Measuring, control and sensor technology

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ProMinent GmbH
Im Schuhmachergewann 5-11
69123 Heidelberg
Germany
Phone +49 6221 842–0
info@prominent.com
www.prominent.com

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Product Catalogue Volume 2

Measuring, Control and Sensor Technology

Precision by design

Precise sensor technology and high-performance measuring and control technology are the guarantee of process safety when metering liquid media.

We deal with it in detail in **Chapter 1**! Discover a huge range of DULCOTEST® sensors for precise recording of different parameters in real time.

The controllers in **Chapter 2** will introduce consistent quality into your process. From the simple conversion of measuring signals to controllers optimised for complex, application-specific control tasks - the optimum product for every task awaits you here!

Completely assembled measuring and control points are described in **Chapter 3**. They are designed for the measurement of potable water, cooling water and waste water. The ready-wired plug-and-play modules, with perfectly matched components, are ready for fast and easy installation.

Chapter 4 is devoted to the treatment of swimming pool water. The product range DULCODOS® Pool is available for this. These complete **panel-mounted systems** are available in different models - for private pools to public swimming pools.

We're happy to help

We're there to help with the selection of your products. We'd be pleased to advise you on the integration of individual components into your individual metering processes.

Give us a call! We look forward to hearing from you.

Monday to Friday 8:00 – 16:30

ProMinent Sales
0049 6221 842-0
info@prominent.com

Technical Consulting
0049 6221 842-1850
service@prominent.com

We can also support you by phone in selecting the right products and, in many cases, optimising entire applications. With more complex requirements, our consultants will then hand the task over to a field sales colleague, who will then clarify your requirements in person on site.

After-sales Service

Our service technicians are on hand to help you. Whether for the initial installation or for maintenance and repair work. We're happy to help!

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New Measuring, Control and Sensor Technology Products

NEW

Ozone Sensor OZR 1-mA

Sensor for measuring and monitoring the absence of ozone. For operation on controllers with 4-20 mA input

- Measured variable: Ozone, without cross sensitivity to chlorine, hydrogen peroxide
- Diaphragm-covered sensor (encapsulated) minimises faults caused by changing flow or ingredients in the water
- Suitable also for monitoring the absence of ozone (rupture monitoring on filters) and for discontinuous ozone treatment processes
- Resistance to films of dirt by pore-free diaphragm

For more information see page → 1-78

Controller AEGIS II/Cool Control Pro

The controller AEGIS II/Cool Control Pro continuously measures and regulates the conductivity and controls the biocide concentration to keep pipework and heat exchangers clean.

AEGIS II/Cool Control Pro records all the necessary measuring parameters for cooling water and steam generator water treatment and controls the functions necessary for smooth operation:

- Electrolytic conductivity – controls bleeding
- Corrosion measurement – determines whether enough corrosion inhibitor is being metered
- pH measurement – measures and controls pH
- Biocide measurement (e.g. chlorine) – measures and controls the biocide concentration

For more information see page → 2-88

Controller DULCOMETER® diaLog DACa With New Features

- Optional web server – Visualisation of the measured values and statuses simply via a web browser
- Optional PROFIBUS® DP interface – Connection, for example, to programmable logic controllers (PLC)
- Optional Profinet® interface – Connection, for example, to programmable logic controllers (PLC)
- Optional Modbus RTU interface – Connection, for example, to programmable logic controllers (PLC)

For more information see page → 2-3

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1.0 Overview of Sensor Technology DULCOTEST®

1.0.1 Selection Guide

Selection Guide for pH Sensors DULCOTEST®

Medium	Temperature/ pressure	Sensor type	Typical application
Clear, pH 3 – 14	Max. 100 °C/3 bar Max. 25 °C/6 bar	PHEP-H	Chemical processes
Clear, pH 2 – 12	Max. 80 °C/ no overpressure	PHEN	Chemically contaminated water, low-conductivity water < 50 µS/cm
	Max. 60 °C/3 bar	PHES	Swimming pool water, potable water, glass shaft
		PHEK	Swimming pool, aquarium, plastic shaft
	Max. 80 °C/6 bar	PHEP/PHEPT	Process water
	Max. 80 °C/8 bar	PHED	Chemically contaminated water, e.g. Cr^{6+}, CN^-
Solid matter, turbidity	Max. 80 °C/6 bar	PHER	Cooling water, waste water
Solid matter, non-translucent	Max. 100 °C/16 bar	PHEX	Suspensions, sludge, emulsions
Clear to turbid, containing fluoride, pH 0 - 7	Max. 50 °C/7 bar	PHEF	Exhaust air scrubber, semiconductor industry, electroplating

DULCOTEST® ORP sensor selection guide

Medium	Temperature/ pressure	Sensor type	Typical application
clear, pH 2 – 12	max. 80 °C/ no overpressure	RHEN	Chemically contaminated water, low-conductivity water < 50 µS/cm
	max. 60 °C/3 bar	RHES	Swimming pool water, potable water, glass shaft
		RHEK	Swimming pool, aquarium, plastic shaft
	max. 80 °C/6 bar	RHEP-Pt	Process water
		RHEP-Au	Chemically contaminated water, e.g. CN^-, ozone treatment
solid residues, turbidity	max. 80 °C/6 bar	RHER	Cooling water, waste water
Solid matter, non-translucent	max. 100 °C/16 bar	RHEX	Suspensions, sludge, emulsions

Note: All DULCOTEST® pH and ORP sensors are made using lead-free glass (RoHS-compliant)

1.0 Overview of Sensor Technology DULCOTEST®

Selection guide for DULCOTEST® amperometric sensors

Measured variable	Applications	Graduated measuring range	Connection to DULCOMETER®	Sensor type	See page
Free chlorine	Potable water, swimming pools	0.01–100 mg/l	D1C, DACa	CLE 3-mA-xppm, CLE 3.1-mA-xppm	→ 1-51
Free chlorine	Process and waste water	10 - 200 mg/l	D1C, DACa	CLR 1-mA	→ 1-61
Free chlorine	Potable water, swimming pool water	0.01 - 10 mg/l	DULCOMARIN® II	CLE 3-CAN-xppm, CLE 3.1-CAN-xppm	→ 1-54
Free chlorine	Potable water, swimming pool water, in situ electrolysis (without diaphragm)	0.02-10 mg/l	D1C, DACa	CLO 1-mA-xppm	→ 1-56
Free chlorine	Hot water up to 70 °C (legionella), in situ electrolysis (without diaphragm)	0.02-2 mg/l	D1C, DACa	CLO 2-mA-2ppm	→ 1-57
Free chlorine	Potable water, swimming pools	0.01–50 mg/l	DMT	CLE 3-DMT-xppm	→ 1-53
Free chlorine	Potable water, swimming pools	0.05-5 mg/l	COMPACT	CLB 2-µA-xppm	→ 1-58
Free chlorine	Potable water, swimming pool water	0.05-5 mg/l	COMPACT	CLB 3-µA-xppm	→ 1-59
Free chlorine	Cooling, industrial and waste water, water with higher pH values (stable); seawater (free chlorine exists as bromine)	0.01-10 mg/l	D1C, DACa	CBR 1-mA-xppm	→ 1-60
Total available chlorine	Swimming pool water with chlorine-organic disinfectants	0.02–10 mg/l	D1C, DACa	CGE 3-mA-xppm	→ 1-62
Total available chlorine	Swimming pool water with organic chlorine disinfectants, in situ electrolysis (without diaphragm)	0.02 - 10 mg/l	D1C, DACa	CGE 3-mA	→ 1-62
Total available chlorine	Swimming pool water with chlorine-organic disinfectants	0.01–10 mg/l	DULCOMARIN® II	CGE 2-CAN-xppm	→ 1-63
Total chlorine	Potable, industrial, process and waste water	0.01–10 mg/l	D1C, DACa	CTE 1-mA-xppm	→ 1-64
Total chlorine	Potable, industrial, process and waste water	0.01–10 mg/l	DMT	CTE 1-DMT-xppm	→ 1-65
Total chlorine	Potable, industrial, process and waste water	0.01–10 mg/l	DULCOMARIN® II	CTE 1-CAN-xppm	→ 1-66
Combined chlorine	Swimming pool water	0.02–2 mg/l	DACa	CTE 1-mA-2 ppm + CLE 3.1-mA-2 ppm	→ 1-66
Combined chlorine	Swimming pool water	0.01–10 mg/l	DULCOMARIN® II	CTE 1-CAN-xppm + CLE 3.1-CAN-xppm	→ 1-66
Total available bromine	Cooling water, waste water, swimming pool water, whirlpool water, bromine with BCDMH	0.01-10 mg/l	D1C, DACa	BCR 1-mA (replaces earlier type BRE 1)	→ 1-68
Total available bromine	Cooling water, swimming pool water, whirlpool water with organic or inorganic bromine compounds	0.02-10 mg/l	DULCOMARIN® II	BRE 3-CAN-10 ppm	→ 1-69
Free and bound bromine	Cooling, industrial, waste water, water with higher pH values (stable); seawater	0.02-20 mg/l	D1C, DACa	CBR 1-mA-xppm	→ 1-60
Chlorine dioxide	Potable water	0.01–10 mg/l	D1C, DACa	CDE 2-mA-xppm	→ 1-71
Chlorine dioxide	Bottle washer systems	0.02–2 mg/l	D1C, DACa	CDP 1-mA	→ 1-72
Chlorine dioxide	Hot water up to 60 °C, cooling water, waste water, irrigation water	0.01-10 mg/l	D1C, DACa, DULCOMARIN® II	CDR 1-mA-xppm, CDR 1-CAN-xppm	→ 1-73
Chlorite	Potable, wash water	0.02–2 mg/l	D1C, DACa, DULCOMARIN® II	CLT 1-mA-xppm, CLT 1-CAN-xppm	→ 1-75
Ozone	Potable water, swimming pool water	0.02–2 mg/l	D1C, DACa	OZE 3-mA	→ 1-77
Ozone	Process, service or cooling water	0.02–2 mg/l	D1C, DACa	OZR 1-mA-2 ppm*	→ 1-78
Dissolved oxygen	Potable, surface water	2–20 mg/l	D1C, DACa	DO 1-mA-xppm	→ 1-79
Dissolved oxygen	Activated sludge tank, sewage treatment plants	0.1–10 mg/l	D1C, DACa	DO 2-mA-xppm	→ 1-80
Peracetic acid	CIP, antiseptic food filling process	1–2,000 mg/l	D1C, DACa	PAA 1-mA-xppm	→ 1-81
Hydrogen peroxide	Clear water, fast control	1–2,000 mg/l	DACa	PEROX sensor PEROX-H2.10 P	→ 1-83
Hydrogen peroxide	Process, swimming pool water	2–20,000 mg/l	D1C, DACa	PER1-mA-xppm	→ 1-83

1.0 Overview of Sensor Technology DULCOTEST®

Conductivity sensor selection guide

Conductivity > 20 mS/cm or residue-forming medium or chemically aggressive medium?

yes ↓ | ↓ **no**

Inductive conductivity measurement

↓

Do the following conditions exist?

- **Chemically corrosive medium or**
- **Temperatures > 70 °C or**
- **Measured value < 200 µS/cm or > 1000 mS/cm**

Yes ↓ | ↓ **No**

Series ICT 2

Installation in the process line: with stainless steel flange accessory

For immersion with accessory: Immersion fitting IMA - ICT 2

Series ICT1

↓

Installation in the process line?

Yes ↓ | ↓ **No**

Type ICT 1
For installation in a pipe

Type ICT 1-IMA
For immersion

Conductive conductivity measurement

↓

Further selection according to summary table:

- **Measuring range**
- **Temperature**
- **Process adjustment**
- **Electrical connection**

↓

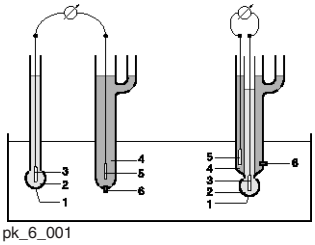
Product ranges LF, LMP, CK

1.1 Sensor Technology DULCOTEST® Measuring Principles

1.1.1 Three Measurement Priciples for Reliable Water Treatment

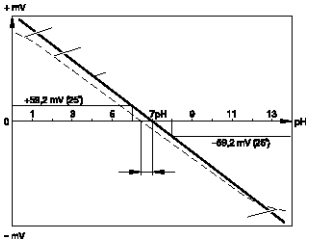
- Potentiometry is used to determine: pH value, ORP and fluoride concentration
- Amperometry is used to determine: chlorine, bromine, chlorine dioxide, ozone, hydrogen peroxide, peracetic acid
- Conductometry is used to determine electrolytic conductivity

1.1.2 Potentiometry - Measures an Electrode's Potential in a Sample Solution



pk_6_001

1 Glass membrane
2 Internal pH buffer
3 Internal derivation
4 Electrolyte
5 External derivation
6 Diaphragms



pk_6_002

1 Acid error
2 Exponential (in practice)
3 Theoretical (nominal slope)
4 Zero point deviation (asymmetrical potential)
5 Alkali error
6 Voltage of probe

As the measurement of the potential of a sensor (half chain) is not possible, a measuring chain is used that comprises two half chains. Their potential difference can be measured using a very high resistance voltmeter, i.e. nearly without any current.

A measuring chain always comprises:

A measuring electrode, which reacts as specifically as possible to concentration changes for a particular reactant and a reference electrode (reference), which supplies, as constantly as possible, a voltage that is dependent on the concentration of the reactant.

An example of a measuring system, such as this, is the pH measuring sensor, designed as a two-rod sensor or single rod sensor (Fig. pk_6_001).

pH - is equal to the negative logarithm of the hydrogen ion activity

As hydrogen ion concentrations occur in a wide range of less than 10^{-14} g/l up to more than 10 g/l (or mol/l) in aqueous solutions and the exponential nomenclature is unwieldy, the pH scale is defined as:

$pH = -\log a_{H^+}$

For concentrations that are not too high, activity and concentration can be set equally.

Then a concentration of 10^{-14} corresponds to a pH value of 14 and a concentration of $10^0 = 1$ corresponds to a pH value of 0.

pH value 7 is identified as neutral. This means that the effective concentrations of H^+ and OH^- ions here, which originate from the dissociation of water ($H_2O \rightarrow H^+ + OH^-$), are the same size.

If the hydrogen ions are in a majority due to the addition of acid (e.g. HCl) then the pH values are less than 7. If a base (alkali) is added (e.g. NaOH) then the values are greater than 7 and the solution becomes alkaline.

Each change in the pH value by 1 corresponds to a factor of 10 concentration change and results from the logarithmic relationship.

Fig. pk_6_002 shows the theoretical voltage curve for pH glass electrodes. In practice glass electrodes exhibit a greater or lesser deviation from the theoretical curve.

The electrode system generally exhibits a zero-point deviation (asymmetry potential), which is smaller than ± 0.5 pH, however. The electrode slope (mV/pH) may also deviate from the theoretical value U_N (59.2 mV/pH at 25 °C), which is particularly the case for used glass electrodes.

Other deviations occur at very low pH values, the so-called acid error, while at high pH values allowance must be made for the so-called alkali error (or Na error).

pH measuring amplifiers must be matched to the respective measuring chain by means of zero point and slope calibration

Here the zero point is calibrated using a buffer solution, the value of which is about pH 7 while the slope is calibrated using a buffer in an acidic or alkaline range that has a pH value 2 or 3 above or below the neutral point.

With pH measurements that differ from pH 7, the fluctuating temperature of the measuring medium may result in a need for temperature compensation.

In this respect three questions must be answered:

1 What pH value is to be measured?

2 How large are the temperature deviations?

3 How accurate must the measurements be?

Example of the influence of temperature without compensation:

At pH 10, an incorrect indication of approximately + 0.1 pH occurs for a temperature increase of about 10 °C. This effect is greater the greater the pH value differs from pH 7.

1.1 Sensor Technology DULCOTEST® Measuring Principles

Measurement of the redox voltage is also a potentiometric measurement

The term "redox" (or ORP - oxidation/reduction potential) stands for the reduction and oxidation that occur alongside each other in aqueous solutions. In general, oxidation involves the removal of electrodes with an oxidising agent acting as an electron acceptor. Reduction is the opposite with electrodes being taken up, with the reducing agent acting as an electron donor.

The redox voltage is measured with a precious metal electrode, generally platinum. In an oxidising agent containing liquid (e.g. chlorine) there is a positive redox voltage, in a reducing agent (e.g. sodium bisulphite) a negative redox voltage.

The level of the redox voltage gives an indication of how strongly oxidising or reducing a solution is. Where disinfection is concerned, the redox voltage gives an indication of how great the germicidal effect of, for example, chlorine or ozone is.

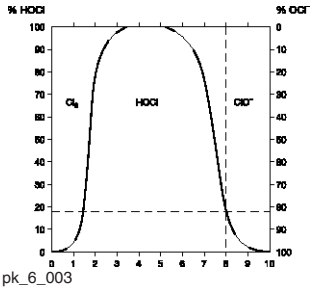
Consequently the redox voltage can be considered as a hygiene parameter in water treatment.

It should be noted that the redox voltage varies with the pH value so that qualitative conclusions need to be made at a constant pH value.

Examples of typical applications for redox measurements

- Cyanide detoxification at a high pH value by oxidation using gold electrodes.
- Chromate detoxification at a low pH value by oxidation using platinum electrodes.
- Monitoring of the disinfection effect during oxidising agent metering (chlorine/bromine) using platinum electrodes.

1.1.3 Amperometry - A Current Measurement Used to Determine the Concentration of Predetermined Dissolved Solids in Aqueous Solutions



pk_6_003

Disassociation curve of hypochlorous acid (HOCl)

This type of current measurement concentrates on the nA (10^{-9} A) or µA (10^{-6} A) range. Open or diaphragm-covered 2 or 3-probe sensors are used with operating measurements in this range. The amperometric sensor product range makes determining the concentration of chlorine, bromine, chlorine dioxide, chlorite, ozone, hydrogen peroxide, peracetic acid and dissolved oxygen possible.

Our amperometric DULCOTEST® sensors represent proven diaphragm-covered 2-probe sensors.

By separation of the electrode chamber from the measurement medium using a special diaphragm, clear metrological conditions are created and disturbing influences excluded.

ProMinent DULCOTEST® 2-probe sensors use gold or platinum as the working electrode (cathode). The counter electrode (anode) is silver with a special coating.

In contrast to open, fault-prone sensors, membrane-covered sensors exhibit hardly any flow dependency above a minimum flow (approx. 30 l/h). Consequently there is no need for costly measures to maintain the flow at a constant rate.

The pH value has a decisive influence on the chlorine measurement

It is important to know, in what forms chlorine is present in aqueous solutions. It is only at a very low pH value that chlorine occurs as dissolved chlorine gas Cl_2 in water and above a pH of about 3 as hypochlorous acid HOCl, which upon the further increase in the pH value dissociates into hypochlorite (see Fig. pk_6_003).

Compared with hypochlorous acid, hypochlorite is about 100 times less powerful as a disinfectant. Therefore it makes no sense to measure it with the chlorine sensor. Yet both hypochlorous acid and hypochlorite are considered to be "free chlorine" and, as such, are also measured by the DPD 1 measuring method, generally used as a comparison measurement.

A corresponding example:

At pH 8 (see Fig. pk_6_003), only some 20% is in the effective HOCl form, while 80% is in the nearly ineffective form OCL^-. However, it is possible to set this up using a sensitivity (slope) comparison to obtain a value corresponding to the DPD comparison measurement on the measuring device display.

The pH value needs to be kept constant for a useful measurement. If not, a new slope calibration must be carried out. The maximum permissible pH value is pH 8.0 for the sensors for inorganic chlorine and pH 9.5 for organic chlorine.

The influence of temperature on chlorine measurement is not insignificant. Therefore automatic temperature compensation occurs in DULCOTEST® chlorine sensors

While there are no problems with chlorine measurements involving inorganic chlorine (chlorine gas Cl_2, sodium-calcium hypochlorite NaOCl or calcium hypochlorite $Ca(OCl)_2$) provided the pH value remains constant, if organic chlorine additives are used (isocyanuric acid) then difficulties may occur which can be easily overcome using the organic chlorine cell (CGE).

If organic chlorine stabilisers are added, then not only does hypochlorous acid form, but also chlorine bound to isocyanuric acid. Both species are detected by the organic chlorine sensor (CGE).

If a measurement is made using the DPD 1 method, organic chlorine is also measured, in the same way as the practically ineffective hypochlorite (at high pH values). In this case, the DPD measurement can falsify hygienic safety, which is not in fact the case.

