

# SPECTRO Series

## ► SPECTRO-1-POF-IR

- 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)
- IR LED, 860 nm (AC-, DC-operation, can be switched or OFF in case of luminous objects)
- High scan frequency
- Gray scale detection (12-bit resolution)
- Insensitive to outside light (in AC-operation)
- Brightness correction can be activated (STAT/DYN)
- Averaging can be activated (from 1 up to over 32000 values)
- TEACH via PC or PLC
- 2 digital inputs (0V/+Ub)
- 2 digital outputs (max. 60 kHz switching frequency)
- 1 analog output (0V...+10V or 4...20mA), selectable via software
- Switching state indication by means of 2 yellow LEDs
- RS232 interface (USB or ETHERNET converter available)
- Parameterizable via Windows® software, scope function
- Temperature compensated (from 0°C to 60°C)
- Automatic threshold correction can be activated
- Switching threshold can be parameterized relative or absolute
- Various switching threshold functions (window, upper/lower threshold)
- Intensity control of luminous objects (LEDs, halogen lamps, displays, ...)
- Connection of an external IR laser light source ELS-IRL is possible



## Design

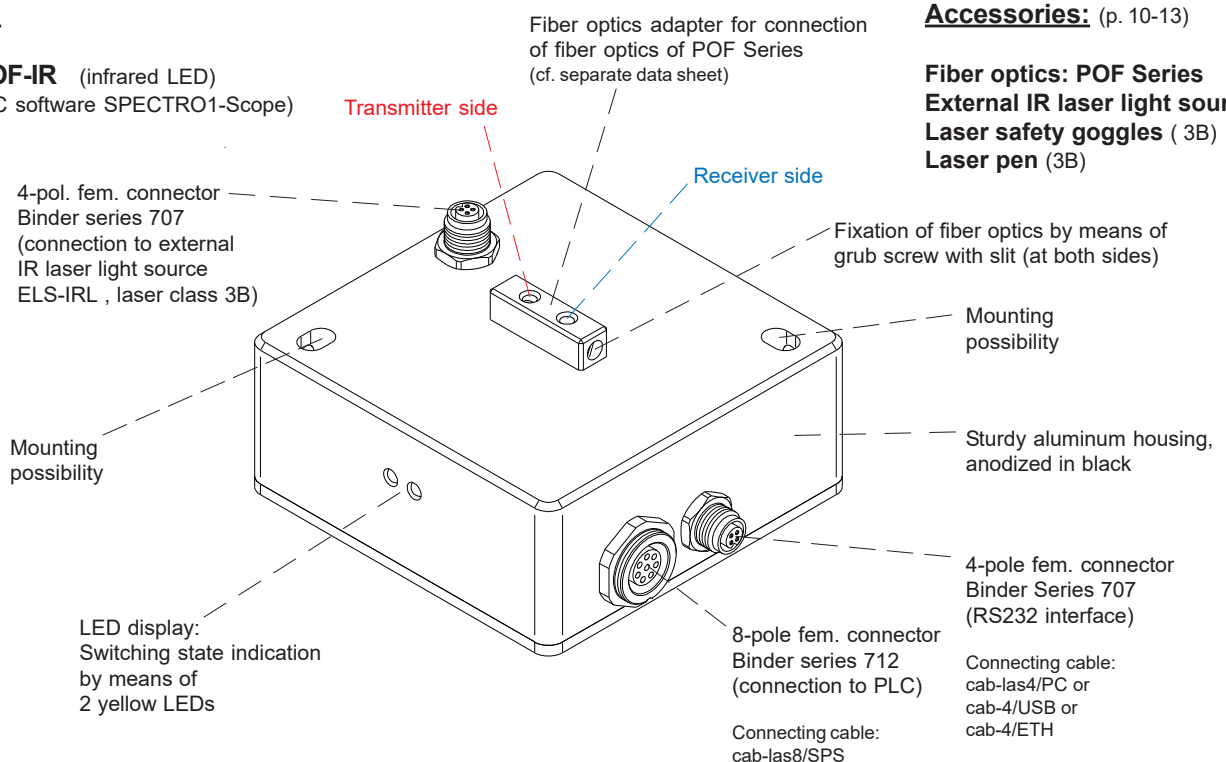
### Product name:

**SPECTRO-1-POF-IR** (infrared LED)  
(incl. Windows® PC software SPECTRO1-Scope)

### Accessories:

 (p. 10-13)

