Manual

# CR200E and CR210E

## Version 1.1


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.

Registered trademarks are the property of their manufacturers.

CR200E and CR210E - Manual V1.1



## Revision history

| Manual version | Date | Changes |
|---|---|---|
| 1.0 | 02.03.2015 | New design |
| 1.1 | 18.04.2018 | Color value memory cells, drawing, EtherNet/IP, CE declaration |

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<br>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 steps |
| Object illumination | Power white light LED<br>Adjustable (4096 Steps)<br>Can be switched off |
| Ambient light compensation | Can be switched off |
| Standard interfaces | 12 Switching outputs<br>2 Control inputs<br>Serial (RS-232)<br>USB |
| Optional field bus interfaces | Profibus<br>Fast Ethernet<br>Profinet<br>EtherNet/IP |
| Displays | 22 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 | CR200: Difference measurement<br>Channel 1<br>Channel 1 drift compensated<br>Channel 1+2<br>CR210: Channel 1<br>Channel 1 drift compensated |
| Color space modes | Non-self-shining objects<br>XYZ, XyY, u'v'L*, L*a*b*, xyl<br>Self-shining objects<br>XYZ, xyY, u'v'L*, xyl |
| Color recognition modes | Check spherical tolerance<br>Check cylindrical tolerance<br>Minimal distance |
| Operating modes | External triggering<br>Color grouping<br>Color sequence recognition |
| Parameterization | Elaborately via PC Software<br>Limited via 3 buttons |

# 2 Specification electrical interfaces

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

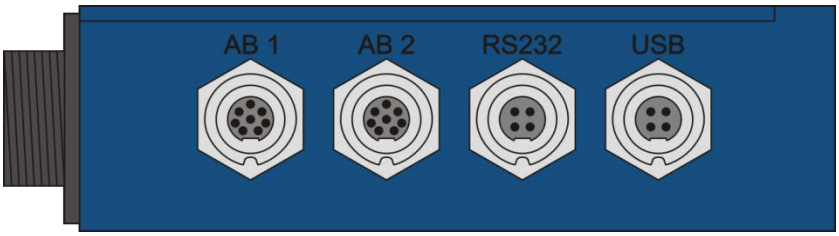



**Figure 1 : Electrical interfaces**

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."<br>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<br>LOW: 0 V; HIGHT: $+U_B$ - 1 V; max. 100 mA |
| 2 (OUT2) | Push-Pull<br>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<br>LOW: 0 V; HIGHT: $+U_B$ - 1 V; max. 100 mA |
| 6 (OUT4) | Push-Pull<br>LOW: 0 V; HIGHT: $+U_B$ - 1 V; max. 100 mA |
| 7 (GND) | 0 V |
| 8 ($+U_B$) | 18 ... 28 VDC, max. 500 mA<br>(optional 9 ... 28 VDC) |

**Table 6 : Electrical specification sensor connector AB2**

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

## 3.1 General information

The Color sensors CROMLAVIEW® CR200E and CR210E are equipped with an Ethernet interface. Via this interface several commands can be sent to the sensor.

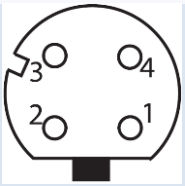
Through the Ethernet interface, the sensor data are available throughout the network. Especially the processing and documentation of the recognition results is thus facilitated.

## 3.2 Connections

The CR210E and CR200E can be easily connected to a network by using the M12-connector (Binder-series 715, 4-pin, D-coded)

The pin assignment of the Ethernet interface and the RJ45 connector is shown in Table 10.

**Table 10 : Ethernet pin assignment**

| Description | Ethernet-IN | RJ45-Connector |
|---|---|---|
| Scheme |  | |
| TD+ | 1 | 1 = white / orange |
| RD+ | 2 | 3 = white / green |
| TD- | 3 | 2 = orange |
| RD- | 4 | 6 = green |



## 3.3 Data transmission

The communication between the color sensor and the network uses the character-based (ASCII) Telnet protocol via TCP/IP. There are several commands to request data from the sensor.

