

FS 12-100-1 M G8-B8-E and FS 12-100-2 M G8-B8-E

Version 1.0

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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.

FS 12-100-1 M G8-B8-E and FS 12-100-2 M G8-B8-E - Manual V1.0

Revision history

Manual version	Date	Changes
1.0	02.03.2015	First release



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 di-soric.

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1 Technical Data

Table 1 : General technical data

Sensing channels	FS 12-100-2 M G8-B8-E: 2 Sensing channels FS 12-100-1 M G8-B8-E: 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 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
Displays	19 LEDs for outputs and status
Buttons	3 Buttons for Teach-In
Color resolution (L*a*b*)	$\Delta E_{Lab} \leq 1$
Response time	$\geq 50 \mu s$ (limited functionality)
Off-Delay (channel specific)	0 ms ... 65535 ms
On-Delay	0 ms ... 65535 ms
Hysteresis	0 % ... 255 %
Color value memory cells	350
Color output channels	12 (up to 350 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	FS 12-100-2 M G8-B8-E: Difference measurement Channel 1 Channel 1 drift compensated Channel 1+2 FS 12-100-1 M G8-B8-E: 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.

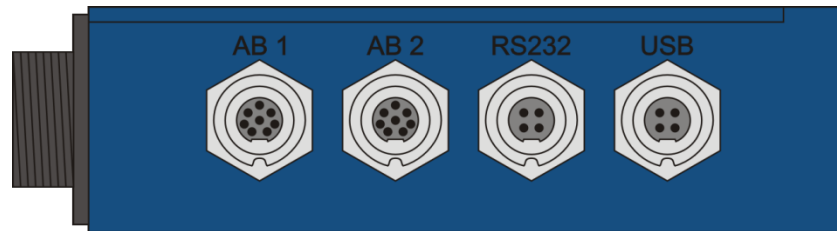


Figure 1 : Electrical interfaces

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

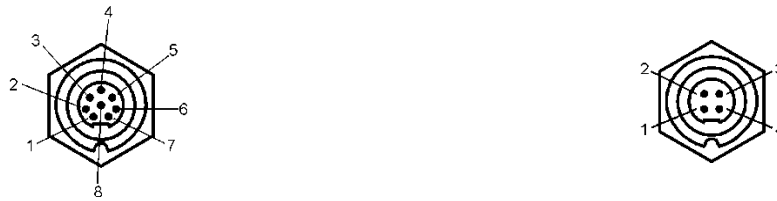


Figure 2 : Counting order of the round connectors

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 Ethernet

3.1 General information

The color sensors FS 12-100-1 M G8-B8-E and FS 12-100-2 M G8-B8-E are equipped with an Ethernet interface. Via this interface several commands can be sent to the sensor.

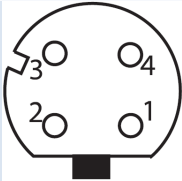
Through the Ethernet interface, the sensor data are available throughout the network. Especially the processing and documentation of the recognition results is thus facilitated.

3.2 Connections

The FS 12-100-1 M G8-B8-E and FS 12-100-2 M G8-B8-E 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 FS 12-100-2 M G8-B8-E or FS 12-100-1 M G8-B8-E 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" 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.

