The Best of Two Worlds.
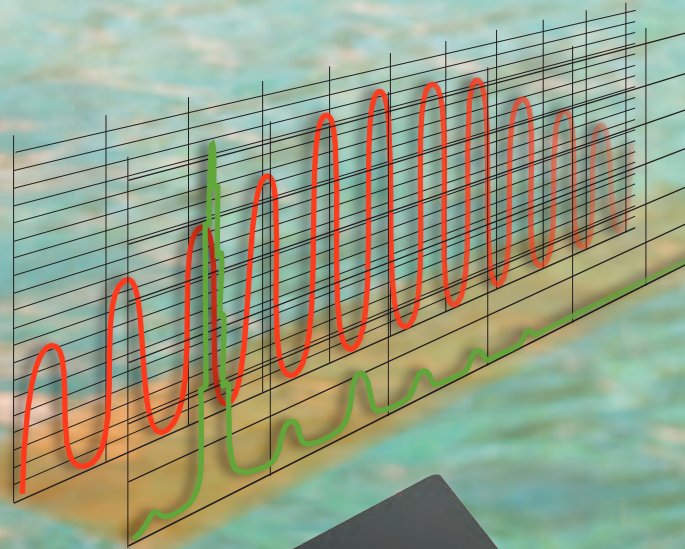
Color-Gloss Inspection with Structure Detection.
Gloss Inspection with Structure Detection.

COAST Series / GLAST Series

Color-Gloss and Structure Sensors
Gloss and Structure Sensors

Sensor Instruments

Let's make sensors more individual

COAST Series

▶   **COAST-85-45°/45°**

- Recommended measurement distance: 85 mm ± 5 mm
- Big dynamic range due to focused white-light operation
- Two controllers in one sensor (color and gloss+structure)
- Up to 31 colors and up to 31 structure vectors can be stored
- RS232 interface (USB or Ethernet adapter is available)
- 2 ring light illuminations with each 9 super-bright
  white-light LEDs, focused (AC-, DC-, PULSE-operation
  or OFF for luminous objects can be switched)
- Evaluation of the forward and backward scattering
  (alternating, can be switched via input IN0)
- Color detection, contrast detection, gray scale detection
  as well as structure evaluation
- Insensitive to outside light (in AC- or PULSE-operation)
- Brightness correction can be activated (STAT/DYN)
- Several TEACH functions (via PC, PLC, or push button)
- Various evaluation algorithms can be activated
- "BEST HIT" mode ("human color assessment")
- Switching state display by means of 2x 5 yellow LEDs
- Parameterizable via Windows® software, scope function
- Temperature compensated
- 3-color filter detector (true color detector: "human color perception") and line detector (512 pixel)

Design

Product name:

COAST-85-45°/45°

(incl. Windows® PC software
SPECTRO3-Scope and STRUCT-Scope)

45°/45°: Optical axes of the two ring lights are inclined each
at an angle of 45° from the vertical.

Several transmitter/receiver combinations are possible:
IN0=1:   Backward refection + color sensor
          Forward reflection + structure sensor
IN0=0:   Forward reflection + color sensor
          Backward reflection + structure sensor

Optics holding device
(aluminum, anodized),
scratch-resistant optics
cover made of glass

Receiver optics with
3-color filter detector
(True Color), trans-
mitter optics with
9 white-light LED

Receiver optics with fixed aperture
and line detector, transmitter optics
with 9 white-light LED

Optics holding device
(aluminum, anodized),
scratch-resistant optics
cover made of glass

Sturdy aluminum
housing, anodized
in black

COLOR

STRUCTURE

8-pole fem. conn.
Binder Series 712
(connection of
color sensor to PLC)

Connecting cable:
cab-las8/SPS

TEACH button
(external teaching
of color sensor
via input IN0)

LED display:
Switching state
indication for
color sensor
by means of 5
yellow LED)

4-pole fem. conn.
Binder Series 707
(connection of color
sensor to PC)

Connecting cable:
cab-las4/PC or
cab-4/USB or
cab-4/ETH

Mounting possibilities
(threaded M5 or
Ø 9.2 mm)

8-pole fem. conn.
Binder Series 712
(connection of
structure sensor
to PLC)

Connecting cable:
cab-las8/SPS

4-pole fem. conn.
Binder Series 707
(connection of
structure sensor
to PC)

Connecting cable:
cab-las4/PC or
cab-4/USB or
cab-4/ETH

LED display:
Switching state indication
for structure sensor
by means of 5 yellow LED)

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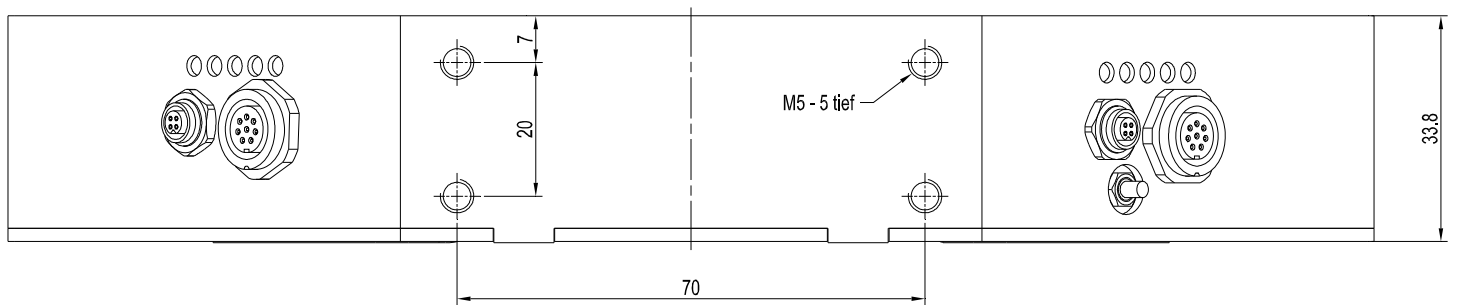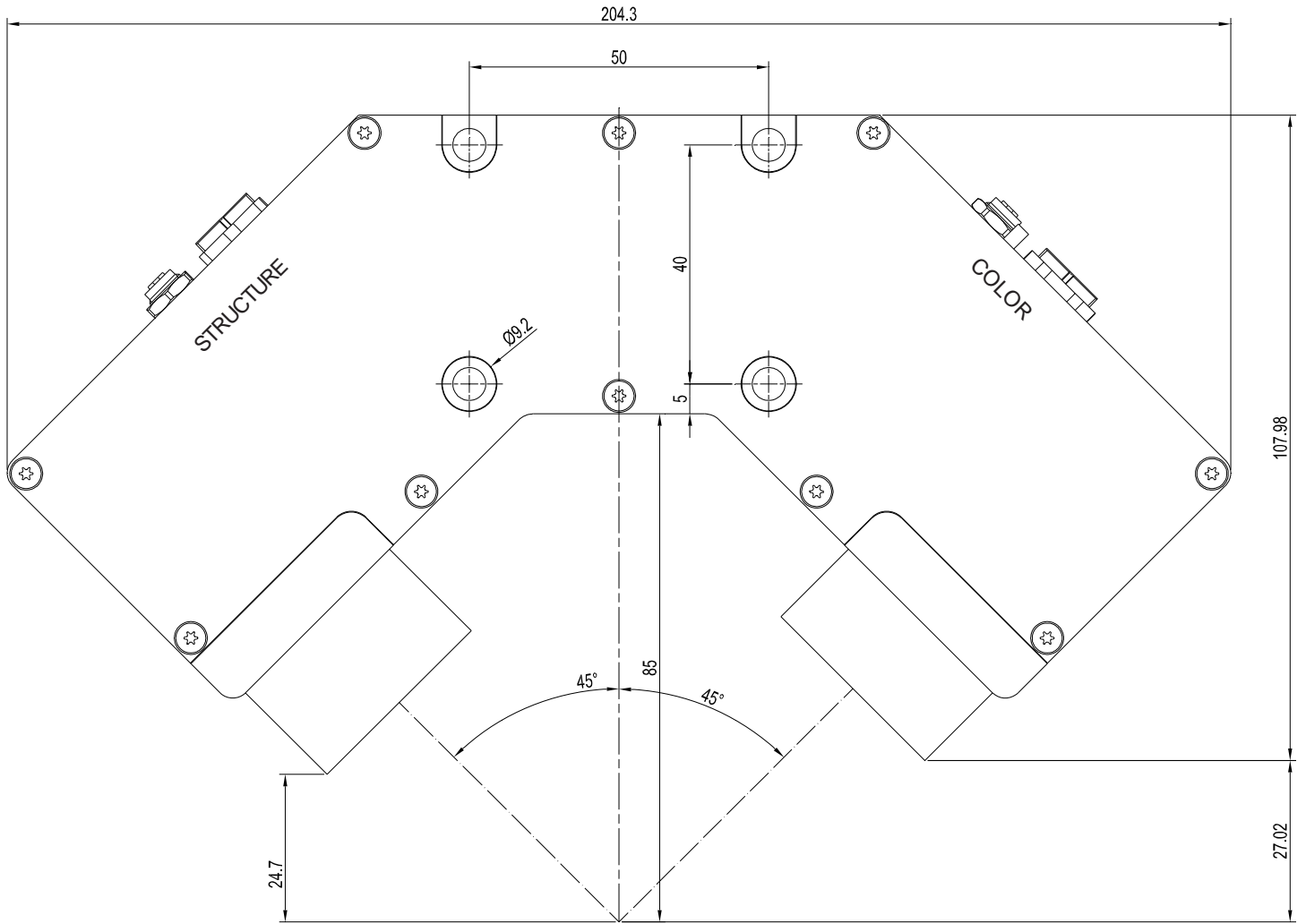
Technical Data

Model	COAST-85-45°/45°
Voltage supply	+24VDC (± 10%), reverse polarity protected, overcurrent protected
Current consumption	< 500 mA
Max. switching current	100 mA, short circuit proof
Switching state indication (each 5x LED)	Color sensor: 5 yellow LED visualize the physical state of the outputs OUT0 ... OUT4 Structure sensor: 5 yellow LED visualize the physical state of the outputs OUT0 ... OUT4
Input digital (each 1x)	Color sensor: 1 digital input: IN0 (Pin 3), digital (0V/+24V) or teach button at the housing Structure sensor: 1 digital input: IN0 (Pin 3), digital (0V/+24V) The digital inputs IN0 of color sensor and structure sensor are connected internally
Outputs digital (each 5x)	Color sensor: OUT0...OUT4 (Pin 4..8): digital (0V/+24V), pn-/pnp-able (bright-/dark-switching, can be switched) Structure sensor: OUT0...OUT4 (Pin 4..8): digital (0V/+24V), pn-/pnp-able (bright-/dark-switching, can be switched)
Interface (each 1x)	Color sensor: RS232, structure sensor: RS232
Pulse lengthening	Color sensor: 0 ... 100 ms (adjustable via PC software), structure sensor: 100 ms ... 1 s (adjustable via PC software)
Averaging	max. 32768 values, adjustable via PC software
Scan frequency (alternating light operation/ direct light operation)	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) PULSE operation: max. 5 kHz (depends on parameterization)
Max. measuring frequency	Color sensor: typ. 10 kHz (AC), structure sensor: typ. 10 Hz
Angle of incidence	Optical axes of the two ring lights are inclined each at an angle of 45° from the normal (vertical)
Measuring distance	typ. 85 mm ± 5 mm
Transmitter (light source)	2 optics with each 9 super-bright white-light LED, focused
Transmitter control	Can be switched via PC software: AC operation (LED MODE-AC), DC operation (LED MODE-DC)
Receiver	Color sensor: 3-color filter detector (TRUE COLOR, "human color perception"), color filter curves acc. to CIE 1931 structure sensor: line detector, 512 pixel
Receiver gain setting respectively exposure time	Color sensor: 8 steps (AMP1 ... AMP8), adjustable via PC software + INTEGRAL (software implemented addition of consecutive values) Structure sensor: software implemented adjustment of exposure time (EXPOSURE TIME)
Ambient light	max. 5000 Lux
Detection range	Color sensor: half intensity width typ. Ø 20 mm at a distance of 85 mm Structure sensor: measuring length typ. 20 mm at a distance of 85 mm
Reproducibility	Color sensor: in the X, Y color range each 1 digit at 12-bit A/D conversion, structure sensor: 20mm/512
Temperature drift X,Y	$\Delta X/\Delta T$; $\Delta Y/\Delta T$ typ. 0.2 digits/°C (< 0.01% / °C)
Resolution	Color sensor: ΔE >= 0.5 , structure sensor: 20mm/4096
Color space (color sensor)	X Y INT siM (Lab)
Memory capacity	Color sensor: non-volatile EEPROM with parameter sets for max. 31 colors Structure sensor: max. 8 spatial frequency spectra (max. 31 structure vectors)
Housing dimensions	LxWxH approx. 204.3 mm x 108 mm x 33.8 mm, without connectors
Housing material	Aluminum, anodized in black (optics holding device: aluminum, anodized)
Enclosure rating	IP64
Connecting cables	2x to PLC: cab-las8/SPS or cab-las8/SPS-w (each 1x for color sensor and for structure sensor) 2x to PC/RS232 interface: cab-las4/PC or cab-las4/PC-w (each 1x for color sensor and for structure sensor) alternatively: 2x to PC/USB-interface: cab-4/USB or cab-4/USB-w alternatively: 2x 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)
Temperature ranges	Operating temperature range: -20°C ... +55°C, storage temperature range: -20°C ... +85°C
EMC test acc. to	DIN EN 60947-5-2 CE

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Dimensions

STRUCTURE

COLOR

204.3

50

40

5

Ø9.2

85

45°   45°

24.7

107.98

27.02

M5 - 5 tief

7

20

70

33.8

All dimensions in mm

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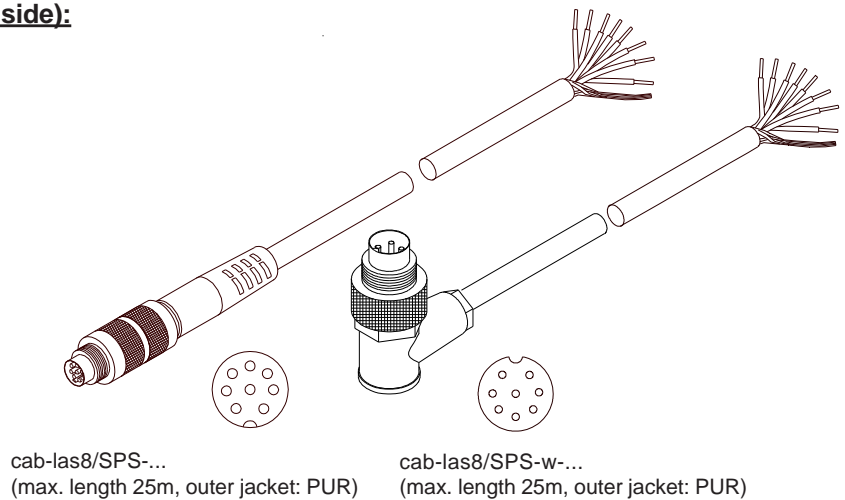
Connector Assignment

Connector assignment of color sensor (COLOR side):

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

Pin:	Color:	Assignment:
1	white	GND (0V)
2	brown	+24VDC (±10%)
3	green	IN0
4	yellow	OUT0
5	grey	OUT1
6	pink	OUT2
7	blue	OUT3
8	red	OUT4

Connecting cable:
cab-las8/SPS-(length)
cab-las8/SPS-w-(length) (angle type, 90°)
(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:
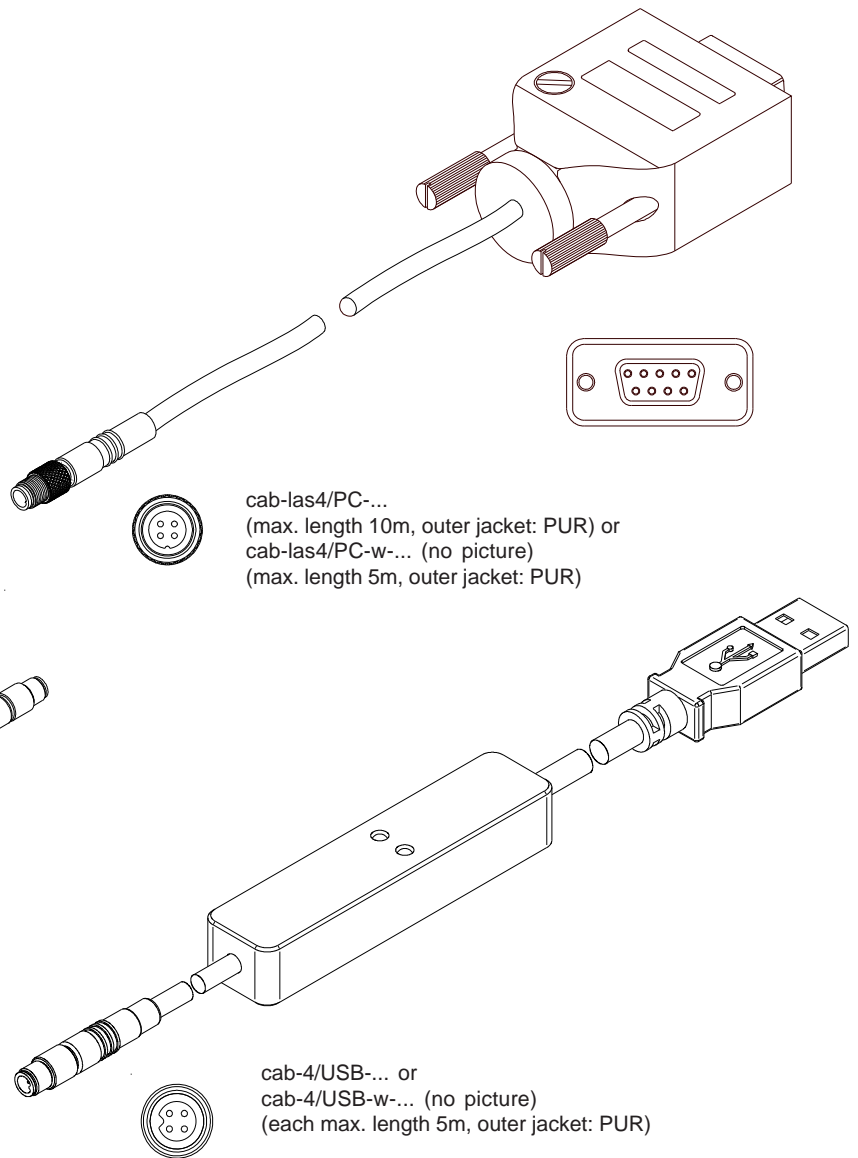*Connection via USB interface at the PC:*
Connecting cable (incl. driver software):
cab-4/USB-(length)
cab-4/USB-w-(length) (angle type 90°)
(standard length 2m)

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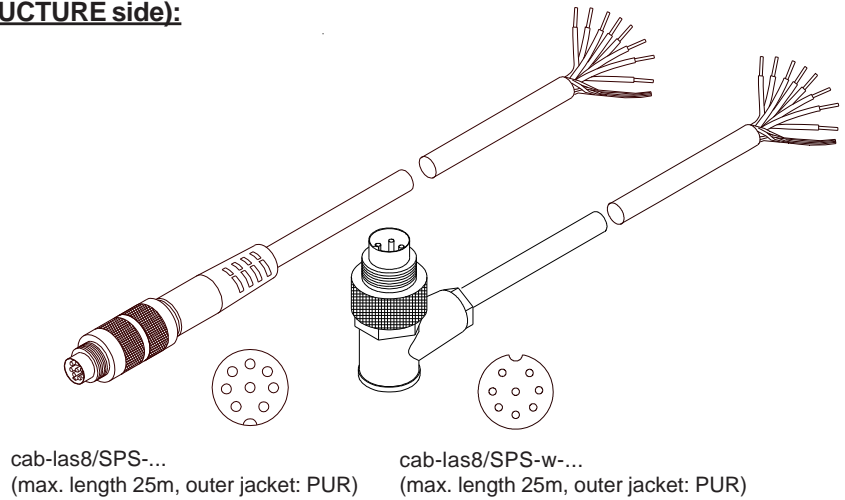(max. length 10m, outer jacket: PUR) or
cab-las4/PC-w-... (no picture)
(max. length 5m, outer jacket: PUR)

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)

Connector Assignment

Connector assignment of structure sensor (STRUCTURE side):

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

Pin:	Color:	Assignment:
1	white	GND (0V)
2	brown	+24VDC (±10%)
3	green	IN0
4	yellow	OUT0
5	grey	OUT1
6	pink	OUT2
7	blue	OUT3
8	red	OUT4

Connecting cable:
cab-las8/SPS-(length)
cab-las8/SPS-w-(length) (angle type, 90°)
(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:
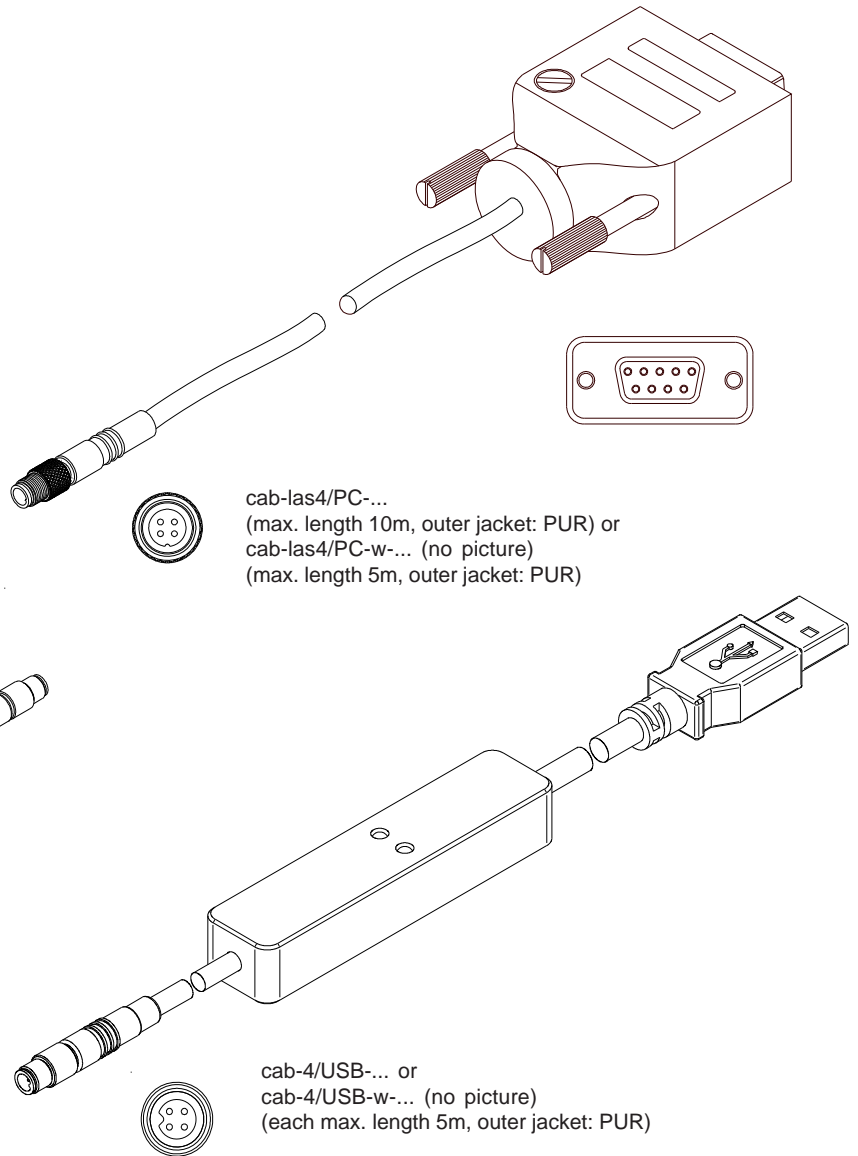*Connection via USB interface at the PC:*
Connecting cable (incl. driver software):
cab-4/USB-(length)
cab-4/USB-w-(length) (angle type 90°)
(standard length 2m)

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-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)

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Measuring principle of COAST series sensors:

The COAST sensor (COlor And STructure sensor) is a hybrid sensor that comprises two sensors that only are synchronised by the LED ring light but otherwise operate independently of each other. Both sensors can be connected to a PLC or to a PC. One of the two sensors (color sensor) provides information about the color and gloss of the object to be inspected, while the other sensor (structure sensor) checks the structure of the surface.