In the network the CR200E or CR210E is addressed by an adjustable IP-address and subnet mask. The TCP-port 23 (Telnet) is used.

To find an Ethernet sensor in the network, a UDP-broadcast can be sent.

### TCP/IP and Telnet

The sensors were delivered with a preset IP-address and subnet mask.

**IP Address:** **192.168.0.53**

**Subnet mask:** **255.255.255.0**

IP-address and subnet mask can be adapted by the user. The procedure is described on page 10.

To communicate directly with the sensor via a network, telnet (TCP port 23) is required. If this is successfully established, the data from the sensor can be requested by predefined commands. The commands consist of two ASCII characters and the termination character 'LF'. The sensor also responds ASCII coded. The available commands are listed in section Commands on page 11.

## Setup with program Ethertool

If the IP-address of your PC does not match 192.168... you have to disconnect the PC from the network and change the IP-address. After that you have to connect the color sensor directly to your PC.

To check the IP-address of your PC you have to start the command-line and type "ipconfig".

Start the program "Ethertool" of ASTECH and click the "Search" button. The connection details of the found sensors will be shown in the upper region of the program window. Mark the sensor you want to connect to and click the "Connect" button.

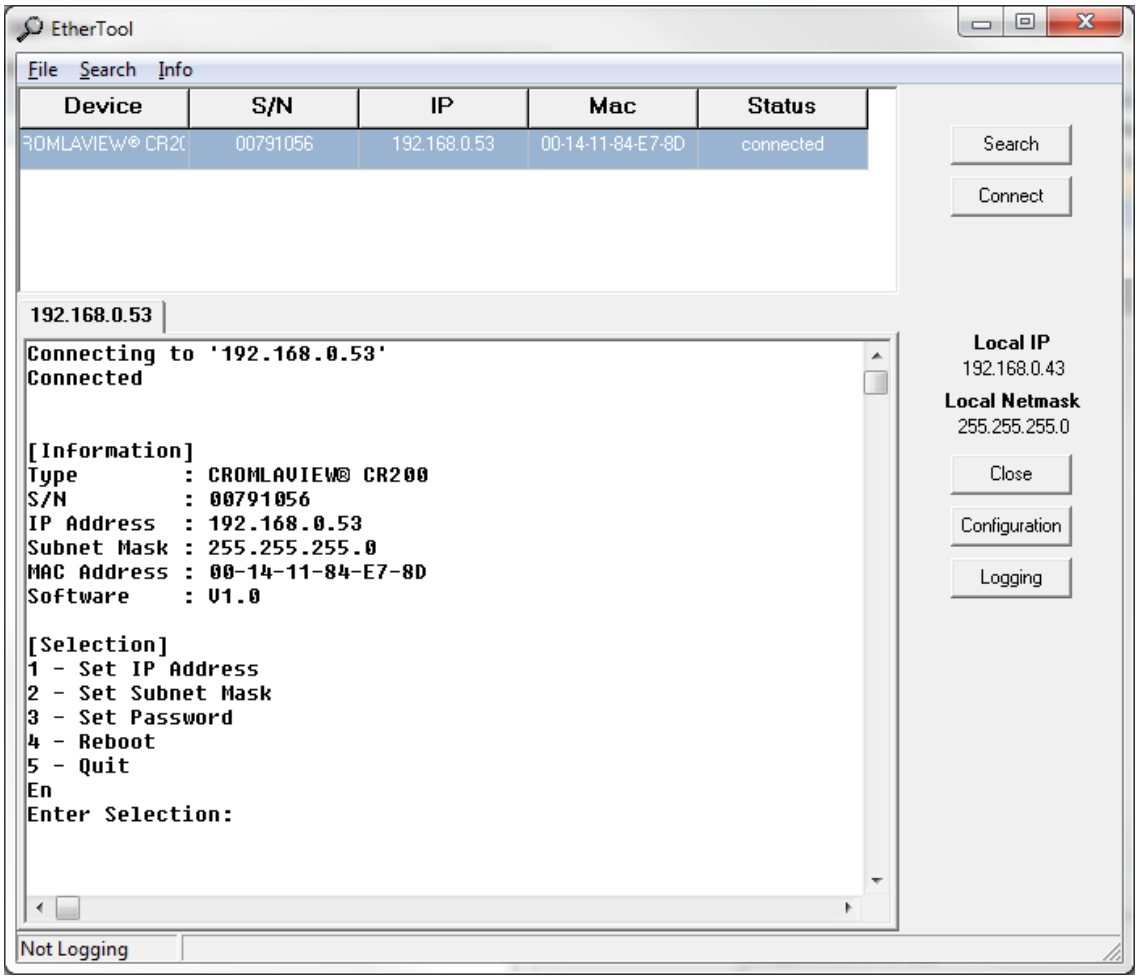



**Figure 3 : Configuration mode of the program Ethertool**

If the Telnet-connection is active, just type in "#" to enter the configuration mode. By entering the number corresponding to [Selection], the IP-address and the subnet mask can be changed.

The modified IP address and subnet mask are not implemented until the device is restarted. Then, you must set up a Telnet connection again.

The configuration mode can be password protected. The password must be at least 4 characters long, if no sign is entered, the password will be deleted.

Keep the password in a safe place and protected against loss. The configuration mode cannot be accessed without the password.

## Commands

The commands consist of two ASCII characters and the termination character 'LF' (0x0A).

The following commands are available.

