

E N G L I S H

Please carefully read this operating instructions completely before commissioning the probe!
Do not discard!

The operator shall be liable for any damage caused by installation or operating errors!

Chlorine dioxide	CD10 (analog-out/analog)	analog signal output Dual power supply $\pm 5 - \pm 15$ VDC Single power supply 10 - 30 VDC analog internal signal processing no galvanical isolation
Peracetic acid	P10 (analog-out/analog)	
Ozone	OZ10 (analog-out/analog)	
Hydrogen peroxide	WP10 (analog-out/analog)	

Chlorine dioxide	CD10 (analog-out/digital)	analog signal output power supply 12 VDC or 24 VDC digital internal signal processing galvanical isolation
Peracetic acid	P10 (analog-out/digital)	
Ozone	OZ10 (analog-out/digital)	
Hydrogen peroxide	WP10 (analog-out/digital)	

Chlorine dioxide	CD10 (digital-out/digital)	Modbus-signaltransmitting power supply 12 VDC or 24 VDC digital internal signal processing galvanical isolation
Peracetic acid	P10 (digital-out/digital)	
Ozone	OZ10 (digital-out/digital)	
Hydrogen peroxide	WP10 (digital-out/digital)	

Chlorine dioxide	CD10 4-20mA (analog-out/analog)	analog signal output power supply 12 – 30 VDC analog internal signal processing no galvanical isolation
Peracetic acid	P10 4-20mA (analog-out/analog)	
Ozone	OZ10 4-20mA (analog-out/analog)	
Hydrogen peroxide	WP10 4-20mA (analog-out/analog)	

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1 General information

The range of application of these sensors includes almost all water qualities. These sensors are resistant to chemicals and surfactants as they are equipped with a special membrane system.

A complete measuring and/or control system normally consists of the following components:

- sensor
- electrical leads and connectors
- flow chambers and connections
- measuring and control device
- dosing equipment
- analysing instrumentation

This operating instructions primarily refers to the sensor. Please pay attention to the corresponding operating instructions of the peripheral devices!

Warning: *Do not touch the electrode finger and keep it clean!
Do not remove the layer on the electrode finger!*

1.1 Chlorine dioxide sensor CD10

The chlorine dioxide sensor is insensitive to chlorine. Ozone is measured with a sensitivity 25 times higher than chlorine dioxide. The sensor can be used in the pH range from >pH 1 in alkaline fluids up to the chlorine dioxide stability limit is reached. Precipitations (e. g. lime) may block the membrane!

1.2 Peracetic acid sensor P10

The sensor can be used in the pH range from >pH 1 up to pH 6. At a pH >6 the peracetic anion is present which cannot be measured by the sensor. (Lime may block the membrane!)

1.3 Ozone sensor OZ10

The ozone probe is insensitive to chlorine. Chlorine dioxide increases the measuring value about 6%. The probe can be used within the pH range of pH 2 to pH 12 (lime may block the membrane!).

1.4 Hydrogen peroxide sensor WP10

The probe can be used in the pH range from >pH 2 up to pH 11 (lime may block the membrane!)

2 Function

The sensor is a membrane covered amperometric 2-electrode system. The measuring electrode is membrane covered and is in the electrolyte area together with the combined counter and reference electrode. This electrolyte area contains a special electrolyte and is separated from the measuring water. In this measuring method the disinfectant diffuses out of the measuring water, through the membrane and causes in compound with the electrolyte an electrical signal at the measuring electrode. The electrical signal at the measuring electrode is proportional to the concentration of the disinfectant and is amplified by the electronics of the sensor. The measuring signal is independent from the temperature of the measuring water due to an integrated temperature compensation. tensides (surfactants) are mostly tolerated.

3 Intended use

The sensor has to be inserted in the flow chamber FLC according to this operating instructions (see section 6). The use of the sensor in other flow chambers has to be released by the manufacturer of the sensor. Otherwise the liability for a proper function of the sensors and personal injury and damage to equipment resulting from that is disclaimed.

The maximum allowed operating pressure of the sensor is 1.0 bar / 10 mwc. The allowed temperature operating range of the sensor is 0 up to <45 °C. Further operating guidelines see sections 13 + 14. The sensor is to be used only for the measurement and control of the concentration of chlorine dioxide / peracetic acid / hydrogen peroxide.

Only trained and authorised staff should operate the sensor.

Each application beyond this is a not intended use so the warranty becomes void and the liability is disclaimed.

We do not accept liability for injury to persons or damage to property if the operating instructions in this manual have not been followed, or the original state of the sensor has been changed, or the sensor has been used under conditions other than those specified.

If installing the sensor outside Germany, please comply with the corresponding local regulations.


4 Scope of supply

Keep the packaging for the sensor completely. In case of repair or warranty return the sensor in this package.


Check that the delivery is intact. In case of damage please contact your supplier.

Check that the delivery is complete by comparing with the below mentioned scope of supply.

4.1 Sensor with voltage/modbus output. 4-20 mA with 5-pole M12

	<ul style="list-style-type: none"> 1 sensor with membrane cap M10H, M10N, M10G or M10G O3 1 G-holder with tweezers 1 btl. 100 mL electrolyte ECD4●ECD7/W, EPS7/W, EPS9H/W, EPS9L/W, EOZ7/W or EWP7/W 1 emery S2 1 G-holder with o-ring 20 x 1.5 (spare part) 1 operating manual <p><i>Fig. similar</i></p>
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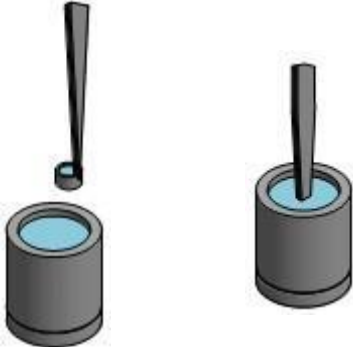
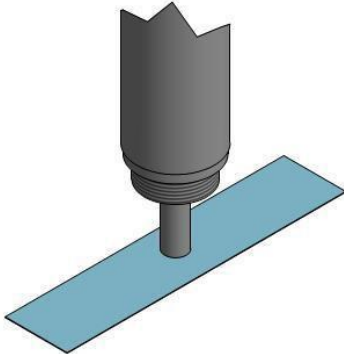
4.2 Sensor with 4-20 mA output with 2-pole terminal



	<ul style="list-style-type: none"> 1 sensor with membrane cap M10H, M10N, M10G or M10G O3 1 G-holder with tweezers 1 mA-cap with o-ring 20 x 1.5 1 btl. 100 mL electrolyte ECD4●ECD7/W, EPS7/W, EPS9H/W, EPS9L/W, EOZ7/W or EWP7/W 1 emery S2 1 G-holder with o-ring 20 x 1.5 (spare part) 1 operating manual <p><i>Fig. similar</i></p>
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5 Preparation of the sensor for start up

Safety hint: *Some electrolytes contain diluted acids. Please heed the warnings on the electrolyte bottle.
Do not swallow the electrolyte. Avoid contact of the electrolyte with skin and eyes.
Otherwise wash with a lot of water. In case of eye inflammation, contact a doctor.*

Keep out of reach of children.

