

MANUAL

EMMA

STRAIN GAUGE AMPLIFIER IO-LINK

Operating manual with description of the IO-Link parameters



 IO-Link

Document	Version	Date	Applies to
Operating manual	V00x	09/2026	EMMA (type EPG-IO)

The EMMA converts the signal of a strain gauge full bridge into an IO-Link signal and records a load spectrum while doing so: it counts the operating hours per load band and per head temperature. Section 5 describes mounting and connection, section 6 operation over IO-Link, section 7 the load spectrum.



Contents

1 General	2
1.1 About this manual	2
1.2 Signs and abbreviations	3
2 Transport, packaging, storage	3
2.1 Transport	3
2.2 Packaging	3
2.3 Storage	3
3 Safety instructions	4
3.1 Intended use	4
3.2 Personnel qualification	4
3.3 Special hazards	4
4 Product description	5
4.1 Function	5
4.2 Versions	5
4.3 Product label	5
5 Mounting and start-up	6
5.1 Before mounting	6
5.2 Mechanical mounting	6
5.3 Electrical connection	6
5.4 Electrical start-up	7
5.5 Function test and fault detection	7
6 Operation over IO-Link	8
6.1 IO-Link and IODD	8
6.2 Communication data	8
6.3 Process data	8
6.4 User settings and commands	9
6.5 Type plate and service data	9
6.6 Archive	9
6.7 Events	10
6.8 Live AD values	10
7 Load spectrum and observation	11
7.1 Setting the observation range	11
7.2 Operating hours per load band	11
7.3 Operating hours per head temperature	11
7.4 Current and maximum values	11
7.5 Operating hours, evaluation, reset	11
8 Fault recovery	12
9 Maintenance, dismantling, return, cleaning, disposal	12
9.1 Maintenance	12
9.2 Dismantling	12
9.3 Return	12
9.4 Cleaning	12
9.5 Disposal	13
10 Technical data	14
11 Dimensions	15

1 General

1.1 About this manual

- This operating manual gives important handling instructions for the strain gauge amplifier. Compliance with all safety and handling instructions in this manual is a requirement for safe work.
- Qualified personnel must have read and understood this operating manual before mounting and start-up of the amplifier.
- This operating manual is part of the product. Keep it at a place accessible for all users and on site.
- Comply with the local regulations and safety instructions for the field of application of the amplifier.

- If the serial number on the product label becomes illegible (e.g. through mechanical damage), traceability can no longer be ensured.
- The manufacturer's liability is void in the case of any damage caused by using the product contrary to its intended use, non-compliance with this operating manual, assignment of insufficiently qualified personnel or unauthorised modifications to the amplifier.

1.2 Signs and abbreviations

Sign	Meaning
Danger!	Failure to comply with the safety instructions risks serious or fatal injury caused by electrical power.
Warning!	Non-compliance can cause injuries to persons and/or the destruction of the device. There can be a danger to life.
Attention!	Non-compliance can cause faulty device operation or lead to property damage.
Information!	Non-compliance can influence the operation of the device or cause unintentional reactions.

Abbreviation	Meaning
U+	positive supply connection
U–	negative supply connection (GND)
S+, S–	signal connections of the strain gauge bridge
C/Q	IO-Link (communication line)
IODD	Input-Output Device Description, device description file for IO-Link
FSO	full scale output; values in % FSO refer to the full scale value
RO · RW · WO	read only · read and write · write only

2 Transport, packaging, storage

2.1 Transport

Check the device for any damage that may have been caused during transportation. Report obvious damage at once.

2.2 Packaging

Do not remove the packaging until just before mounting. Keep the packaging, as it provides optimum protection during transport (e.g. change of installation site, returns).

2.3 Storage

For long-term storage, avoid the following influences:

- direct sunlight or proximity to hot objects
- mechanical vibration, mechanical shock (rough setting down)
- soot, steam, dust and corrosive gases

If possible, store the device in its original packaging or equivalent. Storage temperature –20 ... +85 °C.

