

# SPECTRO Series

## ► SPECTRO-3-POF-SLA

- Big assortment of plastic optic fibers of POF Series available (diffuse reflection or through-beam sensor types)
- Working range for diffuse reflection types: typ. 1 mm ... 100 mm  
Working range for through-beam types: typ. 1 mm ... 500 mm (depends on the optic fiber type used)
  - RS232 interface (USB or Ethernet adapter is available)
  - Super-bright white-light LED (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. 90 kHz (in DC- or OFF-operation)
  - 3 analog outputs, that either provide the red, green, blue components or the calculated color coordinates (X, Y, INT or s, i, M) from 0...+10V or 4...20mA
  - 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")



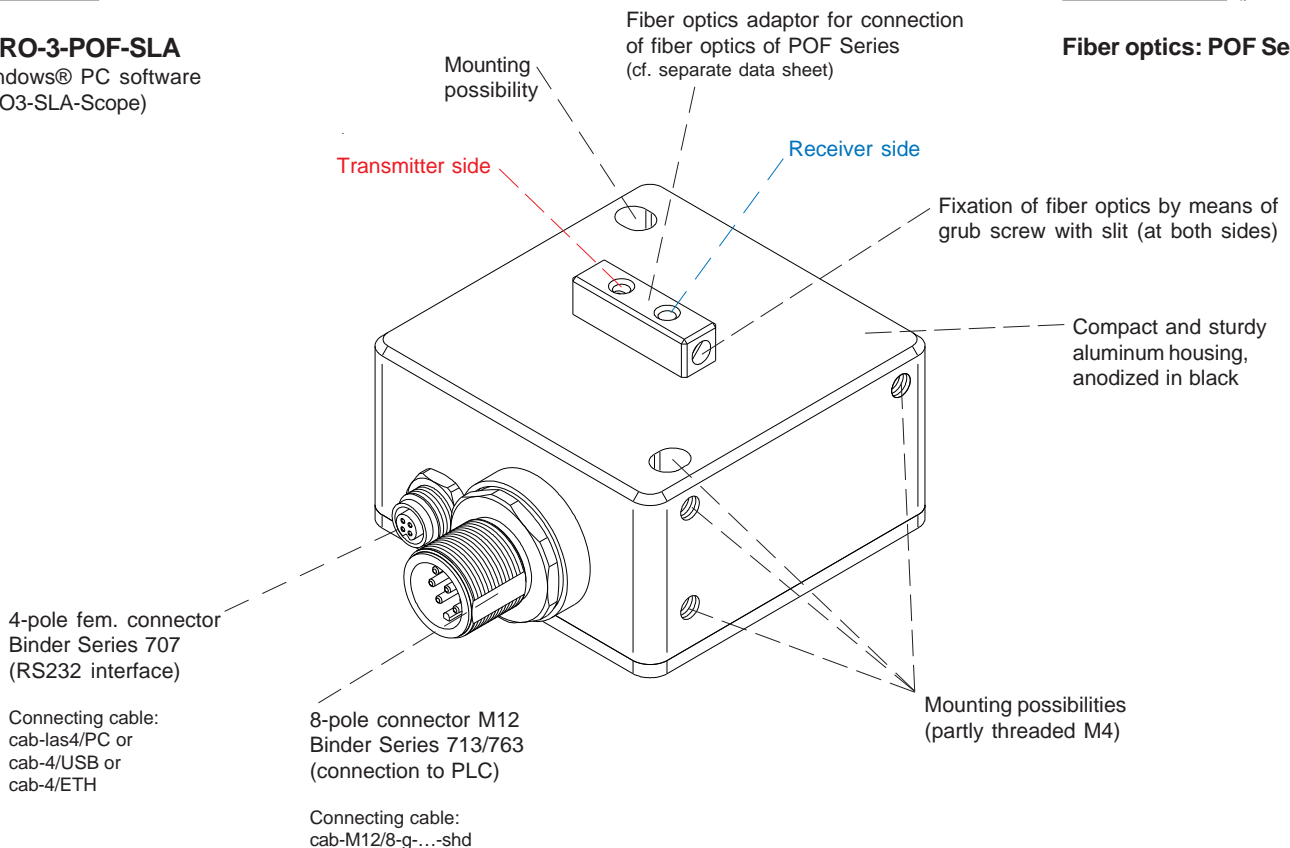
## Design

### Product name:

**SPECTRO-3-POF-SLA**  
(incl. Windows® PC software  
SPECTRO3-SLA-Scope)

### Accessories: (p. 8-9)

**Fiber optics: POF Series**

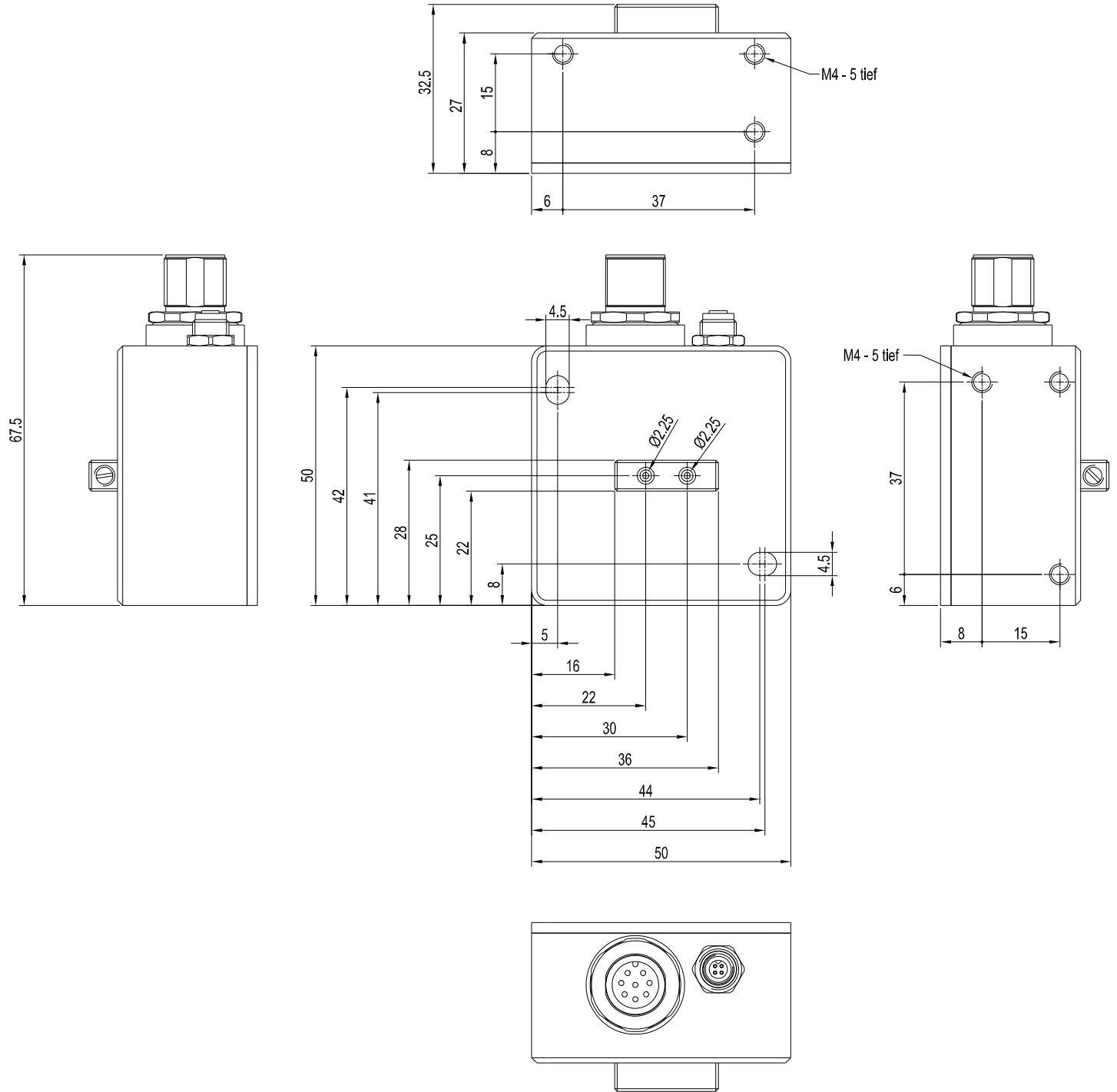




**Technical Data**

Model	SPECTRO-3-POF-SLA
Voltage supply	+24VDC ( $\pm 10\%$ ), 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 analog (3x)	ANA OUT R (red), ANA OUT gG (green), ANA OUT B (blue) (Pin 6, 7 and 8): Voltage output 0...+10V or current output 4...20mA (R,G,B or X,Y,INT or s,i,M)