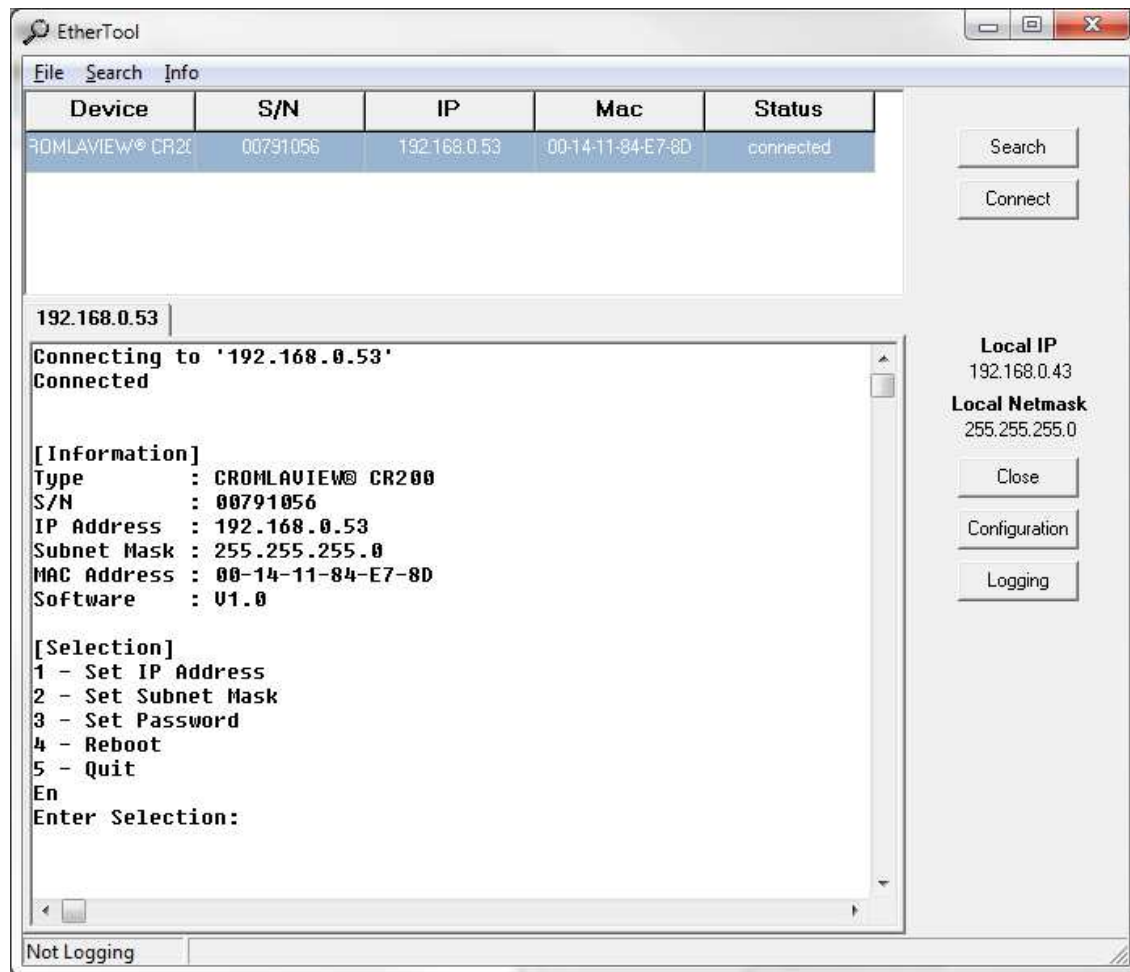


Figure 3 : Configuration mode of the program Ethertool

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 = FS-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: „ FS 12-100-1 M G8-B8-E“
 Command: <ID\CR\LF>
 Response: < FS 12-100-1/2 M G8-B8-E \CR\LF>

SN

With the SN command the serial number of the 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
		Tech-In-Mode
4	13	0 = as adjusted in sensor 1 = TabIndex, table index
4	14	TRG1, control line for Teach-IN
4	15	TRG0, control line to update the outputs

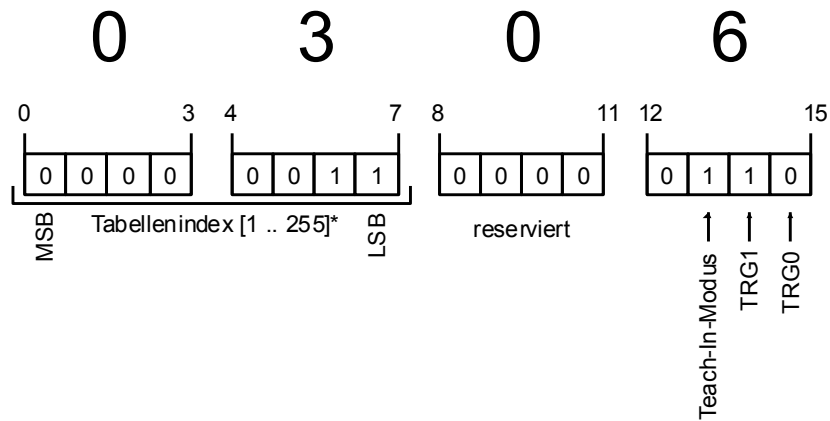
In Teach-IN mode bit 13 decides on which table space the new value is stored. If this bit is set, the specified with the first two characters of table space is chosen.