Measuring principle of the color sensor:

The SPECTRO-3 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 and allows a scan-frequency of up to 35 kHz. 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". In PULSE operation extremely dark surfaces can be reliably detected. 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 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 SPECTRO-3 color sensor can be "taught" up to 31 colors. 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 IN0 can then 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. At the same time the detected color code is visualised by means of 5 LEDs at the housing of the SPECTRO-3.

With a TEACH button at the sensor housing the color sensor can be taught up to 31 colors. For this purpose the corresponding evaluation mode must be set with the software. The TEACH button is connected in parallel to the input IN0 (green wire at cable cab-las8/SPS).

Parameters and measurement values can be exchanged between a PC and the SPECTRO-3 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 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 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 fields.
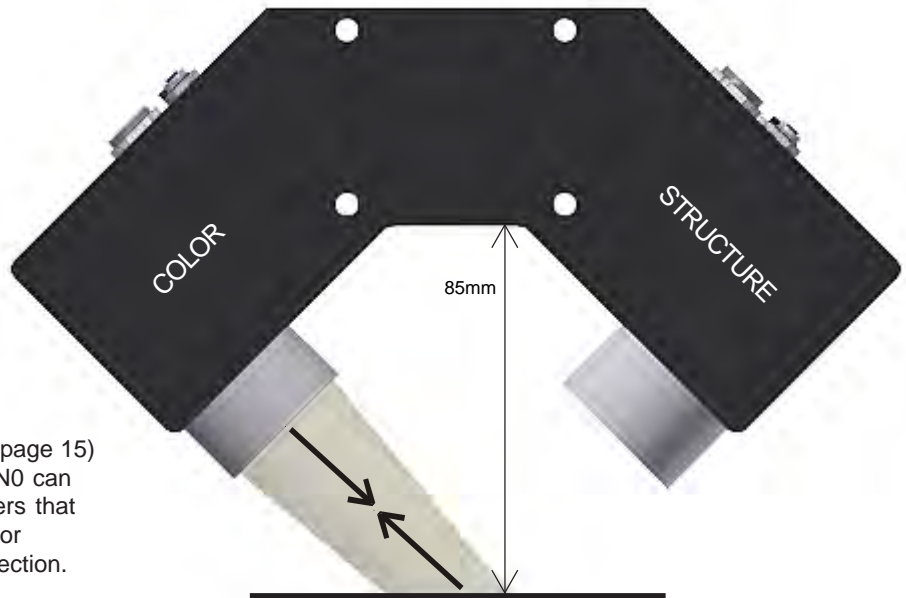
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Measuring Principle

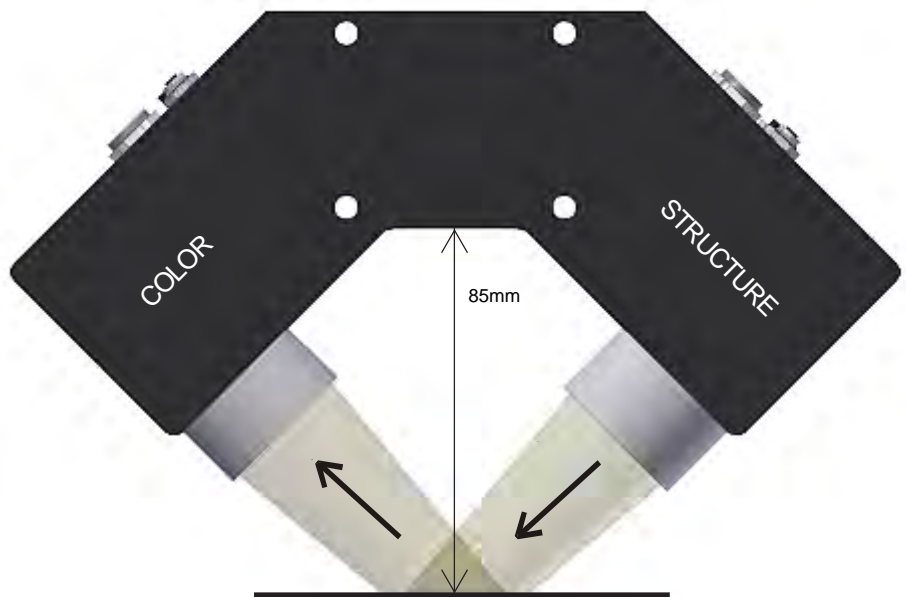**Measuring principle of the color sensor:**

The ring light can be switched over (forward scattering light / backward scattering light) by way of input INØ:

IN0 = 1
Backward reflection is used
(viewed from the color sensor)

With the PARA mode (see page 15) the color sensor through IN0 can be operated with parameters that can be independently set for forward and backward reflection.

IN0 = 0
Forward reflection is used
(viewed from the color sensor)

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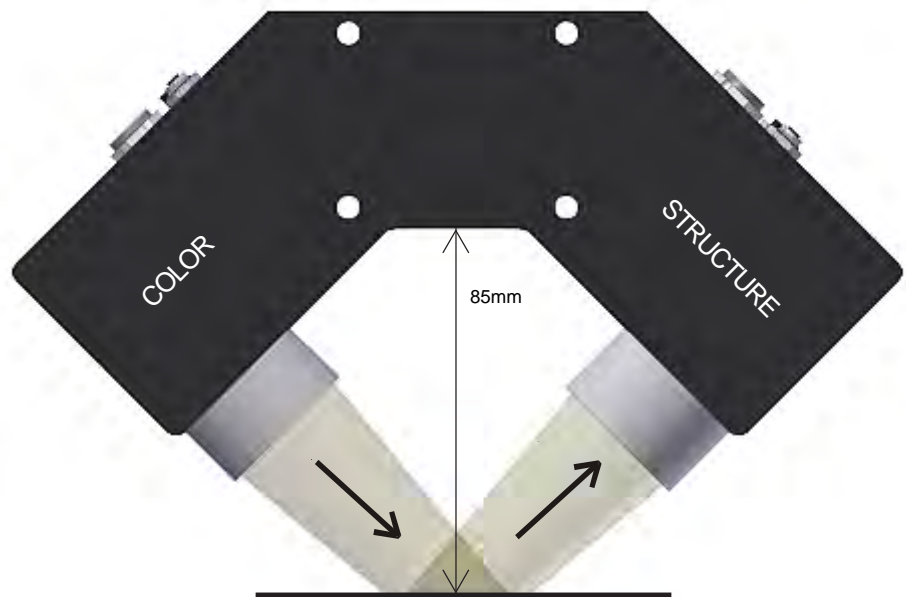**Measuring principle of the structure sensor:**

The structure sensor in principle is a line camera that features two independently controllable ring-light LED sources (that can be selected through IN0). The detection range (line) is 20 mm at a distance of 85 mm from the sensor body (see dimensions) and runs crosswise to the longitudinal direction of the sensor. The line-shaped section of the surface to be inspected (approx. 20 mm x 0.5 mm) is mapped on the line detector by the projection lens (receiver optics). By way of suitable algorithms the video signal generated by the line detector is converted into a structure signal (spatial frequency spectrum) by the sensor's internal controller. This means that a signal is thus available that provides information about the structure of the surface.

For each LED light (forward reflection, backward reflection) up to 8 spatial frequency spectrums or up to 31 structures can be stored in the sensor. For inspection the current spatial frequency spectrum (structure signal) is compared with the spatial frequency spectrums (depending on IN0 = 1 or 0) stored in the memory, and the most similar spatial frequency spectrum is searched (similar to the BESTHIT method of the color sensor).

As with the color sensor, parameters for the structure sensor also can be changed through IN0 (**PARA mode**):
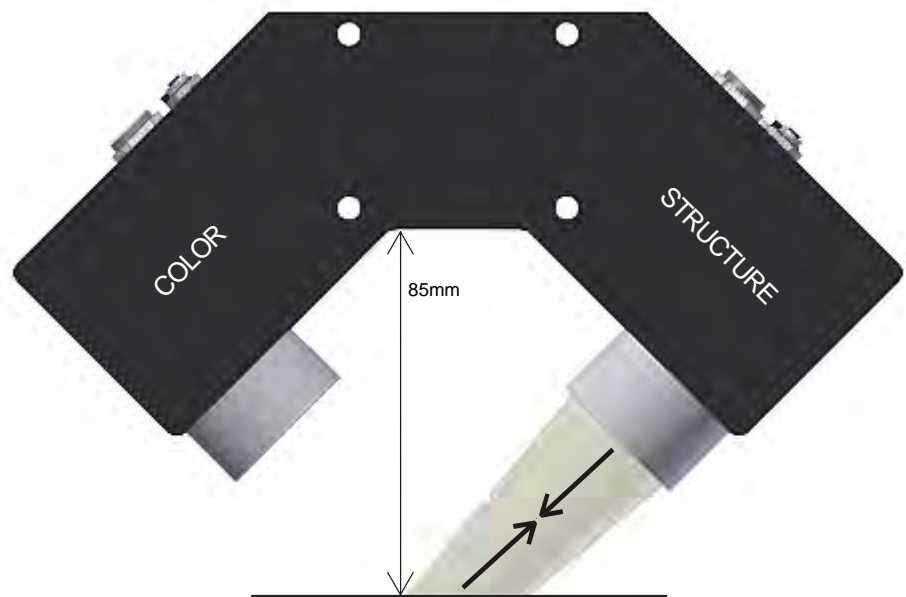
IN0 = 1
Forward reflection is used
(viewed from the structure sensor)

IN0 = 0
Backward reflection is used
(viewed from the structure sensor)

Visualization

Visualization of color code (COLOR side) and structure code (STRUCTURE side):

The color code is visualized by means of 5 yellow LEDs at the housing of the COAST sensor. The color code that is indicated at the LED display simultaneously is provided in binary mode (OUT BINARY) as 5-bit binary information at digital outputs OUT0 ... OUT4 of the 8-pole PLC connector at the COLOR side.

The COAST sensor is able to process a maximum of 31 colors (color code 0 … 30) corresponding to the individual rows in the COLOR TEACH TABLE. The color sensor indicates an "error" or a "not detected color" by turning on all the LEDs (digital outputs OUT0 ... OUT4 at HIGH level).

The structure sensor can store a maximum of 8 structures each for correlation evaluation (8 for IN0 = 0 and 8 for IN0 = 1) as well as a maximum of 31 structure vectores.

A maximum of 5 teach colors (no. 0, 1, 2, 3, 4) are permitted in DIRECT mode (OUT DIRECT HI or OUT DIRECT LO). If the selector switch is set to DIRECT HI, the corresponding digital output is HI and the other four are LO. If no color was detected, the digital outputs are in LO state (no LED is on).

If the selector switch is set to DIRECT LO, the corresponding digital output is LO and the other four are HI. If no color was detected, the digital outputs are in HI state (all LEDs are on).
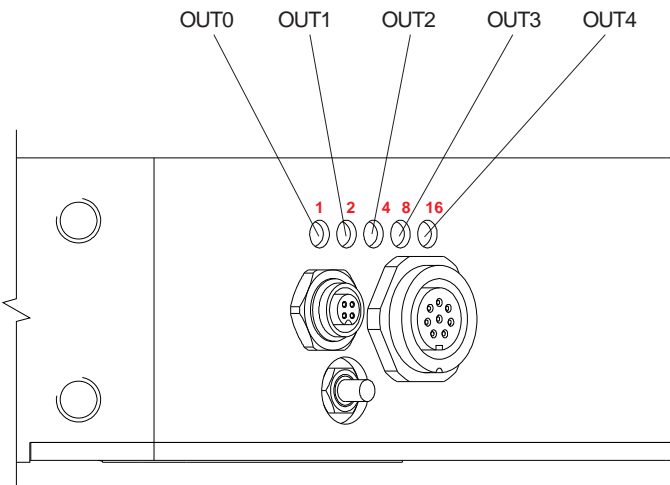
COLOR side:

STRUCTURE side:

LED Display

LED display color sensor (COLOR side):

The color code is visualized by means of 5 yellow LEDs at the housing of the color sensor. At the same time the color code indicated at the LED display is output as 5-bit binary information at the digital outputs OUT0 ... OUT4 of the 8-pole PLC connector.

In the DIRECT mode the maximum number of color codes to be taught is 5. These 5 color codes can be directly output at the 5 digital outputs. The respective detected color code is displayed by means of the 5 yellow LEDs at the color sensor housing.
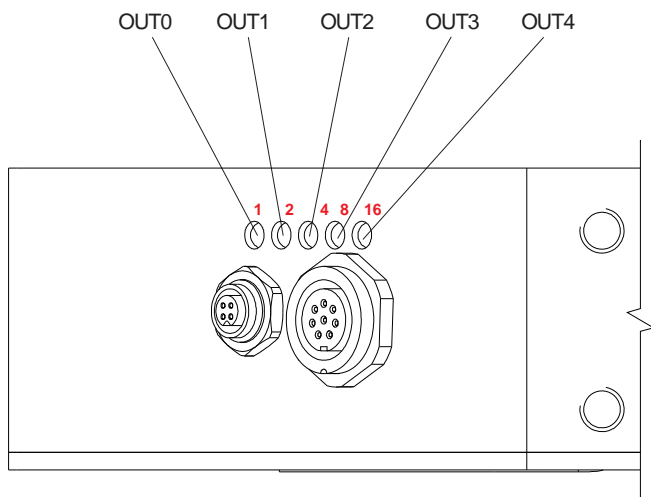
○○○○○ **0**	●○○○○ **1**	○●○○○ **2**
●●○○○ **3**	○○●○○ **4**	●○●○○ **5**
○●●○○ **6**	●●●○○ **7**	○○○●○ **8**
●○○●○ **9**	○●○●○ **10**	●●○●○ **11**
○○●●○ **12**	●○●●○ **13**	○●●●○ **14**
●●●●○ **15**	○○○○● **16**	●○○○● **17**
○●○○● **18**	●●○○● **19**	○○●○● **20**
●○●○● **21**	○●●○● **22**	●●●○● **23**
○○○●● **24**	●○○●● **25**	○●○●● **26**
●●○●● **27**	○○●●● **28**	●○●●● **29**
○●●●● **30**	●●●●● Error or „not detected"	

OUT0   OUT1   OUT2   OUT3   OUT4

1   2   4   8   16

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LED Display

LED display structure sensor (STRUCTURE side):

The structur vector is visualized by means of 5 yellow LEDs at the housing of the structure sensor. At the same time the structure vector indicated at the LED display is output as 5-bit binary information at the digital outputs OUT0 ... OUT4 of the 8-pole PLC connector.

In the DIRECT mode the maximum number of structure vectors to be taught is 5. These 5 structure vectors can be directly output at the 5 digital outputs. The respective detected structure vector is displayed by means of the 5 yellow LEDs at the structure sensor housing.

⭘⭘⭘⭘⭘ 0
🟡⭘⭘⭘⭘ 1
⭘🟡⭘⭘⭘ 2

🟡🟡⭘⭘⭘ 3
⭘⭘🟡⭘⭘ 4
🟡⭘🟡⭘⭘ 5

⭘🟡🟡⭘⭘ 6
🟡🟡🟡⭘⭘ 7
⭘⭘⭘🟡⭘ 8

🟡⭘⭘🟡⭘ 9
⭘🟡⭘🟡⭘ 10
🟡🟡⭘🟡⭘ 11

⭘⭘🟡🟡⭘ 12
🟡⭘🟡🟡⭘ 13
⭘🟡🟡🟡⭘ 14

🟡🟡🟡🟡⭘ 15
⭘⭘⭘⭘🟡 16
🟡⭘⭘⭘🟡 17

⭘🟡⭘⭘🟡 18
🟡🟡⭘⭘🟡 19
⭘⭘🟡⭘🟡 20

🟡⭘🟡⭘🟡 21
⭘🟡🟡⭘🟡 22
🟡🟡🟡⭘🟡 23

⭘⭘⭘🟡🟡 24
🟡⭘⭘🟡🟡 25
⭘🟡⭘🟡🟡 26

🟡🟡⭘🟡🟡 27
⭘⭘🟡🟡🟡 28
🟡⭘🟡🟡🟡 29

⭘🟡🟡🟡🟡 30
🟡🟡🟡🟡🟡 Error or „not detected"

OUT0   OUT1   OUT2   OUT3   OUT4

1   2   4   8   16

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(2016-01-16) COAST-85-45°/45° / Page 11 of 16
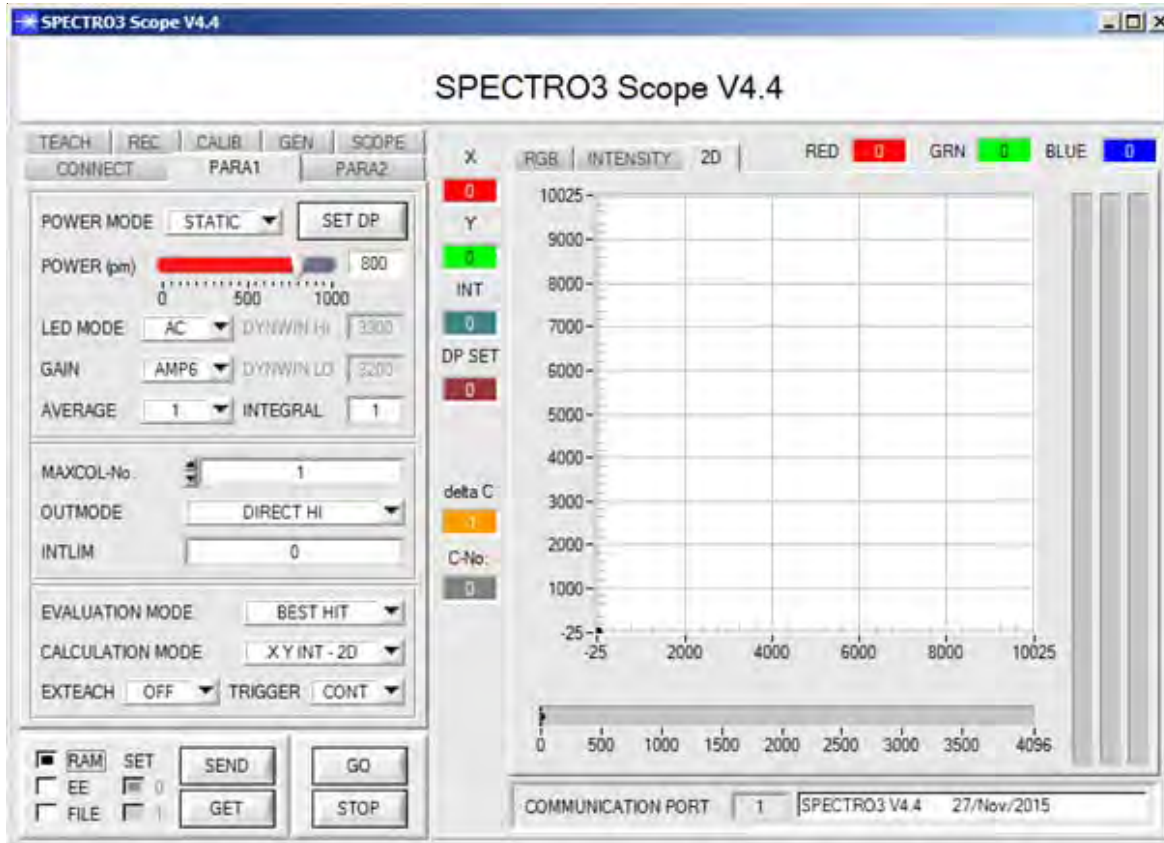*(1021.02)*
Subject to alteration

Parameterization

Windows® user interface:

The COAST sensor is parameterized under Windows® with the SPECTRO3-Scope software as well as the STRUCT-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 COAST sensor..

