SI-COLO Series

SI-COLO84

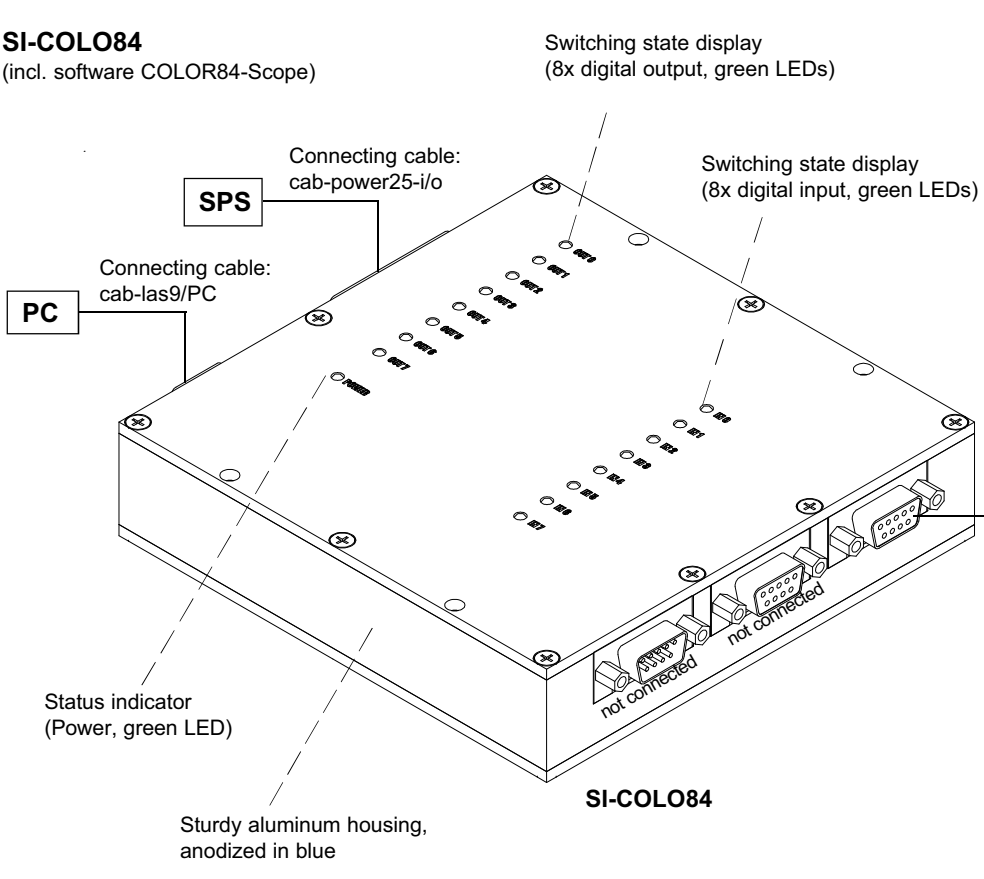
Color Sensor Control System

- Various color sensor frontends are available
- 12-bit accuracy
- Up to 100 colors can be stored
- 8 switching outputs (NPN and PNP)
- Switching state display
- External teaching via digital signal
- Parameterizable under Windows® via RS232-interface
- 'Averaging' can be activated (from 1 up to over 32000 values)

Design

Product name:

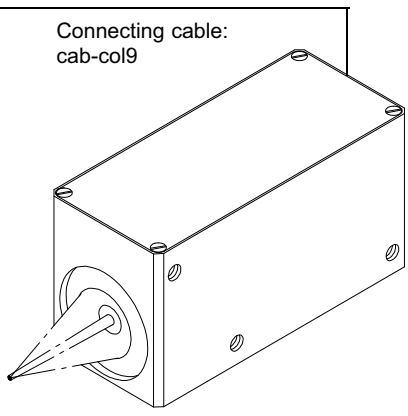
SI-COLO84
(incl. software COLOR84-Scope)



SI-COLO84

Available color sensor frontends:
(please order separately)

SI-COLO2-20-...-ANA 84
SI-COLO2-30-...-ANA 84
SI-COLO2-50-...-ANA 84
SI-COLO2-80-...-ANA 84
SI-COLO2-200-...-ANA 84
SI-COLO2-500-...-ANA 84
SI-COLO2-30-RING-ANA 84
SI-COLO2-50-RING-ANA 84
SI-COLO2-80-RING-ANA 84
SI-COLO2-30-DIL-ANA 84
SI-COLO2-30/90-DIL-ANA 84
SI-COLO2-200-DIL-ANA 84
SI-COLO2-LWL-ANA 84
SI-COLO2-LWL-SP-ANA 84



Color sensor frontend

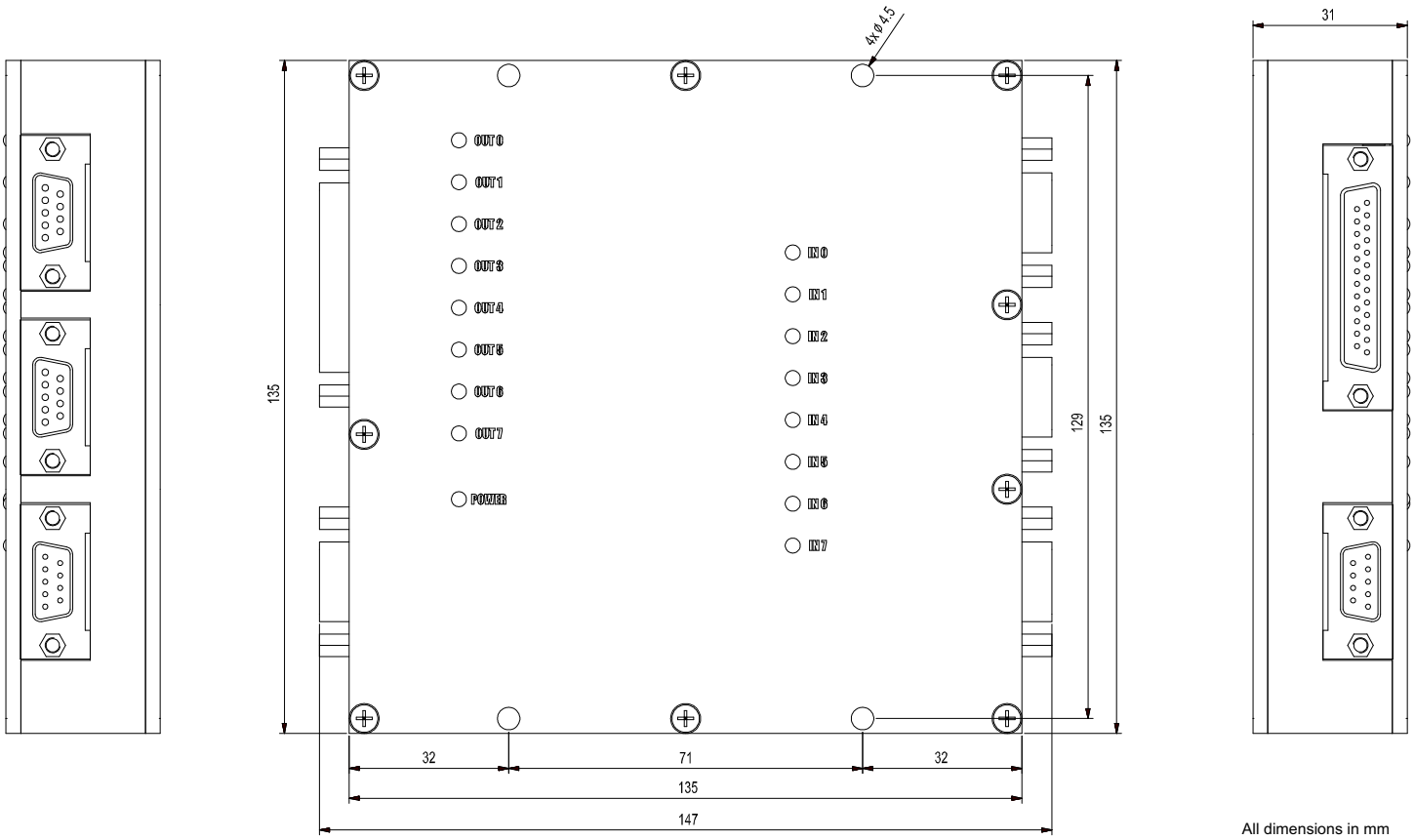
Parameterization under Windows® with software COLOR84-Scope:

The SI-COLO84 electronic control unit can be parameterized via serial interface (RS232) under Windows® (please cf. pages 32-34).
Up to 100 colors can be taught, and stored into the sensor. If the sensor detects one of a taught color, a change of switching state is performed through 8 digital outputs (visualized by means of 8 green LEDs).

Technical Data

Model	SI-COLO84
Voltage supply	+18 ... +36 VDC, reverse-polarity protected, overcurrent protected
Current consumption	max. 300 mA
Operating temperature	-10°C up to +55°C
Enclosure rating	IP54
Housing	Aluminum, anodized in blue
Housing dimensions	approx. 147 mm x 135 mm x 31 mm
8x digital input	24V input with protective circuit, non-opto-decoupled
Outputs	8x pnp/npn, short-circuit-protected (max. 100 mA per output (polarity can be adjusted under Windows®)
8x switching state display	Visualization of digital outputs by means of 8 green LEDs at the housing
Status display	Visualization of evaluation status by means of 8 yellow LEDs at the housing (inputs)
4x analog outputs	4-channel 12 bit D/A-converter, 0 ... +5V or 0 ... +10V
4x analog inputs	4-channel 12 bit D/A-converter, max. 100 kHz free frequency
2x source of current	2 constant sources of current (max. 50 mA) for operation of external sensors
1x incremental interface	Incremental interface, +5VDC, RS485 for A, A/, B, B/ und Z, Z/, interface for variable reset possibilities, 3 MHz band width
Data transfer	Serial interface according to RS232 standard, 19200 Baud, 8, N, 1
Mikrocontroller	Siemens SAB 80C166, 10 MIPS
Memory	128 kByte FLASH-EEPROM
EMC test acc. to	IEC - 801 ... CE
Connector type	1x 25-pin SUB-D connector (connection to PLC via cable cab-power25-i/o) 1x 9-pin SUB-D connector (connection to PC via cable cab-las9/PC) 1x 9-pin SUB-D female connector (connection to color sensor frontend via cable cab-col9) 1x 9-pin SUB-D connector (n.c.) 1x 9-pin SUB-D female connector (n.c.)
Averaging	1 ... 32768 values (adjustable under Windows®)
Teach function	extern via signal or teach button respectively under Windows®
Number of colors to be taught	max. 100
Accuracy	12 bit-A/D-converter
Light power	adjustable under Windows®
Color control	various evaluation modes available (selection under Windows®)

Dimensions



All dimensions in mm

LED Display

Output LEDs (OUT0 ... OUT7):

The function of the output LEDs depends on the selected evaluation mode (OUTMODE). OUTMODE offers the method of how to control the 8 digital outputs, you can select between BINARY or DIRECT (DIRECT HI respectively DIRECT LO) output.

BINARY: In this mode the maximum number of colors to be taught is 100.
If in this row-by-row comparison the current color values correspond with the teach-in parameters entered in the color teach table, this color in the color teach table is displayed as a color number (C-No.) and is sent to the digital outputs (OUT0 ... OUT7) as a **bit pattern**.

Output:	OUT0	OUT1	OUT2	OUT3	OUT4	OUT5	OUT6	OUT7
Value (binär) of the output:	1	2	4	8	16	32	64	128
Status of the output-LEDs for pos. 18:	off	on	off	off	on	off	off	off

DIRECT: In this mode the maximum number of colors to be taught is 8.
If in this row-by-row comparison the current color values correspond with the teach-in parameters entered in the color teach table, this color in the color teach table is displayed as a color number (C-No.) and is sent **direct** to the digital outputs (OUT0 ... OUT7), i.e. color in row 0 -> OUT0, color in row 1 -> OUT1, etc.
Moreover, you can choose between DIRECT HI and DIRECT LO:
If DIRECT HI is activated, the specially output LED (OUT = HIGH) is lighting, no other LED is lighting (LOW).
If DIRECT LO is activated, the specially output-LED (OUT = LOW) is not lighting, all other LEDs are lighting (HIGH).

Input LEDs (IN0 ... IN7):

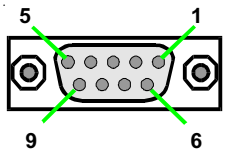
The only purpose of the input LEDs is to visualize the status of the inputs. If, for example, there is a HIGH signal (+24V) at input IN0, input LED IN0 lights up. If the inputs are not connected, they are pulled down to 0V by an internal pull-down resistor, i.e. all the input LEDs are off.
This visualization of the input LEDs is used in the different evaluation modes, e.g. TRIGGER, FIRST HIT, ADAPTIVE CONTR, EXT TEACH, etc.

Connector Assignment

Connection of SI-COLO84 to SI-COLO2-...-ANA 84:

9-pin SUB-D female connector:

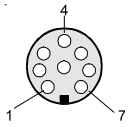
Pin:	Assignment:
1	GND (0V)
2	+5V SENS
3	+24V
4	DA0
5	DA1
6	AD0 (RED)
7	AD1 (GREEN)
8	AD2 (BLUE)
9	K1



Connecting cable: cab-col9 (l=2m)

8-pin female connector Binder 712 (SI-COLO2-...-ANA 84):

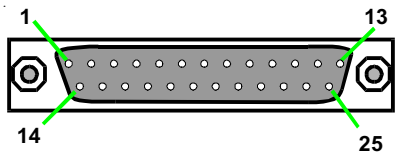
Pin:	Color:	Assignment:
1	white	GND (0V)
2	brown	+12 ... +30 VDC
3	green	I-CONTROL (0V ... +5V)
4	yellow	ANA RED (0V ... +5V)
5	grey	ANA GREEN (0V ... +5V)
6	pink	ANA BLUE (0V ... +5V)
7	blue	n.c.
8	red	n.c.