Typical applications for DULCOTEST® chlorine sensors include swimming pool water (also sea water), potable water and process water

The chlorine measurement can be disrupted by bromine, iodine, ozone and chlorine dioxide. Not however by dissolved oxygen. The presence of surfactants will block the working of the diaphragms of the sensor for free chlorine, type CLE. The sensor cannot then be used, by contrast, however, the CTE type combined chlorine sensor can be used in applications such as this.

A cell that functions according to the same principle as for the inorganic chlorine measurement is used to measure chlorine dioxide. The chlorine dioxide measurement is independent of the pH value. Its temperature dependency is compensated. Dissolved oxygen and chlorite do not interfere with the measurement results. The presence of surfactants causes problems with CDE type sensors. By contrast, the CDP type can also be used in media containing surfactants.

In addition amperometric sensors can also be used for the measurement of bromine and ozone dissolved in water.

1.1.4 Advantages of DULCOTEST® Amperometric Sensors at a Glance

Simple to use

- No zero point calibration necessary
- Sample liquid need not be de-chlorinated with active carbon filter
- Installation and calibration is very quick

Reliable measurement in real-time

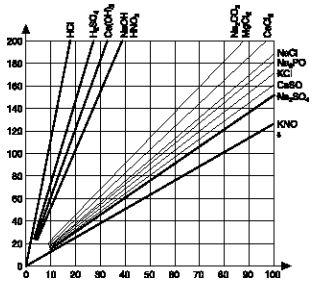
- No cross-sensitivity because of turbidity and colouration
- The DULCOTEST® chlorine measurement can also be used in sea water and brine baths
- The measured value is largely unaffected by the flow rate
- Online measurement

Minimum maintenance

- Maintenance is limited to the 6-12 month replacement of the membrane cap and electrolyte
- Long-term operating costs are therefore low

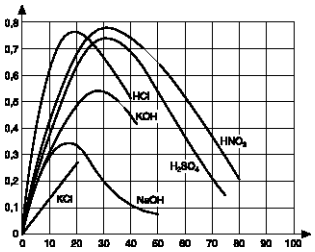
1.1 Sensor Technology DULCOTEST® Measuring Principles

1.1.5 Conductometry – The Measurement of Electrolytic Conductivity



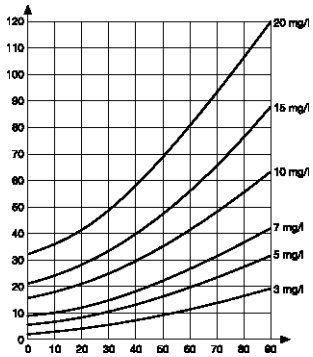
pk_6_004

Dependence of electrolytic conductivity on the concentration of dissolved acids, alkalis and salt solutions



pk_6_005

Dependence of specific conductivity on the concentration in percentage weight of concentrated acids, alkalis and salt solutions



pk_6_006

Conductivity of aqueous solutions of NaCl depending on the temperature of different concentrations

In contrast to metallic conductivity where the electric charge is carried by electrons, in electrolytic conductivity, ions are responsible for carrying the charge, that is positively or negatively charged atoms or groups of atoms which are primarily created by dissolving in or dissociation in aqueous solutions. Conductivity sensors are differentiated according to the following criteria:

- **The cell constant as a distinguishing feature**
  An arrangement in which the conductivity of an electrolyte would be measured in a tube of length l = 1 cm and cross section q = 1 cm^2 has a cell constant of k = 1 cm^{-1}. If the length l = 10 cm (or if the cross section q = 0.1 cm^2), then the cell constant would be k = 10 cm^{-1}. By contrast, if the cross section was increased to q = 10 cm^2 (or l reduced to 0.1 cm), then a cell constant of k = 0.1 cm^{-1} is obtained. It can easily be seen that a conductivity sensor with a smaller cell constant is used for measurements of lower conductivity while a cell with a larger cell constant is used for higher conductivities. This is done to increase the measurement sensitivity at lower conductivities (e.g. k = 0.1 cm^{-1}) – or to reduce it at higher conductivities (e. g. k = 10 cm^{-1}).
- **Sensor materials**
  The selection of the correct cell constant is just as important as selection of a suitable electrode material. Stainless steel has shown its suitability in the lower range, up to approximately 500 µS/cm. By contrast in the upper range, where, because of the occurrence of polarisation effects, stainless steel is less suitable, special graphite is primarily used. As errors due to polarisation effects have to be avoided during electrolytic conductivity measurements, measurements can only be carried out using AC voltage. At low conductivities, frequencies of about 50 Hz are favoured and in the higher range up to approximately 5 kHz. Both at very low and also very high conductivities, long measuring lines can result in incorrect results, in the lower range caused by line capacities and in the upper range by line resistance. Therefore the distance between the sensor and measurement amplifier should be kept as short as possible.

Every conductivity measurement is temperature-dependent

Different dissolved substances mostly have different temperature coefficients α (alpha), leading to a particular temperature curve that can change depending on the concentration and temperature. (Fig. pk_6_006)

As, in general, conductivity measurements are used because we want to draw conclusions about substance concentrations, temperature compensation is used for exact measurements, even with a measured value compensated to an international standard reference temperature of 25 °C. Suitable transducers for temperature compensation are NTC or Pt 100 temperature sensors with the Pt 100 being significantly superior because of its linearity and hence accuracy.

Inductive conductivity measurement

While errors can occur due to polarisation effects and deposits on the electrode surfaces, with open conductivity measurements, errors can be avoided using inductive conductivity measurement where no electrodes are used. Regular cleaning is therefore not necessary and measuring reliability is significantly higher.

1.2 pH, ORP, Fluoride and Temperature Sensors DULCOTEST®

The following generally applicable points should be noted for optimum functioning of pH and ORP sensors:

- The sensors should never dry out
- The insertion angle must be > 15 ° from the horizontal (except with PHEK-L)
- Maximum flow < 0.8 m/s
- Use of suitable measuring lines
- Measuring lines should be as short as possible
- Use of suitable measuring devices/transducers (high resistance input)
- Calibration using quality buffer solutions
- Selection of electrode type according to the application
- The storage duration should be as short as possible

Signal leads for pH/ORP measurement see page → 1-113, pH quality buffer solutions see page → 1-116

pH sensor selection guide

Medium	Temperature/ pressure	Sensor type	Typical application
Clear, pH 3 – 14	Max. 100 °C/3 bar Max. 25 °C/6 bar	PHEP-H	Chemical processes
Clear, pH 2 – 12	Max. 80 °C/ no overpressure	PHEN	Chemically contaminated water, low-conductivity water < 50 µS/cm
	Max. 60 °C/3 bar	PHES	Swimming pool water, potable water, glass shaft
		PHEK	Swimming pool, aquarium, plastic shaft
	Max. 80 °C/6 bar	PHEP/PHEPT	Process water
	Max. 80 °C/8 bar	PHED	Chemically contaminated water, e.g. Cr^{6+}, CN^{-}
Solid matter, turbidity	Max. 80 °C/6 bar	PHER	Cooling water, waste water
Solid matter, non-translucent	Max. 100 °C/16 bar	PHEX	Suspensions, sludge, emulsions
Clear to turbid, containing fluoride, pH 0 - 7	Max. 50 °C/7 bar	PHEF	Exhaust air scrubber, semiconductor industry, electroplating

Note: All DULCOTEST® pH and ORP sensors are made using lead-free glass (RoHS-compliant)

1.2 pH, ORP, Fluoride and Temperature Sensors DULCOTEST®

DULCOTEST® ORP sensor selection guide

Medium	Temperature/ pressure	Sensor type	Typical application
clear, pH 2 – 12	max. 80 °C/no overpressure	RHEN	Chemically contaminated water, low-conductivity water < 50 µS/cm
	max. 60 °C/3 bar	RHES	Swimming pool water, potable water, glass shaft
		RHEK	Swimming pool, aquarium, plastic shaft
	max. 80 °C/6 bar	RHEP-Pt	Process water
		RHEP-Au	Chemically contaminated water, e.g. CN^-, ozone treatment
solid residues, turbidity	max. 80 °C/6 bar	RHER	Cooling water, waste water
Solid matter, non-translucent	max. 100 °C/16 bar	RHEX	Suspensions, sludge, emulsions

Note: All DULCOTEST® pH and ORP sensors are made using lead-free glass (RoHS-compliant)

1.2 pH, ORP, Fluoride and Temperature Sensors DULCOTEST®

1.2.1 pH Sensors With SN6 or Vario Pin Plug-In Head

pH sensors with plug-in heads are connected to a shielded coaxial cable with the appropriate socket. The rotatable sensor head sleeve prevents the cable from twisting when inserting and dismantling the sensor (e.g. when calibrating). The cable can therefore remain connected. This avoids the penetration of troublesome water onto the plug-in contacts.

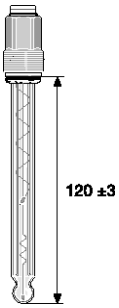
Series							
PHE	pH sensor						
	Properties						
	X	With solid electrolyte and circular gap diaphragm					
	K	With insensitive plastics shaft					
	N	KCl refillable sensor					
	E	Plug-in sensor					
	R	With PTFE circular diaphragm					
	P	Pressure-tight up to 6 bar					
	D	2 ceramics diaphragms (double junction)					
	S	Swimming pool sensor					
	F	Resistant to hydrofluoric acid					
		Without specification: standard gel sensor					
		Special equipment					
		T	With integral temperature gauge				
		H	Temperature up to 100 °C, alkali-resistant				
		L	Vertical to horizontal installation				
			pH measuring range				
			012	pH measuring range: 0 – 12			
			112	pH measuring range: 1 - 12			
			314	pH measuring range: 3 – 14			
				Electrical connection at the sensor			
				S	Plug for coax connector SN6		
				V	Vario Pin plug		
					Internal thread		
					E	Internal thread PG 13.5 for installation	
					L	None, laboratory sensor refillable with KCl	
						Diaphragm	
						3D	3 ceramic diaphragms

pH Sensor PHES 112 SE

pH sensor optimised for use in potable water treatment, swimming pools/hot tubs at up to 60 °C/3 bar

Your benefits

- Electrochemical combination electrode: pH and reference electrode integrated
- Diaphragm and reference system optimised for use in swimming pools and for potable water
- Ceramic diaphragm with special material, optimised size and optimised pore diameter
- Long service life due to reduced diffusion ("bleeding") of the electrolyte
- Long service life due to the material, which is inert to aggressive disinfectants
- Stable reference system
- Twist protection for the sensor cable connected. This means that the cables can remain connected during installation and dismantling of the sensor, avoiding troublesome moisture on the connector contacts
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)



pk_6_016

pH range	1 … 12
Temperature	0 … 60 °C
Max. pressure	3.0 bar
Min. conductivity	150 µS/cm
Electrolyte	Gel containing potassium chloride
Diaphragm	Ceramic
Sensor shaft	Glass
Shaft diameter	12 mm
Fitting length	120 ±3 mm
Fitting position	Vertical up to +25°
Thread	PG 13.5
Electrical connection	SN6 plug-in head, rotatable with a ProMinent cable
Enclosure rating	IP 65
Installation	Bypass: open outlet or return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	Swimming pools, whirlpools, potable water
Resistance to	Disinfectant
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, gel electrolyte, ceramic diaphragm, separate temperature measurement for temperature compensation needed

	Fitting length	Order no.
PHES 112 SE	120 ±3 mm	150702
PHES 112 SE	225 ±3 mm	150092

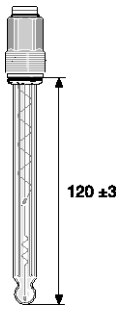
1.2 pH, ORP, Fluoride and Temperature Sensors DULCOTEST®

pH Sensor PHES 112 SE 3D

pH sensor optimised for use in potable water treatment, swimming pools/hot tubs and at low electrolytic conductivities of up to 60 °C/3 bar

Your benefits

- Electrochemical combination electrode: pH and reference electrode integrated
- Diaphragm and reference system optimised for use in swimming pools
- Ceramic diaphragm with special material, optimised size and optimised pore diameter
- Three ceramic diaphragms optimised for low electrolytic conductivities
- Long service life due to reduced diffusion ("bleeding") of the electrolyte
- Long service life due to the material, which is inert to aggressive disinfectants
- Stable reference system
- Twist protection for the sensor cable connected. This means that the cables can remain connected during installation and dismantling of the sensor, avoiding troublesome moisture on the connector contacts
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)



pk_6_016

pH range	1 … 12
Temperature	0 … 60 °C
Max. pressure	3.0 bar
Min. conductivity	50 µS/cm
Electrolyte	Gel containing potassium chloride
Diaphragm	3 Ceramic diaphragms
Sensor shaft	Glass
Shaft diameter	12 mm
Fitting length	120 ±3 mm
Fitting position	Vertical up to +25°
Thread	PG 13.5
Electrical connection	SN6 plug-in head, rotatable with a ProMinent cable
Enclosure rating	IP 65
Installation	Bypass: open outlet or return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	Low conductivity water
Resistance to	Disinfectant
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, gel electrolyte, ceramic diaphragm, separate temperature measurement for temperature compensation needed

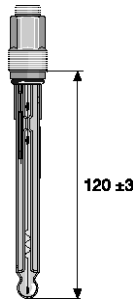
	Order no.
PHES 112 SE 3D	1045759

pH Sensor PHEP 112 SE

pH sensor optimised for use with clear process water and conditions of up to 80 °C/6 bar

Your benefits

- Electrochemical combination electrode: pH and reference electrode integrated
- Diaphragm and reference system optimised for exacting process requirements
- Ceramic diaphragm with special material, optimised size and optimised pore diameter
- Long service life due to reduced diffusion ("bleeding") of the electrolyte
- Long service life due to the material, which is inert to aggressive disinfectants
- Stable reference system for high pressure/temperature requirements
- Twist protection for the sensor cable connected. This means that the cables can remain connected during installation and dismantling of the sensor, avoiding troublesome moisture on the connector contacts
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)



pk_6_019

pH range	1 … 12
Temperature	0 … 80 °C
Max. pressure	6.0 bar
Min. conductivity	150 µS/cm
Electrolyte	Gel containing potassium chloride
Diaphragm	Ceramic
Sensor shaft	Glass
Shaft diameter	15 mm
Fitting length	120 ±3 mm
Fitting position	Vertical up to +25°
Thread	PG 13.5
Electrical connection	SN6 plug-in head, rotatable with a ProMinent cable
Enclosure rating	IP 65
Installation	Bypass: open outlet or return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	Swimming pools during pressurisation for higher temperatures and pressures, potable and industrial water, electroplating, chemical industries
Resistance to	Disinfectant
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, gel electrolyte, ceramic diaphragm, separate temperature measurement for temperature compensation needed

	Order no.
PHEP 112 SE	150041

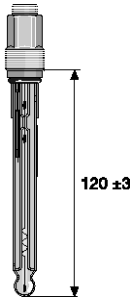
1.2 pH, ORP, Fluoride and Temperature Sensors DULCOTEST®

pH Sensor PHEP-H 314 SE

pH sensor optimised for use with clear process water, specifically for alkaline process solutions at high temperatures of up to 100 °C

Your benefits

- Electrochemical combination electrode: pH and reference electrode integrated
- Diaphragm and reference system optimised for exacting process requirements
- Optimised pH-sensitive glass for high alkali content and high temperatures
- Long service life / excellent precision: Measurement at a high pH value of up to 14
- Long service life: at high temperatures of up to 100 °C
- Stable reference system for high pressure / temperature requirements
- Twist protection for the sensor cable connected. This means that the cables can remain connected during installation and dismantling of the sensor, avoiding troublesome moisture on the connector contacts
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)



pk_6_019

pH range	3 … 14 (Note: use below pH 3 shortens the service life)
Temperature	0 … 100 °C
Max. pressure	6.0 bar up to 25 °C, 3.0 bar up to 100 °C
Min. conductivity	150 µS/cm
Electrolyte	Gel containing potassium chloride
Diaphragm	Ceramic
Sensor shaft	Glass
Shaft diameter	12 mm
Fitting length	120 ±3 mm
Fitting position	Vertical up to +25°
Thread	PG 13.5
Electrical connection	SN6 plug-in head, rotatable with a ProMinent cable
Enclosure rating	IP 65
Installation	Bypass: open outlet or return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	Monitoring or control of chemical processes with neutral to highly-alkaline media and temperatures up to 100 °C
Resistance to	Disinfectant, high alkalinity
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, highly alkaline tempered glass, ceramic diaphragm, gel electrolyte, separate temperature measurement for temperature compensation needed

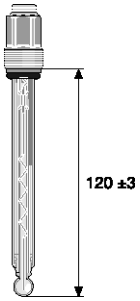
	Order no.
PHEP-H 314 SE	1024882

pH Sensor PHER 112 SE

pH sensor optimised for use in contaminated water containing solids and for low conductivity of > 50 µS/cm at up to 80 °C/6 bar

Your benefits

- Electrochemical combination electrode: pH and reference electrode integrated
- The large dirt-repellent Teflon® diaphragm prevents the reference system from becoming blocked up
- Long service life when solids are present
- High-viscosity electrolyte combined with a salt reservoir prevents the electrolyte from "bleeding"
- Long service life without drifts when there is clear water with low conductivity
- Twist protection for the sensor cable connected. This means that the cables can remain connected during installation and dismantling of the sensor, avoiding troublesome moisture on the connector contacts
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)



pk_6_018

pH range	1 … 12
Temperature	0 … 80 °C
Max. pressure	6.0 bar
Min. conductivity	50 µS/cm
Electrolyte	With KCl supply (salt rings in the reference electrolyte)
Diaphragm	PTFE ring diaphragm
Sensor shaft	Glass
Shaft diameter	12 mm
Fitting length	120 ±3 mm
Fitting position	Vertical up to +25°
Thread	PG 13.5
Electrical connection	SN6 plug-in head, rotatable with a ProMinent cable
Enclosure rating	IP 65
Installation	Bypass: open outlet or return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	Municipal and industrial waste water, cooling water, industrial water, water in chemicals industry and paper production, generally for water with a solid matter fraction, water with low conductivity, e.g. from reverse osmosis.
Resistance to	Disinfectant, solids content (turbid types of water)
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, Teflon ring diaphragm, polymer electrolyte, separate temperature measurement for temperature compensation needed

	Order no.
PHER 112 SE	1001586

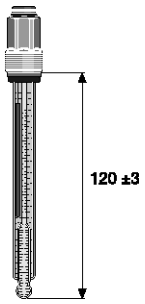
1.2 pH, ORP, Fluoride and Temperature Sensors DULCOTEST®

pH Sensor PHEX 112 SE

pH sensor optimised for use with contaminated water with a high solids content at 6 bar/100 °C or 16 bar/25 °C

Your benefits

- Electrochemical combination electrode: pH and reference electrode integrated
- Diaphragm and reference system optimised for extremely high solids content
- The solid electrolyte makes the diaphragm redundant and prevents the reference system from becoming blocked up
- Long service life when sludge is present due to lack of a diaphragm
- Long service life as the solid electrolyte prevents the electrolyte from "bleeding"
- Stable reference system
- Twist protection for the sensor cable connected. This means that the cables can remain connected during installation and dismantling of the sensor, avoiding troublesome moisture on the connector contacts
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)



pk_6_017

pH range	1 … 12
Temperature	0 … 100 °C
Max. pressure	16.0 bar up to 25 °C, 6.0 bar up to 100 °C
Min. conductivity	500 µS/cm
Electrolyte	Polymer containing potassium chloride (solid)
Diaphragm	Circular gap diaphragm (solid electrolyte)
Sensor shaft	Glass
Shaft diameter	12 mm
Fitting length	120 ±3 mm
Fitting position	Vertical up to +25°
Thread	PG 13.5
Electrical connection	SN6 plug-in head, rotatable with a ProMinent cable
Enclosure rating	IP 65
Installation	Bypass: open outlet or return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	Waste water, industrial water, process chemistry, emulsions, suspensions, protein-containing media, in general for water with a high solid fraction, not suitable for use in clear water.not suitable for media with oxidation agents
Resistance to	Solids content (turbid types of water), sludge, emulsions
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, no diaphragm, polymer electrolyte, separate temperature measurement for temperature compensation needed

	Fitting length	Order no.
PHEX 112 SE	120 ±3 mm	305096
PHEX 112 SE	225 ±3 mm	150061

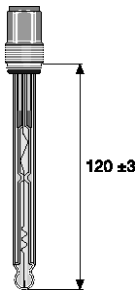
ex HD works

pH Sensor PHED 112 SE

pH sensor optimised for use with chemically contaminated but clear water at up to 80 °C/8 bar