Software SPECTRO3-Scope (COLOR side):

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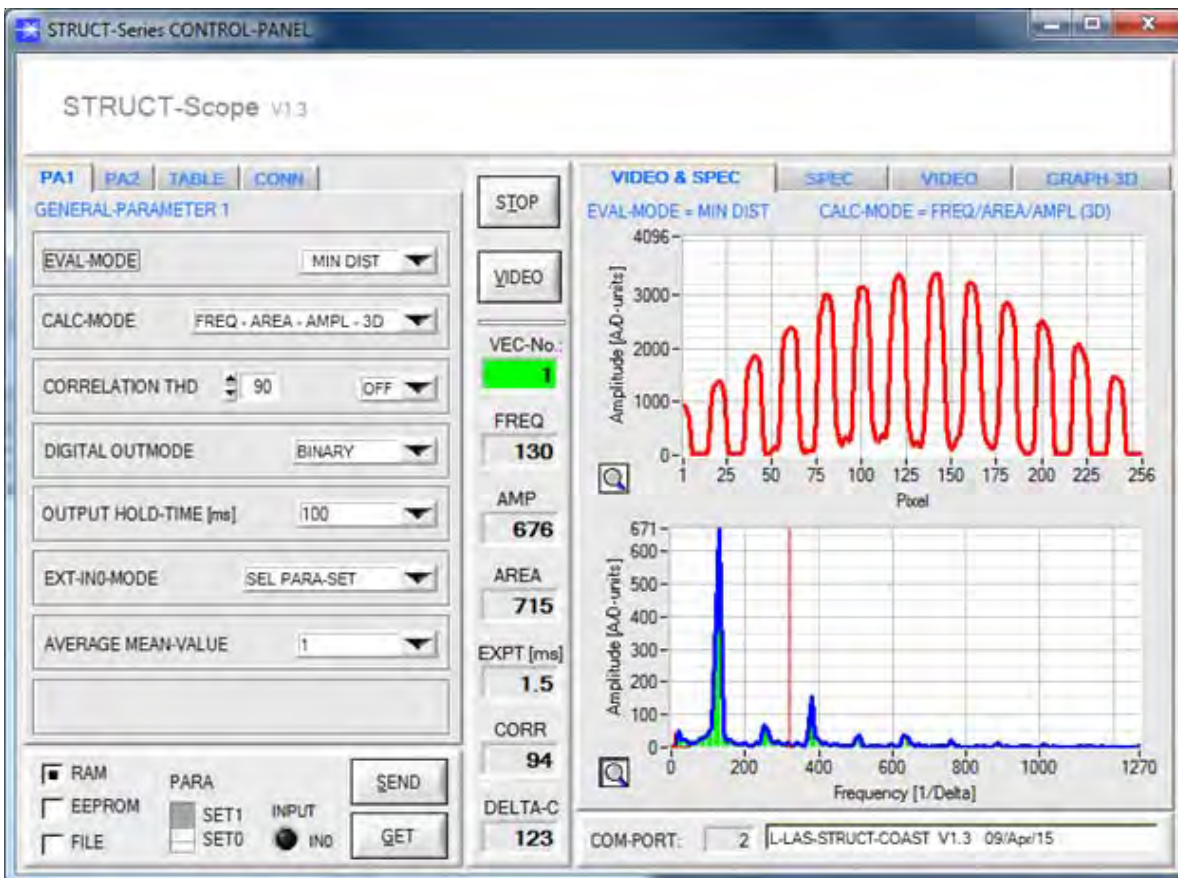
The RS232 interface (tab PARA1 or PARA2) is used for setting parameters such as:

- POWER MODE: Light power of the LED
- LED MODE: Triggering of the internal light source
- GAIN: Used for setting the gain of the receiver
- AVERAGE: Averaging over a maximum of 32768 values
- 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
- MAXCOL-No.:   Number of colors to be checked
- OUTMODE: Triggering of the digital outputs
- INTLIM: Minimum intensity required for color evaluation
- EVALUATION MODE: Various evaluation modes to choose from (FIRST HIT, BEST HIT, MIN DIST, COL5, THD RGB)
- CALCULATION MODE: 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 for both methods. Color evaluation according to "s i M - 2D" uses the Lab calculation method.
- EXTEACH: 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

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Parameterization

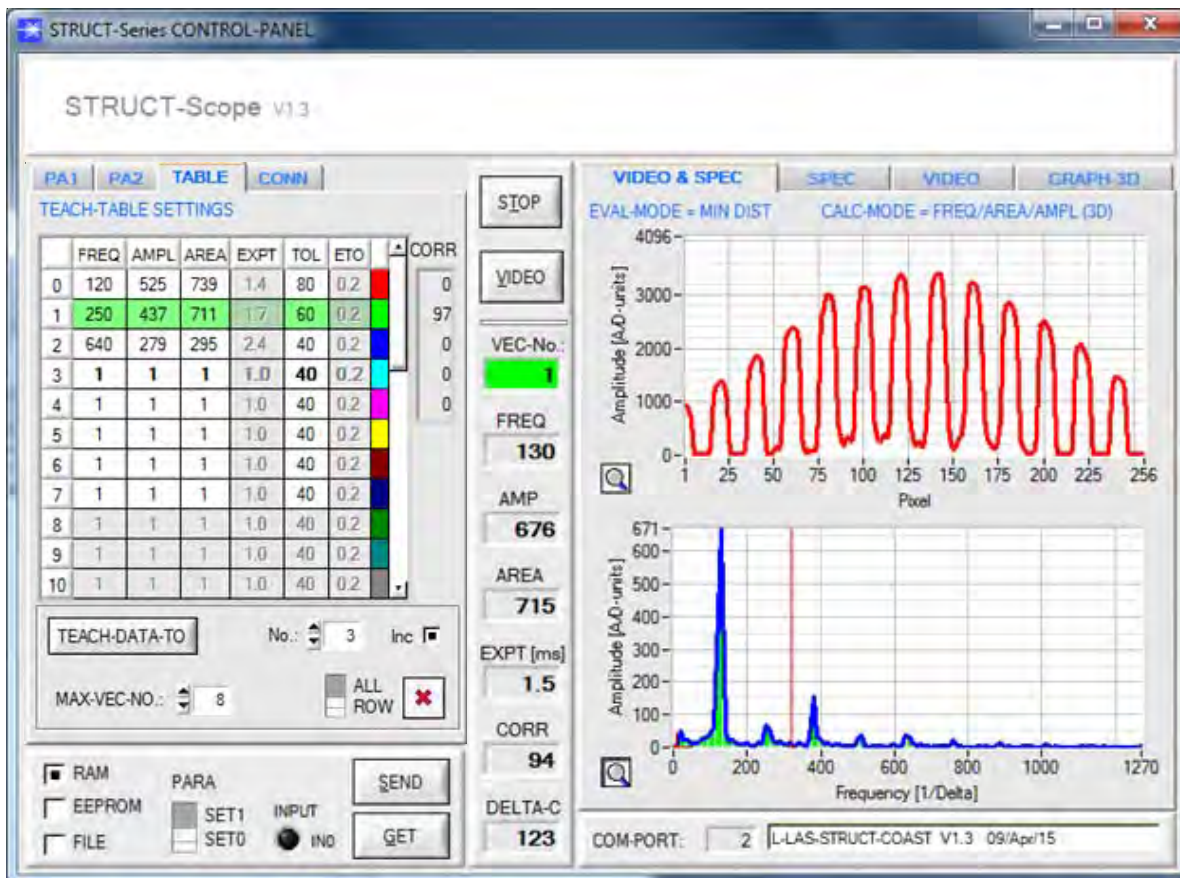**Software STRUCT-Scope (STRUCTURE side): GENERAL-PARAMETER 1 and VIDEO & SPEC**

The RS232 interface (tab PA1, PA2 and TABLE) is used for setting parameters such as:

EVAL-MODE:	Evaluation mode in the 2D/3D number range
CALC-MODE:	Calculation mode of information from the spectrum
CORRELATION THD:	Threshold used in correlation calculation
DIGITAL OUTMODE:	Control mode of digital outputs
OUTPUT HOLD-TIME:	Output hold time
EXT-IN0-MODE:	This list field is used to set the external trigger mode.
	(CONTINUOUS, TRIGG-IN0 L/H, TRIGG IN0 HIGH, SEL PARA-SET)
AVERAGE MEAN-VALUE:	This list field is used to set the averaging function sensor (possible values: 1, 2,4,8,16, or 32)

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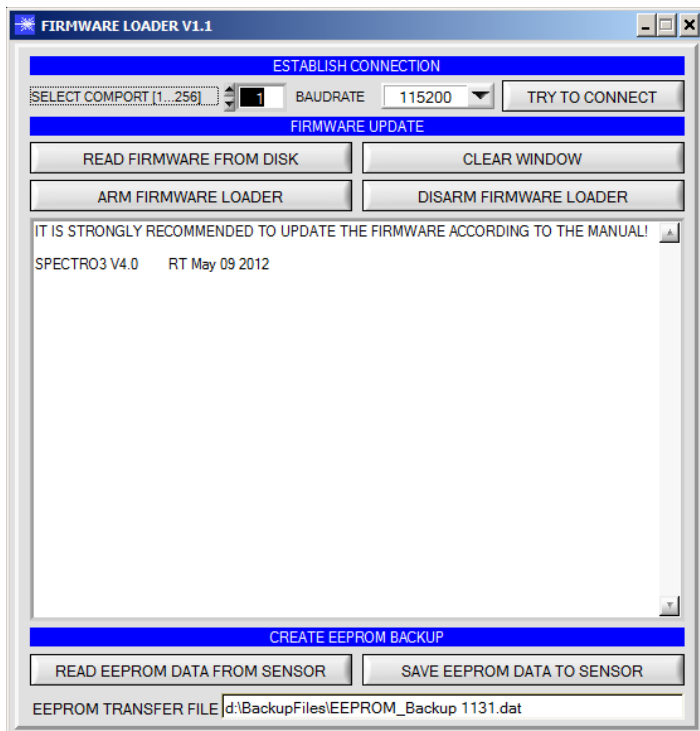**Software STRUCT-Scope (STRUCTURE side): TEACH-TABLE**

TEACH-TABLE:

Maximally 31 structure vectors (vector entries) for distinguishing 31 different structures, presetting of tolerances for the evaluation values (TOL) from the spectrum, and presetting of the tolerance for the exposure time (ETO).
Display of the correlation value for max. 8 comparison spectrums (spatial frequency spectrums).
TEACH-IN button for teaching the current spectrum to the teach table.

Display and input of the following evaluation values:
FREQ: Frequency
AMPL: Amplitude/10 of the frequency spectrum
AREA: Normed area ratio calculated from the frequency spectrum
EXPT: Exposure time of the respective structure
TOL: Tolerance for frequency and amplitude
ETO: Tolerance for exposure time

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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.

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PARA Mode

Using forward and backward scattering of object surfaces in PARA mode:

Some object surfaces are very hard to differentiate if only backward scattering is used.

If, however, forward scattering is used in addition, surfaces that have very similar colours but slightly different structures can be differentiated quite well.

Light is directed onto the surface at an angle of -45° and +45° from the normal (vertical). Only one light source is active at a time, which allows independent evaluation of forward and backward scattering.

For each sensor (color sensor and structure sensor) a specific parameter set is saved both for backward and forward scattering, i.e. altogether 4 parameter sets are available:

1. Parameter set (IN0 = 0)   →   Color sensor: Forward reflection

2. Parameter set (IN0 = 0)   →   Structure sensor: Backward reflection

3. Parameter set (IN0 = 1)   →   Color sensor: Backward reflection

4. Parameter set (IN0 = 1)   →   Structure sensor: Forward reflection

COAST Series

▶ **COAST-85-30°/30°**

- Recommended measurement distance: 85 mm ± 5 mm
- Big dynamic range due to focused white-light operation
- Two controllers in one sensor (color and gloss+structure)
- Up to 31 colors and up to 31 structure vectors can be stored
- RS232 interface (USB or Ethernet adapter is available)
- 2 ring light illuminations with each 9 super-bright white-light LEDs, focused (AC-, DC-, PULSE-operation or OFF for luminous objects can be switched)
- Evaluation of the forward and backward scattering (alternating, can be switched via input IN0)
- Color detection, contrast detection, gray scale detection as well as structure evaluation
- Insensitive to outside light (in AC- or PULSE-operation)
- Brightness correction can be activated (STAT/DYN)
- Several TEACH functions (via PC, PLC, or push button)
- Various evaluation algorithms can be activated
- "BEST HIT" mode ("human color assessment")
- Switching state display by means of 2x 5 yellow LEDs
- Parameterizable via Windows® software, scope function
- Temperature compensated
- 3-color filter detector (true color detector: "human color perception") and line detector (512 pixel)
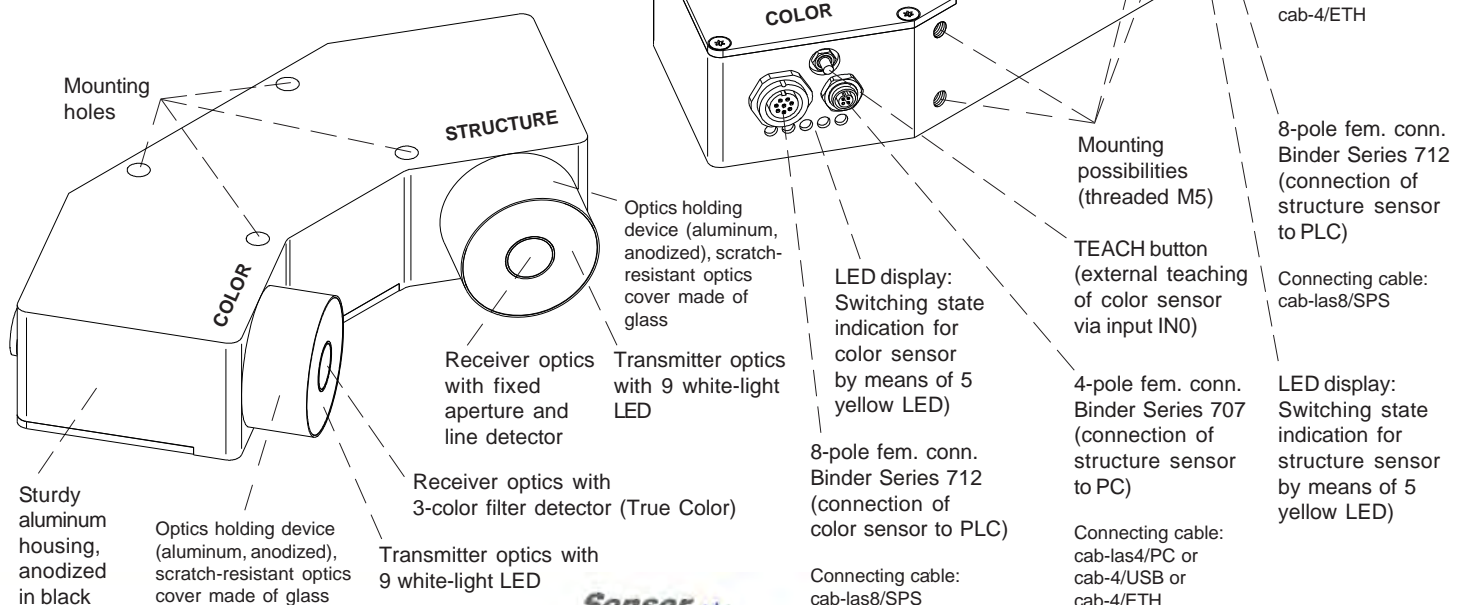

Design

Product name:

COAST-85-30°/30°
(incl. Windows® PC software SPECTRO3-Scope and STRUCT-Scope)

30°/30°: Optical axes of the two ring lights are inclined each at an angle of 30° from the vertical.

Several transmitter/receiver combinations are possible:
IN0=1: Backward refection + color sensor
       Forward reflection + structure sensor
IN0=0: Forward reflection + color sensor
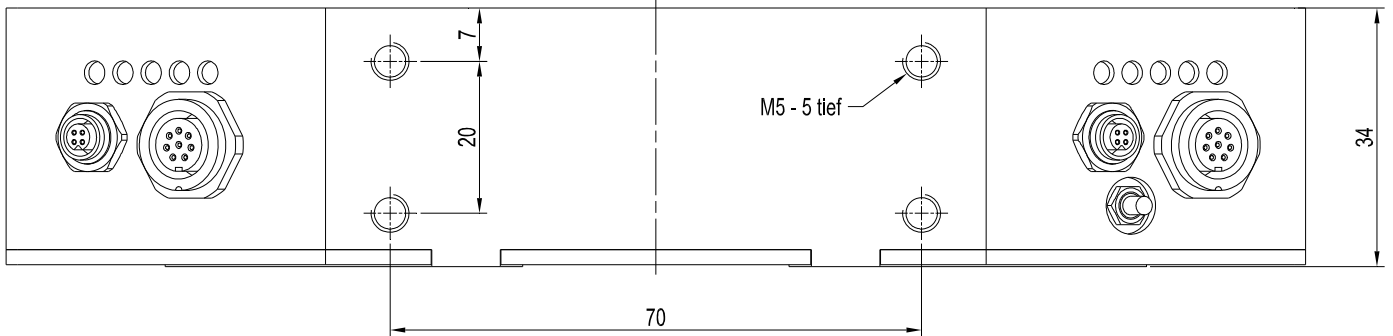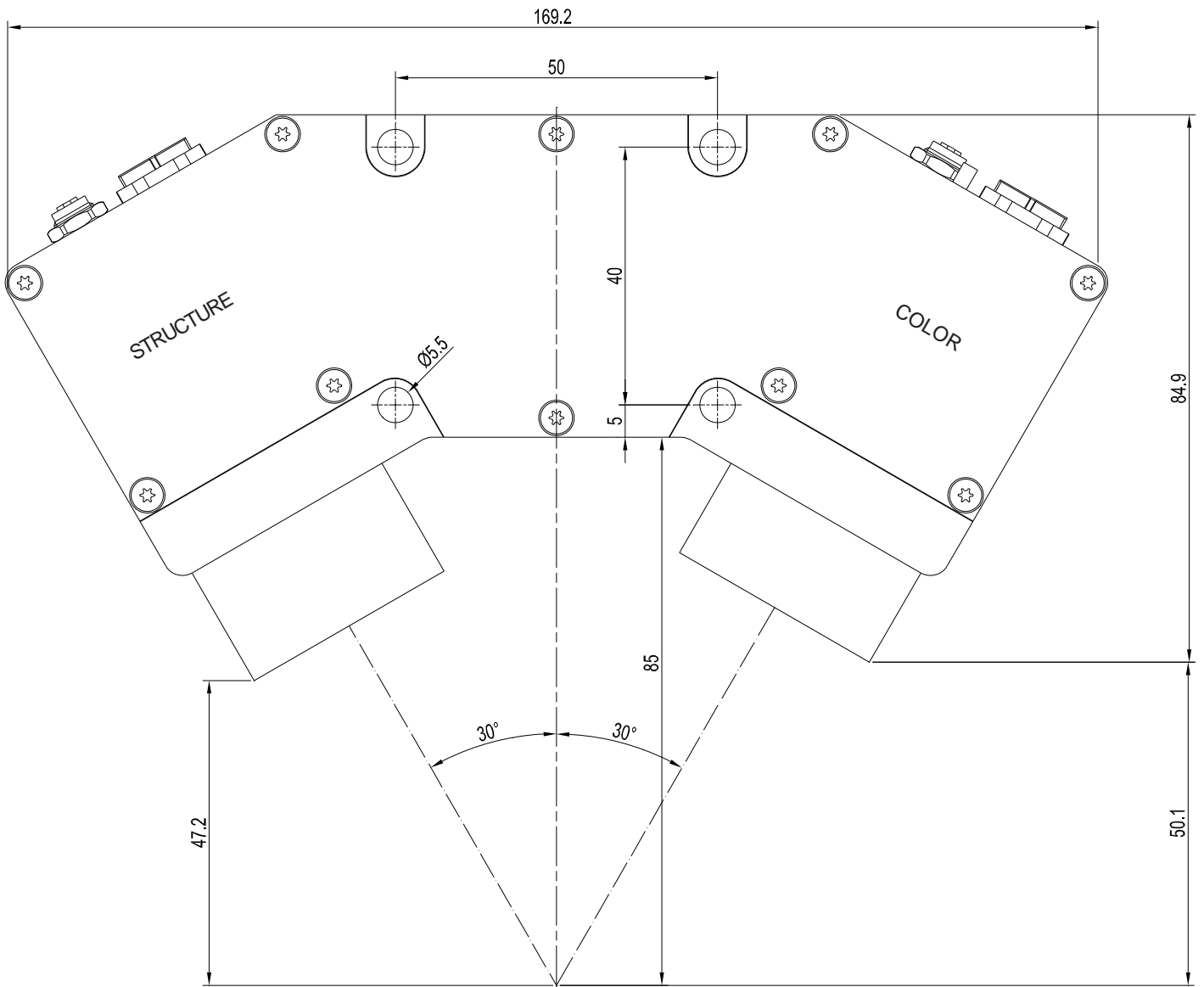   Backward reflection + structure sensor

Mounting holes

STRUCTURE

COLOR

Sturdy aluminum housing, anodized in black

Optics holding device (aluminum, anodized), scratch-resistant optics cover made of glass

Transmitter optics with 9 white-light LED

Receiver optics with fixed aperture and line detector

Optics holding device (aluminum, anodized), scratch-resistant optics cover made of glass

Receiver optics with 3-color filter detector (True Color)

Transmitter optics with 9 white-light LED

STRUCTURE

COLOR

LED display: Switching state indication for color sensor by means of 5 yellow LED)