Connection of SI-COLO84 to PLC:

25-pin SUB-D connector

Pin:	Color:	Assignment:
1	wht	GND (0V)
2		GND (0V)
3	green	IN0
4	violet	IN1
5	black	IN2
6	red	IN3
7	blue	IN4
8	pink	IN5
9	yellow	IN6
10	grey	IN7
11		n.c.
12		GND (0V)
13		GND (0V)
14		GND (0V)
15	brown	+24VDC
16	green/white	OUT0
17	white/red	OUT1
18	green/yellow	OUT2
19	orange/blue	OUT3
20	orange	OUT4
21	blue/black	OUT5
22	orange/green	OUT6
23	pink/blue	OUT7
24		+24VDC
25		GND (0V)

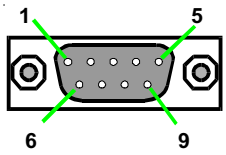


Connecting cable: cab-power25-i/o (l=2m)

Connection of SI-COLO84 to PC:

9-pin SUB-D connector

Pin:	Assignment:
1	n.c.
2	TX0
3	RX0
4	n.c.
5	GND (0V)
6	TX1
7	RX1
8	n.c.
9	n.c.

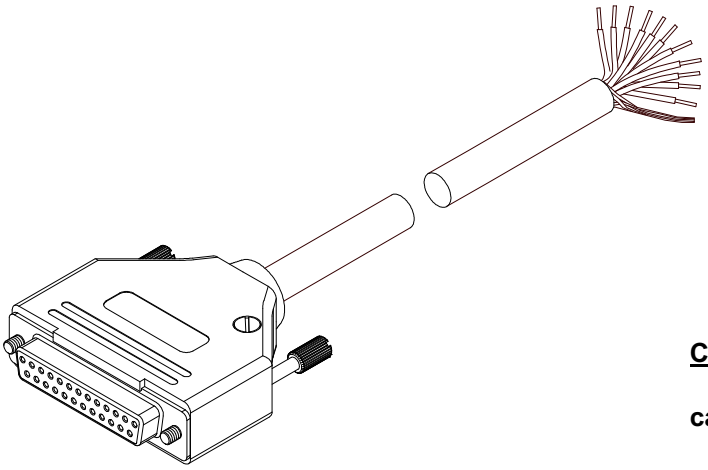


Connecting cable: cab-las9/PC (l=2m)

Connecting Cables

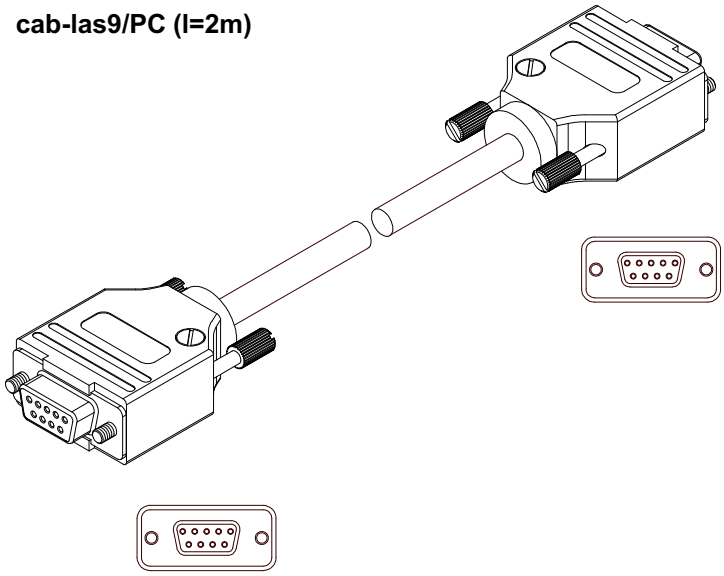
Connecting cable SI-COLO84 / PLC:

cab-power25-i/o (l=2m)



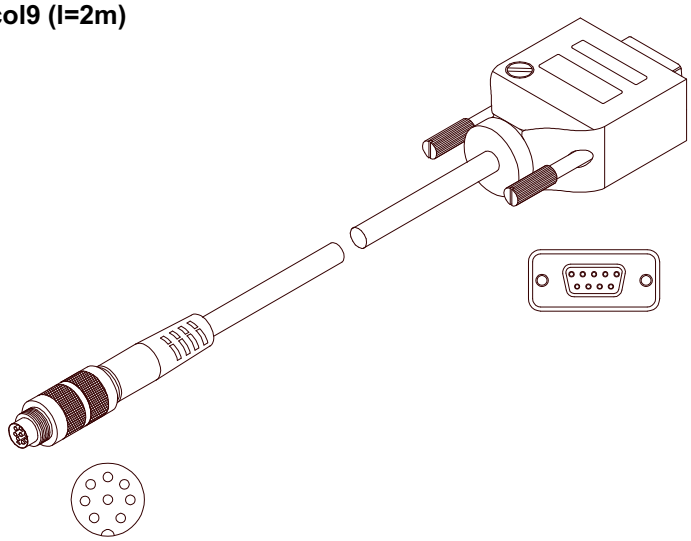
Connecting cable SI-COLO84 / PC:

cab-las9/PC (l=2m)



Connecting SI-COLO84 / SI-COLO2-...-ANA 84:

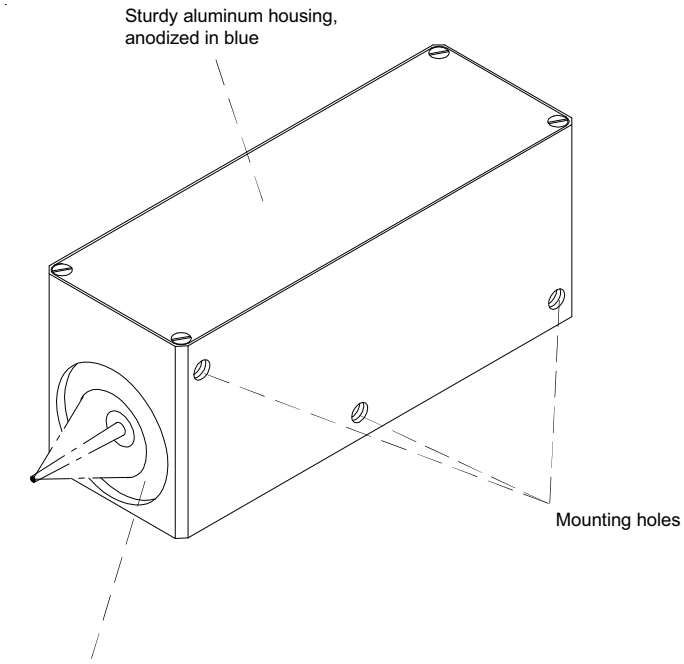
cab-col9 (l=2m)

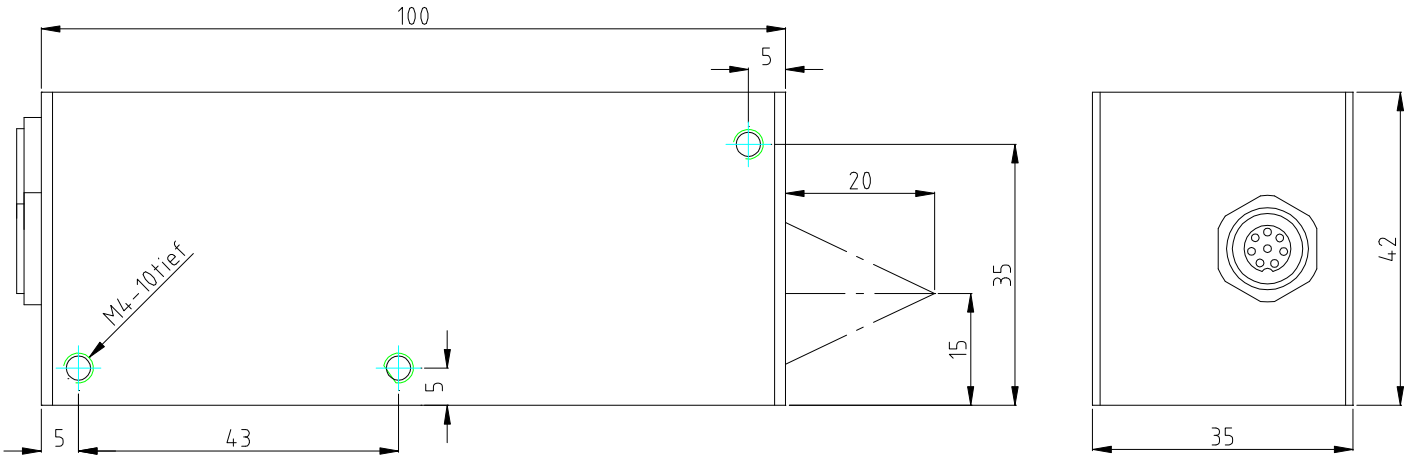


Color Sensor Frontend

Product name:

SI-COLO2-20-d0-ANA 84 d0 = Light spot size typ. Ø 0.8 mm at 20 mm object distance





All dimensions in mm

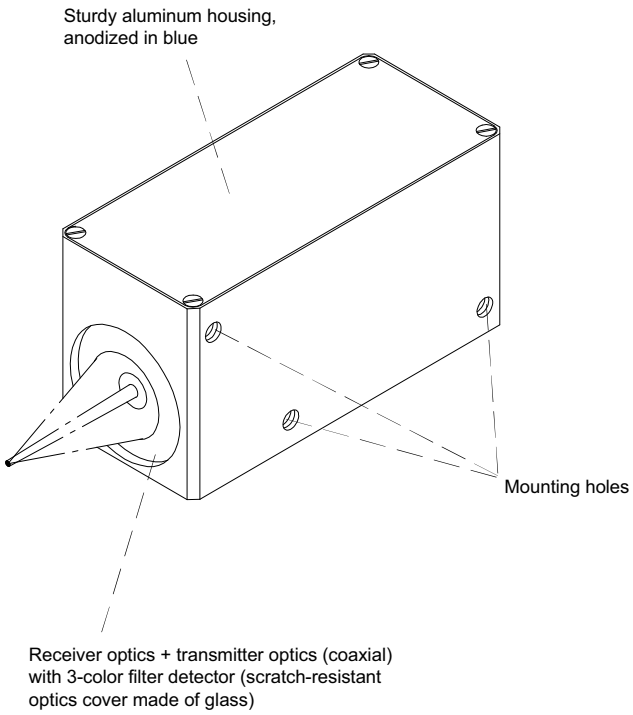
Color Sensor Frontend

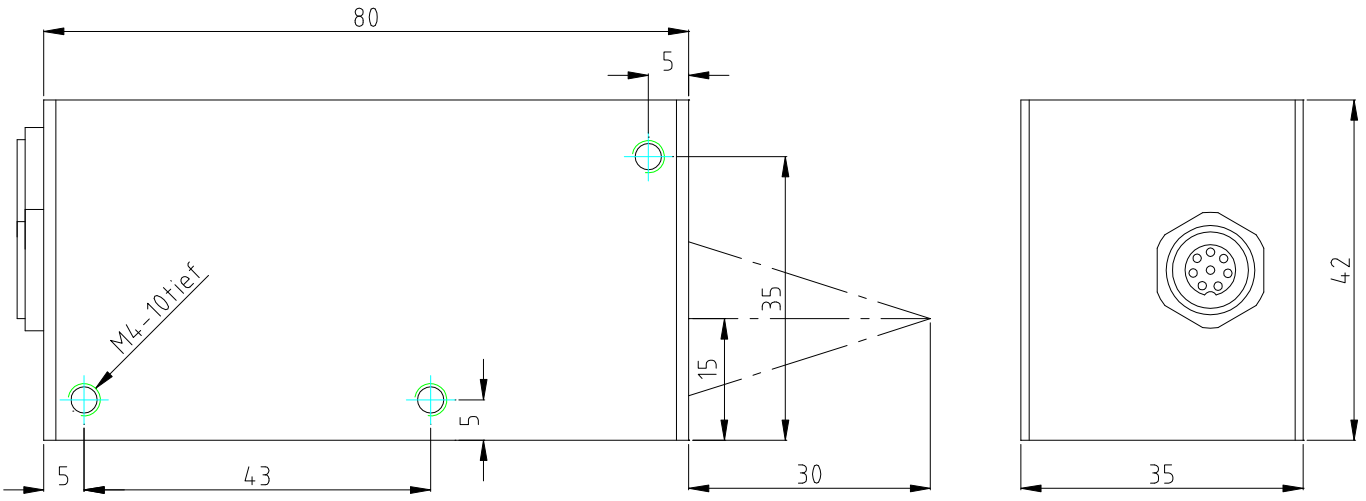
Model	**SI-COLO2-20-...-ANA 84**
Light source	White-light LED, modulated 100 kHz
Object distance	typ. 18 mm ... 24 mm
Light spot size	Type d0: Ø 0.8 mm (typ.) at 20 mm distance
Receiver	3-color filter detector
Alternating light operation	100 kHz
Ambient light	up to 5000 Lux
Enclosure rating	IP64
Current consumption	typ. 180 mA
Connector type	Connection to electronic control unit SI-COLO84: 8-pin female connector (Binder Series 712)
EMC test acc. to	IEC - 801 CE
Housing	Aluminum, anodized in blue
Operating temperature range	-20°C ... +55°C
Storage temperature range	-20°C ... +85°C
Input	I-CONTROL (0V ... +5V), adjustment of luminous power via analog signal
Output	3x analog (0V ... +5V)
Voltage supply	+12VDC ... +30VDC, reverse-polarity protected, overcurrent protected
Housing dimensions	approx. 100 mm x 35 mm x 42 mm

Color Sensor Frontend

Product name:

SI-COLO2-30-d0-ANA 84 d0 = Light spot size typ. Ø 1.5 mm at 30 mm object distance
SI-COLO2-30-d1-ANA 84 d1 = Light spot size typ. Ø 2.0 mm at 30 mm object distance
SI-COLO2-30-d2-ANA 84 d2 = Light spot size typ. Ø 3.0 mm at 30 mm object distance
SI-COLO2-30-d3-ANA 84 d3 = Light spot size typ. Ø 4.5 mm at 30 mm object distance





