

# SI-COLO Series

## ▶ SI-COLO2-M18 Color Sensor

- Measuring range typ. 20mm ... 200 mm with reflected light operation, typ. 100 ... 2000 mm with transmitted light operation
- White-light LED, 100 kHz modulated
- Sturdy M18-metal housing



## ▶ SI-COLO2-CON1 Electronic Control Unit

- Up to 15 colors can be stored
- RS232 - interface (USB adapter available)
- Color and grey scale detection
- Brightness correction can be activated
- Several TEACH-functions (via PC, PLC, or push button)
- Various evaluation algorithms can be activated
- Switching state display by means of 4 yellow LEDs
- Insensitive to outside light
- 'Material adaption' can be activated (adaptive control)
- 'Averaging' can be activated (from 1 up to over 32000 values)



## Design

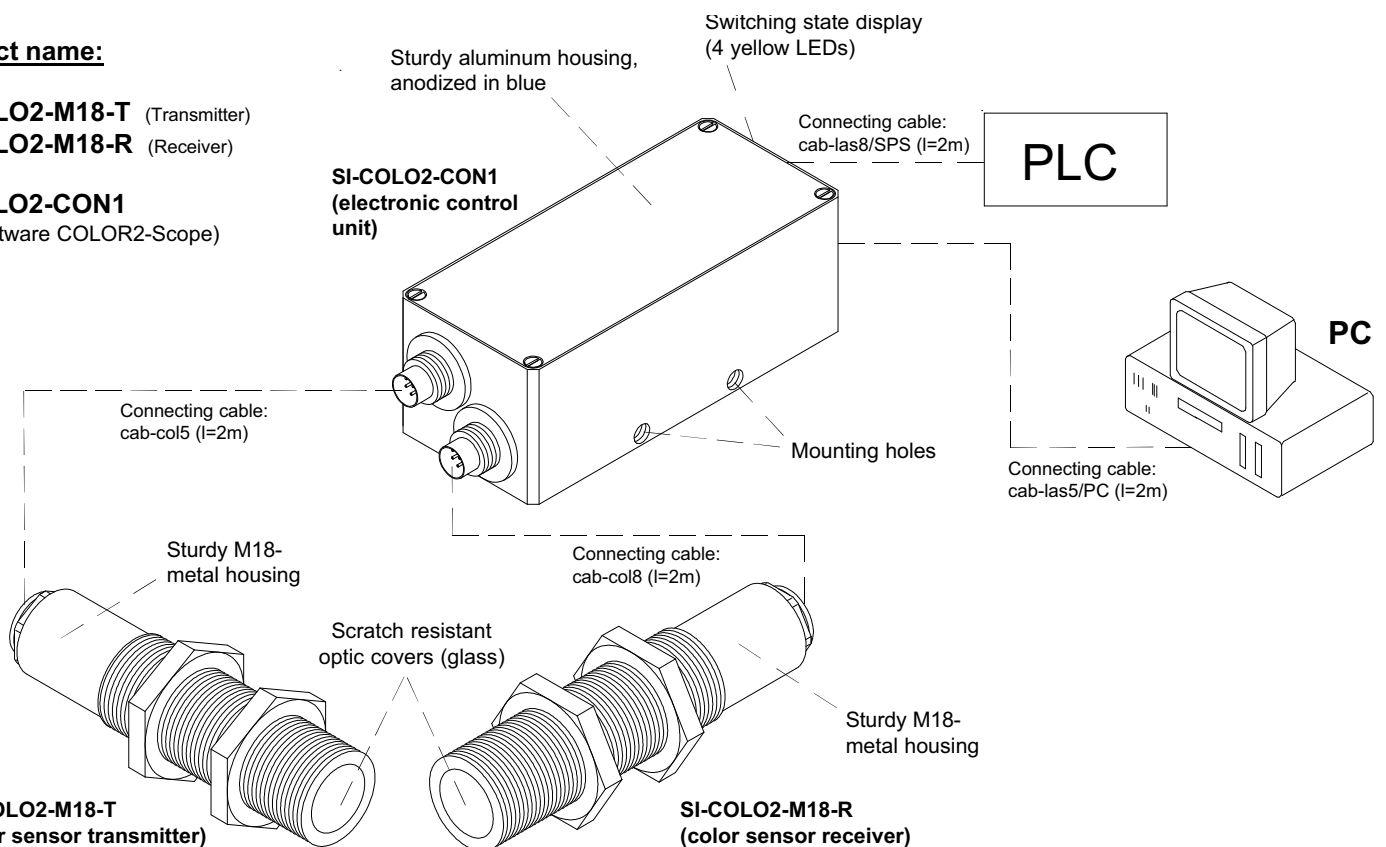
### Product name:

**SI-COLO2-M18-T** (Transmitter)

**SI-COLO2-M18-R** (Receiver)

**SI-COLO2-CON1**

(incl. software COLOR2-Scope)



### Parameterization under Windows® with software COLOR2-Scope:

The SI-COLO2-M18 color sensor can be parameterized by means of the electronic control unit SI-COLO2-CON1 via serial interface (RS232) under Windows® (please cf. pages 8-10). Up to 15 colors can be taught, and stored in the control unit. If the color sensor detects one of the taught colors, a change of switching state is performed through 4 encoded digital outputs (visual display by means of 4 yellow LEDs at the SI-COLO2-CON1 housing).



**Technical Data**

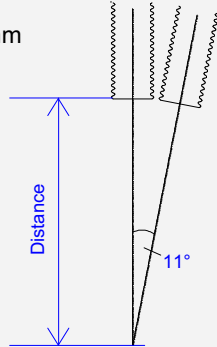
Model	SI-COLO2-M18
Light source	White-light LED, 100 kHz modulated
Working range (target distance)	With reflected light operation: typ. 20 mm ... 200 mm With transmitted light operation: typ. 100 mm ... 2000 mm
Light spot size	typ. 5 mm in diameter at 100 mm distance
Reproducibility	In the X,Y color range 1 digit each at 8 bit A/D conversion
Receiver	3-color filter detector
Pulsating light operation	100 kHz
Ambient light	Up to 5000 Lux
Type of protection	IP67
Current consumption	typ. 50 mA
Connector type	SI-COLO2-M18-T (transmitter): 5-pin female connector (type Binder Series 712) SI-COLO2-M18-R (receiver): 8-pin female connector (type Binder Series 712)
Housing material	SI-COLO2-M18-T (transmitter): Brass, nickel-plated SI-COLO2-M18-R (receiver): Brass, nickel-plated
Operating temperature range	-20°C ... +55°C
Storage temperature range	-20°C ... +85°C
EMC test acc. to	IEC - 801

Model	SI-COLO2-CON1
Voltage supply	+12VDC ... +30VDC, protected against polarity reversal, overload protected
Type of protection	IP64
Current consumption	typ. 180 mA
Max. switching current	100 mA, short-circuit-proof
Interface	RS232, parameterizable under Windows®
Pulse lengthening	adjustable under Windows® 0 ms ... 100 ms
Switching frequency	Max. 2 kHz with 15 teach-in colors, max. 5 kHz with 1 teach-in color, max. 28 kHz with contrast detection
Outputs	OUT 0 ... OUT 3 (DIGITAL, +U <sub>b</sub> /0V)
Averaging	Over 32768 values max.
Switching state display	Visualization by means of 4 yellow LEDs
Color memory capacity	Non-volatile EEPROM with parameter sets for 15 colors max.
Connector type	to SI-COLO2-M18-T: 5-pin plug (type Binder 712) / to SI-COLO2-M18-R: 8-pin plug (type Binder 712) to PLC: 8-pin female connector (type Binder 712) / to PC: 5-pin female connector (type Binder 712)
Housing material	Aluminum, anodized in blue
Operating temperature range	-20°C ... +55°C
Storage temperature range	-20°C ... +85°C
EMC test acc. to	IEC - 801