	<p><u>Filling the membrane cap</u> The sensor is delivered with the membrane cap loosely screwed on the electrode shaft. Pull the transparent protection cap off the membrane cap and unscrew the membrane cap. Place the membrane cap onto a clean base. Fill up the membrane cap up to the edge with the enclosed electrolyte, empty it out and refill again up to the edge.</p>
	<p><u>Filling the G-Holder</u> Place the G-Holder on a clean and not absorptive ground and moisturise it with electrolyte.</p>
	<p><u>Mounting of the G-Holder in the membrane cap</u> Loop up the G-Holder which is moisturized with electrolyte with the supplied tweezers. Insert the G-holder with the tweezers in the filled membrane cap. Let it down until the G-holder is absorbed and fixed by the deepening in the middle of the membrane cap. Then remove the tweezers carefully. The G-holder stays in the membrane cap.</p>
	<p><u>Cleaning of the gold electrode</u> With the emery supplied only clean the tip of the dry electrode probe (= working electrode). Hold the emery paper in place at one of its corners and while holding the sensor upright, move the tip of the electrode two to three times across the emery paper.</p>

	<p><u>Assembling of the sensor</u></p> <p>Holding the electrode shaft upright, place it onto the filled membrane cap with the mounted G-holder. You may have to turn it counter-clockwise first until the thread catches. Then screw the electrode shaft (manually) slowly clockwise into the membrane cap.</p>
	<p>Make sure the red O-ring (20 x 1.5) is in its proper position as it is the seal of the membrane cap. Screw the membrane cap (manually) tightly to the electrode shaft. The red O-ring (20 x 1.5) will be firmly squeezed between the two parts. After this procedure make sure that no electrolyte leaks out of the sensor. The membrane, i.e. the membrane disk, is deflected to the outside by the electrode probe. Please make sure not to knock it against an object!!!</p> <p>Make sure that the membrane cap is tightly fastened to the electrode shaft! Wash up the excess electrolyte with water.</p> <p>Important: Check whether the membrane cap is completely screwed in up to the stop.</p> <p>Caution: When the filled membrane cap is completely screwed onto the electrode shaft it is not allowed to touch or to adjoin the membrane!</p>

6 Insertion of the sensor in the flow chambers FLC

Depressurise the system before inserting the sensor into the flow chamber type FLC. Close the stop valves before and after the flow chamber.

Insertion of the sensor into the flow chamber should be carried out slowly.

The sensor is not allowed to be pushed against the bottom of the flow chamber!

Warning: A sudden failure of the sensor may lead to a very dangerous overdosing of the disinfectant – please provide preventative measures. In case of a very high overdose, the titration may be imprecise as the titration volume gets too large.

Recommendations: e. g. dosage volume monitoring, dosage time monitoring, limit value monitoring.

Safety hint: Please make sure that the sensor is tightly fastened in place!
Otherwise it may be pressed out of the flow chamber when it is under pressure.

Operating mode	Flow chamber	Operating pressure max.	Operating temperature max.	Flow rate l/h
IMPORTANT:	!! Heed and comply with the max. allowed operating pressure / operating temperature of the sensor !!			
Operation of the sensor without retaining ring	FLC-1	0.5 bar (5 mWS)	45 °C	15 (45)
	FLC-3		70 °C	45 (15)

Operation of the sensor with retaining ring	FLC-1	4.0 bar (40 mWS)	45 °C	15 (45)
	FLC-3	8.0 bar (80 mWS)	70 °C	45 (15)

6.1 Mounting with retaining ring

For the installation of the sensor in the flow chamber the sensor can be equipped with retaining ring, slide-ring and O-ring by the manufacturer (see fig. 1). For installation of the sensor in the flow chamber unscrew the 1 ¼” screw-connection from the flow chamber. Prepare the sensor according paragraph 5. Make sure that retaining ring, slide-ring and O-ring are properly fixed according fig. 1.

Fig. 1:

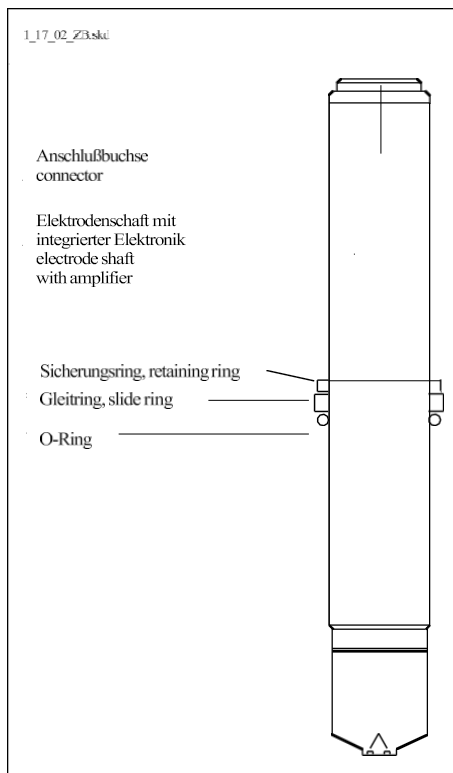
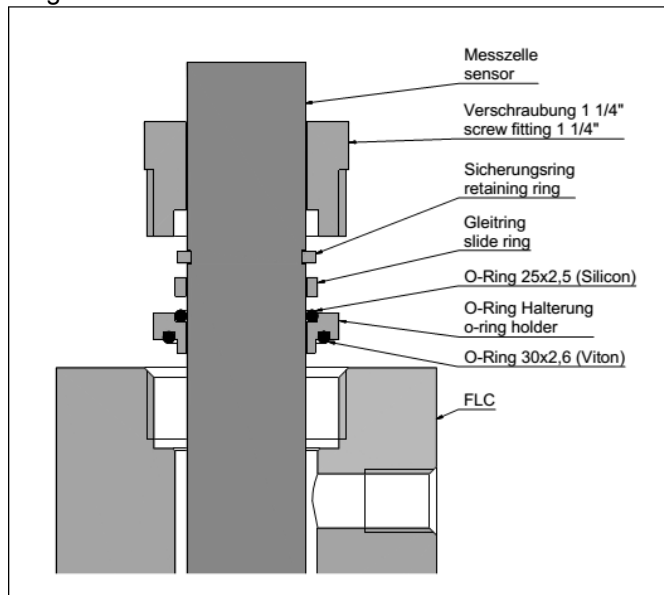