Interface	RS232
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 and OFF operation: max. 90 kHz (depends on parameterization)
Analog band width	max. 90 kHz (-3dB)
Transmitter (light source)	super-bright white-light LED
Transmitter control	can be switched via PC software: AC operation (LED MODE-AC), DC operation (LED MODE-DC), OFF operation (LED MODE-OFF)
Object distance (measuring range)	with reflected light fiber optics: typ. 1 mm ... 100 mm (depends on selected fiber optics of POF Series) with transmitted light fiber optics: typ. 1 mm ... 500 mm (depends on selected fiber optics of POF Series)
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	typ. $\varnothing$ 1 mm ... $\varnothing$ 20 mm (depends on selected fiber optics of POF series)
Reproducibility	in the X, Y color range each 1 digit at 12-bit A/D conversion
Temperature drift X,Y	$\Delta X/\Delta T$ ; $\Delta Y/\Delta T$ typ. 0,2 digits/ $^{\circ}$ C (< 0,01% / $^{\circ}$ C)
Color difference	$\Delta E \geq 0,5$
Color space	X Y INT siM (Lab)
Housing dimensions	LxWxH approx. 50 mm x 50 mm x 32.5 mm (without flange connectors)
Housing material	aluminum, anodized in black
Enclosure rating	IP64
Connecting cables	to PLC: cab-M12/8-g-...-shd 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
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 $^{\circ}$ C ... +55 $^{\circ}$ C
Storage temperature range	-20 $^{\circ}$ C ... +85 $^{\circ}$ C
EMC test acc. to	DIN EN 60947-5-2

Dimensions



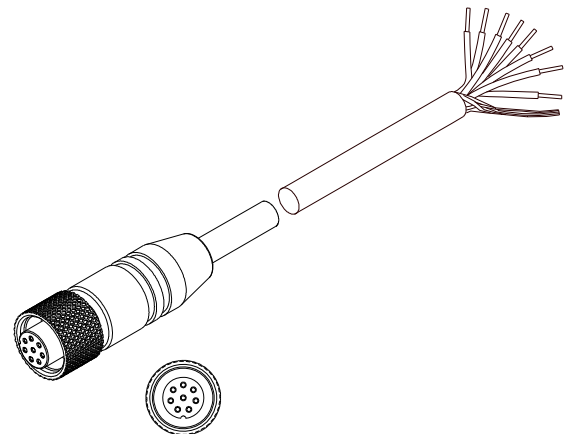
All dimensions in mm



**Connector Assignment**
**Connection to PLC:****8-pole M12 connector Binder Series 713/763**

Pin:	Color:	Assignment:
1	white	GND (0V)
2	brown	+24VDC ( $\pm 10\%$ )
3	green	IN0
4	yellow	not connected
5	grey	not connected
6	pink	ANA OUT (analog R or X or s: 0...+10V or 4...20mA)
7	blue	ANA OUT (analog G or Y or i: 0...+10V or 4...20mA)
8	red	ANA OUT (analog B or INT or M: 0...+10V or 4...20mA)

Connecting cable:  
 cab-M12/8-g-(length)-shd (shielded)  
 (standard length 2m)



cab-M12/8-g-...-shd  
 (max. length 5m, 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)

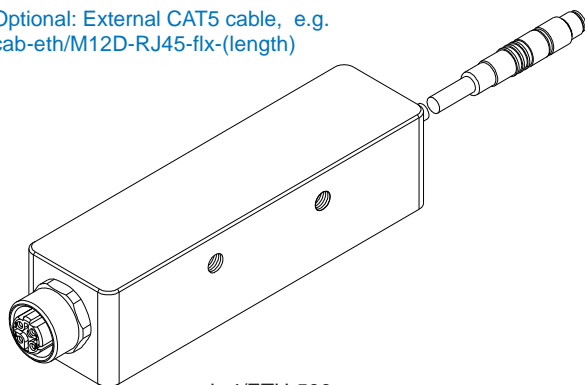
**alternative:****Connection via USB interface at the PC:**

Connecting cable (incl. driver software):  
 cab-4/USB-(length)  
 cab-4/USB-w-(length) (angle type 90°)  
 (standard length 2m)