All dimensions in mm

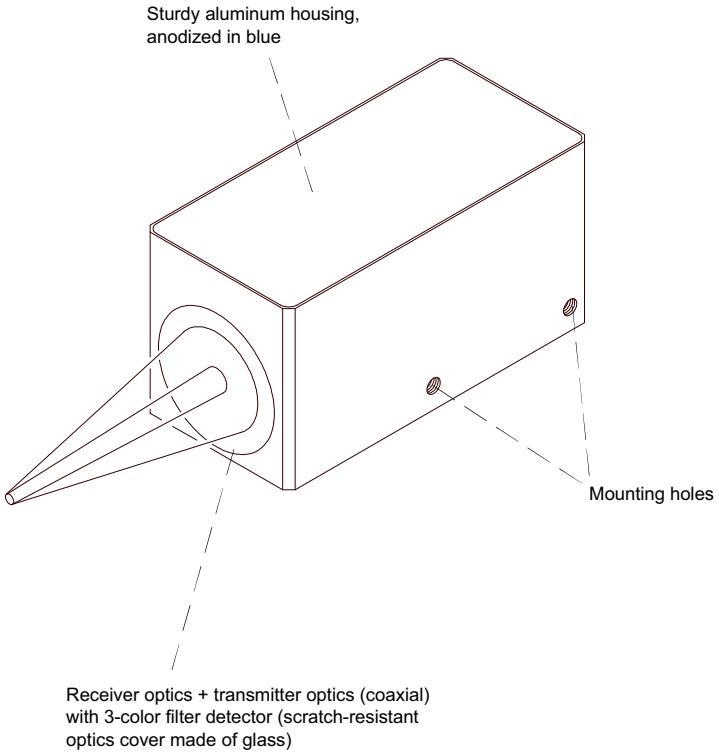
Color Sensor Frontend

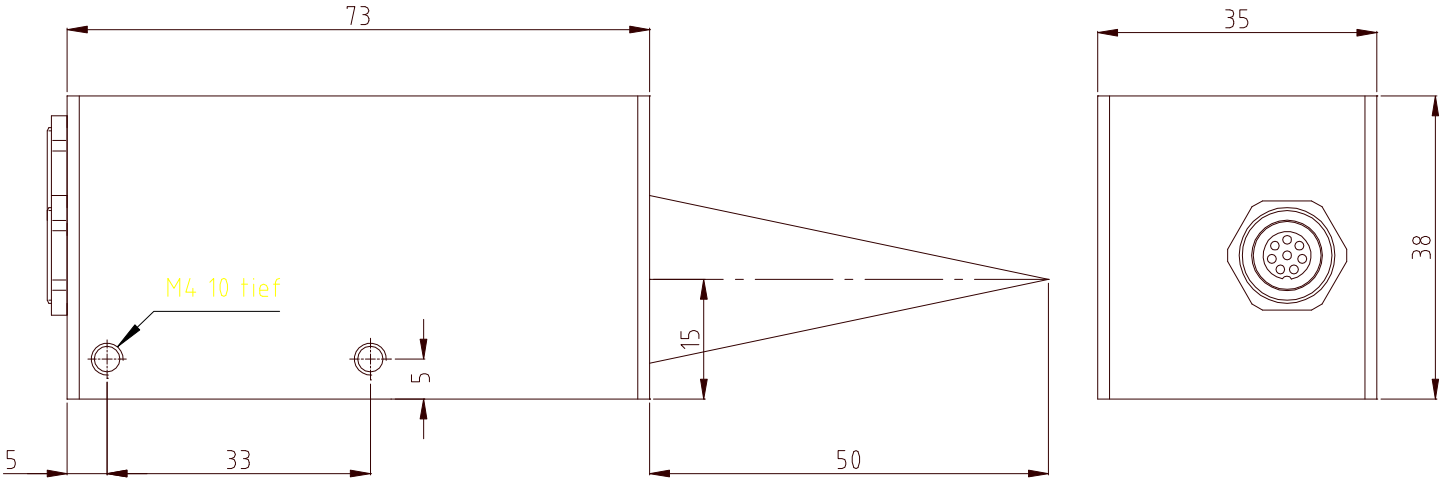
Model	**SI-COLO2-30-...-ANA 84**
Light source	White-light LED, modulated 100 kHz
Object distance	typ. 25 mm ... 55 mm
Light spot size	Type d0: Ø 1.5 mm (typ.) at 30 mm distance Type d1: Ø 2.0 mm (typ.) at 30 mm distance Type d2: Ø 3.0 mm (typ.) at 30 mm distance Type d3: Ø 4.5 mm (typ.) at 30 mm distance
Receiver	3-color filter detector
Alternating light operation	100 kHz
Ambient light	up to 5000 Lux
Enclosure rating	IP64
Current consumption	typ. 180 mA
Connector type	Connection to electronic control unit SI-COLO84: 8-pin female connector (Binder Series 712)
EMC test acc. to	IEC - 801 CE
Housing	Aluminum, anodized in blue
Operating temperature range	-20°C ... +55°C
Storage temperature range	-20°C ... +85°C
Input	I-CONTROL (0V ... +5V), adjustment of luminous power via analog signal
Output	3x analog (0V ... +5V)
Voltage supply	+12VDC ... +30VDC, reverse-polarity protected, overcurrent protected
Housing dimensions	approx. 80 mm x 35 mm x 42 mm

Color Sensor Frontend

Product name:

SI-COLO2-50-d1-ANA 84 d1 = Light spot size typ. Ø 3.5 mm at 50 mm object distance
SI-COLO2-50-d2-ANA 84 d2 = Light spot size typ. Ø 5.5 mm at 50 mm object distance
SI-COLO2-50-d3-ANA 84 d3 = Light spot size typ. Ø 8.0 mm at 50 mm object distance





All dimensions in mm

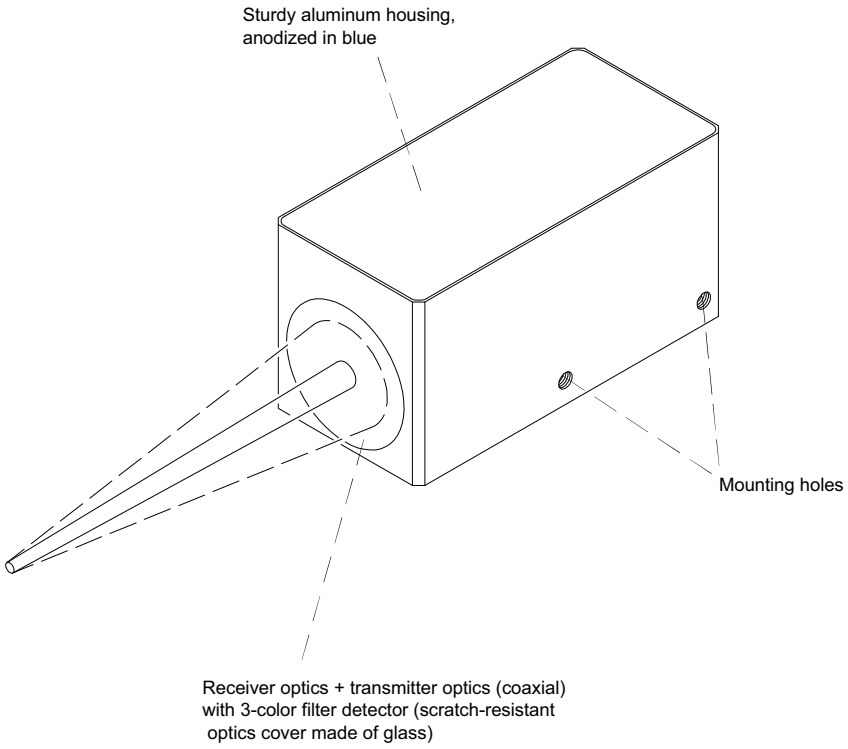
Color Sensor Frontend

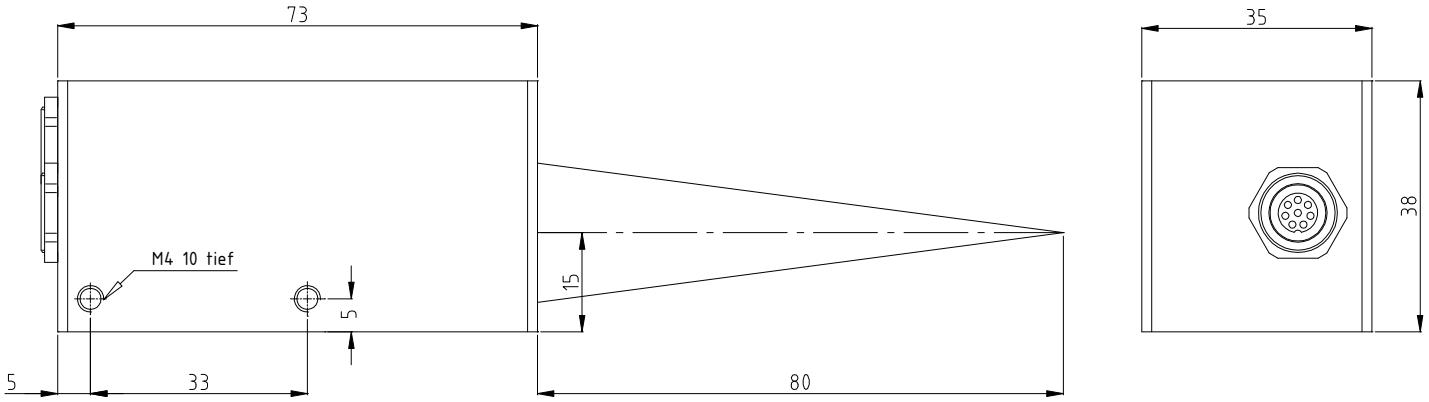
Model	**SI-COLO2-50-...-ANA 84**
Light source	White-light LED, modulated 100 kHz
Object distance	typ. 30 mm ... 90 mm
Light spot size	Type d1: Ø 3.5 mm (typ.) at 50 mm distance Type d2: Ø 5.5 mm (typ.) at 50 mm distance Type d3: Ø 8.0 mm (typ.) at 50 mm distance
Receiver	3-color filter detector
Alternating light operation	100 kHz
Ambient light	up to 5000 Lux
Enclosure rating	IP64
Current consumption	typ. 180 mA
Connector type	Connection to electronic control unit SI-COLO84: 8-pin female connector (Binder Series 712)
EMC test acc. to	IEC - 801 CE
Housing	Aluminum, anodized in blue
Operating temperature range	-20°C ... +55°C
Storage temperature range	-20°C ... +85°C
Input	I-CONTROL (0V ... +5V), adjustment of luminous power via analog signal
Output	3x analog (0V ... +5V)
Voltage supply	+12VDC ... +30VDC, reverse-polarity protected, overcurrent protected
Housing dimensions	approx. 73 mm x 35 mm x 38 mm

Color Sensor Frontend

Product name:

SI-COLO2-80-d1-ANA 84 d1 = Light spot size typ. Ø 6.5 mm at 80 mm object distance
SI-COLO2-80-d2-ANA 84 d2 = Light spot size typ. Ø 9.0 mm at 80 mm object distance
SI-COLO2-80-d3-ANA 84 d3 = Light spot size typ. Ø 13.0 mm at 80 mm object distance