Fig. 2:



Insert the sensor according fig. 2 into the flow chamber. Push the earlier unscrewed 1 ¼” screw-connection carefully over the inserted sensor and fasten it tightly, otherwise leaks may occur.

First open the measuring water outlet. Then open slowly the measuring water supply. Avoid installations that allow air bubbles to enter the measuring water.

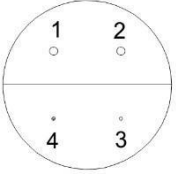
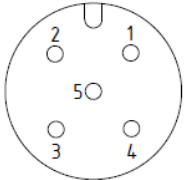
6.2 Mounting without retaining ring

If the sensor is not equipped with retaining ring, slide-ring and o-ring it can also be installed in the flow chamber by using an o-ring and 2 slide rings. The second slide ring has to be used instead of the retaining ring. Loosen the 1 ¼” screw-connection of the flow chamber. Insert the sensor (after preparation according paragraph 5) into the flow chamber until the distance between the membrane and the inflow-opening is approx. 2 cm. Fasten the 1 ¼” screw-connection tightly. Please make sure that the sensor is tightly fastened in place, otherwise it may be pressed out of the flow chamber when it is under pressure and / or leaks may occur.

First open the measuring water outlet. Then open slowly the measuring water supply. Avoid installations that allow air bubbles to enter the measuring water.

7 Startup of the sensor

Connect the sensor with the measuring device.

<p>Connection of sensors with 0...+/- 2000 mV signal output</p>	<p>4 pole connector, reverse polarity protection, symmetrical or unipolar power supply pin configuration: 1 (socket) +U 2 (socket) -U or voltage GND 3 (PIN) GND or Signal GND 4 (PIN) signal output</p>	
<p>Connection of sensors with modbus signal transmission</p>	<p>5 pole screw-connector, M12, reverse polarity protection pin configuration: PIN 2 +12 V / +24 V PIN 3 GND PIN 4 RS485 B PIN 5 RS485 A There are no termination resistors in the sensor!</p>	
<p>Connection of mA-sensors with 5-pole M12 plug-on flange</p>	<p>5 pole screw-connector, M12, reverse polarity protection pin configuration: PIN 2: +U PIN 3: -U</p>	
<p>Connection of mA-sensors with 2-pole terminal</p>	<p>2-pole terminal clamp Push the sensor cable through the black cable gland of the cap. Then fasten the wires in the terminals of the sensor electronics. By hand, screw the cap only now onto the sensor body/shaft until the o-ring seals. Now tighten the black cable gland (fixing the cable). For disconnection untighten the black cable gland first to release the cable. Recommended cable: diameter approx. 4 mm, 2 x 0.25 mm².</p>	

As a rule the sensor is run in after about 3 hours so that a first adjustment can be made. The adjustment has to be repeated after approx. one day and several times in the first days of operation. The sensor reaches a stable slope after some days of operation. If there is some disinfectant peroxide in the measuring water it benefits the run-in period. For proper function of the sensor the slope adjustment has to be repeated in regular intervals.

8 Control of the sensor / Analytics

A balance or checking of the probe using sulphuric titration with potassium permanganate is recommended. This should be performed regularly depending on utilization. Recommendation: weekly check, if necessary more frequently. The titrated value is adjusted by means of slope calibration function of the controller (see Operation Manual of the Controller). We recommend to replace the electrolyte every 3 - 6 month.

8.1 Analytics chlorine dioxide

Provided that there are no other oxidants present in the measuring water, e. g. chlorine and ozone, chlorine dioxide can be determined in the same way as “free chlorine” (DPD-1). The result of this determination has to be multiplied by the factor 1.9, which shows the concentration in mg/l of chlorine dioxide.

8.2 Analytics peracetic acid

The determination of the peracetic acid concentration should be performed by using sulphuric titration with potassium permanganate and sodium thiosulfate.

8.3 Analytics ozone

Provided that there are no other oxidants in the measuring water, e. g. chlorine and chlorine dioxide, ozone can be determined by DPD-method. For this, a DPD total chlorine determination has to be done (DPD-4 or DPD-1 + DPD-3). The measuring value obtained has to be multiplied by a factor of 0.68, which shows the ozone concentration in mg/l. This method can be used for ozone concentrations up to 1 mg/l.

8.4 Analytix hydrogen peroxide

The determination of the hydrogen peroxide concentration should be performed by using one-level sulphuric titration with potassium permanganate.

8.5 Sensors with digital internal signal processing

The fixation of the connector is transparent. Through this two LEDs (orange and green) can be seen:

Green LED	<p><i>Continuous light:</i> Power supply ok., program in processor is working.</p> <p><i>Flickering or no light:</i> indicates that the voltage is too low with the result in a malfunction of the processor.</p>
Orange LED	<p><i>No light:</i> everything ok, sensor signal has the right polarity</p> <p><i>Continuous light:</i> indicates wrong polarity of the sensor signal. The displayed output signal is to multiply with -1.</p> <p><i>Regular flickering:</i> The electrochemical cell is overdriven. Cause: chlorine concentration is too high. (Due to the different sensitivities/slopes of the electrochemical cells an overdrive may occur although the maximum measuring range is not reached yet.)</p>

8.6 Sensors with 2-pole terminal + CE-mark (4-20 mA)

Factory provided the potentiometer sideways to the 2-pole-connector is adjusted on the measuring range which is specified on the label. This adjustment is secured by a sealing wax. The setting of the potentiometer should not be changed.

