



OPTISYS CL 1100 **Technical Datasheet**

Free chlorine/chlorine dioxide/ozone measuring system

- ASR - Automatic Sensor Cleaning feature for reliable measurement
- High quality and precise gold electrodes for usage in water analysis
- Membrane-free sensor for a wide application range

The documentation is only complete when used in combination with the relevant documentation for the signal converter.

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1.1 Free chlorine/chlorine dioxide/ozone measuring system for water applications

The OPTISYS CL 1100 measuring system consists of the membrane free OPTISENS CL 1100 sensor. The sensor is characterised by standardised design, easy handling and a long life cycle. Together with the MAC 100 signal converter, flow-through holders, valves, temperature sensor and an optional pH sensor OPTISENS PH 8500, this is a tested and pre-wired measuring system which is very reliable and easy to maintain. The measuring system is suitable for a wide range of water analysis measurement tasks.



Highlights

- ASR - Automatic Sensor Cleaning feature for reliable measurement
- The measuring system is completely mounted and can be easily installed in the measuring loop.
- Unique combination of a membrane-free sensor with 2 gold electrodes for long-term stability and easy maintenance
- Suitable for measuring free chlorine, chlorine dioxide or ozone

Industries

- Water industry

Applications

- Monitoring drinking water quality
- Disinfection control
- Process water treatment
- Emergency chlorination for drinking water

1.2 Design and options

MAC 100 Multiparameter signal converter for liquid analytical measurements



A complete measuring system consists of:

- MAC 100 Multiparameter signal converter
- 1 or 2 sensors
- Mounting assemblies

Up to two sensors (for identical or different parameters) can be connected to the signal converter.

The signal converter MAC 100 can be adapted perfectly for your requirements: you specify the number and type of signal inputs and outputs, you define the complexity of the measuring point and the number of parameters. The standardised user interface also speeds up commissioning of the device and opens access to a wide range of diagnostic functions for devices and processes.

OPTISYS CL 1100



Ready to use system for measuring free chlorine, chlorine dioxide or ozone.

The measuring system consists of the following devices:

- MAC 100 Multiparameter signal converter
- OPTISENS CL 1100 sensor
- OPTISENS PH 8500 sensor (optional)
- Temperature sensor with sensor cable

OPTISENS CL 1100



The OPTISENS CL 1100 is a single rod sensor with integrated reference electrode. This potentiostatic sensor with 2 gold electrodes is in combination with our signal converter suitable for measuring free chlorine, chlorine dioxide or ozone. In addition to excellent measurement accuracy this leads to a high chemical and mechanical resistance of the electrode and therefore to a long service life with stable measurement performance.

OPTISENS PH 8500



The OPTISENS PH 8500 sensor is manufactured using highly sensitive special glass which can be used in almost all standard water applications due to its robust sensor design. In cases the pH value lies between pH 8 and 8.5 it is recommended to activate the pH compensation by choosing the dual channel version of the MAC 100.

Made to fit

The measuring system OPTISYS CL 1100 is already equipped with flow-through cells for temperature sensor and OPTISENS CL 1100 sensor. As an option an additional flow-through cell will be added for a pH sensor if the pH compensation or measurement is requested.