### SO

This command returns the state of the switching outputs, a byte with status information as well as a life-counter. The data is ASCII hex coded. The exact partition of the response string is shown in Table 11.

**Table 11: Response to the 'SO' command**

| Sign | Meaning |
|---|---|
| 1 | Life-Counter, upper 4 Bit |
| 2 | Life-Counter, lower 4 Bit |
| 3 | Status, upper 4 Bit |
| 4 | Status, lower 4 Bit |
| 5 | Reserved |
| 6 | Switching output 9 ... 12 |
| 7 | Switching output 5 ... 8 |
| 8 | Switching output 1 ... 4 |

The 8 bit status information have the following meanings.

**Table 12: Meaning of the individual status bits**

| Bit | Name | Function |
|---|---|---|
| 0 | Trigger-Ack | Toggle Bit for Trigger-Mode |
| 1 | Stab-Error | 1 = Stabilization channel over or underdriven |
| 2 | Math-Error | 1 = Mathematical overdrive of the transformation function |
| 3 | Software-Acc | 1 = CR-Tool software access on sensor |
| 4 | Reserved | For fatal error |
| 5 | Reserved | For fatal error |
| 6 | Reserved | For fatal error |
| 7 | Reserved | Not used |

### C1 and C2

The commands C1 and C2 returns the latest color values of the respective sensor channel.

The values are transferred as ASCII coded strings. Eight characters are transferred to one of three color values. The space between the values is filled with zero character.

**Example:**

Latest color value: a* = 65.9 b* = -25.5 L* = 56.1
Command: <C1\CR\LF>
Response: <65.9\00\00\00\00–25.5\00\00\0056.1\00\00\00\00\CR\LF>

### I1 and I2

The commands I1 and I2 are used to read out the recognition result of the respective channel. The recognition result consists of a table index of the detected color (0 if no color is detected), the current color distance and the current lightness distance. The distances are calculated on the difference between the current color and a stored color reference with a minimum distance.

For every single value within the sensor response, 8 signs are used.

**Example:**

Current value: Index = 3 Color distance = 2.5 Lightness distance = 12.8
Command: <I1\CR\LF>
Response: <3.00\00\00\00\002.5\00\00\00\00\0012.8\00\00\00\00\CR\LF>

**ID**

On this command, the sensor responds with its internal ID-string.

