# **SPECTRO** Series

## SPECTRO-3-POL-SLE

- Measuring range typ. 5 mm ... 50 mm
- Integrated transmitter and receiver optics
- Polarization filter (very strong reduction of gloss effect )
- Up to 31 colors can be taught (max. 64 colors in GROUP mode)
- RS232 interface (USB or Ethernet adapter is available)
- Super-bright white-light LED, diffuse, polarisation filter (AC-/DC-operation or OFF for luminous objects can be switched)
- Color detection, contrast detection, and gray scale detection
- Insensitive to outside light (in AC-operation)
- Brightness correction can be activated (STATIC/DYNAMIC)
- Scan frequency max. 35 kHz (in DC- or OFF-operation)
- Switching frequency typ. 35 kHz
- 5 digital outputs to output the detected colors (provided either as a binary code or directly, if only up to 5 colors are to be detected)
- Several TEACH functions (via PC or PLC)
- Various evaluation algorithms can be activated
- "BEST HIT" mode ("human color assessment")
- Parameterizable via Windows® software, scope function
- Temperature compensated
- Averaging can be activated (from 1 up to over 32000 values)
- Color control of luminous objects (LEDs, halogen lamps, displays, ...)
- 3-color filter detector (true color detector: "human color perception")



### Design

# SPECTRO-3-POL-SLE (incl. Windows® PC software SPECTRO3-SLE-Scope and SPECTRO3-COMFORT-Scope)

Product name:

Receiver optics incl. 3-color filter detector (True Color), transmitter optics with white light LED as well as polarization filter, scratch-resistant optics cover made of glass

Sturdy aluminum housing, anodized

in black

4-pole fem. connector

Binder Series 707

(RS232 interface)

Connecting cable:

SI-RS232/Ethernet-4

cab-las4/PC or cab-las4/USB or

/ 8-pole connector M12 Binder Series 713/763 (connection to PLC)

> Connecting cable: cab-M12/8-g-...-shd

> > Sensor

Mounting possibilities (threaded M4)

Sensor Instruments GmbH • D-94169 Thurmansbang • Schlinding 11 Tel. +49 (0)8544 9719-0 • Fax +49 (0)8544 9719-13 Instruments