9 Disassembling of the sensor

Switch of secondary measuring and/or control systems or switch them to manual operation before dismantling the sensor. A disassembled sensor results in an incorrect measuring value, which may cause an uncontrolled dosing within a control system.
Lock the measuring water supply at first and after that the outlet. Disconnect the sensor from the device.

Disconnection of sensors with 2-pole terminal: First untighten the cable gland so that the cable is released. Unscrew the cap from the sensor. Then disconnect the wires from the 2-pole-terminal.

Untighten the screw-connection and pull out the sensor carefully.

10 Maintenance of the sensor

Caution: *The brown coating of the electrode finger must not be emiered!!
Do not unscrew the metallic membrane holder from the cap as this will damage the membrane.*

Check the sensor regularly for dirt, algae and bubbles. As far as possible avoid contamination of the membrane with solid particles, deposits etc. Bubbles on the outside of the membrane can be eliminated by increasing the flow rate temporary.

A slope adjustment has to be made after a change of the membrane cap or the electrolyte.

10.1 Change of electrolyte

Recommendation: Change the electrolyte every 3 – 6 months. And also, if an adjustment is impossible due to unstable or too low values displayed.

Remove the membrane cap. Wash the electrode finger with clean water and dry it with a clean paper towel. Shake the sensor several times in the same way as a clinical thermometer to remove the water.

This empties the compensation opening. Wipe dry using a clean paper towel.

The special emery paper supplied is used only for cleaning the tip of the dry electrode probe (working electrode). Take the special S2 emery paper in place in one of its corners and, holding the sensor upright, move the electrode tip two to three times across the emery (see fig. 3). In case the red 20x1.5 o-ring no longer fits tightly (it may have expanded) it must be replaced.

The G-holder is in the membrane cap. Because of this rinse the membrane cap carefully with clean water.

If necessary remove the G-Holder with the tweezers. Rinse both sides of the tissue of the G-Holder carefully with clean water. Replace the G-Holder in the membrane cap and fill it with electrolyte (see section 5).

If the sensor still displays too low or unstable values, a new membrane cap with new G-Holder must be used.

Please note that with a new membrane cap, the run-in period may take up to one day!

10.2 Change of membrane cap

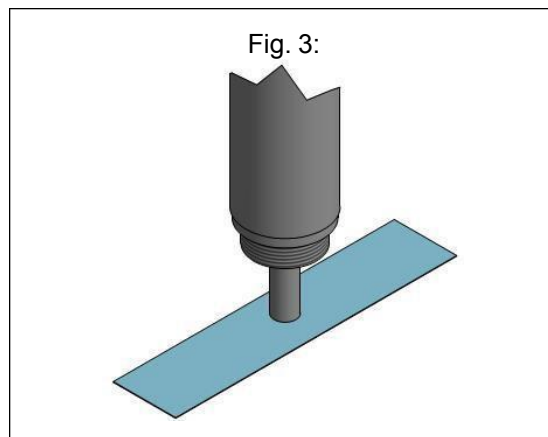
Recommendation: Change of the membrane cap once a year. And also, if an adjustment is impossible due to unstable or too low values displayed.

Remove the membrane cap. Wash the electrode finger with clean water and dry it with a clean paper towel. Shake the sensor several times in the same way as a clinical thermometer to remove the water. This empties the compensation opening. Wipe dry using a clean paper towel.

The special emery paper supplied is used only for cleaning the tip of the dry electrode probe (working electrode). Take the special S2 emery paper in place in one of its corners and, holding the sensor upright, move the electrode tip two to three times across the emery (see fig. 3). In case the red 20x1.5 o-ring no longer fits tightly (it may have expanded) it must be replaced.

Take a new membrane cap with a new G-holder and fill them with electrolyte (see section 5). Please note that with a new membrane cap, the run-in period may take up to one day!

If the sensor still displays too low or unstable values, a check / reconditioning at by the manufacturer has to be done.



11 Storage

To store the sensor the membrane cap is unscrewed and the G-Holder removed with the tweezers. Membrane cap and electrode finger are rinsed in clean water and dried in a place free of dust. The dry membrane cap is then loosely screwed onto the electrode shaft to protect the electrode finger. The membrane must not rest against the measuring electrode.

When putting the sensor back into use after storage, the electrode tip must be cleaned with the special abrasive paper and a new membrane cap with new G-Holder must be used (see section 5).

Used membrane caps which have been in operation for at least 1 day cannot be stored and reused.


12 Electrical specifications

The sensors have to be operated potentialfree. A current flow between the sensors and the measuring water is not allowed. Therefore the measuring and control devices must be supplied with a galvanical isolation. When a 4-20 mA current loop is present a galvanical isolation can be achieved by using a isolating amplifier.


The sensors are only allowed to be operated with the specified voltage supply. Ensure that the supply voltage of the measuring and/or control device is stable. Too low a voltage supply can cause incorrect measuring values, which may result in dangerous overdosing within a control system.

NOTE: A potential-free electrical connection is necessary as the sensor electronic is not equipped with a galvanical isolation.

12.1 Chlorine dioxide sensor CD10 / Ozone sensor OZ10

Type	N / H / L		Up / HUp	MA-x	
	EMC-Testing DIN EN 61326-1 RoHS compliant				
Voltage supply	12 VDC (+11.5...+13 VDC)	24 VDC (+22.5...+26 VDC)	±5 ... ±15 V DC	+10 ...+30 V DC	12 V DC (load resistor: max. 50Ω) Up to 30 V DC (load resistor: 50Ω until 900Ω)
Power consumption	approx. 40 mA	approx. 20 mA	approx. 10 mA		approx. 4 mA (max. current by overloading: approx. 30 mA)
Signal transmission	Analog signal output (mV per mg/l) or Modbus RTU		Analog signal output (mV per mg/l) N: ca. -100 H: ca. -1000 L: ca. -10	Analog signal output (mV per mg/l) Up: ca. +100 HUp: ca. +1000	Analog signal output 4 – 20 mA (uncalibrated) (16 mA/measuring range in ppm = nominal slope in mA/ppm)
Internal signal processing	digital		analog		
Measuring range (mg/L)	N: 0.05...20.00 H: 0.005...2.000 L: 0.5...200.0		Up: 0.05...20.00 HUp: 0.005...2.000		x = Measuring range in mg/L (e. g. CD10MA2: Measuring range up to 2 mg/L ClO ₂)
Connection information	– analog: 4-pole screw connector Modbus: 5-pole M12 plug-in flange – power supply is galvanically isolated – output signal is galvanically isolated – Anschlüsse verpolungsgeschützt	– 4-pole screw connector – Ground power supply and ground signal are the same – connections are protected against polarity reversal	– 4-pole screw connector – power supply is galvanically isolated – connections are protected against polarity reversal	– 2-pole terminal or 5-pole M12 plug-on flange – connection is protected against polarity reversal – the 4-20 mA connection to the device also supplies the sensor with current – slope adjustment at the device necessary	

