST HIT
- TRIGGER: Continuous or external or self trigger (CONT, EXT1, EXT2, TRANS)
- EXTEACH: In all the evaluation modes teaching of a color can be performed externally through IN0.
- INTLIM: Minimum intensity required for color evaluation
- MAXCOL-No.: Number of colors to be checked
- DIGITAL OUTMODE: Control of the two digital outputs (OUT0, OUT1)

Tab TEACH Opens a window where you can teach colors to the TEACH TABLE
Tab CALIB Selection of calibration mode (FCAL = factory calibration or UCAL = user calibration).
Tab SCOPE Visualises an oscilloscope
Tab GEN Displays the current temperature value TEMP in the sensor housing
Tab REC Data recorder

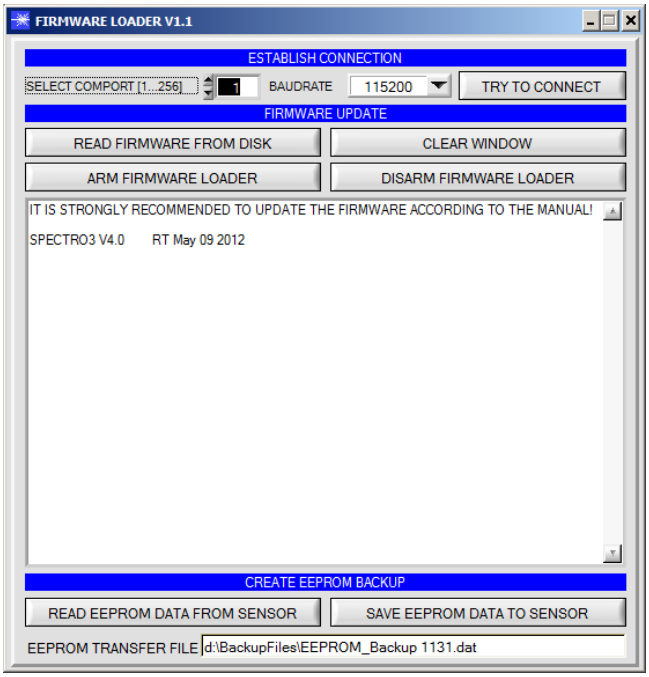
Firmware Update

Windows® software „FirmwareLoader“:

(The current software version is available for download on our website.)

The software „Firmware Loader“ allows the user to perform an automatic firmware update. The update will be carried out through the RS232 interface.

An initialisation file (xxx.ini) and a firmware file (xxx.elf.S) are required for performing a firmware update. These files can be obtained from your supplier. In some cases an additional firmware file for the program memory (xxx.elf.p.S) is also needed, and this file will be automatically provided together with the other two files.



Monitoring Software

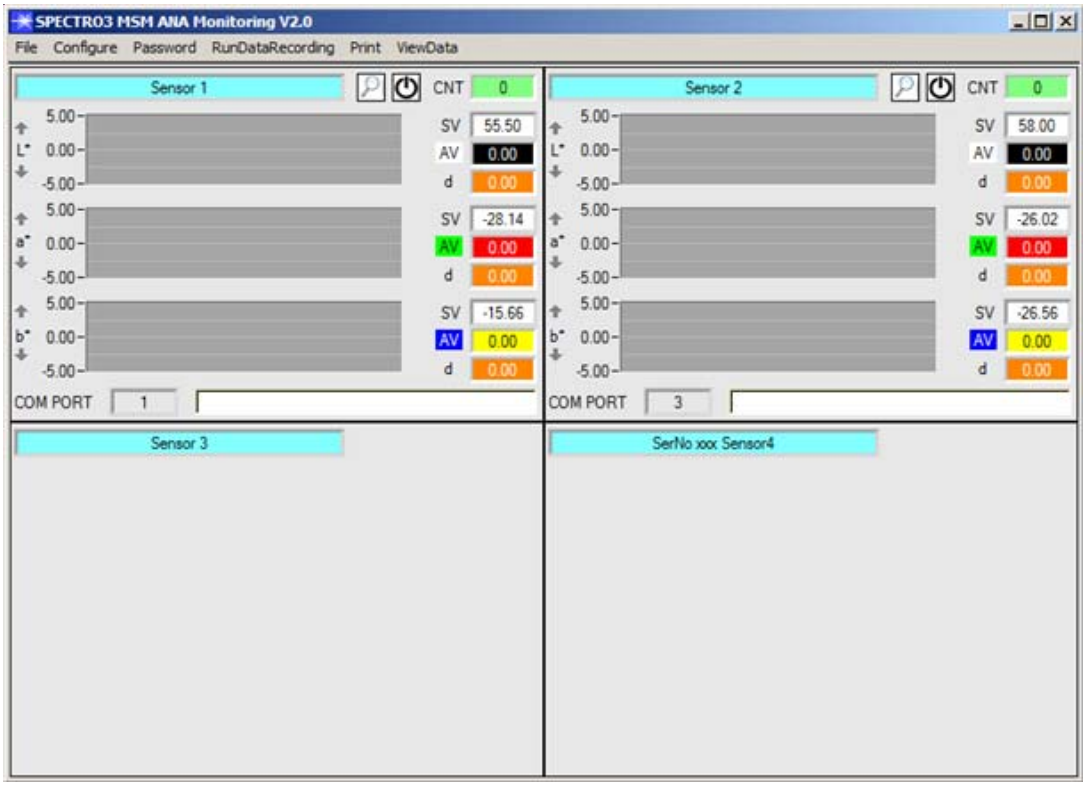
Windows® software „SPECTRO3-MSM-ANA-Monitoring“:

(The current software version is available for download on our website.)

The software „SPECTRO3-MSM-ANA-Monitoring“ was developed for configuring up to 8 color sensors of the SPECTRO-3-MSM-ANA series in a multi-sensor system that can be used for the continuous inline measurement and control of surfaces at several measuring points at the same time. Measurement values are recorded and are also displayed at the PC monitor, and they can be printed out after the end of recording.

The software concept provides two user levels: A password-protected administrator function for configuring the inline measurement system and for setting all the parameters for operation, and an easy-to-use user function that only allows the setting of the start and end of recording with input of production parameters (that have been determined by the administrator). The print function also is available for the normal user.

As a support for commissioning and operation of the SPECTRO3-MSM-ANA-MONITORING software this manual explains the individual functional elements of the graphic Windows® user interface.



UV Fiber Optics

Available standard fiber optics (FIO Series):
(please order separately)



UV reflected light fiber optics
R-S-A1.1-(1.5)-...-22°-UV
R-S-A2.0-(2.5)-...-22°-UV
R-S-A3.0-(3.0)-...-22°-UV
R-S-R1.1-(3x0.5)-...-22°-UV
R-S-R2.1-(6x1)-...-22°-UV
Available in standard length 600mm or 1200mm.
Special lengths of 2000 mm, 3000 mm, 5000 mm on request.
Can be used with an additional optical frontend KL-...

UV transmitted light fiber optics
D-S-A2.0-(2.5)-...-22°-UV
D-S-A3.0-(3.0)-...-22°-UV
Available in standard length 600mm or 1200mm.
Special lengths on request.
Can be used, for example, for emulsion detection (oil content in water) or in a V-shaped transmitter/receiver arrangement (use without additional optical frontend KL-...).

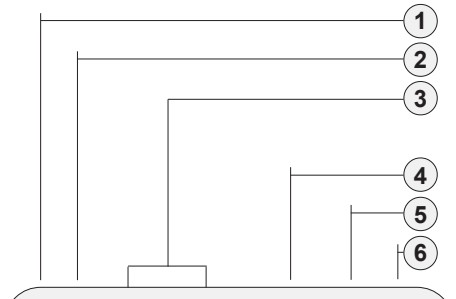
Further types of fiber optics on request.

Please note:
For operation with the SPECTRO-3-FIO-UV/BL-MSM-ANA solely UV light optical fibers with a beam opening angle of 22° are to be used!

Characteristics:

Light-conducting glass fibers are optical components that allow the transmission of light through any curved path based on the principle of total reflection. The individual fiber is composed of high-break core glass and low-break cladding glass. The light beams entering the core glass within the critical angle are guided through the fiber by way of reflection at the core/cladding contact surfaces (step index fiber). The highly flexible optical fibers are made of bundled individual glass fibers. The ends are each glued into a sensor head and a connector. The faces are optically polished. For protection against mechanical, chemical, or thermal destruction the optical fibers are provided with a corresponding protective sheath.