3 Safety instructions

3.1 Intended use

The EMMA has been designed and constructed solely for the intended use described here and may only be used in this way: as a measuring amplifier for a strain gauge full bridge whose measured value is transmitted over IO-Link to an IO-Link master. Select the correct amplifier regarding function and equipment before mounting, start-up and operation.

- The technical specifications in this operating manual are mandatory. Inappropriate handling or operating the device outside of its technical specifications requires an immediate shutdown and inspection by the manufacturer.
- When the device is transported from a cold into a warm environment, condensation can cause a device malfunction. Wait for device temperature and room temperature to equalise before a new start-up.
- The manufacturer shall not be liable for claims of any kind based on operation contrary to the intended use.

Warning Do not use this device in safety or emergency stop installations. Improper use of the device may result in injury. The status bit "Overload switch-off" is a message, not a protective function: the amplifier itself never switches off (section 6.3).

3.2 Personnel qualification

For mounting and start-up the personnel have to be familiar with the applicable country-specific regulations and directives and have the required qualifications. They must have knowledge of measurement and control technology, be familiar with electrical circuits, be able to carry out the work described and recognise potential hazards independently. Depending on the operating conditions, other knowledge may also be required, e.g. of corrosive media.

Warning Risk of injury if qualification is insufficient. Improper handling can lead to considerable property damage and injury. Have the tasks described carried out by qualified personnel only and keep unqualified personnel away from hazardous areas.

3.3 Special hazards

- Comply with your country-specific norms and regulations (e.g. standards). In the case of special applications, comply with the relevant norms and regulations. Non-compliance can cause heavy injuries and property damage.
- Electrostatic discharge (ESD) protection is required. When working with open circuits (PCBs), grounded worktops and personal wristbands are required to prevent damage to sensitive electronic components.
- Installation and mounting of electrical equipment may only be carried out by qualified electricians.

Danger Danger to life due to electric current. If live parts are touched, there is an immediate danger of death. Operation with a defective power supply unit (e.g. short-circuit from mains voltage to output voltage) can cause life-threatening voltages on the unit.

4 Product description

4.1 Function

The EMMA has a connection for a strain gauge full bridge. It supplies the bridge with 3 V from its own supply; the output signal of the bridge changes in proportion to the change of force or pressure. The amplifier converts this signal into a standardised IO-Link signal and passes it to the IO-Link master as a digital measured value. The device has no display and no keys; all settings and read-outs run over IO-Link.

- Process data: measured value (Input_1), head temperature and five status bits.
- Load spectrum: operating hours per band of the input, in % of a freely set observation range, and per head temperature – stored in the device (section 7).
- Current and maximum load, maximum value, maximum head temperature.
- Service interval in operating hours, archive with ten records, six event messages.
- Signal smoothing, pre-filtering, auto-zero (tare) over IO-Link.
- Housing PBT GF30, protection at least IP65, electronics fully potted.

4.2 Versions

The evaluation side is always an M12x1 plug, 4-pole. Towards the sensor there are two versions:

Version	Connection to the sensor
standard	M12x1 socket, 5-pole, on the housing
cable	cable 2 m, 4 wires (wire colours in section 5.3)

4.3 Product label

The product label shows the part number (Art.-Nr.), the type designation EPG-IO, the serial number (SN) as well as input and output (Input: Strain gauge, Output: IO-Link). The product label always lists the information for the specific device; where it deviates from this manual, the product label applies.

Over IO-Link the device reports itself with the product name "EPG-IO Strain Gauge Transmitter with Limit Switch" and the product ID 1069 (section 6.2).

5 Mounting and start-up

5.1 Before mounting

- Check the delivery for completeness and visible defects immediately after receipt. If parts are missing or you detect defects, inform the transport company and the supplier immediately.
- Check that the amplifier was delivered completely assembled.
- Keep the packaging, as it offers optimum protection during transportation.
- Ensure the connection contacts are protected from damage.