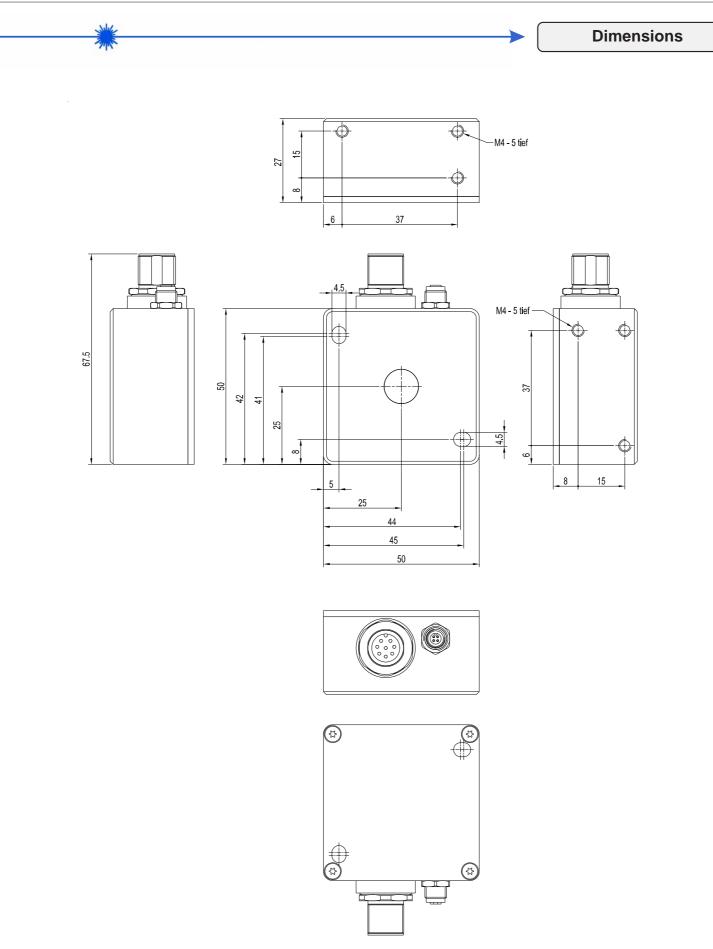
 $-\mathbf{h}$ 

**Technical Data** 

Model	SPECTRO-3-POL-SLE	
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 (5x)	OUT0 OUT1 (Pin 4 Pin 8): digital (0V/+24V), npn-/pnp-able (bright-/dark-switching, can be switched)	
Interface	RS232	
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. 20 kHz (depends on parameterization) DC and OFF operation: max. 35 kHz (depends on parameterization)	
Switching frequency	typ. 35 kHz	
Transmitter (light source)	super-bright white-light LED, focused, polarisation filter	
Transmitter control	can be switched via PC software: AC operation (LED MODE-AC), DC operation (LED MODE-DC), OFF operation (LED MODE-OFF)	
Measuring range	typ. 5 mm 50 mm	
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	
Detection range (half intensity width)	typ. 3 mm at a distance of 5 mmtyp. 10 mm at a distance of 30 mmtyp. 6 mm at a distance of 15 mmtyp. 12 mm at a distance of 40 mmtyp. 10 mm at a distance of 20 mmtyp. 14 mm at a distance of 50 mm	
Reproducibility	in the X, Y color range each 1 digit at 12-bit A/D conversion	
Temperature drift X,Y	ΔX/ΔT; ΔΥ/ΔT typ. 0,2 digits/°C (< 0,01% / °C)	
Color difference	$\Delta E >= 0,5$	
Color space	X Y INT siM (Lab)	
Color memory capacity	non-volatile EEPROM with parameter sets for max. 31 colors (max. 64 colors in GROUP mode)	
Housing dimensions	LxWxH approx. 50 mm x 50 mm x 27 mm (without flange connectors)	
Housing material	aluminum, anodized in black	
Enclosure rating	IP64	
Connecting cables	to PLC: cab-M12/8-gshd to PC/RS232 interface: cab-las4/PC or cab-las4/PC-w to PC/USB interface: cab-las4/USB or cab-las4/USB-w to PC/Ethernet interface: SI-RS232/Ethernet-4	
Type of connector	connection to PLC: 8-pole M12-connector (Binder 713/763), 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 <b>CE</b>	

