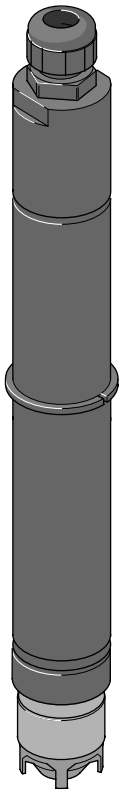
ProMinent®

Operating Instructions

DULCOTEST® Chlorine Dioxide Sensor
Typ CDP 1-mA-2 ppm



Please read the operating instructions through completely before commissioning this equipment! Do not discard!
The operator shall be liable for any damage caused by installation or operating errors!

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Operating Instructions
DULCOTEST® Chlorine Dioxide Sensor CDP

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Subject to technical alterations.

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Instructions for Use

This operating instructions manual includes product descriptions in the main text,

- enumerated points
- ▶ highlighted points

and safety guidelines indicated with symbols:

CAUTION

Could result in lesser injuries or damage to property if safety guidelines are not observed.

IMPORTANT

Could result in damage to property if safety guidelines are not observed.

NOTE

Working guidelines.

1 About this Sensor

The CDP chlorine dioxide probe is a membrane covered amperometric dual electrode sensor. It is used to determine chlorine dioxide concentrations in water with or without surfactants present. This sensor has been developed for use in bottle washing systems (water containing surfactants, sudden temperature changes). The sensor emits a standard 4 - 20 mA signal via a two wire interface that is largely unaffected by water flow. Power is also supplied to the sensor via the two-wire interface.

2 Safety

Correct use of equipment

The sensor may be used only to determine and regulate chlorine dioxide concentrations (ClO_2).

All other applications and modification of this equipment are forbidden.

The sensor is not a safety component!

CAUTION

- ***The sensor will operate correctly only if used in a purpose-designed ProMinent probe housing assembly (see Assembly).***
- ***The sensor can be operated only with a DULCOMETER® D1C measurement and control device with automatic temperature correction. (Identity code: D1CAxxD12x1xxxxxx or D1CAxxD13x1xxxxxx).***
- ***There must be free discharge from the probe housing assembly.***
- ***The supply voltage to the measuring device and the sensor must not be interrupted. After long intervals without power (more than 2 h) the probe should be given a further run-in period and recalibrated (see 7.1 "Run-in period" and 7.2 " Calibration").***

IMPORTANT

- ***The probe may be assembled, installed, serviced and operated only by appropriately trained and authorised personnel.***
- ***Check the sensor regularly for dirt, algae growth and air bubbles. (see 8 "Troubleshooting").***
- ***Observe valid national directives for the maintenance, servicing and calibration intervals.***

3 Construction and Function

Construction

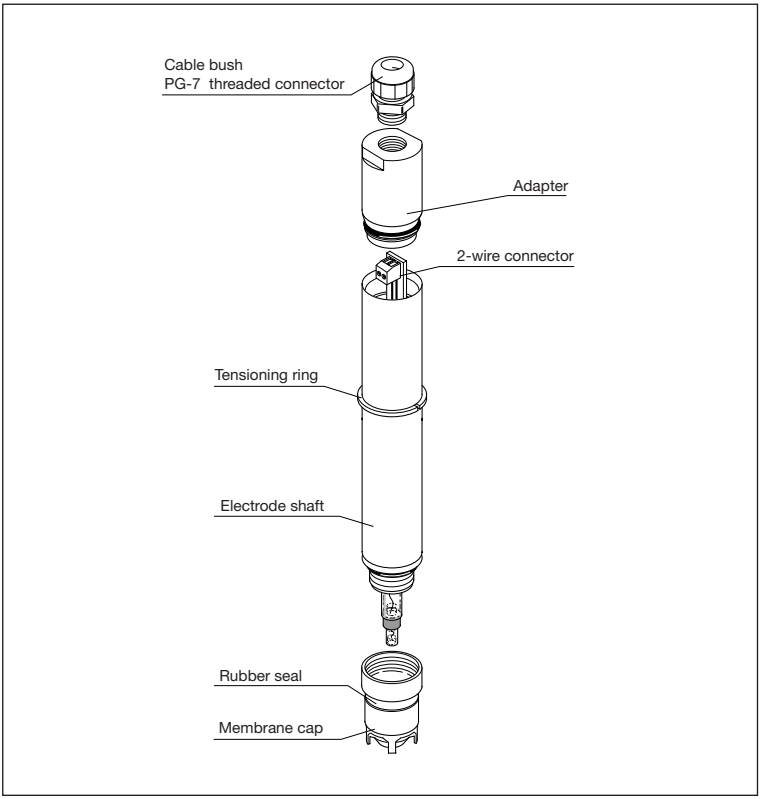
The CDP chlorine dioxide sensor is a membrane covered dual electrode measurement sensor. It essentially consists of the membrane cap and the electrode shaft. The membrane cap filled with electrolyte forms the measuring chamber. The electrodes in the electrode shaft project into the measurement chamber. The sample water passes over the micro-porous membrane and the gases pass through the membrane into the measurement chamber. The amplifying electronics are situated above the electrodes in the electrode shaft, above which is located the two-wire terminal.