5.2 Mechanical mounting

The amplifier is screwed into place on site via four mounting holes Ø 4.6 mm; the hole spacing is 45.5 × 26 mm (drawing in section 11). Any fitting position is permitted.

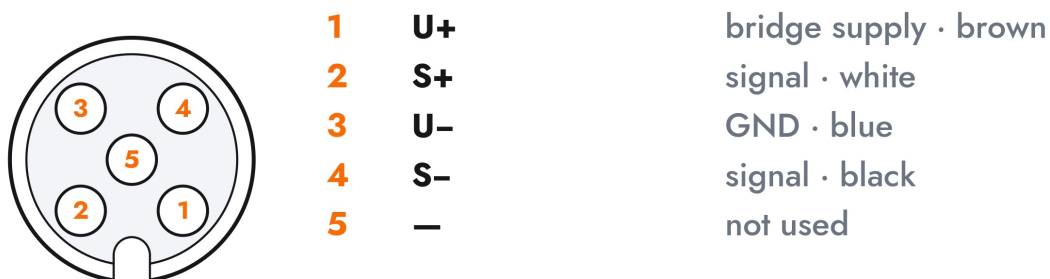
- Only operate the device when mounted.
- Comply with the temperature limits before and during operation: operation –20 ... +80 °C.
- Cable to the sensor element max. 2 m, cable to the IO-Link master max. 20 m.

5.3 Electrical connection

Danger Danger of electric shock! Conduct electrical mounting only in dead-voltage condition.

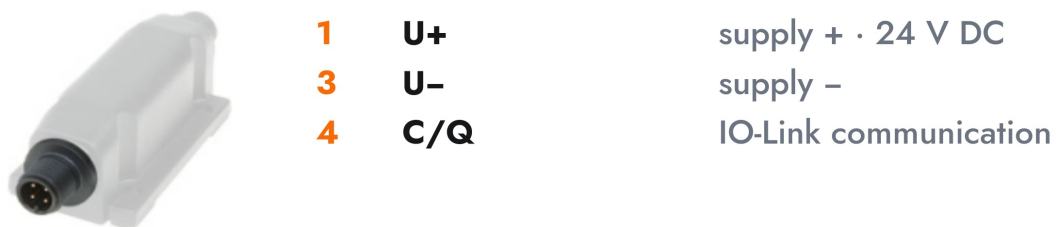
Attention Property damage by electrostatic discharge! Comply with safety measures as per DIN EN 61340-5-1/-3. Only qualified personnel is allowed to work on the electronics.

Electrical connection sensor · M12x1 socket, 5-pole



M12x1 socket to the sensor, 5-pole · front view, notch at the bottom

Electrical connection IO-Link · M12x1 plug, 4-pole



M12x1 plug to the evaluation (IO-Link master), 4-pole

To the sensor

Signal	M12x1 socket, 5-pole	Cable, 4 wires
U+	pin 1	brown (bn)
S+	pin 2	white (wh)
U– (GND)	pin 3	blue (bu)
S–	pin 4	black (bk)
not used	pin 5	–

To the evaluation (IO-Link master)

Signal	M12x1 plug, 4-pole	Meaning
U+	pin 1	supply +, 24 V DC
–	pin 2	not connected (IODD: n/c)
U–	pin 3	supply –
C/Q	pin 4	IO-Link

Info The information listed here can occasionally deviate from the actual device values. The product label always lists the information for the specific device.

Supply 24 V DC. Current consumption < 30 mA, switching current (SIO) max. 100 mA, total current max. 130 mA. Reverse voltage protection is provided: with the supply reversed the device does not work, but it is not damaged.

5.4 Electrical start-up

- Connect the 5-pole M12x1 plug of the sensor with the sensor socket of the device (for the cable version connect the wires as per section 5.3).
- Connect the 4-pole M12x1 socket of the IO-Link interface with the evaluation plug of the device.
- The device is now ready for operation. The switch-on delay is < 5 s.