All dimensions in mm

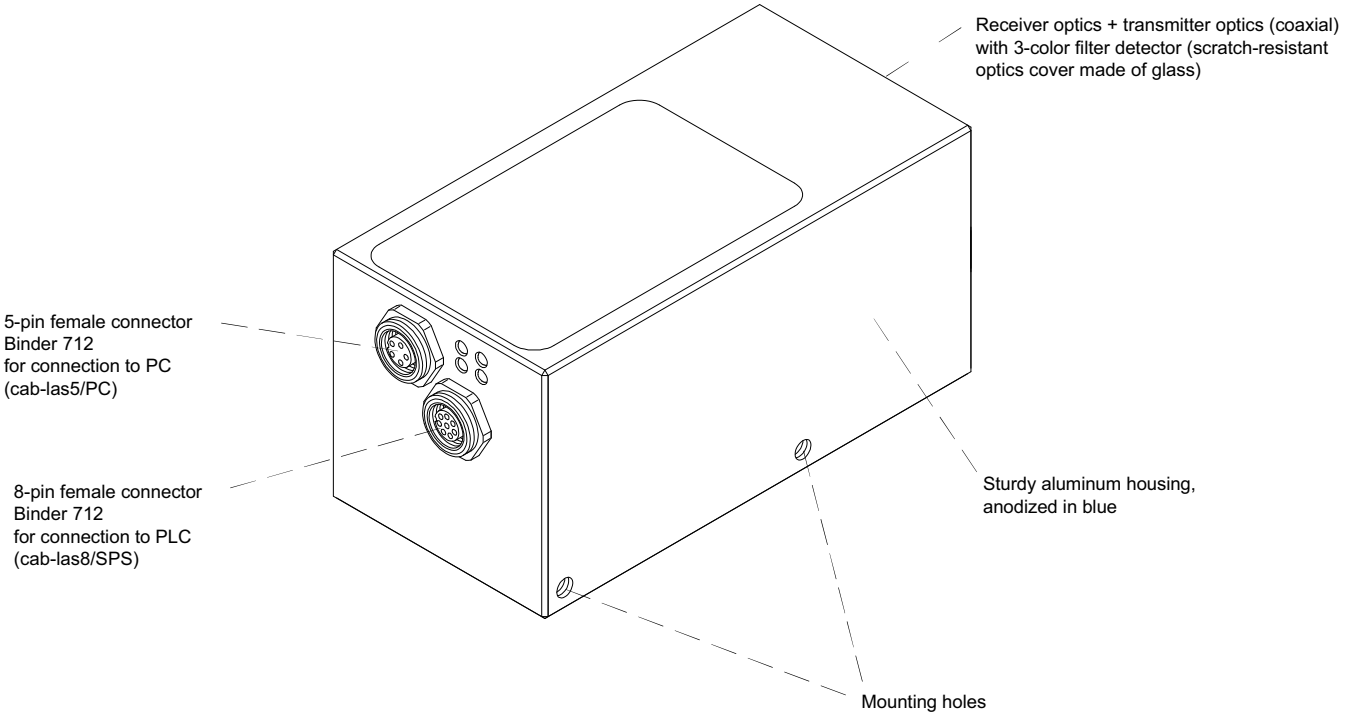
Color Sensor Frontend

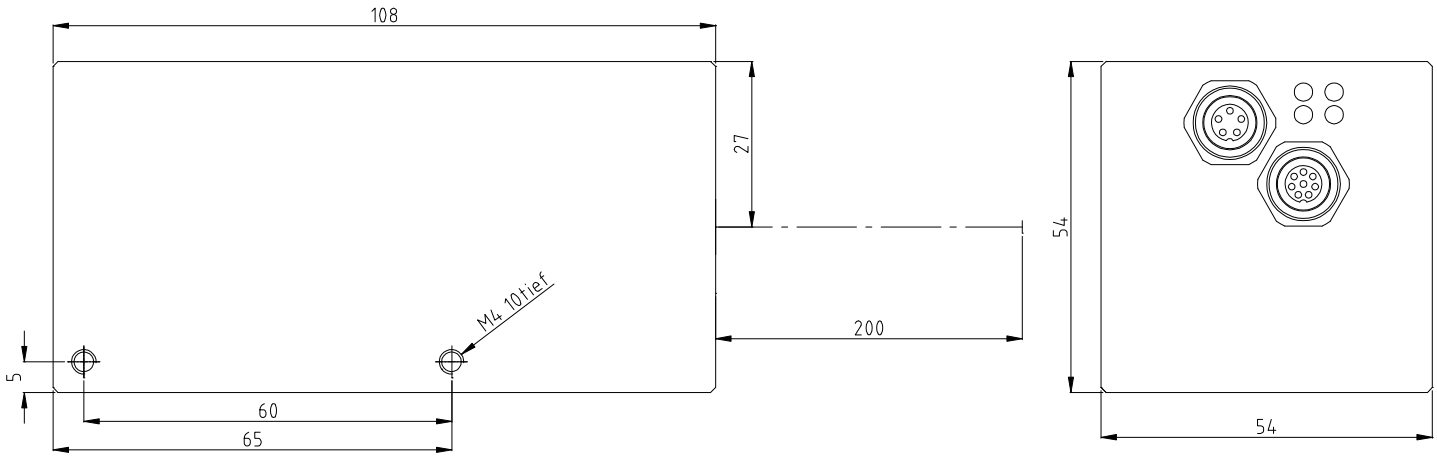
Model	**SI-COLO2-80-...-ANA 84**
Light source	White-light LED, modulated 100 kHz
Object distance	typ. 50 mm ... 150 mm
Light spot size	Type d1: Ø 6.5 mm (typ.) at 80 mm distance Type d2: Ø 9.0 mm (typ.) at 80 mm distance Type d3: Ø 13.0 mm (typ.) at 80 mm distance
Receiver	3-color filter detector
Alternating light operation	100 kHz
Ambient light	up to 5000 Lux
Enclosure rating	IP64
Current consumption	typ. 180 mA
Connector type	Connection to electronic control unit SI-COLO84: 8-pin female connector (Binder Series 712)
EMC test acc. to	IEC - 801 CE
Housing	Aluminum, anodized in blue
Operating temperature range	-20°C ... +55°C
Storage temperature range	-20°C ... +85°C
Input	I-CONTROL (0V ... +5V), adjustment of luminous power via analog signal
Output	3x analog (0V ... +5V)
Voltage supply	+12VDC ... +30VDC, reverse-polarity protected, overcurrent protected
Housing dimensions	approx. 73 mm x 35 mm x 38 mm

Color Sensor Frontend

Product name:

SI-COLO2-200-d1-ANA 84 d1 = Light spot size typ. Ø 12 mm at 200 mm object distance
SI-COLO2-200-d2-ANA 84 d2 = Light spot size typ. Ø 25 mm at 200 mm object distance





All dimensions in mm

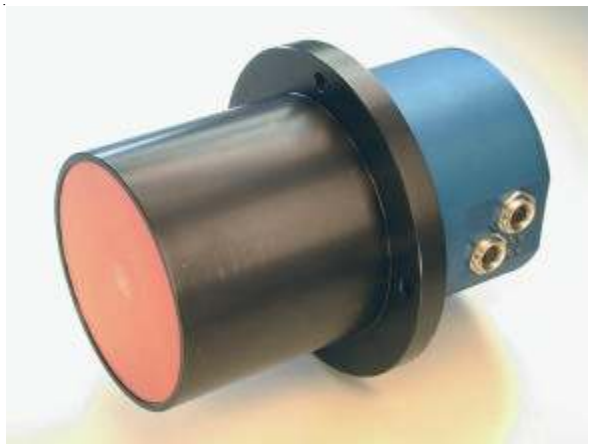
Color Sensor Frontend

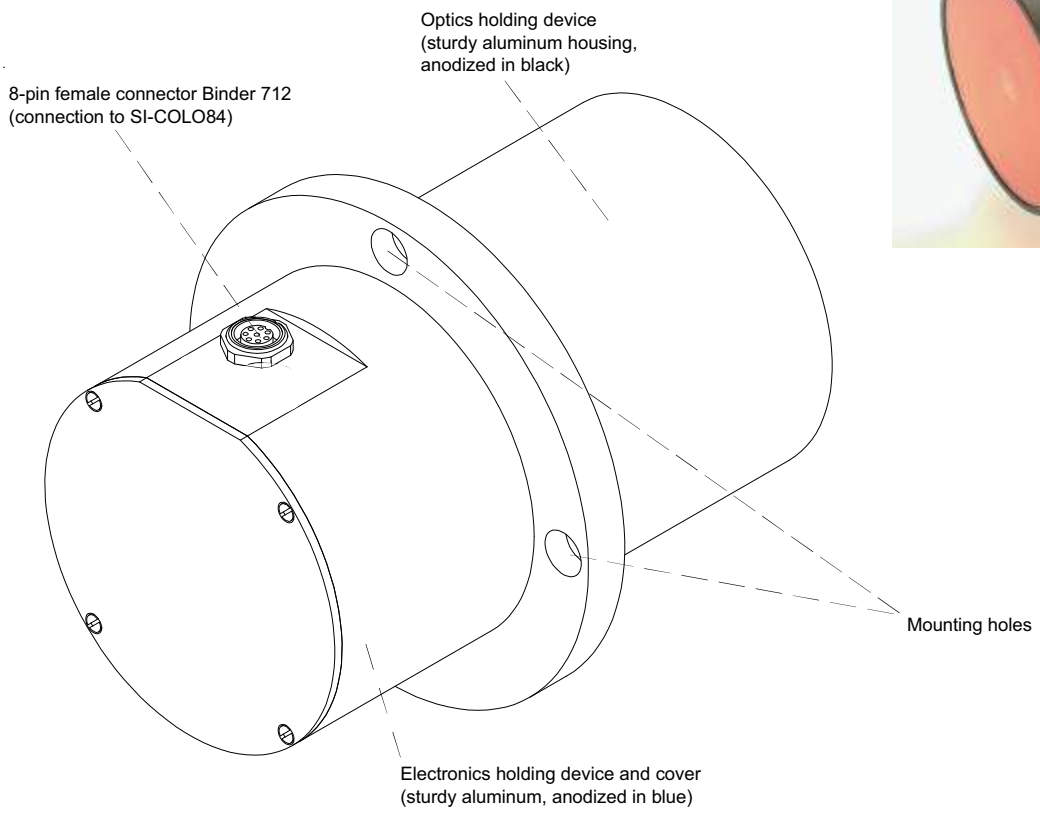
Model	**SI-COLO2-200-...-ANA 84**
Light source	White-light LED, modulated 100 kHz
Object distance	Type d1: typ. 100 mm ... 350 mm Type d2: typ. 100 mm ... 400 mm
Light spot size	Type d1: Ø 12 mm (typ.) at 200 mm distance Type d2: Ø 25 mm (typ.) at 200 mm distance
Receiver	3-color filter detector
Alternating light operation	100 kHz
Ambient light	up to 5000 Lux
Enclosure rating	IP64
Current consumption	typ. 180 mA
Connector type	Connection to electronic control unit SI-COLO84: 8-pin female connector (Binder Series 712)
EMC test acc. to	IEC - 801 CE
Housing	Aluminum, anodized in blue
Operating temperature range	-20°C ... +55°C
Storage temperature range	-20°C ... +85°C
Input	I-CONTROL (0V ... +5V), adjustment of luminous power via analog signal
Output	3x analog (0V ... +5V)
Voltage supply	+12VDC ... +30VDC, reverse-polarity protected, overcurrent protected
Housing dimensions	approx. 108 mm x 54 mm x 54 mm

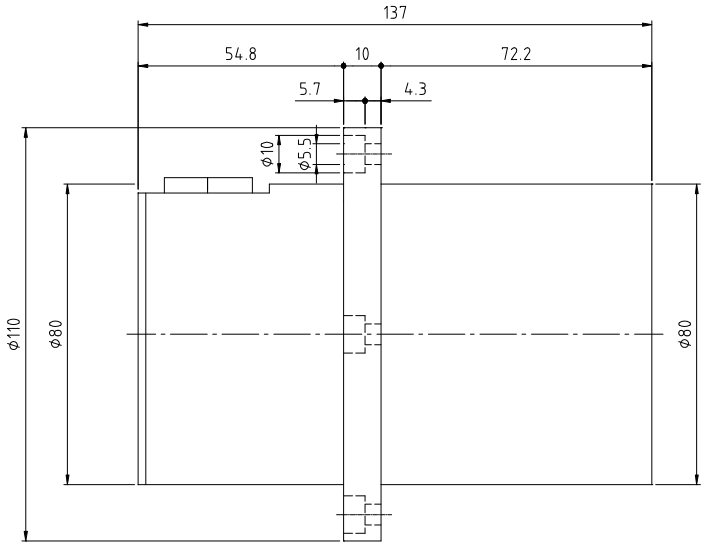
Color Sensor Frontend

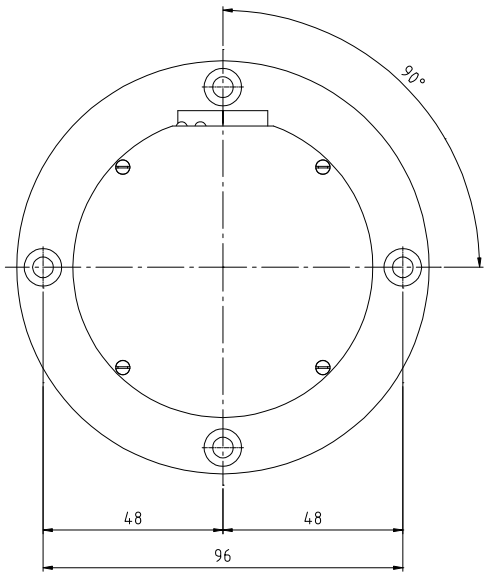
Product name:

SI-COLO2-500-d2-ANA 84 d2 = Light spot size typ. Ø 23 mm at 500 mm object distance
SI-COLO2-500-d3-ANA 84 d3 = Light spot size typ. Ø 50 mm at 500 mm object distance









All dimensions in mm

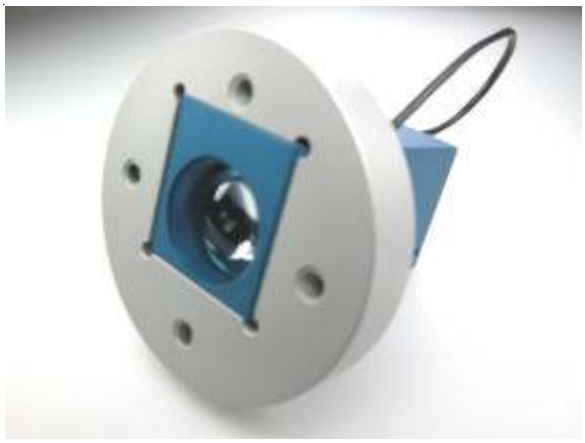
Color Sensor Frontend

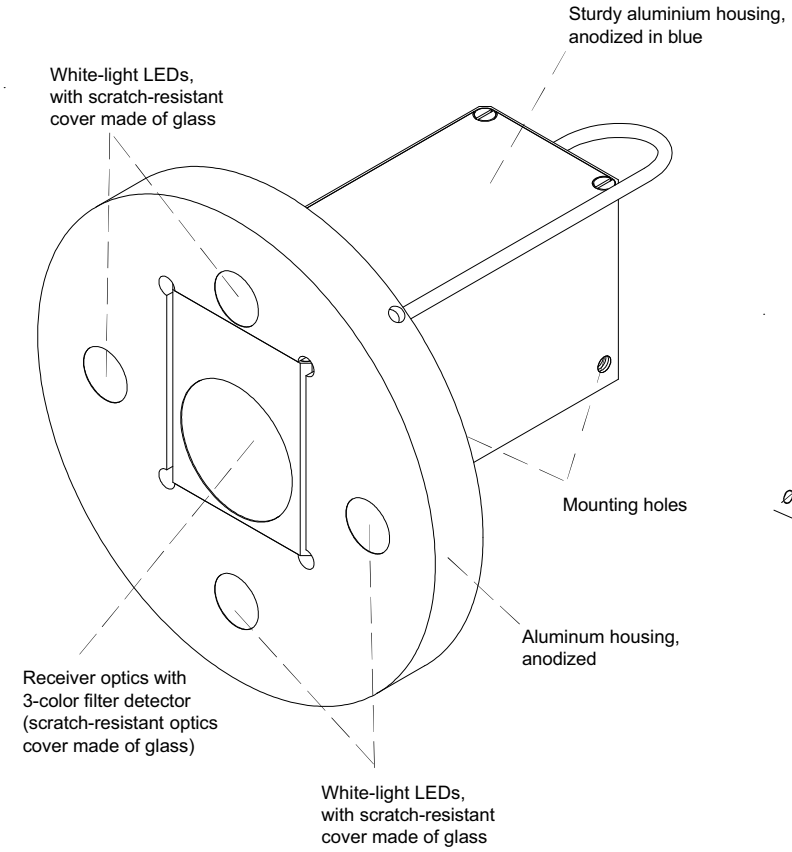
Model	**SI-COLO2-500-...-ANA 84**
Light source	White-light LED, modulated 100 kHz
Object distance	Type d2: typ. 200 mm ... 600 mm Type d3: typ. 200 mm ... 800 mm
Light spot size	Type d2: Ø 23 mm (typ.) at 500 mm distance Type d3: Ø 50 mm (typ.) at 500 mm distance
Receiver	3-color filter detector
Alternating light operation	100 kHz
Ambient light	up to 5000 Lux
Enclosure rating	IP64
Current consumption	typ. 180 mA
Connector type	Connection to electronic control unit SI-COLO84: 8-pin female connector (Binder Series 712)
EMC test acc. to	IEC - 801 CE
Housing	Aluminum, anodized in blue
Operating temperature range	-20°C ... +55°C
Storage temperature range	-20°C ... +85°C
Input	I-CONTROL (0V ... +5V), adjustment of luminous power via analog signal
Output	3x analog (0V ... +5V)
Voltage supply	+12VDC ... +30VDC, reverse-polarity protected, overcurrent protected
Housing dimensions	Optics diameter approx. 80 mm, outside diameter approx. 110 mm, total length approx. 137 mm