1.3 Measuring principle

Free chlorine measurement

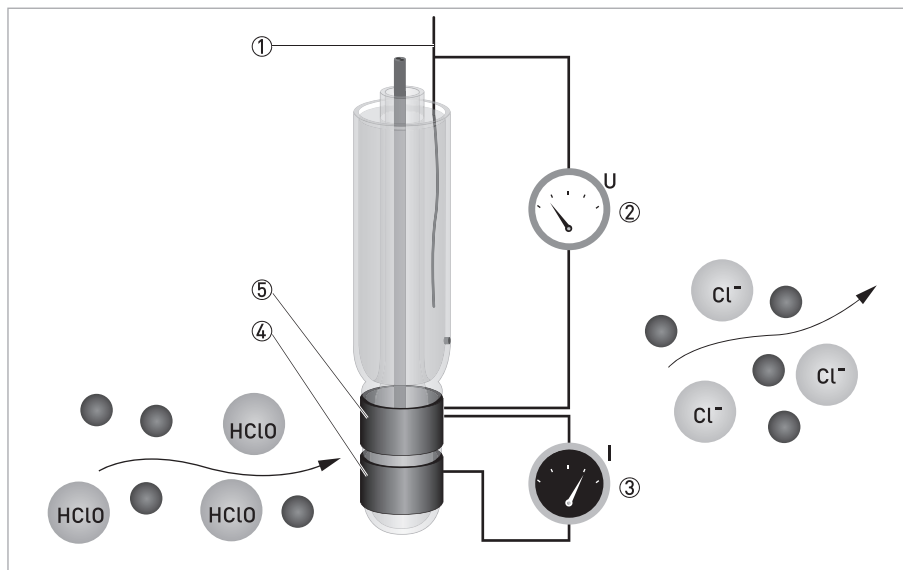


Figure 1-1: Free chlorine measurement

- ① Reference electrode
- ② Applied chlorine specific potential
- ③ Current needed to maintain the constant potential
- ④ Counter electrode
- ⑤ Measuring electrode

The sensor has three electrodes: a measuring electrode (gold), a counter electrode (gold), and a reference electrode (Ag/AgCl). A precise potential is built up between the measuring and the reference electrode. The measuring electrode starts polarising, i.e. ions collect close to the electrode to neutralize the electrical field. After polarisation the electrical current decreases to 0 mA as long as the polarising layer is not changed.

Free chlorine molecules that hit the surface of the measuring electrode take a defined portion of the charge with them, changing the measuring potential. The signal converter constantly measures the potential between measuring and reference electrode and immediately readjusts the potential as soon as it begins to change. The current needed to maintain a constant potential is directly correlated to the free chlorine concentration in the measuring medium.

Free chlorine (chlorine dissolved in water) changes its chemical composition depending on the pH value of the water. The pH value has consequences for the disinfection strength: with increasing pH the disinfection strength decreases.

- below pH3: Chlorine gas (Cl_2)
- between pH3 and pH8: Hypochlorous acid (HClO)
- above pH8: Hypochlorite (ClO^-)

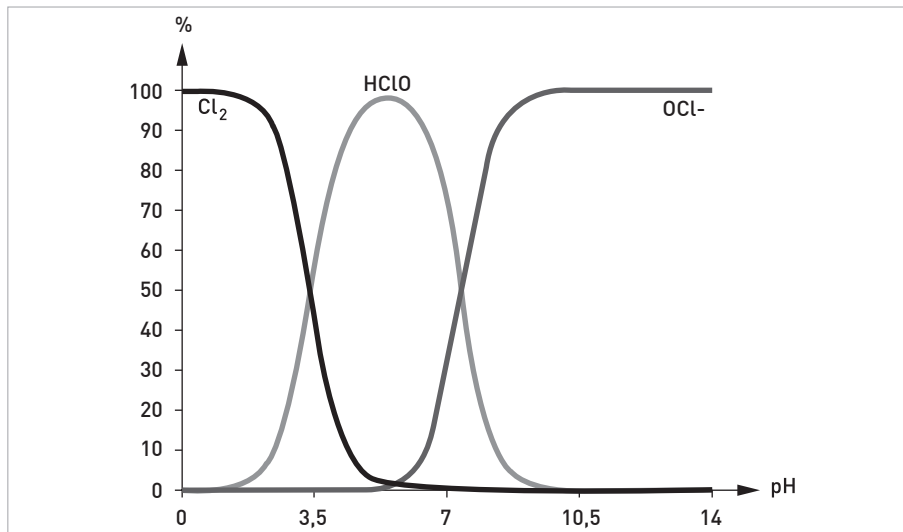


Figure 1-2: Composition of free chlorine depending on pH value

In order to obtain a reliable free chlorine measurement you should either control or compensate the pH value of the measuring medium. Because the pH measurement is temperature dependent, it also makes sense to measure the temperature. For further information on installing a pH sensor with temperature measurement, refer to the pH sensor manual.

