Manual

CR200P and CR210P

Version 1.4

ASTECH
Angewandte Sensortechnik

Notes

The information contained in this manual has been thoroughly researched and prepared. Nevertheless, we cannot assume liability for omissions or errors of any nature whatsoever. We would, however, be grateful for your comments or suggestions.

We shall not accept any claims for damages, except for those resulting from intent or gross negligence.

As this product is available in several designs, there might be deviations between the descriptions and instructions in hand and the product supplied.

We reserve the right to make technical changes, which serve to improve the product, without prior notification. Thus, it cannot be assumed that subsequent versions of a product will have the same features as those described here.

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CR200P and CR210P - Manual V1.3

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Revision history

Manual version	Date	Changes
1.0	14.04.2015	First release
1.1	11.06.2015	Converting the numerical format has changed
1.2	09.04.2018	Delivery-Profibus address changed p. 9
1.3	18.04.2018	Color value memory cells, drawing, EtherNet/IP, CE declaration
1.4	22.11.2024	new GSD File

The instruments are not to be used for safety applications, in particular applications in which safety of persons depends on proper operation of the instruments.
These instruments shall exclusively be used by qualified personnel.
Repair only by ASTECH.

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1 Technical Data

Table 1 : General technical data

Sensing channels	CR200: 2 Sensing channels CR210: 1 Sensing channel, 1 Internal stab. channel
Drift stabilization	CROMLASTAB®, Can be switched off
Receiving detector	Three range photo diode
Sensitivity	Adjustable by user
Sensitivity steps	8 (1x, 4x, 20x, 40x, 80x, 200x, 400x, 800x)
Receiving signal resolution	3 x 4096 Stufen
Object illumination	Power white light LED Adjustable (4096 Steps) Can be switched off
Ambient light compensation	Can be switched off
Standard interfaces	12 Switching outputs 2 Control inputs Serial (RS-232) USB
Optional Field bus interfaces	**Profibus** Fast Ethernet Profinet EtherNet/IP
Displays	20 LEDs for outputs and status
Buttons	3 Buttons for Teach-In
Color resolution (L*a*b*)	$\Delta E_{Lab} \leq 1$
Response time	≥ 50 µs (limited functionality)
Off-Delay (channel specific)	0 ms ... 65535 ms
On-Delay	0 ms ... 65535 ms
Hysteresis	0 % ... 255 %
Color value memory cells	100
Color output channels	12 (up to 100 at binary encoding)
Protection standard	IP54
Power supply	18 ... 28 VDC, max. 500 mA
Case temperature for operation	-10 °C ... 55 °C
Coupling in signal path	Via optical fiber
Optical fiber adaption	M18x1
Housing material	Aluminum, anodized
Housing size	100 mm × 70 mm × 30 mm
Weight	Ca. 260 g

Table 2 : Operational functionality

Channel measurement methods	CR200P: Difference measurement Channel 1 Channel 1 drift compensated Channel 1+2 CR210P: Channel 1 Channel 1 drift compensated
Color space modes	Non-self-shining objects XYZ, XyY, u'v'L*, L*a*b*, xyl Self-shining objects XYZ, xyY, u'v'L*, xyl
Color recognition modes	Check spherical tolerance Check cylindrical tolerance Minimal distance
Operating modes	External triggering Color grouping Color sequence recognition
Parameterization	Elaborately via PC Software Limited via 3 buttons

2 Specification electrical interfaces

Figure 1 shows the electrical connectors (type M9) of the sensor.

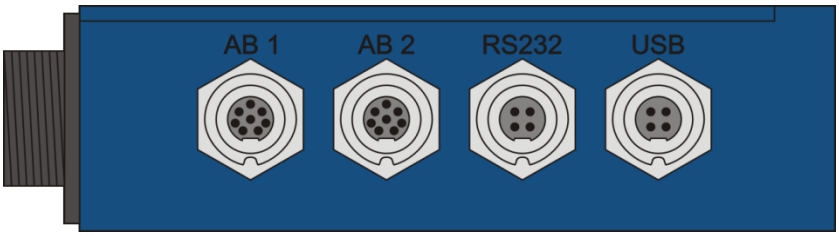


Figure 1 : Electrical interfaces

The counting order of round connectors is shown in Figure 2.