Your benefits

- Electrochemical combination electrode: pH and reference electrode integrated
- Diaphragm and reference system optimised for use in chemically contaminated but clear water
- Double junction: two coupled ceramic diaphragms protect the reference system
- Long service life when chemical pollutants are present
- Special construction permits a maximum pressure of 8 bar
- Twist protection for the sensor cable connected. This means that the cables can remain connected during installation and dismantling of the sensor, avoiding troublesome moisture on the connector contacts
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)



pk_6_022

pH range	1 … 12
Temperature	0 … 80 °C
Max. pressure	8.0 bar
Min. conductivity	150 µS/cm
Electrolyte	Gel containing potassium chloride
Diaphragm	Double junction
Sensor shaft	Glass
Shaft diameter	12 mm
Fitting length	120 ±3 mm
Fitting position	Vertical up to +25°
Thread	PG 13.5
Electrical connection	SN6 plug-in head, rotatable with a ProMinent cable
Enclosure rating	IP 65
Installation	Bypass: open outlet or return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	Chemically loaded waste water, industrial water, cooling water
Resistance to	Disinfectants, water-soluble chemicals
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, double junction, gel electrolyte, separate temperature measurement for temperature compensation needed

	Order no.
PHED 112 SE	741036

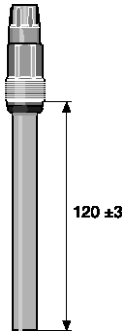
1.2 pH, ORP, Fluoride and Temperature Sensors DULCOTEST®

pH Sensor PHEF 012 SE

pH sensor optimised for use with acidic water containing fluoride and abrasive water containing solids at up to 50 °C/7 bar

Your benefits

- Electrochemical combination electrode: pH and reference electrode integrated
- Optimised pH glass for use in the presence of glass-corroding hydrofluoric acid (HF). HF is formed primarily in the presence of fluoride (F^-) at a pH of < 4. Glass corrosion is promoted by a constant concentration of fluoride, a falling pH value and a rising temperature. The glass composition and structure of the PHEF type reduce the release of SiF_4. Extended service life in the presence of fluoride (F^-) at a pH of < 7
- Twist protection for the sensor cable connected. This means that the cables can remain connected during installation and dismantling of the sensor, avoiding troublesome moisture on the connector contacts
- The flat shape of the glass diaphragm and large ring diaphragm facilitate use in contaminated water, which also contains abrasive solids



pk_6_007

HF

pH range	0 … 12
Temperature	0 … 50 °C
Max. pressure	7.0 bar
Min. conductivity	150 µS/cm
Electrolyte	Gel containing potassium chloride
Diaphragm	HDPE ring diaphragm, flat (Double Junction)
Sensor shaft	Epoxy
Shaft diameter	12 mm
Fitting length	120 ±3 mm
Fitting position	Vertical up to +25°
Thread	PG 13.5
Electrical connection	SN6 plug-in head, rotatable with a ProMinent cable
Enclosure rating	IP 65
Installation	Bypass: open outlet or return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	A significantly longer service life can be achieved compared with standard pH sensors in media containing hydrofluoric acid, e.g. waste water from the semiconductor industry or electroplating applications and air scrubbers
Resistance to	Disinfectant, solids content (turbid types of water), hydrofluoric acid (HF), abrasive particles
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, PE ring diaphragm, HF-compatible flat glass diaphragm, gel electrolyte, separate temperature measurement for temperature compensation needed

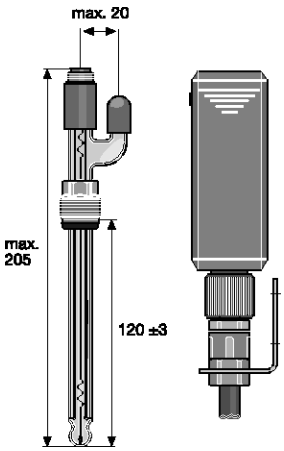
	Order no.
PHEF 012 SE	1010511

pH Sensor PHEN 112 SE

Refillable pH sensor optimised for use with chemically contaminated water at up to 80 °C/without excess pressure

Your benefits

- Electrochemical combination electrode: pH and reference electrode integrated
- Renewable liquid electrolyte by continuous replenishment from an electrolyte bottle installed above the electrode
- 1 ceramic diaphragm made of special material and with an optimised size / with optimised pore diameter
- Twist protection for the sensor cable connected. This means that the cables can remain connected during installation and dismantling of the sensor, avoiding troublesome moisture on the connector contacts
- Long service life in the presence of chemicals dissolved in the water, which could contaminate the reference system
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)



pk_6_021

pH range	1 … 12
Temperature	0 … 80 °C
Max. pressure	Atmospheric pressure
Min. conductivity	150 µS/cm
Electrolyte	KCL electrolyte, refillable
Diaphragm	Ceramic
Sensor shaft	Glass
Shaft diameter	12 mm
Fitting length	120 ±3 mm
Fitting position	Vertical up to +25°
Thread	PG 13.5
Electrical connection	SN6 plug-in head, rotatable with a ProMinent cable
Enclosure rating	IP 65
Installation	Bypass: open outlet or return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	Waste water, cooling waterchemically contaminated water
Resistance to	Disinfectant, only for clear types of water
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, liquid electrolyte, 1 ceramic diaphragm, separate temperature measurement for temperature compensation needed

	Order no.
PHEN 112 SE	305090

Supplied without PE storage tank and tube

	Order no.
PE storage tank with connectors and tube	305058

We recommend installation approx. 0.5-1 m above the sample fluid level

	Capacity ml	Order no.
KCl solution, 3 molar	250	791440
KCl solution, 3 molar	1,000	791441

1.2 pH, ORP, Fluoride and Temperature Sensors DULCOTEST®

pH Sensor PHEN 112 SE 3D

Refillable pH sensor optimised for use in contaminated water containing solids and water with a low conductivity of > 50 µS/cm at up to 80 °C/without overpressure

Your benefits

- Electrochemical combination electrode: pH and reference electrode integrated
- Renewable liquid electrolyte by continuous replenishment from an electrolyte bottle installed above the electrode
- 3 ceramic diaphragms made of special material, with optimised size and optimised pore diameter
- Twist protection for the sensor cable connected. This means that the cables can remain connected during installation and dismantling of the sensor, avoiding troublesome moisture on the connector contacts
- Long service life in water with low conductivity > 50 µS/cm and where solids are present
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)

pH range	1 … 12
Temperature	0 … 80 °C
Max. pressure	Atmospheric pressure
Min. conductivity	50 µS/cm
Electrolyte	3 molar potassium chloride solution, refillable
Diaphragm	3 ceramic diaphragms
Sensor shaft	Glass
Shaft diameter	12 mm
Fitting length	120 ±3 mm
Fitting position	Vertical up to +25°
Thread	PG 13.5
Electrical connection	SN6 plug-in head, rotatable with a ProMinent cable
Enclosure rating	IP 65
Installation	Bypass: open outlet or return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	Waste water, water with low conductivity, e.g. from reverse osmosis.
Resistance to	Disinfectant, solids content (turbid types of water)
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, liquid electrolyte, 1 ceramic diaphragm, separate temperature measurement for temperature compensation needed

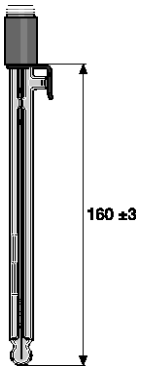
	Order no.
PHEN 112 SE 3D	150078

pH Sensor PHEN 012 SL

Refillable pH sensor for use with manual measuring instruments, optimised for clear and also chemically contaminated water at up to 80 °C/without overpressure

Your benefits

- Electrochemical combination electrode: pH and reference electrode integrated
- Renewable liquid electrolyte by continuous replenishment from an electrolyte bottle installed above the electrode
- 1 ceramic diaphragm made of special material and with an optimised size / with optimised pore diameter
- Long service life in the presence of dissolved chemicals, which could contaminate the reference system
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)



pk_6_020

pH range	0 … 12
Temperature	0 … 80 °C
Max. pressure	Atmospheric pressure
Min. conductivity	150 µS/cm
Electrolyte	KCl electrolyte, refillable
Diaphragm	Ceramic
Sensor shaft	Glass
Shaft diameter	12 mm
Fitting length	160 ±3 mm
Fitting position	Vertical up to +25°
Thread	None
Electrical connection	SN6 plug-in head
Enclosure rating	IP 65
Installation	Immersion by tripod or manually
Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	Manual measurements in laboratories
Resistance to	Disinfectants, water-soluble chemicals
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, liquid electrolyte, 1 ceramic diaphragm, separate temperature measurement for temperature compensation needed

	Order no.
PHEN 012 SL	305078

1.2 pH, ORP, Fluoride and Temperature Sensors DULCOTEST®

pH Sensor PHEN 012 SL 3D

Refillable pH sensor for use with manual measuring instruments, optimised for contaminated water containing solids and with a low conductivity of > 50 µS/cm at up to 80 °C/without overpressure

Your benefits

- Electrochemical combination electrode: pH and reference electrode integrated
- Renewable liquid electrolyte by continuous replenishment from an electrolyte bottle installed above the electrode
- 3 ceramic diaphragms made of special material and with an optimised size / with optimised pore diameter
- Long service life in water with low conductivity > 50 µS/cm and where solids are present
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)

pH range	0 … 12
Temperature	0 … 80 °C
Max. pressure	Atmospheric pressure
Min. conductivity	50 µS/cm
Electrolyte	3 molar potassium chloride solution, refillable
Diaphragm	3 ceramic diaphragms
Sensor shaft	Glass
Shaft diameter	12 mm
Fitting length	160 ±3 mm
Fitting position	Vertical up to +25°
Thread	None
Electrical connection	SN6 plug-in head
Enclosure rating	IP 65
Installation	Immersion by tripod or manually
Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	Laboratories, water with low conductivity, e.g. from reverse osmosis.Waste water
Resistance to	Disinfectant, solids content (turbid types of water)
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, liquid electrolyte, 3 ceramic diaphragms, separate temperature measurement for temperature compensation needed

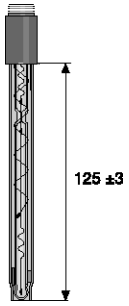
	Order no.
PHEN 012 SL 3D	791508

pH Sensor PHEK 112 S

pH sensor for use with manual measuring instruments, with plastic shaft, optimised for use in potable water treatment, swimming pools/hot tubs at up to 80 °C/3 bar

Your benefits

- Electrochemical combination electrode: pH and reference electrode integrated
- Diaphragm and reference system optimised for use in swimming pools and for potable water
- Ceramic diaphragm with special material, optimised size and optimised pore diameter
- With plastic shaft to prevent glass breakage
- Mechanical protection of the glass diaphragm
- Long service life due to reduced diffusion ("bleeding") of the electrolyte
- Long service life due to the material, which is inert to aggressive disinfectants
- Stable reference system
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)



pk_6_023

pH range	1 … 12
Temperature	0 … 60 °C
Max. pressure	3.0 bar
Min. conductivity	150 µS/cm
Electrolyte	Gel containing potassium chloride
Diaphragm	Ceramic
Sensor shaft	Polycarbonate
Shaft diameter	12 mm
Fitting length	120 ±3 mm
Fitting position	Vertical up to +25°
Thread	None
Electrical connection	SN6 plug-in head
Enclosure rating	IP 65
Installation	Immersion by tripod or manually
Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	Hand-held measurement in swimming pools, potable water
Resistance to	Disinfectant
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, gel electrolyte, ceramic diaphragm, separate temperature measurement for temperature compensation needed

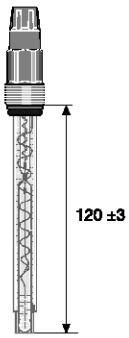
	Order no.
PHEK-112-S	305051

pH Sensor PHEK 112 SE

pH sensor with plastic shaft, optimised for use in potable water treatment, swimming pools/hot tubs at up to 60 °C/3 bar

Your benefits

- Electrochemical combination electrode: pH and reference electrode integrated
- Diaphragm and reference system optimised for use in swimming pools and for potable water
- Ceramic diaphragm with special material, optimised size and optimised pore diameter
- With plastic shaft to prevent glass breakage
- Mechanical protection of the glass diaphragm
- Long service life due to reduced diffusion ("bleeding") of the electrolyte
- Long service life due to the material, which is inert to aggressive disinfectants
- Stable reference system
- Twist protection for the sensor cable connected. This means that the cables can remain connected during installation and dismantling of the sensor, avoiding troublesome moisture on the connector contacts
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)



pk_6_090

pH range	1 … 12
Temperature	0 … 60 °C
Max. pressure	3.0 bar
Min. conductivity	150 µS/cm
Electrolyte	Gel containing potassium chloride
Diaphragm	Ceramic
Sensor shaft	Polycarbonate
Shaft diameter	12 mm
Fitting length	120 ±3 mm
Fitting position	Vertical up to +25°
Thread	PG 13.5
Electrical connection	SN6 plug-in head, rotatable with a ProMinent cable
Enclosure rating	IP 65
Installation	Bypass: open outlet or return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	Swimming pools, potable water, aquaria
Resistance to	Disinfectant
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, gel electrolyte, ceramic diaphragm, separate temperature measurement for temperature compensation needed

	Order no.
PHEK 112 SE	1028457

ex HD works

pH Sensor PHEK-L 112 SE

pH sensor with plastic shaft, optimised for use in potable water treatment, swimming pools/hot tubs, horizontal installation possible, at up to 60 °C/3 bar

Your benefits

- Electrochemical combination electrode: pH and reference electrode integrated
- With plastic shaft to prevent glass breakage
- Horizontal (level) installation possible (90° angle) (usually limited to 0 - 75° angle)
- Diaphragm and reference system optimised for use in swimming pools and for potable water
- Ceramic diaphragm with special material and optimised size / optimised pore diameter
- Long service life due to reduced diffusion ("bleeding") of the electrolyte
- Twist protection for the sensor cable connected. This means that the cables can remain connected during installation and dismantling of the sensor, avoiding troublesome moisture on the connector contacts
- Long service life due to the material, which is inert to aggressive disinfectants
- Stable reference system

pH range	1 … 12
Temperature	0 … 60 °C
Max. pressure	3.0 bar
Min. conductivity	150 µS/cm
Electrolyte	Gel containing potassium chloride
Diaphragm	Ceramic
Sensor shaft	Polycarbonate
Shaft diameter	12 mm
Fitting length	120 ±3 mm
Fitting position	Vertically to horizontally
Thread	PG 13.5
Electrical connection	SN6 plug-in head, rotatable with a ProMinent cable
Enclosure rating	IP 65
Installation	Bypass: open outlet or return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	Swimming pools, potable water, aquaria. Horizontal installation possible.
Resistance to	Disinfectant
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, gel electrolyte, ceramic diaphragm, separate temperature measurement for temperature compensation needed

	Order no.
PHEK-L 112 SE	1034918

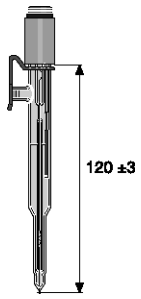
1.2 pH, ORP, Fluoride and Temperature Sensors DULCOTEST®

pH Sensor PHEE 112 S

pH sensor for use with manual measuring instruments as a puncture sensor for samples that can be punctured

Your benefits

- Electrochemical combination electrode: pH and reference electrode integrated
- pH measuring prod for inserting into solids into which a prod can be inserted
- 3 ceramic diaphragms made of special material for measurement after insertion
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)



pk_6_025

pH range	1 … 12
Temperature	0 … 60 °C
Max. pressure	Atmospheric pressure
Min. conductivity	150 µS/cm
Electrolyte	Gel containing potassium chloride
Diaphragm	3 ceramic diaphragms
Sensor shaft	Glass
Shaft diameter	12 mm
Fitting length	120 ±3 mm
Fitting position	Vertical up to +25°
Thread	None
Electrical connection	SN6 plug-in head
Enclosure rating	IP 65
Installation	Manual insertion
Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	pH measurement in foodstuffs, e.g. meat, cheese, non sterilisable
Resistance to	Mechanical stress when inserting
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, gel electrolyte, ceramic diaphragm, separate temperature measurement for temperature compensation needed, mechanically loadable measuring prod

	Order no.
PHEE 112 S	791094

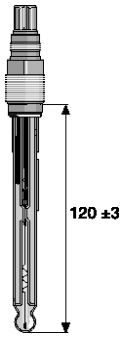
	Capacity ml	Order no.
Cleaning fluid Pepsin/hydrochloric acid	250	791443

pH Sensor PHEPT 112 VE

pH sensor with integral temperature measurement, optimised for use with clear process water and changing process temperature of up to 80 °C/6 bar

Your benefits

- Electrochemical combination electrode: pH and reference electrode integrated
- Diaphragm and reference system optimised for exacting process requirements
- Ceramic diaphragm with special material, optimised size and optimised pore diameter
- Long service life due to reduced diffusion ("bleeding") of the electrolyte
- Long service life due to the material, which is inert to aggressive chemicals
- Stable reference system for high pressure / temperature requirements
- Integrated Pt 100 temperature sensor for temperature compensation of the pH measurement in higher-order measuring instruments eliminates the need for an additional sensor housing and external temperature sensor
- Vario Pin plug-in head with IP 67 specification
- Twist protection for the sensor cable connected. This means that the cables can remain connected during installation and dismantling of the sensor, avoiding troublesome moisture on the connector contacts
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)



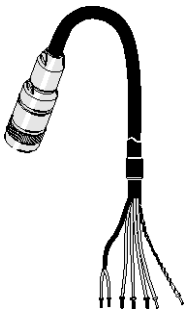
pk_6_068

pH range	1 … 12
Temperature	0 … 80 °C
Max. pressure	6.0 bar
Min. conductivity	150 µS/cm
Electrolyte	gel containing potassium chloride
Diaphragm	Ceramic
Sensor shaft	Glass
Shaft diameter	15 mm
Fitting length	120 ±3 mm
Fitting position	vertical up to +25°
Thread	PG 13.5
Electrical connection	Vario Pin plug-in head
Enclosure rating	IP 67
Installation	Bypass: open outlet or return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Measuring and control equipment	all DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	Swimming pools during pressurisation for higher temperatures and pressures, potable and industrial water, electroplating, chemical industry, processes with a temperature change.
Resistance to	Disinfectant
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, gel electrolyte, ceramic diaphragm, integrated temperature measurement for temperature compensation

	Order no.
PHEPT 112 VE	1004571

Accessories: Measuring Line for Sensors with Vario Pin Plug-in Head

Ready-made 6-wire measuring line with Vario Pin plug for connection to sensor type PHEPT 112 VE.



pk_6_069

	Length	Order no.
Vario Pin signal lead VP 6-ST/ 2 m	2 m	1004694
Vario Pin signal lead VP 6-ST/ 5 m	5 m	1004695
Vario Pin signal lead VP 6-ST/10 m	10 m	1004696

1.2.2 pH Sensors with Fixed Cable

pH sensors with fixed cable contain a shielded coaxial cable, which is firmly connected to the sensor head by a rotating sleeve, thereby preventing the cable from twisting when inserting and dismantling the sensor.

Series									
PHE	pH sensor								
	Properties								
	X	with solid electrolyte and annular gap diaphragms							
	K	with insensitive plastic shaft							
	N	KCl refillable sensor							
	R	with PTFE ring diaphragms							
	P	pressure-tight up to 6 bar							
	D	with double diaphragm (double junction)							
	S	Swimming pool sensor							
		Special equipment							
		T	with integral temperature gauge						
			pH measuring range						
			112	pH measuring range: 1...12					
				Electrical connection at the sensor					
				F	Fixed cable sensor				
					Internal thread				
					E	Internal thread			
					L	none, laboratory sensor refillable			
						Cable diameter			
						3	cable diameter 3 mm		
						5	cable diameter 5 mm		
							Cable length		
							01	cable length in metres	
								Electrical connection at device	
								S	SN6
								D	DIN
								B	BNC
								O	without connector
								M	SN6 male

The technical data corresponds to pH sensors with SN6 plug-in head (see page → 1-28)

pH Sensor PHES 112 F

pH sensor for use with manual measuring instruments, optimised for use in potable water treatment, swimming pools/hot tubs at up to 60 °C/3 bar

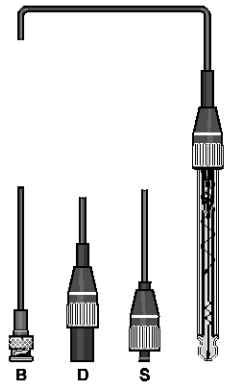
Your benefits

- Electrochemical combination electrode: pH and reference electrode integrated
- Diaphragm and reference system optimised for use in swimming pools and for potable water
- Ceramic diaphragm with special material, optimised size and optimised pore diameter
- Long service life due to reduced diffusion ("bleeding") of the electrolyte
- Long service life due to the material, which is inert to aggressive disinfectants
- Stable reference system
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)

pH sensor, gel-filled, with fixed coaxial cable and device plug, without screw-in thread.