An external sensor gauge Pt 100 compensates for temperature influences.

Function

The chlorine dioxide passes through the membrane into the measuring chamber and delivers an electron to the collector. The voltage between the collector and reference electrode causes an electrical current to be produced. This current is proportional to the chlorine dioxide content present within the sample. The amplification electronics transform the current into an un-calibrated standard output signal. This is taken up by the two-wire terminal and transmitted to the controller.

Fig. 1
Sensor construction



4 Transport and Storage

NOTE

Sensor must be transported, sent and stored in the original packaging only. Please retain packaging complete with polystyrene parts.

Storage

Storage and transport temperature	5 to 50 °C
Humidity	max. 90 % relative humidity Non-condensing
Shelf life of sensor and membane cap in original packaging:	2 years
Shelf life of electrolyte:	1 year

NOTE

If a sensor has been stored for longer than a year, return it to ProMinent for checking or servicing. We cannot otherwise guarantee the safe function and accurate measurement of the device.

Contents

- 1 CDP sensor
- 1 bottle of electrolyte (100 ml)
- 1 operating instructions manual
- 2 replacement membrane caps

5 Assembly

Adding the electrolyte

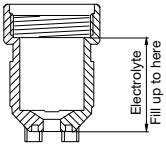
IMPORTANT

- ***The membrane at the lower end of the membrane cap and the electrodes at the lower end of the electrode shaft should not be touched, damaged or brought into contact with greasy substances. The sensor will not otherwise work correctly. If this occurs, install a new membrane cap or return to ProMinent to have the electrodes cleaned.***
- ***The electrolyte gel is non-toxic and is easily removed from skin/clothing using water.***

NOTE

Carry out the following steps at a washbasin!

- ▶ Open the electrolyte bottle (included with sensor) and screw on the nozzle.
- ▶ Remove the red cap completely from the nozzle and flip up the end of the nozzle to open.
- ▶ Pull off the protective cover and unscrew the membrane cap from the electrode shaft.
- ▶ Rinse the membrane cap and the electrode with a small amount of electrolyte.



- ▶ Place the lower edge of the nozzle of the electrolyte bottle vertically downwards into the inside the membrane cap without touching the membrane.
- ▶ Fill the membrane cap in one movement up to the start of the thread with electrolyte (see drawing), keep the nozzle in the electrolyte all the time. A few very small bubbles may form.
- ▶ Check that the membrane is fully wetted - the previously white membrane will darken. If necessary, wait a while. Repeat filling if the membrane fails to go dark.

Assembling the membrane cap

- ▶ Locate the electrode shaft vertically onto the filled membrane cap and turn until the thread bites.
- ▶ Turn the electrode shaft until the small hole below the rubber seal is visible at the top.
- ▶ **Slowly** tighten the membrane cap by hand (do not hold the rubber seal!). The membrane must not be allowed to distort under the internal pressure otherwise it will be unusable. Excess electrolyte should drain out of the small hole below the seal as the sensor is screwed together.
- ▶ Hands and sensor should be rinsed thoroughly in cold water in order to remove excess electrolyte.