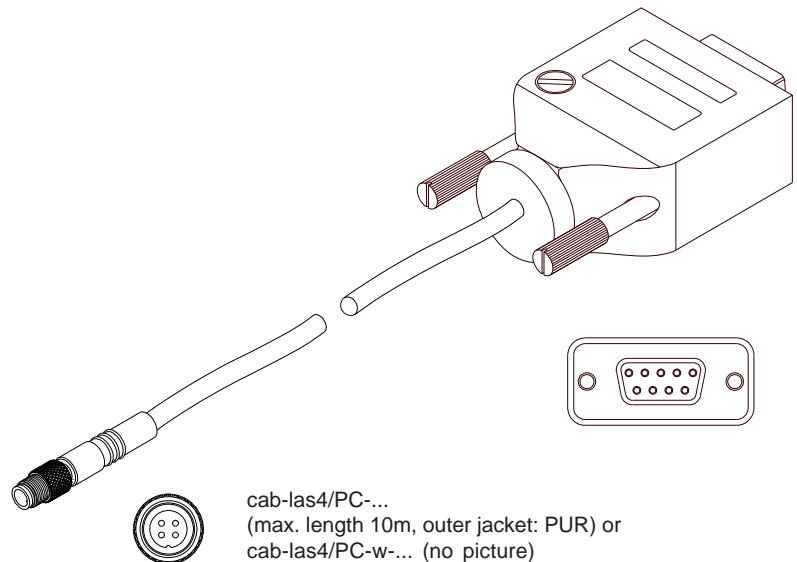
**alternative:****Connection to local network via Ethernet bus:**

Adapter (incl. software „SensorFinder“):  
 cab-4/ETH-500  
 (standard length 0.5m)

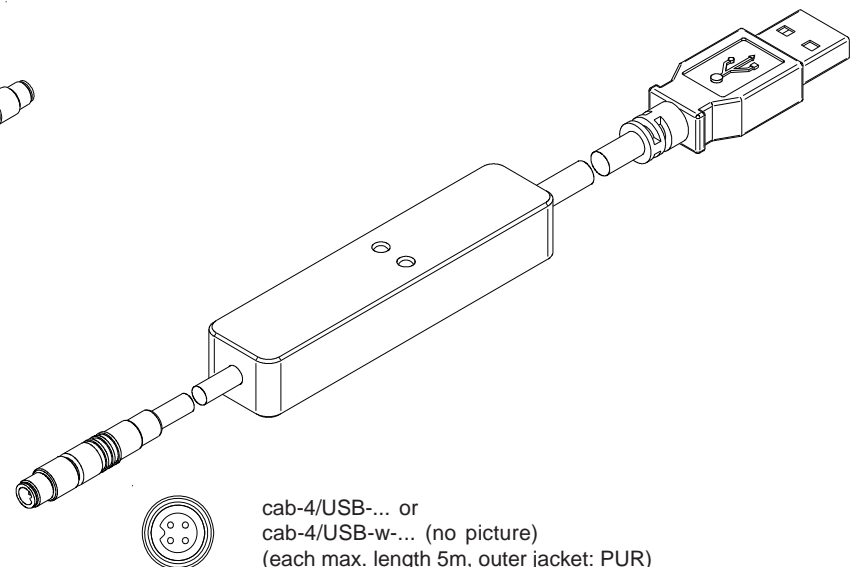
Optional: External CAT5 cable, e.g.  
 cab-eth/M12D-RJ45-flx-(length)



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



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

**Measuring Principle****Measuring principle of the color sensors of SPECTRO-3-SLA series:**

The SPECTRO-3-...-SLA 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-...-SLA color sensor is activated, the sensor detects the radiation that is diffusely reflected from the object. As a light source the SPECTRO-3 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.

The sensor is equipped with 3 analog outputs that either provide the red, green, blue components or the calculated color coordinates (X, Y, INT or s, i, M) from 0...+10V or 4...20mA.