Chlorine dioxide measurement

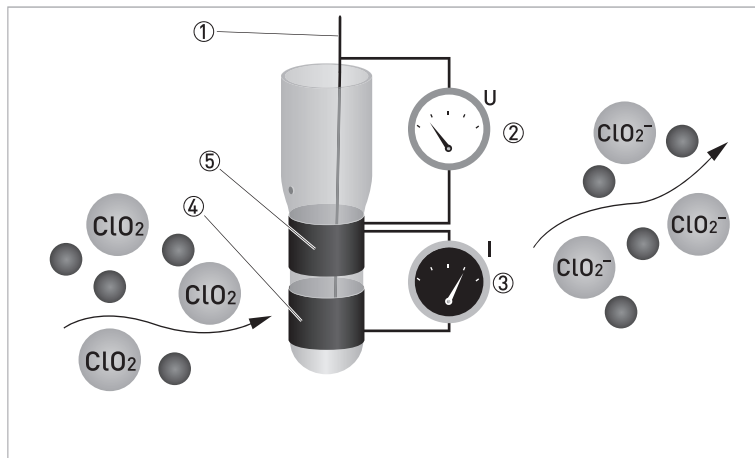


Figure 1-3: Chlorine dioxide measurement

- ① Reference electrode
- ② Applied chlorine dioxide specific potential
- ③ Current needed to maintain the constant potential
- ④ Counter electrode
- ⑤ Measuring electrode

Chlorine dioxide measurement

Chlorine dioxide (ClO_2) is an instable, non-storable, toxic gas with a characteristic scent. The molecule consists of one chlorine atom and two oxygen atoms – represented in the chemical formula ClO_2 . It is very reactive. To avoid the risk of spontaneous explosions of gaseous chlorine dioxide or concentrated solutions, it is generally handled in dilution with low concentrations. ClO_2 is soluble in water, but tends to evaporate quickly. Typically it is prepared on site, for example from hydrochloric acid and sodium chlorite. The procedure provides solutions with approx. 2 g/l ClO_2 that can be safely handled and stored for several days.

The disinfection effect of ClO_2 is due to the transfer of oxygen instead of chlorine, so that no chlorinated byproducts are formed. ClO_2 is used as disinfectant against biofilm, bacteria, spores, and viruses. Today it is believed that the molecule's unpaired electron is transferred to the DNA of the microorganism which cracks and causes cell necrosis. ClO_2 has a long-term effect of several days. In contrast to chlorine, the disinfection strength of ClO_2 does not depend on pH, and neither does the measurement show a pH influence in the range of pH 6 to pH 9.

ClO_2 is measured potentiostatic with measuring and counter electrodes of pure gold and an Ag/AgCl reference. The measurement shows high selectivity towards ClO_2 . A precise potential is built up between the measuring and the reference electrode. The measuring electrode starts polarising, i.e. ions collect close to the electrode to neutralise the electrical field. ClO_2 molecules that hit the surface take a defined portion of the charge with them. The controller measures the potential between measuring and reference electrode and readjusts the charge on the electrode surface. The current needed to maintain a constant potential is directly correlated to the dissolved chlorine dioxide concentration in the measuring medium.

Ozone measurement

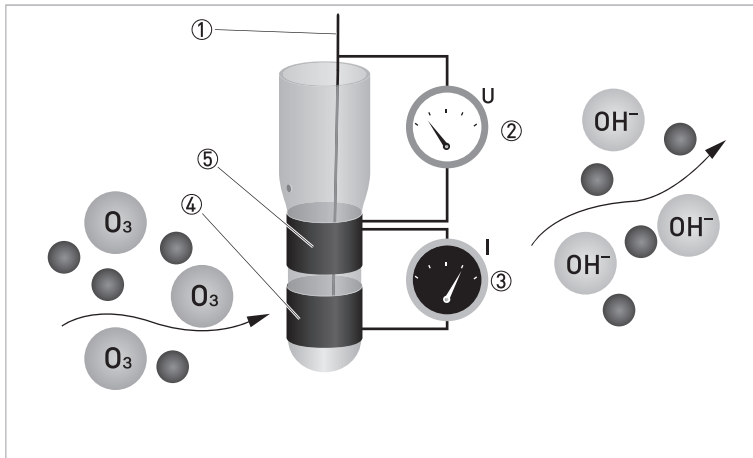


Figure 1-4: Ozone measurement

- ① Reference electrode
- ② Applied ozone specific potential
- ③ Current needed to maintain the constant potential
- ④ Counter electrode
- ⑤ Measuring electrode

Ozone measurement

Ozone (O_3) is an instable molecule of three oxygen atoms and a very strong oxidizing agent. At room temperature it is a gas. Due to its instability it cannot be stored in pressurised cylinders and has to be prepared on site.