**Technical Data**
**DYN-Mode****Transmitter/receiver with an angle of 11°**

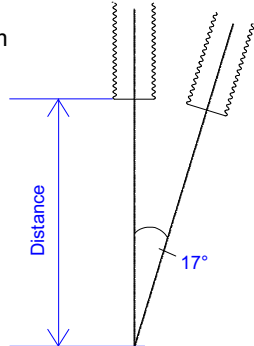
Distance: 140 mm ... 160 mm

**COLOR VALUE CHANGE [distance], typ.**

$\Delta x = \pm 4$	$\Delta y = \pm 2$	Color: RAL 3020 (traffic red)
$\Delta x = \pm 3$	$\Delta y = \pm 2$	Color: RAL 1026 (luminous yellow)
$\Delta x = \pm 2$	$\Delta y = \pm 2$	Color: RAL 6024 (traffic green)
$\Delta x = \pm 3$	$\Delta y = \pm 2$	Color: RAL 5017 (traffic blue)

**DYN-Mode****Transmitter/receiver with an angle of 17°**

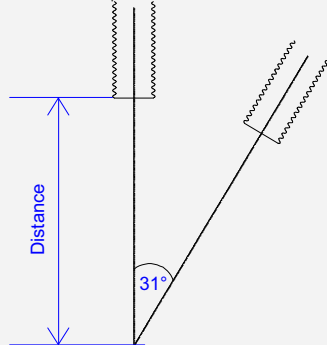
Distance: 90 mm ... 110 mm

**COLOR VALUE CHANGE [distance], typ.**

$\Delta x = \pm 2$	$\Delta y = \pm 2$	Color: RAL 3020 (traffic red)
$\Delta x = \pm 3$	$\Delta y = \pm 2$	Color: RAL 1026 (luminous yellow)
$\Delta x = \pm 2$	$\Delta y = \pm 2$	Color: RAL 6024 (traffic green)
$\Delta x = \pm 2$	$\Delta y = \pm 2$	Color: RAL 5017 (traffic blue)

**DYN-Mode****Transmitter/receiver with an angle of 31°**

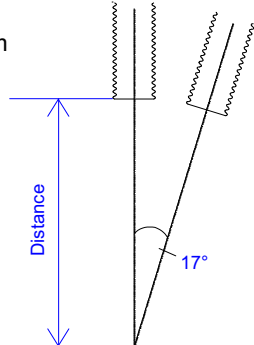
Distance: 40 mm ... 60 mm

**COLOR VALUE CHANGE [distance], typ.**

$\Delta x = \pm 5$	$\Delta y = \pm 1$	Color: RAL 3020 (traffic red)
$\Delta x = \pm 2$	$\Delta y = \pm 3$	Color: RAL 1026 (luminous yellow)
$\Delta x = \pm 1$	$\Delta y = \pm 5$	Color: RAL 6024 (traffic green)
$\Delta x = \pm 1$	$\Delta y = \pm 3$	Color: RAL 5017 (traffic blue)

**STAT-Mode****Transmitter/receiver with an angle of 17°**

Distance: 90 mm ... 110 mm

**COLOR VALUE CHANGE [distance], typ.**

$\Delta x = \pm 3$	$\Delta y = \pm 2$	Color: RAL 3020 (traffic red)
$\Delta x = \pm 3$	$\Delta y = \pm 1$	Color: RAL 1026 (luminous yellow)
$\Delta x = \pm 2$	$\Delta y = \pm 2$	Color: RAL 6024 (traffic green)
$\Delta x = \pm 2$	$\Delta y = \pm 2$	Color: RAL 5017 (traffic blue)



Technical Data

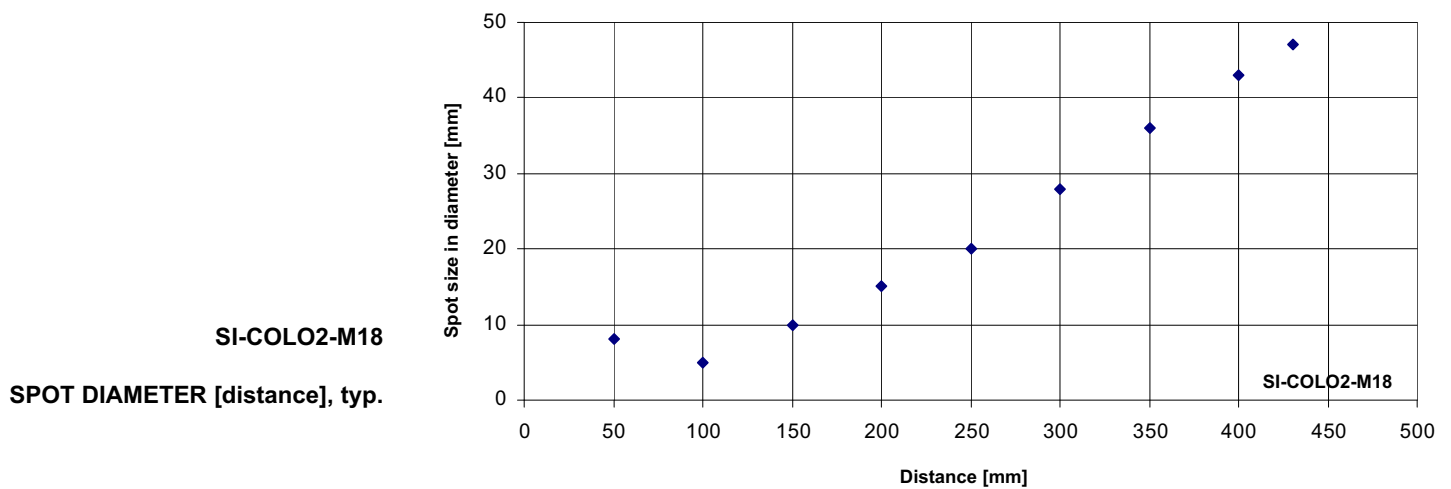
<b>DYN-Mode</b>	<b>COLOR VALUE CHANGE [temperature], typ.</b>
SI-COLO2-M18	$\Delta x/\Delta T = 0.3/^\circ\text{C}$ $\Delta y/\Delta T = 0.2/^\circ\text{C}$
<b>DYN-Mode</b>	<b>INTENSITY CHANGE [temperature], typ.</b>
SI-COLO2-M18	$\Delta \text{INT}/\Delta T = 0.1/^\circ\text{C}$
<b>STAT-Mode</b>	<b>COLOR VALUE CHANGE [temperature], typ.</b>
SI-COLO2-M18	$\Delta x/\Delta T = 0.3/^\circ\text{C}$ $\Delta y/\Delta T = 0.2/^\circ\text{C}$
<b>STAT-Mode</b>	<b>INTENSITY CHANGE [temperature], typ.</b>
SI-COLO2-M18	$\Delta \text{INT}/\Delta T = 0.7/^\circ\text{C}$