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 FS-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

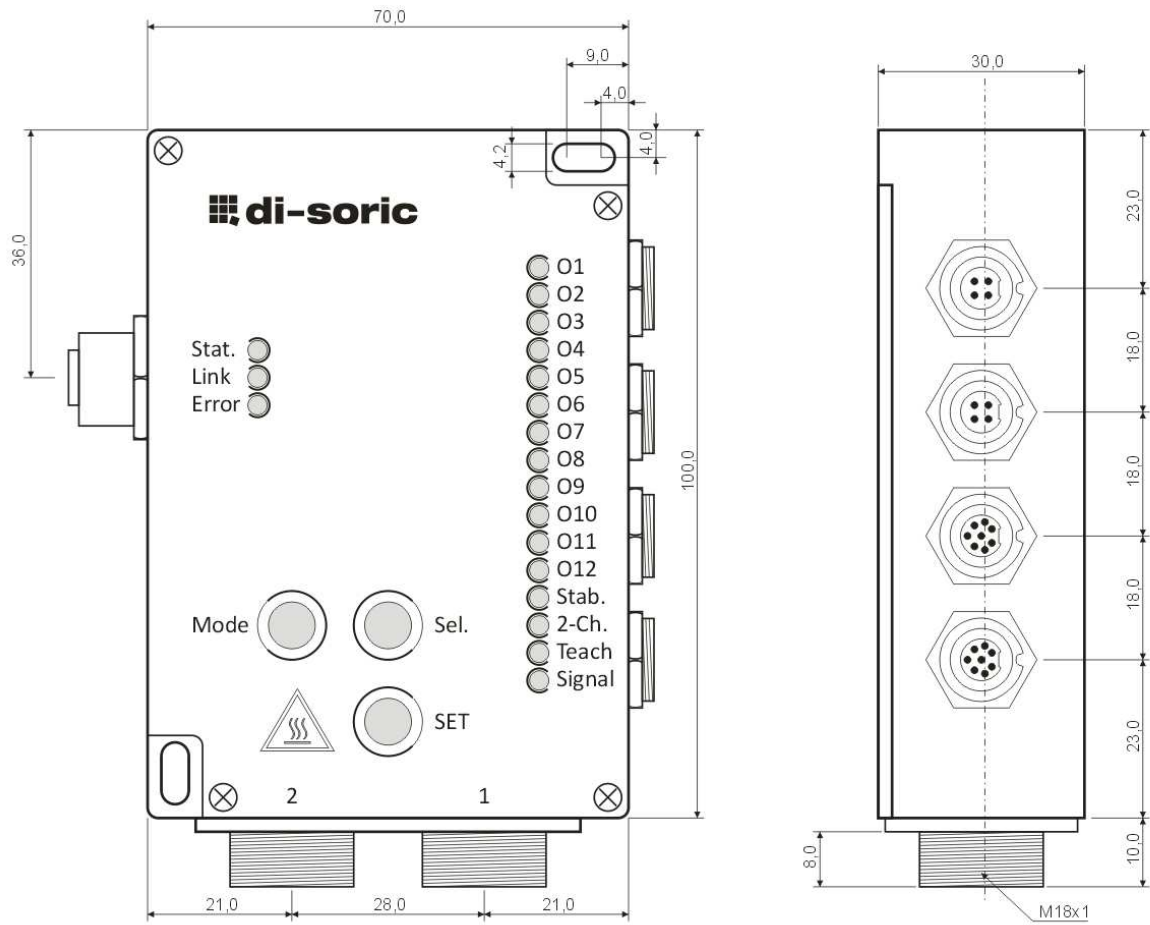


Figure 4 : Drawings FS 12-100-2 M G8-B8-E for connecting two separate fiber optical cables