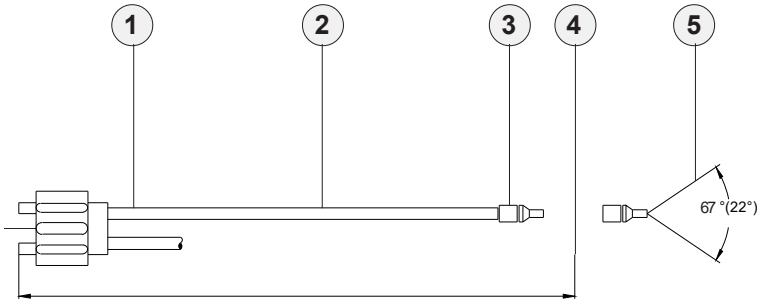
Order Code:



1 **Operating mode** (R = reflected light operation)
2 **Sheathing type** (e.g. S = silicone-metal sheathing)
3 **Sensor type** (e.g. A2.0 = sensor type A, variant 2.0)
(**and size of fiber bundle or fiber gap**, e.g. Ø 2.5 mm)
4 **Total length of optical fiber** (e.g. 1200 mm)
5 **Beam angle** (opening angle 22°)
6 **UV** (ultraviolet type)

Order code for optical fiber

(For detailed description of the various types of fiber optics please cf. catalog „FIO Series“)



Dimensions of adapter	cf. catalog FIO Series
Attachment optics (e.g. focus lens, reflex optics, prismn optics)	cf. catalog FIO Series
Fiber optics for reflex light operation	cf. catalog FIO Series
Fiber optics for transmitted light operation	cf. catalog FIO Series
Mounting hints	cf. catalog FIO Series

Optical Frontends

Optical frontends for UV reflected light fiber optics (22°-UV):

(please order separately)



KL-3-A2.0
KL-4-A1.1
KL-5-R1.1
KL-8-R2.1
KL-9-A3.0



KL-M8-A1.1



KL-M12-A1.1
KL-M12-A2.0
KL-M12-A3.0
KL-M12-R1.1



KL-M12-XL-A1.1
KL-M12-XL-A2.0
KL-M12-XL-R1.1



KL-M18-A1.1
KL-M18-A2.0
KL-M18-A3.0
KL-M18-R1.1
KL-M18-R2.1



KL-M18-XL-A1.1
KL-M18-XL-A2.0
KL-M18-XL-A3.0
KL-M18-XL-R1.1
KL-M18-XL-R2.1



KL-M34-A1.1
KL-M34-A2.0
KL-M34-A3.0
KL-M34-R1.1
KL-M34-R2.1



KL-M34-XL-A1.1
KL-M34-XL-A2.0
KL-M34-XL-A3.0
KL-M34-XL-R1.1
KL-M34-XL-R2.1



KL-M34/62-A1.1
KL-M34/62-A2.0
KL-M34/62-A3.0
KL-M34/62-R1.1
KL-M34/62-R2.1



Optical Frontends

Optical frontends for UV reflected light fiber optics (22°-UV):

(please order separately)