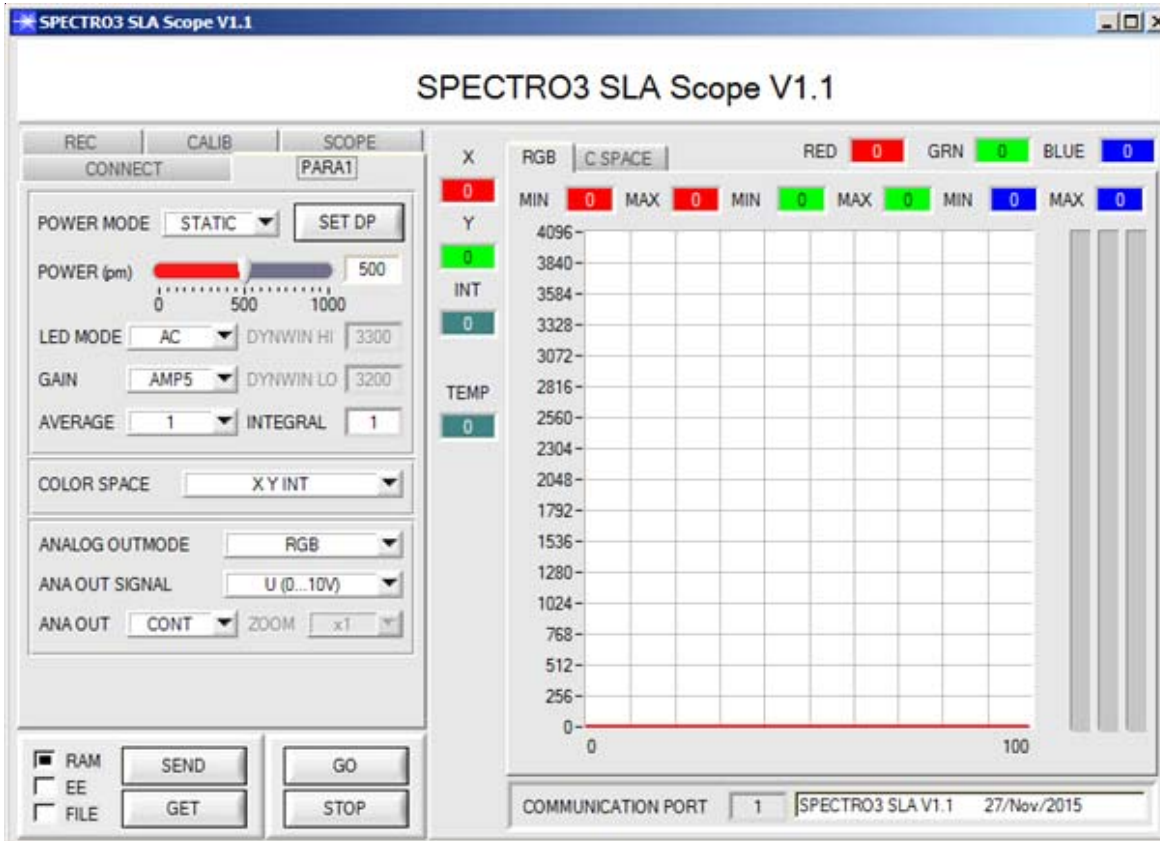
Parameters and measurement values can be exchanged between a PC and the SPECTRO-3-...-SLA color sensor through the serial RS232 interface. All the parameters for color detection also can be saved to the non-volatile EEPROM of the SPECTRO-3-...-SLA color sensor through this serial RS232 interface. When 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-...-SLA series can be calibrated (white-light balancing). Balancing can be performed to any white surface. A ColorChecker™ table with 24 color fields is available as an alternative. White-light balancing or calibration can be performed to one of the white fields.

As a light source the SPECTRO-3-UV-SLA (or SPECTRO-3-FIO-UV-SLA) color sensor uses a UV-LED (375 nm) with adjustable transmitter power to excite the luminescent marking. These UV-sensors can be optimally adjusted to almost any luminescent colorant that can be excited in the long-wave UV range (365 nm or 375 nm). The sensors of the SPECTRO-3-...-UV-SLA series also can be calibrated. Analogous to white-light balancing with color sensors, balancing of the SPECTRO-3-UV-SLA (or SPECTRO-3-FIO-UV-SLA) could be performed to any luminescent color marking.


**Parameterization**
**Windows® user interface:**

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



Under Windows® representation of the color value on a PC in numeric form and in a color chart, and representation of RGB values in a time chart. In addition the current RGB values are displayed as a bar chart.