Sensor N

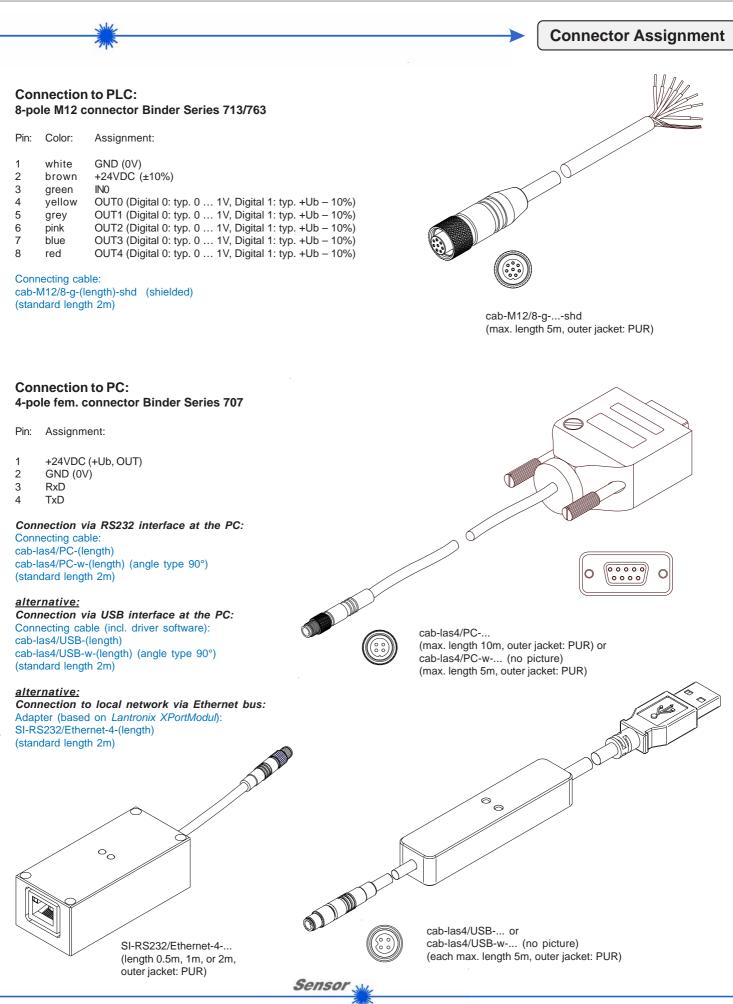
SPECTRO-3 Series • True Color Sensors



All dimensions in mm

Sensor W

Instruments



Sensor Instruments GmbH • D-94169 Thurmansbang • Schlinding 11 Tel. +49 (0)8544 9719-0 • Fax +49 (0)8544 9719-13 Instruments

**Measuring Principle** 

#### Measuring Principle of the color sensors of SPECTRO-3-SLE series:

The SPECTRO-3-...-SLE 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. An OFF function turns off the integrated light source at the sensor and changes to DC operation. The sensor then can detect so-called "self-luminous objects". 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 or any "self-luminous object".

When the integrated light source of the SPECTRO-3-...-SLE color sensor is activated, the sensor detects the radiation that is diffusely reflected from the object. As a light source the SPECTRO-3-...-SLE color sensor uses a white-light LED with adjustable transmitter power. An integrated 3-fold receiver for the red, green, and blue content of the light that is reflected from the object, or the light that is emitted by a "self-luminous object", is used as a receiver.

As a light source the SPECTRO-3-UV-SLE or SPECTRO-3-FIO-UV-SLE color sensor uses a UV-LED (375 nm) with adjustable transmitter power to excite the luminescent marking. An integrated 3-fold receiver for the red, green, and blue content of the visible light that is emitted by the luminescent marking is used as a receiver. A special feature here is that the gain of the receiver can be set in 8 steps. This makes it possible to optimally adjust the sensor to almost any luminescent colorant that can be excited in the long-wave UV range.

The SPECTRO-3-...-SLE color sensor can be "taught" up to 31 colors, which are output directly via the outputs, and up to 64 colors which are output via color groups. For each of these taught colors it is possible to set tolerances. In "X Y INT - 2D" or "s i M - 2D" mode these tolerances form a color cylinder in space. In "X Y INT - 3D" or "s i M - 3D" mode the tolerances form a color sphere in space. Color evaluation according to "s i M - 2D" is based on the lab calculation method. All modes can be used in combination with several operating modes such as "FIRST HIT" and "BEST HIT". Raw data are represented with 12 bit resolution.

As a special feature the sensor can be taught two completely independent parameter sets. Input INO can be used to tell the sensor which parameter set it should work with.

Color detection either operates continuously or is started through an external PLC trigger signal. The respective detected color either is provided as a binary code at the 5 digital outputs or can be sent directly to the outputs, if only up to 5 colors are to be detected. Through input IN0 the color sensor can be taught up to 31 colors (64 colors in group mode). For this purpose the corresponding evaluation mode must be set with the software.

Parameters and measurement values can be exchanged between a PC and the SPECTRO-3-...-SLE color sensor through the serial RS232 interface. All the parameters for color detection also can be saved to the non-volatile EEPROM of the SPECTRO-3-...-SLE color sensor through this serial RS232 interface. When parameterisation is finished, the color sensor continues to operate with the current parameters in STAND-ALONE mode without a PC.

The sensors of the SPECTRO-3-...-SLE series can be calibrated (white-light balancing). Balancing can be performed to any white surface. A ColorCheckerTM table with 24 color fields is available as an alternative. White-light balancing or calibration can be performed to one of the white, grey, or black fields.

The UV color sensors SPECTRO-3-UV-SLE and SPECTRO-3-FIO-UV-SLE also can be calibrated. Analogous to white-light balancing with color sensors, balancing of the SPECTRO-3-UV-SLE or SPECTRO-3-FIO-UV-SLE could be performed to any luminescent color marking.





#### Windows® user interface:

The color sensor is parameterized under Windows® with the SPECTRO3-SLE-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.