8-pole fem. conn. Binder Series 712 (connection of color sensor to PLC)

Connecting cable: cab-las8/SPS

Mounting possibilities (threaded M5)

TEACH button (external teaching of color sensor via input IN0)

4-pole fem. conn. Binder Series 707 (connection of structure sensor to PC)

Connecting cable: cab-las4/PC or cab-4/USB or cab-4/ETH

4-pole fem. conn. Binder Series 707 (connection of structure sensor to PC)

Connecting cable: cab-las4/PC or cab-4/USB or cab-4/ETH

8-pole fem. conn. Binder Series 712 (connection of structure sensor to PLC)

Connecting cable: cab-las8/SPS

LED display: Switching state indication for structure sensor by means of 5 yellow LED)

Sensor Instruments

Technical Data

Model	COAST-85-30°/30°
Voltage supply	+24VDC (± 10%), reverse polarity protected, overcurrent protected
Current consumption	< 500 mA
Max. switching current	100 mA, short circuit proof
Switching state indication (each 5x LED)	Color sensor: 5 yellow LED visualize the physical state of the outputs OUT0 ... OUT4 Structure sensor: 5 yellow LED visualize the physical state of the outputs OUT0 ... OUT4
Input digital (each 1x)	Color sensor: 1 digital input: IN0 (Pin 3), digital (0V/+24V) or teach button at the housing Structure sensor: 1 digital input: IN0 (Pin 3), digital (0V/+24V) The digital inputs IN0 of color sensor and structure sensor are connected internally
Outputs digital (each 5x)	Color sensor: OUT0...OUT4 (Pin 4..8): digital (0V/+24V), pn-/pnp-able (bright-/dark-switching, can be switched) Structure sensor: OUT0...OUT4 (Pin 4..8): digital (0V/+24V), pn-/pnp-able (bright-/dark-switching, can be switched)
Interface (each 1x)	Color sensor: RS232, structure sensor: RS232
Pulse lengthening	Color sensor: 0 ... 100 ms (adjustable via PC software), structure sensor: 100 ms ... 1 s (adjustable via PC software)
Averaging	max. 32768 values, adjustable via PC software
Scan frequency (alternating light operation/ direct light operation)	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) PULSE operation: max. 5 kHz (depends on parameterization)
Max. measuring frequency	Color sensor: typ. 10 kHz (AC), structure sensor: typ. 10 Hz
Angle of incidence	Optical axes of the two ring lights are inclined each at an angle of 30° from the normal (vertical)
Measuring distance	typ. 85 mm ± 5 mm
Transmitter (light source)	2 optics with each 9 super-bright white-light LED, focused
Transmitter control	Can be switched via PC software: AC operation (LED MODE-AC), DC operation (LED MODE-DC)
Receiver	Color sensor: 3-color filter detector (TRUE COLOR, "human color perception"), color filter curves acc. to CIE 1931 Structure sensor: line detector, 512 pixel
Receiver gain setting respectively exposure time	Color sensor: 8 steps (AMP1 ... AMP8), adjustable via PC software + INTEGRAL (software implemented addition of consecutive values) Structure sensor: software implemented adjustment of exposure time (EXPOSURE TIME)
Ambient light	max. 5000 Lux
Detection range	Color sensor: half intensity width typ. Ø 20 mm at a distance of 85 mm Structure sensor: measuring length typ. 20 mm at a distance of 85 mm
Reproducibility	Color sensor: in the X, Y color range each 1 digit at 12-bit A/D conversion, structure sensor: 20mm/512
Temperature drift X,Y	$\Delta X/\Delta T$; $\Delta Y/\Delta T$ typ. 0.2 digits/°C (< 0.01% / °C)
Resolution	Color sensor: ΔE >= 0.5 , structure sensor: 20mm/4096
Color space (color sensor)	X Y INT siM (Lab)
Memory capacity	Color sensor: non-volatile EEPROM with parameter sets for max. 31 colors Structure sensor: max. 8 spatial frequency spectra (max. 31 structure vectors)
Housing dimensions	LxWxH approx. 169.2 mm x 84.9 mm x 34 mm, without connectors
Housing material	Aluminum, anodized in black (optics holding device: aluminum, anodized)
Enclosure rating	IP64
Connecting cables	2x to PLC: cab-las8/SPS or cab-las8/SPS-w (each 1x for color sensor and for structure sensor) 2x to PC/RS232 interface: cab-las4/PC or cab-las4/PC-w (each 1x for color sensor and for structure sensor) alternatively: 2x to PC/USB-interface: cab-4/USB or cab-4/USB-w alternatively: 2x 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)
Temperature ranges	Operating temperature range: -20°C ... +55°C, storage temperature range: -20°C ... +85°C
EMC test acc. to	DIN EN 60947-5-2 CE

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Dimensions

STRUCTURE

COLOR

169.2

50

40

5

Ø5.5

84.9

85

30° 30°

47.2

50.1

7

20

M5 - 5 tief

34

70

All dimensions in mm

Connector Assignment

Connector assignment of color sensor (COLOR side):

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

Pin:	Color:	Assignment:
1	white	GND (0V)
2	brown	+24VDC (±10%)
3	green	IN0
4	yellow	OUT0
5	grey	OUT1
6	pink	OUT2
7	blue	OUT3
8	red	OUT4

Connecting cable:
cab-las8/SPS-(length)
cab-las8/SPS-w-(length) (angle type, 90°)
(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:
Connecting cable (incl. driver software):
cab-4/USB-(length)
cab-4/USB-w-(length) (angle type 90°)
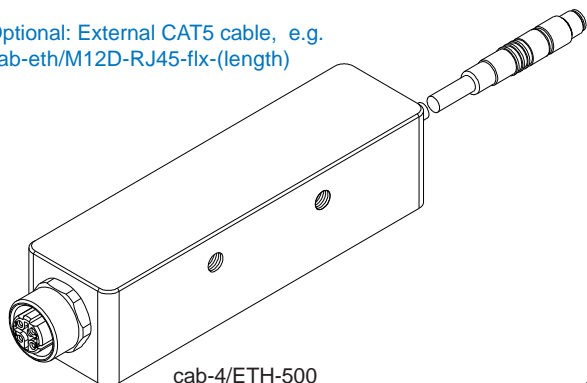(standard length 2m)

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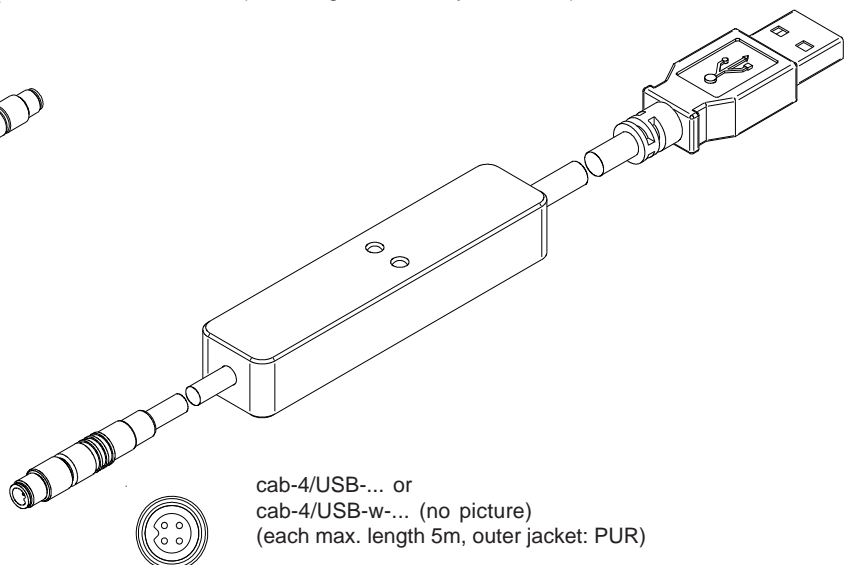cab-4/ETH-500
(standard length 0.5m)

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

cab-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)
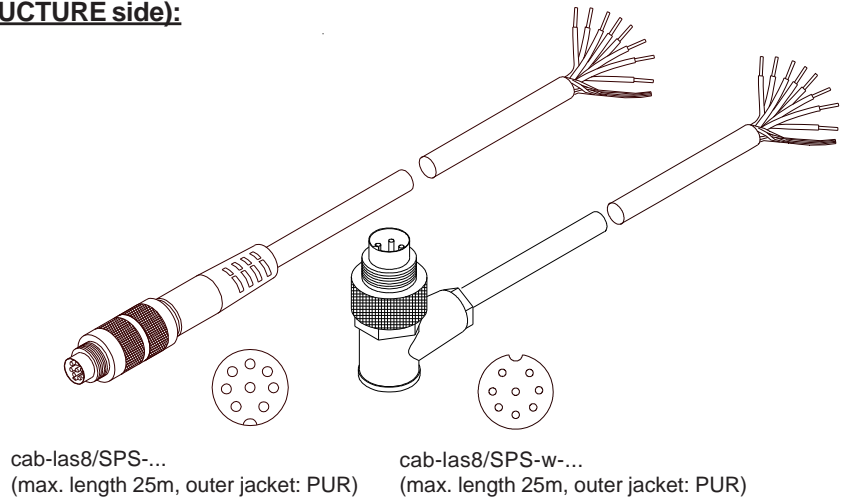(each max. length 5m, outer jacket: PUR)

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Connector Assignment

Connector assignment of structure sensor (STRUCTURE side):

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

Pin: Color: Assignment:
1   white   GND (0V)
2   brown   +24VDC (±10%)
3   green   IN0
4   yellow   OUT0
5   grey   OUT1
6   pink   OUT2
7   blue   OUT3
8   red   OUT4

Connecting cable:
cab-las8/SPS-(length)
cab-las8/SPS-w-(length) (angle type, 90°)
(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:
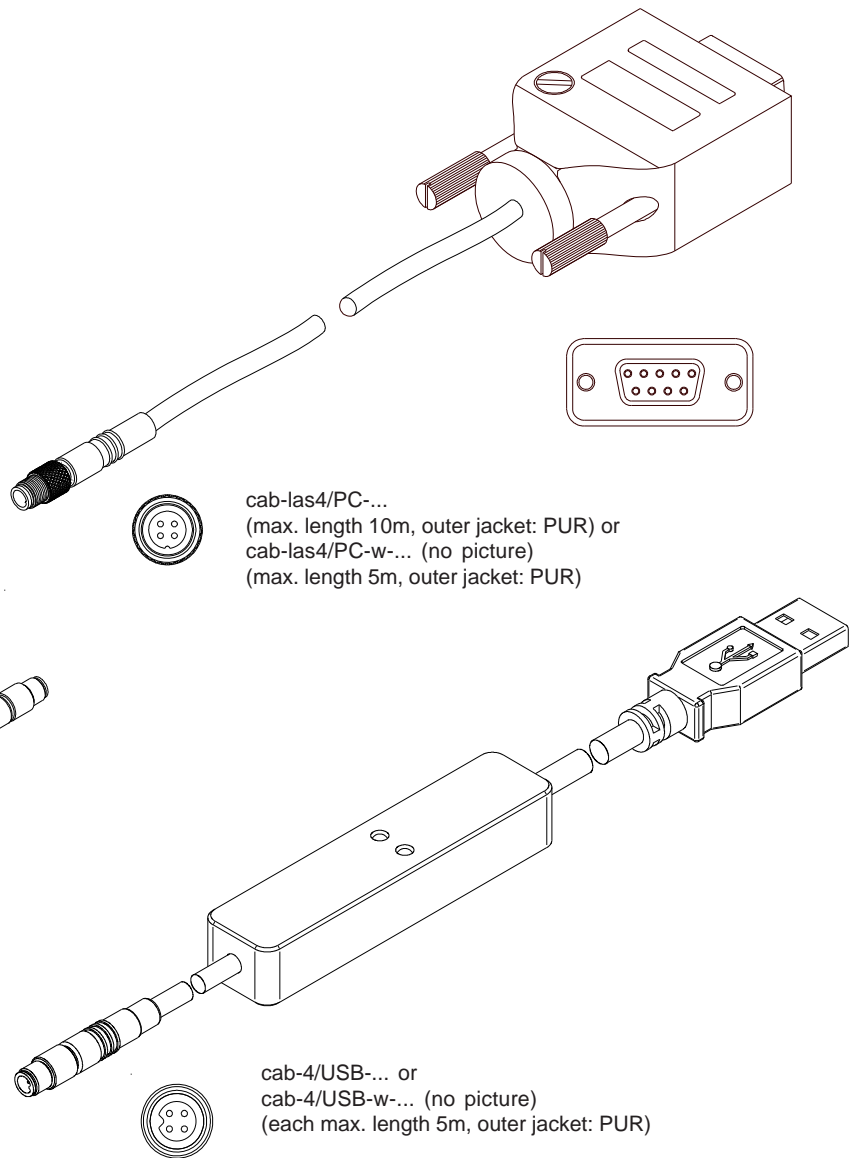*Connection via USB interface at the PC:*
Connecting cable (incl. driver software):
cab-4/USB-(length)
cab-4/USB-w-(length) (angle type 90°)
(standard length 2m)

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-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)

Measuring Principle

Measuring principle of COAST series sensors:

The COAST sensor (COlor And STructure sensor) is a hybrid sensor that comprises two sensors that only are synchronised by the LED ring light but otherwise operate independently of each other. Both sensors can be connected to a PLC or to a PC. One of the two sensors (color sensor) provides information about the color and gloss of the object to be inspected, while the other sensor (structure sensor) checks the structure of the surface.

Measuring principle of the color sensor:

The SPECTRO-3 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 and allows a scan-frequency of up to 35 kHz. 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". In PULSE operation extremely dark surfaces can be reliably detected. 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 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 SPECTRO-3 color sensor can be "taught" up to 31 colors. 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 IN0 can then 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. At the same time the detected color code is visualised by means of 5 LEDs at the housing of the SPECTRO-3.

With a TEACH button at the sensor housing the color sensor can be taught up to 31 colors. For this purpose the corresponding evaluation mode must be set with the software. The TEACH button is connected in parallel to the input IN0 (green wire at cable cab-las8/SPS).

Parameters and measurement values can be exchanged between a PC and the SPECTRO-3 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 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 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 fields.
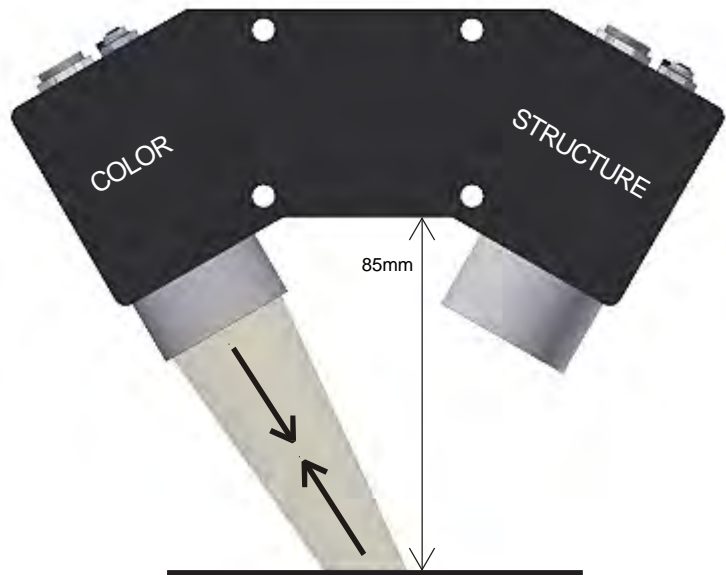
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Measuring Principle

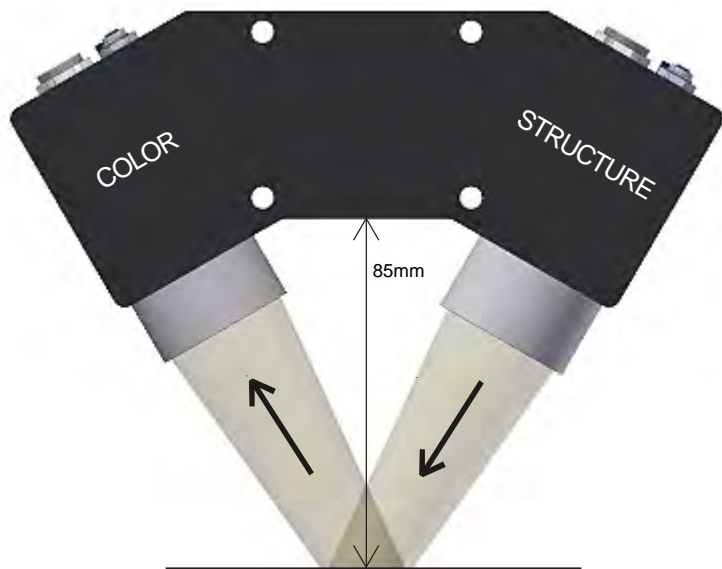**Measuring principle of the color sensor:**

The ring light can be switched over (forward scattering light / backward scattering light) by way of input INØ:

IN0 = 1
Backward reflection is used
(viewed from the color sensor)

With the PARA mode (see page 15)
the color sensor through IN0 can
be operated with parameters that
can be independently set for
forward and backward reflection.

85mm

IN0 = 0
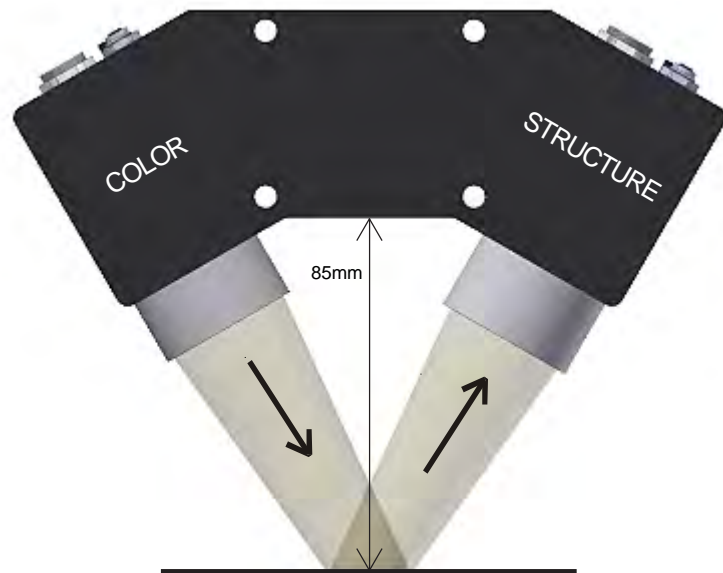Forward reflection is used
(viewed from the color sensor)

85mm

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Measuring principle of the structure sensor:

The structure sensor in principle is a line camera that features two independently controllable ring-light LED sources (that can be selected through IN0). The detection range (line) is 20 mm at a distance of 85 mm from the sensor body (see dimensions) and runs crosswise to the longitudinal direction of the sensor. The line-shaped section of the surface to be inspected (approx. 20 mm x 0.5 mm) is mapped on the line detector by the projection lens (receiver optics). By way of suitable algorithms the video signal generated by the line detector is converted into a structure signal (spatial frequency spectrum) by the sensor's internal controller. This means that a signal is thus available that provides information about the structure of the surface.
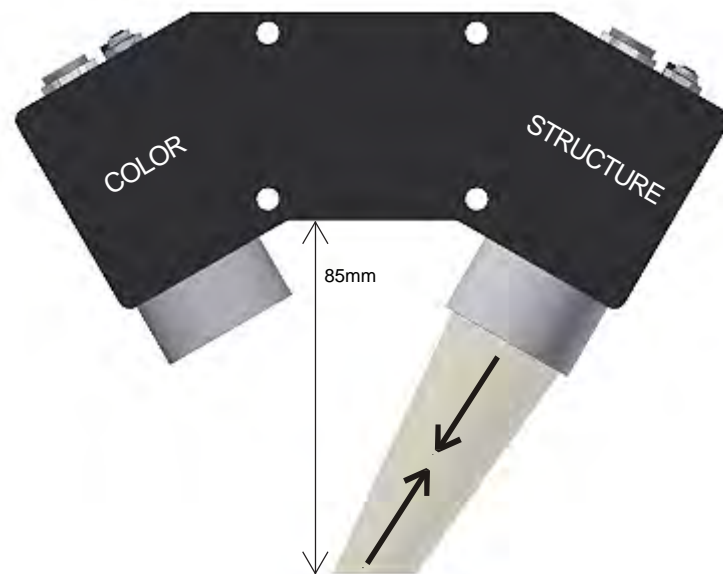
For each LED light (forward reflection, backward reflection) up to 8 spatial frequency spectrums or up to 31 structures can be stored in the sensor. For inspection the current spatial frequency spectrum (structure signal) is compared with the spatial frequency spectrums (depending on IN0 = 1 or 0) stored in the memory, and the most similar spatial frequency spectrum is searched (similar to the BESTHIT method of the color sensor).

As with the color sensor, parameters for the structure sensor also can be changed through IN0 (**PARA mode**):

IN0 = 1
Forward reflection is used
(viewed from the structure sensor)

85mm

IN0 = 0
Backward reflection is used
(viewed from the structure sensor)

85mm

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Visualization

Visualization of color code (COLOR side) and structure code (STRUCTURE side):

The color code is visualized by means of 5 yellow LEDs at the housing of the COAST sensor. The color code that is indicated at the LED display simultaneously is provided in binary mode (OUT BINARY) as 5-bit binary information at digital outputs OUT0 ... OUT4 of the 8-pole PLC connector at the COLOR side.

The COAST sensor is able to process a maximum of 31 colors (color code 0 … 30) corresponding to the individual rows in the COLOR TEACH TABLE. The color sensor indicates an "error" or a "not detected color" by turning on all the LEDs (digital outputs OUT0 ... OUT4 at HIGH level).

The structure sensor can store a maximum of 8 structures each for correlation evaluation (8 for IN0 = 0 and 8 for IN0 = 1) as well as a maximum of 31 structure vectores.