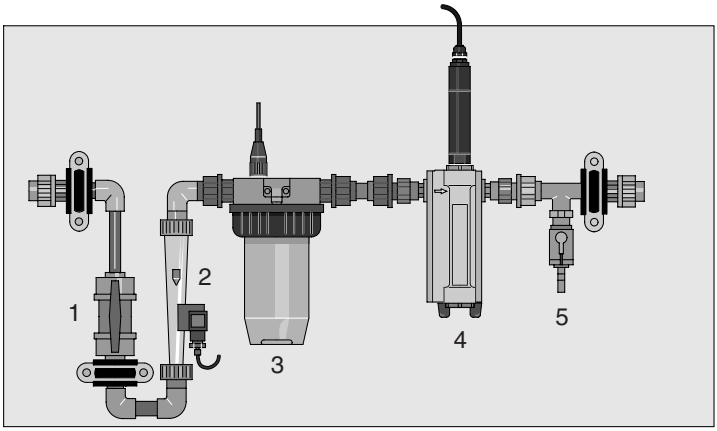
Inserting the sensor

IMPORTANT

- ***The sensor must be mounted in a CDP probe housing assembly as shown in the diagram (see also 15 "Technical Data").***
- ***The sensor must be slowly inserted into or withdrawn from the DGM in-line probe housing assembly (4). The membrane could otherwise be damaged.***
- ***Do not touch the in-line probe housing assembly flow resistor with the membrane.***
- ***The sensor must be kept wet at all times once commissioned - e.g. the in-line probe housing assembly must not be allowed to run dry.***

NOTE

- ***On bottle washing machines an isolation valve should be mounted directly onto the probe sampling water extraction point. It should only be possible to open this valve when the bottle washing machine is in a normal operating status. When the machine is undergoing cleaning processes, the valve should remain closed. This prevents highly concentrated anti-scalant chemicals from coming into contact with the sensor.***
- ***Install the sensor as described in the operating instructions of the in-line probe DGM.***



1 Isolation valve
2 In-line flow housing
3 DLG III
4 DGM
5 Sampling tap

6 Installation

IMPORTANT

- **The probe is not electrically isolated from the sample water. Ensure that it is electrically insulated against all other elements. The controller must be insulated both against the sensor and from the supply voltage.**

The sensor incorporates a passive 4-20 mA two wire interface, i.e. the power is supplied externally, e.g. via the controller.

- The sensor must be used only when connected to a DULCOMETER® D1C controller with automatic temperature correction. (Corresponding identity code: D1CAxxD12x1xxxxxx or D1CAxxD13x1xxxxxx).
- Do not switch off the measuring system when in intermittent use. If necessary, dosing equipment should be timer-controlled.

Electrical installation

▶ Rotate the sensor adapter anticlockwise through 90° and pull off (bayonet fitting).

▶ Unscrew the PG-7 threaded connector tensioning screw and insert the signal cable from the controller.

▶ Strip the ends of the cable and attach to the 2-wire terminal: 1 = plus, 2 = minus.

▶ Insert approx. 5 cm of signal cable into the sensor and tighten the PG-7 threaded connector tensioning screw.

▶ Push the sensor adapter right into the housing and twist in a clockwise direction until you reach the stop taking care not to damage the bayonet fitting.

7 Operation

IMPORTANT

Do not switch off the measuring system during interval operation! After operation without chlorine dioxide, running-in periods are to be rockoned with. If required, switch on metering unit time-delayed! If no chlorine dioxide is metered for a longer period of time, the sensor must be disconnected from the power supply and stored dry.

7.1 Run-in Period

The sensor requires a run-in period before it will display stable readings.

First commissioning:	4 - 12 h
Re-commissioning:	2 - 4 h
Membrane-/electrolyte replacement:	approx 1 h

7.2 Calibration

The sensor can be calibrated after the run-in period.