**Fiber optics: POF Series**  
**External IR laser light source**  
**Laser safety goggles (3B)**  
**Laser pen (3B)**





**Technical Data**

Model	SPECTRO-1-POF-IR		
Voltage supply	+24VDC ( $\pm 10\%$ ), reverse polarity protected, overcurrent protected		
Current consumption	< 160 mA (in case of use with external infrared laser light source ELS-IRL: < 500 mA)		
Max. switching current	100 mA, short circuit proof		
Switching state indication	2 yellow LED visualize the physical state of the outputs OUT0 and OUT1		
Digital inputs (2x)	IN0 and IN1 (Pin 3 and 4): digital (0V/+24V)		
Digital outputs (2x)	OUT0 and OUT1 (Pin 5 and 6): digital (0V/+24V), npn-/pnp-able (bright-/dark-switching, can be switched)		
Analog output (1x)	ANALOG (Pin 8): voltage 0 ... +10V or current 4 ... 20mA, adjustable via PC software		
Interface	RS232		
Pulse lengthening	0 ... 100 ms, adjustable via PC software		
Averaging	max. 32768 values, adjustable via PC software		
Scan frequency (LED mode AC, DC or OFF, can be switched via PC software)	LED mode AC (depends on parameterization):		LED mode DC / OFF (depends on parameterization):
	Frequency [Hz]	Digital outputs	Analog output
	Max. 50 000	Off	Off
	Max. 48 000	On	Off
	Max. 42 000	Off	On
Max. 41 000	On	On	On
Measurements were made with the smallest gain at the receiver (AMP1). At the highest gain (AMP8), the frequency is reduced by a factor of 10.			The frequency is independent of the gain set at the receiver.
Switching frequency	max. 60 kHz		
Analog band width	max. 90 kHz (-3 dB)		
Transmitter (light source)	IR LED (860 nm)		
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	photo diode		
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	2 digits at 12-bit A/D conversion		
Housing dimensions	LXWxH approx. 65 mm x 65 mm x 36 mm (incl. adaptor for plastic optic fibers, 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		
Type of connector	connection to PLC: 8-pole fem. connector (Binder 712) connection to PC: 4-pole fem. connector (Binder 707) connection to external infrared laser light source ELS-IRL or ELS-IRL-FIO: 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		
External light source	possibility of connection of an external laser light source (each class 3B laser product): infrared laser light source ELS-IRL (with integrated optics)		



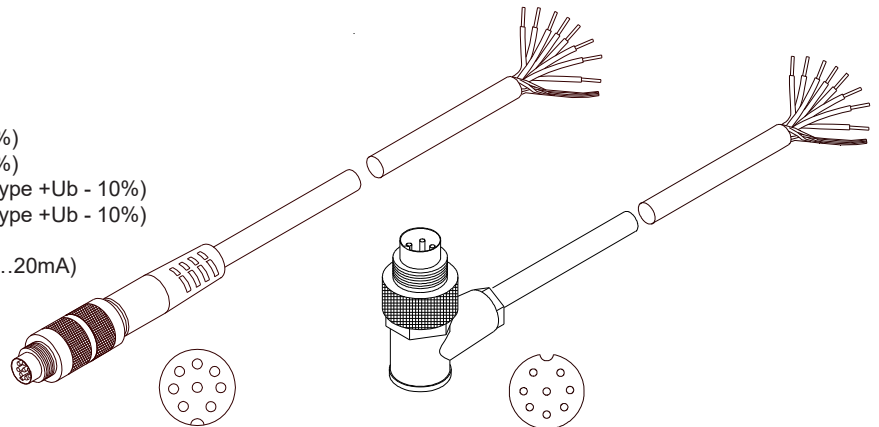
## Connector Assignment

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

Pin:	Color:	Assignment:
1	white	GND (0V)
2	brown	+24VDC ( $\pm 10\%$ )
3	green	IN0 (Digital 0: 0 ... 1V, Digital 1: +Ub - 10%)
4	yellow	IN1 (Digital 0: 0 ... 1V, Digital 1: +Ub - 10%)
5	grey	OUT0 (Digital 0: Type 0 ... 1V, Digital 1: Type +Ub - 10%)
6	pink	OUT1 (Digital 0: Type 0 ... 1V, Digital 1: Type +Ub - 10%)
7	blue	not connected
8	red	ANALOG (voltage 0...+10V <u>or</u> current 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)