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

- POWER MODE: Light power of the LED
- SET DP: Set Double Parameter (for setting of two parameter sets)
- LED MODE: Triggering of the internal light source
- GAIN: Used for setting the gain of the receiver
- AVERAGE: 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: 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
- ANALOG OUTMODE: used to determine the signals that the sensor provides at its analog output (ANA OUT) (R G B, RGB MM, X Y INT, s i M or CS REF)
- INTLIM: Minimum intensity required for color evaluation
- COLOR SPACE: Used to set the color space that should be calculated (X Y INT or s i M)

Tab CALIB Selection of calibration (white light balancing or offset calibration)  
 Tab SCOPE Visualises an oscilloscope  
 Tab REC Data recorder



## Firmware Update

### Firmware update by means of the software „FirmwareLoader“:



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.



# POF Series

## Plastic Optic Fibers

The plastic optic fibers of POF Series are used for **contactless detecting, counting, controlling, positioning** as well as **scanning of micro objects at processing stations, feed and automatic systems.**

- Big assortment of sensors (diffuse reflection or through-beam)
- Small sensing heads with different lines of sight (axial, angular, flexible)
- Trouble-free shortening of the plastic optic fibers
- Small bending radius, low weight
- Possible application in explosion-hazardous areas
- No interference by magnet or high-frequency fields (welding plants, switchgear et al.)
- Sturdy, flexible, vibration-proof
- For temperatures from -55°C to +80°C (or +350°C with HT type)



### Characteristics:

Our plastic optic fiber systems consist of an optoelectronic fiber optic sensor (e.g. SPECTRO-1-POF, SPECTRO-1-POF-IR, SPECTRO-3-POF-SL, SPECTRO-3-POF-SLA, SPECTRO-3-POF-SLE) and a flexible plastic optic fiber with a sensing head.

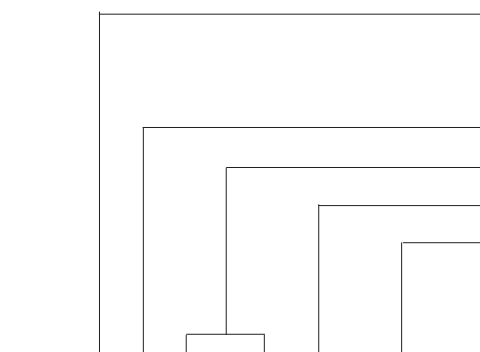
The principle of operation is similar to a through-beam sensor or a diffuse reflection sensor.

The optoelectronic fiber optic sensor includes transmitter, receiver, evaluation electronics and amplifier. It uses e.g. white light or IR light, which is transmitted through the fiber by the principle of total internal reflection (see figure "reflection inside a plastic optic fiber").

We offer a wide choice of sensing heads that can be adapted to suit varying field conditions. E.g. as a diffuse reflection sensor or as a through-beam sensor with axial or radial light emission or with a 90mm flexible stainless steel sleeve which is even capable of „looking“ round corners, if needed.

The advantages of plastic optic fibers are the small bending radii. The fiber optics are bendable in any directions within the stated bending radii. It is also possible to cut the fibers in the field to any desired length using the fiber cutting tool (POF-CUTTER).

### Order code:



**POF-D-80-d2.5/d1-(0.5)-2000**

Order code plastic optic fibers (example)

(For detailed description of the various types of plastic optic fibers, please cf. catalog „POF Series“)

#### Function principle of the plastic optic fiber

(D = through-beam operation, D/90 = through-beam operation, angular 90°

R = reflective light operation, R/90 = reflective light operation, angular 90°)

**Working range (scanning range)** (in mm)

**Sensor head type** (e.g. d2.5/d1 = sensor head case style Ø 2.5mm and Ø 1mm)

**Cross section of fiber bundle** (in mm)

**Total length of optic fiber** (in mm)

Special versions:

-**HT**: Sensor head for use in applications with high temperature (up to 350°C)

-**VA**: Stainless steel sheathing (VA / SUS) of the optical fibers

-**CSC**: Cross section converter

-**SPX**: Simplex (plastic optic fiber in simple version without a sensor head)





(For detailed description of the various types of plast optic fibers, please cf. catalog „POF Series“)