O_3 is an eco-friendly disinfectant. However, its great disinfection strength can only be used to good advantage in suitable reactors with a reaction time of at least 3 minutes. The long-term effect of O_3 is only a few minutes.

O_3 is measured potentiostatic with measuring and counter electrodes of pure gold and an Ag/AgCl reference. The measurement shows high selectivity towards ozone. A precise potential is built up between the measuring and the reference electrode. The measuring electrode starts polarising, i.e. ions collect close to the electrode to neutralize the electrical field. O_3 molecules that hit the surface take a defined portion of the charge with them. The controller measures the potential between measuring and reference electrode and readjusts the charge on the electrode surface. The current needed to maintain a constant potential is directly correlated to the dissolved ozone concentration in the measuring medium. The sensor design with 3 electrodes in a single rod enables us to use our patented cleaning procedure ASR (patent Dr. A. Kuntze) providing you with a low-maintenance measuring setup.

2.1 Technical data

Measuring system

Measuring principle	Potentiostatic with double gold electrodes		
Application range	Continuous measurement of free chlorine in water applications.	Continuous measurement of chlorine dioxide in water applications.	Continuous measurement of ozone in water applications.
Measuring range	Cl ₂ : 0.03...20 mg/l	ClO ₂ : 0.05...5 mg/l	O ₃ : 0.05...5 mg/l

Installation conditions

Installation	Wall installation with sample feed
Ingress protection for housing	IP65
Sample flow connections	Tube connection DN6/8
Drill hole	10 mm / 0.39"

Measuring accuracy

Reference conditions	Medium: water
	Temperature: 20°C / 68°F
	Pressure: 1 bar / 14.5 psi (absolute)
Maximum measuring error	0.1 mg/l
	Temperature: 1.0% full scale
Repeatability	0.01 mg/l
Resolution	0.01 mg/l
Long-term stability	24 hours: tested within accuracy definition
Temperature drift	Tested within accuracy definition
Response time (t ₉₀)	< 20 seconds

Operating conditions

Ambient temperature	-15...+55°C / +5...+131°F
Process temperature	0...+50°C / +32...+122°F
Max. operating pressure	6 bar at 20°C / 87 psi at 68°F
Flow rate	≥ 30 l/h / 7.93 gal/h
Min. conductivity	≥ 200 μS/cm

Material

Wetted	Flow cell	Acrylic glass
	Float	PVC
	Temperature sensor	PVC
	Chlorine sensor	Glas with measuring and counter electrode made of gold Reference electrode Ag/AgCl
	Sealings	EPDM
	Valves	PP
Non-Wetted	Converter housing	Die-cast aluminium (polyurethane coated) Optional stainless steel with polyamide cable glands
	Mounting plate	PVC

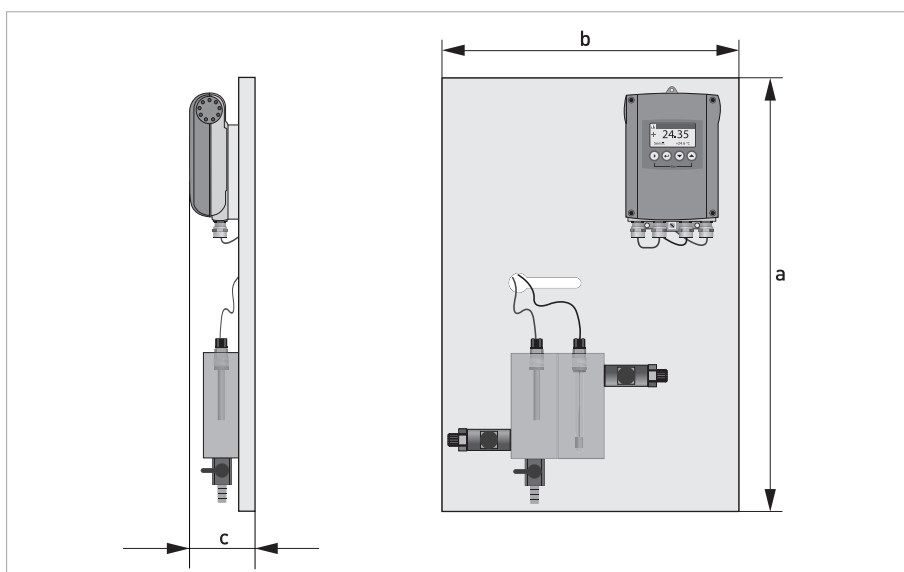
Power supply

Voltage	100...230 VAC (-15% / +10%), 50/60 Hz; 240 VAC + 5% is included in the tolerance range. 12...24 VAC/DC
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Inputs and outputs