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

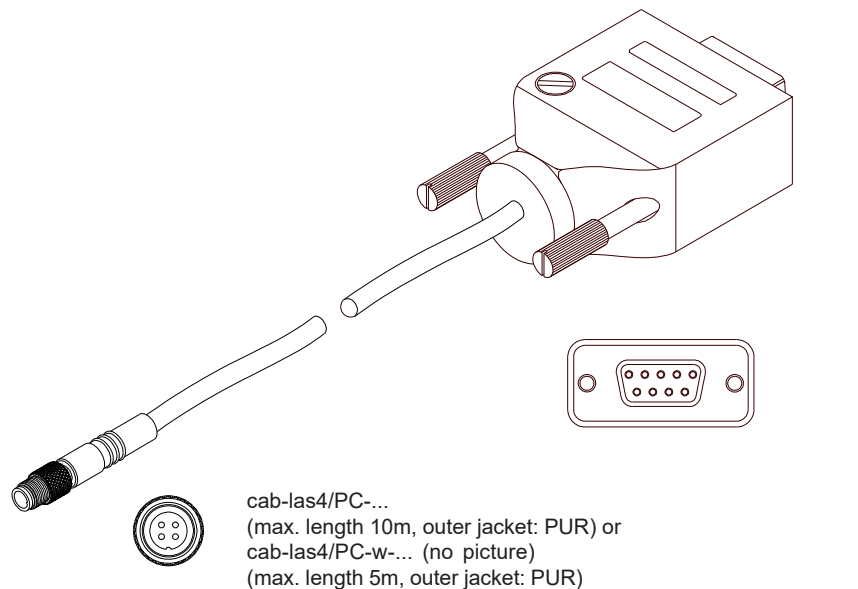
USB converter (incl. driver software):  
cab-4/USB-(length)  
cab-4/USB-w-(length) (angle type 90°)  
(standard length 2m)

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

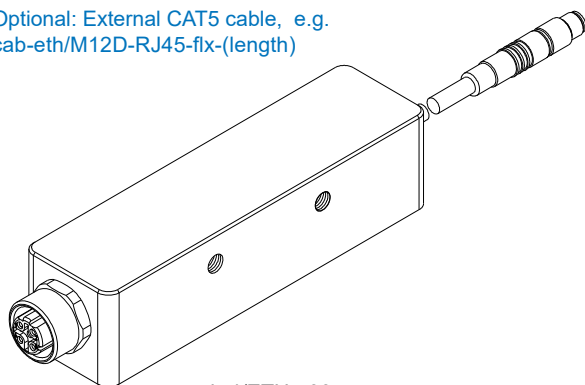
Ethernet converter (incl. software „SensorFinder“):  
cab-4/ETH-500  
(standard length 0.5m)

Optional: External CAT5 cable, e.g.

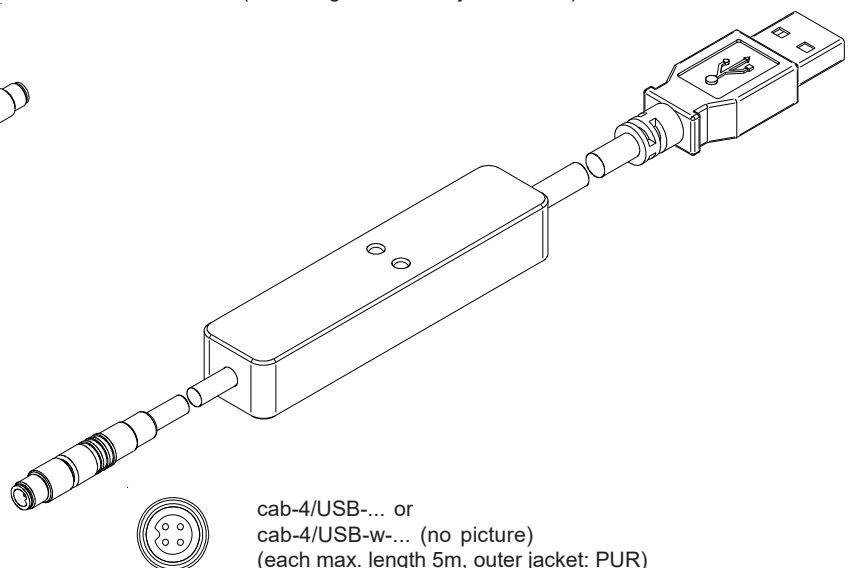
cab-eth/M12D-RJ45-flx-(length)



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



cab-4/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)