Diagrams

**Diagram: SPOT SIZE (DIAMETER)**

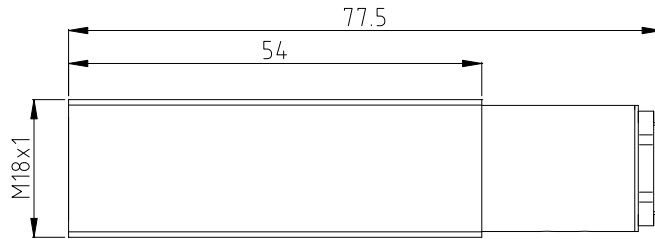
Spot size: Ø 5 mm (typ.) at 100 mm distance



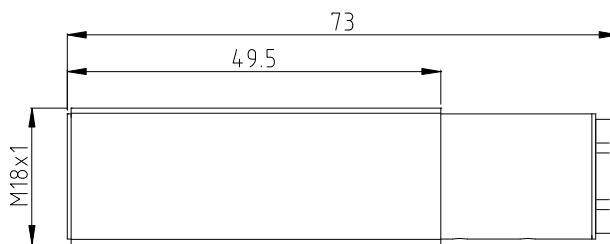


Dimensions

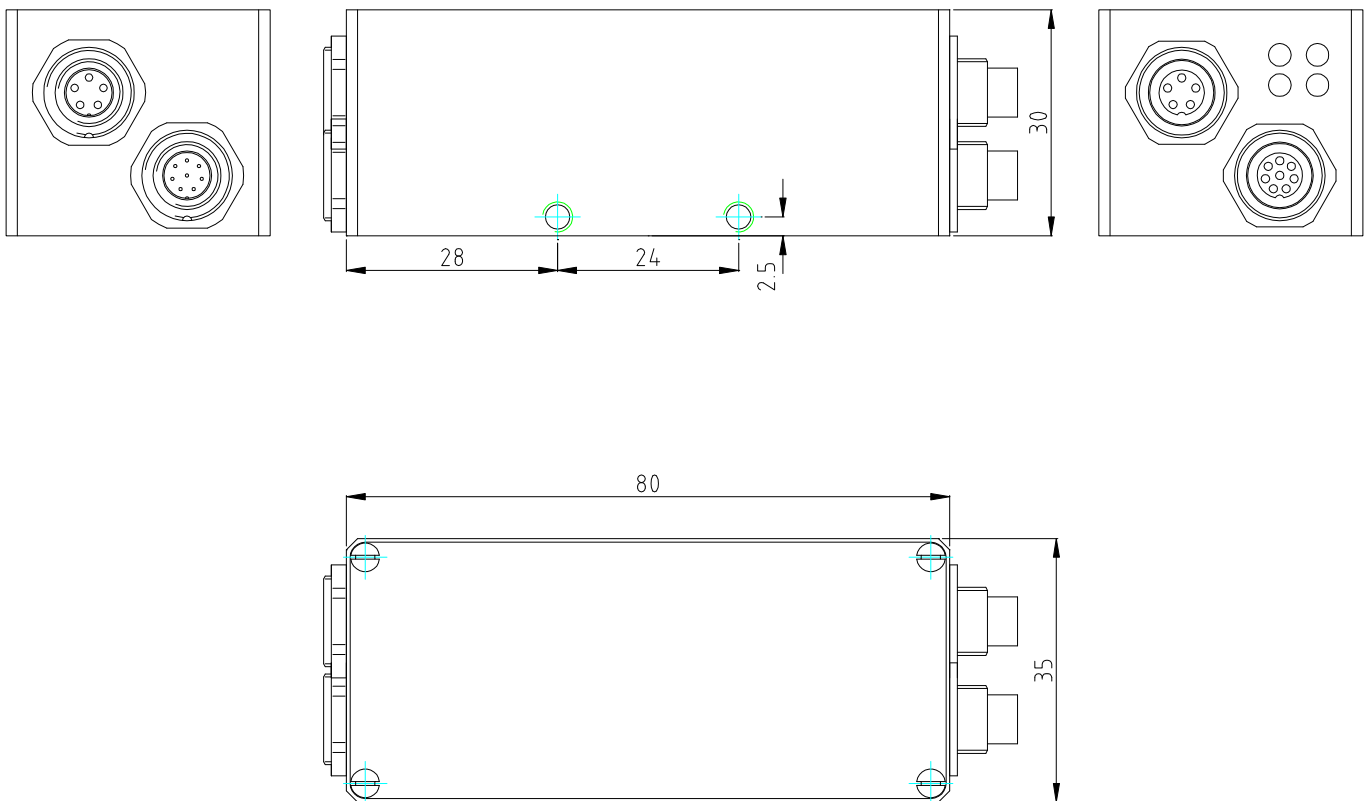
**SI-COLO2-M18-T (transmitter):**



**SI-COLO2-M18-R (receiver):**



**SI-COLO2-CON1 (electronic control unit):**



All dimensions in mm

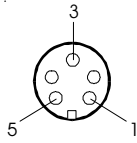
Connector Assignment

**Connection of SI-COLO2-CON1 to SI-COLO2-M18-T (transmitter):**

**5-pin plug, type Binder series 712**

Pin: Assignment:

- 1 Transmitter Anode
- 2 Transmitter Cathode
- 3 GND (0V)
- 4 GND (0V)
- 5 GND (0V)



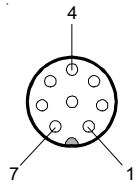
Connecting cable: cab-col5 (l=2m)

**Connection of SI-COLO2-CON1 to SI-COLO2-M18-R (receiver):**

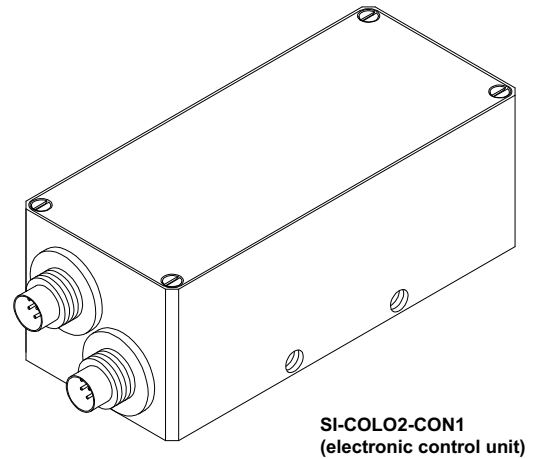
**8-pin plug, type Binder Series 712**

Pin: Assignment:

- 1 AC - red
- 2 GND (0V)
- 3 AC - blue
- 4 GND (0V)
- 5 AC - green
- 6 GND (0V)
- 7 +Ub
- 8 GND (0V)



Connecting cable: cab-col8 (l=2m)



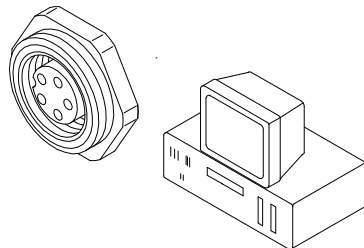
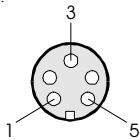
SI-COLO2-CON1  
(electronic control unit)

**Connecting of SI-COLO2-CON1 to PC:**

**5-pin female connector, type Binder Series 712**

Pin: Assignment:

- 1 GND (0V)
- 2 TX0
- 3 RX0
- 4 n.c.
- 5 n.c.