General	All in- and outputs are electrically isolated from each other and from all other circuits. All operating data and output values can be adjusted.
Current output	Three isolated outputs (4...20 mA), all galvanic isolated, errors signals 3.25 mA and 22 mA, active mode Output data: depending on sensor Operating data: $U_{int, nom} = 15$ VDC, $I = 0(4)...22$ mA, $I_{max} \leq 22$ mA, $R_L \leq 550 \Omega$
Relay outputs	Three electro-mechanical relays that can work as alarm relays or limit switches Possible conditions: NO (normally open) or NC (normally closed) Contact ratings: Relays for low voltages: $U \leq 30$ VDC, $I \leq 1$ A, resistive load (PELV / SELV) or $U \leq 50$ VAC, $I \leq 4$ A, resistive load (PELV / SELV) Relays for high voltages: $U = 100...230$ VAC, $I \leq 4$ A, max. 1000 VA resistive load
Control input	Passive, not polarity sensitive, $U_{ext, max} \leq 32$ VDC, $I_{nom} = 6.5$ mA with $U_{ext} = 24$ VDC, $I_{nom} = 8.2$ mA with $U_{ext} = 32$ VDC Switching point for identifying "contact open or closed": contact open ("off") at $U_0 \leq 2.5$ V with $I_{nom} = 0.4$ mA, contact closed ("on") at $U_0 \geq 8$ V with $I_{nom} = 2.8$ mA

2.2 Dimensions and weights for the system



	Dimensions	
	[mm]	[inch]
a	700	27.56
b	400	15.75
c	105.2	4.14

Weight: 5.15 kg / 11.35 lb

2.3 Combination sensor/signal converter

Sensor type	Measured parameter	Measuring principle	Signal converter	
			Input A	Input B
pH	pH value	Potentiometric	X	X
ORP	ORP value	Potentiometric	X	X
Cl ₂	Free chlorine	Amperometric	X	-
ClO ₂	Chlorine dioxide	Amperometric	X	-
O ₃	Ozone	Amperometric	X	-
DO	Dissolved oxygen	Amperometric ①	X	-
		Optical ①	X	-
COND	Conductivity/ specified resistance	Conductive	X	X
IND	Toroidal conductivity	Inductive	X	X
TUR	Turbidity	Optical ①	X	-

① only for single channel version

3.1 General notes on installation

Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

Do a check of the packing list to make sure that you have all the elements given in the order.

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

3.2 Intended use

Responsibility for the use of the measuring devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.

This device is a Group 1, Class A device as specified within CISPR11:2009. It is intended for use in industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.

The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose.

The intended use of the OPTISYS CL 1100 system is the measurement of dissolved free chlorine, chlorine dioxide or ozone in industrial water applications.

3.3 Pre-installation requirements

- Do not touch or scratch the gold electrodes of the sensor.
- Make sure that the gold electrodes are clean and dust-free. If necessary, clean the tip as described in the manual of the OPTISENS CL 1100 sensor.
- The device must not be heated by radiated heat (e.g. exposure to the sun) to a electronics housing surface temperature above the maximum permissible ambient temperature. If it is necessary to prevent damage from heat sources, a heat protection (e.g. sun shade) has to be installed.