Figure 2 : Counting order of the round connectors

Table 3 : Signal description sensor connector AB1

Pin (color)	Name	Description
1 (white)	OUT1	Sensor output 1
2 (brown)	OUT2	Sensor output 2
3 (green)	TRG1	Input for external triggered Teach-In in mode "Ext. Teach"
4 (yellow)	TRG0	Input for updating the sensor outputs in mode "Extern Trig." Input for trigger controlled color sequence in mode "Trig. Sequ."
5 (grey)	OUT3	Sensor output 3
6 (pink)	OUT4	Sensor output 4
7 (blue)	GND	Ground
8 (red)	$+U_B$	Power supply
Shield	SH	Device shield (earth)

Table 4 : Signal meaning sensor connector AB2

Pin (color)	Name	Description
1 (white)	OUT5	Sensor output 5
2 (brown)	OUT6	Sensor output 6
3 (green)	OUT7	Sensor output 7
4 (yellow)	OUT8	Sensor output 8
5 (grey)	OUT9	Sensor output 9
6 (pink)	OUT10	Sensor output 10
7 (blue)	OUT11	Sensor output 11
8 (red)	OUT12	Sensor output 12
Shield	SH	Device shield (earth)

Table 5 : Electrical specification sensor connector AB1

Pin	Specification
1 (OUT1)	Push-Pull LOW: 0 V; HIGHT: +U_B - 1 V; max. 100 mA
2 (OUT2)	Push-Pull LOW: 0 V; HIGHT: +U_B - 1 V; max. 100 mA
3 (TRG1)	LOW: 0 V ... 3 V; HIGH: 18 V ... 28 V
4 (TRG0)	LOW: 0 V ... 3 V; HIGH: 18 V ... 28 V
5 (OUT3)	Push-Pull LOW: 0 V; HIGHT: +U_B - 1 V; max. 100 mA
6 (OUT4)	Push-Pull LOW: 0 V; HIGHT: +U_B - 1 V; max. 100 mA
7 (GND)	0 V
8 (+U_B)	18 ... 28 VDC, max. 500 mA (optional 9 ... 28 VDC)

Table 6 : Electrical specification sensor connector AB2

Pin	Specification
1 (OUT5)	Push-Pull LOW: 0 V; HIGHT: +U_B - 1 V; max. 100 mA
2 (OUT6)	Push-Pull LOW: 0 V; HIGHT: +U_B - 1 V; max. 100 mA
3 (OUT7)	Push-Pull LOW: 0 V; HIGHT: +U_B - 1 V; max. 100 mA
4 (OUT8)	Push-Pull LOW: 0 V; HIGHT: +U_B - 1 V; max. 100 mA
5 (OUT9)	Push-Pull LOW: 0 V; HIGHT: +U_B - 1 V; max. 100 mA
6 (OUT10)	Push-Pull LOW: 0 V; HIGHT: +U_B - 1 V; max. 100 mA
7 (OUT11)	Push-Pull LOW: 0 V; HIGHT: +U_B - 1 V; max. 100 mA
8 (OUT12)	Push-Pull LOW: 0 V; HIGHT: +U_B - 1 V; max. 100 mA

Table 7 : RS-232

Pin	Description	Specification
1 (GND)	GND	0 V
2 (TXD)	Send	-5 V ... +5 V
3 (RXD)	Receive	-5 V ... +5 V
4 (+U_B)	Optional voltage output	18 ... 28 VDC
Shield	Device shield (earth)	Earth

Table 8 : RS-232 Parameters

Parameter	Value
Baud rate	9.600 ... 115.200
Data bits	8
Parity	no
Stop bits	1
Flow control	No

The baud rate of the RS-232 interface is pre-set to 28800.

Table 9 : USB

Pin	Description	Specification
1 (GND)	GND (black)	0 V
2 (VBUS)	VBUS (red)	+5 V
3 (D-)	D- (white)	-400 mV
4 (D+)	D+ (green)	+400 mV
Shield	Device shield (earth)	Earth

Make sure that the respective shield wires of the used sensor cables are properly connected to earth!

3 PROFIBUS DP

3.1 General

Color sensors that are equipped with the optional Profibus interface, can be easily integrated into existing bus systems. They work as Profibus standard slave and support baud rates up to 12 MBaud (autodetect).

The Profibus address of the device is set via the bus master (e.g. Siemens PG or any master with SET_SLAVE_ADD). The default factory set address is **126** and should be changed after integration into the bus.