	Cable length m	Device plug	Order no.
PHES 112 F 301 S	1	SN6	304976
PHES 112 F 301 B	1	BNC	304980
PHES 112 F 303 B	3	BNC	304981

Further types on request.



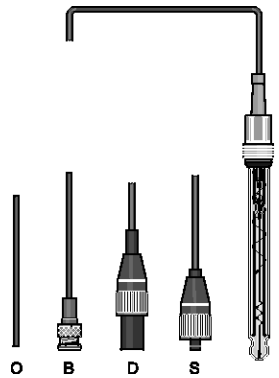
pk_6_024

pH Sensor PHES 112 FE

pH sensor optimised for use in potable water treatment, swimming pools/hot tubs at up to 60 °C/3 bar

Your benefits

- Electrochemical combination electrode: pH and reference electrode integrated
- Diaphragm and reference system optimised for use in swimming pools and for potable water
- Ceramic diaphragm with special material, optimised size and optimised pore diameter
- Long service life due to reduced diffusion ("bleeding") of the electrolyte
- Long service life due to the material, which is inert to aggressive disinfectants
- Stable reference system
- Rotating sensor head sleeve prevents the cable twisting when inserting and dismantling the sensor
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)



pk_6_028

	Cable length m	Device plug	Order no.
PHES 112 FE 303 S	3	SN6	304984
PHES 112 FE 310 S	10	SN6	304985
PHES 112 FE 503 D	3	DIN	304986
PHES 112 FE 303 B	3	BNC	304988
PHES 112 FE 310 O	10	without	304990
PHES 112 FE 301 B	1	BNC	150079
PHES 112 FE 301 S	1	SN6	150926
PHES 112 FE 303 O	1	without	150101

Further types on request.

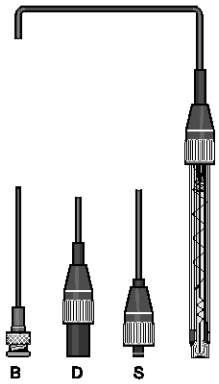
pH Sensor PHEK 112 F

pH sensor for use with manual measuring instruments, with plastic shaft, optimised for use in potable water treatment, swimming pools/hot tubs at up to 80 °C/3 bar

Your benefits

- Electrochemical combination electrode: pH and reference electrode integrated
- Diaphragm and reference system optimised for use in swimming pools and for potable water
- Ceramic diaphragm with special material, optimised size and optimised pore diameter
- With plastic shaft to prevent glass breakage
- Mechanical protection of the glass diaphragm
- Long service life due to reduced diffusion ("bleeding") of the electrolyte
- Long service life due to the material, which is inert to aggressive disinfectants
- Stable reference system
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)

pH sensor with polycarbonate plastic shaft, glass membrane protection, with fixed coaxial cable and device plug, without screw-in thread.



pk_6_027

	Cable length m	Device plug	Order no.
PHEK 112 F 301 S	1	SN6	304994
PHEK 112 F 501 D	1	DIN	304995
PHEK 112 F 301 B	1	BNC	304996

Further types on request.

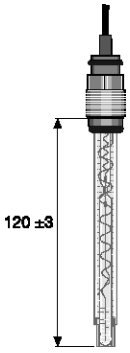
1.2 pH, ORP, Fluoride and Temperature Sensors DULCOTEST®

pH Sensor PHEK 112 FE

pH sensor with plastic shaft, optimised for use in potable water treatment, swimming pools/hot tubs at up to 60 °C/3 bar

Your benefits

- Electrochemical combination electrode: pH and reference electrode integrated
- Diaphragm and reference system optimised for use in swimming pools and for potable water
- Ceramic diaphragm with special material, optimised size and optimised pore diameter
- With plastic shaft to prevent glass breakage
- Mechanical protection of the glass diaphragm
- Long service life due to reduced diffusion ("bleeding") of the electrolyte
- Long service life due to the material, which is inert to aggressive disinfectants
- Stable reference system
- Rotating sensor head sleeve prevents the cable twisting when inserting and dismantling the sensor
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)



pk_6_090_1

pH sensor with polycarbonate plastic shaft, glass membrane protection, with fixed coaxial cable and device plug, with screw-in thread.

	Cable length m	Device plug	Order no.
PHEK 112 FE 303 B	3	BNC	1028458

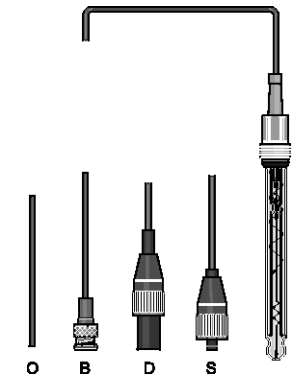
Other types on request.

pH Sensor PHEP 112 FE

pH sensor optimised for use with clear process water and conditions of up to 80 °C/6 bar

Your benefits

- Electrochemical combination electrode: pH and reference electrode integrated
- Diaphragm and reference system optimised for exacting process requirements
- Ceramic diaphragm with special material, optimised size and optimised pore diameter
- Long service life due to reduced diffusion ("bleeding") of the electrolyte
- Long service life due to the material, which is inert to aggressive disinfectants
- Stable reference system for high pressure/temperature requirements
- Rotating sensor head sleeve prevents the cable twisting when inserting and dismantling the sensor
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)

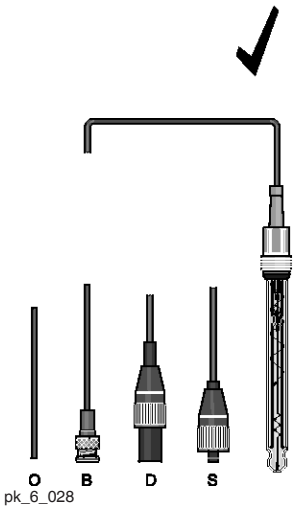


pk_6_028

	Cable length m	Device plug	Order no.
PHEP 112 FE 303 S	3	SN 6	150673
PHEP 112 FE 305 O	5	without	150689
PHEP 112 FE 510 O	10	without	150929

Further types on request.

pH Sensor PHER 112 FE



pH sensor optimised for use in contaminated water containing solids and for low conductivity of > 50 µS/cm at up to 80 °C/6 bar

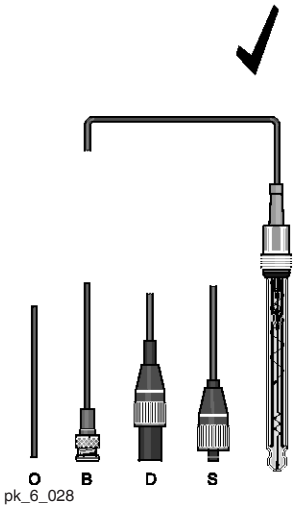
Your benefits

- Electrochemical combination electrode: pH and reference electrode integrated
- The large dirt-repellent Teflon® diaphragm prevents the reference system from becoming blocked up
- Long service life when solids are present
- High-viscosity electrolyte combined with a salt reservoir prevents the electrolyte from "bleeding"
- Long service life without drifts when there is clear water with low conductivity
- Rotating sensor head sleeve prevents the cable twisting when inserting and dismantling the sensor
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)

	Cable length m	Device plug	Order no.
Type PHER 112 FE 503 O	3	without	150878
Type PHER 112 FE 510 O	10	without	150874

Other types on request.

pH Sensor PHEX 112 FE



pH sensor optimised for use with contaminated water with a high solids content at 6 bar/100 °C or 16 bar/25 °C

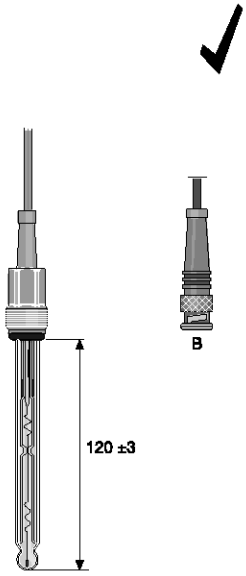
Your benefits

- Electrochemical combination electrode: pH and reference electrode integrated
- Diaphragm and reference system optimised for extremely high solids content
- The solid electrolyte makes the diaphragm redundant and prevents the reference system from becoming blocked up
- Long service life when sludge is present due to lack of a diaphragm
- Long service life as the solid electrolyte prevents the electrolyte from "bleeding"
- Stable reference system
- Rotating sensor head sleeve prevents the cable twisting when inserting and dismantling the sensor
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)

	Cable length m	Device plug	Order no.
Type PHEX 112 FE 510 S	10	SN 6	150025
Type PHEX 112 FE 510 O	10	without	150084
Type PHEX 112 FE 302 O	2	without	150086

Further types on request.

1.2 pH, ORP, Fluoride and Temperature Sensors DULCOTEST®



pH Sensor PHED 112 FE

pH sensor optimised for use with chemically contaminated but clear water at up to 80 °C/8 bar

Your benefits

- Electrochemical combination electrode: pH and reference electrode integrated
- Diaphragm and reference system optimised for use in chemically contaminated but clear water
- Double junction: two coupled ceramic diaphragms protect the reference system
- Long service life when chemical pollutants are present
- Special construction permits a maximum pressure of 8 bar
- Rotating sensor head sleeve prevents the cable twisting when inserting and dismantling the sensor
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)

	Cable length m	Device plug	Order no.
PHED 112 FE 303 B	3	BNC	741038

Further types on request.

1.2.3 ORP Sensors with SN6 Plug-in Head

ORP sensors with SN6 plug-in head are connected to a shielded coaxial cable with the appropriate socket. The rotating sensor head sleeve prevents the cable from twisting when inserting and dismantling the sensor. The cable can therefore remain connected. This avoids moisture from contacting the plug-in contacts.

Series						
RHE	ORP sensor					
	Properties					
	X	with solid electrolyte and circular gap diaphragm				
	K	with insensitive plastic shaft				
	P	pressure tight up to 6 bar				
	R	with PTFE circular diaphragm				
	N	KCl refillable sensor				
	S	swimming pool sensor				
		Special equipment				
		L	vertical to horizontal installation			
			Sensor material			
			Pt	Platinum (pin)		
			Au	Gold (pin)		
				Electrical connection at the sensor		
				S	Plug for coax connector SN6	
					Internal thread	
					E	PG 13.5

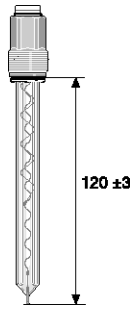
DULCOTEST® ORP sensor selection guide see page → 1-1

ORP Sensor RHES-Pt-SE

ORP sensor optimised for use in potable water treatment, swimming pools/hot tubs at up to 60 °C/3 bar

Your benefits

- Electrochemical combination electrode: ORP and reference electrode integrated
- Diaphragm and reference system optimised for use in swimming pools and for potable water
- Ceramic diaphragm with special material, optimised size and optimised pore diameter
- Long service life due to reduced diffusion ("bleeding") of the electrolyte
- Long service life due to the material, which is inert to aggressive disinfectants
- Stable reference system
- Rotating sensor head sleeve. This means that the cables can remain connected during installation and dismantling of the sensor, avoiding moisture on the plug-in contacts
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)



pk_6_031

pH range	1 … 12
Temperature	0 … 60 °C
Max. pressure	3.0 bar
Min. conductivity	150 µS/cm
Electrolyte	Gel containing potassium chloride
ORP electrode	Platinum
Diaphragm	Ceramic
Sensor shaft	Glass
Shaft diameter	12 mm
Fitting length	120 ±3 mm
Fitting position	Vertical up to +25°
Thread	PG 13.5
Electrical connection	SN6 plug-in head, rotatable with a ProMinent cable
Enclosure rating	IP 65
Installation	Bypass: open outlet or return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube

Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	Swimming pools, whirlpools, potable water
Resistance to	Disinfectant
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, gel electrolyte, ceramic diaphragm

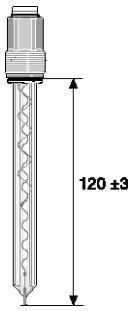
	Order no.
RHES-Pt-SE	150703

ORP Sensor RHES-Au-SE

ORP sensor optimised for use in potable water treatment, swimming pools/hot tubs when electrolysis processes are used for disinfection and with ozone treatment at up to 60 °C/3 bar

Your benefits

- Electrochemical combination electrode: ORP and reference electrode integrated
- Gold electrode to prevent faults by products from electrolysis processes where the electrodes are immersed directly into the sample water
- Diaphragm and reference system optimised for use in swimming pools and for potable water
- Ceramic diaphragm with special material, optimised size and optimised pore diameter
- Long service life due to reduced diffusion ("bleeding") of the electrolyte
- Long service life due to material, which is inert to aggressive disinfectants
- Stable reference system
- Rotating sensor head sleeve. This means that the cables can remain connected during installation and dismantling of the sensor, avoiding moisture on the plug-in contacts
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)



pk_6_031

pH range	1 … 12
Temperature	0 … 60 °C
Max. pressure	3.0 bar
Min. conductivity	150 µS/cm
Electrolyte	Gel containing potassium chloride
ORP electrode	Gold
Diaphragm	Ceramic
Sensor shaft	Glass
Shaft diameter	12 mm
Fitting length	120 ±3 mm
Fitting position	Vertical up to +25°
Thread	PG 13.5
Electrical connection	SN6 plug-in head, rotatable with a ProMinent cable
Enclosure rating	IP 65
Installation	Bypass: open outlet or return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	Swimming pools, whirlpools, potable water, with disinfectants from electrolysis processes (electrodes directly in the process water)
Resistance to	Disinfectant, by-products from electrolysis process and from ozone treatment process
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, gel electrolyte, ceramic diaphragm

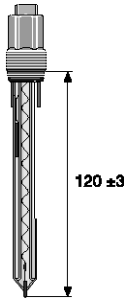
	Order no.
RHES-Au-SE	1044544

ORP Sensor RHEP-Pt-SE

ORP sensor optimised for use with clear process water and conditions of up to 80 °C/6 bar

Your benefits

- Electrochemical combination electrode: ORP and reference electrode integrated
- Diaphragm and reference system optimised for exacting process requirements
- Ceramic diaphragm with special material, optimised size and optimised pore diameter
- Long service life due to reduced diffusion ("bleeding") of the electrolyte
- Long service life due to material, which is inert to aggressive chemicals
- Stable reference system for high pressure / temperature requirements
- Rotating sensor head sleeve. This means that the cables can remain connected during installation and dismantling of the sensor, avoiding moisture on the plug-in contacts
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)



pk_6_035

pH range	1 … 12
Temperature	0 … 80 °C
Max. pressure	6.0 bar
Min. conductivity	150 µS/cm
Electrolyte	Gel containing potassium chloride
ORP electrode	Platinum
Diaphragm	Ceramic
Sensor shaft	Glass
Shaft diameter	15 mm
Fitting length	120 ±3 mm
Fitting position	Vertical up to +25°
Thread	PG 13.5
Electrical connection	SN6 plug-in head, rotatable with a ProMinent cable
Enclosure rating	IP 65
Installation	Bypass: open outlet or return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	Swimming pools during pressurisation for higher temperatures and pressures, potable and industrial water, electroplating,
Resistance to	Disinfectant, not suitable for media containing ozone, cyanides, electrolysis processes (electrodes directly in the sample water)
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, gel electrolyte, ceramic diaphragm

	Order no.
RHEP-Pt-SE	150094

ORP Sensor RHEP-Au-SE

ORP sensor optimised for use with clear process water when electrolysis processes are used for disinfection and with ozone treatment and with cyanide detoxification at conditions of up to 80 °C/6 bar

Your benefits

- Electrochemical combination electrode: ORP and reference electrode integrated
- Gold electrode to prevent faults by products from electrolysis processes where the electrodes are immersed directly into the sample water
- Diaphragm and reference system optimised for exacting process requirements
- Ceramic diaphragm with special material, optimised size and optimised pore diameter
- Long service life due to reduced diffusion ("bleeding") of the electrolyte
- Long service life due to the material, which is inert to aggressive chemicals
- Stable reference system for high pressure / temperature requirements
- Rotating sensor head sleeve. This means that the cables can remain connected during installation and dismantling of the sensor, avoiding moisture on the plug-in contacts
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)

pH range	1 … 12
Temperature	0 … 80 °C
Max. pressure	6.0 bar
Min. conductivity	150 µS/cm
Electrolyte	Gel containing potassium chloride
ORP electrode	Gold
Diaphragm	Ceramic
Sensor shaft	Glass
Shaft diameter	15 mm
Fitting length	120 ±3 mm
Fitting position	Vertical up to +25°
Thread	PG 13.5
Electrical connection	SN6 plug-in head, rotatable with a ProMinent cable
Enclosure rating	IP 65
Installation	Bypass: open outlet or return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	Cyanide detoxification, ozone monitoring
Resistance to	Disinfectant, by-products from electrolysis process and from ozone treatment process, cyanides
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, gel electrolyte, ceramic diaphragm

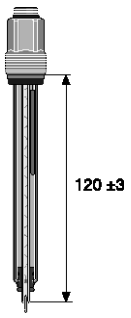
	Order no.
RHEP-Au-SE	1003875

ORP Sensor RHER-Pt-SE

ORP sensor optimised for use in contaminated water containing solids and for low conductivity of > 50 µS/cm at up to 80 °C/6 bar

Your benefits

- Electrochemical combination electrode: ORP and reference electrode integrated
- The large dirt-repellent Teflon® diaphragm prevents the reference system from becoming blocked up
- Long service life when solids are present
- High-viscosity electrolyte combined with a salt reservoir prevents the electrolyte from "bleeding"
- Long service life without drifts when there is clear water with low conductivity
- Rotating sensor head sleeve. This means that the cables can remain connected during installation and dismantling of the sensor, avoiding moisture on the plug-in contacts
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)



pk_6_034

pH range	1 … 12
Temperature	0 … 80 °C
Max. pressure	6.0 bar
Min. conductivity	50 µS/cm
Electrolyte	Electrolyte with KCl supplement (salt rings in the reference electrolyte)
ORP electrode	Platinum
Diaphragm	PTFE ring diaphragm
Sensor shaft	Glass
Shaft diameter	12 mm
Fitting length	120 ±3 mm
Fitting position	Vertical up to +25°
Thread	PG 13.5
Electrical connection	SN6 plug-in head/other versions on request
Enclosure rating	IP 65
Installation	Bypass: open outlet or return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	Municipal and industrial waste water, cooling water, process water, chemical applications, paper manufacturing. In general for water with a noticeable solid fraction.
Resistance to	Disinfectant, solids content (turbid types of water)
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, Teflon ring diaphragm, polymer electrolyte

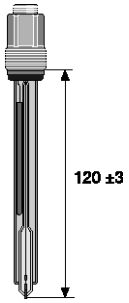
	Order no.
RHER-Pt-SE	1002534

ORP Sensor RHEX-Pt-SE

ORP sensor optimised for use with contaminated water with a high solids content at 6 bar/100 °C or 16 bar/25 °C

Your benefits

- Electrochemical combination electrode: ORP and reference electrode integrated
- Diaphragm and reference system optimised for extremely high solids content
- The solid electrolyte makes the diaphragm redundant and prevents the reference system from becoming blocked up
- Long service life when sludge is present due to lack of a diaphragm
- Long service life as the solid electrolyte prevents the electrolyte from "bleeding"
- Stable reference system
- Rotating sensor head sleeve. This means that the cables can remain connected during installation and dismantling of the sensor, avoiding moisture on the plug-in contacts
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)



pk_6_033

pH range	1 … 12
Temperature	0 … 100 °C
Max. pressure	16.0 bar up to 25 °C, 6.0 bar up to 100 °C
Min. conductivity	500 µS/cm
Electrolyte	Polymer containing potassium chloride (solid)
ORP electrode	Platinum
Diaphragm	Circular gap (solid electrolyte)
Sensor shaft	Glass
Shaft diameter	12 mm
Fitting length	120 ±3 mm
Fitting position	Vertical up to +25°
Thread	PG 13.5
Electrical connection	SN6 plug-in head/other versions on request
Enclosure rating	IP 65
Installation	Bypass: open outlet or return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	Waste water, industrial water, process chemistry, emulsions, suspensions, protein-containing media. In general for water with a high solid fraction. Not suitable for clear media. Not suitable for media with oxidation agents.
Resistance to	Solids content (turbid types of water), sludge, emulsions
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, no diaphragm, polymer electrolyte

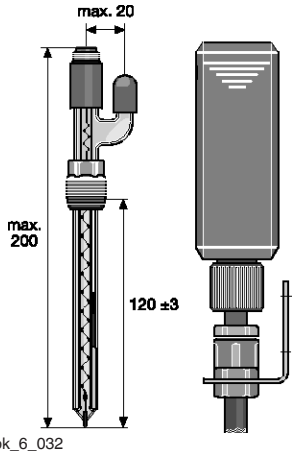
	Order no.
RHEX-Pt-SE	305097

ORP Sensor RHEN-Pt-SE

Refillable ORP sensor optimised for use with chemically contaminated water at up to 80 °C/without excess pressure

Your benefits

- Electrochemical combination electrode: ORP and reference electrode integrated
- Renewable liquid electrolyte by continuous replenishment from an electrolyte bottle installed above the electrode
- 1 ceramic diaphragm made of special material, with an optimised size and with optimised pore diameter
- Long service life in the presence of chemicals dissolved in the water, which could contaminate the reference system
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)



pk_6_032

pH range	1 … 12
Temperature	0 … 80 °C
Max. pressure	Operation at atmospheric pressure
Min. conductivity	150 µS/cm
Electrolyte	KCl electrolyte, refillable
ORP electrode	Platinum
Diaphragm	Ceramic
Sensor shaft	Glass
Shaft diameter	12 mm
Fitting length	120 ±3 mm
Fitting position	Vertical up to +25°
Thread	PG 13.5
Electrical connection	SN6 plug-in head/other versions on request
Enclosure rating	IP 65
Installation	By tripod or manually
Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	Waste water, cooling water, chemically contaminated water, only clear types of water
Resistance to	Disinfectant, chemicals dissolved in water
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, liquid electrolyte, 1 ceramic diaphragm

	Order no.
RHEN-Pt-SE	305091

Supplied without PE storage tank and tube

Accessories

	Capacity ml	Order no.
PE storage tank with connectors and tube	–	305058
KCl solution, 3 molar	250	791440
KCl solution, 3 molar	1,000	791441

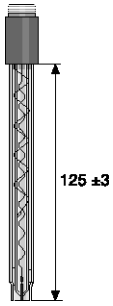
We recommend installation approx. 0.5-1 m above the sample fluid level.