Part number:	Suitable for fiber optics type: (R = reflected light)	Characteristics:
KL-3-A2.0	R-S-A2.0-(2.5)-...-22°-UV	Working distance typ. 10 mm ... 20 mm
KL-4-A1.1	R-S-A1.1-(1.5)-...-22°-UV	Working distance typ. 10 mm ... 15 mm
KL-5-R1.1	R-S-R1.1-(3x0.5)-...-22°-UV	Working distance typ. 8 mm ... 20 mm
KL-8-R2.1	R-S-R2.1-(6x1)-...-22°-UV	Working distance typ. 8 mm ... 25 mm
KL-9-A3.0	R-S-A3.0-(3.0)-...-22°-UV	Working distance typ. 8 mm ... 25 mm
KL-M8-A1.1	R-S-A1.1-(1.5)-...-22°-UV	Working distance typ. 8 mm ... 20 mm
KL-M12-A1.1	R-S-A1.1-(1.5)-...-22°-UV	Working distance typ. 8 mm ... 20 mm
KL-M12-A2.0	R-S-A2.0-(2.5)-...-22°-UV	Working distance typ. 8 mm ... 20 mm
KL-M12-A3.0	R-S-A3.0-(3.0)-...-22°-UV	Working distance typ. 8 mm ... 20 mm
KL-M12-R1.1	R-S-R1.1-(3x0.5)-...-22°-UV	Working distance typ. 8 mm ... 20 mm
KL-M12-XL-A1.1	R-S-A1.1-(1.5)-...-22°-UV	Working distance typ. 30 mm ... 100 mm
KL-M12-XL-A2.0	R-S-A2.0-(2.5)-...-22°-UV	Working distance typ. 30 mm ... 100 mm
KL-M12-XL-R1.1	R-S-R1.1-(3x0.5)-...-22°-UV	Working distance typ. 30 mm ... 100 mm
KL-M18-A1.1	R-S-A1.1-(1.5)-...-22°-UV	Working distance typ. 10 mm ... 60 mm
KL-M18-A2.0	R-S-A2.0-(2.5)-...-22°-UV	Working distance typ. 10 mm ... 80 mm
KL-M18-A3.0	R-S-A3.0-(3.0)-...-22°-UV	Working distance typ. 10 mm ... 80 mm
KL-M18-R1.1	R-S-R1.1-(3x0.5)-...-22°-UV	Working distance typ. 10 mm ... 60 mm
KL-M18-XL-A1.1	R-S-A1.1-(1.5)-...-22°-UV	Working distance typ. 50 mm ... 100 mm
KL-M18-XL-A2.0	R-S-A2.0-(2.5)-...-22°-UV	Working distance typ. 50 mm ... 100 mm
KL-M18-XL-A3.0	R-S-A3.0-(3.0)-...-22°-UV	Working distance typ. 50 mm ... 100 mm
KL-M18-XL-R1.1	R-S-R1.1-(3x0.5)-...-22°-UV	Working distance typ. 50 mm ... 100 mm
KL-M18-XL-R2.1	R-S-R2.1-(6x1)-...-22°-UV	Working distance typ. 50 mm ... 100 mm
KL-M34-A1.1	R-S-A1.1-(1.5)-...-22°-UV	Working distance typ. 50 mm ... 100 mm
KL-M34-A2.0	R-S-A2.0-(2.5)-...-22°-UV	Working distance typ. 50 mm ... 100 mm
KL-M34-A3.0	R-S-A3.0-(3.0)-...-22°-UV	Working distance typ. 50 mm ... 100 mm
KL-M34-R1.1	R-S-R1.1-(3x0.5)-...-22°-UV	Working distance typ. 50 mm ... 100 mm
KL-M34-R2.1	R-S-R2.1-(6x1)-...-22°-UV	Working distance typ. 50 mm ... 100 mm
KL-M34-XL-A1.1	R-S-A1.1-(1.5)-...-22°-UV	Working distance typ. 50 mm ... 100 mm
KL-M34-XL-A2.0	R-S-A2.0-(2.5)-...-22°-UV	Working distance typ. 50 mm ... 100 mm
KL-M34-XL-A3.0	R-S-A3.0-(3.0)-...-22°-UV	Working distance typ. 50 mm ... 100 mm
KL-M34-XL-R1.1	R-S-R1.1-(3x0.5)-...-22°-UV	Working distance typ. 50 mm ... 100 mm
KL-M34-XL-R2.1	R-S-R2.1-(6x1)-...-22°-UV	Working distance typ. 50 mm ... 100 mm
KL-M34/62-A1.1	R-S-A1.1-(1.5)-...-22°-UV	Working distance typ. 80 mm ... 100 mm
KL-M34/62-A2.0	R-S-A2.0-(2.5)-...-22°-UV	Working distance typ. 80 mm ... 100 mm
KL-M34/62-A3.0	R-S-A3.0-(3.0)-...-22°-UV	Working distance typ. 80 mm ... 100 mm
KL-M34/62-R1.1	R-S-R1.1-(3x0.5)-...-22°-UV	Working distance typ. 80 mm ... 100 mm
KL-M34/62-R2.1	R-S-R2.1-(6x1)-...-22°-UV	Working distance typ. 80 mm ... 100 mm