5.5 Function test and fault detection

The output signal must be proportional to the sensor signal. If this is not the case, it can be a sign of a wrong mounting position or a bad setting; read section 8 in that case. The read-outs of the menu "Live AD Values" (section 6.8) are useful for the check.

6 Operation over IO-Link

6.1 IO-Link and IODD

IO-Link is a digital point-to-point connection between sensor and an IO-Link master, which forms the interface to the higher-level controller. Process data such as the measured value are transmitted cyclically, parameters and diagnosis on demand. Once read, the signal is processed digitally and no accuracy is lost. All parameters of a device can be stored in the IO-Link master and transferred to an identical replacement device. The maximum distance between master and device is 20 m.

The IODD (Input-Output Device Description) describes identification, parameters, process and diagnosis data of the device. The engineering tool of the IO-Link master reads it and builds the menus described in this section. Names in quotation marks are the texts of the IODD; the number in brackets is the index.

Menu	Content
Identification	vendor, product name, product ID, serial number, hardware and firmware revision, function and location tag
Parameter	"User settings, Input_1" · "Reset User Settings" · "Type plate" · "Archive" · "Product Identification" · "Live AD Values"
Observation	operating hours · "Hours above limit" · "Current and maximum values" · "Process data"
Diagnosis	error count, device status, detailed device status

In the role "Observer" the tool shows identification, observation and diagnosis only; the parameter menu is available in the roles "Maintenance" and "Specialist".

6.2 Communication data

Item	Value
IO-Link revision	V1.1
Transmission rate	COM3 (230.4 kbit/s)
Minimum cycle time	2 ms
SIO mode	supported
Process data in	56 bit (7 bytes), no process data out
Vendor ID · device ID · product ID	1807 · 8 · 1069
Vendor (IODD)	octogon GmbH
Product name (IODD)	EPG-IO Strain Gauge Transmitter with Limit Switch
IODD	IODD 1.1, version V1.00 of 22 November 2023

6.3 Process data

The process data are transmitted in the subindices of index 40. Subindex 2 is not used.

Sub	Designation (IODD)	Data type	Bit offset	Gradient
1	Input_1 (measured value)	Integer 16	40	0.1
3	Head temperature, °C	Integer 16	8	0.1
4	Overload switch-off	Boolean	0	—
5	Signal < -0.5	Boolean	1	—
6	Sensor stressed > 100 %	Boolean	2	—
7	Head temperature > 85 °C	Boolean	3	—
8	Service recommended	Boolean	4	—

The status bits are 0 = NO, 1 = YES. The amplifier never switches off. The bit "Overload switch-off" (subindex 4) is set when the measured value reaches the threshold "Switch off at" (148); the threshold is set in the menu "Type plate" (section 6.5).

6.4 User settings and commands

Menu "User settings, Input_1":

Index	Parameter (IODD)	Range	Default	Access
182	Special pre-filtering	0 = off · 1 = on	0	RW
181	Signal smoothing	0 ... 60.0 s in 0.1 s	0.5 s	RW
180	Auto zero tolerance (% FSO)	5 ... 50 %	5 %	RW
130	Difference factory zero point vs. user zero point	—	—	RO
131	Service interval in operating hours (input_1 > 5 %)	5 ... 87 600 h	8 760 h	RW

The service interval only counts while Input_1 is above 5 %. The message "Service recommended" comes with the status bit in subindex 8 and the event 6204.

The gain of the input (4053, RW) is set in steps. The default is step 7:

Step	1	2	3	4	5	6	7
Gain	x1	x2	x4	x8	x16	x32	x64
max. signal	460.8	230.4	115.2	57.6	28.8	14.4	7.2 mV/V

Commands (buttons of the IODD, write only):

Value	Command (IODD)	Menu
164	Auto-Zero (Tare)	User settings, Input_1
162	Reset Auto-Zero	Reset User Settings
130	Restore factory settings	Reset User Settings
163	Move TAG, Installation, Location and OP hours to archive	Type plate
165	Reset input_1 Observation	Type plate

Attention "Restore factory settings" resets the user settings. Note your own settings beforehand.