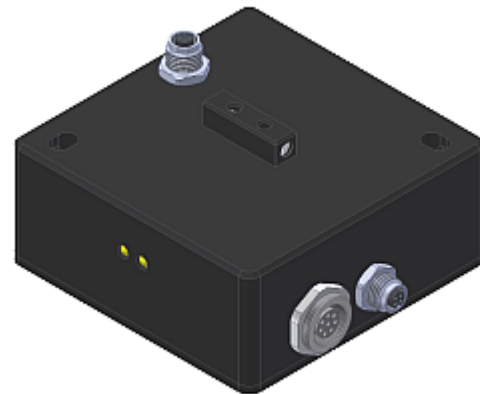
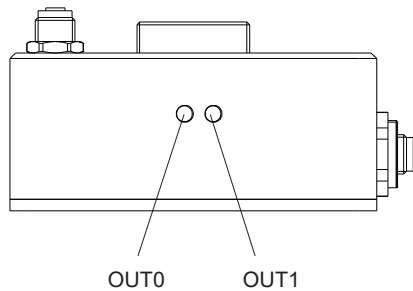
cab-4/USB-... or  
cab-4/USB-w-... (no picture)  
(each max. length 5m, outer jacket: PUR)



## LED Display

### LED display:

By means of the two LEDs the physical state of the two outputs OUT0 and OUT1 is visualized:



## Measuring Principle

### Measuring principle of the sensors of SPECTRO-1 series:

The sensors of the SPECTRO-1 series are of single-channel design, i.e. they acquire the analog signal that comes from a receiver and evaluate this signal. Various light sources such as white light, UV light, IR light, or a laser can be used as a transmitter. The receiver is correspondingly matched to the transmitter. The acquired analog signal is provided through a voltage output and a current output.

The software can be used to select various evaluation modes for the analog signal. The status of the analog signal is provided through 2 digital outputs in accordance with the selected evaluation mode. A digital input allows external "teaching" of the sensor. An additional input allows the "freezing" of the analog output signal upon a positive input edge.

The SPECTRO-1 sensor allows highly flexible signal acquisition. The sensor, for example, can be operated in alternating-light mode (AC mode), which means the sensor is not influenced by external light, or in constant-light mode (DC mode), which provides outstanding high-speed sensor operation. An OFF function deactivates the sensor's integrated light source and changes to DC mode, which allows the sensor to detect so-called "self-luminous objects". With the stepless adjustment of the integrated light source, the selectable gain of the receiver signal, and an INTEGRAL function the sensor can be adjusted to almost any surface or any "self-luminous object".

A micro-controller performs 12-bit analog/digital conversion of the analog signal, which allows recording and evaluation of the signal. Furthermore the SPECTRO-1 sensor offers various options for intelligent signal processing such as e.g. dirt accumulation compensation.

Parameters and measurement values can be exchanged between PC and sensor either through RS232 or Ethernet (using an Ethernet converter). Through the interface all the parameters can be stored in the non-volatile EEPROM of the sensor.

The PC software facilitates the parameterisation, diagnostics, and adjustment of the sensor system (oscilloscope function). The software furthermore provides a data recorder function that automatically records data and stores them on the hard disk of the PC.

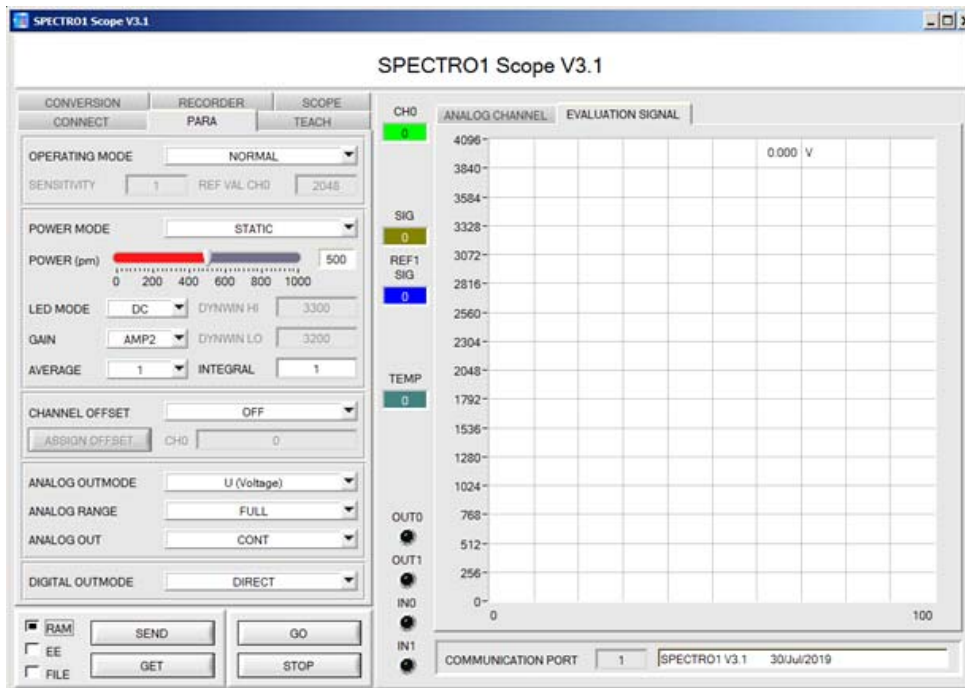
SPECTRO-1 sensors are temperature-compensated over a range of 0°C to 80°C.