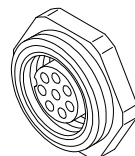
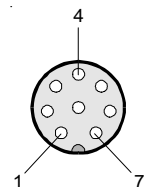
Connecting cable: cab-las5/PC (l=2m)

**Connection of SI-COLO2-CON1 to PLC:**

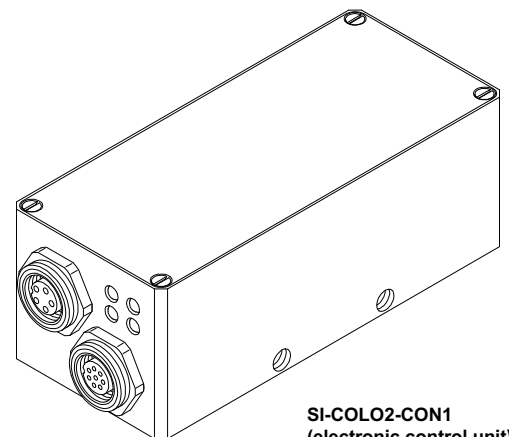
**8-pin female connector, type Binder Series 712**

Pin: Color: Assignment:

- 1 wht GND (0V)
- 2 brn +12 ... +30VDC
- 3 grn IN0
- 4 yel OUT0
- 5 gry OUT1
- 6 pnk OUT2
- 7 blu OUT3
- 8 red n.c.



Connecting cable: cab-las8/SPS (l=2m)

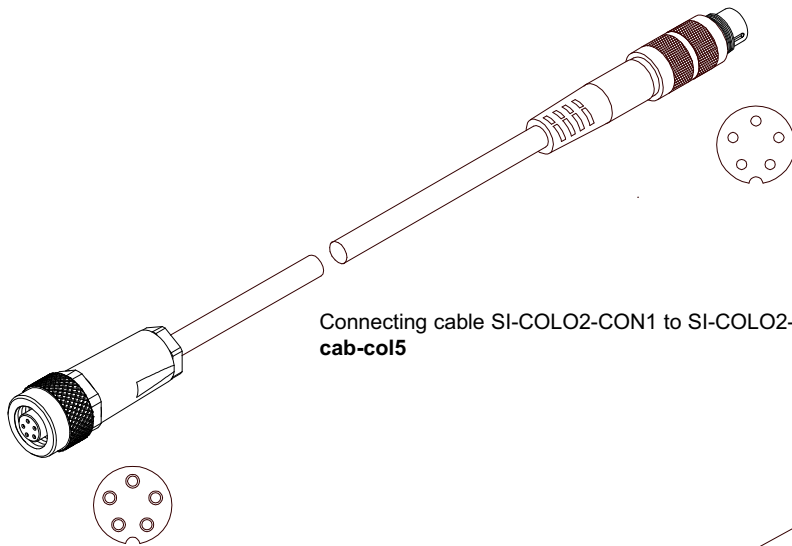


SI-COLO2-CON1  
(electronic control unit)

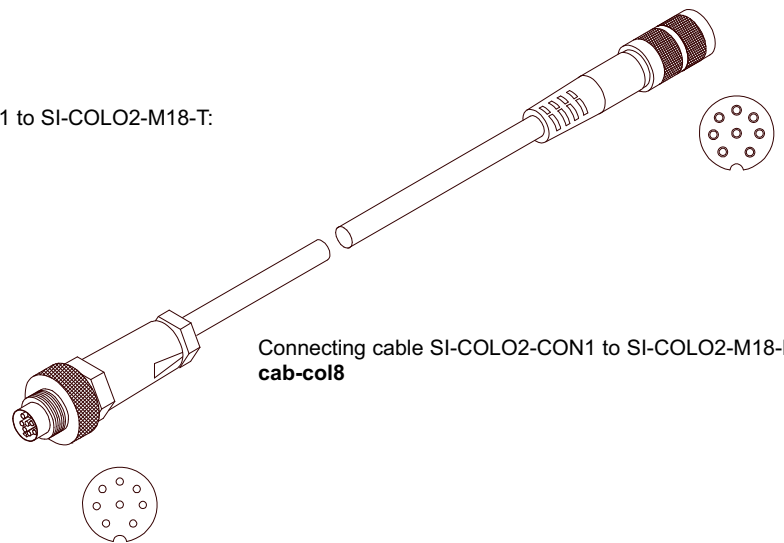
Connecting Cables

**Connecting cables for SI-COLO2-CON1:**

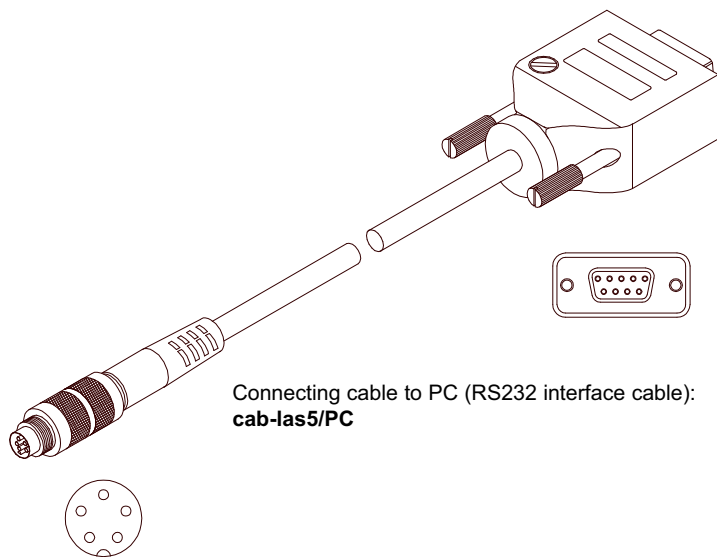
to SI-COLO2-M18-T:	<b>cab-col5</b>	Length: 2m	Outer jacket: PUR, shielded
to SI-COLO2-M18-R:	<b>cab-col8</b>	Length: 2m	Outer jacket: PUR, shielded
to PC:	<b>cab-las5/PC</b>	Length: 2m	Outer jacket: PUR, shielded
to PLC:	<b>cab-las8/SPS</b>	Length: 2m	Outer jacket: PUR, shielded



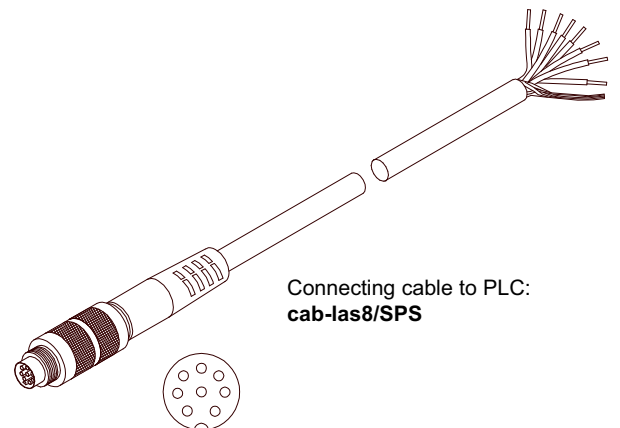
Connecting cable SI-COLO2-CON1 to SI-COLO2-M18-T:  
**cab-col5**