IMPORTANT

- ***A slope test must be carried out after replacing the membrane cap or electrolyte.***
- ***Slope tests must be carried out at regular intervals to ensure correct functioning of the sensor. When used in bottle washing machines it may be necessary to re-calibrate the sensor every week or even more frequently.***
- ***Avoid incorrect dosing due to air bubbles in the sample water. Air bubbles clinging to the sensor membrane can result in a measured variable that is too low and thus lead to incorrect dosage.***
- ***Observe applicable national directives for calibration intervals.***

Preconditions

- The sensor has been run in (see 7.1 “Run-in Period”)
- Constant flow through in-line probe housing assembly (see 15 “Technical Data”)
- Constant sample water temperature
- Similar sample water and sensor temperatures (wait approx. 15 min.)

Zero point calibration

If a ProMinent controller is being used to operate the sensor, zero point calibration is only usually necessary the first time the equipment is commissioned. Zero point calibration should be carried out, however, if operating the sensor in the lower measurement range.

- ▶ Immerse the sensor in a container of clean, ozone, chlorine and ClO_2-free water.
- ▶ Stir with the sensor until the measured variable displayed at the controller has remained stable for 5 min.
- ▶ Calibrate the controller to zero in accordance with the operating instructions.
- ▶ Reinstall the sensor in the in-line probe housing assembly.

Slope test

NOTE

For bottle washing machines, carry out calibration only after a relatively long period of trouble-free operation or if the bottle washing machine is left to stand (ClO_2 concentration remains constant).

Since ClO2 breaks down rapidly it is important that the sensor is calibrated equally rapidly. If a mobile measuring device is not available, please observe the following: Carry out the reaction of the sample water with the DPD-1 reagent directly at the bottle washing machine: then send the probe to the laboratory as fast as possible for measuring.

- ▶ Determine the chlorine dioxide content in the sample water using an appropriate measurement device (e.g. Photometer DT 1).
- ▶ Enter the resulting value into the controller in accordance with the operating instructions.

Repeat calibration after 1 day.

8 Troubleshooting

Fault	Possible cause	Remedy
The sensor cannot be calibrated - measuring device/ controller display value is *greater* than DPD-1 measurement	Run-in period too short	▶ See 7.1 “Run-in period”
	Membrane cap damaged	▶ Replace membrane cap. Run-in sensor, calibrate
	Interference from water contaminants (see 15 “Technical Data”, “Cross-Sensitivity”)	▶ Identify interfering contaminant and implement remedy
	Short circuit in signal cable	▶ Identify short circuit and repair
	Outdated DPD chemicals	▶ Use new DPD chemicals, repeat calibration
The sensor cannot be calibrated - measuring device/ controller display value is *smaller* than DPD-1 measurement	Run-in period too short	▶ See 7.1 “Run-in period”
	Membrane cap deposits	▶ Remove deposits (see 9 “Servicing”). Replace membrane cap. Run-in sensor, calibrate
	Sample water flow inadequate	▶ Increase flow (see 15 “Technical Data”)
	Air bubbles on the outside of the membrane	▶ Tap to remove air bubbles and increase flow if necessary
	Reference electrode spent (shiny patches appearing)	▶ Return sensor to ProMinent
	No electrolyte in membrane cap	▶ Add new electrolyte (see 5 “Assembly”, 7.1 “Run-in Period” and 7.2 “Calibration”)
	Electrolyte is penetrating sample water via gas bubbles	▶ Discuss with ProMinent
Measured variable value is “zero”	Interference from water contaminant (see 15 “Technical Data”, “Cross-Sensitivity”)	▶ Identify contaminant and replace water if necessary
	ClO_2 content below the lower measuring range limit	▶ Add ClO_2 and then repeat calibration or use appropriate sensor
	Sensor incorrectly connected to controller	▶ Connect sensor correctly to controller
Measured variable display unstable	Air bubbles on the outside of the membrane	▶ Tap to remove air bubbles and increase flow if necessary
	Membrane damaged	▶ Replace membrane cap. Run-in sensor, calibrate
	Cause lies with the controller	▶ Identify cause and remedy

9 Servicing

IMPORTANT

- ***The sensor must be regularly serviced in order to avoid exceeding dosage due to sensor failure.***
- ***Observe applicable national directives for service intervals.***

Service intervals daily / weekly depending upon application.