## Parameterization

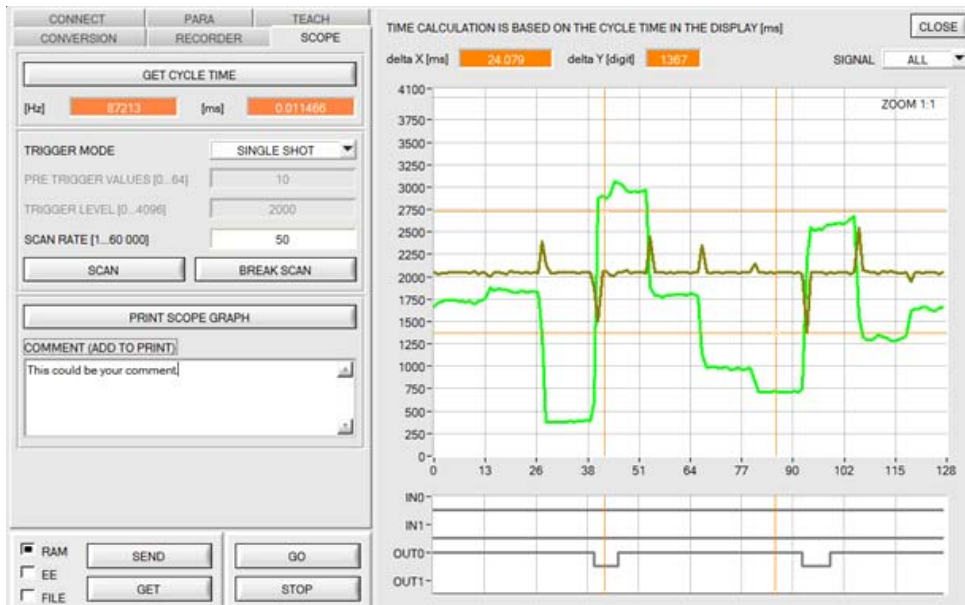
### Windows® user interface:

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



The PC software SPECTRO1-Scope facilitates the parameterization, the diagnosis, and the adjustment of the sensor system (oscilloscope function). Moreover, the software features a data recorder function that allows the automatic recording of recorded data and the saving of those at the hard disk of the PC.

Parameters and measurement values can be exchanged between PC and sensor either through RS232 or Ethernet (using an Ethernet converter). Through the interface all the parameters can be stored in the non-volatile EEPROM of the sensor.

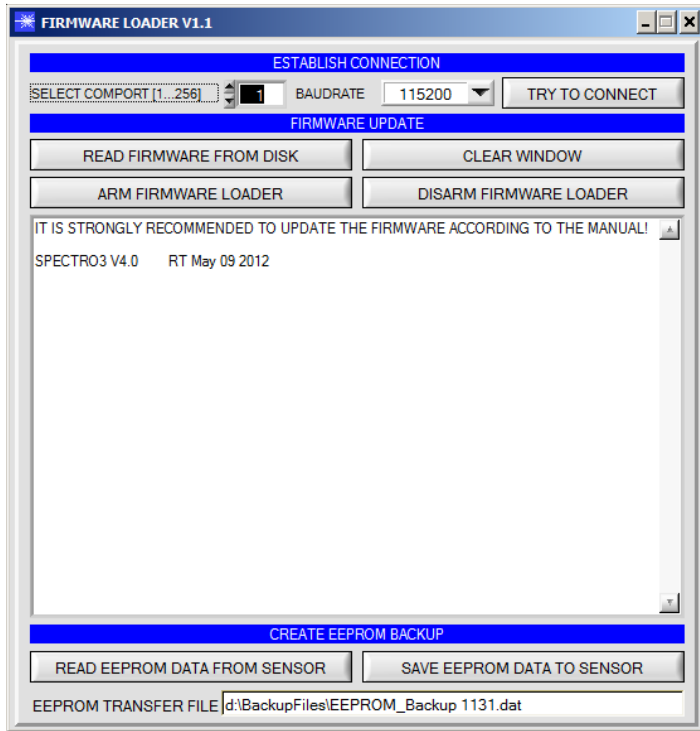


The SCOPE tab visualises an oscilloscope.