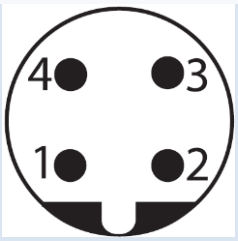
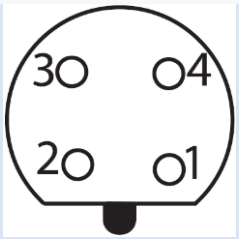
The user can choose the data, which is transferred to the Profibus master, via different modes. The possibilities range from status-information and the current state of the switching outputs to the transfer of all color values, including the color detection result and the color distance.

3.2 Connections

The sensor is connected to the bus via two standard circular connectors (Binder series 715, 4 pin, B coded). If only one of the two is connected (PB-IN), the other is to be provided with a terminating resistor.

The pin assignment of the connectors is shown in Table 10.

Table 10 : Pin assignment of the Profibus connectors

Description	PB-IN	PB-Out
Scheme		
+ UB	n.c.	1
Line A	2	2
GND	n.c.	3
Line B	4	4

3.3 Data transfer

The CROMLAVIEW® CR200 CR210 color sensors with Profibus interface have to be configured as standard Profibus slave. By the first parameter setting after power on, the sensor recognize the chosen mode by the Profibus input bytes. The data format of the different modes is explained in the following section.

The data length of the several modes is shown in Table 11.

Table 11 : Data length

Mode	Length of input data (Profibus-IN)	Length of control data(Profibus-Out)
1	4 Byte	2 Byte
2	16 Byte	2 Byte
3	28 Byte	2 Byte

3.4 Profibus-IN

For the format of the input data there are three different modes available. The data is sent to the Profibus-master.

Mode 1

In mode 1 the color sensor sends a life-counter, status information and the current state of the switching outputs of the sensor to the bus.

Life-counter (byte 1)

- Counts cyclic from 0 to 255 (1 byte)
- Is incremented with every measured value of the sensor
- Ensures the validity of the measured value
- Importance if the sampling rate of the sensor is faster than the bus cyclic time

Status (byte 2)

- Shows information about the state of the sensor
- Is updated with each bus request
- Trigger-Ack confirms the correct reception of a rising edge of one of the two trigger bits from the Profibus in bytes

Table 12 shows the meaning of the bits in the status byte.

Table 12 : Meaning of the bits in the status byte

Bit	Name	Function
0	Trigger-Ack	Toggle Bit für Trigger-Mode
1	Stab-Error	1 = Stabilization channel under- respectively over steered
2	Math-Error	1 = mathematical over steering of the transformation function
3	Software-Acc	1 = Access of the parameter setting software CR-Tool on the sensor
4	Reserved	Not used
5	Reserved	Not used
6	Reserved	Not used
7	Reserved	Not used

Switching outputs (byte 3 and 4)

- Show the latest state of the 12 color sensor switching outputs
- Byte 3: 0 ... 3: switching outputs 9 to 12
- Byte 4: 0 ... 7: switching outputs 1 to 8

Mode 2

In mode 2 the sensor outputs all data of mode 1 and all relevant color and recognition data of the sensors first measuring channel. These include the three color values (e.g. a*, b*, L* or X, Y, Z) and the result of the recognition including the two color distances.

The individual values are 16 byte long and the higher byte is transferred first.

Mode 3

Mode 3 outputs the data of mode 1, mode 2 and the color and recognition data of the sensors second measuring channel. This mode is only useful for the CR200P sensor. Only in this case the measuring channels are evaluated separately.

Overview of all modes

Table 13 : Profibus-IN data

Byte	Mode	Data
1	1+2+3	Life-Counter
2	1+2+3	State
3	1+2+3	Switch outputs 9 ... 12
4	1+2+3	Switch outputs 1 ... 8
5	2+3	Color value 1 channel 1 High
6	2+3	Color value 1 channel 1 Low
7	2+3	Color value 2 channel 1 High
8	2+3	Color value 2 channel 1 Low
9	2+3	Color value 3 channel 1 High
10	2+3	Color value 3 channel 1 Low
11	2+3	Color index channel 1 High
12	2+3	Color index channel 1 Low
13	2+3	Color distance Channel 1 High
14	2+3	Color distance Channel 1 Low
15	2+3	Lightness distance Channel 1 High[1]
16	2+3	Lightness distance Channel 1 Low[1]
17	3	Color value 1 Channel 2 High
18	3	Color value 1 Channel 2 Low
19	3	Color value 2 Channel 2 High
20	3	Color value 2 Channel 2 Low
21	3	Color value 3 Channel 2 High
22	3	Color value 3 Channel 2 Low
23	3	Color index Channel 2 High
24	3	Color index Channel 2 Low
25	3	Color distance Channel 2 High
26	3	Color distance Channel 2 Low
27	3	Lightness distance Channel 2 High[1]
28	3	Lightness distance Channel 2 Low[1]