A maximum of 5 teach colors (no. 0, 1, 2, 3, 4) are permitted in DIRECT mode (OUT DIRECT HI or OUT DIRECT LO). If the selector switch is set to DIRECT HI, the corresponding digital output is HI and the other four are LO. If no color was detected, the digital outputs are in LO state (no LED is on).

If the selector switch is set to DIRECT LO, the corresponding digital output is LO and the other four are HI. If no color was detected, the digital outputs are in HI state (all LEDs are on).
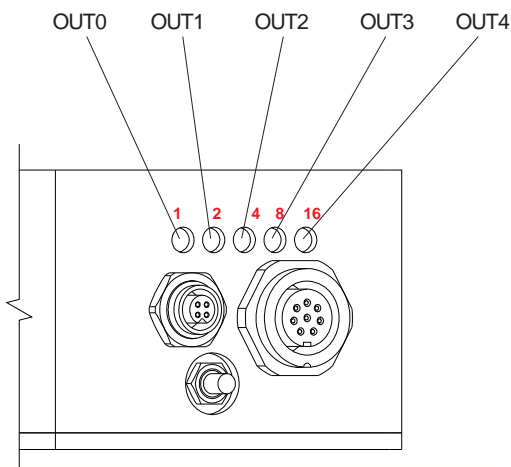
COLOR side:

STRUCTURE side:

LED Display

LED display color sensor (COLOR side):

The color code is visualized by means of 5 yellow LEDs at the housing of the color sensor. At the same time the color code indicated at the LED display is output as 5-bit binary information at the digital outputs OUT0 ... OUT4 of the 8-pole PLC connector.

In the DIRECT mode the maximum number of color codes to be taught is 5. These 5 color codes can be directly output at the 5 digital outputs. The respective detected color code is displayed by means of the 5 yellow LEDs at the color sensor housing.

OUT0 OUT1 OUT2 OUT3 OUT4

1 2 4 8 16

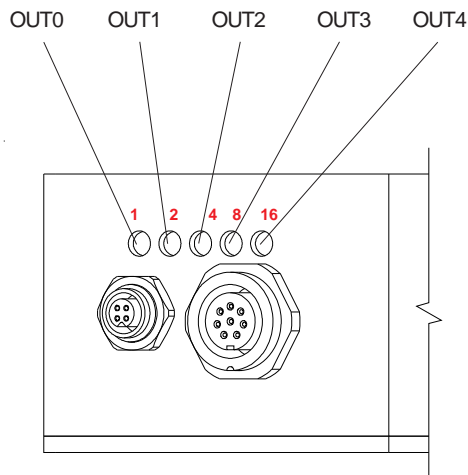| Code	LED pattern	Code	LED pattern	Code	LED pattern
0	○○○○○	1	●○○○○	2	○●○○○
3	●●○○○	4	○○●○○	5	●○●○○
6	○●●○○	7	●●●○○	8	○○○●○
9	●○○●○	10	○●○●○	11	●●○●○
12	○○●●○	13	●○●●○	14	○●●●○
15	●●●●○	16	○○○○●	17	●○○○●
18	○●○○●	19	●●○○●	20	○○●○●
21	●○●○●	22	○●●○●	23	●●●○●
24	○○○●●	25	●○○●●	26	○●○●●
27	●●○●●	28	○○●●●	29	●○●●●
30	○●●●●	Error or „not detected"	●●●●●		

LED Display

LED display structure sensor (STRUCTURE side):

The structur vector is visualized by means of 5 yellow LEDs at the housing of the structure sensor. At the same time the structure vector indicated at the LED display is output as 5-bit binary information at the digital outputs OUT0 ... OUT4 of the 8-pole PLC connector.

In the DIRECT mode the maximum number of structure vectors to be taught is 5. These 5 structure vectors can be directly output at the 5 digital outputs. The respective detected structure vector is displayed by means of the 5 yellow LEDs at the structure sensor housing.

OUT0 OUT1 OUT2 OUT3 OUT4

0	1	2
3	4	5
6	7	8
9	10	11
12	13	14
15	16	17
18	19	20
21	22	23
24	25	26
27	28	29
30	Error or „not detected"	

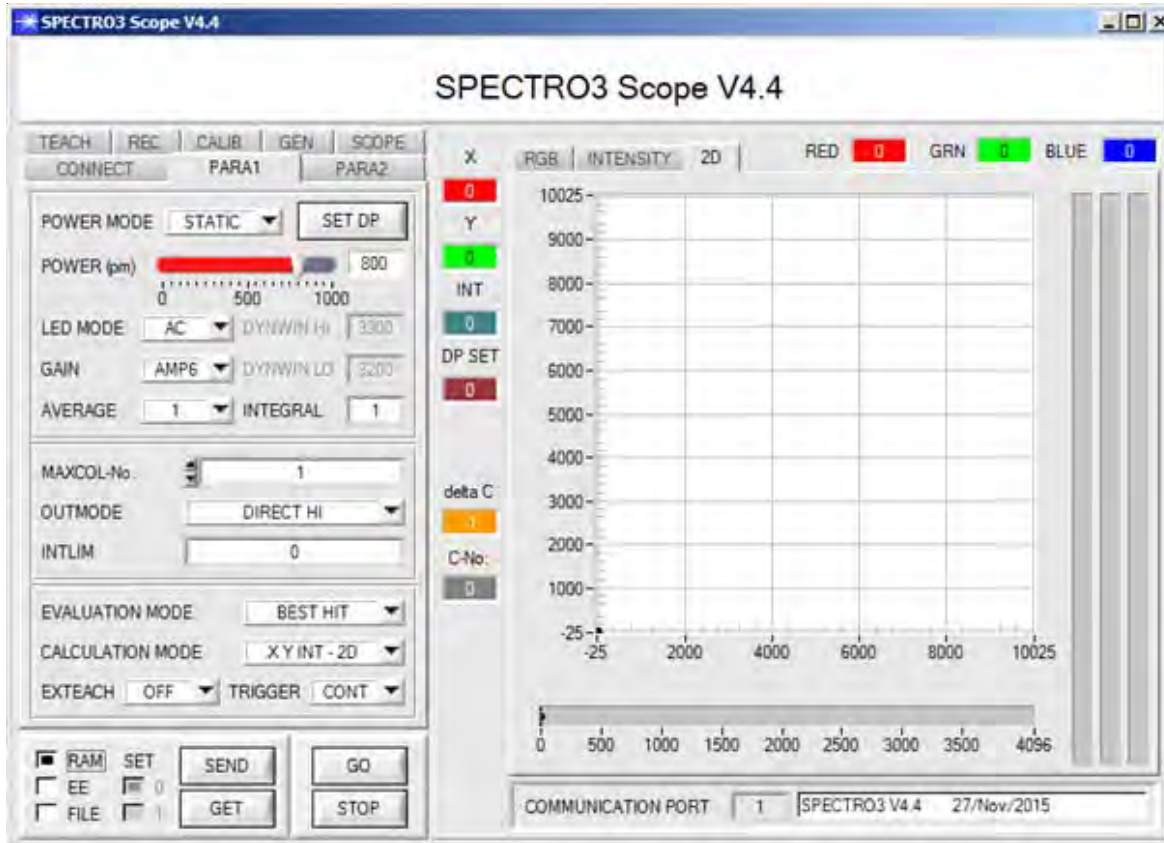**Windows® user interface:**

The COAST sensor is parameterized under Windows® with the SPECTRO3-Scope software as well as the STRUCT-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 COAST sensor..

Software SPECTRO3-Scope (COLOR side):

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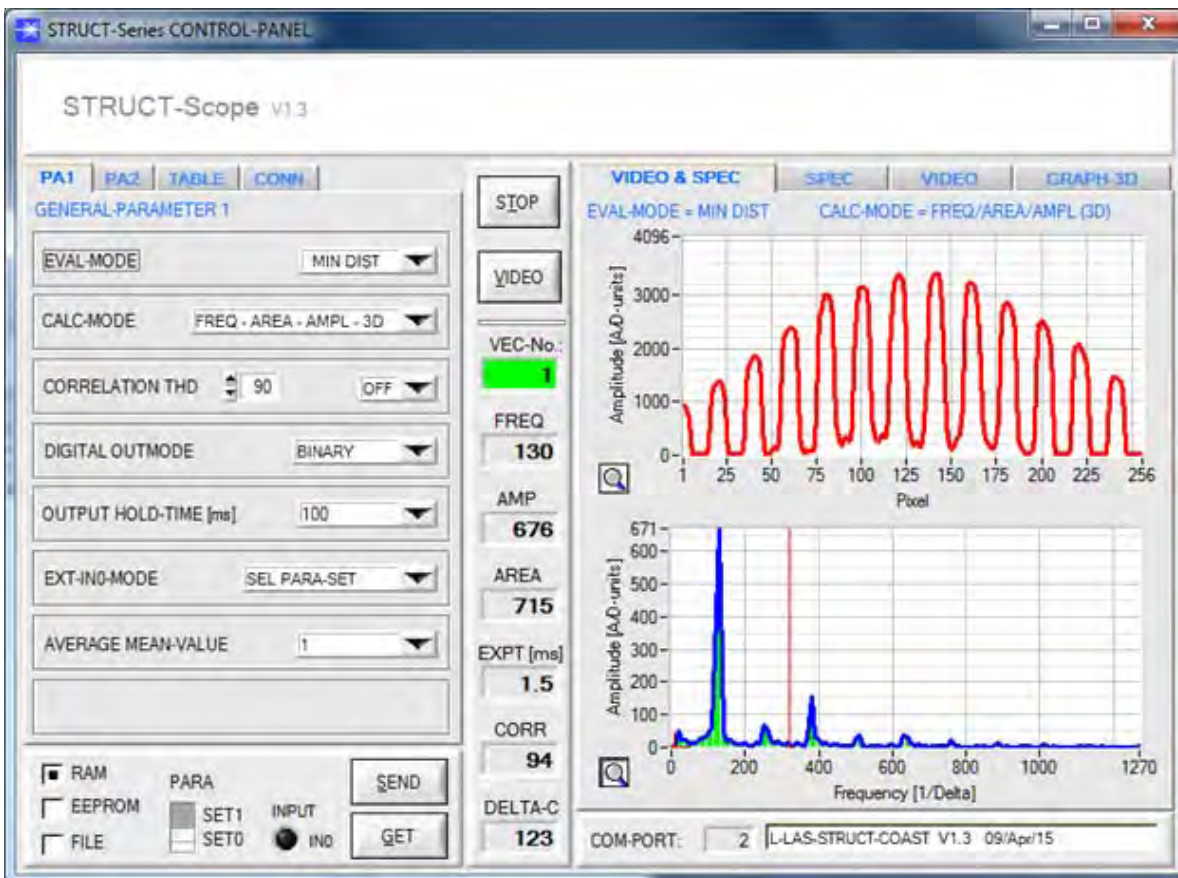
The RS232 interface (tab PARA1 or PARA2) is used for setting parameters such as:

- POWER MODE: Light power of the LED
- LED MODE: Triggering of the internal light source
- GAIN: Used for setting the gain of the receiver
- AVERAGE: Averaging over a maximum of 32768 values
- 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
- MAXCOL-No.:   Number of colors to be checked
- OUTMODE: Triggering of the digital outputs
- INTLIM: Minimum intensity required for color evaluation
- EVALUATION MODE: Various evaluation modes to choose from (FIRST HIT, BEST HIT, MIN DIST, COL5, THD RGB)
- CALCULATION MODE: 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 for both methods. Color evaluation according to "s i M - 2D" uses the Lab calculation method.
- EXTEACH: 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

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Parameterization

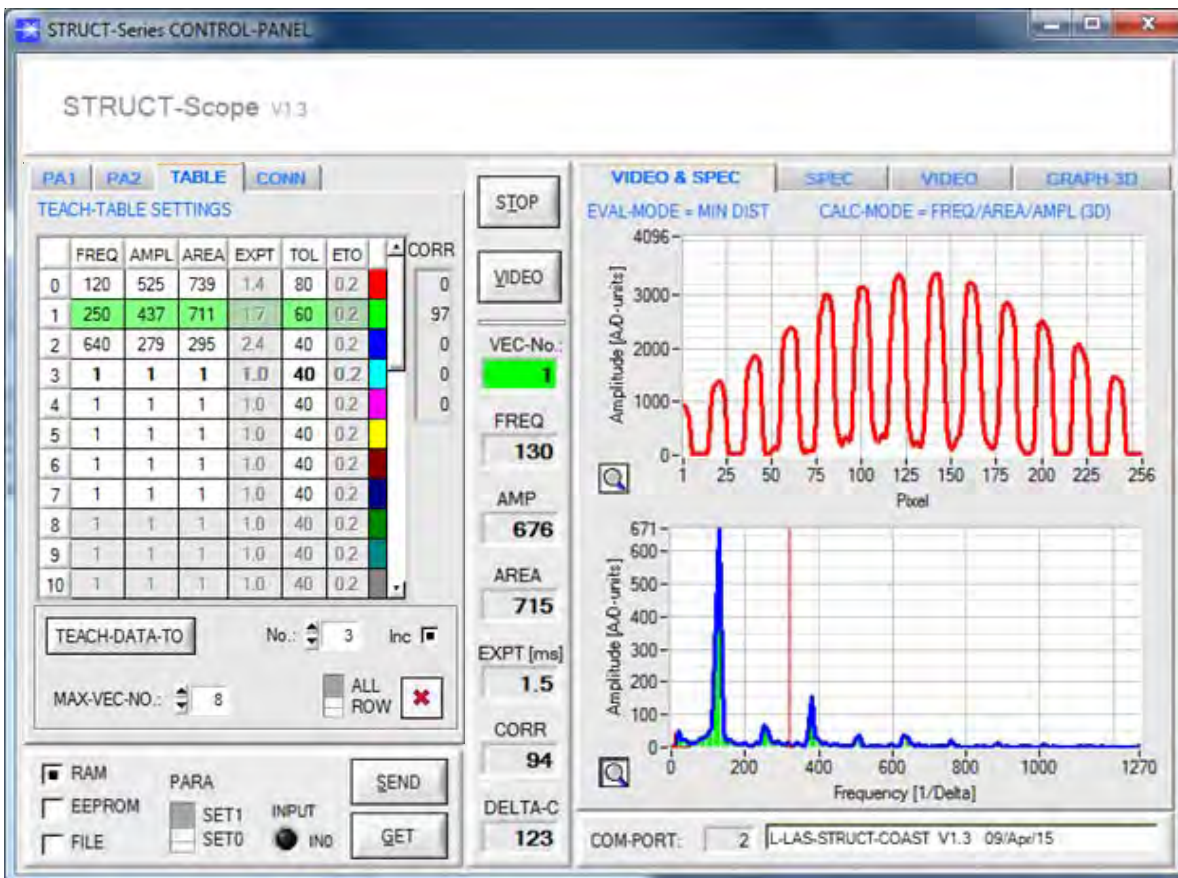**Software STRUCT-Scope (STRUCTURE side): GENERAL-PARAMETER 1 and VIDEO & SPEC**

The RS232 interface (tab PA1, PA2 and TABLE) is used for setting parameters such as:

EVAL-MODE:	Evaluation mode in the 2D/3D number range
CALC-MODE:	Calculation mode of information from the spectrum
CORRELATION THD:	Threshold used in correlation calculation
DIGITAL OUTMODE:	Control mode of digital outputs
OUTPUT HOLD-TIME:	Output hold time
EXT-IN0-MODE:	This list field is used to set the external trigger mode.
	(CONTINUOUS, TRIGG-IN0 L/H, TRIGG IN0 HIGH, SEL PARA-SET)
AVERAGE MEAN-VALUE:	This list field is used to set the averaging function sensor (possible values: 1, 2,4,8,16, or 32)

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Parameterization

Software STRUCT-Scope (STRUCTURE side): TEACH-TABLE

TEACH-TABLE:

Maximally 31 structure vectors (vector entries) for distinguishing 31 different structures, presetting of tolerances for the evaluation values (TOL) from the spectrum, and presetting of the tolerance for the exposure time (ETO).
Display of the correlation value for max. 8 comparison spectrums (spatial frequency spectrums).
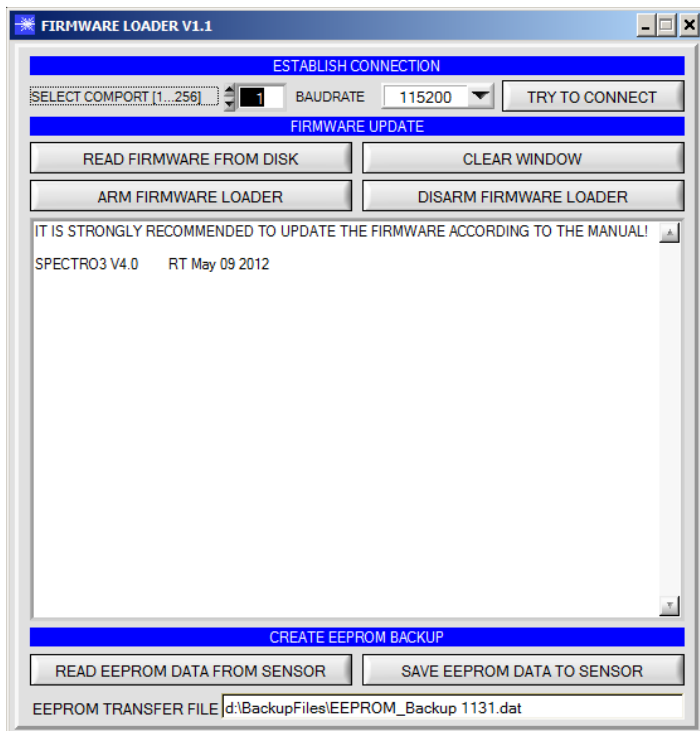TEACH-IN button for teaching the current spectrum to the teach table.

Display and input of the following evaluation values:
FREQ: Frequency
AMPL: Amplitude/10 of the frequency spectrum
AREA: Normed area ratio calculated from the frequency spectrum
EXPT: Exposure time of the respective structure
TOL: Tolerance for frequency and amplitude
ETO: Tolerance for exposure time

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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.

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PARA Mode

Using forward and backward scattering of object surfaces in PARA mode:

Some object surfaces are very hard to differentiate if only backward scattering is used.

If, however, forward scattering is used in addition, surfaces that have very similar colours but slightly different structures can be differentiated quite well.

Light is directed onto the surface at an angle of -30° and +30° from the normal (vertical). Only one light source is active at a time, which allows independent evaluation of forward and backward scattering.

For each sensor (color sensor and structure sensor) a specific parameter set is saved both for backward and forward scattering, i.e. altogether 4 parameter sets are available:

1. Parameter set (IN0 = 0)   →   Color sensor: Forward reflection

2. Parameter set (IN0 = 0)   →   Structure sensor: Backward reflection

3. Parameter set (IN0 = 1)   →   Color sensor: Backward reflection

4. Parameter set (IN0 = 1)   →   Structure sensor: Forward reflection

GLAST Series

▶   **GLAST-85-45°/45°-DIF-...**

- Recommended measurement distance: 85 mm ± 2 mm
- Determination of the direct reflection behaviour of glossy objects by way of spatial frequency analysis (frequency and amplitude) of a line grid
- Diffuse lighting with three different line grids available (0.5/0.5, 1.0/1.0 or 2.0/2.0)
- Up to 31 states can be saved
- Line detector (512 pixel) incl. projection lens
- RS232 interface (USB or Ethernet adapter is available)
- Haze control
- Brightness correction can be activated (STAT/DYN)
- Several TEACH functions (via PC, PLC, or push button)
- Various evaluation algorithms can be activated
- „BEST HIT" mode
- Switching state display by means of 5 yellow LEDs
- Parameterizable via Windows® software
- Temperature compensated
- Sturdy aluminum housing

Design

Product name:

GLAST-85-45°/45°-DIF-0.5/0.5
GLAST-85-45°/45°-DIF-1.0/1.0
GLAST-85-45°/45°-DIF-2.0/2.0
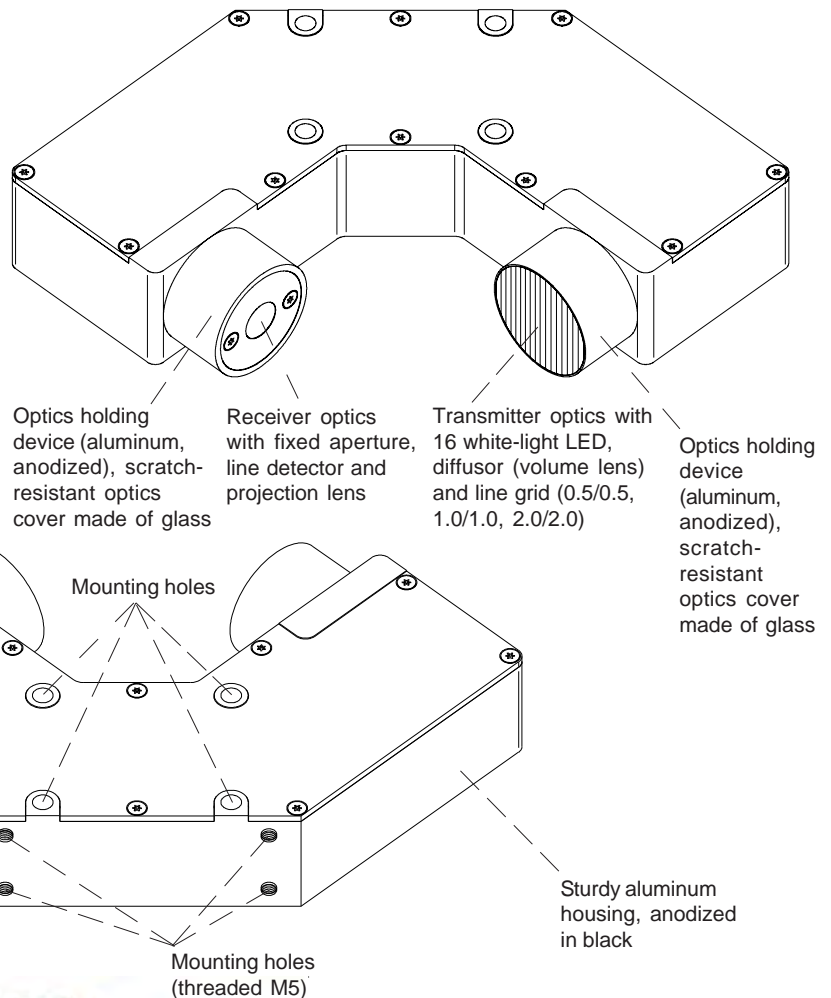(incl. Windows® PC software STRUCT-Scope)