ORP Sensor RHEK-Pt-S

ORP sensor with plastic shaft for use with manual measuring instruments, optimised for use in potable water treatment, swimming pools/hot tubs at up to 60 °C/3 bar

Your benefits

- Electrochemical combination electrode: ORP and reference electrode integrated
- Diaphragm and reference system optimised for use in swimming pools and for potable water
- With plastic shaft to prevent glass breakage
- Mechanical protection of the glass diaphragm
- Ceramic diaphragm with special material, optimised size and optimised pore diameter
- Long service life due to reduced diffusion ("bleeding") of the electrolyte
- Long service life due to the material, which is inert to aggressive disinfectants
- Stable reference system
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)



pk_6_036

pH range	1 … 12
Temperature	0 … 60 °C
Max. pressure	Operation at atmospheric pressure
Min. conductivity	150 µS/cm
Electrolyte	Gel containing potassium chloride
ORP electrode	Platinum
Diaphragm	Ceramic
Sensor shaft	Polycarbonate
Shaft diameter	12 mm
Fitting length	125 ±3 mm
Fitting position	Vertical up to +25°
Thread	None
Electrical connection	SN6 plug-in head, rotatable with a ProMinent cable
Enclosure rating	IP 65
Installation	By tripod or manually
Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	Manual measurement e.g. swimming pools, potable water, aquarium water
Resistance to	Disinfectant
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, gel electrolyte, ceramic diaphragm

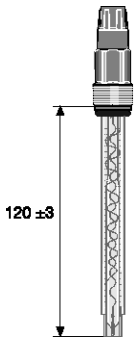
	Order no.
RHEK-Pt-S	305052

ORP Sensor RHEK-Pt-SE

ORP sensor with plastic shaft, optimised for use in potable water treatment, swimming pools/hot tubs at up to 60 °C/3 bar

Your benefits

- Electrochemical combination electrode: ORP and reference electrode integrated
- Diaphragm and reference system optimised for use in swimming pools and for potable water
- With plastic shaft to prevent glass breakage
- Mechanical protection of the glass diaphragm
- Ceramic diaphragm with special material, optimised size and optimised pore diameter
- Long service life due to reduced diffusion ("bleeding") of the electrolyte
- Long service life due to the material, which is inert to aggressive disinfectants
- Stable reference system
- Rotating sensor head sleeve. This means that the cables can remain connected during installation and dismantling of the sensor, avoiding moisture on the plug-in contacts
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)



pk_6_091

pH range	1 … 12
Temperature	0 … 60 °C
Max. pressure	3.0 bar
Min. conductivity	150 µS/cm
Electrolyte	Gel containing potassium chloride
ORP electrode	Platinum
Diaphragm	Ceramic
Sensor shaft	Polycarbonate
Shaft diameter	12 mm
Fitting length	120 ±3 mm
Fitting position	Vertical up to +25°
Thread	PG 13.5
Electrical connection	SN6 plug-in head, rotatable with a ProMinent cable
Enclosure rating	IP 65
Installation	Bypass: open outlet or return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	Swimming pool,Potable water,Aquariums,
Resistance to	Disinfectant
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, gel electrolyte, ceramic diaphragm

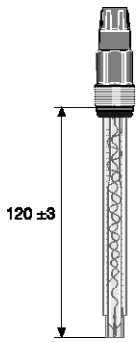
	Order no.
RHEK-Pt-SE	1028459

ORP Sensor RHEK-L Pt-SE

ORP sensor with plastic shaft, optimised for vertical to horizontal installation position for use in potable water treatment, swimming pools/hot tubs at up to 60 °C/3 bar

Your benefits

- Electrochemical combination electrode: ORP and reference electrode integrated
- With plastic shaft to prevent glass breakage
- Horizontal (level) installation possible (90° angle) (usually limited to 0 - 75° angle)
- Diaphragm and reference system optimised for use in swimming pools and for potable water
- Ceramic diaphragm with special material, optimised size and optimised pore diameter
- Long service life due to reduced diffusion ("bleeding") of the electrolyte
- Rotating sensor head sleeve. This means that the cables can remain connected during installation and dismantling of the sensor, avoiding moisture on the plug-in contacts
- Long service life due to the material, which is inert to aggressive disinfectants
- Stable reference system



pk_6_091

pH range	1 … 12
Temperature	0 … 60 °C
Max. pressure	3.0 bar
Min. conductivity	150 µS/cm
Electrolyte	Gel containing potassium chloride
ORP electrode	Platinum
Diaphragm	Ceramic
Sensor shaft	Polycarbonate
Shaft diameter	12 mm
Fitting length	120 ±3 mm
Fitting position	vertical to horizontal
Thread	PG 13.5
Electrical connection	SN6 plug-in head, rotatable with a ProMinent cable
Enclosure rating	IP 65
Installation	Bypass: open outlet or return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Measuring and control equipment	All DULCOMETER® controllers and solenoid metering pumps types D_4a and delta®
Typical applications	Swimming pools, Potable water,Aquariums,Horizontal installation possible.
Resistance to	Disinfectant
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, gel electrolyte, ceramic diaphragm

	Order no.
RHEK-L Pt-SE	1034919

1.2.4 ORP Sensors with Fixed Cable

All ORP sensors with fixed cable contain a shielded coaxial cable, which is firmly connected to the sensor head by a rotating sleeve. This prevents the cable from twisting when inserting and dismantling the sensor.

Series								
RHE	ORP sensor							
	Properties							
	K	Plastic shaft						
	S	Swimming pool sensor						
		Sensor material						
		Pt	Platinum					
			Electrical connection at the sensor					
			F	Fixed cable sensor				
				Internal thread				
				E	internal thread PG 13.5			
					Cable diameter			
					3	cable diameter 3 mm		
					5	cable diameter 5 mm		
						Cable length		
						01	cable length in metres	
							Electrical connection at device	
							S	SN6
							D	DIN
							B	BNC

The technical data corresponds to pH sensors with SN6 plug-in head (see page → 1-33)

ORP Sensor RHES-Pt-FE

ORP sensor optimised for use in potable water treatment, swimming pools/hot tubs at up to 60 °C/3 bar

Your benefits

- Electrochemical combination electrode: ORP and reference electrode integrated
- Diaphragm and reference system optimised for use in swimming pools
- Ceramic diaphragm with special material, optimised size and optimised pore diameter
- Long service life due to reduced diffusion ("bleeding") of the electrolyte
- Long service life due to the material, which is inert to aggressive disinfectants
- Stable reference system
- Anti-twist mechanism on the fixed cable prevents the cable from twisting when inserting and removing the sensor
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)

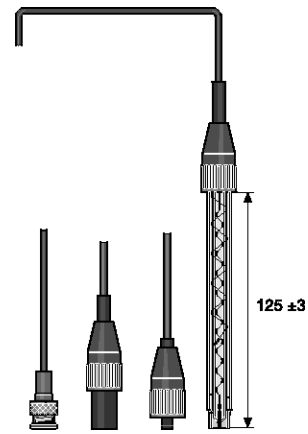
	Cable length m	Device plug	Order no.
RHES-Pt-FE 301 B	1	BNC	150758
RHES-Pt-FE 303 B	3	BNC	150038
RHES-Pt-FE 301 S	3	SN6	304949

Other types on request.

1.2 pH, ORP, Fluoride and Temperature Sensors DULCOTEST®

ORP Sensor RHES-Pt-F

ORP sensor for use with manual measuring instruments, optimised for use in swimming pools / hot tubs at up to 60 °C / 3 bar



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Your benefits

- Electrochemical combination electrode: ORP and reference electrode integrated
- Diaphragm and reference system optimised for use in swimming pools
- Ceramic diaphragm with special material, optimised size and optimised pore diameter
- Long service life due to reduced diffusion ("bleeding") of the electrolyte
- Long service life due to the material, which is inert to aggressive disinfectants
- Stable reference system
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)

	Cable length m	Device plug	Order no.
RHES-Pt-F 303 B	3	BNC	304983

Other types on request.

ORP Sensor RHEK-Pt-F

ORP sensor with plastic shaft for use with manual measuring instruments, optimised for use in potable water treatment, swimming pools/hot tubs at up to 60 °C/3 bar

Your benefits

- Electrochemical combination electrode: ORP and reference electrode integrated
- Diaphragm and reference system optimised for use in swimming pools
- With plastic shaft to prevent glass breakage
- Mechanical protection of the glass diaphragm
- Ceramic diaphragm with special material, optimised size and optimised pore diameter
- Long service life due to reduced diffusion ("bleeding") of the electrolyte
- Long service life due to the material, which is inert to aggressive disinfectants
- Stable reference system
- Lead-free glass for advanced and environmentally-friendly production, use and disposal (RoHS-compliant)

	Cable length m	Device plug	Order no.
RHEK-Pt-F 301 S	1	SN 6	304997
RHEK-Pt-F 501 D	1	DIN	304998

Further types on request.

1.2.5 DULCOTEST® Fluoride Sensors

DULCOTEST® fluoride sensors are ion selective sensors, which function according to the potentiometric measuring principle and are suitable for determining the concentration of fluoride anions in aqueous solutions. The measuring point with the FPV1 type measuring transducer was optimised for use in monitoring the fluoridation of potable water in waterworks (measurement range up to 10 ppm). The measuring point with the measuring transducer FP 100 V1 with a measurement range up to 100 ppm is used for clear waste water free of solid material.

Fluoride Sensor FLEP 010-SE / FLEP 0100-SE

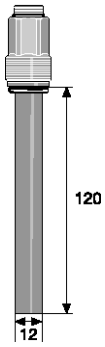
Highly selective, online fluoride sensor, optimised for the fluoridation of potable water and monitoring of waste water with a pH of up to 9.5

Your benefits

- Highly selective measurement of fluoride by LaF_3 single crystal silicon
- Unique pH range of up to pH 9.5 by optimisation of the electrolyte
- Two measuring ranges available: 0.05 -10 ppm for potable water; 0.5 -100 ppm for waste water

Technical details

A 4-20 mA measuring transducer, a reference electrode and a temperature sensor for temperature compensation are required as well as the fluoride sensor.



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Measured variable	Fluoride ion concentration
Reference method	Photometrically (Photometer DT2C)
Measuring range	**With measuring transducer FPV1:** 0.05...10 mg/l **With measuring transducer FP100V1:** 0.5...100 mg/l
pH range	5.5 … 9.5
Temperature	1 … 35 °C
Max. pressure	7.0 bar, (no pressure surges)
Min. conductivity	100 µS/cm
Shaft diameter	12.0 mm
Fitting length	120 mm
Thread	PG 13.5
Electrical connection	SN6 plug-in head
Enclosure rating	IP 65
Installation	Bypass: open outlet or return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Intake flow	10…200 l/h
Flow	20 l/h (recommended)
Response time T95 max.	30 s (for conc. > 0.5 ppm)
Shelf life	6 months
In-line probe fitting	Bypass fitting DLG IV
Measuring and control equipment	D1C/DAC/DULCOMARIN® II
Typical applications	Monitoring the fluoridation of potable water in waterworksWaste water
Resistance to	Disinfectant, solids content (turbid types of water)
Measuring principle, technology	Direct potentiometric measurement, 2 electrodes, gel electrolyte, ceramic diaphragm, separate temperature measurement for temperature compensation needed

	Order no.
FLEP 010-SE / FLEP 0100-SE	1028279

1.2 pH, ORP, Fluoride and Temperature Sensors DULCOTEST®

Accessories

	Order no.
Measuring transducer 4-20 mA FPV1	1028280
Measuring transducer 4-20 mA FP 100 V1	1031331
Signal cable, sold by the metre 2 x 0.25 mm² Ø 4 mm	725122
Reference electrode, REFP-SE	1018458
Pt 100 SE	305063
Polishing paste	559810

Panel-mounted fluoride measuring station

The panel-mounted measuring stations that could be ordered to date with part no.1010602 (230 V) and 1010603 (115 V) can now be ordered as measuring stations of the DULCOTROL® DWCa product line.

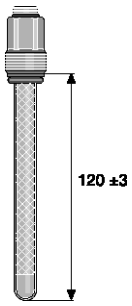
Overview of DULCOTROL® PWC_P Potable Water/F&B See page → 3-3

1.2.6 DULCOTEST® Temperature Sensors

Temperature measurement with DULCOTEST® sensors: Can be used for direct temperature measurement or temperature compensation during measurement of pH, fluoride, conductivity, chlorine dioxide or hydrogen peroxide.

Your benefits

- Select Pt 100 or Pt 1000, depending on measuring range and accuracy required
- Sturdy design with dimensions of a standard pH sensor; the sensor element is integrated in a chemically inert glass sleeve.
- Easily installed in a similar way to standard pH sensors with a PG13.5 thread in existing fittings.
- Transmitter with display/operation and without display/operation for transmission/conversion of the primary signal into a 4-20 mA signal and for transmission to a central control unit (PLC)



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Temperature	0 … 100 °C
Max. pressure	10.0 bar
Thread	PG 13.5
Electrical connection	SN6
Typical applications	Temperature measurement and pH temperature correction

	Order no.
Pt 100 SE	305063
Pt 1000 SE	1002856

1.3 Amperometric Sensors DULCOTEST®

1.3.1 Amperometric Sensors for Chlorine, Bromine, Chlorine Dioxide, Chlorite, Ozone, Dissolved Oxygen, Peracetic Acid and Hydrogen Peroxide

The advantages at a glance:

- 12 measuring parameters available with analogue construction, each for simple installation to the same fittings and controllers
- Application-specific sensor models permit optimum operation with varying process conditions
- Efficient process management by precise measurement in real-time
- Amperometric measuring principle means no interference by turbidity or discolouration
- Diaphragm-covered measuring electrodes ensure reliable operation and long service life even under adverse and variable process conditions

Note the following points for optimum operation of amperometric sensors:

- Use of DULCOMETER® controllers
- Installation only in ProMinent fittings type DGM or DLG III
- Specified flow between 30…60 l/h
- Chlorine measurement only with a steady pH: if not possible, see Chapter 3.4
- Regular calibration with a photometer (e.g. type DT)

Important:

No amperometric sensors are galvanically isolated. When using with external devices (e.g. PLC), ensure that the supply voltage and analogue input signal are galvanically isolated.

Selection guide for DULCOTEST® amperometric sensors

Measured variable	Applications	Graduated measuring range	Connection to DULCOMETER®	Sensor type	See page
Free chlorine	Potable water, swimming pools	0.01–100 mg/l	D1C, DACa	CLE 3-mA-xppm, CLE 3.1-mA-xppm	→ 1-51
Free chlorine	Process and waste water	10 - 200 mg/l	D1C, DACa	CLR 1-mA	→ 1-61
Free chlorine	Potable water, swimming pool water	0.01 - 10 mg/l	DULCOMARIN® II	CLE 3-CAN-xppm, CLE 3.1-CAN-xppm	→ 1-54
Free chlorine	Potable water, swimming pool water, in situ electrolysis (without diaphragm)	0.02-10 mg/l	D1C, DACa	CLO 1-mA-xppm	→ 1-56
Free chlorine	Hot water up to 70 °C (legionella), in situ electrolysis (without diaphragm)	0.02-2 mg/l	D1C, DACa	CLO 2-mA-2ppm	→ 1-57
Free chlorine	Potable water, swimming pools	0.01–50 mg/l	DMT	CLE 3-DMT-xppm	→ 1-53
Free chlorine	Potable water, swimming pools	0.05-5 mg/l	COMPACT	CLB 2-µA-xppm	→ 1-58
Free chlorine	Potable water, swimming pool water	0.05-5 mg/l	COMPACT	CLB 3-µA-xppm	→ 1-59
Free chlorine	Cooling, industrial and waste water, water with higher pH values (stable); seawater (free chlorine exists as bromine)	0.01-10 mg/l	D1C, DACa	CBR 1-mA-xppm	→ 1-60
Total available chlorine	Swimming pool water with chlorine-organic disinfectants	0.02–10 mg/l	D1C, DACa	CGE 3-mA-xppm	→ 1-62
Total available chlorine	Swimming pool water with organic chlorine disinfectants, in situ electrolysis (without diaphragm)	0.02 - 10 mg/l	D1C, DACa	CGE 3-mA	→ 1-62
Total available chlorine	Swimming pool water with chlorine-organic disinfectants	0.01–10 mg/l	DULCOMARIN® II	CGE 2-CAN-xppm	→ 1-63
Total chlorine	Potable, industrial, process and waste water	0.01–10 mg/l	D1C, DACa	CTE 1-mA-xppm	→ 1-64
Total chlorine	Potable, industrial, process and waste water	0.01–10 mg/l	DMT	CTE 1-DMT-xppm	→ 1-65
Total chlorine	Potable, industrial, process and waste water	0.01–10 mg/l	DULCOMARIN® II	CTE 1-CAN-xppm	→ 1-66
Combined chlorine	Swimming pool water	0.02–2 mg/l	DACa	CTE 1-mA-2 ppm + CLE 3.1-mA-2 ppm	→ 1-66
Combined chlorine	Swimming pool water	0.01–10 mg/l	DULCOMARIN® II	CTE 1-CAN-xppm + CLE 3.1-CAN-xppm	→ 1-66

1.3 Amperometric Sensors DULCOTEST®

Measured variable	Applications	Graduated measuring range	Connection to DULCOMETER®	Sensor type	See page
Total available bromine	Cooling water, waste water, swimming pool water, whirlpool water, bromine with BCDMH	0.01-10 mg/l	D1C, DACa	BCR 1-mA (replaces earlier type BRE 1)	→ 1-68
Total available bromine	Cooling water, swimming pool water, whirlpool water with organic or inorganic bromine compounds	0.02-10 mg/l	DULCOMARIN® II	BRE 3-CAN-10 ppm	→ 1-69
Free and bound bromine	Cooling, industrial, waste water, water with higher pH values (stable); seawater	0.02-20 mg/l	D1C, DACa	CBR 1-mA-xppm	→ 1-60
Chlorine dioxide	Potable water	0.01–10 mg/l	D1C, DACa	CDE 2-mA-xppm	→ 1-71
Chlorine dioxide	Bottle washer systems	0.02–2 mg/l	D1C, DACa	CDP 1-mA	→ 1-72
Chlorine dioxide	Hot water up to 60 °C, cooling water, waste water, irrigation water	0.01-10 mg/l	D1C, DACa, DULCOMARIN® II	CDR 1-mA-xppm, CDR 1-CAN-xppm	→ 1-73
Chlorite	Potable, wash water	0.02–2 mg/l	D1C, DACa, DULCOMARIN® II	CLT 1-mA-xppm, CLT 1-CAN-xppm	→ 1-75
Ozone	Potable water, swimming pool water	0.02–2 mg/l	D1C, DACa	OZE 3-mA	→ 1-77
Ozone	Process, service or cooling water	0.02–2 mg/l	D1C, DACa	OZR 1-mA-2 ppm*	→ 1-78
Dissolved oxygen	Potable, surface water	2–20 mg/l	D1C, DACa	DO 1-mA-xppm	→ 1-79
Dissolved oxygen	Activated sludge tank, sewage treatment plants	0.1–10 mg/l	D1C, DACa	DO 2-mA-xppm	→ 1-80
Peracetic acid	CIP, antiseptic food filling process	1–2,000 mg/l	D1C, DACa	PAA 1-mA-xppm	→ 1-81
Hydrogen peroxide	Clear water, fast control	1–2,000 mg/l	DACa	PEROX sensor PEROX-H2.10 P	→ 1-83
Hydrogen peroxide	Process, swimming pool water	2–20,000 mg/l	D1C, DACa	PER1-mA-xppm	→ 1-83

1.3 Amperometric Sensors DULCOTEST®

1.3.2 Sensors for Chlorite

Different forms of dissolved chlorine are present in water:

Free (effective) chlorine:	Recommended sensors for Cl_2, HOCl (hypochlorous acid), OCl^- (hypochlorite): **Types CLE, CLO, CLB, CBR, reference method: DPD1**
Combined chlorine:	Mono-, di-, trichloroamine. The measuring result of type CLE (free chlorine) is subtracted from the measurement result of type CTE (total chlorine). Reference method: DPD4 minus DPD1
Total chlorine:	Total of free and combined chlorine; recommended sensor: **Type CTE, reference method DPD4**
Total available chlorine (organic combined chlorine):	Chlorine bound to (iso)cyanic acid/isocyanurate and the free (effective) chlorine resulting from it; recommended sensor: **Type CGE, reference method DPD1**
Applications:	Chlorine measurement in potable, swimming pool, cooling, service, process and waste water or water of comparable quality, as well as salt water/seawater with up to 15% chloride content. For chlorine measurements at high pH values (8...9.5), we recommend chlorine sensors CGE and CTE for total chlorine and total available chlorine. We recommend the sensor type CBR or the system for metering pH buffer solution into the sample water bypass (see Chapter 3.4) for measuring free chlorine at high pH values
Unit connection:	Do not use sensors CLE CLO, CLB and CBR in the presence of isocyanuric acid/chlorine stabilisers! Types CLE 3.1, CBR, CTE and CGE 2 operate incorrectly when chlorinating using electrolysis processes without diaphragm. Sensors with the designation -mA are used for controllers D1Cb, DAC and DULCOMARIN®. Sensors with the designation -4P are used for the former WS controllers and for metering pumps with integral chlorine controllers. Sensors with the designation DMT are used for DMT transducers. Sensors with the designation CAN are used with the swimming pool controller DULCOMARIN® II. Sensors CLB 1 and CLB 2 with the designation -µA do not have a signal transformer and function solely with the Compact Controller.