12.2 Peracetic acid sensor P10 / hydrogen peroxide sensor WP10

Type	N / H / L			Up / HUp	MA-x
	EMC-Testing DIN EN 61326-1 RoHS compliant				
Voltage supply	12 VDC (+11.5...+13 VDC)	24 VDC (+22.5...+26 VDC)	±5 ... ±15 V DC	+10 ...+30 V DC	12 V DC (load resistor: max. 50Ω) Up to 30 V DC (load resistor: 50Ω until 900Ω)
Power consumption	approx. 40 mA	approx. 20 mA	approx. 10 mA		approx. 4 mA (max. current by overloading: approx. 30 mA)
Signal transmission	Analog signal output (mV per mg/l) or Modbus RTU	Analog signal output (mV per mg/l) N: ca. -1 H: ca. -10 L: ca. -0.1	Analog signal output (mV per mg/l) Up: ca. +1 HUp: ca. +10	Analog signal output (mV per mg/l)	Analog signal output 4 – 20 mA (uncalibrated) (16 mA/measuring range in ppm = nominal slope in mA/ppm)
Internal signal processing	digital		analog		
Measuring range (ppm)	N: 0...2000 H: 0...200 L: 0...20000 (2%)			Up: 0...2000 HUp: 0...200	x = Measuring range in ppm (e. g. P10MA-200: Measuring range up to 200 ppm PAA)
Connection information	– analog: 4-pole screw connector Modbus: 5-pole M12	– 4-pole screw connector – Ground power	– 4-pole screw connector – power supply is	– 2-pole terminal or 5-pole M12 plug-on flange	
	plug-in flange – power supply is galvanically isolated – output signal is galvanically isolated – connections are protected against polarity reversal	supply and ground signal are the same – connections are protected against polarity reversal	galvanically isolated – connections are protected against polarity reversal	– connection is protected against polarity reversal – the 4-20 mA connection to the device also supplies the sensor with current – slope adjustment at the device necessary	

13 Technical data

Data sheets are available for each type of sensor.

13.1 Chlorine dioxide CD10

Application	All kinds of water treatment, also sea water (e. g. bottle washing machine, CIP-plants) The membrane system is highly resistant to surfactants (tensides).
Measuring system	Membrane covered, amperometric 2-electrode system.
Electronic	<p>Analog version:</p> <ul style="list-style-type: none"> - voltage output - not galvanically isolated electronics - analog internal data processing - output signal: analog (analog-out/analog) <p>Digital version:</p> <ul style="list-style-type: none"> - electronic is completely galvanically isolated - digital internal data processing - output signal: analog (analog-out/digital) or digital (digital-out/digital) <p>mA-version:</p> <ul style="list-style-type: none"> - current output analog - not galvanically isolated electronics - output signal: analog (analog-out/analog) - only valid for sensors with 2-pole-terminal & CE-mark: poti for (restricted) adjustment of measuring range
Information about the measuring range of sensors with 4-20 mA	<p>Slope of a sensor can vary production-related or application-related between 65% and 150% of the nominal slope</p> <p>-> Recommendation to determine the suitable measuring range or the suitable sensor: Concentration to be measured x factor 1.5 = measuring range of the sensor</p> <p>Example: Concentration to be measured 1.6 ppm x 1.5 = 2.4 -> recommended sensor with a measuring range of 5 ppm</p>
Slope drift At repeatability conditions (25 °C, pH 7,2 in drinking water)	approx. <-1% per month
indicator	Chlorine dioxide
Working temperature	0 – <50 °C (no ice crystals in the measuring water)
Temperature compensation	Automatically, by an integrated temperature sensor Temperature changes <5 °C / h
Max. allowed working pressure	1.0 bar, no pressure impulses and/or vibrations
Flow rate	approx. 15-30 l/h in FLC-1, small flow rate dependence is given
pH-range	pH 2 – pH 11
Run-in time	First start-up approx. 1 h
Response time	T ₉₀ : approx. 1 min.
Accuracy after calibration at repeatability conditions (25°C, pH 7.2 in drinking water) of the upper full scale	<ul style="list-style-type: none"> - Measuring range 2 ppm: at 0.4 ppm <1% at 1.6 ppm <1% - Measuring range 20 ppm: at 1.5 ppm <0.1%
Zero point adjustment	Not necessary
Slope calibration	At the device, by analytical determination

interferences	Cl ₂ : does not disturb O ₃ : is measured with a sensitivity 25-times higher than ClO ₂
material	PVC-U, stainless steel 1.4571
Connection	analog-out/analog version: 4-pole plug adapter analog-out/digital version: 4-pole plug adapter digital-out/digital version: 5-pole M12, plug-on flange 4-20 mA version: 2-pole terminal (2 x 1 mm ²) or 5-pole M12, plug-on flange (PIN2: +U, PIN3: -U)
Size	diameter: approx. 25 mm Length: analog-out/analog version approx. 175 mm analog-out/digital version approx. 195 mm digital-out/digital version approx. 205 mm 4-20 mA version approx. 220 mm (2-pole-terminal) approx. 190 mm (5-pole-M12)
storage	Probe: Frost-protected, dry and without electrolyte no limit at >5 - <40 °C Membrane cap: Used membrane caps cannot be stored! Electrolyte: in original bottle protected from sunlight min. 1 year at >10 - <35 °C
maintenance	Regularly control of the measuring signal, min. once a week The following specifications highly depend on the water quality: Change of the membrane cap: once a year Change of the electrolyte: every 3 - 6 months