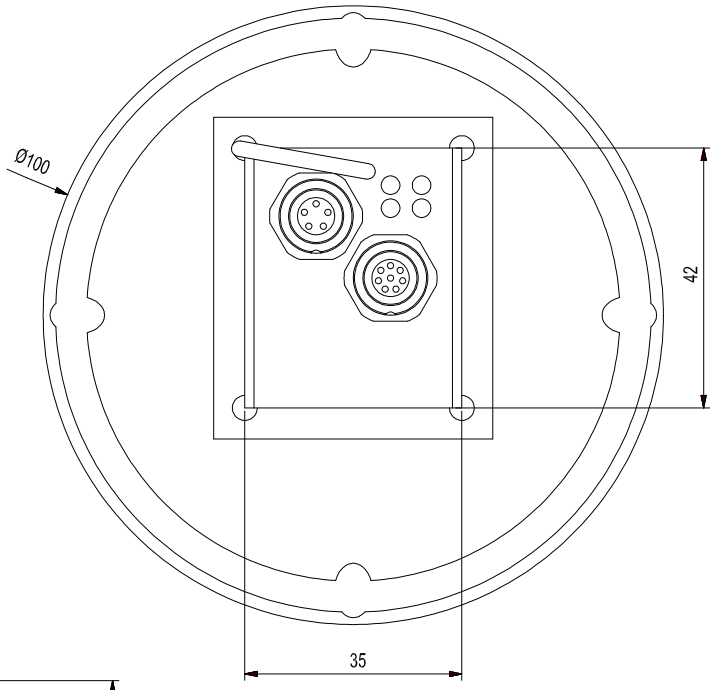
Color Sensor Frontend

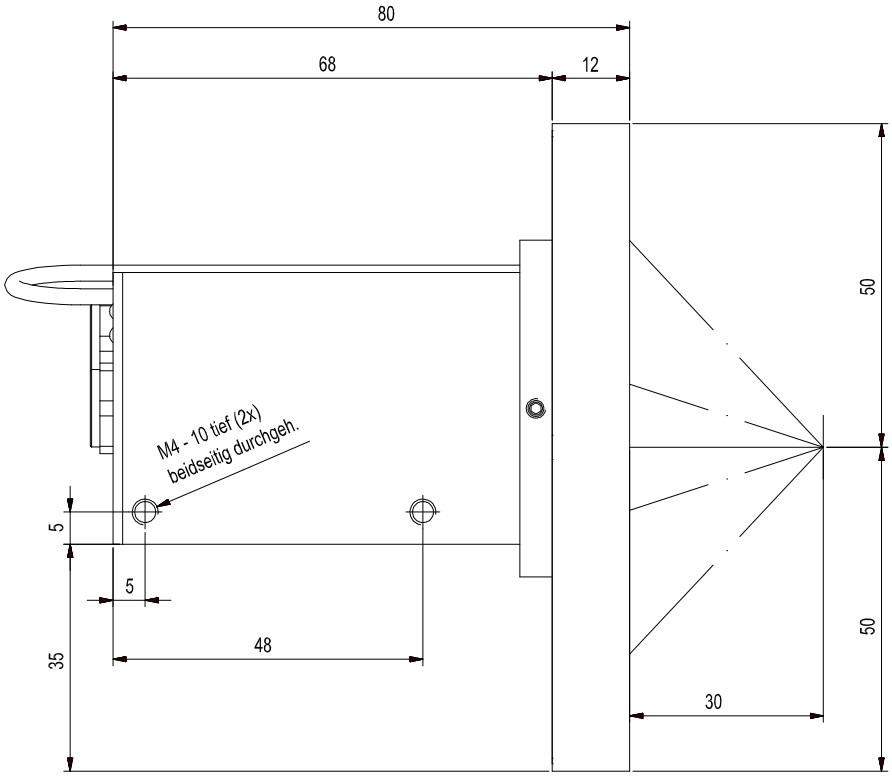
Product name:

SI-COLO2-30-RING-ANA 84









All dimensions in mm

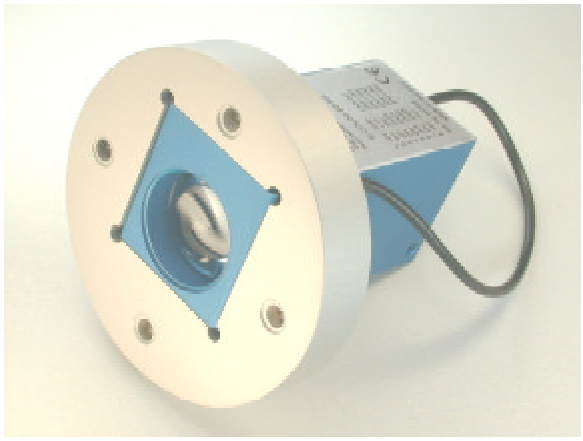
Color Sensor Frontend

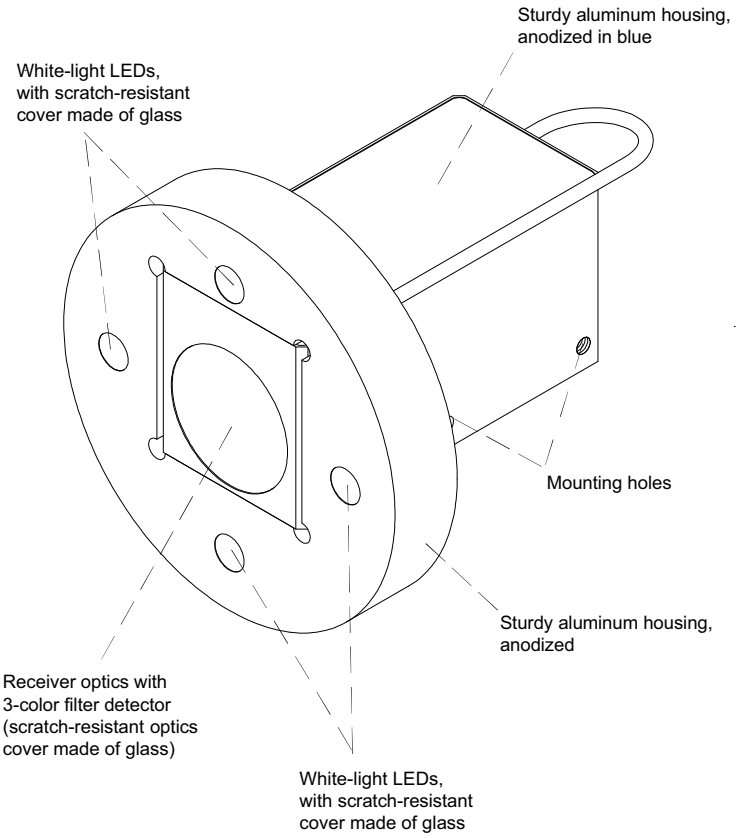
Model	**SI-COLO2-30-RING-ANA 84**
Light source	4x white-light LED, modulated 100 kHz
Object distance	typ. 25 mm ... 50 mm
Light spot size	typ. Ø 6 mm (at 25 mm distance) ... Ø 8 (at 50 mm distance)
Receiver	3-color filter detector
Alternating light operation	100 kHz
Ambient light	up to 5000 Lux
Enclosure rating	IP64
Current consumption	typ. 180 mA
Connector type	Connection to electronic control unit SI-COLO84: 8-pin female connector (Binder Series 712)
EMC test acc. to	IEC - 801 CE
Housing	Aluminum, anodized in blue respectively ring anodized in nature
Operating temperature range	-20°C ... +55°C
Storage temperature range	-20°C ... +85°C
Input	I-CONTROL (0V ... +5V), adjustment of luminous power via analog signal
Output	3x analog (0V ... +5V)
Voltage supply	+12VDC ... +30VDC, reverse-polarity protected, overcurrent protected
Housing dimensions	Outside diameter approx. 100 mm, total length approx. 80 mm

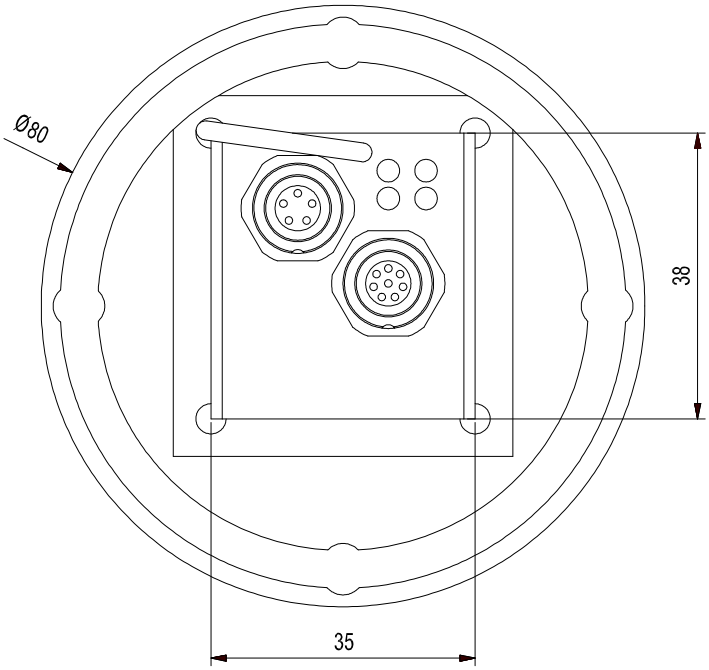
Color Sensor Frontend

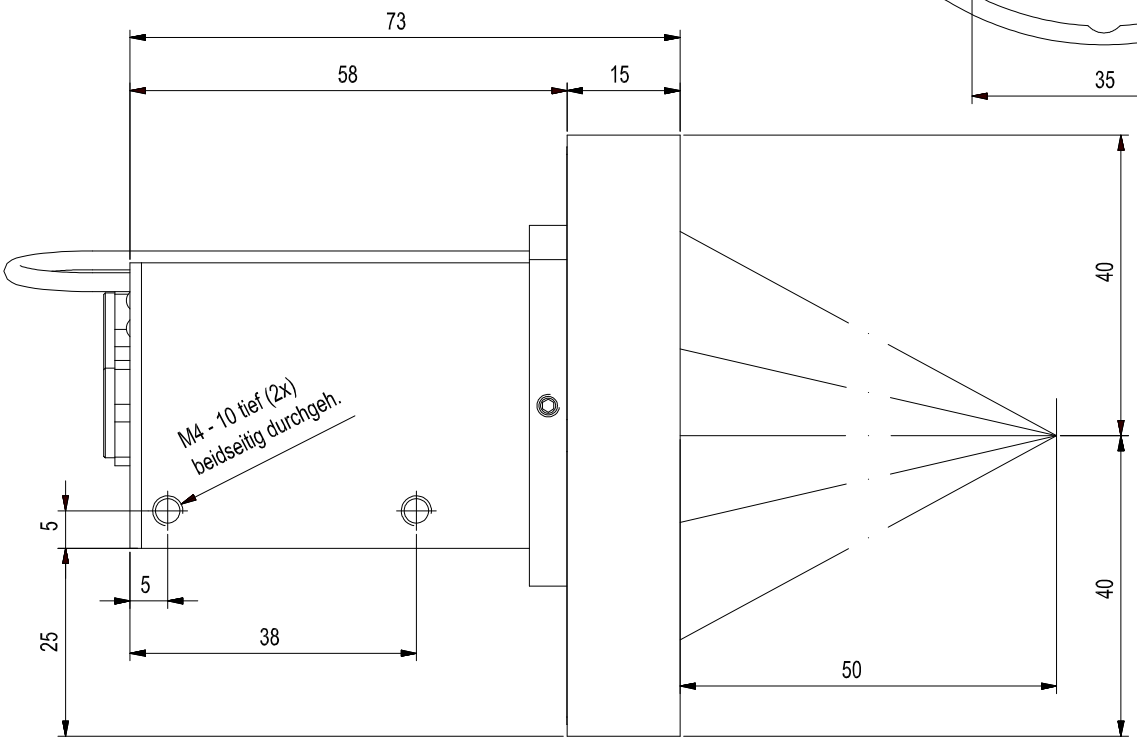
Product name:

SI-COLO2-50-RING-ANA 84









Alle Abmessungen in mm

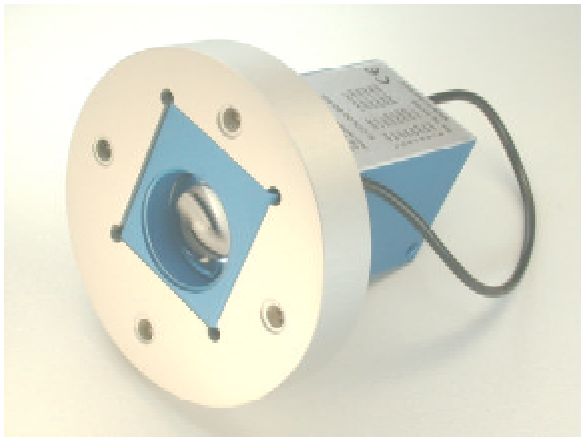
Color Sensor Frontend

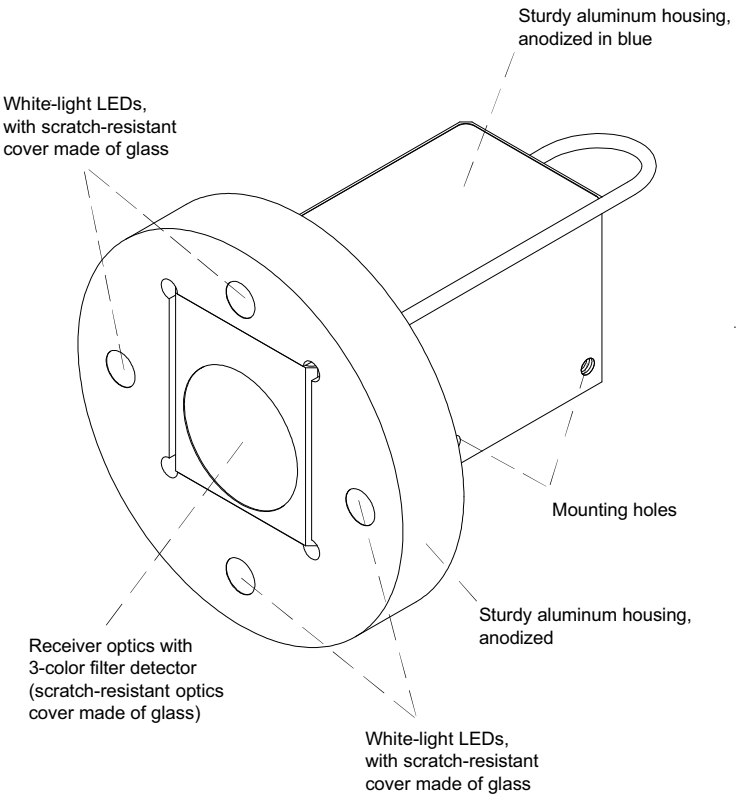
Model	**SI-COLO2-50-RING-ANA 84**
Light source	4x white-light LED, modulated 100 kHz
Object distance	typ. 40 mm ... 75 mm
Light spot size	typ. Ø 5 mm (at 40 mm distance) ... Ø 9 mm (at 75 mm distance)
Receiver	3-color filter detector
Alternating light operation	100 kHz
Ambient light	up to 5000 Lux
Enclosure rating	IP64
Current consumption	typ. 180 mA
Connector type	Connection to electronic control unit SI-COLO84: 8-pin female connector (Binder Series 712)
EMC test acc. to	IEC - 801 CE
Housing	Aluminum, anodized in blue respectively ring anodized in nature
Operating temperature range	-20°C ... +55°C
Storage temperature range	-20°C ... +85°C
Input	I-CONTROL (0V ... +5V), adjustment of luminous power via analog signal
Output	3x analog (0V ... +5V)
Voltage supply	+12VDC ... +30VDC, reverse-polarity protected, overcurrent protected
Housing dimensions	Outside diameter approx. 80 mm, total length approx. 73 mm