## Firmware Update

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



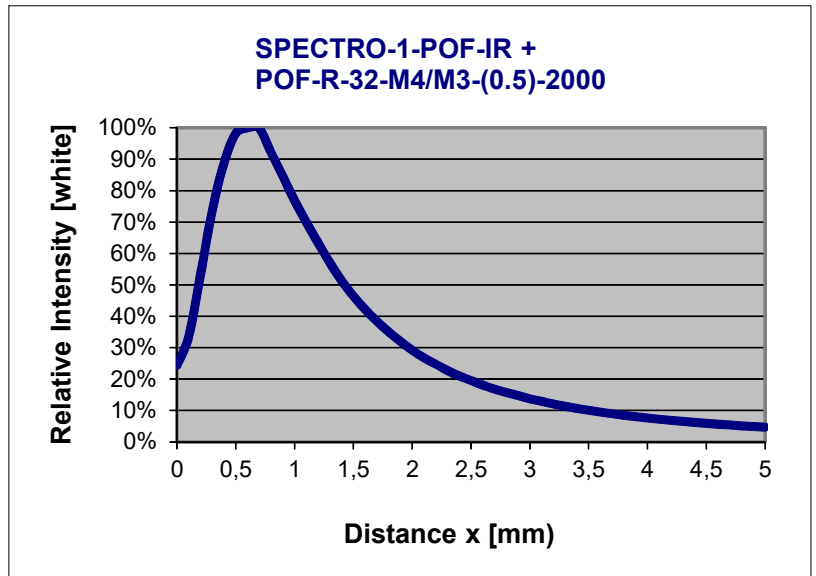
The software „Firmware Loader“ allows the user to perform an automatic firmware update. The update will be carried out through the RS232 interface.

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.

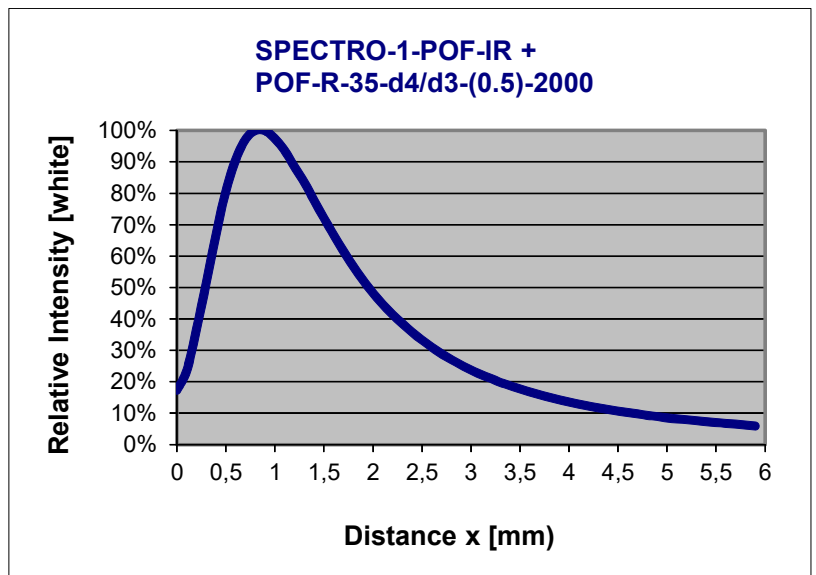


Diagrams

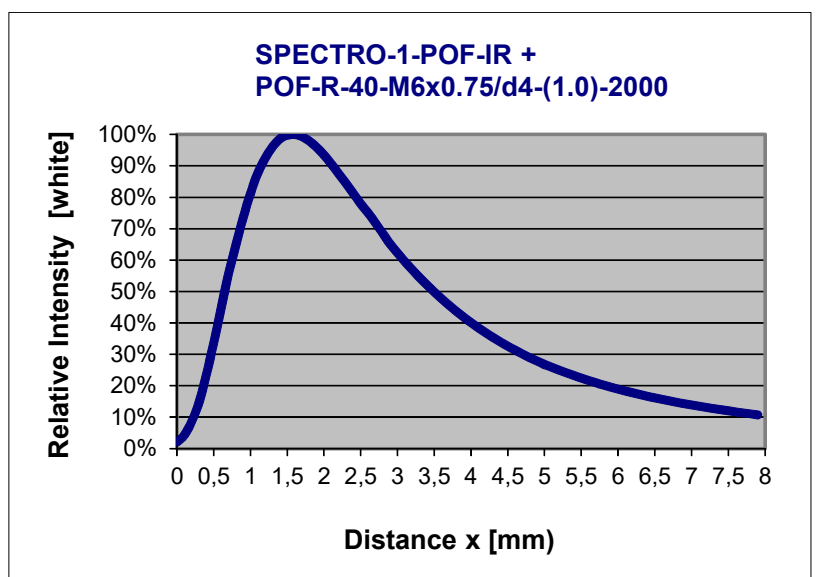
**Diagrams:** RELATIVE INTENSITY depending on the distance of the object (white paper) to the optical fiber head