13.2 Peracetic acid sensor P10

Application	All kinds of water treatment, also sea water Tensides and conductivity acids are tolerated (e. g. bottle washing machine, CIP-plants)
Measuring system	Membrane covered, amperometric 2-electrode system
Electronic	Analog version: - voltage output - not galvanically isolated electronics - analog internal data processing - output signal: analog (analog-out/analog) Digital version: - electronic is completely galvanically isolated - digital internal data processing - output signal: analog (analog-out/digital) or digital (digital-out/digital) mA-version: - current output analog - not galvanically isolated electronics - output signal: analog (analog-out/analog) - only valid for sensors with 2-pole-terminal & CE-mark: poti for (restricted) adjustment of measuring range
Information about the measuring range of sensors with 4-20 mA	Slope of a sensor can vary production-related or application-related between 65% and 150% of the nominal slope -> Recommendation to determine the suitable measuring range or the suitable sensor: Concentration to be measured x factor 1.5 = measuring range of the sensor
	Example: Concentration to be measured 1.6 ppm x 1.5 = 2.4 -> recommended sensor with a measuring range of 5 ppm
indicator	Peracetic acid
Working temperature	>0 – <45 °C (no ice crystals in the measuring water)

Temperature compensation	Automatically, by an integrated temperature sensor, T ₉₀ : approx. 8 min.
Max. allowed working pressure	1.0 bar, no pressure impulses and/or vibrations
Flow rate	approx. 45 (15) l/h in FLC-3, small flow rate dependence is given
pH-range	pH 1 – pH 6
Run-in time	P10H: First start-up approx. 3 h P10N: First start-up approx. 1 h P10L: First start-up approx. 30 min.
Response time	T ₉₀ : approx. 5 min. at 10 °C, approx. 1,5 min. at 45 °C
Zero point adjustment	Not necessary
Slope calibration	At the device, by analytical determination
interferences	O ₃ : results in a 2.500-times higher measuring value ClO ₂ : is measured with 100 % H ₂ O ₂ : very low influence on the measuring value (reduce of the PAA-signal)
influence of conductivity acids	1 % sulfuric acid, 1 % nitric acid or 1 % phosphoric acid in the water have no influence to the measuring behaviour
Connection	analog-out/analog version: 4-pole plug adapter analog-out/digital version: 4-pole plug adapter digital-out/digital version: 5-pole M12, plug-on flange 4-20 mA version: 2-pole terminal (2 x 1 mm ²) or 5-pole M12, plug-on flange (PIN2: +U, PIN3: -U)
material	PVC-U, stainless steel 1.4571
Size	diameter: approx. 25 mm Length: analog-out/analog version approx. 175 mm analog-out/digital version approx. 195 mm digital-out/digital version approx. 205 mm 4-20 mA version approx. 220 mm (2-pole-terminal) approx. 190 mm (5-pole-M12)
storage	Probe: Frost-protected, dry and without electrolyte no limit at >5- <40 °C Membrane cap: Used membrane caps cannot be stored! Electrolyte: in original bottle protected from sunlight min. 1 year at >10 - <35 °C
maintenance	Regular control of the measuring signal, min. once a week The following specifications depend on the water quality: Change of the membrane cap: once a year Change of the electrolyte: every 3 - 6 months

13.3 Ozone sensor OZ10

indicator	ozone
Application	All kinds of water treatment, also sea water Surfactants (tensides) are tolerated. (e. g. bottle washing machine, CIP-plants, rinser)
Measuring system	Membrane covered, amperometric 2-electrode system
Electronic	Analog version: - voltage output - not galvanically isolated electronics - analog internal data processing - output signal: analog (analog-out/analog)

	<p>Digital version:</p> <ul style="list-style-type: none"> - electronic is completely galvanically isolated - digital internal data processing - output signal: analog (analog-out/digital) or digital (digital-out/digital) <p>mA-version:</p> <ul style="list-style-type: none"> - current output analog - not galvanically isolated electronics - output signal: analog (analog-out/analog) - only valid for sensors with 2-pole-terminal & CE-mark: poti for (restricted) adjustment of measuring range
Information about the measuring range of sensors with 4-20 mA	<p>Slope of a sensor can vary production-related or application-related between 65% and 150% of the nominal slope</p> <p>-> Recommendation to determine the suitable measuring range or the suitable sensor: Concentration to be measured x factor 1.5 = measuring range of the sensor</p> <p>Example: Concentration to be measured 1.6 ppm x 1.5 = 2.4 -> recommended sensor with a measuring range of 5 ppm</p>
Accuracy after calibration at repeatability conditions (15°C, pH 7.2 in drinking water) of the upper full scale	<ul style="list-style-type: none"> - Measuring range 2 mg/l: at 0.4 mg/l <1% - Measuring range 20 mg/l: at 4 mg/l <1% at 16 mg/l <2%
Working temperature	0 – <45 °C (no ice crystals in the measuring water)
Temperature compensation	Automatically, by an integrated temperature sensor T ₉₀ : approx. 8 min.
Max. allowed working pressure	1.0 bar, no pressure impulses and/or vibrations
Flow rate	approx. 15-30 l/h in FLC-1, small flow rate dependence is given
pH-range	pH 2 – pH 11
Run-in time	First start-up approx. 1 h
Response time	T ₉₀ : approx. 5 min.
Zero point adjustment	Not necessary
Slope calibration	At the device, by analytical determination
interferences	<p>Cl₂: OZ10H: increases the measuring value about 1,5 % OZ10N: negligible</p> <p>ClO₂: OZ10N: increases the measuring value about 6 %</p>
Connection	<p>analog-out/analog version: 4-pole plug adapter</p> <p>analog-out/digital version: 4-pole plug adapter</p> <p>digital-out/digital version: 5-pole M12, plug-on flange</p> <p>4-20 mA version: 2-pole terminal (2 x 1 mm²) or 5-pole M12, plug-on flange (PIN2: +U, PIN3: -U)</p>
material	PVC-U, stainless steel 1.4571
Size	<p>diameter: approx. 25 mm</p> <p>Length: analog-out/analog version approx. 175 mm</p> <p>analog-out/digital version approx. 195 mm</p> <p>digital-out/digital version approx. 205 mm</p> <p>4-20 mA version approx. 220 mm (2-pole-terminal)</p> <p>approx. 190 mm (5-pole-M12)</p>
storage	Probe: Frost-protected, dry and without electrolyte no limit at >5 - <40 °C

	Membrane cap: Used membrane caps cannot be stored! Electrolyte: in original bottle protected from sunlight min. 1 year at >10 - <35 °C
maintenance	Regularly control of the measuring signal, min. once a week The following specifications depend on the water quality: Change of the membrane cap: once a year Change of the electrolyte: every 3 - 6 months