Converting the numerical format

The color values and the recognition result in mode 2 and mode 3 are transmitted in 16Bit-signed-integer format. To present color values in a correct way they have to be divided by 100. The range of value in the sensor is between +32768 and -32667 and has consequently to be converted in a range of +327.68 and -326.67.

Due to the internal data processing, the value of the color distance is squared. For further processing it has to be calculated with the square root function. In case of usage of the cylinder mode also lightness distance parameter will be transmitted. This value has to be divided by 100, like color values.

[1] If spherical tolerance is chosen, the lightness distance is set to the maximum(0xFFFF)

3.5 Profibus-OUT

Within all modes, two data bytes are transferred to the sensor with every bus-cycle. The first byte specifies the table index for the controlled teach-in of a color. The individual bits of the second byte are used to control the sensor. Table 14 provides an overview of the functions.

Table 14 : Meaning of the control bits in the second Profibus-Out-Byte

Bit	Name	Function
0	TRG 0	Control line to update the outputs
1	TRG 1	Control line for Teach-In
2	Teach	Teach-In Mode 0 = as adjusted in the DSP 1 = TabIndex
3		Reserved
4		Reserved
5		Reserved
6		Reserved
7		Reserved
8-15	TabIndex	Table index for Teach-In (if bit 2 = '1')

The Teach-Bit determines how the teach in takes place.

Teach = low triggered teach-in, as adjusted in the sensor
Teach = high the new reference color is stored in the table space, as indicated in byte 2

The reserved control bits are not evaluated. They should be kept to 'low'.

3.6 Diagnostics and Error-Handling

The connection to the Profibus is realized by an integrated communication module, which cyclical request the data from the main processor of the color sensor.

If an error occurs during the data transmission between the processors, it will be detected and a diagnostic message is sent to the Profibus master.

The two diagnosis bytes then have the following value.

Byte 1: $0x02_h = 00000010_b$

Byte 2: $0x01_h = 00000001_b$

Once the communication between the processors of the sensor is working correctly again, the diagnostic message is deleted.

3.7 GSD file

```
;=============================================================
; Profibus Device ASTECH CROMLAVIEW CR2x0P
; Model : CR2x0P Series
; Description : CR2x0P Series with Profibus-DP
; Language : English
; Date : 21 April 2010
; Author : ASTECH GmbH
;=============================================================
```

```
#Profibus_DP

GSD_Revision       = 1

; Device identification
Vendor_Name        = "ASTECH"
Model_Name         = "CR2x0P1"
Revision           = "V1.0"
Ident_Number       = 0x3218
Protocol_Ident     = 0
Station_Type       = 0
FMS_supp           = 0
Hardware_Release   = "Revision F"
Software_Release   = "V1.2"

; Supported baudrates
9.6_supp           = 1
19.2_supp          = 1
93.75_supp         = 1
187.5_supp         = 1
500_supp           = 1
1.5M_supp          = 1
3M_supp            = 1
6M_supp            = 1
12M_supp           = 1

; Maximum responder time for supported baudrates
MaxTsdr_9.6        = 60
MaxTsdr_19.2       = 60
MaxTsdr_93.75      = 60
MaxTsdr_187.5      = 60
MaxTsdr_500        = 100
MaxTsdr_1.5M       = 150
MaxTsdr_3M         = 250
MaxTsdr_6M         = 450
MaxTsdr_12M        = 800

; Supported hardware features
Redundancy         = 0      ; not supported
Repeater_Ctrl_Sig  = 0      ; not supported
24V_Pins           = 0      ; not connected
Implementation_Type = "SPC3"
Bitmap_Device      = "CR2x0P_"

; Supported DP features
Freeze_Mode_supp   = 1
Sync_Mode_supp     = 1
Auto_Baud_supp     = 1
Set_Slave_Add_supp = 1
```

```
; Maximum polling frequency
Min_Slave_Intervall = 1      ; 100 us

; Maximum supported sizes
Modular_Station     = 1      ; modular
Max_Module          = 1
Max_Input_Len       = 244
Max_Output_Len      = 244
Max_Data_Len        = 432
Modul_Offset        = 0

Fail_Safe           = 0      ; state CLEAR not accepted
Slave_Family        = 9
Max_Diag_Data_Len   = 8

; Definition of modules
Module = "M1: 2Out-Word/2In-Byte" 0xD1,0xE0
EndModule
Module = "M2: 8Out-Word/2In-Byte" 0xD7,0xE0
EndModule
Module = "M3: 14Out-Word/2In-Byte" 0xDD,0xE0
EndModule


;============================================================
```