Servicing tasks

- ▶ Check the sensor display value on the controller using an appropriate chlorine dioxide measuring system (e.g. Photometer DT 1: observe note in 7 “Operation/Calibration”).
- ▶ If necessary recalibrate the sensor (see 7.2 “Calibration”).
- ▶ Check the DLG cup at regular intervals for dirt.

If it is no longer possible to calibrate the sensor to the D1C you can try to clean the membrane.

Cleaning the membrane

You can remove small amounts of dirt by rinsing under a gently stream of tap water. In all other cases you must replace the membrane cap.

IMPORTANT

Never attempt to clean the membrane with acids/alkalis or mechanical aids (brushes or similar).

If the sensor fails to calibrate after cleaning, you must replace the membrane cap.

Replacing the membrane cap

Firstly, unscrew the old membrane cap and rinse off as much of the electrolyte gel clinging to it as possible under running water. The rest of the gel can be removed with the aid of a soft paper handkerchief. Rub lightly over the sensor, particularly the reference system (brown ring). Then fill a new membrane cap with electrolyte gel and screw on (see 5 “Assembly”).

10 Repairs

The sensor may be repaired only at the factory. Please return in its original packaging. Prior to return, please carry out instructions as described in 11 “Decommissioning”.

11 Decommissioning

Decommissioning sensor: observe all safety guidelines as given in section 5 “Assembly”.

- ▶ Disconnect sensor from power supply (see 6 “Installation”).
- ▶ Depressurise the in-line probe housing assembly.
- ▶ Loosen the tensioning screw.
- ▶ Slowly pull out the sensor from the in-line probe housing assembly.
- ▶ Unscrew the membrane cap over a wash basin or similar and empty.
- ▶ Rinse away the electrolyte gel with cold water (see 9 “Servicing”).
- ▶ Rinse the electrodes with clean water and allow to dry.
- ▶ Screw on a fresh membrane cap loosely to protect the electrodes.
- ▶ Fit the membrane cap cover to protect the membrane cap.

12 Disposal

Elektrolyte

The electrolyte is non-toxic and can be disposed of with in-house waste.

Sensor

IMPORTANT

- ***Electronic waste is classified as special waste.***
- ***Observe currently applicable local directives.***

In Germany used parts may be disposed of at communal town or district collection points.
Used devices can alternatively be returned to ProMinent headquarters for a small charge. Please apply correct postage.

13 Ordering Information

• 1 bottle of electrolyte (100 ml)	Part no. 1002712
• 1 membrane cap	Part no. 1002710
• Accessory set (2 membrane caps + 1 bottle of electrolyte)	Part no. 1002744
• Two-wire signal cable (2 x 0.25 mm^2, Ø 4 mm)	Part no. 725122.6
• CDP 1-mA-2 ppm (complete set)	Part no. 1002149

The sensors themselves can be ordered only as complete sets:

1 sensor
1 bottle of electrolyte
2 replacement membrane caps
1 operating instructions manual

14 Complies with Directives and Standards

EU directives:	EG-EMV RL 89/336/EWG
	91/263/EWG i.d.F. 92/31/EWG
International standards:	EN 50 081-1
	EN 50 082-2

15 Technical data

Measured variable	Chlorine dioxide (ClO_2)
Application range	Process water containing surfactants, drinking water
Measurement range	0.02 - 2 mg/l (at 40 °C)
pH range	5.5 - 10.5
Temperature range	10 - 45 °C, 55 °C for short periods Temperature compensated with external temperature sensor Pt 100
Temperature fluctuation speed	Up to 10 °C/min
Storage temperature	5 - 50 °C
Resolution	Corresponds to measurement range limits below
Max. pressure	3 bar, 1 bar recommended (zero pressure at outlet, no pressure surges)
Sample flow	Recommended: 60 l/h Minimum: 40 l/h Maximum: 100 l/h
Cross-sensitivity	Ozone, chlorine
Shelf life Membrane cap	Typically 3 - 6 months depending upon the water quality
Materials	Membrane cap: Clear PVC Electrode shaft: Black PP and natural coloured PMMA
Supply voltage	16 - 24 V DC
Output signal	4 - 20 mA
Enclosure rating	IP 65

Addresses and Delivery Records from the manufacturer:

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