Relative Intensity  
SPECTRO-1-POF-IR with optical fiber  
POF-R-32-M4/M3-(0.5)-2000  
100% at an object distance of 0.6 mm  
(INTENSITY 4040)



Relative Intensity  
SPECTRO-1-POF-IR with optical fiber  
POF-R-35-d4/d3-(0.5)-2000  
100% at an object distance of 0.8 mm  
(INTENSITY 3705)



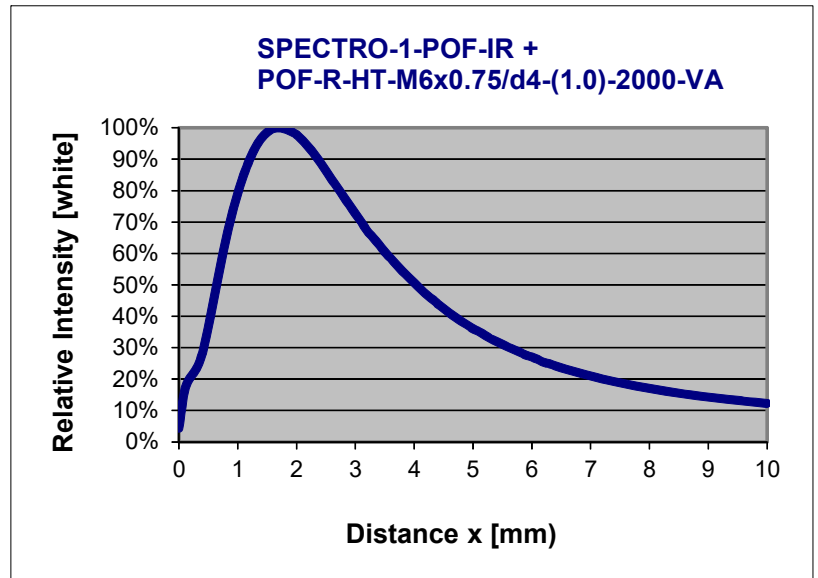
Relative Intensity  
SPECTRO-1-POF-IR with optical fiber  
POF-R-40-M6x0.75/d4-(1.0)-2000  
100% at an object distance of 1.6 mm  
(INTENSITY 3822)





Diagrams

**Diagrams:** RELATIVE INTENSITY depending on the distance of the object (white paper) to the optical fiber head



Relative Intensity  
 SPECTRO-1-POF-IR with optical fiber  
 POF-R-HT-M6x0.75/d4-(1.0)-2000-VA  
 100% at an object distance of 1.7 mm  
 (INTENSITY 3957)



# 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.

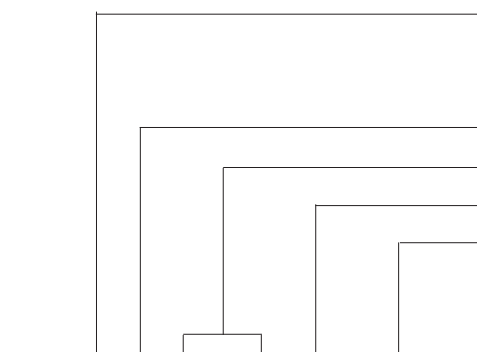
The principle of operation is similar to a through-beam sensor or a diffuse reflection sensor.