1.3 Amperometric Sensors DULCOTEST®

Selection Guide

		CLE 3/ [CLR 1]	CLE 3.1	CLO 1	CLO 2	CLB 2/ CLB 3	CBR 1	CGE 3	CTE 1	BCR 1
Measured variable	Free chlorine	x, [x]	x	x	x	x	x [1)]			
	Total available chlorine (cyanuric acid derivatives)							x		
	Total chlorine								x	X [2)]
Selectivity of free chlorine	Raised		x							
	Yes	x, [x]		x	x	x	x	x		
	No								x	x
Application	Public swimming pools	x	x	(x)		(x)	(x)	x		
	Private swimming pools	x	x	x		x		x		
	Potable water	x			x	x	x		x	
	Cooling water						x			x
	Waste water	[x]					x		x	x
Disinfectant	Chlorine gas, hypochlorite, electrolysis (with diaphragm)	x, [x]	x	x	x	x	x		x	
	Electrolysis (without membrane)			x	x	x		x		
	Chlorine-containing cyanuric acid derivatives					(x)		x		
	BCDMH									x
Specifications	Measuring range [ppm]	0.01-100, [10-200]	0.01-10	0.02-10	0.02-2	0.02-10	0.01-10	0.02-10	0.01-10	0.01 - 10
	pH range	5.5-8.0	5.5-8.0	5.0-9.0	5.0-9.0	5.0-9.0	5.0-9.5	5.5-9.5	5.5-9.5	5.0 - 9.5
	Temperature [°C]	5-45	5-45	5-45	5-70	5-45	5-45	5 - 45	5-45	5 - 45
	Max. pressure [bar]	1	1	8	8	3	1	3	3	1
Installation	Open outlet	x	x	x	x	x	x	x	x	x
	Direct installation in the circuit			x	x	x				

* 1) As well as free and combined bromine (see Chap. 1.3.3: "Bromine Sensors")

2) As well as total available bromine (see Chap. 1.3.3: "Bromine Sensors")

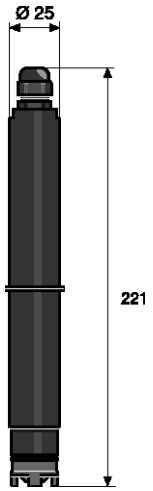
1.3.3 DULCOTEST® Sensors for Free Chlorine

Sensor for Free Chlorine CLE 3-mA

Standard sensor for measuring free chlorine in clear water. For operation on controllers with 4-20 mA input

Your benefits

- Measured variable: free chlorine, no significant cross sensitivity to combined chlorine (chloramines)
- Diaphragm-covered sensor (encapsulated) minimises faults caused by changing flow or ingredients in the water



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Measured variable	Free chlorine (hypochlorous acid HOCl)
Reference method	DPD1
pH range	5.5 … 8.0
Temperature	5 … 45 °C
Max. pressure	1.0 bar
Intake flow	30…60 l/h (in DGM or DLG III)
Supply voltage	16...24 V DC (two-wire technology)
Output signal	4…20 mA ≈ measuring range, temperature-compensated, uncalibrated, not electrically isolated
Selectivity	Free chlorine as against combined chlorine, even if there is not an excess of it
Disinfection process	Chlorine gas, hypochlorite, electrolysis with diaphragm, disinfectants with organic chlorine, e. g. based on cyanuric acid, are unsuitable
Installation	Bypass: open sample water outlet
Sensor fitting	DGM, DLG III
Measuring and control equipment	D1Cb, DAC, delta® solenoid diaphragm metering pump
Typical applications	CLE 3-mA-0,5 ppm: potable water; CLE 3-mA-2.0/10 ppm: swimming pools (surfactant-free)
Resistance to	Salts, acids, alkalis. Not surfactants
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CLE 3-mA-0.5 ppm	0.01…0.5 mg/l	792927
CLE 3-mA-2 ppm	0.02…2.0 mg/l	792920
CLE 3-mA-5 ppm	0.01…5.0 mg/l	1033392
CLE 3-mA-10 ppm	0.10…10.0 mg/l	792919
CLE 3-mA-20 ppm	0.20…20.0 mg/l	1002964
CLE 3-mA-50 ppm	0.50…50.0 mg/l	1020531
CLE 3-mA-100 ppm	1.00…100.0 mg/l	1022786

Chlorine sensors complete with 100 ml of electrolyte

A mounting kit, order no. 815079, is required for initial fitting of the chlorine sensors in the in-line probe housing DLG III.

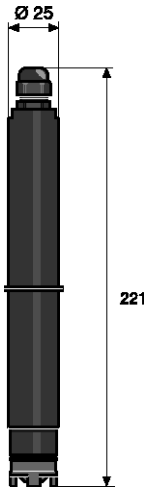
1.3 Amperometric Sensors DULCOTEST®

Sensor for Free Chlorine CLE 3.1-mA

Sensor for the measurement of free chlorine in clear water with higher selectivity towards combined chlorine. For use on controllers with 4-20 mA input

Your benefits

- Measured variable: free chlorine, no cross sensitivity to combined chlorine (chloramines), even if there is an excess of it
- Diaphragm-covered sensor (encapsulated) minimises faults caused by changing flow or ingredients in the water



pk_6_039

Measured variable	Free chlorine (hypochlorous acid HOCl) with high levels of combined chlorine; for determining the combined chlorine with a DAC controller and sensor for total chlorine type CTE 1-mA
Reference method	DPD1
pH range	5.5 … 8.0
Temperature	5 … 45 °C
Max. pressure	1.0 bar
Intake flow	30…60 l/h (in DGM or DLG III)
Supply voltage	16...24 V DC (two-wire technology)
Output signal	4…20 mA ≈ measuring range, temperature-compensated, uncalibrated, not electrically isolated
Selectivity	Free chlorine as against combined chlorine, even if there is an excess of it
Disinfection process	Chlorine gas, hypochlorite, electrolysis with diaphragm, disinfectants with organic chlorine, e. g. based on cyanuric acid, are unsuitable
Installation	Bypass: open sample water outlet
Sensor fitting	DGM, DLG III
Measuring and control equipment	D1Cb, DAC, delta® solenoid diaphragm metering pump
Typical applications	Potable water with higher volumes of combined chlorineSwimming pools.To determine the combined chlorine from the difference: Total chlorine minus free chlorine in the controller DACa
Resistance to	Salts, acids, alkalis. Not surfactants
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CLE 3.1-mA-0.5 ppm	0.01…0.5 mg/l	1020530
CLE 3.1-mA-2 ppm	0.02…2.0 mg/l	1018369
CLE 3.1-mA-5 ppm	0.01…5.0 mg/l	1019398
CLE 3.1-mA-10 ppm	0.10…10.0 mg/l	1018368

Chlorine sensors complete with 100 ml of electrolyte

A mounting kit, order no. 815079, is required for initial fitting of the chlorine sensors in the in-line probe housing DLG III.

Signal leads see Sensor Accessories, p. → 1-113

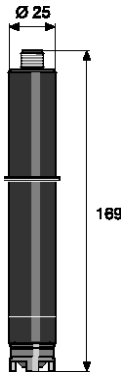
1.3 Amperometric Sensors DULCOTEST®

Sensor for Free Chlorine CLE 3-DMT

Standard sensor for measuring free chlorine in clear water. For operation on ProMinent transmitters type DMT

Your benefits

- Measured variable: free chlorine, no significant cross sensitivity to combined chlorine (chloramines)
- Diaphragm-covered sensor (encapsulated) minimises faults caused by changing flow or ingredients in the water



pk_6_038

Measured variable	Free chlorine (hypochlorous acid HOCl)
Reference method	DPD1
pH range	5.5 … 8.0
Temperature	5 … 45 °C
Max. pressure	1.0 bar
Intake flow	30…60 l/h (in DGM or DLG III)
Supply voltage	3.3 V DC (5 P)
Output signal	0...1 V DC, uncalibrated, not temperature compensated, not electrically isolated
Temperature measurement	About the integrated Pt 1000. The temperature compensation is carried out in DMT.
Selectivity	Free chlorine as against combined chlorine, even if there is not an excess of it
Disinfection process	Chlorine gas, hypochlorite, electrolysis with diaphragm, disinfectants with organic chlorine, e. g. based on cyanuric acid, are unsuitable
Installation	Bypass: open sample water outlet
Sensor fitting	DGM, DLG III
Measuring and control equipment	DMT
Typical applications	CLE 3-mA-0,5 ppm: potable water; CLE 3-mA-2.0/10 ppm: swimming pools (surfactant-free)
Resistance to	Salts, acids, alkalis. Not surfactants
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CLE 3-DMT-5 ppm	0.01…5.0 mg/l	1005511
CLE 3-DMT-50 ppm	0.05…50.0 mg/l	1005512

Chlorine sensors complete with 100 ml of electrolyte

A mounting kit, order no. 815079, is required for initial fitting of the chlorine sensors in the in-line probe housing DLG III.

Signal leads see Sensor Accessories, p. → 1-113

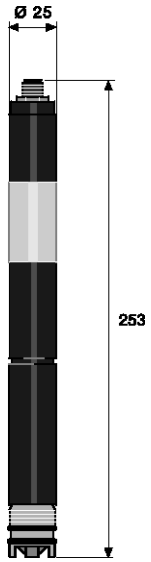
1.3 Amperometric Sensors DULCOTEST®

Sensor for Free Chlorine CLE 3-CAN

Standard sensor for measuring free chlorine in clear water. For use on controllers with CAN-bus connection

Your benefits

- Measured variable: free chlorine, no significant cross sensitivity to combined chlorine (chloramines)
- Diaphragm-covered sensor (encapsulated) minimises faults caused by changing flow or ingredients in the water
- Operation on the CAN-bus with all the associated benefits



pk_6_096

Measured variable	Free chlorine (hypochlorous acid HOCl)
Reference method	DPD1
pH range	5.5 … 8.0
Temperature	5 … 45 °C
Max. pressure	1.0 bar
Intake flow	30…60 l/h (in the DGM or DLG III)
Supply voltage	Via CAN interface (11 - 30 V)
Output signal	Uncalibrated, temperature compensated, electrically isolated
Selectivity	Free chlorine as against combined chlorine, even if there is not an excess of it
Disinfection process	Chlorine gas, hypochlorite, electrolysis with diaphragm, disinfectants with organic chlorine, e. g. based on cyanuric acid, are unsuitable
Installation	Bypass: open sample water outlet
Sensor fitting	DGM, DLG III
Measuring and control equipment	DULCOMARIN® II
Typical applications	CLE 3-mA-0,5 ppm: potable water; CLE 3-mA-2.0/10 ppm: swimming pools (surfactant-free)
Resistance to	Salts, acids, alkalis. Not surfactants
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CLE 3-CAN-10 ppm	0.01…10.0 mg/l	1023425

Chlorine sensors complete with 100 ml of electrolyte

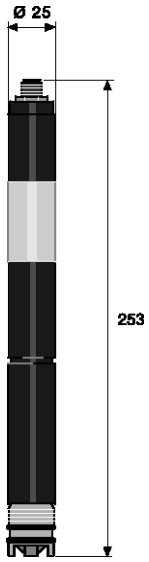
A mounting kit, order no. 815079, is required for initial fitting of the chlorine sensors in the in-line probe housing DLG III.

Sensor for Free Chlorine CLE 3.1-CAN

Sensor for the measurement of free chlorine in clear water with higher selectivity towards combined chlorine. For use on controllers with CAN-bus connection

Your benefits

- Measured variable: free chlorine, no cross sensitivity to combined chlorine (chloramines) even if there is an excess of it
- Diaphragm-covered sensor (encapsulated) minimises faults caused by changing flow or ingredients in the water
- Operation on the CAN-bus with all the associated benefits



pk_6_096

Measured variable	Free chlorine (hypochlorous acid HOCl) with large proportions of bound chlorine; to detect bound chlorine using DULCOMARIN® II and Sensor for Total Chlorine type CTE 1-CAN
Reference method	DPD1
pH range	5.5 … 8.0
Temperature	5 … 45 °C
Max. pressure	1.0 bar
Intake flow	30…60 l/h (in DGMa or DLG III)
Supply voltage	Via CAN interface (11 – 30 V)
Output signal	Uncalibrated, temperature compensated, electrically isolated
Selectivity	Free chlorine
Disinfection process	Chlorine gas, hypochlorite, electrolysis with diaphragm, disinfectants with organic chlorine, e. g. based on cyanuric acid, are unsuitable
Installation	Bypass: open sample water outlet
Sensor fitting	DGM, DLG III
Measuring and control equipment	DULCOMARIN® II
Typical applications	Potable water with higher percentages of combined chlorine;Swimming pools.To determine the combined chlorine from the difference: Total chlorine minus free chlorine in the controller DULCOMARIN® II
Resistance to	Salts, acids, alkalis. Not surfactants
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CLE 3.1-CAN-10 ppm	0.01…10.0 mg/l	1023426

Chlorine sensors complete with 100 ml of electrolyte

A mounting kit, order no. 815079, is required for initial fitting of the chlorine sensors in the in-line probe housing DLG III.

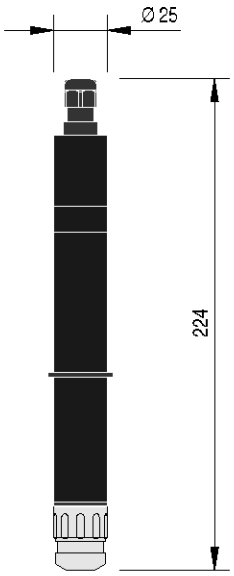
1.3 Amperometric Sensors DULCOTEST®

Sensor for Free Chlorine CLO 1-mA

Sensor for the measurement of free chlorine in clear water even when using electrolysis processes for disinfection, up to 45 °C or 8 bar (25 °C). For use with controllers with 4-20 mA input

Your benefits

- Measured variable: free chlorine, no significant cross sensitivity to combined chlorine (chloramines)
- Use with return of the sample water to the process line
- Use at higher pressures
- Minimisation of faults by electrolysis systems in which the electrodes are immersed directly into the sample water (without diaphragm) by open sensor (no diaphragm) and gold electrodes
- Measurement of free chlorine up to pH 9 and use at high pressure of up to 8 bar is possible



P_DT_0072_SW1

Measured variable	Free chlorine (hypochlorus acid HOCl)
Reference method	DPD1
pH range	5.0 … 9.0
Temperature	5 … 45 °C
Max. pressure	8.0 bar (25 °C)
Intake flow	30…60 l/h (in DGM or DLG III), constant flow as flow-dependent signal
Supply voltage	16...24 V DC (2-wire)
Output signal	4…20 mA = Measuring range, temperature-compensated, uncalibrated, not electrically isolated
Selectivity	Free chlorine as against combined chlorine
Disinfection process	Chlorine gas, hypochlorite, electrolysis with diaphragm, electrolysis without diaphragm with electrodes in the process
Installation	Bypass: open outlet or return of the sample water into the process line, inline: direct installation into the tubes with the INLI fitting
Sensor fitting	DLG up to 1 bar/55 °C; DGM up to 6 bar/30 °C; INLI up to 7 bar/40 °C
Measuring and control equipment	D1Cb, DAC, delta® solenoid diaphragm metering pump
Typical applications	Swimming pools, uncontaminated potable water and industrial service water, and can also be used together with diaphragm-free electrolysis processes
Resistance to	surfactants
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CLO 1-mA-2 ppm	0.02…2.0 mg/l	1033871
CLO 1-mA-10 ppm	0.10…10.0 mg/l	1033870

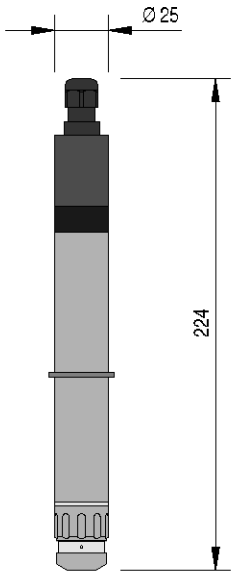
1.3 Amperometric Sensors DULCOTEST®

Sensor for Free Chlorine CLO 2-mA

Sensor for the measurement of free chlorine in clear water even when using electrolysis processes for disinfection, up to 70 °C or 8 bar (25 °C). For use with controllers with 4-20 mA input

Your benefits

- Measured variable: free chlorine, no significant cross sensitivity to combined chlorine (chloramines)
- Use with return of the sample water to the process line
- Use at higher pressures/temperatures
- Minimisation of faults by electrolysis systems in which the electrodes are immersed directly into the sample water (without diaphragm) by open sensor (no diaphragm) and gold electrodes
- Measurement of free chlorine up to pH 9 and use at high pressure of up to 8 bar is possible



P_DT_0073_SW1

Measured variable	Free chlorine (hypochlorus acid HOCl)
Reference method	DPD1
pH range	5.0 … 9.0
Temperature	5 … 70 °C
Max. pressure	8.0 bar (25 °C)
Intake flow	30…60 l/h (in DGM or DLG III), constant flow as flow-dependent signal
Supply voltage	16...24 V DC (2-wire)
Output signal	4…20 mA= Measuring range, temperature-compensated, uncalibrated, not electrically isolated
Selectivity	Free chlorine as against combined chlorine
Disinfection process	Chlorine gas, hypochlorite, electrolysis with diaphragm, electrolysis without diaphragm with electrodes in the process
Installation	Bypass: open outlet or return of the sample water into the process line, inline: direct installation into the tubes with the INLI fitting
Sensor fitting	DLG up to 1 bar/55 °C; DGM up to 1 bar/60 °C; INLI up to 2 bar/70 °C. Prerequisite: constant flow
Measuring and control equipment	D1Cb, DAC, delta® solenoid diaphragm metering pump
Typical applications	Hot water up to 70 °C, combating legionella, uncontaminated potable water and industrial service water, can also be used together with diaphragm-free electrolysis processes
Resistance to	surfactants
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CLO 2-mA-2 ppm	0.02…2.0 mg/l	1033878