Connecting cable SI-COLO2-CON1 to SI-COLO2-M18-R:  
**cab-col8**



Connecting cable to PC (RS232 interface cable):  
**cab-las5/PC**



Connecting cable to PLC:  
**cab-las8/SPS**

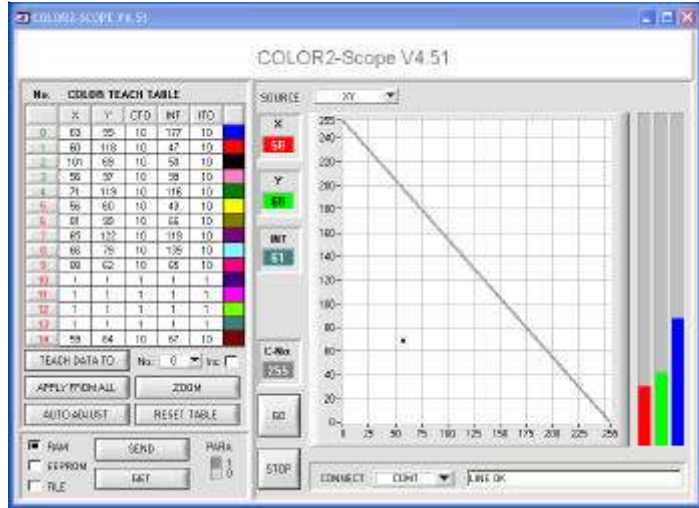


Parameterization

**Windows® user interface:**

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

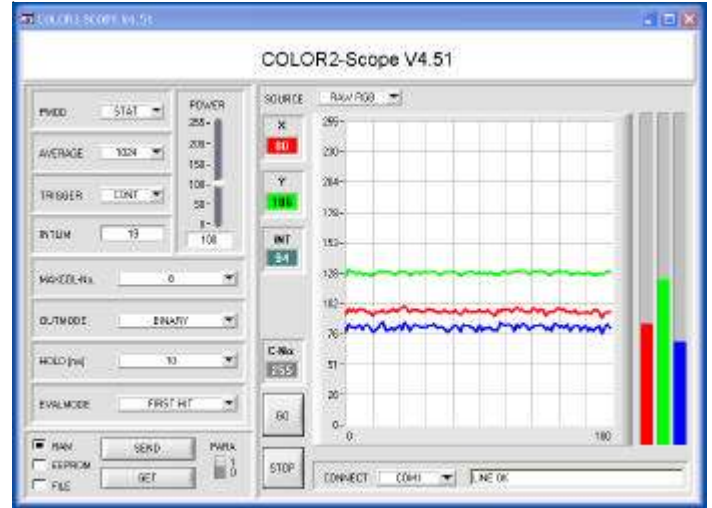
**X,Y-chart:**



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:



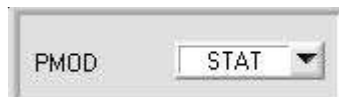
**RGB-t-chart:**



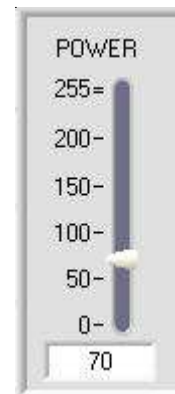
Display of the current raw data (red, green, blue) from the color sensor in „scroll mode“ (oscilloscope function). In addition the current raw data are visualized as a bar display. This facilitates the adjustment of the color sensor.

**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 sensor 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 color sensor 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.: 15

HOLD [ms]: 10

EVALMODE: FIRST HIT

No.	X	Y	CTO	INT	ITO	
0	63	99	10	177	10	Blue
1	60	118	10	47	10	Red
2	101	69	10	50	10	Black
3	56	97	10	99	10	Pink
4	71	119	10	116	10	Green
5	56	60	10	40	10	Yellow
6	81	99	10	66	10	Olive
7	65	122	10	119	10	Purple
8	66	79	10	139	10	Cyan
9	88	62	10	65	10	Magenta
10	1	1	1	1	1	Dark Purple
11	1	1	1	1	1	Bright Pink
12	1	1	1	1	1	Light Green
13	1	1	1	1	1	Dark Teal
14	59	64	10	67	10	Brown

TEACH DATA TO No.: 0 Inc

APPLY FROM ALL ZOOM

AUTO ADJUST RESET TABLE

**MAXCOL-No.:**

In this function field the number of colors to be checked can be set. With the color sensor a maximum of 15 colors can be checked.

**HOLD:**

In this edit box a pulse lengthening (100 ms max.) at the digital outputs of the color sensor can be set.

**EVALMODE:**

In this function field the evaluation mode at the color sensor 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, adaptation to product fluctuations.

**COLOR TEACH TABLE:**

Input of parameters X, Y, CTO, INT, and ITO in the corresponding input fields, or automatically by clicking the **TEACH DATA TO** 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 **APPLY FROM ALL** button.

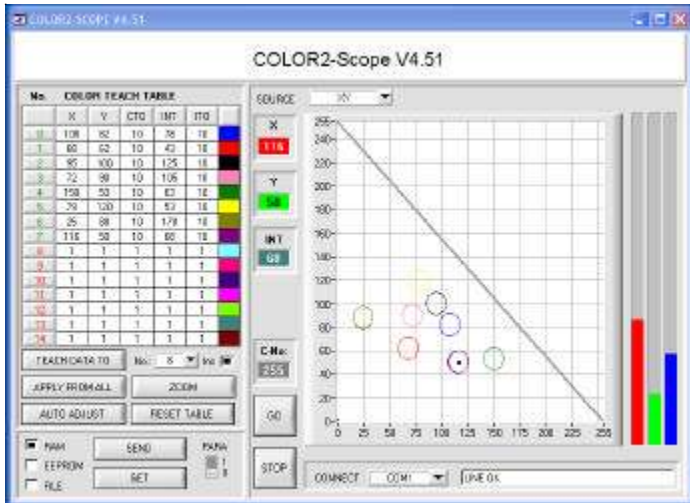


The tolerance circle around the teach-in color (X,Y) is specified by entering „CTO“.