4 Drawings

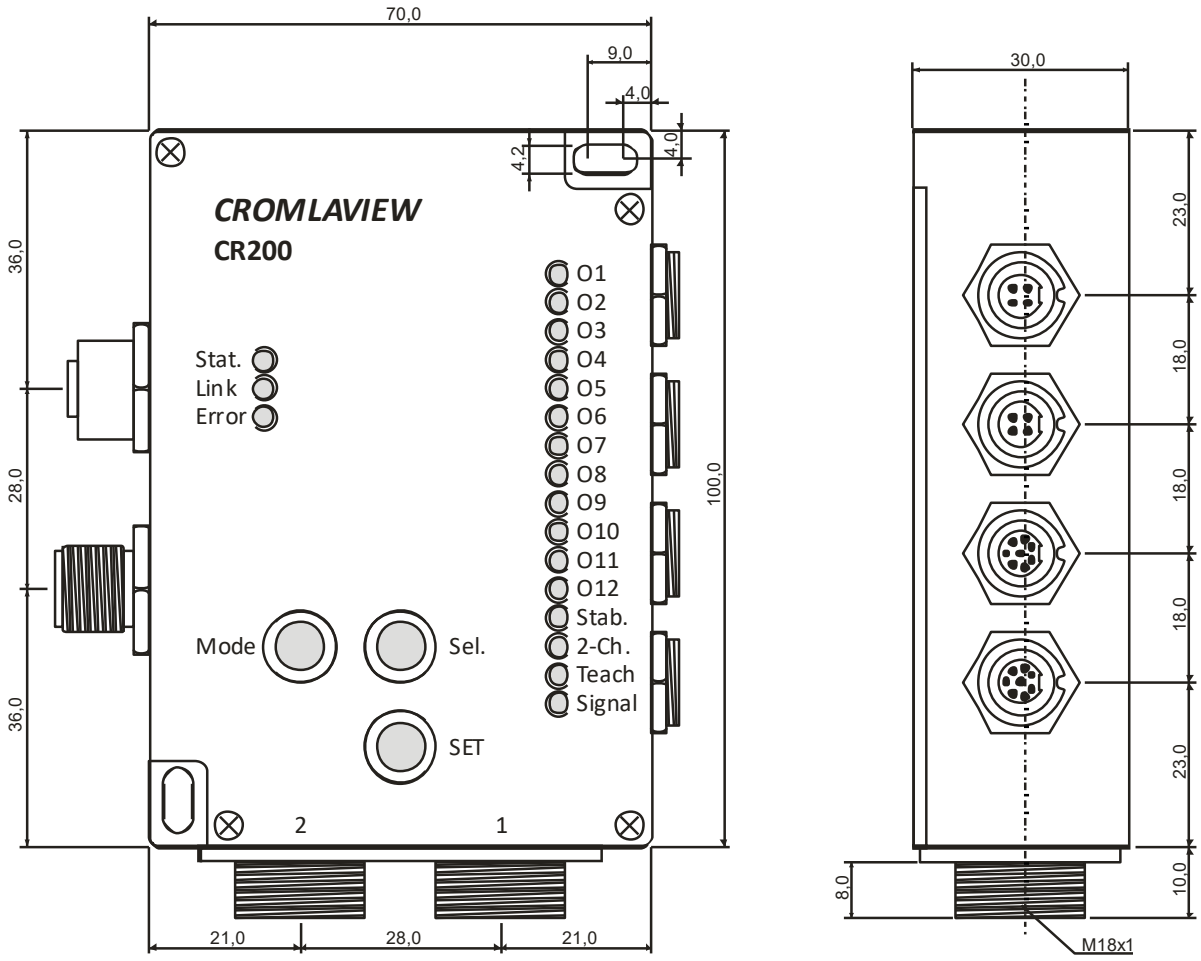


Figure 3 : Drawings CR200P for connecting two separate fiber optical cables

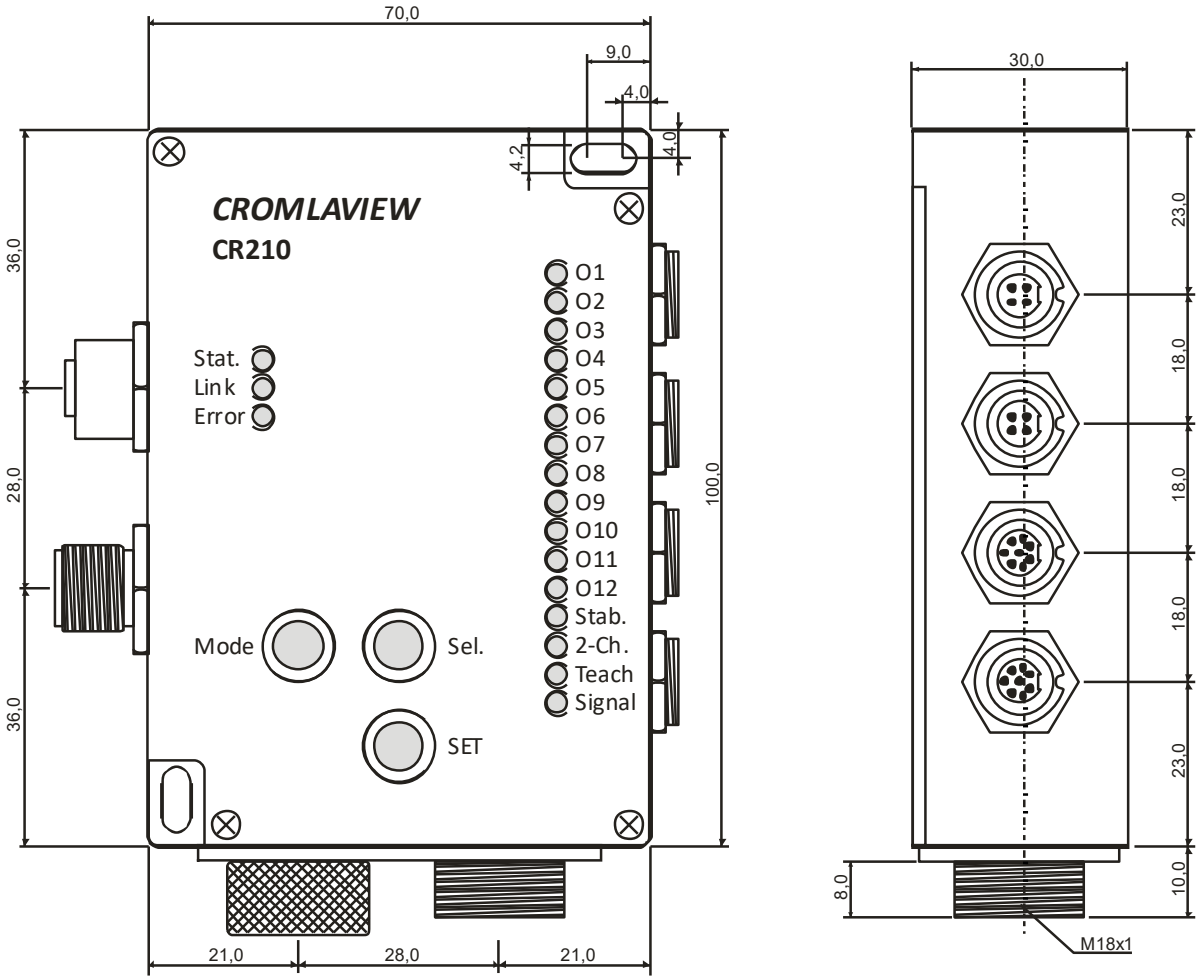


Figure 4 : Drawings CR210P with built-in control devices for the drift stabilization CROMLASTAB®

To control the stabilization channel, the cap on the left side is removed and the underlying slotted screw adjusted. The leveling can be controlled either in the software CR-Tool or in the control display O1 - O12 when setting with the buttons.