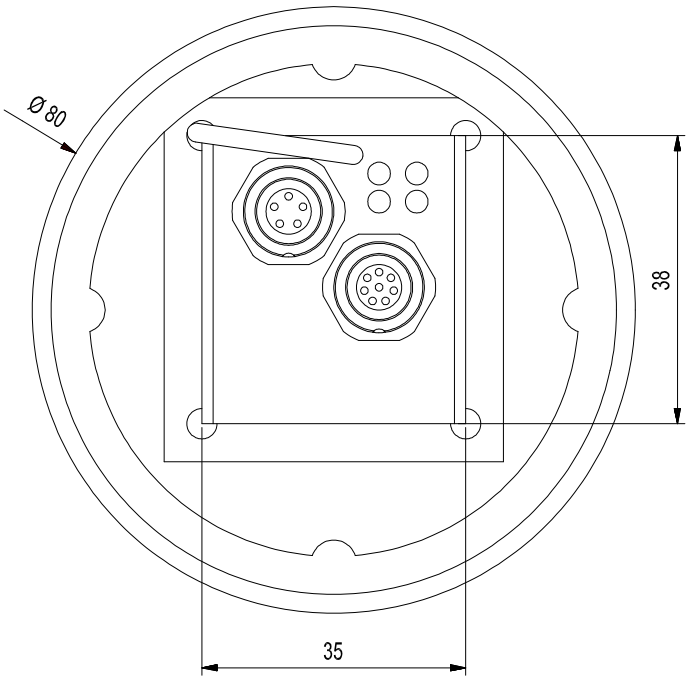
Color Sensor Frontend

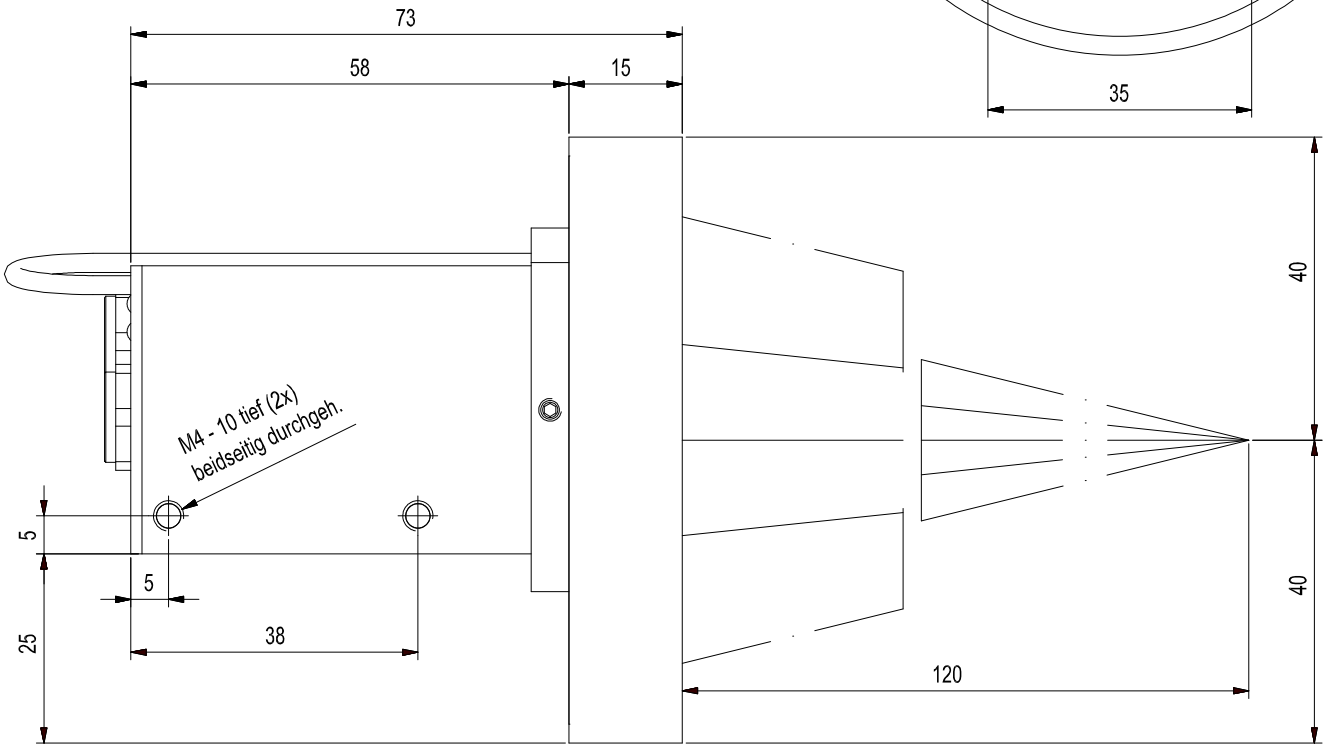
Product name:

SI-COLO2-80-RING-ANA 84









All dimensions in mm

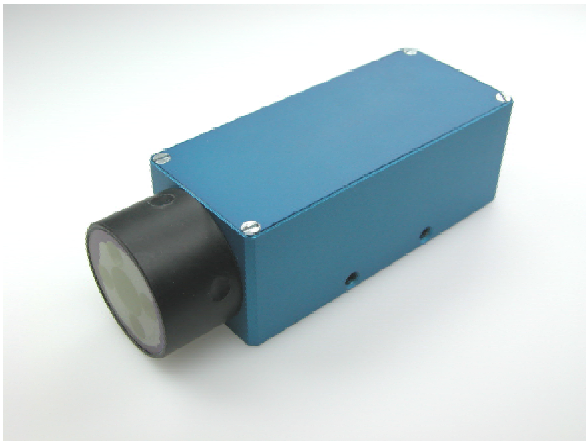
Color Sensor Frontend

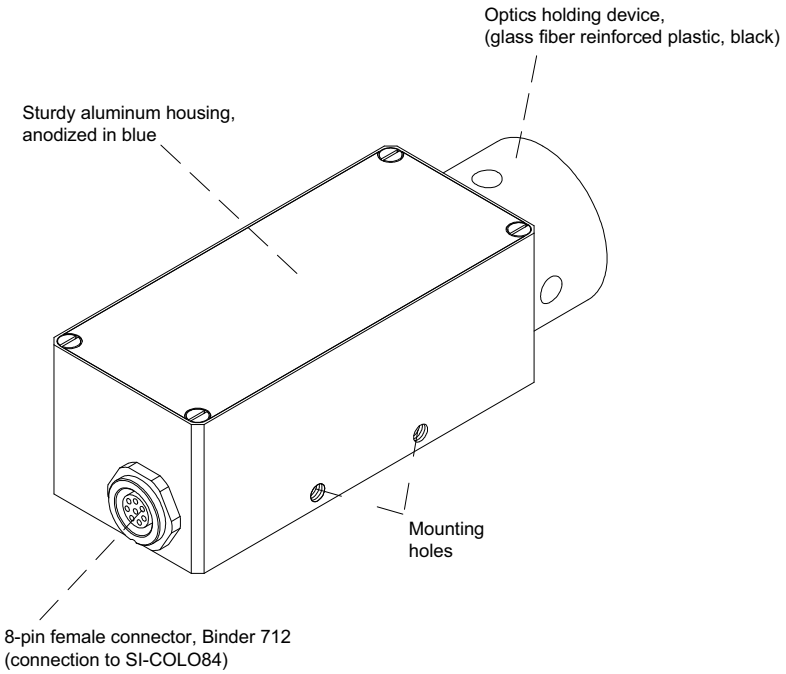
Model	SI-COLO2-80-RING-ANA 84
Light source	4x white-light LED, modulated 100 kHz
Object distance	typ. 50 mm ... 100 mm
Light spot size	typ. Ø 5 mm (at 50 mm distance) ... Ø 15 mm (at 100 mm distance)
Receiver	3-color filter detector
Alternating light operation	100 kHz
Ambient light	up to 5000 Lux
Enclosure rating	IP64
Current consumption	typ. 180 mA
Connector type	Connection to electronic control unit SI-COLO84: 8-pin female connector (Binder Series 712)
EMC test acc. to	IEC - 801 CE
Housing	Aluminum, anodized in blue respectively ring anodized in nature
Operating temperature range	-20°C ... +55°C
Storage temperature range	-20°C ... +85°C
Input	I-CONTROL (0V ... +5V), adjustment of luminous power via analog signal
Output	3x analog (0V ... +5V)
Voltage supply	+12VDC ... +30VDC, reverse-polarity protected, overcurrent protected
Housing dimensions	Outside diameter approx. 80 mm, total length approx. 73 mm

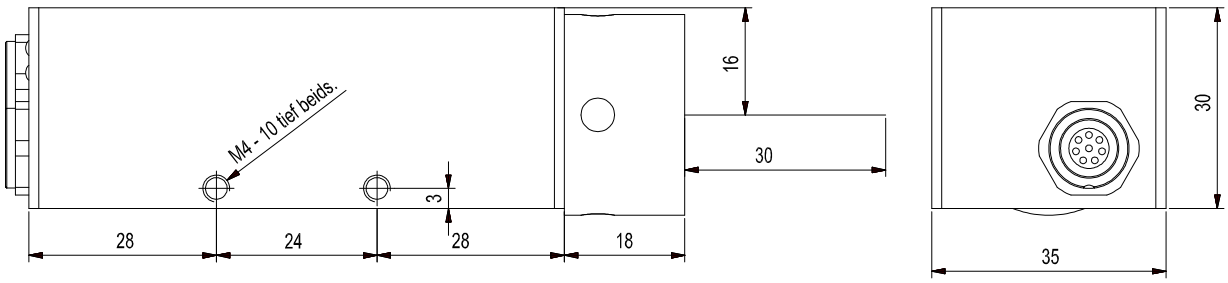
Color Sensor Frontend

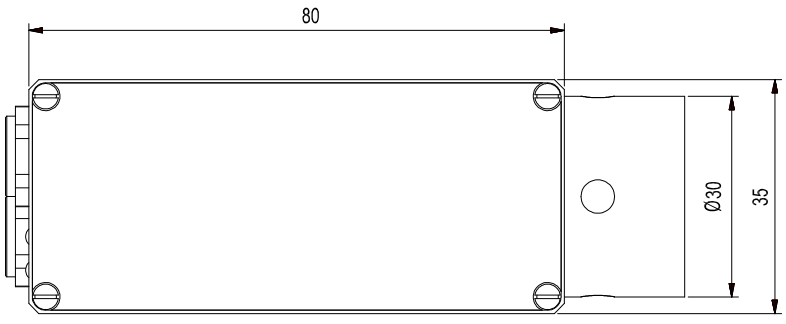
Product name:

SI-COLO2-30-DIL-ANA 84









All dimensions in mm

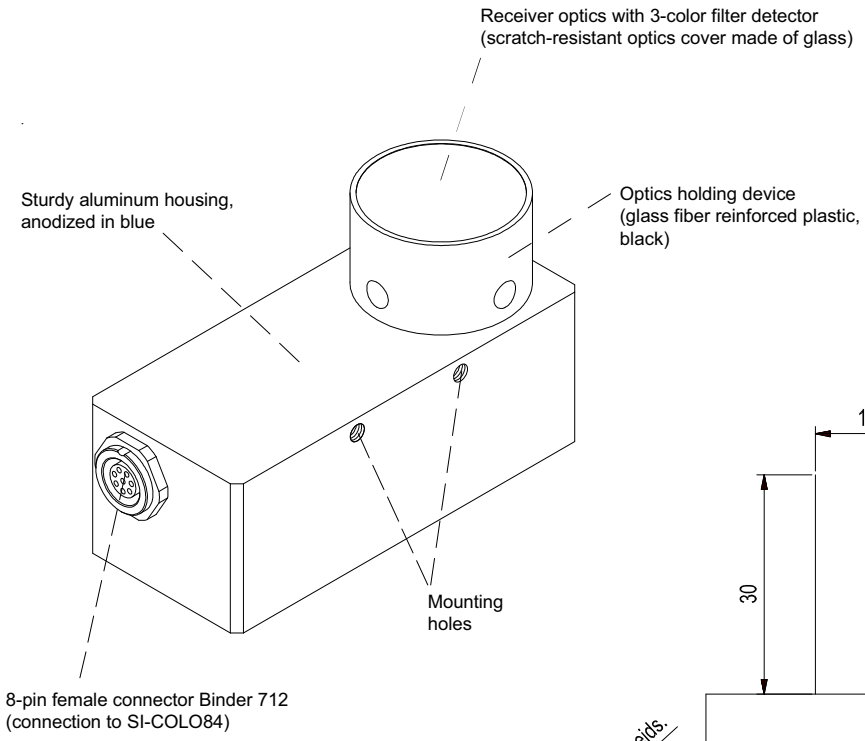
Color Sensor Frontend

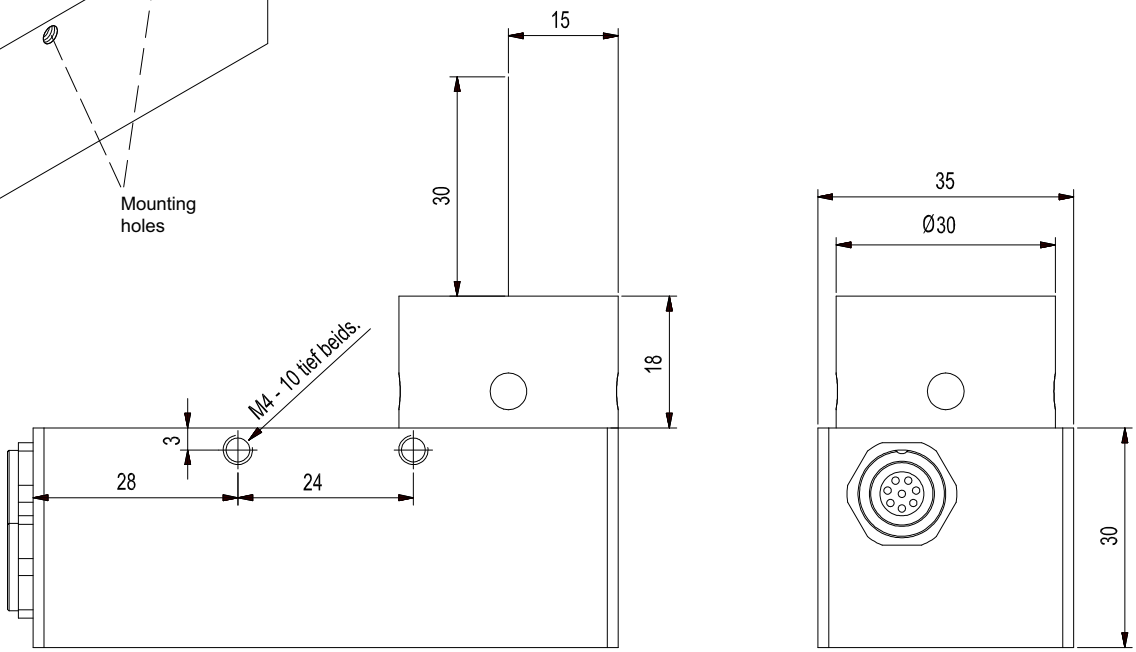
Model	SI-COLO2-30-DIL-ANA 84
Light source	4x white-light LED, modulated 100 kHz, diffuse
Target distance	typ. 10 mm ... 60 mm
Detection range (half intensity width)	typ. 12 mm (at 20 mm distance) ... 20 mm (at 40 mm distance)
Receiver	3-color filter detector
Alternating light operation	100 kHz
Ambient light	up to 5000 Lux
Type of protection	IP64
Current consumption	typ. 180 mA
Interface	RS232, parameterizable under Windows®
Connector type	Connection to electronic control unit SI-COLO84: 8-pin female connector (Binder Series 712)
EMC test acc. to	IEC - 801 CE
Housing	Aluminum, anodized in blue Optics holding device made of glass fiber reinforced plastic
Operating temperature range	-20°C ... +55°C
Storage temperature range	-20°C ... +85°C
Input	I-CONTROL (0V ... +5V), adjustment of light power via analog signal
Outputs	3x analog output (0V ... +5V)
Averaging	over 32768 values max.
Voltage supply	+12VDC ... +30VDC, protected against polarity reversal, overload protected
Dimensions	L x W x H = approx. 98 mm x 35 mm x 30 mm

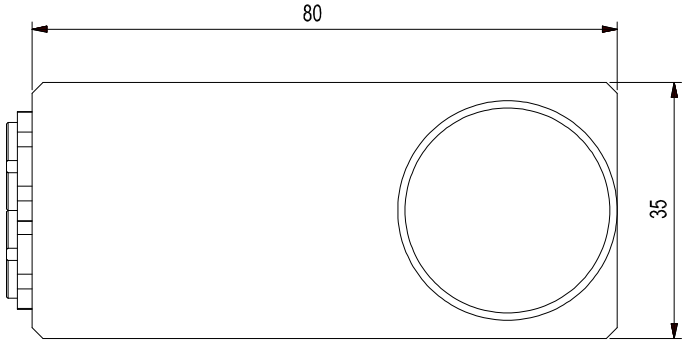
Color Sensor Frontend

Product name:

SI-COLO2-30/90-DIL-ANA 84







All dimensions in mm

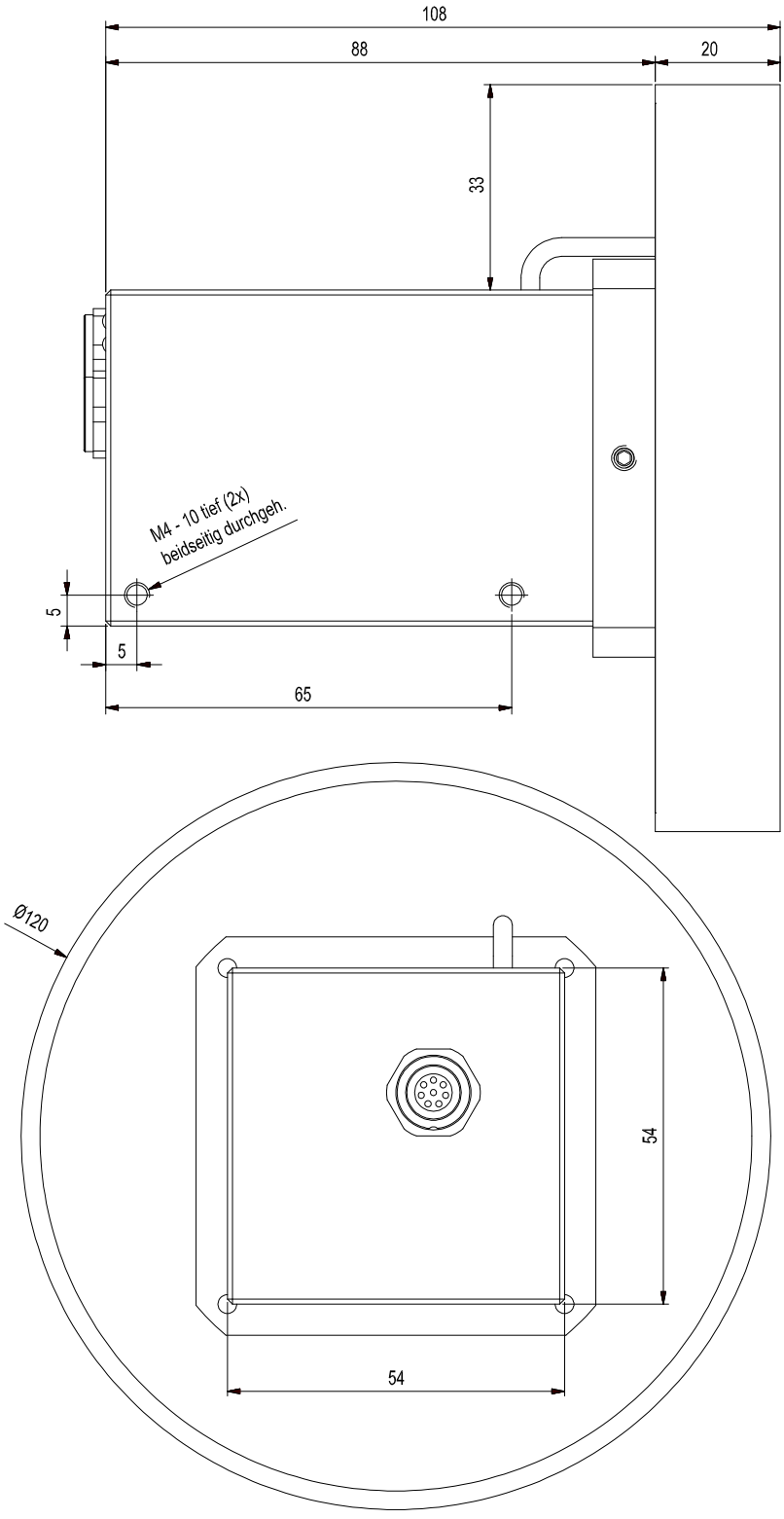
Color Sensor Frontend

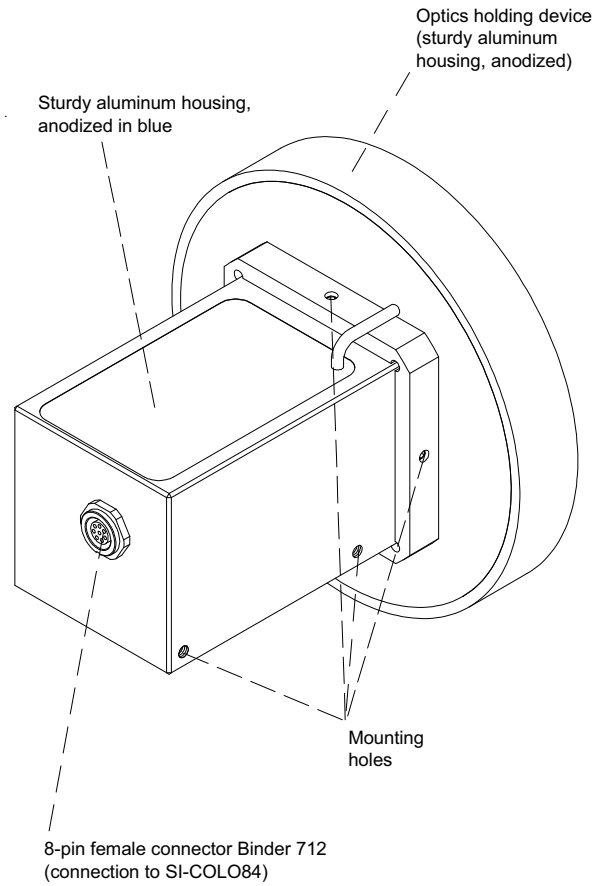
Model	SI-COLO2-30/90-DIL-ANA 84
Light source	4x white-light LED, modulated 100 kHz, diffuse
Target distance	typ. 10 mm ... 60 mm
Detection range (half intensity width)	typ. 12 mm (at 20 mm distance) ... 20 mm (at 40 mm distance)
Receiver	3-color filter detector
Alternating light operation	100 kHz
Ambient light	up to 5000 Lux
Type of protection	IP64
Current consumption	typ. 180 mA
Interface	RS232, parameterizable under Windows®
Connector type	Connection to electronic control unit SI-COLO84: 8-pin female connector (Binder Series 712)
EMC test acc. to	IEC - 801 CE
Housing	Aluminum, anodized in blue Optics holding device made of glass fiber reinforced plastic
Operating temperature range	-20°C ... +55°C
Storage temperature range	-20°C ... +85°C
Input	I-CONTROL (0V ... +5V), adjustment of light power via analog signal
Outputs	3x analog output (0V ... +5V)
Averaging	over 32768 values max.
Voltage supply	+12VDC ... +30VDC, protected against polarity reversal, overload protected
Dimensions	L x W x H = approx. 80 mm x 35 mm x 48 mm

Color Sensor Frontend

Product name:

SI-COLO2-200-DIL-ANA 84





All dimensions in mm

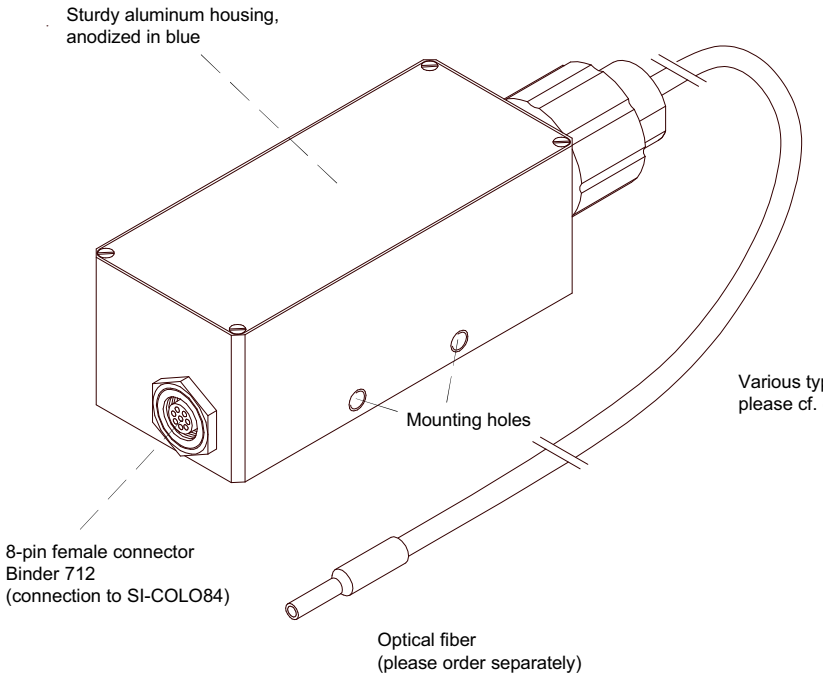
Color Sensor Frontend

Model	**SI-COLO2-200-DIL-ANA 84**
Light source	28x white-light LED, modulated 100 kHz, diffuse
Target distance	typ. 50 mm ... 350 mm
Detection range (half intensity width)	typ. 15 mm (at 150 mm distance) ... 30 mm (at 350 mm distance)
Receiver	3-color filter detector
Alternating light operation	100 kHz
Ambient light	up to 5000 Lux
Type of protection	IP64
Current consumption	typ. 180 mA
Interface	RS232, parameterizable under Windows®
Connector type	Connection to electronic control unit SI-COLO84: 8-pin female connector (Binder Series 712)
EMC test acc. to	IEC - 801... CE
Housing	Aluminum, anodized in blue Optics holding device made of glass fiber reinforced plastic
Operating temperature range	-20°C ... +55°C
Storage temperature range	-20°C ... +85°C
Input	I-CONTROL (0V ... +5V), adjustment of light power via analog signal
Outputs	3x analog output (0V ... +5V)
Voltage supply	+12VDC ... +30VDC, protected against polarity reversal, overload protected
Dimensions	Total length approx. 108 mm, Ø optics holding device approx. 120 mm