**"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.

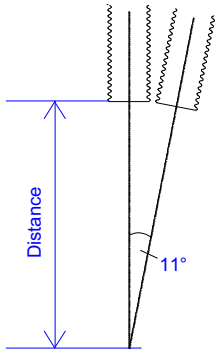


$$X = \frac{R}{R+G+B} * 255$$

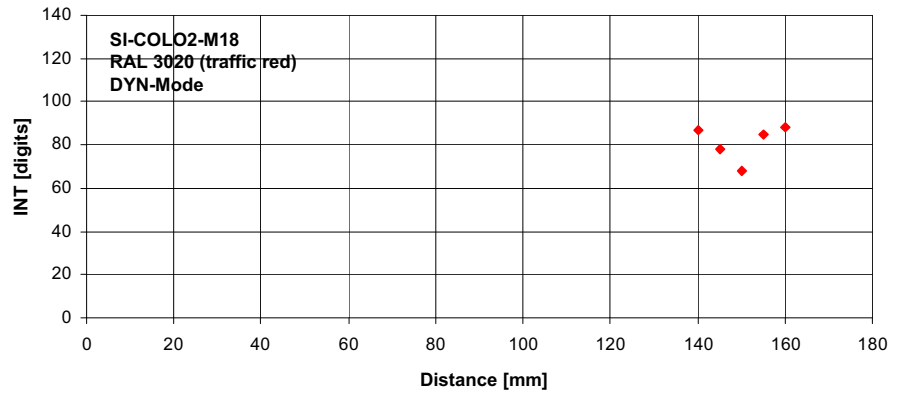
$$Y = \frac{G}{R+G+B} * 255$$

Diagrams

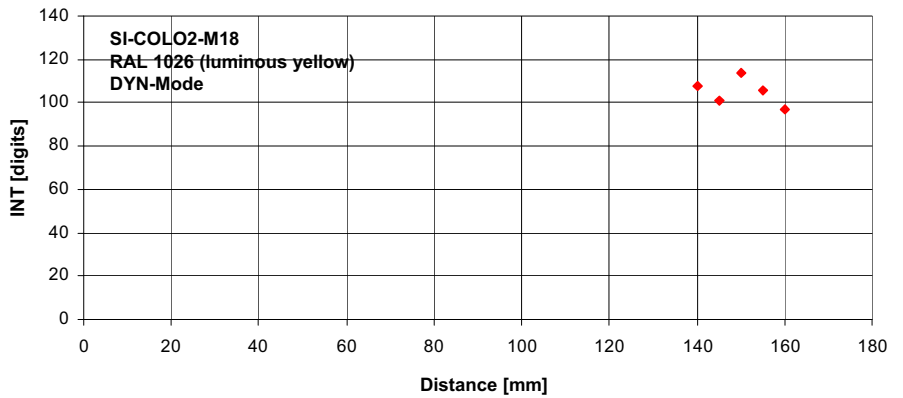
**Diagrams:** INTENSITY  
SI-COLO2-M18, transmitter/receiver arranged with an angle of 11°  
DYN-Mode



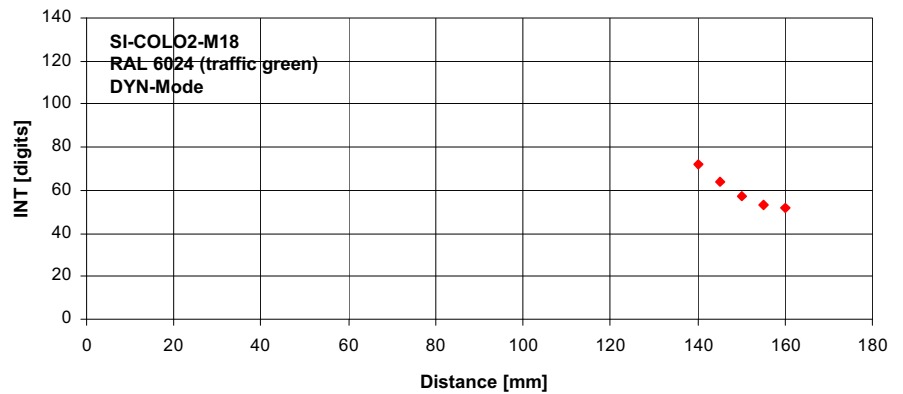
INTENSITY [distance], typ.  
DYN-Mode  
transm./receiver  $\sphericalangle$  : 11°  
Color: RAL 3020 (traffic red)



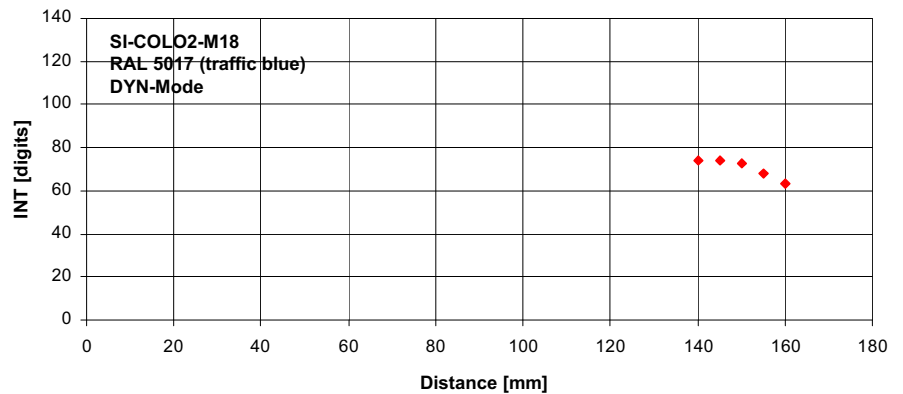
INTENSITY [distance], typ.  
DYN-Mode  
transmitter/receiver  $\sphericalangle$  : 11°  
Color: RAL 1026 (luminous yellow)



INTENSITY [distance], typ.  
DYN-Mode  
transmitter/receiver  $\sphericalangle$  : 11°  
Color: RAL 6024 (traffic green)

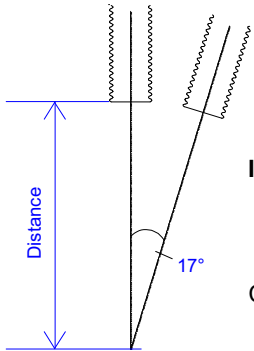


INTENSITY [distance], typ.  
DYN-Mode  
transmitter/receiver  $\sphericalangle$  : 11°  
Color: RAL 5017 (traffic blue)

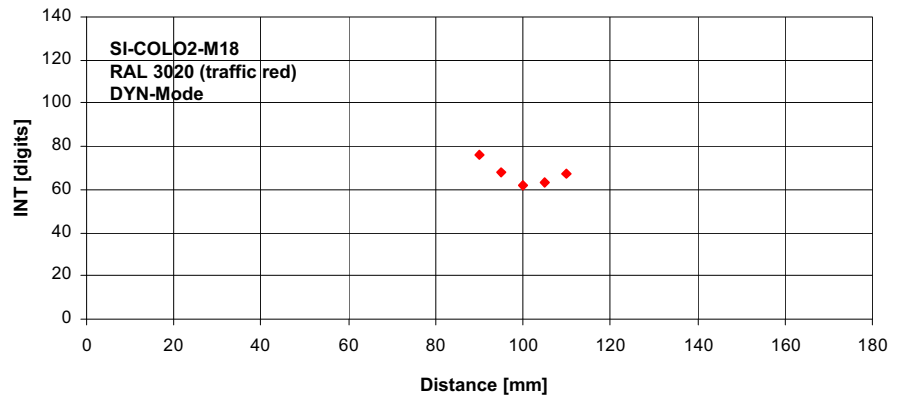


Diagrams

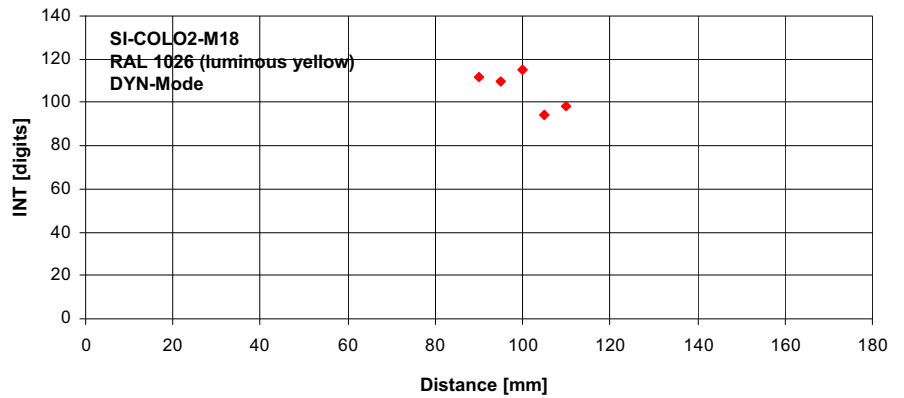
**Diagrams:** INTENSITY  
SI-COLO2-M18, transmitter/receiver arranged with an angle of 17°  
DYN-Mode