5 Displays

Table 15 : LED meaning

LED	Meaning
O1-O12	State output 1-12
Stab.	Error stabilization
2-Ch.	Two channel operation
Teach	Teach-in mode active
Signal	Signal mode active
Sel.	Sensing channel 2 active
SET	Tolerance
Stat., Link, Error	Interface specific

Table 16 : Assignment of flash impulses to tolerance values

Flash impulses	Tolerance	Tolerance value
1	Very small	3
2	Small	6
3	Medium	9
4	Large	15
5	Very large	20

If the sensor signal is clipping the LEDs are flashing alternately.

6 Button operation

Automatic signal adjustment

- Position sensor to object
- Press "Mode" button shortly until "Sig." mode is active
- Press "SET" button for at least 2 seconds
- To store parameters press "Mode" button for at least 2 seconds

Sample stabilization reference value

- Press "Mode" button shortly until "Sig." mode active
- Press "Sel." Button shortly to select stabilization channel
- Adjust signal level for stabilization channel mechanically (adjusting screw)
- Press "SET" button for at least 2 seconds
- To store parameters press "Mode" button for at least 2 seconds

Teaching in colors

- Position sensor to object
- Press "Mode" button shortly until "Teach-In" mode active
- Press "Sel." button to select table entry
- Press "SET" button for at least 2 seconds
- To store parameters press "Mode" button for at least 2 seconds

Adjust tolerance

- Press "Mode" button shortly until "Teach-In" mode active
- Press "SET" button shortly to select tolerance
- Press "SET" button for at least 2 seconds
- To store parameters press "Mode" button for at least 2 seconds

Clear color table

- Press "Mode" button shortly until "Teach-In" mode active
- Press "Sel." button for at least 2 seconds
- To store parameters press "Mode" button for at least 2 seconds

7 Part numbers

Part	Part number
CR200 color sensor	10-3001-00
CR200P (Profibus interface)	10-3001-01
CR200E (Fast Ethernet interface)	10-3001-03
CR200PN (Profinet interface)	10-3001-04
CR200EI (EtherNet/IP interface)	10-3001-05
CR210 color sensor	10-3002-00
CR210P (Profibus interface)	10-3002-01
CR210E (Fast Ethernet interface)	10-3002-03
CR210PN (Profinet interface)	10-3002-04
CR210EI (EtherNet/IP)	10-3002-05
Fiber optical cables	See catalogue (18-0003-00)
STR-C2.0-M18	14-3001-00
External stabilization target CR200	
Connection cable, 8-pin, M9 / open, 2 m	15-3000-00
RS232 cable, 4-pin, M9 / D-SUB9, 2 m	15-3001-00
USB cable, 4-pin, M9 / USB-A, 2 m	15-3003-00
M9 protection cap for sensor connector	15-3010-00
Terminator for Profibus	15-0000-00
Male cable connector Profibus OUT, 4-pin, B-coded	15-0014-00
Female cable connector Profibus IN, 4-pin, B-coded	15-0015-00
Profibus cable, B-coded, 5 m	64-0304-00
Profibus cable, B-coded, 10 m	64-0304-00
Profibus cable, B-coded, 15 m	64-0304-02

Surge protection

To use the sensor in systems where the supply voltage line > 3 meters, it is recommenced to use a filter module to protect against surges. A suitable 24 V DC filter module (surge) is available from the company WAGO under order number 750-626.

8 Declaration of Conformity

Manufacturer	**ASTECH Angewandte Sensortechnik GmbH**
Address	18057 Rostock
	Schonenfahrerstr. 5
	Deutschland
Product name	CR200P/ CR210P
Device description	Color sensor

EG Declaration of Conformity

In accordance with the directive 2011/65/EU and 2014/30/EU

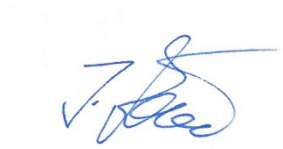
Conforming to the following standards

Radio disturbance characteristics:	EN 61000-6-3:2007 +A1:2011
EMC immunity	EN 61000-6-2:2005

In addition the following standard is passed:

EN 61326-1:2013:	Electrical equipment for measurement, control and laboratory use – EMC requirements; Classification: Class B (emission); Industrial equipment (immunity)
Place	Rostock
Date	April 2018

ASTECH Angewandte Sensortechnik GmbH



Jens Mirow

Managing director

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