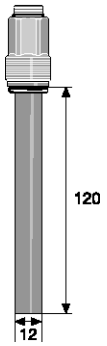
1.3 Amperometric Sensors DULCOTEST®

Sensor for Free Chlorine CLB 2-µA

Cost-effective, simple sensor for the measurement of free chlorine in clear water, even with a changing media temperature. Use even when electrolysis processes are used for disinfection at up to 45 °C/3 bar. For operation with the Compact controller DCCa

Your benefits

- Measured variable: free chlorine, no significant cross sensitivity to combined chlorine (chloramines)
- Cost-effective due to its simple construction without separate wear parts
- Simple, cost-effective maintenance without handling of the diaphragm caps
- Minimisation of faults by electrolysis systems without diaphragm in which the electrodes are immersed directly into the sample water by an open sensor (no diaphragm)
- Measurement of free chlorine up to pH 9 and use at high pressure of up to 8 bar by the absence of a diaphragm



pk_6_095

Measured variable	Free chlorine (hypochlorous acid HOCl)
Measuring range	0.05 – 5.0 mg/l, can be used for short-term shock chlorination up to 10 mg/l
Reference method	DPD1
pH range	5.0 … 9.0
Temperature	5 … 45 °C
Max. pressure	3.0 bar
Intake flow	30…60 l/h (in DGMA), constant flow needed as flow-dependent signal
Supply voltage	Only for compact controllers
Output signal	Non-amplified primary current signal, not temperature-compensated, uncalibrated, not electrically isolated
Temperature measurement	Pt 1000, integrated, calculation in the compact controller
Selectivity	Free chlorine as against combined chlorine
Disinfection process	Chlorine gas, hypochlorite, electrolysis with diaphragm, electrolysis without diaphragm with electrodes in the process
Installation	Bypass: open sample water outlet, inline: direct installation into the pipework
Sensor fitting	DGM, DLG III
Measuring and control equipment	Compact controller
Typical applications	Swimming pools, potable water, can also be used with membrane-free chlorine production electrolysis processes, even with varying media temperatures
Resistance to	surfactants
Measuring principle, technology	Amperometric, 3 electrodes, without diaphragm

	Measuring range	Order no.
CLB 2-µA-5 ppm	0.05…5.0 mg/l	1038902

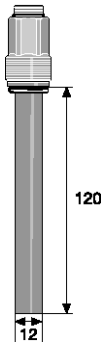
1.3 Amperometric Sensors DULCOTEST®

Sensor for Free Chlorine CLB 3-µA

Cost-effective, simple sensor for the measurement of free chlorine in clear water when the media temperature is constant. Use even when electrolysis processes are used for disinfection at up to 45 °C/3 bar. For operation with the Compact controller DCCa

Your benefits

- Measured variable: free chlorine, no significant cross sensitivity to combined chlorine (chloramines)
- Cost-effective due to its simple construction without separate wear parts
- Simple, cost-effective maintenance without handling of the diaphragm caps
- Minimisation of faults by electrolysis systems without diaphragm in which the electrodes are immersed directly into the sample water by an open sensor (no diaphragm)
- Measurement of free chlorine up to pH 9 and use at high pressure of up to 8 bar by the absence of a diaphragm



pk_6_095

Measured variable	Free chlorine (hypochlorous acid HOCl)
Measuring range	0.05 - 5.0 mg/l: linear, can be used for shock chlorination up to 10.0 mg/l
Reference method	DPD1
pH range	5.0 … 9.0
Temperature	5 … 45 °C constant temperature needed, as temperature-dependent signal
Max. pressure	3.0 bar
Intake flow	30…60 l/h (in DGMA), constant flow necessary, as flow-dependent signal
Supply voltage	Only for compact controllers
Output signal	Non-amplified primary current signal, not temperature-compensated, uncalibrated, not electrically isolated
Temperature measurement	None
Selectivity	Free chlorine as against combined chlorine
Disinfection process	Chlorine gas, hypochlorite, electrolysis with diaphragm, electrolysis without diaphragm with electrodes in the process
Installation	Bypass: open sample water outlet, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting)
Sensor fitting	DGM, DLG III
Measuring and control equipment	Compact controller
Typical applications	Swimming pools, potable water, can also be used with membrane-free chlorine production electrolysis processes
Resistance to	surfactants
Measuring principle, technology	Amperometric, 3 electrodes, without diaphragm

	Measuring range	Order no.
CLB 3-µA-5 ppm	0.05…5.0 mg/l	1041696

1.3 Amperometric Sensors DULCOTEST®

Sensor for Free Chlorine CBR 1-mA

Sensor for free chlorine and bromine in contaminated water, also suitable for high pH values of up to 9.5. For use with controllers with 4-20 mA input

Your benefits

- Measured variable: free chlorine as well as free and combined bromine (bromamines)
- Diaphragm-covered sensor minimises faults caused by changing flow or ingredients in the water
- Resistance to films of dirt and biofilms by electrolyte with antimicrobial effect and large-pore diaphragm
- Use at high pH value of up to 9.5 by optimisation of the electrolyte diaphragm system

Measured variable	Free chlorine (hypochlorous acid, HOCl, OCl^-), free bromine, bound bromine BCDMH (1,3-dibrom-5,5-dimethyl-hydantoin)
Reference method	DPD1
pH range	5.0 … 9.5
Temperature	5 … 45 °C
Max. pressure	1.0 bar
Intake flow	30…60 l/h (in DGM, DLG II)
Supply voltage	16...24 V DC (2-wire)
Output signal	4…20 mA = Measuring range, temperature-compensated, uncalibrated, not electrically isolated
Selectivity	Free chlorine as against combined chlorine
Disinfection process	Chlorine gas, hypochlorite, electrolysis with diaphragm, bromide + hypochlorite, DBDMH
Installation	Bypass: open sample water outlet
Sensor fitting	DGM, DLG III
Measuring and control equipment	D1Cb, DAC, delta® solenoid diaphragm metering pump
Typical applications	Cooling water, process water, waste water, Water with higher pH values (stable pH), Seawater
Resistance to	Dirt films, biofilms, surfactants
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CBR 1-mA-0,5 ppm	0.01…0.5 mg/l…*	1038016
CBR 1-mA-2 ppm	0.02…2.0 mg/l…*	1038015
CBR 1-mA-5 ppm	0.05…5.0 mg/l…*	1052138
CBR 1-mA-10 ppm	0.10…10.0 mg/l…*	1038014

* Measuring range based on chlorine. When measuring bromine, the lower and upper limit of the measuring range are increased by the factor 2.25, therefore for example CBR 1-mA-0.5ppm: 0.02 ...1.1 ppm.

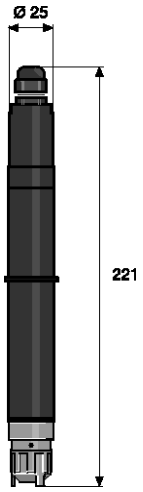
1.3 Amperometric Sensors DULCOTEST®

Sensor for Free Chlorine CLR 1-mA

Sensor for free chlorine above 10 ppm in contaminated washing water for use with controllers with 4-20 mA input

Your benefits

- Measured variable free chlorine for high concentrations of up to 1,000 ppm
- Diaphragm-covered sensor prevents faults caused by changing flow or ingredients in the water
- Resistance to films of dirt by pore-free diaphragm



pk_6_040

Measured variable	Free chlorine (hypochlorous acid HOCl)
Reference method	DPD1
pH range	5.5 … 8.0
Temperature	5 … 45 °C
Max. pressure	1.0 bar
Intake flow	30…60 l/h (in DGM, DLG II)
Supply voltage	16...24 V DC (2-wire)
Output signal	4…20 mA = Measuring range, temperature-compensated, uncalibrated, not electrically isolated
Selectivity	Free chlorine as against combined chlorine
Disinfection process	Chlorine gas, hypochlorite, electrolysis with diaphragm
Installation	Bypass: open sample water outlet
Sensor fitting	DLG III
Measuring and control equipment	D1Cb, DAC, delta® solenoid diaphragm metering pump
Typical applications	Salad, vegetable and poultry washing water, contaminated process and waste water
Resistance to	
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CLR 1-mA-200 ppm	10.0…200 mg/l	1047978

Important note: Measuring range from 10.0 ... 1,000 mg/l on request

A mounting kit, order no. 815079, is required for initial fitting of the chlorine sensors in the in-line probe housing DLG III.

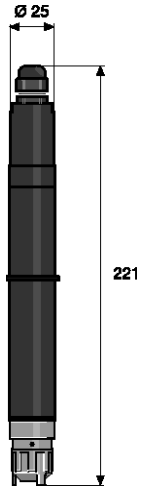
1.3.4 DULCOTEST® Sensors for Total Available Chlorine

Sensor for Total Available Chlorine CGE 3-mA

Sensor for total available chlorine, such as derivatives of chloro(iso)cyanuric acid trouble-free when disinfection is provided by electrolysis processes when used in swimming pools. For operation with controllers with 4-20 mA input

Your benefits

- Measured variable: total available chlorine, for instance disinfectant with organic chlorine, such as derivatives of chloro(iso)cyanuric acid
- Gold electrode to prevent faults by products from electrolysis processes where the electrodes are immersed directly into the sample water (without diaphragm)
- Diaphragm-covered sensor (encapsulated) minimises faults caused by changing flow or ingredients in the water
- Hydrophilic diaphragm guarantees the permeability of chloro(iso)cyanuric acid derivatives towards the measuring electrodes
- The special reaction system of the electrolyte allows the total available chlorine to be determined and use at a high pH of up to 9.5



pk_6_040

Measured variable	Total available chlorine: Total of organic combined chlorine (e.g. bound to cyanuric acid) and free chlorine
Reference method	DPD1
pH range	5.5 … 9.5
Temperature	5 … 45 °C
Max. pressure	3.0 bar
Intake flow	30…60 l/h (in DGM or DLG III)
Supply voltage	16...24 V DC (2-wire system)
Output signal	4-20 mA ≈ Measuring range, temperature-compensated, uncalibrated, not electrically isolated
Selectivity	Total available chlorine as against combined chlorine (chloramines)
Disinfection process	Disinfectants with organic chlorine, e.g. based on cyanuric acid
Installation	Bypass: open sample water outlet
Sensor fitting	DGM, DLG III
Measuring and control equipment	D1C, DAC, delta® solenoid diaphragm metering pump
Typical applications	Swimming pool water, combined disinfection processes with chloro(iso)cyanuric acid derivatives and diaphragm-free electrolysis
Resistance to	surfactants
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CGE 3-mA-2 ppm	0.02…2.0 mg/l	1047959
CGE 3-mA-10 ppm	0.10…10.0 mg/l	1047975

A mounting kit, order no. 815079, is required for initial fitting of the chlorine sensors in the in-line probe housing DLG III.

1.3 Amperometric Sensors DULCOTEST®

Sensor for Total Available Chlorine CGE 2-CAN

Sensor for total available chlorine, such as derivatives of chloro(iso)cyanuric acid when used in swimming pools. For use on controllers with CAN-bus connection

Your benefits

- Measured variable: total available chlorine, for instance disinfectant with organic chlorine, such as derivatives of chloro(iso)cyanuric acid
- Diaphragm-covered sensor (encapsulated) minimises faults caused by changing flow or ingredients in the water
- Hydrophilic diaphragm guarantees the permeability of chloro(iso)cyanuric acid derivatives towards the measuring electrodes
- The special reaction system of the electrolyte allows the total available chlorine to be determined and use at a high pH of up to 9.5
- Operation on the CAN-bus with all the associated benefits

Measured variable	Total available chlorine: Total of organic combined chlorine (e.g. bound to cyanuric acid) and free chlorine
Reference method	DPD1
pH range	5.5 … 9.5
Temperature	5 … 45 °C
Max. pressure	3.0 bar
Intake flow	30…60 l/h (in the DGM or DLG III)
Supply voltage	Via CAN interface (11 – 30 V DC)
Output signal	Uncalibrated, temperature-compensated, electrically isolated
Selectivity	Only limited against combined chlorine (chloramines)
Disinfection process	Disinfectants with organic chlorine, e.g. based on cyanuric acid
Installation	Bypass: open sample water outlet
Sensor fitting	DGM, DLG III
Measuring and control equipment	DULCOMARIN® II
Typical applications	Swimming pool water, Disinfection processes with chloro(iso)cyanuric acid derivatives
Resistance to	surfactants
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CGE 2-CAN-10 ppm	0.01…10.0 mg/l	1024420

A mounting kit, order no. 815079, is required for initial fitting of the chlorine sensors in the in-line probe housing DLG III.

1.3 Amperometric Sensors DULCOTEST®

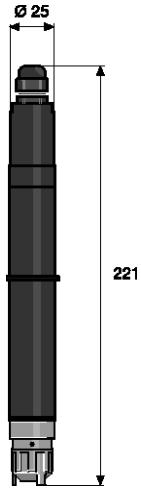
1.3.5 DULCOTEST® Sensors for Total Chlorine

Sensor for Total Chlorine CTE 1-mA

Sensor for total chlorine, including, for example, free chlorine, chloramines etc. even with high pH values in different kinds of water. For use on controllers with mA input

Your benefits

- Measured variable: Total chlorine, chlorine compounds, in which chlorine acts as an oxidising agent, e.g. free chlorine (HOCl and OCl^-), chloramines etc.
- Diaphragm-covered sensor (encapsulated) prevents faults caused by changing flow or ingredients in the water
- Hydrophilic diaphragm guarantees permeability for different water-soluble oxidising agents towards the measuring electrodes
- The special reaction system of the electrolyte allows components containing oxidising chlorine to be determined and used at a high pH of up to 9.5



pk_6_040

Measured variable	Total chlorine
Reference method	DPD4
pH range	5.5 … 9.5
Temperature	5 … 45 °C
Max. pressure	3.0 bar
Intake flow	30…60 l/h (in DGM or DLG III)
Supply voltage	16...24 V DC (two-wire technology)
Output signal	4…20 mA ≈ measuring range, temperature-compensated, uncalibrated, not electrically isolated
Selectivity	Non-selective, cross-sensitive towards many oxidation agents
Disinfection process	Chlorine gas, hypochlorite, electrolysis with diaphragm, monochloramine
Installation	Bypass: open sample water outlet
Sensor fitting	DGM, DLG III
Measuring and control equipment	D1C, DAC, delta® solenoid diaphragm metering pump
Typical applications	Potable, industrial, process, waste water
Resistance to	surfactants
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CTE 1-mA-0.5 ppm	0.01…0.5 mg/l	740686
CTE 1-mA-2 ppm	0.02…2.0 mg/l	740685
CTE 1-mA-5 ppm	0.05…5.0 mg/l	1003203
CTE 1-mA-10 ppm	0.10…10.0 mg/l	740684

Chlorine sensors complete with 50 ml of electrolyte

A mounting kit, order no. 815079, is required for initial fitting of the chlorine sensors in the in-line probe housing DLG III.

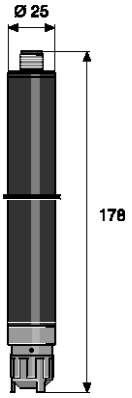
1.3 Amperometric Sensors DULCOTEST®

Sensor for Total Chlorine CTE 1-DMT

Sensor for total chlorine, including, for example, free chlorine, chloramines etc. even with high pH values in different kinds of water. For operation with the transmitter DMT

Your benefits

- Measured variable: Total chlorine, chlorine compounds, in which chlorine acts as an oxidising agent, e.g. free chlorine (HOCl and OCl^-), chloramines etc.
- Diaphragm-covered sensor (encapsulated) prevents faults caused by changing flow or ingredients in the water
- Hydrophilic diaphragm guarantees permeability for different water-soluble oxidising agents towards the measuring electrodes
- The special reaction system of the electrolyte allows components containing oxidising chlorine to be determined and used at a high pH of up to 9.5



pk_6_015

Measured variable	Total chlorine
Reference method	DPD4
pH range	5.5 … 9.5
Temperature	5 … 45 °C
Max. pressure	3.0 bar
Intake flow	30…60 l/h (in DGM or DLG III)
Supply voltage	3.3 V DC (5 P)
Output signal	Uncalibrated, not temperature-compensated, not electrically isolated
Selectivity	Non-selective, cross-sensitive towards many oxidation agents
Disinfection process	Chlorine gas, hypochlorite, electrolysis with diaphragm, monochloramine
Installation	Bypass: open sample water outlet
Sensor fitting	DGM, DLG III
Measuring and control equipment	DMT
Typical applications	Potable, industrial, process, waste water
Resistance to	surfactants
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CTE 1-DMT-10 ppm	0.01…10.0 mg/l	1007540

Chlorine sensors complete with 50 ml of electrolyte

A mounting kit, order no. 815079, is required for initial fitting of the chlorine sensors in the in-line probe housing DLG III.

Signal leads see Sensor Accessories, p. → 1-113

1.3 Amperometric Sensors DULCOTEST®

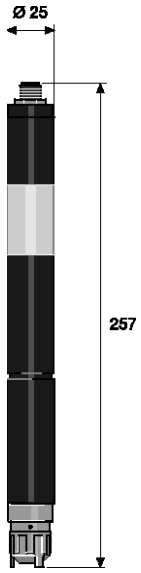
Sensor for Total Chlorine CTE 1-CAN

Sensor for total chlorine, including, for example, free chlorine, chloramines etc. even with high pH values in different kinds of water. For use on controllers with CAN-bus connection

Your benefits

- Measured variable: Total chlorine, chlorine compounds, in which chlorine acts as an oxidising agent, e.g. free chlorine (HOCl and OCl^-), chloramines etc.
- Diaphragm-covered sensor (encapsulated) prevents faults caused by changing flow or ingredients in the water
- Hydrophilic diaphragm guarantees permeability for different water-soluble oxidising agents towards the measuring electrodes
- The special reaction system of the electrolyte allows components containing oxidising chlorine to be determined and used at a high pH of up to 9.5
- Operation on the CAN-bus with all the associated benefits

Sensor for connection to a CAN interface (e.g. DULCOMARIN® II swimming pool controller)



pk_6_084

Measured variable	Total chlorine
Reference method	DPD4
pH range	5.5 … 9.5
Temperature	5 … 45 °C
Max. pressure	3.0 bar
Intake flow	30…60 l/h (in DGMa or DLG III)
Supply voltage	Via CAN interface (11 - 30 V)
Output signal	Uncalibrated, temperature-compensated, electrically isolated
Selectivity	Non-selective, cross-sensitive towards many oxidation agents
Disinfection process	Chlorine gas, hypochlorite, electrolysis with diaphragm, monochloramine
Installation	Bypass: open sample water outlet
Sensor fitting	DGM, DLG III
Measuring and control equipment	DULCOMARIN® II
Typical applications	CTE 1-mA-0.5 ppm: Potable water; CTE 1-mA-2/5/10 ppm: Potable, industrial, process, waste water. In swimming pools combined with CLE 3.1 to detect combined chlorine
Resistance to	surfactants
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CTE 1-CAN-10 ppm	0.01…10.0 mg/l	1023427

Chlorine sensors complete with 100 ml of electrolyte

A mounting kit, order no. 815079, is required for initial fitting of the chlorine sensors in the in-line probe housing DLG III.

1.3.6 DULCOTEST® Sensors for Bromine

Bromination agents

The following stabilised bromination agents are frequently used for disinfection during water treatment:

- BCDMH (1-**B**romo-3-**C**hloro-5,5-**Dim**ethyl-**H**ydantoin), marketed under trade names such as Brom-Sticks®
- DBDMH (1,3-**Dib**romo-5,5-**Dim**ethyl-**H**ydantoin) marketed under trade names such as Albrom 100®
- N-bromamide sulfonate

These bromination agents are initially available as solids (tablets, sticks, pellets) and are transferred via "bromine chutes" into a saturated aqueous solution, that contains the free bromine (HOBr, OBr^-) and the carrier molecule. The free bromine and the halogen (bromine, chlorine) still available in the carrier molecule is jointly referred to as "Total available bromine". This solution is metered during the process.

Free bromine is generated directly without a carrier by metering of sodium-calcium hypochlorite + acid + sodium bromide, e.g. the Acti-Brom® process (Nalco company) or through the metering of sodium-calcium hypochlorite into seawater (bromide containing).

Bromamines are designated as combined bromine, which are more reactive when compared with chloramines (combined chlorine).

Applications

Typical applications are in swimming pools, whirlpools, seawater and cooling circuits. Particular attention must be paid to the quality of the sample water in cooling circuits and, where necessary, compatibility with other chemicals used (e.g. corrosion inhibitors) must be checked.