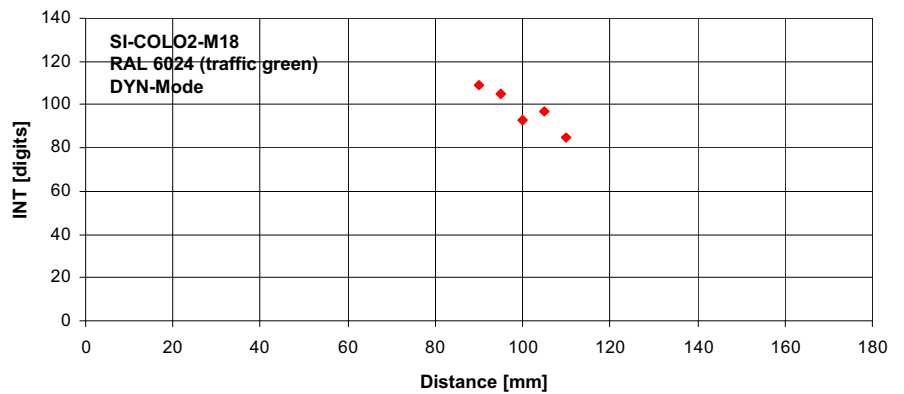
INTENSITY [distance], typ.  
DYN-Mode  
transm./receiver  $\sphericalangle$  : 17°  
Color: RAL 3020 (traffic red)



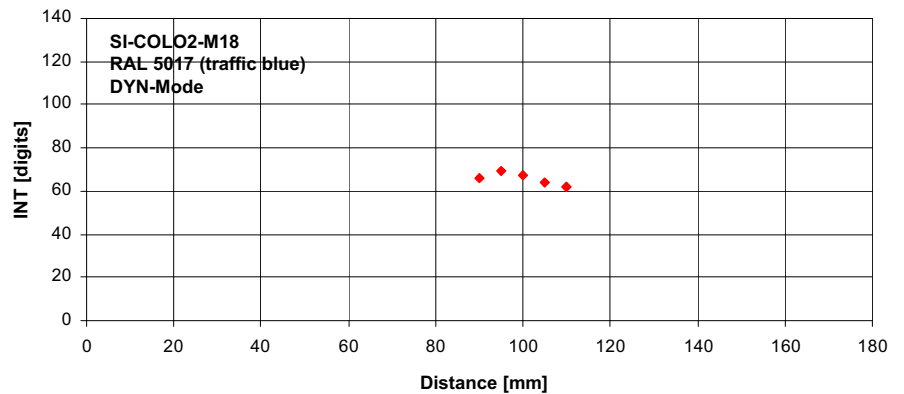
INTENSITY [distance], typ.  
DYN-Mode  
transmitter/receiver  $\sphericalangle$  : 17°  
Color: RAL 1026 (luminous yellow)



INTENSITY [distance], typ.  
DYN-Mode  
transmitter/receiver  $\sphericalangle$  : 17°  
Color: RAL 6024 (traffic green)

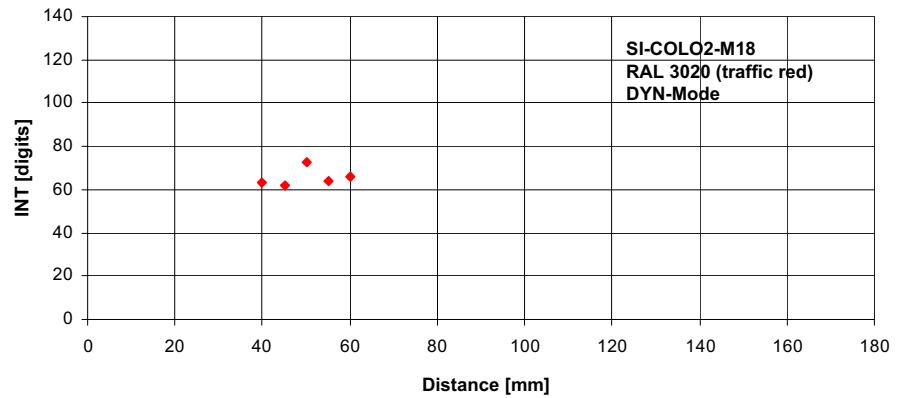
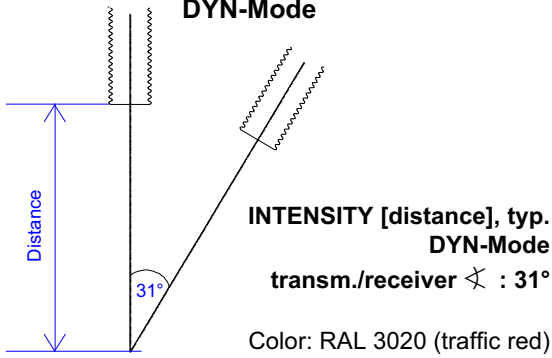


INTENSITY [distance], typ.  
DYN-Mode  
transmitter/receiver  $\sphericalangle$  : 17°  
Color: RAL 5017 (traffic blue)

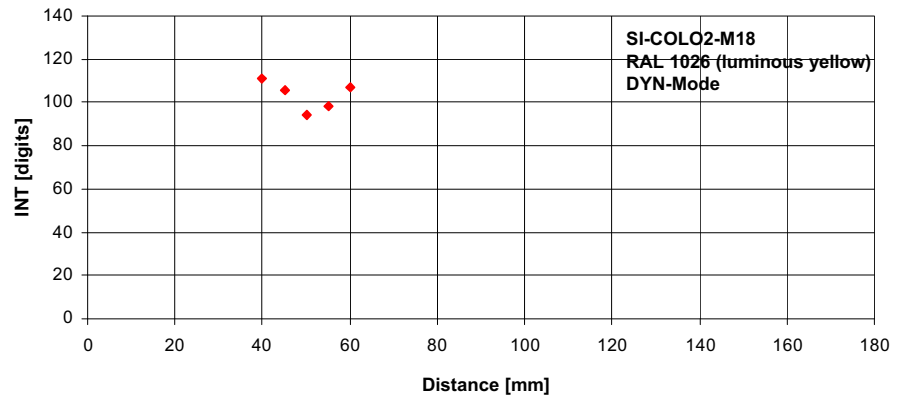


Diagrams

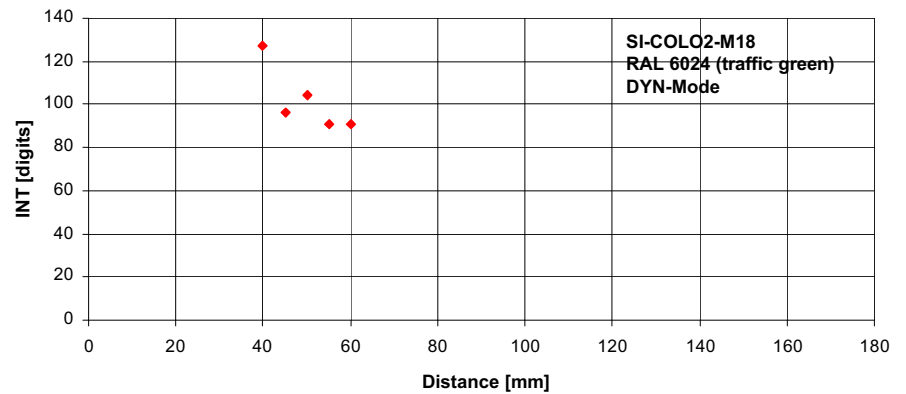
**Diagrams:** INTENSITY  
 SI-COLO2-M18, transmitter/receiver arranged with an angle of 31°  
 DYN-Mode