45°/45°: The optical axes each have an angle of 45° with
respect to the vertical

Various grid dimensions (line grids) available
in front of diffuse lighting:
0.5/0.5 (0.5 mm line thickness, 0.5 mm spacing)
1.0/1.0 (1.0 mm line thickness, 1.0 mm spacing)
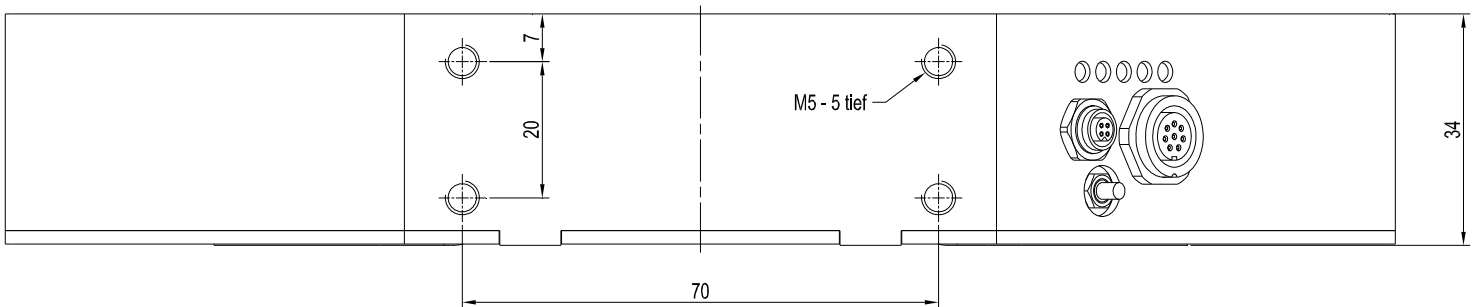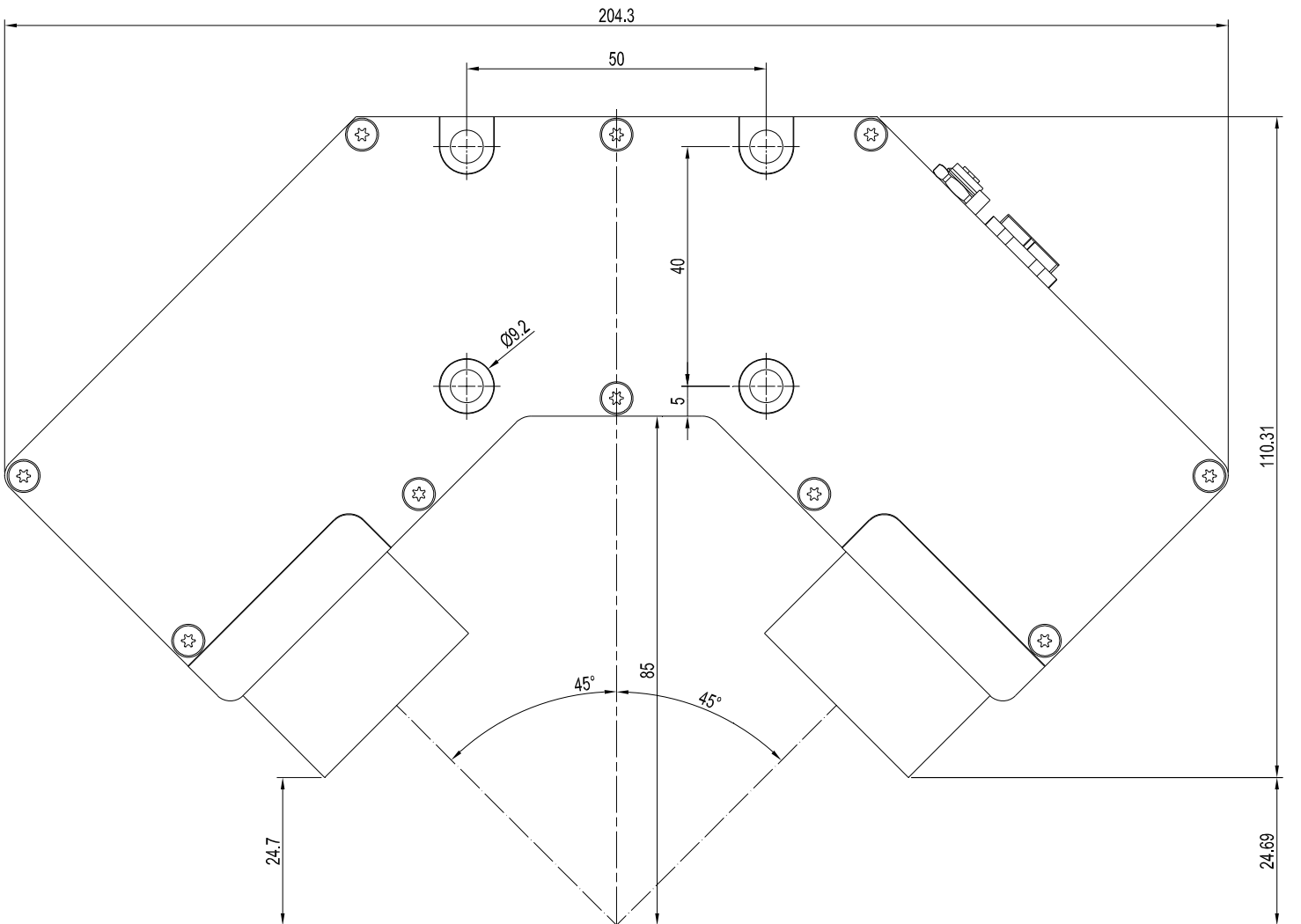2.0/2.0 (2.0 mm line thickness, 2.0 mm spacing)

Optics holding device (aluminum, anodized), scratch-resistant optics cover made of glass

Receiver optics with fixed aperture, line detector and projection lens

Transmitter optics with 16 white-light LED, diffusor (volume lens) and line grid (0.5/0.5, 1.0/1.0, 2.0/2.0)

Optics holding device (aluminum, anodized), scratch-resistant optics cover made of glass

TEACH button (external teaching via input IN0)

8-pole fem. conn. Binder Series 712 (connection to PLC)

Connecting cable: cab-las8/SPS

4-pole fem. conn. Binder Series 707 (connection to PC)

Connecting cable: cab-las4/PC or cab-4/USB or cab-4/ETH

LED display: Switching state indication by means of 5 yellow LED)

Mounting holes

Mounting holes (threaded M5)

Sturdy aluminum housing, anodized in black

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Technical Data

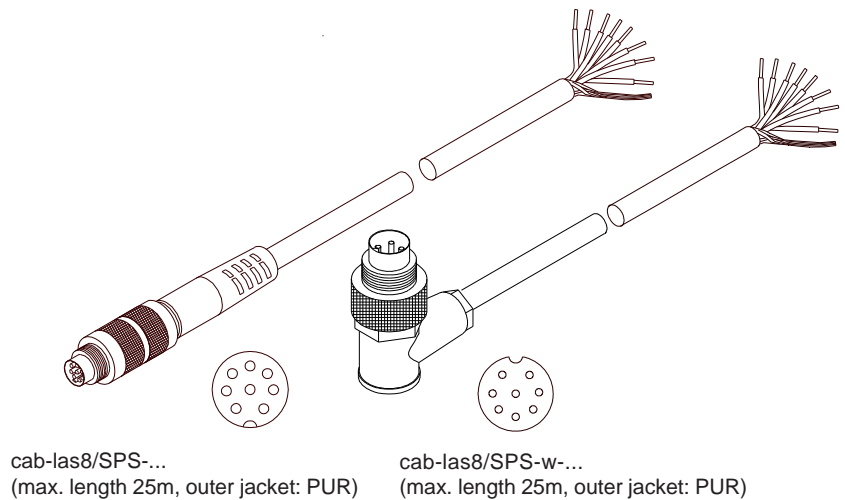| Model	GLAST-85-45°/45°-DIF-0.5/0.5 GLAST-85-45°/45°-DIF-1.0/1.0 GLAST-85-45°/45°-DIF-2.0/2.0
Voltage supply	+24VDC (± 10%), reverse polarity protected, overcurrent protected
Current consumption	< 500 mA
Max. switching current	100 mA, short circuit proof
Switching state indication	5 yellow LED visualize the physical state of the outputs OUT0 ... OUT4
Inputs digital	1 digital input: IN0 (Pin 3), digital (0V/+24V)
Outputs digital	OUT0...OUT4 (Pin 4..8): digital (0V/+24V), pn-/pnp-able (bright-/dark-switching, can be switched)
Interface	RS232
Pulse lengthening	100 ms ... 1 s (adjustable via PC software)
Averaging	max. 32 values (adjustable via PC software)
Line grid (grid dimension)	Various line grids available: GLAST-85-45°/45°-DIF-0.5/0.5: Line grid with 0.5 mm line thickness and 0.5 mm spacing GLAST-85-45°/45°-DIF-1.0/1.0: Line grid with 1.0 mm line thickness and 1.0 mm spacing GLAST-85-45°/45°-DIF-2.0/2.0: Line grid with 2.0 mm line thickness and 2.0 mm spacing
Max. measuring frequency	typ. 10 Hz
Angle of incidence	The optical axes are inclined each at an angle of 45° from the normal (vertical)
Measuring distance	typ. 85 mm ± 5 mm
Transmitter (light source)	16 super-bright white-light LED, diffusor (volume lens) and line grid
Transmitter control	Can be switched via PC software: AC operation (LED MODE-AC), DC operation (LED MODE-DC),
Receiver	line detector (512 pixel), projection lens, circular aperture (Ø 1 mm)
Exposure time	adjustable via PC software (EXPOSURE TIME)
Detection range	Measuring length typ. 20 mm at a distance of 85 mm
Temperature drift X,Y	$\Delta X/\Delta T$; $\Delta Y/\Delta T$ typ. 0,2 digits/°C (< 0,01% / °C)
Resolution	20mm/4096
Memory capacity	5 spatial frequency spectrums (max. 31 states)
Housing dimensions	LxWxH approx. 204.3 mm x 110.31 mm x 34 mm, without connectors
Housing material	Aluminum, anodized in black (optics holding device: aluminum, anodized)
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 alternatively: to PC/USB interface: cab-4/USB or cab-4/USB-w alternatively: 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)
Temperature ranges	Operating temperature 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

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Connector Assignment

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
4	yellow	OUT0
5	grey	OUT1
6	pink	OUT2
7	blue	OUT3
8	red	OUT4

Connecting cable:
cab-las8/SPS-(length)
cab-las8/SPS-w-(length) (angle type, 90°)
(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)
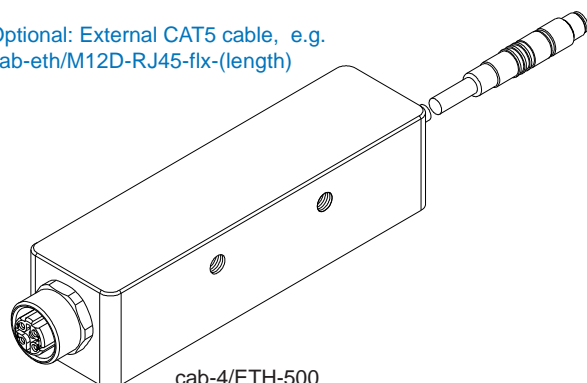cab-las4/PC-w-(length) (angle type 90°)
(standard length 2m)

<u>*alternative:*</u>
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)

<u>*alternative:*</u>
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-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)

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Fields of Application

Fields of application of the sensors of GLAST series:

Inline sensors of the GLAST series primarily are used for the inspection of highly reflecting surfaces (e.g. stainless steel panels, aluminum sheets, painted surfaces, plastic films) and transparent objects (films, glass plates, plexiglass plates).

A projection lens projects a line grid onto a line detector with the help of the object to be inspected, which functions as a more or less optimal mirror. Transparent objects are placed close to the line grid, which again is projected onto a line detector by a projection lens. In both cases the quality of the object determines the quality of the video signal at the line detector.

The reflective method operates at an angle of 30° (respectively 45°) each of the optical axes of the transmitter and receiver branch from the vertical, whereas in the through-beam method the object to be inspected stands vertically to the optical axis of the transmitter-receiver setup. In both cases the transmitter-receiver distance is approx. 135 mm.

Three different line grids are available in each case (0.5m/0.5mm, 1.0mm/1.0mm, and 2.0mm/2.0mm).
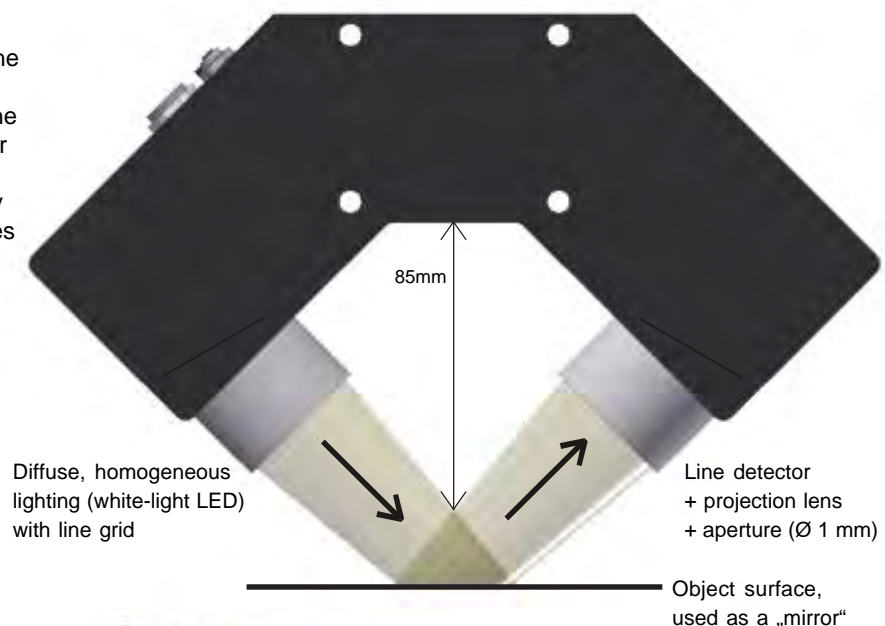
Measuring Principle

Measuring principle of the GLAST series sensors:

The GLAST sensor (**GL**oss **A**nd **ST**ructure) among others was developed to inspect the haze behaviour of objects. For this purpose a line grid is placed in front of a homogeneously illuminated area. A projection lens projects this line grid onto the line detector, and the object to be inspected practically functions as a mirror (reflector). The video signal that is available at the receiver side then provides information about the quality of the "mirror", i.e. about the reflection properties of the object surface. If the haze ratio increases, the video signal "flattens", which also results in a change of the spatial frequency spectrum, the line grid that is projected on the line detector. This means that the higher frequencies are less present, and the amplitudes generally decrease.

The GLAST sensor in principle is a line camera that is equipped with a controllable diffuse light unit (16 white light LED + diffusor + line grid). The detection range (line) is 20 mm at a distance of 85 mm from the sensor body (see dimensions) and runs in longitudinal extension of the sensor. The line-shaped section of the surface to be inspected (approx. 20 mm x 0.5 mm) is projected onto the line detector by the projection lens (receiver optics). The video signal that is generated by the line detector is converted into a spatial frequency spectrum by way of suitable algorithms in the sensor's internal controller. This means that a signal is thus available that provides information about the haze ratio of the surface. Up to 5 spatial frequency spectrums and up to 31 states can be saved in the sensor. During the inspection process the current spatial frequency spectrum is compared with the spatial frequency spectrums saved in the memory, and the most similar spatial frequency spectrum is searched. Amplitudes, frequency, and harmonic waves also are compared.

With the help of the surface to be inspected (object surface) the line grid is reflected in the direction of the projection lens and through the projection optics is projected onto the line detector. The video signal of the line detector and therefore also the spatial frequency spectrum changes depending on the quality of the "mirror" (i.e. on the reflection properties of the object surface).

85mm

Diffuse, homogeneous lighting (white-light LED) with line grid

Line detector + projection lens + aperture (Ø 1 mm)

Object surface, used as a „mirror"

Visualization of the state code:

The state code is visualized by means of 5 yellow LEDs at the housing of the GLAST sensor. The state code that is indicated at the LED display simultaneously is provided in binary mode (OUT BINARY) as 5-bit binary information at digital outputs OUT0 ... OUT4 of the 8-pole PLC connector.

The GLAST sensor is able to process a maximum of 31 states (code 0 … 30) corresponding to the individual rows in the TEACH TABLE. The sensor indicates an "error" or a "not detected state" by turning on all the LEDs (digital outputs OUT0 ... OUT4 at HIGH level).

Besides, the sensor can store a maximum of 5 spatial frequency spectrums for correlation evaluation.

A maximum of 5 teach states (no. 0, 1, 2, 3, 4) are permitted in DIRECT mode (OUT DIRECT HI or OUT DIRECT LO). If the selector switch is set to DIRECT HI, the corresponding digital output is HI and the other four are LO. If no state was detected, the digital outputs are in LO state (no LED is on).

If the selector switch is set to DIRECT LO, the corresponding digital output is LO and the other four are HI. If no state was detected, the digital outputs are in HI state (all LEDs are on).
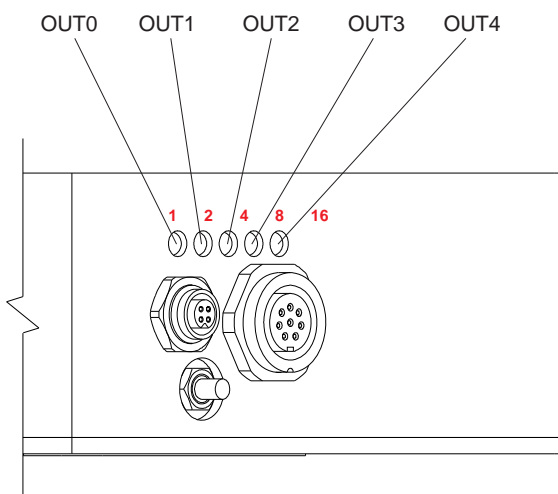
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LED Display

LED display:

The state code is visualized by means of 5 yellow LEDs at the housing of the GLAST sensor. The state code indicated at the LED display is output as 5-bit binary information at the digital outputs OUT0 ... OUT4 of the 8-pole PLC connector.

In the DIRECT mode the maximum number of state codes to be taught is 5. These 5 state codes can be directly output at the 5 digital outputs. The respective detected state code is displayed by means of the 5 yellow LEDs at the housing of the GLAST sensor.