6.5 Type plate and service data

The menu "Type plate" holds the identification of the measuring point, the data of the device and the limits of the observation range.

Index	Parameter (IODD)	Format	Access
140	TAG number	text, 32 characters	RW
141	Installation	text, 16 characters	RW
142	Location	text, 16 characters	RW
149	Date of change (DDMMYY)	text, 6 characters	RW
143	Manufacturer	text, 16 characters	RO
144	Type	text, 50 characters	RO
145	Serial number	text, 22 characters	RO
146	Year of manufacture	number	RO
147	Measurement range	–32000 ... +32000, without unit	RO
148	Switch off at	–32000 ... +32000, without unit	RW
4061	0 % of observation window	number, default 0.0	RW
4062	100 % of observation window	number, default 100.0	RW

The identification menu also holds the function tag (25) and the location tag (26), both writable. The menu "Product Identification" shows device ID (4002), product name (4003), product ID (4004), product text (4005), serial number (4006) and hardware revision (4007), all read only.

6.6 Archive

With the command "Move TAG, Installation, Location and OP hours to archive" (163) the device stores TAG number, installation, location and operating hours as an archive record. This is the step when the measuring point changes: the history stays in the device. The ten archive records (160–169) are read only.

The records are filled from the top down: record 1 always holds the most recent values, with each new archiving operation the older ones move down by one record.

Attention Once all ten records are filled, every new archiving operation deletes the oldest record (record 10). Read the records out beforehand if the history is to be kept.

6.7 Events

The IO-Link master can send the following messages as events. The index is the event code. If the IODD is used in your own software, it has to treat these messages as events too; reading out the state is not intended.

Code	Type	Text (IODD)
6200	error	input_1 is < 0 % FSO
6201	error	input_1 is > 100 % FSO
6202	error	head temperature is > 85 °C
6203	error	overload switch-off
6204	warning	service recommended
6205	warning	user adjustment recommended (auto-zero)

6.8 Live AD values

The menu "Live AD Values" shows the raw values of the converter independently of the process data; they are used for further diagnosis.

Index	Parameter (IODD)	Unit
4022	input_1, AD value	—
4047	input_1, AD percents (–100 ... +100)	%
4024	head temperature, AD value	—
4049	head temperature, AD percents (–100 ... +100)	%
4025	chip temperature of the AD converter	°C
4026	MCU voltage	V
4027	MCU chip temperature (±5 °C)	°C

7 Load spectrum and observation

The EMMA records in the device how long the measuring point has worked in which load band and at which head temperature. The counters are in the observation menu, sub-menu "Hours above limit", and can be read over IO-Link at any time — also after a change of IO-Link master, because they are held in the amplifier.

7.1 Setting the observation range

The load bands refer to an observation range that is set with two values in the menu "Type plate": "0 % of observation window" (4061, zero point) and "100 % of observation window" (4062, full scale value). Default 0.0 and 100.0. Set the range before recording starts and then reset the observation (section 7.5).

7.2 Operating hours per load band

Index	Band of Input_1	Access
121	< 0 % (below observation range)	RO
122	0 ... 5 %	RO
111	< 5 %	RO/Reset
112	> 5 %	RO/Reset
113	5 ... 50 %	RO/Reset
114	50 ... 75 %	RO/Reset
115	75 ... 100 %	RO/Reset
120	> 100 % (observation range exceeded)	RO/Reset

The device counts in seconds; the tool shows hours with three decimals (gradient 1/3600).