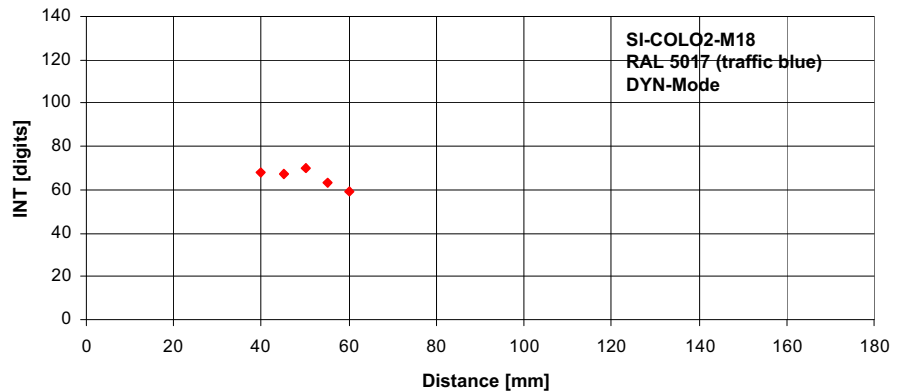
INTENSITY [distance], typ. DYN-Mode  
 transmitter/receiver  $\sphericalangle$  : 31°  
 Color: RAL 1026 (luminous yellow)



INTENSITY [distance], typ. DYN-Mode  
 transmitter/receiver  $\sphericalangle$  : 31°  
 Color: RAL 6024 (traffic green)

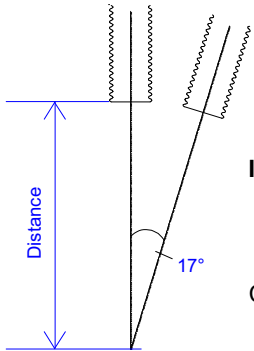


INTENSITY [distance], typ. DYN-Mode  
 transmitter/receiver  $\sphericalangle$  : 31°  
 Color: RAL 5017 (traffic blue)



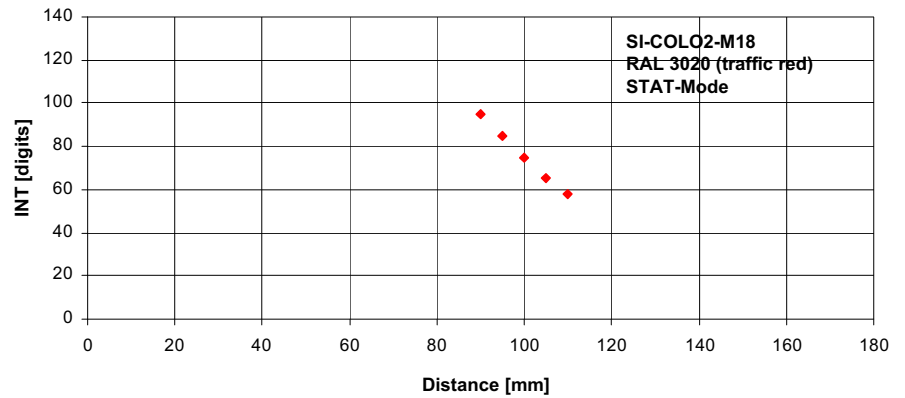
Diagrams

**Diagrams:** INTENSITY  
SI-COLO2-M18, transmitter/receiver arranged with an angle of 17°  
STAT-Mode



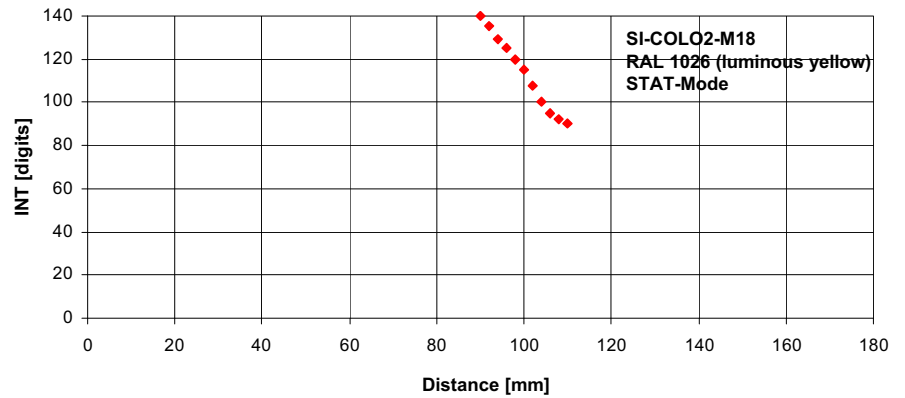
INTENSITY [distance], typ.  
STAT-Mode, POWER = 66  
transm./receiver  $\angle$  : 17°

Color: RAL 3020 (traffic red)



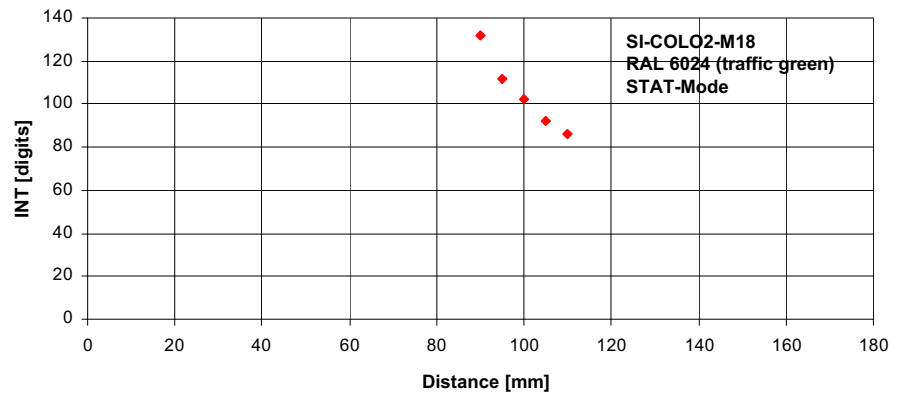
INTENSITY [distance], typ.  
STAT-Mode, POWER = 40  
transmitter/receiver  $\angle$  : 17°

Color: RAL 1026 (luminous yellow)



INTENSITY [distance], typ.  
STAT-Mode, POWER = 255  
transmitter/receiver  $\angle$  : 17°

Color: RAL 6024 (traffic green)



INTENSITY [distance], typ.  
STAT-Mode, POWER = 138  
transmitter/receiver  $\angle$  : 17°

Color: RAL 5017 (traffic blue)