#### Diffuse reflection sensors:

Reflective light fiber optics - optics axial	Catalog
POF-R-12-18x14x6-(0.5)-2000	page 4
POF-R-25-d4/d1.5-(1.1)-1000	page 4
POF-R-30-M6x0.75/d2.5-(1.0)-2000	page 5
POF-R-32-d3-(0.5)-2000	page 5
POF-R-32-M4/M3-(0.5)-2000	page 6
POF-R-35-d4/d3-(0.5)-2000	page 6
POF-R-35-M4/d3-(0.5)-2000	page 7
POF-R-40-M6x0.75/d4-(1.0)-2000	page 7
POF-R-45-M4/d2.5-(0.5)-2000	page 8
POF-R-55-M4/M3-(0.5)-2000	page 8
POF-R-60-M5x0.5-(0.5)-2000	page 9
POF-R-75-d6/d4-(1.0)-2000	page 9
POF-R-75-M6/d4.5-(1.0)-2000	page 10
POF-R-90-M4-(1.0)-2000	page 10
POF-R-110-20x20x5-(1.1)-2000	page 11
POF-R-110-d3-(1.0)-2000	page 11
POF-R-110-M6/d2.5-(1.1)-2000	page 12
POF-R-125-M3/d2-(0.5)-2000	page 12

POF-R-125-M4/d2.5-(0.5)-2000	page 13
POF-R-220-M6-(1.1)-2000	page 13
POF-R-230-15x9.5x5.2-(1.1)-2000	page 14
POF-R-400-M6/d4.5-(1.0)-2000	page 14

Reflective light fiber optics - high temperature resistant	
POF-R-HT-M6x0.75/d4-(1.0)-2000-VA	page 15

Reflective light fiber optics - optics angular 90°	
POF-R/90-12-24x21x4-(0.5)-2000	page 16
POF-R/90-25-d3/d1.5-(0.5)-2000	page 16
POF-R/90-45-d5/d2-(1.1)-2000	page 17
POF-R/90-85-M8/d4-(1.0)-2000	page 17

Reflective light fiber optics - simplex:	
POF-SPX1-d2.2-(1.0)-(Länge)	page 18

#### Through-beam sensors:

Through beam fiber optics - optics axial	Catalog
POF-D-40-d1-(0.5)-500	page 19
POF-D-80-15x15x5-(0.5)-2000	page 19
POF-D-100-d3/d1.5-(0.5)-2000	page 20
POF-D-100-d4/d3-(0.5)-2000	page 20
POF-D-100-M3/d2-(0.5)-2000	page 21
POF-D-100-M4/d1.2-(1.0)-2000	page 21
POF-D-120-M4/M2.6-(1.0)-2000	page 22
POF-D-140-d1.5-(0.5)-2000	page 22
POF-D-140-M3/d0.88-(0.5)-2000	page 23
POF-D-140-M3/d2-(0.5)-2000	page 23
POF-D-140-M4/M2.6-(1.0)-2000	page 24
POF-D-200-M4/d3-(1.0)-2000	page 24
POF-D-290-d3/d2-(1.1)-2000	page 25
POF-D-400-M4/d1.48-(1.0)-2000	page 25
POF-D-440-M4/d3-(1.0)-2000	page 26
POF-D-530-M4/M2.6-(1.0)-2000	page 26
POF-D-800-d2.5-(1.0)-2000	page 27
POF-D-1400-12x8x3-(0.5)-2000	page 27

POF-D-14000-M14-(1.0)-10000	page 28
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Through beam fiber optics - optics angular 90°	
POF-D/90-100-d4-(1.0)-2000	page 28
POF-D/90-180-d2/d1-(1.0)-2000	page 29
POF-D/90-200-d2.5/d1.5-(1.0)-2000	page 29
POF-D/90-200-M4/d3-(1.0)-2000	page 30
POF-D/90-230-M4/M2.6-(1.0)-2000	page 30
POF-D/90-350-69x20x5-(1.1)-2000	page 31
POF-D/90-400-12x8.5x3-(0.5)-2000	page 31
POF-D/90-700-d4-(1.1)-2000	page 32
POF-D/90-800-12x8x3-(0.5)-2000	page 32
POF-D/90-1500-31x13.5x4.2-(1.1)-2000	page 33
POF-D/90-CSC-31x13.5x4.2-(2.2x11)-2000	page 34

Through beam fiber optics - simplex:	
POF-SPX2-d2.2-(1.0)-(Länge)	Seite 35

#### Accessories:

Fiber cutting tool	Catalog
POF-CUTTER	page 35

Reduction sleeve (included in scope of delivery)	
POF-SLV-2.2/1.1	page 36
POF-SLV-2.2/1.3	page 36