7.3 Operating hours per head temperature

Index	Head temperature	Access
116	< 60 °C (< 140 °F)	RO
117	60 ... 70 °C (140 ... 158 °F)	RO
118	70 ... 80 °C (158 ... 176 °F)	RO
119	> 80 °C (> 176 °F)	RO

7.4 Current and maximum values

Index	Parameter (I0DD)	Display
100	Current (% FSO of) Input_1	0 ... 100.0 %
101	Maximum (% FSO of) Input_1	0 ... 100.0 %
102	Maximum Input_1	measured value
105	Maximum head temperature	°C

7.5 Operating hours, evaluation, reset

Index	Counter (I0DD)	Access
110	Operating hours	RO/Reset
108	Operating hours since last "move to archive"	RO/Reset
109	Operating hours since last observation reset	RO/Reset

The command "Reset input_1 Observation" (165) in the menu "Type plate" starts the recording anew; index 109 counts the hours since this command. Counters with the access type RO/Reset can be reset, the counters 116 to 119, 121 and 122 cannot.

Info Read out and document the counters before resetting them. When the measuring point changes, archive first (6.6), then reset.

8 Fault recovery

Fault	Possible cause	Measure
No output signal	Cable break	Check continuity
No output signal	No / wrong supply voltage	Apply correct supply voltage as per operating manual
No / wrong output signal	Connection fault	Comply with pin assignment (product label / operating manual)
Constant output signal during load and force changes	Strain gauge sensor defective	Replace strain gauge sensor
Output signal not as expected	Device configuration wrong	Change configuration
Output signal not as expected	Strain gauge sensor not suitable or defective	Select suitable strain gauge sensor or replace defective device
Signal span erratic / not accurate	EMC interference sources nearby, e.g. frequency converter	Shield sensor, shield cable, remove interference source
Signal span erratic / not accurate	Operating temperature too high / low	Comply with specified temperatures as per operating manual
No connection to IO-Link interface	Cable break	Check cables
No connection to IO-Link interface	IO-Link interface defective	Replace IO-Link interface

Status bits (6.3) and events (6.7) help to narrow the fault down: "Signal < -0.5" and "Sensor stressed > 100 %" point to connection, sensor or overload, "Head temperature > 85 °C" to an operating temperature that is too high.

- Check in advance that the right voltage supply and the correct wiring have been selected.
- Check for correct operation after each system change. If the fault persists, send the amplifier in for repair or replace it.
- Only the manufacturer is allowed to conduct repairs.

Attention In case of service clean the devices before returning them (9.4). Do not use pointed or hard objects for cleaning; the electrical contacts must not be damaged. Unjustified complaints can incur costs.

9 Maintenance, dismounting, return, cleaning, disposal

9.1 Maintenance

The amplifier is maintenance-free. Only the manufacturer is allowed to conduct repairs.

9.2 Dismounting

Achieve dead-voltage condition on the device, remove the electrical connections and carry out the mounting (5.2) in reverse order.

9.3 Return

Before shipping, see section 9.4. To return a device, use the original packaging or similar; anti-static foil, insulating material and marking as sensitive measuring equipment protect it.

9.4 Cleaning

- Before cleaning, switch the device off and achieve complete dead-voltage condition; the connected sensor and the IO-Link interface have to be in dead-voltage condition too.
- Only clean the device with a soft, damp cloth.
- Clean the device regularly to prevent dust from building up. Keep the electrical contacts dry and clean.

Attention Damage to property! Abrasives or corrosive solvents can damage the contacts.

9.5 Disposal

Dispose of device components and packaging materials in an environmentally safe manner in accordance with country-specific waste treatment and disposal regulations. Collect electrical and electronic parts separately, separate metals and plastics, dispose of printed circuit board assemblies professionally.

10 Technical data

Input

Item	Value
Sensor type	strain gauge full bridge, e.g. force / pressure
Bridge supply	3 V
Bridge resistance	min. $1 \times 350 \, \Omega$ for max. 1 full bridge · min. $2 \times 700 \, \Omega$ for max. 2 full bridges; further full bridges possible, the minimum resistance rises accordingly
Measuring range	freely adjustable within $-32000 \dots +32000$
Measuring unit	unitless
Note	other measuring units, ranges and sensor types on request