SPECTRO3 SLE Scope V1.0 numeric form and color chart, and color chart, and				
DIGITAL OUTMODE DIRECT HI	X       RGB       INTENSITY       2D       RED       0       GRN       0       BLUE       0         0       10025- 9000- 9000- INT       9000- 8000- 6000- 5000- 5000- 4000- 5000- 1000- 200- 200- 1000- 225- 2000       0 <t< th=""><th>representation of R values in a time cha In addition the curro RGB values are displayed as a bar chart.</th></t<>	representation of R values in a time cha In addition the curro RGB values are displayed as a bar chart.		
EXTEACH OFF TRIGGER CONT	0 500 1000 1500 2000 2500 3000 3500 4096			

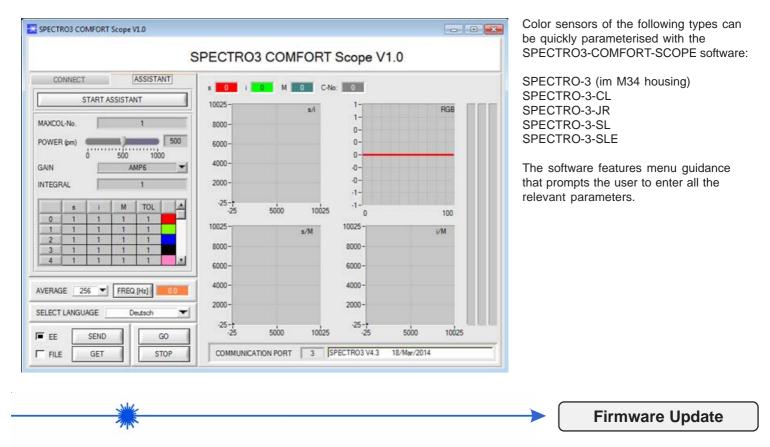
The RS232 interface (tab PARA1 or PARA2) is used for setting parameters such as:

<ul> <li>POWER MODE:</li> <li>LED MODE:</li> <li>GAIN:</li> <li>AVERAGE:</li> <li>INTEGRAL:</li> </ul>	Light power of the LED Triggering of the internal light source Used for setting the gain of the receiver Averaging over a maximum of 32768 values 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
<ul><li>MAXCOL-No.:</li><li>OUTMODE:</li><li>INTLIM:</li></ul>	Number of colors to be checked Triggering of the digital outputs Minimum intensity required for color evaluation
<ul><li>EVALUATION MODE:</li><li>CALCULATION MODE:</li></ul>	Various evaluation modes to choose from (FIRST HIT, BEST HIT, MIN DIST, COL5, THD RGB) There are 2 methods of teaching a color, which are selectable via CALCULATION MODE. The CALCULATION MODE "X Y INT - 3D" (or "s i M - 3D") uses a color sphere in space with radius TOL. Contrary to this, the CALCULATION MODE "X Y INT - 2D" (or "s i M - 2D") uses a color cylinder in space with radius CTO or siTO and with height ITO or M. The teach process is the same
- EXTEACH:	for both methods. Color evaluation according to "s i M - 2D" uses the Lab calculation method In all the evaluation modes teaching of a color can be performed externally through IN0 or by means of the button at the sensor housing
- TRIGGER:	Continuous or external or self trigger

Sensor .



#### Windows® user interface SPECTRO3-COMFORT-Scope as an alternative to SPECTRO3-SL-Scope:



#### Firmware update by means of the software "FirmwareLoader":

💥 FIRMWARE LOADER V1.1	_ <b>_</b> ×				
ESTABLISH CONNECTION					
SELECT COMPORT [1256]	TRY TO CONNECT				
FIRMWARE UPDATE					
READ FIRMWARE FROM DISK	CLEAR WINDOW				
ARM FIRMWARE LOADER	DISARM FIRMWARE LOADER				
IT IS STRONGLY RECOMMENDED TO UPDATE THE FIRMWARE ACCORDING TO THE MANUAL!					
SPECTRO3 V4.0 RT May 09 2012					
	<u>.</u>				
CREATE EEPROM BACKUP					
READ EEPROM DATA FROM SENSOR	SAVE EEPROM DATA TO SENSOR				
EEPROM TRANSFER FILE d:\BackupFiles\EEPROM_Backup 1131.dat					

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.



Diagrams

# Diagramme: DETECTION RANGE (HALF INTENSITY WIDTH) and RELATIVE INTENSITY SPECTRO-3-POL-SLE

#### Detection range (half intensity width)

SPECTRO-3-POL-SLE: 10 mm (typ.) at a working distance of 30 mm