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

External Light Source

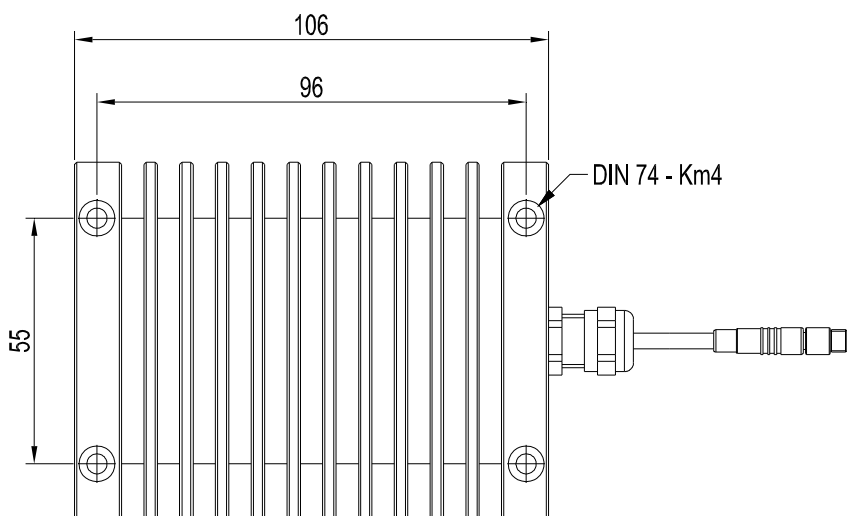
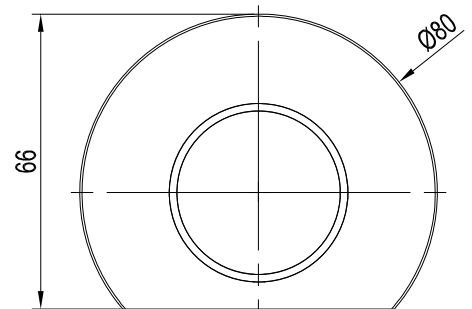
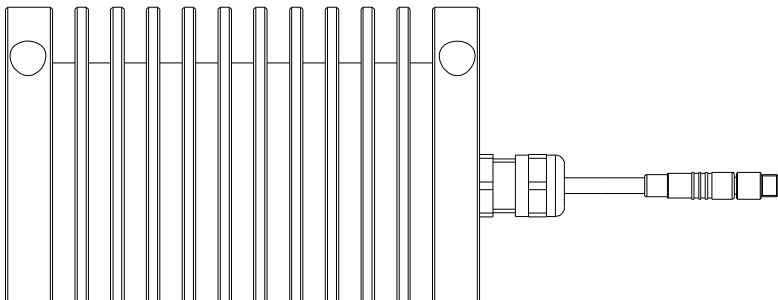
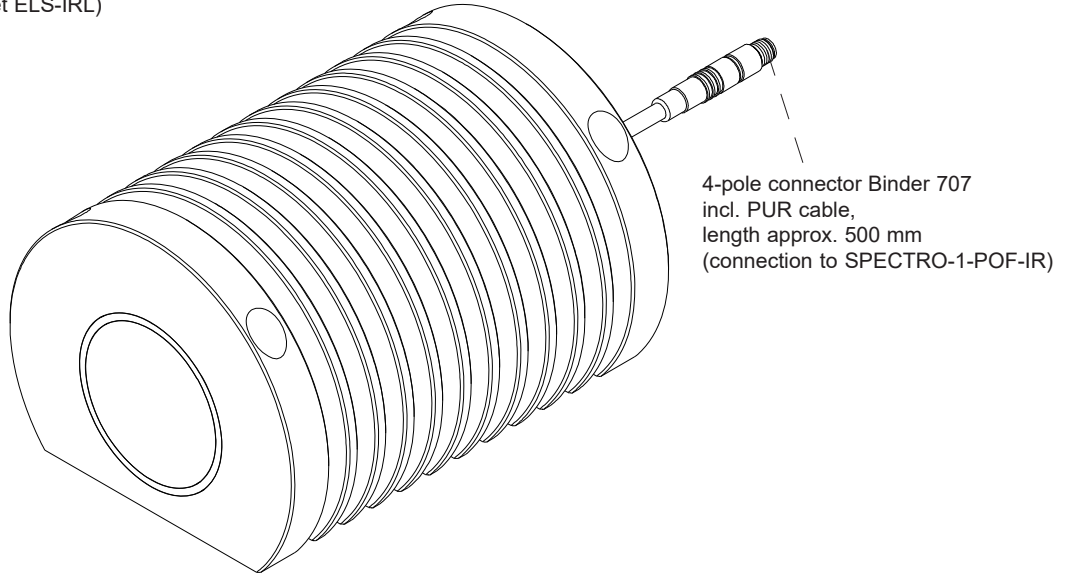
ELS-IRL

External IR laser light source (class 3B)

(please order separately, also cf. data sheet ELS-IRL)

Invisible laser radiation  
AVOID EXPOSURE  
TO BEAM.  
Class 3B laser product.  
(DIN EN 60825-1: 2001-11)

$P_0 = 500 \text{ mW}$   
 $P_p = 1 \text{ W}$   
 $t = 4 \mu\text{s} - 500 \mu\text{s}$   
 $F = 145 \text{ Hz}$   
 $\lambda = 980 \text{ nm}$



All dimensions in mm



Accessories

Laser safety goggles:

**LUMI-SG-IRL-3B**  
(suitable for class 3B laser products)



Laser pen:

**LUMI-LP-IRL/UV/VIS-3B**  
(suitable for class 3B laser products)