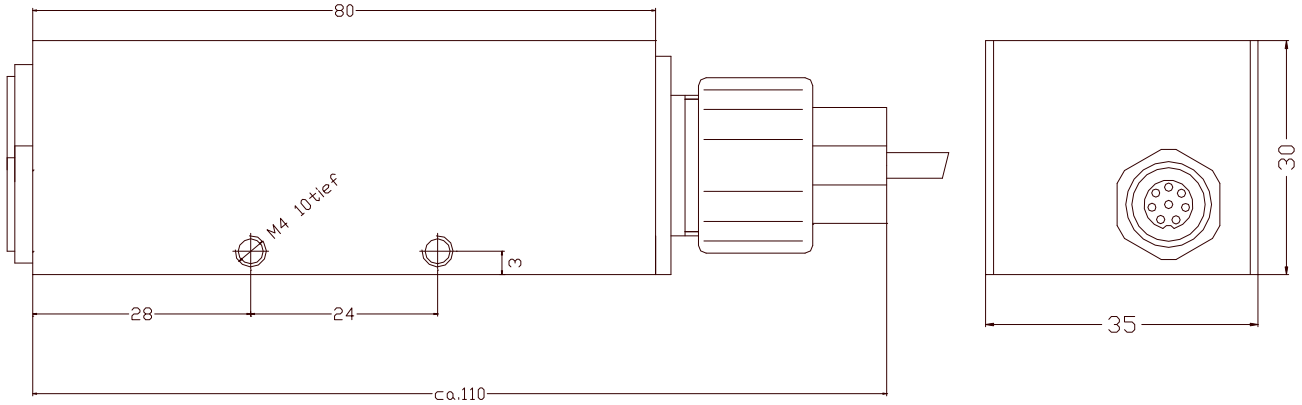
Color Sensor Frontend

Product name:

SI-COLO2-LWL-ANA 84
SI-COLO2-LWL-SP-ANA 84



Various types of optical fibers are available,
please cf. catalog "LWL Series"



All dimensionsin mm

Color Sensor Frontend

Model	**SI-COLO2-LWL-ANA 84** **SI-COLO2-LWL-SP-ANA 84**
Light source	White-light LED, modulated 100 kHz
Object distance	With optical fiber typ. 2 mm ... 10 mm
Light spot size	Depends on the optical fiber used
Receiver	3-color filter detector
Alternating light operation	100 kHz
Ambient light	up to 5000 Lux
Enclosure rating	IP64
Current consumption	typ. 180 mA
Connector type	Connection to electronic control unit SI-COLO84: 8-pin female connector (Binder Series 712)
EMC test acc. to	IEC - 801 CE
Housing	Aluminum, anodized in blue respectively ring anodized in nature
Operating temperature range	-20°C ... +55°C
Storage temperature range	-20°C ... +85°C
Input	I-CONTROL (0V ... +5V), adjustment of luminous power via analog signal
Output	3x analog (0V ... +5V)
Voltage supply	+12VDC ... +30VDC, reverse-polarity protected, overcurrent protected
Housing dimensions	approx. 80 mm x 35 mm x 30 mm

Measuring Principle

Measuring principle:

The SI-COLO84 color sensor system is a combination of a SI-COLO2-...-ANA 84 color sensor that acts as a frontend, and a SI-COLO84 control unit that evaluates the three analog outputs (RED, GREEN, BLUE) of the SI-COLO2-...-ANA 84 color sensor with 12-bit accuracy. The SI-COLO2-...-ANA 84 color sensor detects the radiation that is diffusely reflected from the object to be measured.

As a standard, a white-light LED with adjustable output is used as a light source at the SI-COLO2-...-ANA 84 color sensor. An integrated 3-fold receiver for the RED, GREEN, and BLUE content of the light reflected from the object to be measured is used as a receiver.

The SI-COLO84 color sensor system can be taught up to 100 colors; 5 different color detection modes and 3 contrast detection modes are available for the respective primary color. Evaluation always is performed with 12-bit accuracy.

Color detection either operates continuously, or is started by way of an external PLC trigger signal. The respective detected color is either provided as a binary code at the 8 digital outputs, or can be sent directly to the outputs if only up to 8 colors are to be detected. The detected color code is simultaneously visualised by means of 8 LEDs at the SI-COLO84 housing.

Through the RS232 interface parameters and measured values can be exchanged between the PC and the SI-COLO84 control unit. All the parameters for color detection can be stored in the non-volatile EEPROM of the SI-COLO84 control unit. When parameterization is finished the color sensor continues to operate with the current parameters in „stand alone“ mode without a PC.

Parameterization

Parameterization under Windows® with software COLOR84-Scope:

The SI-COLO84 control unit is parameterized under Windows® with the COLOR84-Scope software.
The RS232 interface is used for setting parameters such as:

- Averaging over a maximum of 32768 values
- Number of colors to be checked
- Light power of the white-light LED
- Automatic light power control ON/OFF
- Pulse lengthening up to 100ms max.
- External or continuous trigger
- Minimum intensity required for color evaluation

Visualization:

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 following evaluation algorithms can also be selected:

- FIRST HIT:
  Target lies within the color tolerance circle of a taught color and within an intensity window

- MINIMAL DIST:
  Determination of the taught color that is most similar to the target (minimum distance between target color and reference color in the color chart)

- COLOR SERIES:
  Checking of the target's color series with a taught color sequence

- CONRAST:
  Contrast check of the target. In this case only one primary color (freely selectable) is used for evaluation
  Advantage: Possibility of using a very high scanning rate of up to 28 kHz.

- EXTERN TEACH:
  With this function field the color sensor can be taught by means of a LOW-signal at pin 3 (for instance via push button, or PLC). During this procedure the object to be taught has to be in the visibility range of the color sensor. The yellow LEDs indicate a successful teaching procedure.

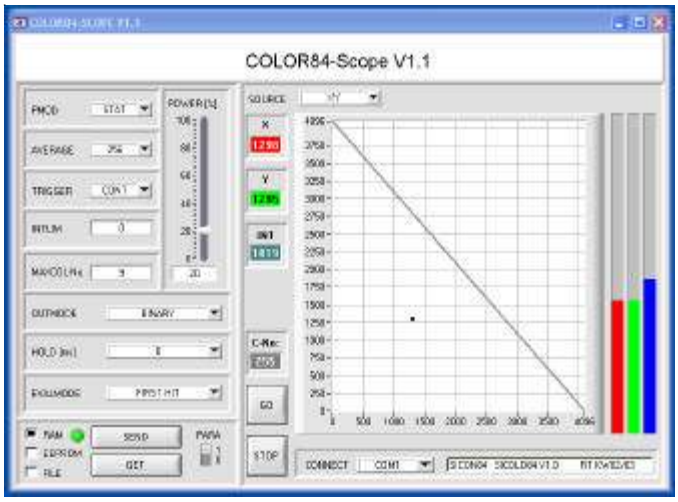
- ADAPTIVE CONTROL:
  During measurement the sensor permanently teaches itself the current setpoint value, i.e. it adapts itself to possible product fluctuations.

Parameterization

Windows® user interface:

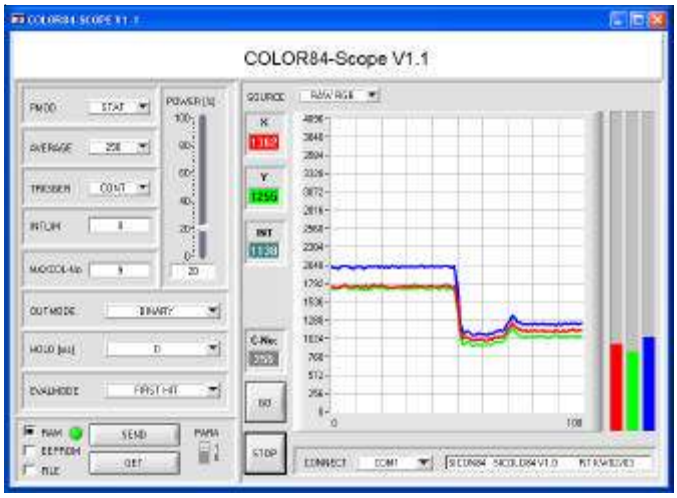
The Windows® user interface facilitates the teach-in process at the SI-COLO84 control unit and supports the operator in the task of adjustment and commissioning of the color sensor.

X,Y-chart:



The color value is displayed graphically by way of the X,Y-color triangle and also in the numerical output fields.
The current raw data (red, green, blue) from the color detector are visualized in a bar chart.
If a color is detected during measuring operation, the currently detected color is displayed in a numeric output field:

RGB-t-chart:



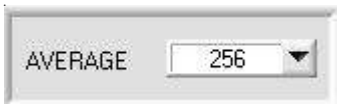
Display of the current raw data (red, green, blue) from the color sensor in „scroll mode“ (oscilloscope function).
In addition the current raw data are visualized as a bar display.
This facilitates the adjustment of the SI-COLO84 control unit.

Parameter setting:

Among others the following parameters can be set:

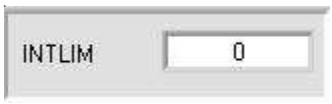
PMOD:
In this function field the operating mode of automatic light power control at the transmitter unit (white-light LED) can be set.
STAT: The LED transmission power is constantly kept at the value set with the POWER slider.
DYN: The LED transmission power is dynamically controlled in accordance with the amount of radiation that is diffusely reflected from the object.

POWER:
With this slider the intensity of the white-light transmitter LED at the SI-COLO84 control unit can be adjusted.



AVERAGE:
Averaging (over 32768 scanning values max.).
Here the number of scanning values over which the raw signal measured at the receiver is averaged can be set.

TRIGGER:
In this function field the trigger mode at the SI-COLO84 control unit can be set.
EXT: Color detection is activated through the external trigger input (IN0).
CONT: Continuous color detection (no trigger event required).



INTLIM:
This edit box is used for setting a lower intensity limit. Color evaluation is stopped if the total intensity of the three primary colors (red, green, blue) that is measured at the receiver unit falls below this limit.

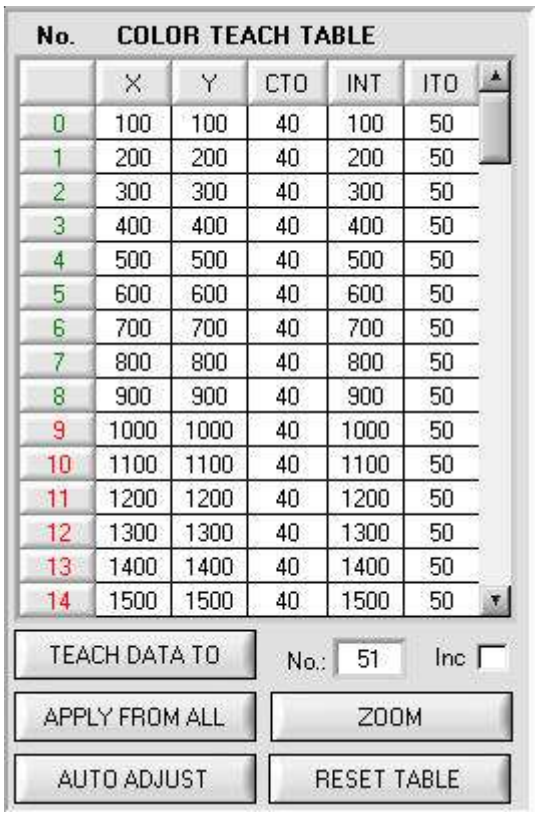
Parameterization

MAXCOL-No.:
In this function field the number of colors to be checked can be set. With the SI-COLO84 control unit a maximum of 100 colors can be checked.

HOLD:
In this edit box a pulse lengthening (100 ms max.) at the digital outputs of the SI-COLO84 control unit can be set.

EVALMODE:
In this function field the evaluation mode at the SI-COLO84 control unit can be set:

FIRST HIT:	The current color value (X,Y) lies within the tolerance circle of a taught color.
MINIMAL DIST:	The current color value (X,Y) is assigned to the teach-in color that lies next to this color value (X,Y) in the color triangle.
COLOR SERIES:	Checking of the color sequence.
CONTRAST:	Intensity check of a selected primary color (red, green, blue) with a maximum switching frequency of 28 kHz.
EXT TEACH:	Teaching procedure is started by setting the input to 0V for instance via PLC, or push button). The integrated yellow LED indicates the successful teaching procedure.
ADAPTIVE CONTROL:	Permanent teaching during measurement, adaption to product fluctuations.



COLOR TEACH TABLE („Farb-Lern-Tabelle“):
nput of parameters X, Y, CTO, INT and ITO in the corresponding input fields, or automatically by clicking the

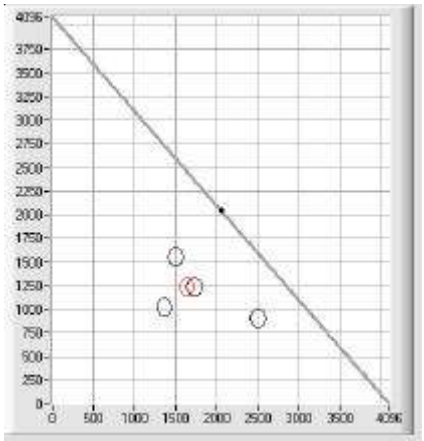
button.

X:	X-value of the teach-in color, normalized red color content
Y:	Y-value of the teach-in color, normalized green color content
CTO:	Tolerance circle around the teach color that is defined as (X,Y) point
INT:	Teach-in value for the total intensity
ITO:	Intensity tolerance around the INT teach-in value

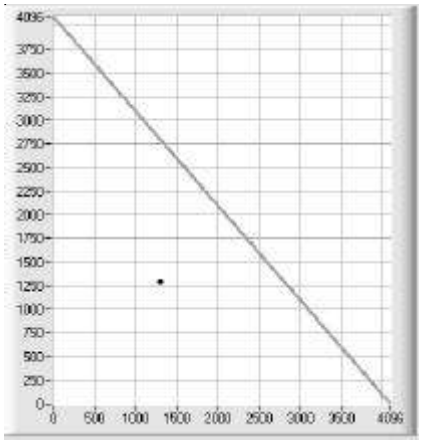
Each of the color ranges defined in the color teach table is represented as a tolerance circle around the teach-in color (X,Y) after a click on the

button.

The tolerance circle around the teach-in color (X,Y) is specified by entering „CTO“.



"COLOR TRIANGLE":
In the color triangle the currently detected color is represented by an X,Y value pair, with the X-value representing the normalized red content, and the Y-value representing the normalized green content of the teach-in color.
The blue content on the color triangle is proportional to the distance of the X,Y value pair from the hypotenuse.



$$X = \frac{R}{R+G+B} * 4095$$

$$Y = \frac{G}{R+G+B} * 4095$$