13.4 Hydrogen peroxide sensor WP10

Application	All kinds of water treatment, also sea water, especially for high H ₂ O ₂ -concentrations. The membrane system is highly resistant to surfactants (tensides).
Measuring system	Membrane covered, amperometric 2-electrode system.
Electronic	<p>Analog version:</p> <ul style="list-style-type: none"> - voltage output - not galvanically isolated electronics - analog internal data processing - output signal: analog (analog-out/analog) <p>Digital version:</p> <ul style="list-style-type: none"> - electronic is completely galvanically isolated - digital internal data processing - output signal: analog (analog-out/digital) or digital (digital-out/digital) <p>mA-version:</p> <ul style="list-style-type: none"> - current output analog - not galvanically isolated electronics - output signal: analog (analog-out/analog) - only valid for sensors with 2-pole-terminal & CE-mark: poti for (restricted) adjustment of measuring range
Information about the measuring range of sensors with 4-20 mA	<p>Slope of a sensor can vary production-related or application-related between 65% and 150% of the nominal slope</p> <p>-> Recommendation to determine the suitable measuring range or the suitable sensor: Concentration to be measured x factor 1.5 = measuring range of the sensor</p> <p>Example: Concentration to be measured 1.6 ppm x 1.5 = 2.4 -> recommended sensor with a measuring range of 5 ppm</p>
indicator	Hydrogen peroxide
Working temperature	0 – <45 °C (no ice crystals in the measuring water)
Temperature compensation	Automatically, by an integrated temperature sensor Temperature changes <5 °C / h T ₉₀ : approx. 8 min.
Max. allowed working pressure	1.0 bar, no pressure impulses and/or vibrations
Flow rate	approx. 15-30 l/h in FLC-1, small flow rate dependence is given
pH-range	pH 2 – pH 11
Run-in time	First start-up approx. 3 h
Response time	T ₉₀ : approx. 8 min.
Accuracy after calibration at repeatability conditions (25°C, pH 7.2 in drinking water) of the upper full scale	<ul style="list-style-type: none"> - Measuring range 200 ppm: at 40 ppm <2% at 160 ppm <2% - Measuring range 2000 ppm: at 400 ppm <0,5% at 1600 ppm <2%

Zero point adjustment	Not necessary
Slope calibration	At the device, by analytical determination
interferences	Cl ₂ : must not be present PAA: must not be present O ₃ : must not be present Sulfides: contaminate the measuring system Phenol: aqueous solution >3 % phenol, destroys the membrane system
Connection	analog-out/analog version: 4-pole plug adapter analog-out/digital version: 4-pole plug adapter digital-out/digital version: 5-pole M12, plug-on flange 4-20 mA version: 2-pole terminal (2 x 1 mm ²) or 5-pole M12, plug-on flange (PIN2: +U, PIN3: -U)
material	PVC-U, stainless steel 1.4571
Size	diameter: approx. 25 mm Length: analog-out/analog version approx. 175 mm analog-out/digital version approx. 195 mm digital-out/digital version approx. 205 mm 4-20 mA version approx. 220 mm (2-pole-terminal) approx. 190 mm (5-pole-M12)
storage	Probe: Frost-protected, dry and without electrolyte no limit at >5 - <40 °C Membrane cap: Used membrane caps cannot be stored! Electrolyte: in original bottle protected from sunlight min. 1 year at >10 - <35 °C
maintenance	Regularly control of the measuring signal, min. once a week The following specifications highly depend on the water quality: Change of the membrane cap: once a year Change of the electrolyte: every 3 - 6 months

14 General operating guidelines

- The sensor has to be operated in an upright position, so that the incoming flow comes from the bottom up to the membrane.
- During unpressurised operation with free outflow of the measuring water air bubbles have no disturbing effect unless they cover the membrane. Air bubbles at the membrane obstruct the inflow of the disinfectant, which leads to incorrect measuring signals.
- A minimum flow rate is necessary. The flow rate must be constant.
- The membrane life is typically one year, but can vary considerably depending on the water quality. Heavy contamination of the membrane should be avoided.
- Each sensor has been tested and the results are documented.
- During interval operation of the measuring system / plant the sensor is not allowed to be disconnected from the power supply. The sensor must be connected to the power supply all the time. The sensor must not be allowed to stand dry.
- The sensor is not allowed to be operated in that is free of disinfectant free water for a longer period (>1 day). Danger: buildup of sediments/contaminations (e. g. biological) on the membrane. This can interfere or block a later measurement of the disinfectant. After any operation without disinfectant, run-in periods must be reckoned with. If required, switch on metering unit time-delayed. If no disinfectant is dosed for a longer period of time, the sensor must be disconnected from the device, disassembled and stored dry (see section 11).
- The presence of reducing-, oxidising reagents and corrosion inhibitors may interfere with the measurement.

15 Spare Parts

Membrane caps	Electrolyte
M10H with G-holder (Art. No. 11045)	
WP10H, WP10N, WP10MA-200, WP10MA-2000	EWP7/W (Art. No. 11201)
M10N with G-holder (Art. No. 11046)	
All CD10	ECD4 • ECD7/W (Art. No. 11030)
P10H, P10N, P10MA-200, P10MA-2000	EPS9H/W (Art. No. 11025)
P10L, P10Up5000, P10MA-2%	EPS9L/W (Art. No. 11024)
M10G with G-holder (Art. No. 11041)	
P10MA-5%	EPS7/W (Art. No. 11020)
WP10L, WP10-20%, WP10MA-2%, WP10MA-5%, WP10MA-20%	EWP7/W (Art. No. 11201)
M10G O3 with G-holder (Art. No. 11052)	
All OZ10	EOZ7/W (Art. No. 11102)

16 Trouble Shooting

Trouble shooting must take account of the whole measuring circuit system from the extraction point to drain. In general, the measuring system consists of:

- sensor
- electrical leads and its connectors
- measuring and control device
- flow chambers with hose connections / pipe connections