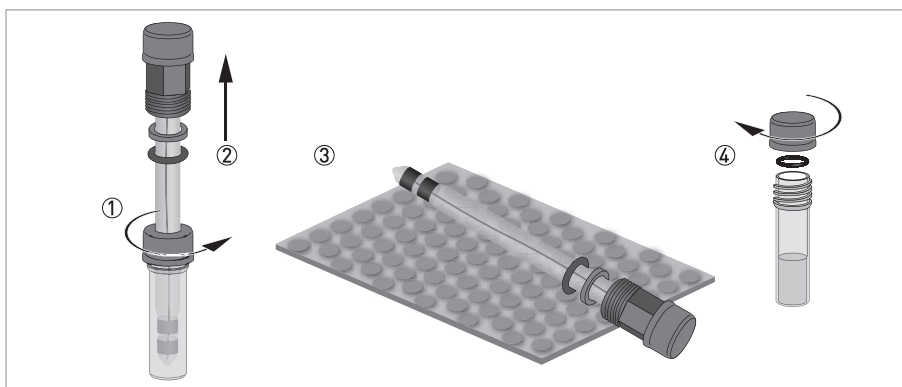


Figure 3-1: Handling the sensor

Unpacking the sensor

- Loosen the storage cap which is screwed on to the plastic tube ①.
- Gently pull the sensor out of the plastic tube ②.
- Lay the sensor on a soft mat/tissue ③.
- Screw the provided sealing cap on to the plastic tube, using O-ring and washer as pictured in the drawing ④. Keep the storage cap (the one with the hole in it) in the original packing.

3.4 Mounting to OPTISYS CL 1100 measuring system

The OPTISYS CL 1100 is a preconfigured free chlorine, chlorine dioxide or ozone measuring system.

The sensors are delivered with protective caps, which have to be removed before mounting into the flow-through cells.

Installing a new sensor

- Make sure that the O-ring and the washer on the sensor are assembled in the correct order.
- Screw the sensor into the female thread of the flow-through cell. Tighten the sensor by hand.
- If you have not yet established the electrical connection to the signal converter, leave the protective cap on the sensor until you establish the electrical connection.

4.1 Safety instructions

All work on the electrical connections may only be carried out with the power disconnected. Take note of the voltage data on the nameplate!

Observe the national regulations for electrical installations!

Observe without fail the local occupational health and safety regulations. Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

4.2 Connecting the cable to the sensor

Moisture on the sensor connector must be avoided! Moisture may cause a short-circuit and a malfunction of the sensor!

If moisture has entered the connector dry it with air (e.g. hair blower).

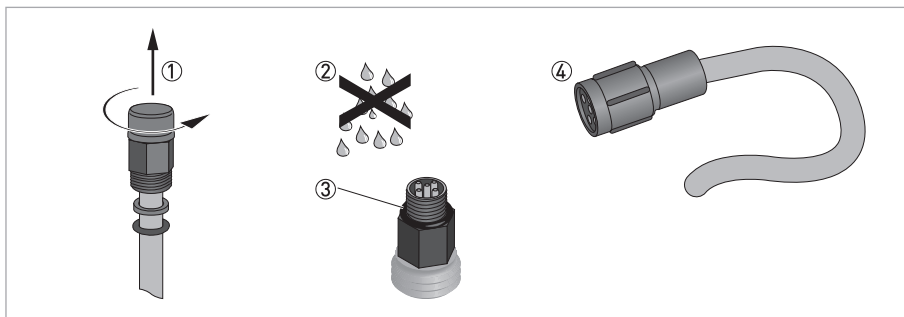


Figure 4-1: Connecting the cable to the sensor

- Unscrew the protective cap from the sensor connector and keep it for future use ①.
- Ensure that both cable and sensor connector are dry ②.
- Make sure that the O-ring is positioned on the sensor connector ③.
- Push the cable connector ④ on to the sensor.
- Screw the cable connector to the sensor and tighten it by hand.

4.3 Connecting the sensor cable to the signal converter

All work on the electrical connections may only be carried out with the power disconnected. Take note of the voltage data on the nameplate!

The sensor cables are prewired to signal converter by the manufacturer.

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

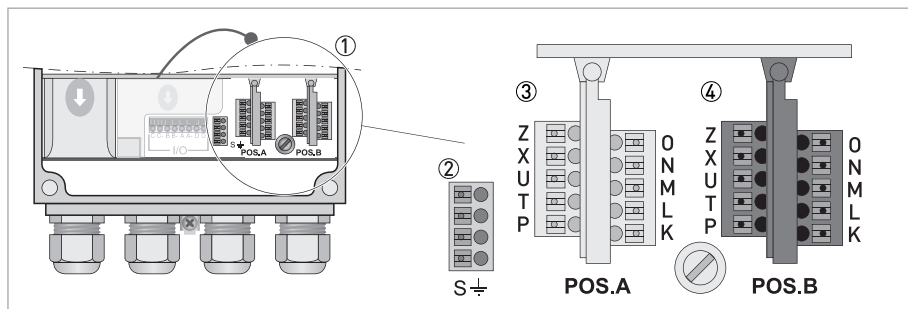


Figure 4-2: Sensor connection terminals on the signal converter

- ① Sensor connection terminals
- ② Terminal block S (protective earth)
- ③ Terminal block Pos.A: terminal for OPTISENS CL 1100 sensor and temperature
- ④ Terminal block Pos.B: terminal for pH sensor and temperature