### Example

Sensor-ID: „CROMLAVIEW® CR210E“
Command: <ID\CR\LF>
Response: <CROMLAVIEW® CR210E\CR\LF>

**SN**

With the SN command the serial number oft he addressed sensor can be read out. The serial number is sent as a sequence of 8 ASCII-coded decimals.

**Example:**
Command: <SN\CR\LF>
Response: <00791021\CR\LF>

**IN**

With the IN command control data can be sent to the sensor in order to replicate the function of the trigger lines of the color sensor. In addition to the command string, two ASCII-encoded hex numbers are sent to the sensor. Each character stands for 4-bit control data. The function of the control character are listed in

**Table 13 : Meaning of control characters of the 'IN' command**

| Character | Bits | Function |
|---|---|---|
| 1 und 2 | 0 ... 7 | Table index for Teach-IN |
| 3 | 8 ... 11 | Reserved |
| 4 | 12 | Reserved |
| 4 | 13 | Tech-In-Mode<br>0 = as adjusted in sensor<br>1 = TabIndex, table index |
| 4 | 14 | TRG1, control line for Teach-IN |
| 4 | 15 | TRG0, control line to update the outputs |

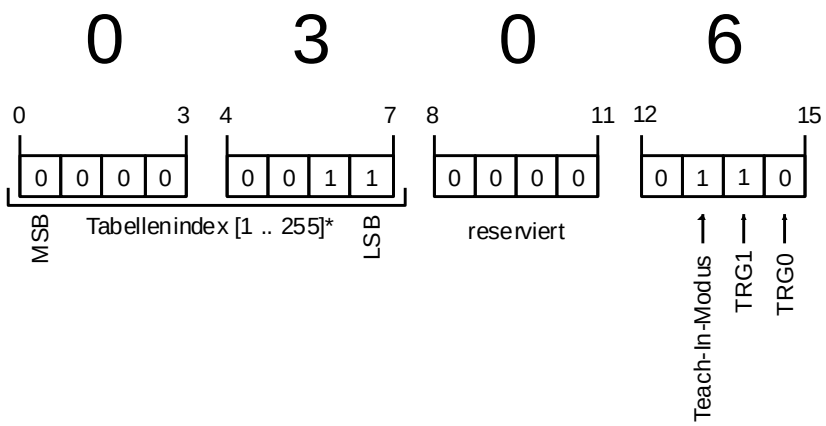
In Teach-IN mode bit 13 decides on which table space the new value is stored. If this bit is set, the specified with the first two characters of table space is chosen.

If bit 13 is not set, the color is stored in the table according to the settings for the external Teach-IN.

**Example:**

Teach-IN of a new color value to table space 3

Command: <IN0306\CR\LF> (* when specifying" Table Space 0")




Update of sensor outputs.

Command: <IN0001\CR\LF>

> The trigger inputs (TRG0 and TRG1) are edge-controlled. They have to be reset after setting. In the example above, <IN0000\CR\LF> must be sent afterwards.
> To use the trigger inputs, the mode "Ext.Trig", "Ext. Teach" or "Ext. Teach & Trig." must be set via the CR-Tool.

**SP**

With the SP (Store Parameters) command, all parameters are stored in the sensor permanently.

> The saving process takes about 2 seconds. During this time the sensor will not respond on the Ethernet interface, RS232 or USB.

**RP**

With the RP (Read Parameters) command all permanently stored parameters are loaded into the RAM. All sensor parameters will be overwritten.