OUT0　OUT1　OUT2　OUT3　OUT4

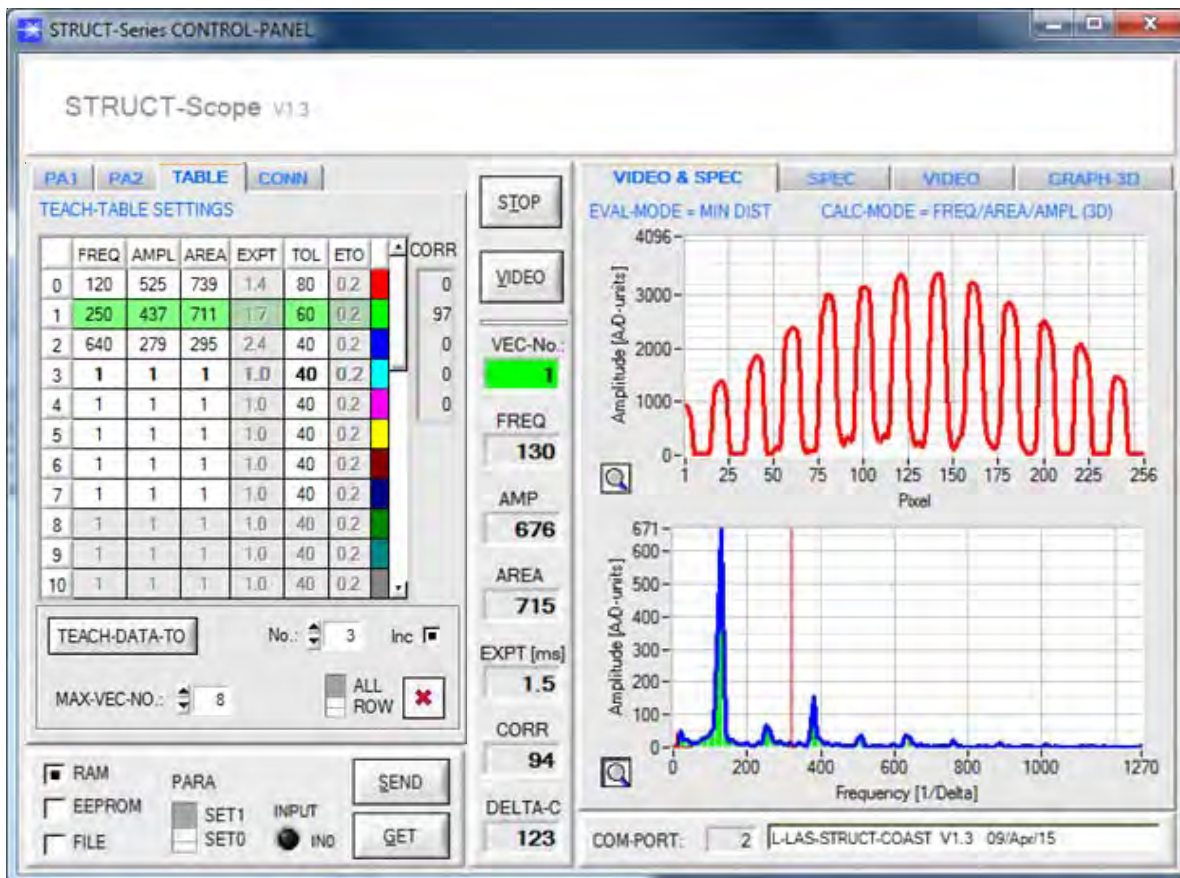| Code	Code	Code
○○○○○ **0**	●○○○○ **1**	○●○○○ **2**
●●○○○ **3**	○○●○○ **4**	●○●○○ **5**
○●●○○ **6**	●●●○○ **7**	○○○●○ **8**
●○○●○ **9**	○●○●○ **10**	●●○●○ **11**
○○●●○ **12**	●○●●○ **13**	○●●●○ **14**
●●●●○ **15**	○○○○● **16**	●○○○● **17**
○●○○● **18**	●●○○● **19**	○○●○● **20**
●○●○● **21**	○●●○● **22**	●●●○● **23**
○○○●● **24**	●○○●● **25**	○●○●● **26**
●●○●● **27**	○○●●● **28**	●○●●● **29**
○●●●● **30**	●●●●● Fehler bzw. „nicht erkannt"	

Parameterization

Software STRUCT-Scope: GENERAL-PARAMETER 1 and VIDEO & SPEC

The RS232 interface (tabs PA1, PA2, and TABLE) is used to set sensor parameters such as:

EVAL-MODE:	Evaluation mode in the 2D/3D number range
CALC-MODE:	Calculation mode of information from the spectrum
CORRELATION THD:	Threshold for use in correlation calculation
DIGITAL OUTMODE:	Control mode of digital outputs
OUTPUT HOLD-TIME:	Output hold time
EXT-IN0-MODE:	Setting of the external trigger mode.
	(CONTINUOUS, TRIGG-IN0 L/H, TRIGG IN0 HIGH, SEL PARA-SET)
AVERAGE MEAN-VALUE:	Setting of averaging at the sensor (possible values: 1, 2,4,8,16 or 32)

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(2016-01-19) *GLAST-85-45°/45°-DIF-... / Page 8 of 12*
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Subject to alteration

Parameterization

Software STRUCT-Scope: TEACH-TABLE

TEACH-TABLE:

Maximum of 31 structure vectors (vector entries) for the differentiation of 31 different structures, setting of tolerances for the evaluation values (TOL) from the spectrum, and setting of the tolerance for the exposure time (ETO).
Display of the correlation value **for max. 5 comparison spectrums** (spatial frequency spectrums).
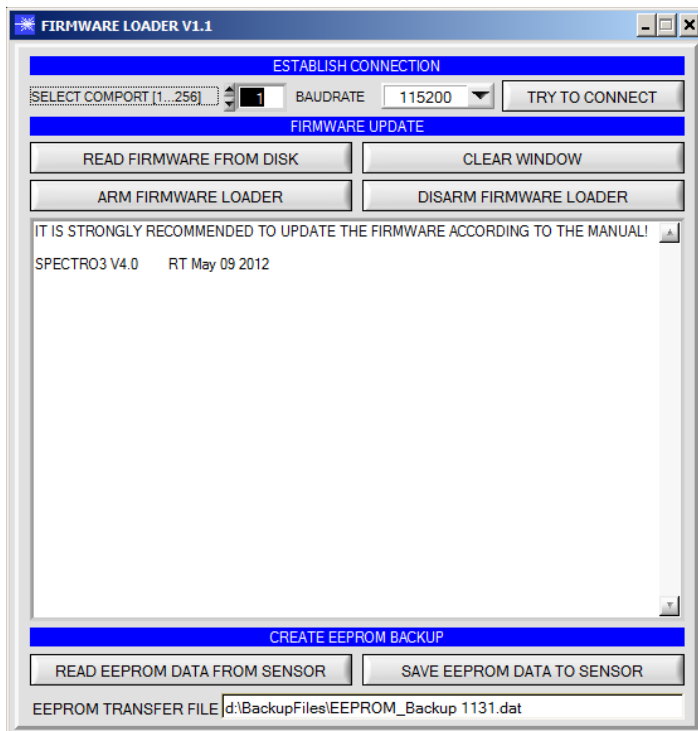TEACH-IN button for teaching the current spectrum to the teach table.

Display and input of the following evaluation values:
FREQ:　　Frequency
AMPL:　　Amplitude
AREA:　　Normed area ratio calculated from the frequency spectrum
EXPT:　　Exposure time of the respective structure
TOL:　　Tolerance for frequency and amplitude
ETO:　　Tolerance for exposure time

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Firmware Update

Firmware update by means of the software „FirmwareLoader":

FIRMWARE LOADER V1.1

ESTABLISH CONNECTION

SELECT COMPORT [1...256] 1 BAUDRATE 115200 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

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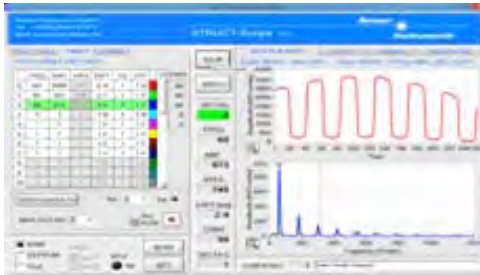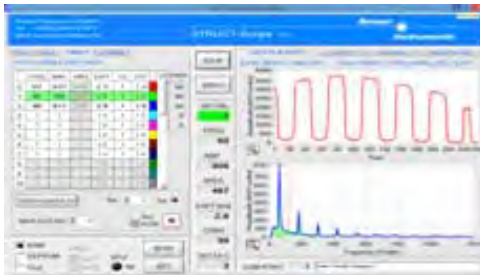
An initialisation file (xxx.ini) and a firmware file (xxx.elf.S) are required for performing a firmware update. These files can be obtained from your supplier. In some cases an additional firmware file for the program memory (xxx.elf.p.S) is also needed, and this file will be automatically provided together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

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Application Examples

Haze control of stainless steel plates

The haze of stainless steel surfaces should be controlled. For this purpose an optical sensor type GLAST-85-30°/30°-DIF-2.0/2.0 is used. At this, the distance to the stainless steel surface is approximately 85 mm and the detected line has a length of around 20 mm at this distance. The haze can be proper detected, as shown in the screen shots.
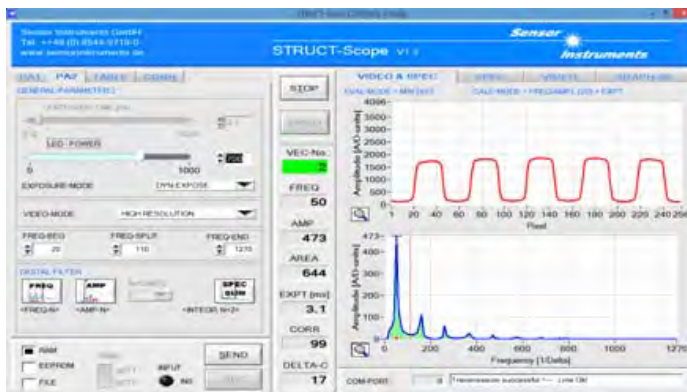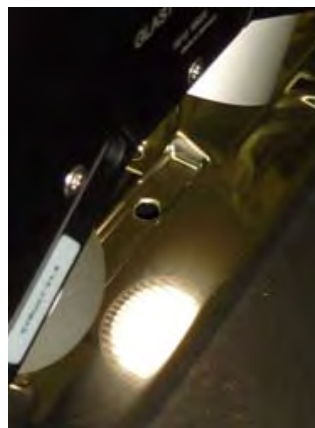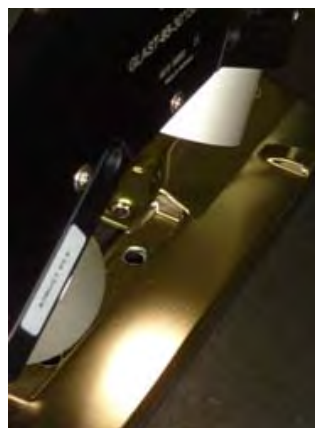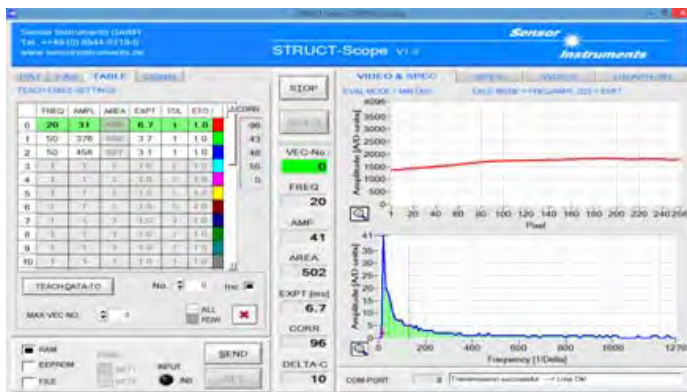
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Application Examples

Differentiation of diverse hazy metal parts

Diverse hazy metal components should be
differentiated. For this purpose, a haze sensor type
GLAST-85-30°/30°-DIF-1.0/1.0 is used.
At this, the sensor is arranged at a distance of
around 85 mm to the object. Furthermore, the
detecting range is approximately 20 mm in length.
The metal parts can be proper haze differentiated as
shown in the screen shots.

GLAST Series

▶ GLAST-85-30°/30°-DIF-...

- Recommended measurement distance: 85 mm ± 2 mm
- Determination of the direct reflection behaviour of glossy objects by way of spatial frequency analysis (frequency and amplitude) of a line grid
- Diffuse lighting with three different line grids available (0.5/0.5, 1.0/1.0 or 2.0/2.0)
- Up to 31 states can be saved
- Line detector (512 pixel) incl. projection lens
- RS232 interface (USB or Ethernet adapter is available)
- Haze control
- Brightness correction can be activated (STAT/DYN)
- Several TEACH functions (via PC, PLC, or push button)
- Various evaluation algorithms can be activated
- „BEST HIT" mode
- Switching state display by means of 5 yellow LEDs
- Parameterizable via Windows® software
- Temperature compensated
- Sturdy aluminum housing

Design

Product name:

GLAST-85-30°/30°-DIF-0.5/0.5
GLAST-85-30°/30°-DIF-1.0/1.0
GLAST-85-30°/30°-DIF-2.0/2.0
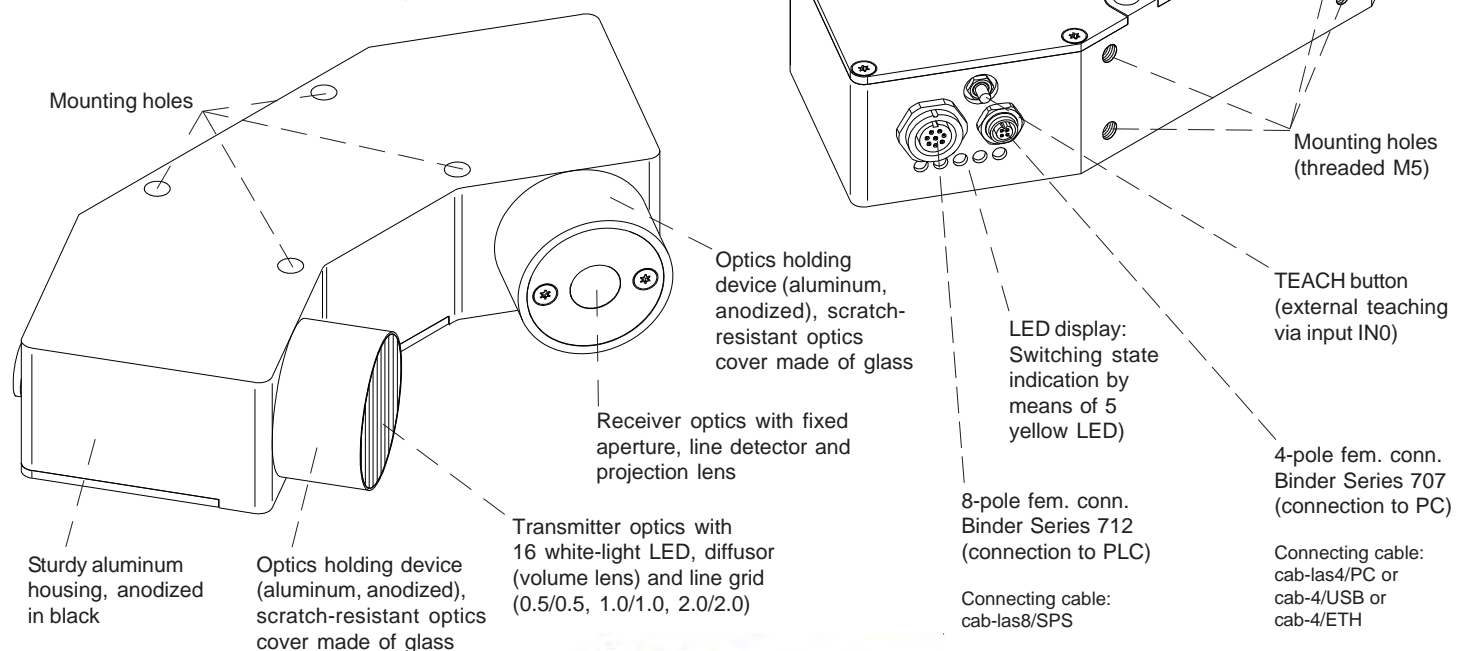(incl. Windows® PC software STRUCT-Scope)

30°/30°: The optical axes each have an angle of 30° with respect to the vertical

Various grid dimensions (line grids) available in front of diffuse lighting:
0.5/0.5 (0.5 mm line thickness, 0.5 mm spacing)
1.0/1.0 (1.0 mm line thickness, 1.0 mm spacing)
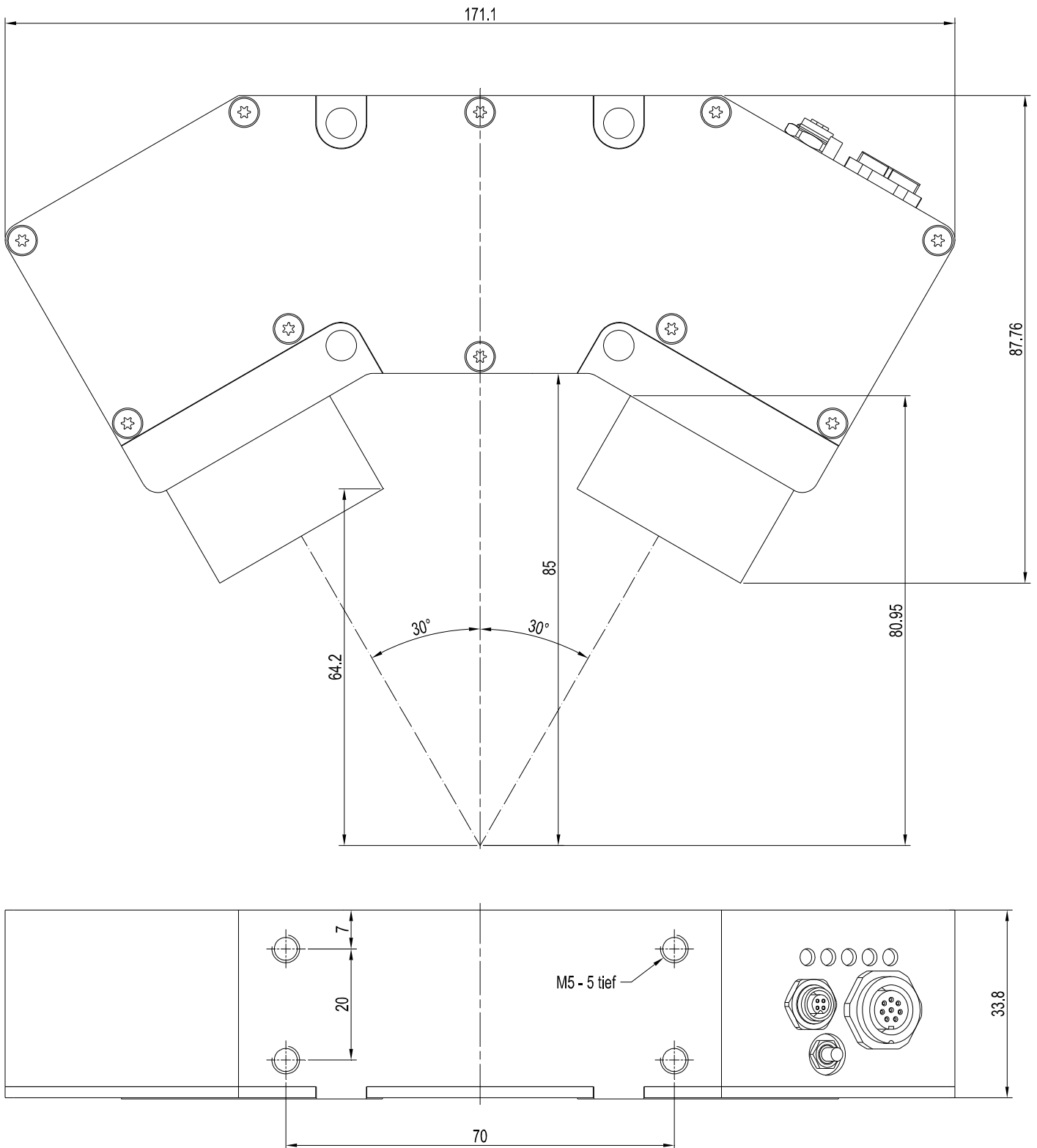2.0/2.0 (2.0 mm line thickness, 2.0 mm spacing)

Mounting holes

Mounting holes
(threaded M5)

Optics holding device (aluminum, anodized), scratch-resistant optics cover made of glass

Receiver optics with fixed aperture, line detector and projection lens

TEACH button
(external teaching via input IN0)

LED display:
Switching state indication by means of 5 yellow LED)

4-pole fem. conn.
Binder Series 707
(connection to PC)

8-pole fem. conn.
Binder Series 712
(connection to PLC)

Connecting cable:
cab-las4/PC or
cab-4/USB or
cab-4/ETH

Connecting cable:
cab-las8/SPS

Sturdy aluminum housing, anodized in black

Optics holding device (aluminum, anodized), scratch-resistant optics cover made of glass

Transmitter optics with 16 white-light LED, diffusor (volume lens) and line grid (0.5/0.5, 1.0/1.0, 2.0/2.0)

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Technical Data

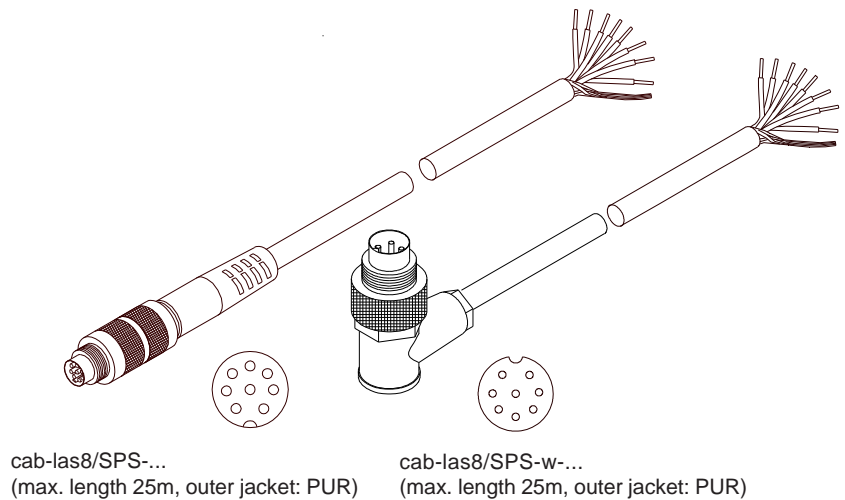| Model	GLAST-85-30°/30°-DIF-0.5/0.5 GLAST-85-30°/30°-DIF-1.0/1.0 GLAST-85-30°/30°-DIF-2.0/2.0
Voltage supply	+24VDC (± 10%), reverse polarity protected, overcurrent protected
Current consumption	< 500 mA
Max. switching current	100 mA, short circuit proof
Switching state indication	5 yellow LED visualize the physical state of the outputs OUT0 ... OUT4
Inputs digital	1 digital input: IN0 (Pin 3), digital (0V/+24V)
Outputs digital	OUT0...OUT4 (Pin 4..8): digital (0V/+24V), pn-/pnp-able (bright-/dark-switching, can be switched)
Interface	RS232
Pulse lengthening	100 ms ... 1 s (adjustable via PC software)
Averaging	max. 32 values (adjustable via PC software)
Line grid (grid dimension)	Various line grids available: GLAST-85-30°/30°-DIF-0.5/0.5: Line grid with 0.5 mm line thickness and 0.5 mm spacing GLAST-85-30°/30°-DIF-1.0/1.0: Line grid with 1.0 mm line thickness and 1.0 mm spacing GLAST-85-30°/30°-DIF-2.0/2.0: Line grid with 2.0 mm line thickness and 2.0 mm spacing
Max. measuring frequency	typ. 10 Hz
Angle of incidence	The optical axes are inclined each at an angle of 30° from the normal (vertical)
Measuring distance	typ. 85 mm ± 5 mm
Transmitter (light source)	16 super-bright white-light LED, diffusor (volume lens) and line grid
Transmitter control	Can be switched via PC software: AC operation (LED MODE-AC), DC operation (LED MODE-DC),
Receiver	line detector (512 pixel), projection lens, circular aperture (Ø 1 mm)
Exposure time	adjustable via PC software (EXPOSURE TIME)
Detection range	Measuring length typ. 20 mm at a distance of 85 mm
Temperature drift X,Y	$\Delta X/\Delta T$; $\Delta Y/\Delta T$ typ. 0,2 digits/°C (< 0,01% / °C)
Resolution	20mm/4096
Memory capacity	5 spatial frequency spectrums (max. 31 states)
Housing dimensions	LxWxH approx. 171.1 mm x 87.76 mm x 34 mm, without connectors
Housing material	Aluminum, anodized in black (optics holding device: aluminum, anodized)
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 alternatively: to PC/USB interface: cab-4/USB or cab-4/USB-w alternatively: 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)
Temperature ranges	Operating temperature range: -20°C ... +55°C, storage temperature range: -20°C ... +85°C
EMC test acc. to	DIN EN 60947-5-2 CE