The sensors for free chlorine, chlorine dioxide or ozone are always connected to terminal block Pos.A of the signal converter. Depending on the configuration of the signal converter, a pH sensor may be connected to terminal block Pos.B. An external temperature sensor may be connected to terminal block Pos.A. (For detailed information how to install and configure a pH and/or a temperature sensor please refer to the pH sensor documentation.)

Wire Cable CL-W-1100	Terminal block Pos.A
blue	K (counter electrode)
white	L (reference electrode)
brown	M (measuring electrode)
coax shield	S (protective earth)

Wire Cable pH/ORP-W-Coax	Terminal block Pos.B
coax shield (red)	N (ref.)
coax core (transparent)	O (pH/ORP)

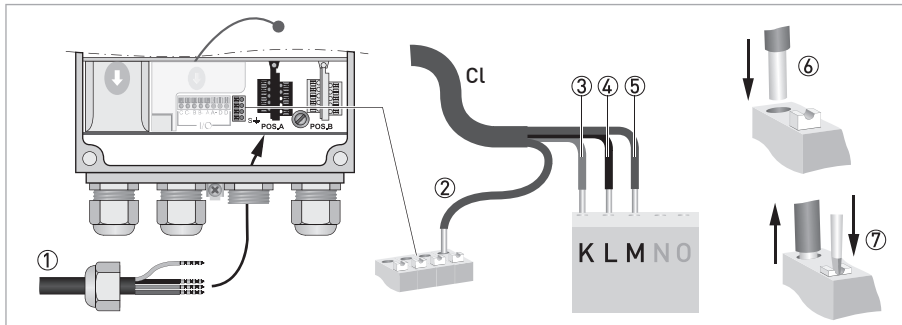


Figure 4-3: Connecting the 4-wire coax cable

Connecting the sensor cable to the signal converter

- Thread the sensor cable through the middle right cable gland ①.
- Push the coax shield cable ⑥ into one of the terminals of terminal block S ②.
- Push the blue ③, white ④, and brown ⑤ wire into the terminals of terminal block Pos.A as described in the previous drawing/table.
- To remove a cable, press down the white clip ⑦ on the corresponding terminal and pull the cable out.

4.4 Connecting the external temperature sensor

Connect an external Pt100 or Pt1000 sensor to terminal block Pos.A/B of the signal converter according to the following drawings:

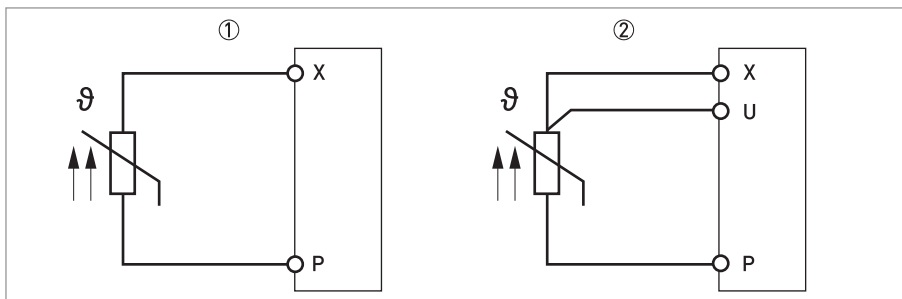


Figure 4-4: Connection of an external Pt100/1000 temperature sensor to the signal converter (2-wire connection)

- ① 2-wire connection
- ② 3-wire connection

5.1 Order code

The characters of the order code highlighted in light grey describe the standard.