# 4 Drawings

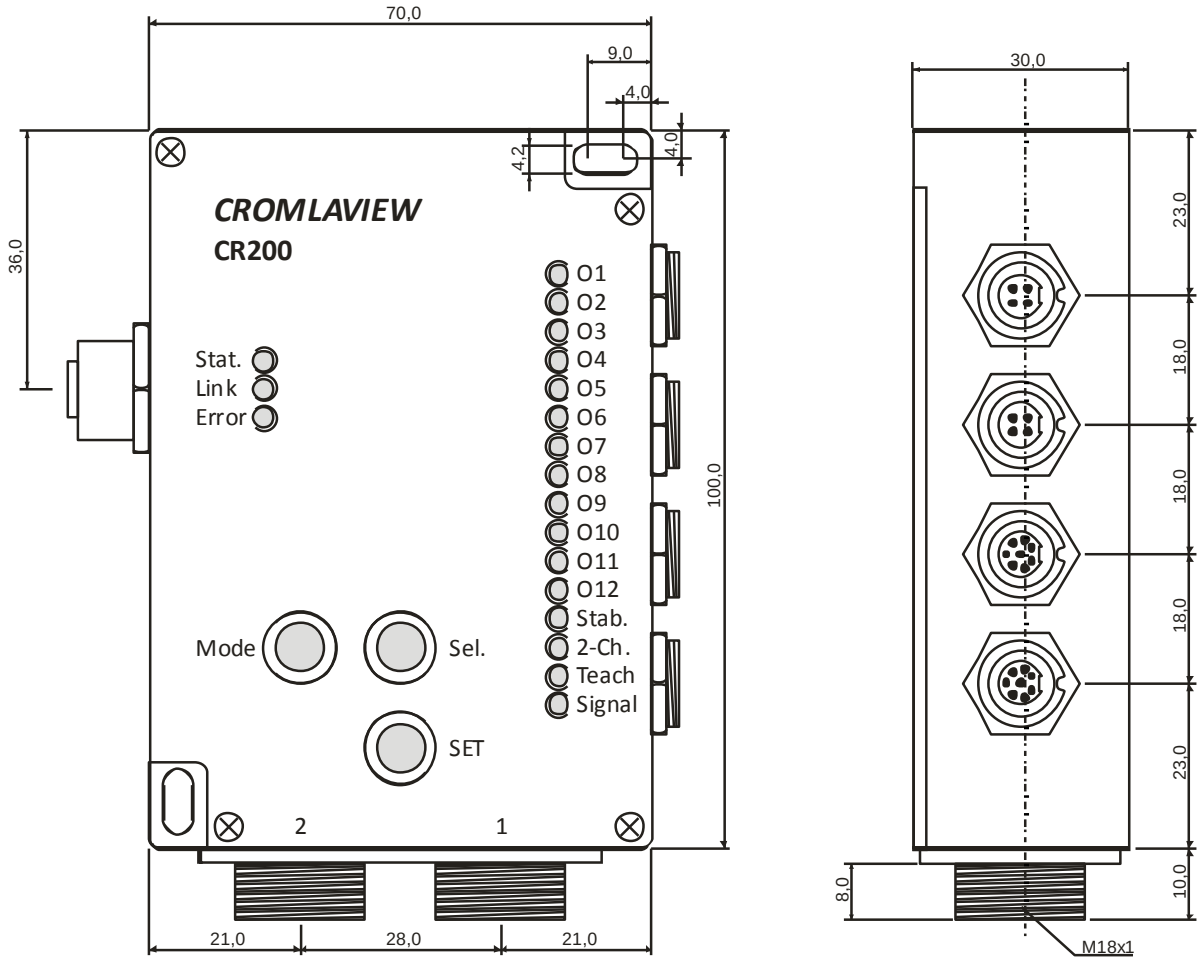



**Figure 4 : Drawings CR200E for connecting two separate fiber optical cables**

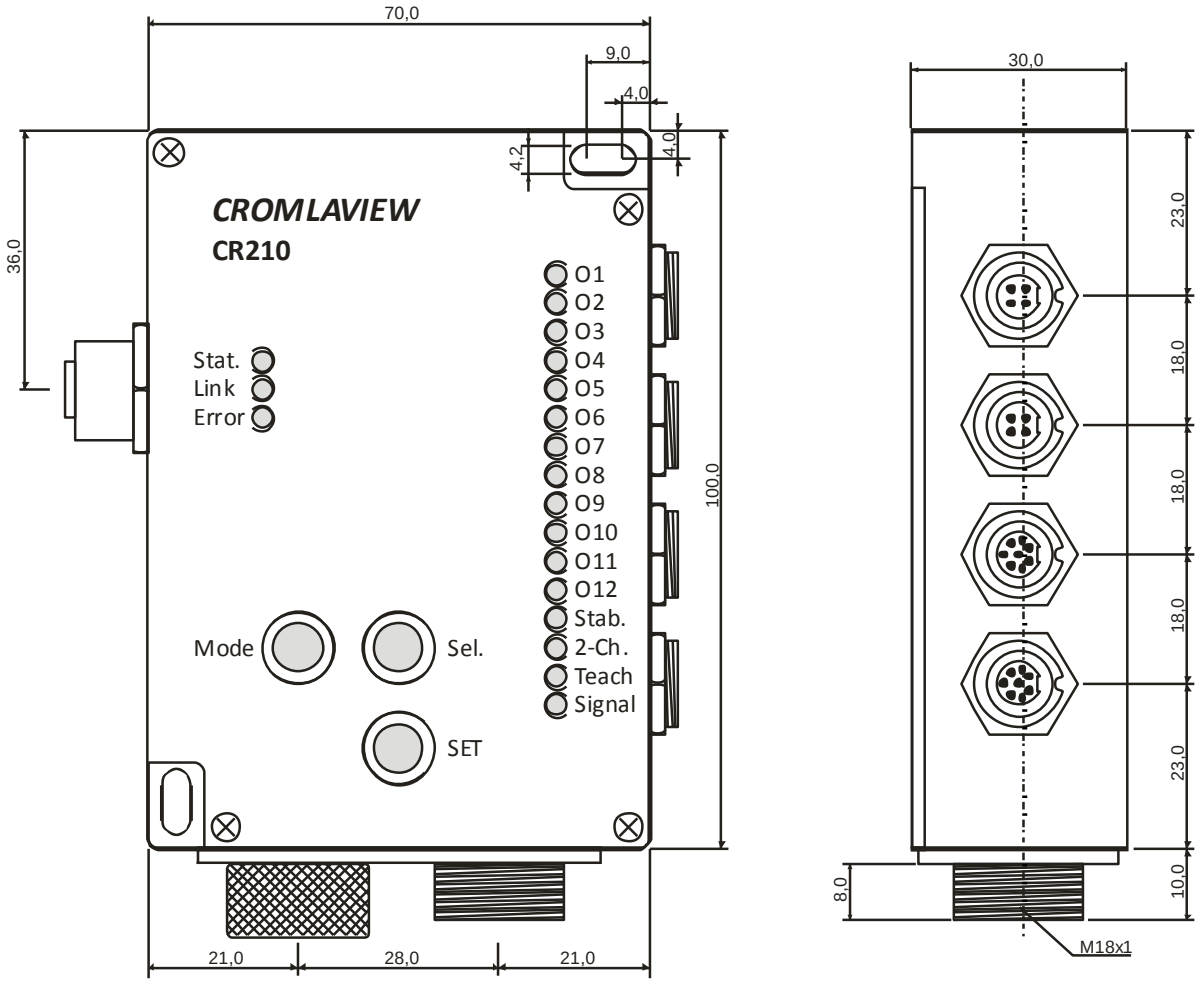



**Figure 5 : Drawings CR210E with built-in control devices for the drift stabilization CROMLASTAB®**

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 14 : 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 15 : 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 |
| Ethernet cable M12M4D-RJ45, 3 m | 15-0040-00 |
| Ethernet cable M12M4D-RJ45, 5 m | 15-0040-01 |
| Ethernet cable M12M4D-RJ45, 10 m | 15-0040-02 |

## 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** | CR200E/ CR210E |
| **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;<br>Classification: Class B (emission);<br>Industrial equipment (immunity) |
| **Place** | Rostock |
| **Date** | April 2018 |

ASTECH Angewandte Sensortechnik GmbH

Jens Mirow

Managing director

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