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Dimensions

171.1

87.76

80.95

85

64.2

30°   30°

7

20

M5 - 5 tief

70

33.8

All dimensions in mm

Connector Assignment

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
4	yellow	OUT0
5	grey	OUT1
6	pink	OUT2
7	blue	OUT3
8	red	OUT4

Connecting cable:
cab-las8/SPS-(length)
cab-las8/SPS-w-(length) (angle type, 90°)
(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)
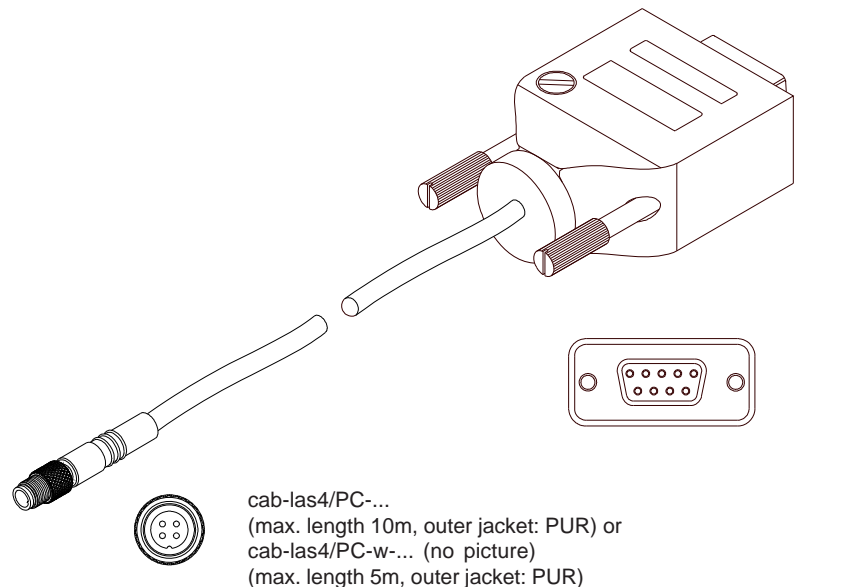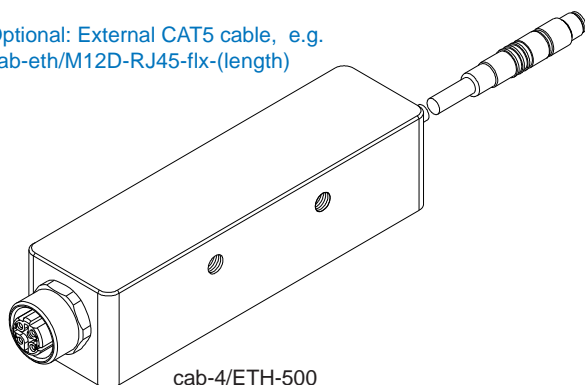cab-las4/PC-w-(length) (angle type 90°)
(standard length 2m)

alternative:
Connection via USB interface at the PC:
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-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)

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Fields of Application

Fields of application of the sensors of GLAST series:

Inline sensors of the GLAST series primarily are used for the inspection of highly reflecting surfaces (e.g. stainless steel panels, aluminum sheets, painted surfaces, plastic films) and transparent objects (films, glass plates, plexiglass plates).

A projection lens projects a line grid onto a line detector with the help of the object to be inspected, which functions as a more or less optimal mirror. Transparent objects are placed close to the line grid, which again is projected onto a line detector by a projection lens. In both cases the quality of the object determines the quality of the video signal at the line detector.

The reflective method operates at an angle of 30° (respectively 45°) each of the optical axes of the transmitter and receiver branch from the vertical, whereas in the through-beam method the object to be inspected stands vertically to the optical axis of the transmitter-receiver setup. In both cases the transmitter-receiver distance is approx. 135 mm.
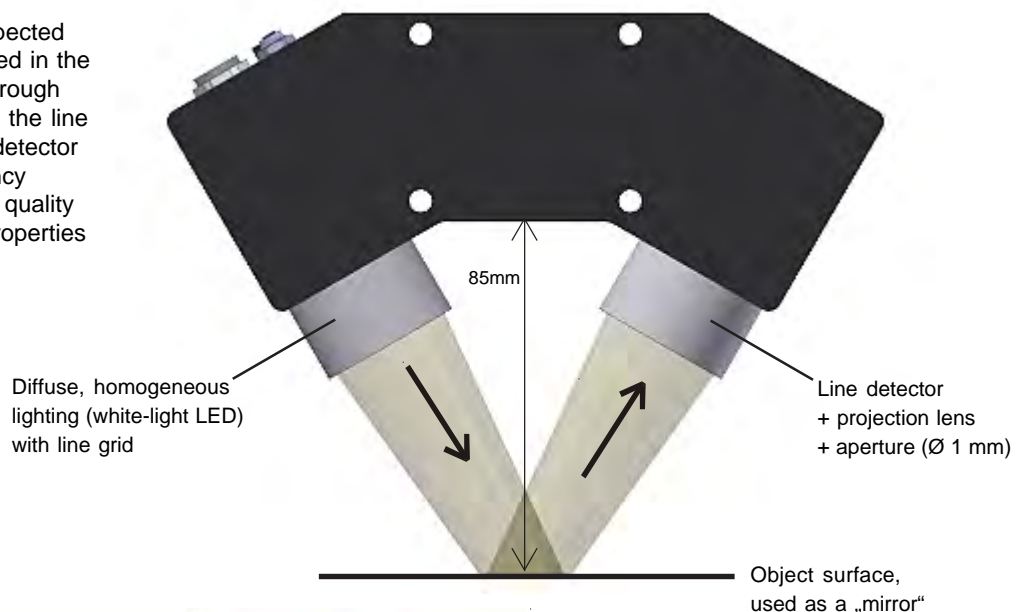
Three different line grids are available in each case (0.5m/0.5mm, 1.0mm/1.0mm, and 2.0mm/2.0mm).

Measuring Principle

Measuring principle of the GLAST series sensors:

The GLAST sensor (**GL**oss **A**nd **ST**ructure) among others was developed to inspect the haze behaviour of objects. For this purpose a line grid is placed in front of a homogeneously illuminated area. A projection lens projects this line grid onto the line detector, and the object to be inspected practically functions as a mirror (reflector). The video signal that is available at the receiver side then provides information about the quality of the "mirror", i.e. about the reflection properties of the object surface. If the haze ratio increases, the video signal "flattens", which also results in a change of the spatial frequency spectrum, the line grid that is projected on the line detector. This means that the higher frequencies are less present, and the amplitudes generally decrease.

The GLAST sensor in principle is a line camera that is equipped with a controllable diffuse light unit (16 white light LED + diffusor + line grid). The detection range (line) is 20 mm at a distance of 85 mm from the sensor body (see dimensions) and runs in longitudinal extension of the sensor. The line-shaped section of the surface to be inspected (approx. 20 mm x 0.5 mm) is projected onto the line detector by the projection lens (receiver optics). The video signal that is generated by the line detector is converted into a spatial frequency spectrum by way of suitable algorithms in the sensor's internal controller. This means that a signal is thus available that provides information about the haze ratio of the surface. Up to 5 spatial frequency spectrums and up to 31 states can be saved in the sensor. During the inspection process the current spatial frequency spectrum is compared with the spatial frequency spectrums saved in the memory, and the most similar spatial frequency spectrum is searched. Amplitudes, frequency, and harmonic waves also are compared.

With the help of the surface to be inspected (object surface) the line grid is reflected in the direction of the projection lens and through the projection optics is projected onto the line detector. The video signal of the line detector and therefore also the spatial frequency spectrum changes depending on the quality of the "mirror" (i.e. on the reflection properties of the object surface).

Diffuse, homogeneous lighting (white-light LED) with line grid

85mm

Line detector
+ projection lens
+ aperture (Ø 1 mm)

Object surface,
used as a „mirror"

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Visualization of the state code:

The state code is visualized by means of 5 yellow LEDs at the housing of the GLAST sensor. The state code that is indicated at the LED display simultaneously is provided in binary mode (OUT BINARY) as 5-bit binary information at digital outputs OUT0 ... OUT4 of the 8-pole PLC connector.

The GLAST sensor is able to process a maximum of 31 states (code 0 … 30) corresponding to the individual rows in the TEACH TABLE. The sensor indicates an "error" or a "not detected state" by turning on all the LEDs (digital outputs OUT0 ... OUT4 at HIGH level).

Besides, the sensor can store a maximum of 5 spatial frequency spectrums for correlation evaluation.

A maximum of 5 teach states (no. 0, 1, 2, 3, 4) are permitted in DIRECT mode (OUT DIRECT HI or OUT DIRECT LO). If the selector switch is set to DIRECT HI, the corresponding digital output is HI and the other four are LO. If no state was detected, the digital outputs are in LO state (no LED is on).

If the selector switch is set to DIRECT LO, the corresponding digital output is LO and the other four are HI. If no state was detected, the digital outputs are in HI state (all LEDs are on).
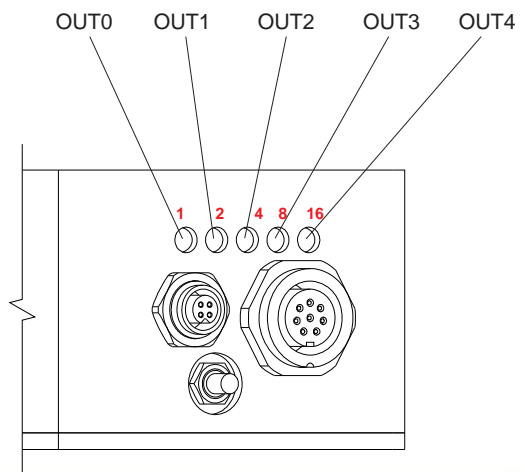

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LED Display

LED display:

The state code is visualized by means of 5 yellow LEDs at the housing of the GLAST sensor. The state code indicated at the LED display is output as 5-bit binary information at the digital outputs OUT0 ... OUT4 of the 8-pole PLC connector.

In the DIRECT mode the maximum number of state codes to be taught is 5. These 5 state codes can be directly output at the 5 digital outputs. The respective detected state code is displayed by means of the 5 yellow LEDs at the housing of the GLAST sensor.

OUT0 OUT1 OUT2 OUT3 OUT4

1 2 4 8 16

0	1	2
3	4	5
6	7	8
9	10	11
12	13	14
15	16	17
18	19	20
21	22	23
24	25	26
27	28	29
30	Fehler bzw. „nicht erkannt"	

Parameterization

Software STRUCT-Scope: GENERAL-PARAMETER 1 and VIDEO & SPEC
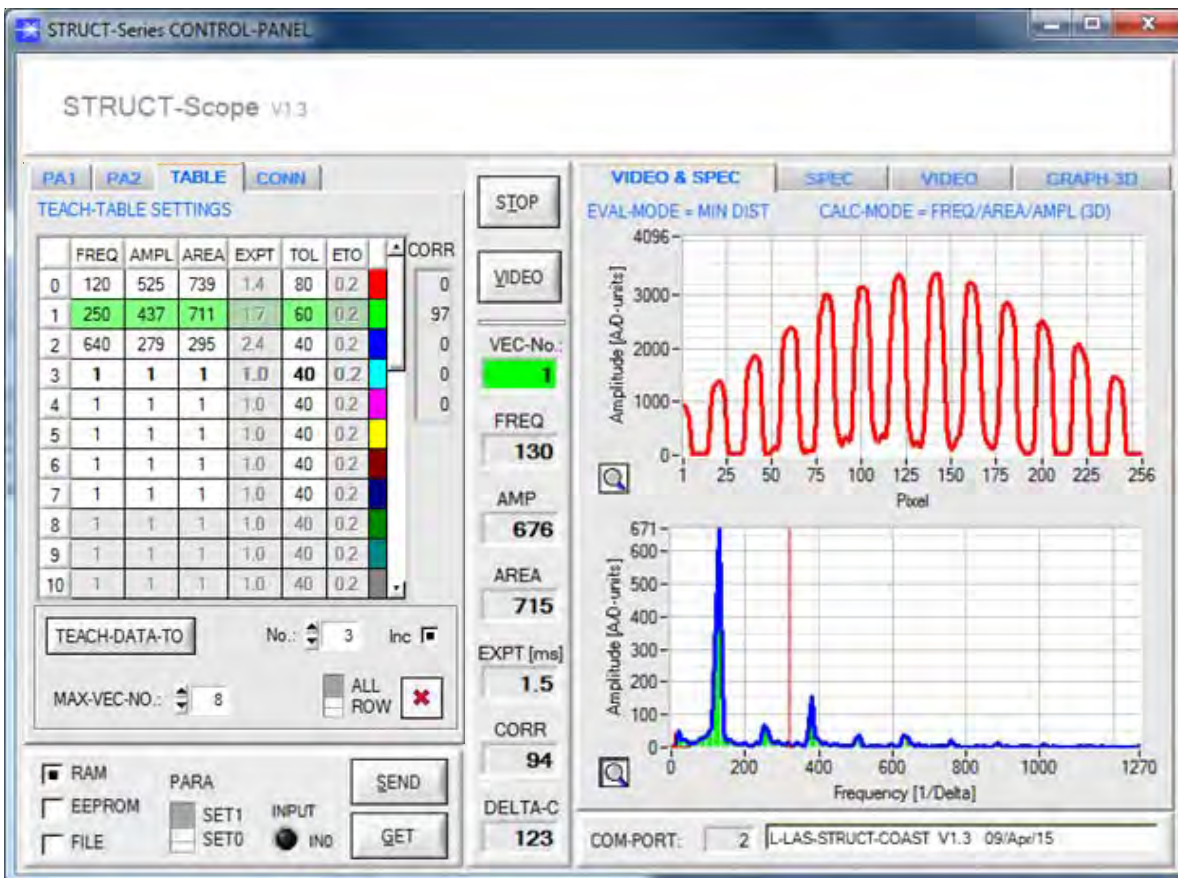

The RS232 interface (tabs PA1, PA2, and TABLE) is used to set sensor parameters such as:

EVAL-MODE:	Evaluation mode in the 2D/3D number range
CALC-MODE:	Calculation mode of information from the spectrum
CORRELATION THD:	Threshold for use in correlation calculation
DIGITAL OUTMODE:	Control mode of digital outputs
OUTPUT HOLD-TIME:	Output hold time
EXT-IN0-MODE:	Setting of the external trigger mode.
	(CONTINUOUS, TRIGG-IN0 L/H, TRIGG IN0 HIGH, SEL PARA-SET)
AVERAGE MEAN-VALUE:	Setting of averaging at the sensor (possible values: 1, 2,4,8,16 or 32)

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Tel. +49 (0)8544 9719-0 • Fax +49 (0)8544 9719-13   (2016-01-19) *GLAST-85-30°/30°-DIF-... / Page 8 of 12*
                                                                           (1022.01)
                                                                    Subject of alteration

Parameterization

Software STRUCT-Scope: TEACH-TABLE

TEACH-TABLE:

Maximum of 31 structure vectors (vector entries) for the differentiation of 31 different structures, setting of tolerances for the evaluation values (TOL) from the spectrum, and setting of the tolerance for the exposure time (ETO).
Display of the correlation value **for max. 5 comparison spectrums** (spatial frequency spectrums).
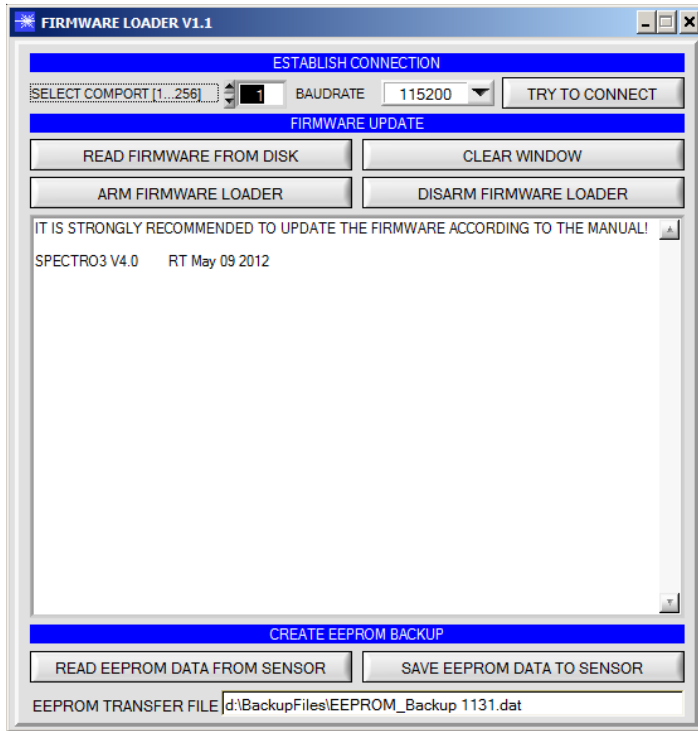TEACH-IN button for teaching the current spectrum to the teach table.

Display and input of the following evaluation values:

FREQ: Frequency
AMPL: Amplitude
AREA: Normed area ratio calculated from the frequency spectrum
EXPT: Exposure time of the respective structure
TOL: Tolerance for frequency and amplitude
ETO: Tolerance for exposure time

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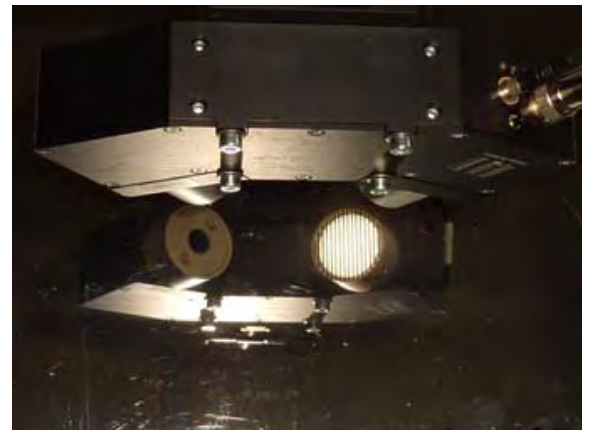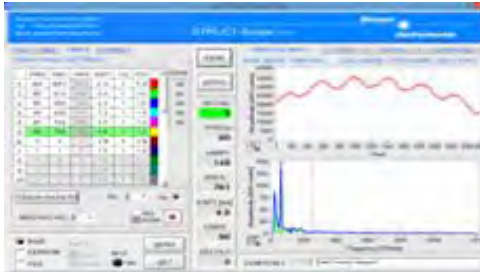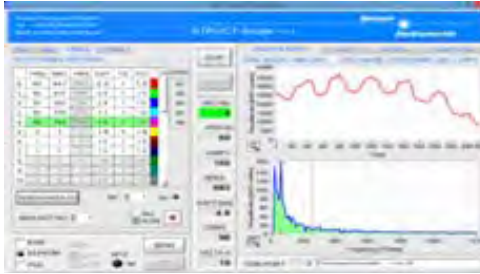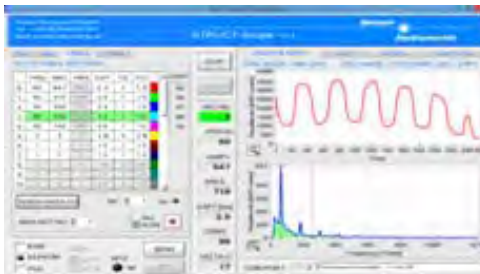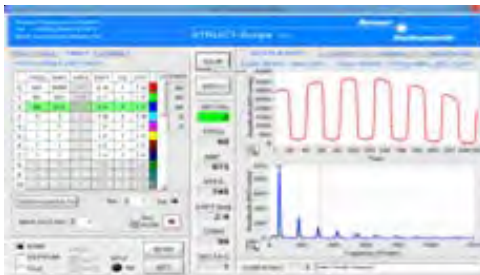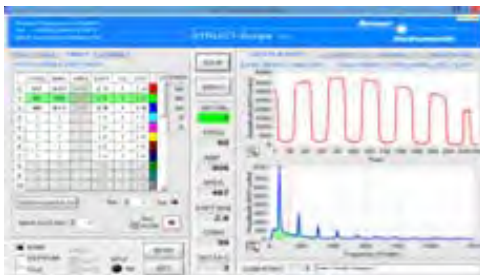
An initialisation file (xxx.ini) and a firmware file (xxx.elf.S) are required for performing a firmware update. These files can be obtained from your supplier. In some cases an additional firmware file for the program memory (xxx.elf.p.S) is also needed, and this file will be automatically provided together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

Application Examples

Haze control of stainless steel plates

The haze of stainless steel surfaces should be controlled. For this purpose an optical sensor type GLAST-85-30°/30°-DIF-2.0/2.0 is used. At this, the distance to the stainless steel surface is approximately 85 mm and the detected line has a length of around 20 mm at this distance. The haze can be proper detected, as shown in the screen shots.

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Subject of alteration

Application Examples

Differentiation of diverse hazy metal parts

Diverse hazy metal components should be differentiated. For this purpose, a haze sensor type GLAST-85-30°/30°-DIF-1.0/1.0 is used.
At this, the sensor is arranged at a distance of around 85 mm to the object. Furthermore, the detecting range is approximately 20 mm in length. The metal parts can be proper haze differentiated as shown in the screen shots.