16.1 General Troubleshooting

Fault	Possible Cause	Action
Sensor cannot be calibrated / deviation of the measuring value from DPD/titration result	Run-in time too short	See section 5, repeat calibration after several hours
	Membrane cracked	Replace membrane cap, see section 10.2
	Membrane cap damaged	Replace membrane cap, see section 10.2
	Interfering substances in the measuring water	Examine the measuring water for interfering substances and remedy, if necessary consult supplier
	Short-circuit / damage in the signal lead	Locate and eliminate short-circuit / defect, if necessary change the measuring cable
	Distance between working electrode and membrane is too great	Screw the membrane cap tightly onto the shaft until it hits the shaft
	DPD-/Titration chemicals spent	Use new DPD-/titration chemicals, repeat calibration
	<u>Only valid for peracetic acid:</u> Improper method of titration	Repeat titration with an appropriate method (with a minimal titration volume)
	Deposits on the membrane	With a soft brush (e. g. toothbrush) and scoring agent remove deposits carefully Otherwise replace membrane cap, see section 10.2
	Air bubbles on the outside of the membrane	Increase the flow rate temporary, if necessary check installation and revise it
	Sensor defective	Return the sensor to the manufacturer for check/reconditioning
	No electrolyte in the membrane cap	Fill membrane cap with electrolyte and follow the instructions of section 5
	concentration of disinfectant exceeds the upper limit of the measuring range	Check the whole system, remedy fault, repeat calibration

<p>Measuring signal is not stable</p>	<p>Membrane cracked</p> <p>Air Bubbles in the electrolyte</p> <p>Air bubbles on the outside of the membrane</p> <p>Pressure fluctuations in the measuring water</p> <p>Reference electrode exhausted and/or contaminated</p>	<p>Replace membrane cap, see section 10.2</p> <p>Empty out the membrane cap and refill it carefully with new electrolyte without bubbles, see section 10.1</p> <p>Increase the flow rate temporary, if necessary check installation and revise it</p> <p>Check installation, if necessary revise it</p> <p>Return sensor for reconditioning to the manufacturer</p>
<p>Only for sensors with digital electronics:</p>		
<p>green LED</p> <p>Flickering or no light</p> <p>orange LED</p> <p>continuous light</p> <p>regular flickering</p>	<p>Voltage too low -> malfunction of the Microcontroller</p> <p>Sensor defective</p> <p>wrong polarity of the sensor signal -> displayed output signal is to multiply with -1</p> <p>electrochemical cell is overdriven -> level of concentration of the disinfectant is too high</p>	<p>Provide correct power supply to the sensor</p> <p>Return sensor for reconditioning to the manufacturer</p> <p>Maintain sensor according to section 10</p> <p>Return sensor for reconditioning to the manufacturer</p> <p>Check installation, if necessary revise it, calibrate or maintain sensor if necessary</p>

<p>Check of the electronic system (dry test)</p>	<ol style="list-style-type: none"> 1. Unscrew membrane cap 2. Thoroughly rinse off electrode finger and dry carefully using clean cloth 3. Connect sensor to measurement/control device and wait for approx. 5 min. 4. Take readings of original sensor signal from measurement/control device or measure using a digital multimeter <ul style="list-style-type: none"> A) Sensor (mV): approx. +/- 0 mV B) Sensor (mA): approx. 4 mA C) Sensor (µA): approx. 0 µA <p>-> If the sensor signal approximately corresponds to the above mentioned values, the electronic system is likely to be ok.</p> <p>-> If the measured value significantly deviates from the above mentioned values, the sensor must be send back to the manufacturer for testing.</p>
<p>Zero point check</p>	<p><u>After the check of the electronic system</u></p> <ul style="list-style-type: none"> - Prepare sensor for start-up according to section 5 of the instruction manual - Connect sensor to measurement/control device - Place sensor carefully into a beaker filled with clean tap water (free from disinfectant!) - Stir for approx. 30 sec. using sensor in beaker (without causing air bubbles) - Then leave the sensor in the beaker and wait until the run-in time has passed (at least for 1 hour) - Take readings of original sensor signal from measurement/control device or measure using a digital multimeter - The sensor signal should approach zero. <p>-> If the sensor signal approaches zero, the zero point is likely to be ok.</p> <p>-> If the measured value deviates significantly from zero, maintenance must be carried out on the sensor according to section 10 of the instruction manual and the zero point check must be repeated. It has to be taken into account that a freshly cleaned working electrode (measuring electrode) has a relatively high zero point. The sensor needs a few days to reach its lowest zero point again.</p> <p>-> If the measured value does not approach zero even after maintenance was carried out, the sensor must be send back to the manufacturer for testing.</p> <p>Note: For sensors with very limited measurement ranges or high sensitivity, the zero points are always slightly above those of sensors with larger measurement ranges or low sensitivity.</p>
<p>Signal check</p>	<p><u>After zero point check</u></p> <ol style="list-style-type: none"> 1. Add some disinfectant to the beaker filled with clean tap water from section "zero point check" 2. Stir as steadily as possible using the sensor connected to the measurement device for at least 5 min. 3. During this time, you should observe an increase of the measuring signal <p>-> If the sensor signal increases, the sensor is likely to be ok. If the sensor does not react to the disinfectant, maintenance must be carried out on the sensor according to section 10 of the operating instructions and the "signal check" must be repeated.</p> <p>-> If the sensor still does not react to the disinfectant, the sensor must be send back to the manufacturer for testing.</p>

Periphery check	e. g. 1. Check flow 2. Check measuring cable 3. Check measurement/control device 4. Check proper calibration 5. Check dosing unit 6. Check concentration of disinfectant in the dosing tank 7. Check suitability of sensor for measuring the dosed disinfectant 8. Check concentration of disinfectant in the measuring water (analytics) 9. Check pH value of the measuring water 10. Check temperature of measuring water 11. Check pressure in the flow fittings 12. Check analytics
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17 Warranty

We grant a manufacturer’s warranty of two years on the electrode body including the electronics subject to appropriate application. The warranty does not apply to the membrane cap (wearing part), the electrolyte (expendable item) and service work to be performed.

(Cleaning of the parts in contact with the electrolyte, renewing the coating of the electrode finger and cleaning of the electrode tip with special abrasive paper). Should there be mechanical damage or should the serial number be illegible, the warranty becomes void.

Return of a sensor for check/reconditioning: Only shipments are accepted that are returned with carriage paid. Otherwise they will be returned to the sender.

On checked/reconditioned sensors we grant a warranty of one year on the electrode body including the electronics subject to appropriate application from the date of check/reconditioning. Should there be mechanical damage or should the serial number be illegible, this warranty becomes void.

18 Liability disclaimer

The sensors are manufactured with the greatest care and is subjected to a documented function test. Should any malfunctions occur in the sensor despite this, no liability claims may be lodged against the manufacturer in case of damage resulting from this malfunction.

Subject to technical changes!!