Output and performance

Item	Value
Interface	IO-Link
Signal level	0/24 V as per IO-Link specification
Accuracy	max. 0.05 % of range + sensor error
Resolution	16 bit
Filter setting	0.5 s (default of the signal smoothing)
Switch-on delay	< 5 s
Response time	20 ms

Supply

Item	Value
Voltage	24 V DC
Current	standard < 30 mA · switching (SIO) max. 100 mA · total max. 130 mA
Reverse voltage protection	yes (no function, no damage)

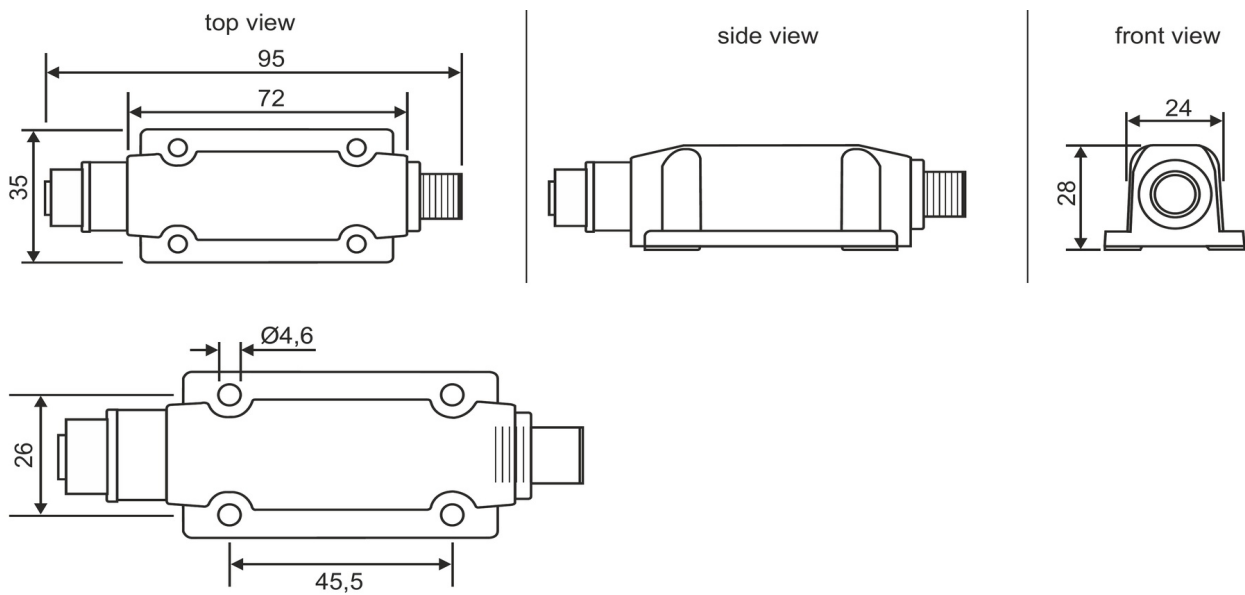
Environmental conditions

Item	Value
Operating temperature	$-20 \dots +80 \, ^\circ\text{C}$
Storage temperature	$-20 \dots +85 \, ^\circ\text{C}$
EMC	tested as per EN 61000-6-2:2005 and EN 61000-6-4:2007 + A1:2011
Cable length	max. 2 m to the sensor element · max. 20 m to the IO-Link master

Mechanics

Item	Value
Housing	PBT GF30, black (other colours on request) · flammability UL94 HB
Dimensions	$72 \times 28 \times 35 \, \text{mm}$ without electrical connection · approx. $95 \times 28 \times 35 \, \text{mm}$ with the M12x1 plug connectors on both sides
Connection to the sensor	M12x1 socket, 5-pole, or cable 2 m
Connection to the evaluation	M12x1 plug, 4-pole
Fitting position	any
Device protection	protection at least IP65 (electronics) · PCBs fully potted
Weight	60 g

11 Dimensions



Dimensions in mm. Below: mounting, 4 holes $\varnothing 4.6$ mm, spacing 45.5 x 26 mm.