VGA K	4	Type/Housing converter
	A	OPTISYS CL 1100 (die cast aluminium)
	B	OPTISYS CL 1100 (stainless steel)
		Sensor input A
	4	Cl ₂ : 0.03...5 mg/l (ppm)
	5	ClO ₂ : 0.05...5 mg/l (ppm)
	6	O ₃ : 0.05...5 mg/l (ppm)
	8	Cl ₂ : 0.03...20 mg/l (ppm)
		Sensor input B
	0	none
	3	pH/ORP (pH preconfigured)
	A	pH/ORP (ORP preconfigured)
		Signal outputs
	3	3 x 0/4...20 mA
		Approvals
	0	none
		Relays
	0	none
	3	3 x free programmable (mechanical)
		Operation language
	1	English
	2	German
	3	French
	4	Spanish
		Power supply
	1	100...230 VAC
	2	24 VAC/DC
		Options
	1	Wall mounting of signal converter
		Documentation
	0	none
	1	English
	2	German
	3	French
	4	Spanish
	7	Italian
		Cable feed through
	1	4 x M20 (Polyamid)

												Supplementary equipment				
												1	ASR Automatic Sensor Cleaning (only for Cl ₂ , ClO ₂ , O ₃)			
												Equipment chlorine system				
												1	Mounted with flow cell (2 pieces)			
												2	Mounted with flow cell, incl. pH measurement (3 pieces)			
VGA K	4															

5.2 Accessories and Spare parts

Accessories

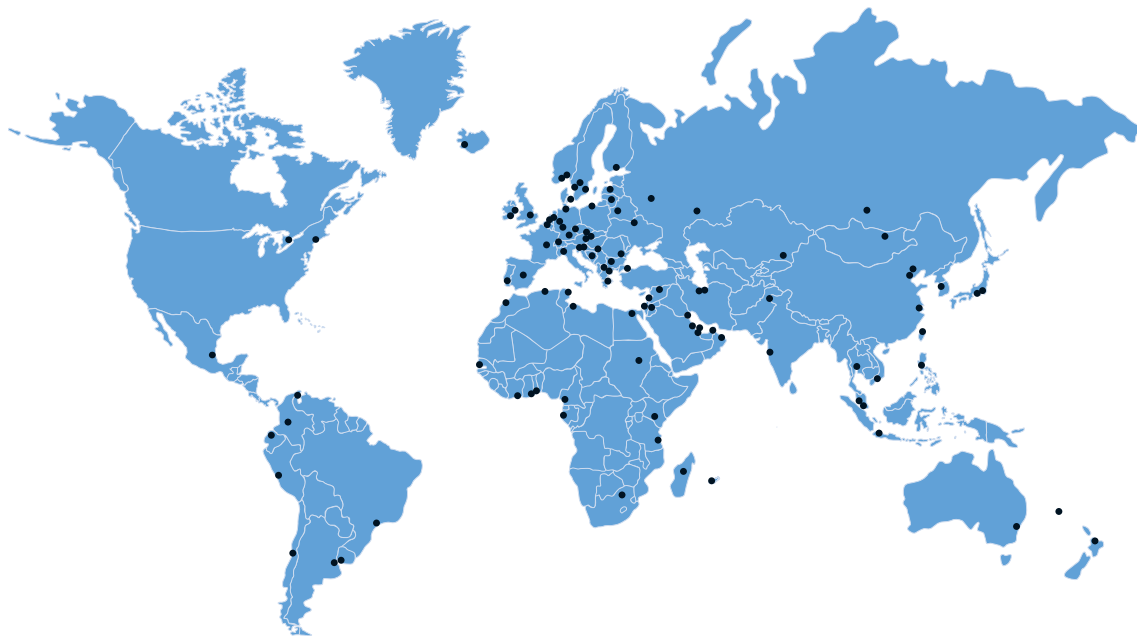
Order code

Chlorine rapid test kit	XGAM010170
Chlorine pocket photometer (case without DPD dispenser)	XGAM010200
DPD dispenser for free chlorine - 100 tests 5 ml for chlorine pocket photometer	XGAM010210
Hose adapter G1/2" to DN8 and DN10 (2 pieces)	XGAM010300
Flow limiter	XGAM010310

Spare parts

Order code

1x flow-cell incl. blind plug and connections bolts	XGAM010180
2x flow-cell incl. valves, float, blind plug and connections bolts	XGAM010190
Pt100 temperature sensor	XGAM010255
Mounting panel for MAC 100	XGAM010240
Multiple sealing insert (IP65)	XGAM010320



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