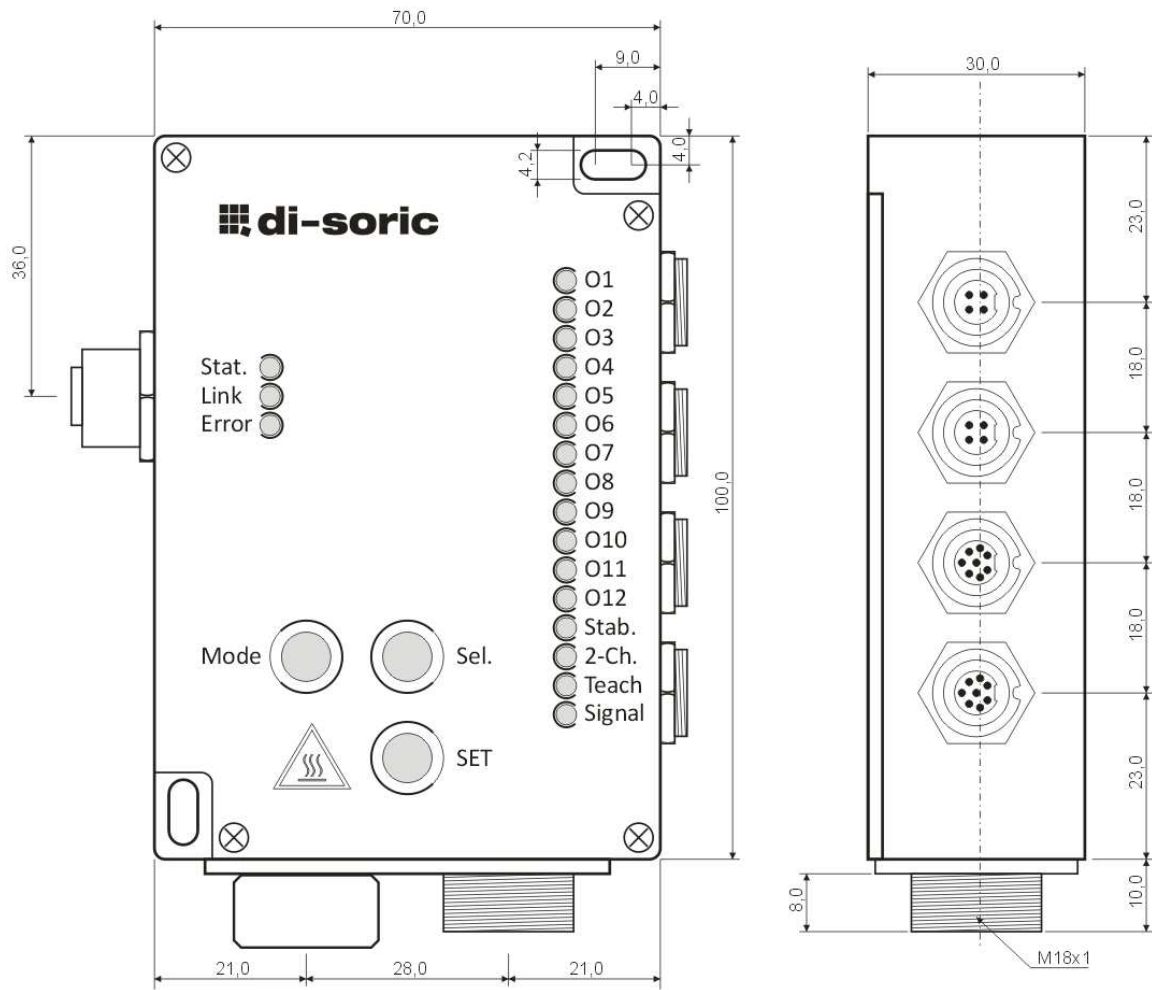


Figure 5 : Drawings FS 12-100-1 M G8-B8-E with built-in control devices for the drift stabilization CROMLASTAB®

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 Surge protection

To use the sensor in systems where the supply voltage line > 3 meters, it is recommended 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.