The photometric DPD measurement method recommends itself as a comparison method (e.g. with DT 1B), calculated and displayed as bromine. If the photometric DPD measurement for "chlorine" is used, the measured value must be multiplied by a factor of 2.25 for conversion into "bromine".

Sensor selection

- The sensor type BCR 1 and its calibration/checking using the DPD4 method, is recommended for the measurement of stabilised bromination agents, such as BCDMH and N-bromamide sulfonate.
- The sensor type CBR 1 and its calibration/checking using the DPD1 method, is recommended for the measurement of free bromine from sodium-calcium hypochlorite and bromide or of free bromine from DBDMH (solely splits off free bromine), or of bromine compounds, which are produced during disinfection (using sodium-calcium hypochlorite or ozone) of seawater. The CBR 1 can likewise be used to measure combined bromine (bromamines), calibrated and checked using the DPD1 method.
- It is essential that the sensor type BRE 3-CAN, calibrated and checked using the DPD4 method, is used to measure bromination agents using the control system DULCOMARIN® II.

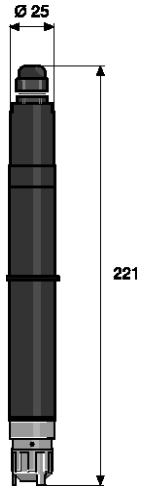
1.3 Amperometric Sensors DULCOTEST®

Sensor for Total Available Bromine BCR 1-mA (Replaces Earlier Type BRE 1)

Sensor for the disinfectant BCDMH and other oxidative-acting bromine-organic disinfectants even in contaminated water and/or for high pH values of up to 9.5. For use on controllers with mA input

Your benefits

- Measured variable: total available bromine from BCDMH (1-bromo-3-chloro-5,5-dimethylhydantoin)
- Diaphragm-covered sensor minimises faults caused by changing flow or ingredients in the water, N-bromamide sulfonate
- Resistance to blocking is achieved by the use of an electrolyte with an antimicrobial effect (less blocking by biofilms) and by a large-pored diaphragm (less blocking by solid particles/dirt)
- Use with high pH values by optimisation of the electrolyte diaphragm system



pk_6_040

Measured variable	Total available bromine from **BCDMH** (bromo-3-chloro-5,5-dimethylhydantoin) and **N-bromamide sulfonate**
Reference method	DPD4
pH range	5.0 … 9.5
Temperature	5 … 45 °C
Max. pressure	1.0 bar
Intake flow	30…60 l/h (in DGM, DLG III)
Supply voltage	16...24 V DC (two wire)
Output signal	4…20 mA = Measuring range, temperature-compensated, uncalibrated, not electrically isolated
Selectivity	Non-selective, cross-sensitive towards many oxidation agents
Disinfection process	BCDMH (1-bromo-3-chloro-5,5-dimethyl-hydantoin), N-bromamide sulfonate
Installation	Bypass: open sample water outlet
Sensor fitting	DGM, DLG III
Measuring and control equipment	D1C, D2C, DAC
Typical applications	Cooling water, process water, waste water, water with higher pH values (stable pH)
Resistance to	–
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
BCR 1-mA-0.5 ppm	0.01…0.5 mg/l	1041697
BCR 1-mA-2 ppm	0.02…2.0 mg/l	1040115
BCR 1-mA-10 ppm	0.10…10.0 mg/l	1041698

1.3 Amperometric Sensors DULCOTEST®

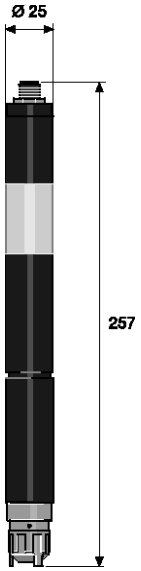
Sensor for Total Available Bromine BRE 3-CAN

Sensor for free and combined bromine, also for use with slightly contaminated water. For use on controllers with CAN-bus connection

Your benefits

- Measured variable: total available bromine from BCDMH and other oxidative-acting bromine organic disinfectants
- Diaphragm-covered sensor minimises faults caused by changing flow or ingredients in the water
- Use with high pH values by optimisation of the electrolyte diaphragm system
- Operation on the CAN-bus with all the associated benefits

Sensor for connection to a CAN interface (e.g. DULCOMARIN® II swimming pool controller)



pk_6_084

Measured variable	Total available bromine
Reference method	For DBDMH, free bromine: DPD1.For BCDMH: DPD4
pH dependence	If the pH changes from pH 7 to pH 8, the sensor sensitivity is reduced a) in the case of DBDMH and free bromine by approx. 10% b) in the case of BCDMH by approx. 25%
Temperature	5 … 45 °C
Max. pressure	3.0 bar
Intake flow	30…60 l/h (in DGM or DLG III)
Supply voltage	Via CAN interface (11 – 30 V)
Output signal	Uncalibrated, temperature-compensated, electrically isolated
Selectivity	Non-selective, cross-sensitive towards many oxidation agents
Disinfection process	DBDMH (1,3-dibromo-5,5-dimethyl-hydantoin), BCDMH (1-bromo-3-chloro-5,5-dimethyl-hydantoin), free bromine (HOBr, OBr^-)
Installation	Bypass: open sample water outlet
Sensor fitting	DGM, DLG III
Measuring and control equipment	DULCOMARIN® II
Typical applications	Swimming pools/whirlpools and cooling water; can also be used in sea water
Resistance to	surfactants
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
BRE 3-CAN-10 ppm	0.02…10.0 mg/l	1029660

Note: a mounting kit (order no. 815079) is required for initial fitting of the bromine sensors in the in-line probe housing DLG III.

Signal leads see Sensor Accessories, p. → 1-113

1.3 Amperometric Sensors DULCOTEST®

Sensor for Free and Combined Bromine CBR 1-mA (Replaces Earlier Type BRE 2)

Sensor for free chlorine and bromine in contaminated water, also suitable for high pH values of up to 9.5. For use with controllers with 4-20 mA input

Your benefits

- Measured variable: free chlorine as well as free and combined bromine (bromamines)
- Diaphragm-covered sensor minimises faults caused by changing flow or ingredients in the water
- Resistance to films of dirt and biofilms by electrolyte with antimicrobial effect and large-pore diaphragm
- Use at high pH value of up to 9.5 by optimisation of the electrolyte diaphragm system

Measured variable	Free chlorine (hypochlorous acid, HOCl, OCl^-), free bromine, bound bromine BCDMH (1,3-dibrom-5,5-dimethyl-hydantoin)
Reference method	DPD1
pH range	5.0 … 9.5
Temperature	5 … 45 °C
Max. pressure	1.0 bar
Intake flow	30…60 l/h (in DGM, DLG II)
Supply voltage	16...24 V DC (2-wire)
Output signal	4…20 mA = Measuring range, temperature-compensated, uncalibrated, not electrically isolated
Selectivity	Free chlorine as against combined chlorine
Disinfection process	Chlorine gas, hypochlorite, electrolysis with diaphragm, bromide + hypochlorite, DBDMH
Installation	Bypass: open sample water outlet
Sensor fitting	DGM, DLG III
Measuring and control equipment	D1Cb, DAC, delta® solenoid diaphragm metering pump
Typical applications	Cooling water, process water, waste water, Water with higher pH values (stable pH), Seawater
Resistance to	Dirt films, biofilms, surfactants
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CBR 1-mA-0,5 ppm	0.01…0.5 mg/l…*	1038016
CBR 1-mA-2 ppm	0.02…2.0 mg/l…*	1038015
CBR 1-mA-5 ppm	0.05…5.0 mg/l…*	1052138
CBR 1-mA-10 ppm	0.10…10.0 mg/l…*	1038014

* Measuring range based on chlorine. When measuring bromine, the lower and upper limit of the measuring range are increased by the factor 2.25, therefore for example CBR 1-mA-0.5ppm: 0.02 ...1.1 ppm.

1.3 Amperometric Sensors DULCOTEST®

1.3.7 DULCOTEST® Sensors for Chlorine Dioxide

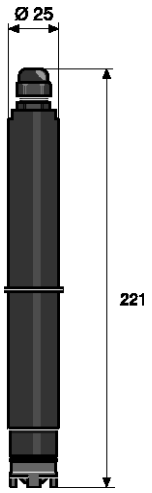
Sensor type		CDE 2-mA	CDP 1-mA	CDR 1-mA
Application		Potable water	Bottle washer system	Cooling water, waste water, agriculture, hot water
Measuring range		0.01-10.0	0.02-2.00	0.01-10.0
Temperature	°C	5 … 45	10 … 45	1 … 55
Temperature compensation		internal	external	internal
Max. pressure	bar	1.0	3.0	3.0
pH range		4.0 … 11.0	5.5 … 10.5	1.0 … 10.0
Response time	s	120	60	180
Run-in time	h	2-6	4-12	2-6
Surfactant-resistance		no	yes	yes
Contamination resistance		no	under certain conditions	yes
Cross sensibility		Ozone	Ozone, chlorine	Ozone

Chlorine Dioxide Sensor CDE 2-mA

Standard sensor for the measurement of chlorine dioxide without cross-sensitivity by free chlorine. For operation on controllers with 4-20 mA input

Your benefits

- Measured variable: Chlorine dioxide, no cross-sensitivity towards free chlorine
- Diaphragm-covered sensor minimises faults caused by changing flow or ingredients in the water



pk_6_039

Measured variable	Chlorine dioxide (ClO_2)
Reference method	DPD1
pH range	4.0 … 11.0 ClO_2 stability range
Cross sensibility	Ozone
Temperature	5 … 45 °C
Max. pressure	1.0 bar
Intake flow	30…60 l/h (in DGM or DLG III)
Supply voltage	16...24 V DC (two-wire technology)
Output signal	4…20 mA ≈ measuring range, temperature-compensated, uncalibrated, not electrically isolated
Response time sensor	120 s
Selectivity	Chlorine dioxide selective towards free chlorine, chlorite and chlorate
Installation	Bypass: open sample water outlet
Sensor fitting	DGM, DLG III
Measuring and control equipment	D1C, DAC
Typical applications	Uncontaminated drinking water (surfactant-free)
Resistance to	Salts, acids, alkalis. Not surfactants
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CDE 2-mA-0.5 ppm	0.01…0.5 mg/l	792930
CDE 2-mA-2 ppm	0.02…2.0 mg/l	792929
CDE 2-mA-10 ppm	0.10…10.0 mg/l	792928

Chlorine dioxide sensors complete with 100 ml of electrolyte

Note: a mounting kit (order no. 815079) is required for initial fitting of the chlorine dioxide sensors in the in-line probe housing DLG III.

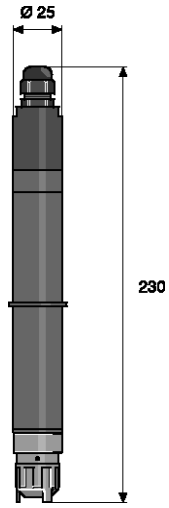
1.3 Amperometric Sensors DULCOTEST®

Chlorine Dioxide Sensor CDP 1-mA

Sensor for the measurement of chlorine dioxide with a fast response time, for example in bottle-washing systems. For operation on controllers with 4-20 mA input

Your benefits

- Measured variable: Chlorine dioxide without interference caused by surfactants
- Diaphragm-covered sensor minimises faults caused by changing flow or ingredients in the water
- Fast response time through open-pored diaphragm and external temperature measurement



pk_6_047

Measured variable	Chlorine dioxide (ClO_2)
Reference method	DPD1
pH range	5.5 … 10.5
Cross sensibility	Ozone, chlorine
Temperature	10 … 45 °C
Max. pressure	3.0 bar
Intake flow	30…60 l/h
Supply voltage	16...24 V DC (two-wire technology)
Output signal	4…20 mA ≈ measuring range, not temperature-compensated, uncalibrated, not electrically isolated
Temperature measurement	Separate temperature measurement needed for compensation
Response time sensor	60 s
Selectivity	Chlorine dioxide as against chlorite and chlorate
Installation	Bypass: open sample water outlet
Sensor fitting	ProMinent recommends installing the sensor in the DLG II in-line probe fitting with upstream flow monitoring together with a Pt 100 temperature sensor
Measuring and control equipment	D1C and DACa with automatic temperature correction only
Typical applications	Process water containing surfactants (bottle washing machines)
Resistance to	Surfactants, slight films of dirt
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CDP 1-mA-2 ppm	0.02…2.0 mg/l	1002149

Chlorine dioxide sensors complete with 100 ml of electrolyte

Note: a mounting kit (order no. 815079) is required for initial fitting of the chlorine dioxide sensors in the in-line probe housing DLG III.

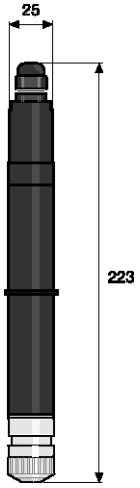
1.3 Amperometric Sensors DULCOTEST®

Chlorine Dioxide Sensor CDR 1-mA

Sensor for the measurement of chlorine dioxide for all kinds of water, including hot and contaminated water. Without cross-sensitivity by free chlorine. For operation on controllers with 4-20 mA input

Your benefits

- Measured variable: Chlorine dioxide, without cross-sensitivity towards free chlorine
- Diaphragm-covered sensor minimises faults caused by changing flow or ingredients in the water
- Resistance to films of dirt by pore-free diaphragm
- Operating temperature up to 60 °C (short term) by appropriate sensor materials



pk_6_083

Measured variable	Chlorine dioxide (ClO_2)
Reference method	DPD1
pH range	1.0 … 10.0
Cross sensibility	Ozone
Temperature	1 … 55 °C (short-term period 60 °C)
Max. pressure	3.0 bar, (30 °C, in DGMA)
Intake flow	30…60 l/h (in DGM or DLG III)
Supply voltage	16...24 V DC
Output signal	4…20 mA Temperature-compensated, uncalibrated, not electrically isolated
Response time sensor	t_{90}~ 3 min.
Selectivity	Chlorite
Installation	Bypass: open sample water outlet
Sensor fitting	DGMa/DLGIII
Measuring and control equipment	D1C, DAC
Typical applications	Contaminated industrial, process water, containing surfactants, cooling water, irrigation water, slightly contaminated waste water, warm water
Resistance to	Surfactants, slight films of dirt, water-soluble chemicals, solids/dirt, biofilms
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CDR 1-mA-0.5 ppm	0.01…0.5 mg/l	1033762
CDR 1-mA-2 ppm	0.02…2.0 mg/l	1033393
CDR 1-mA-10 ppm	0.10…10.0 mg/l	1033404

Note: a mounting kit (order no. 815079) is required for initial fitting of the chlorine dioxide sensors in the in-line probe housing DLG III.

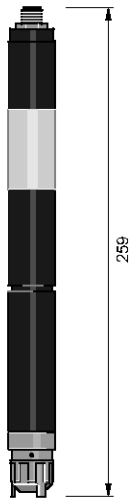
Chlorine Dioxide Sensor CDR 1-CAN

Sensor for the measurement of chlorine dioxide for all kinds of water, including hot and contaminated water. Without cross-sensitivity by free chlorine. For operation on controllers with 4-20 mA input

Your benefits

- Measured variable: Chlorine dioxide, without cross sensitivity to free chlorine
- Diaphragm-covered sensor minimises faults caused by changing flow or ingredients in the water
- Resistance to films of dirt by pore-free diaphragm
- Operating temperature up to 60 °C (short term) by appropriate sensor materials
- Operation on the CAN-bus with all the associated benefits

Sensors for connection to a CAN interface (e.g. Disinfection Controller)



P_DT_0071_SW1

Measured variable	Chlorine dioxide (ClO_2)
Reference method	DPD1
pH range	1.0 … 10.0
Cross sensibility	Ozone
Temperature	5 … 45 °C
Max. pressure	1.0 bar
Intake flow	30…60 l/h (in DGM or DLG III)
Supply voltage	Via CAN interface (11-30 V)
Output signal	Uncalibrated, temperature-compensated, electrically isolated
Response time sensor	t_{90}~ 3 min.
Selectivity	Chlorite, Chlorate, Free chlorine
Installation	Bypass: open sample water outlet
Sensor fitting	DGMa/DLGIII
Measuring and control equipment	DULCOMARIN® II
Typical applications	Contaminated industrial, process water, containing surfactants, cooling water, irrigation water, slightly contaminated waste water, warm water
Resistance to	Surfactants, water-soluble pollutants, solids/dirt, biofilms
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CDR 1-CAN-10 ppm	0.01…10.0 mg/l	1041155

* Complete with 100 ml of electrolyte, connecting cable - CAN M12 5-pin 0.5 m, T-distributor M12 5-pin CAN

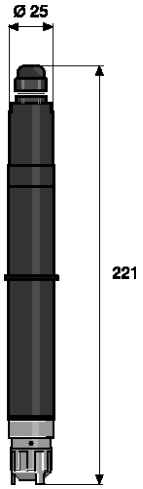
1.3.8 DULCOTEST® Sensors for Chlorite

Chlorite Sensor, CLT 1-mA

Sensor for monitoring the disinfection by-product chlorite in compliance with potable water regulations. Without cross-sensitivity towards chlorine dioxide, chlorate and chlorine. For operation on controllers with 4-20 mA input

Your benefits

- Online monitoring of the disinfection by-product chlorite
- Diaphragm-covered sensor minimises faults caused by changing flow or ingredients in the water
- No interference by chlorine dioxide/chlorine/chlorate
- Online monitoring improves process reliability
- Online monitoring replaces expensive laboratory analysis



pk_6_040

DVGW recommended

Measured variable	Chlorite anion (ClO_2^-)
Reference method	DPD method, chlorite in the presence of chlorine dioxide
pH range	6.5 … 9.5
Cross sensibility	Ozone
Temperature	1 … 40 °C
Max. pressure	1.0 bar
Intake flow	30…60 l/h (in DGM or DLG III)
Supply voltage	16...24 V DC (two-wire technology)
Output signal	4…20 mA ≈ measuring range, temperature-compensated, uncalibrated, not electrically isolated
Selectivity	Chlorite selective towards chlorine dioxide, chlorate and free chlorine
Installation	Bypass: open sample water outlet
Sensor fitting	DGM, DLG III
Measuring and control equipment	D1C, DAC
Typical applications	Monitoring of chlorine dioxide treated potable water or similar water. The selective measurement of chlorite alongside chlorine dioxide, chlorine and chlorate is possible.
Resistance to	surfactants
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CLT 1-mA-0.5 ppm	0.02…0.5 mg/l	1021596
CLT 1-mA-2 ppm	0.10…2.0 mg/l	1021595

Chlorite sensors complete with 50 ml of electrolyte.

Note: A mounting kit (order no. 815079) is required for initial fitting of the chlorite sensors in the in-line probe housing DLG III.

The DT4 photometer is recommended for calibration of the chlorite sensor.

1.3 Amperometric Sensors DULCOTEST®

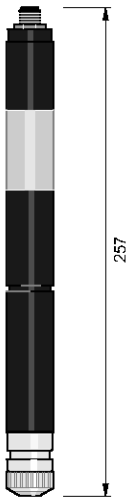
Chlorite Sensor CLT 1-CAN

Sensor for monitoring the disinfection by-product chlorite in compliance with potable water regulations. Without cross-sensitivity towards chlorine dioxide, chlorate and chlorine. For use on controllers with CAN-bus connection

Your benefits

- Online monitoring of the disinfection by-product chlorite
- Diaphragm-covered sensor minimises faults caused by changing flow or ingredients in the water
- No interference by chlorine dioxide/chlorine/chlorate
- Online monitoring improves process reliability
- Online monitoring replaces expensive laboratory analysis
- Operation on the CAN-bus with all the associated benefits

Sensors for connection to a CAN interface (e.g. Disinfection Controller)



P_DT_0070_SW1

Measured variable	Chlorite anion (ClO_2^-)
Reference method	DPD method, chlorite together with chlorine dioxide
pH range	6.5 … 9.5
Cross sensibility	Ozone
Temperature	1 … 40 °C
Max. pressure	1.0 bar
Intake flow	30…60 l/h (in DGM or DLG III)
Supply voltage	Via CAN interface (11-30 V)
Output signal	Uncalibrated, temperature-compensated, electrically isolated
Response time sensor	3 min.
Selectivity	Chlorite selective towards chlorine dioxide, chlorate and free chlorine
Installation	Bypass: open sample water outlet
Parts number/Identity code	DGM, DLG III
Measuring and control equipment	DULCOMARIN® II
Typical applications	Monitoring of potable water or similar water treated with chlorine dioxide. Selective measurement of chlorite and chlorine dioxide, chlorine and chlorate is also possible.
Resistance to	surfactants
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CLT 1-CAN-2 ppm	0.05…2.0 mg/l	1041156

* Complete with 100 ml of electrolyte, connecting cable - CAN M12 5-pin 0.5 m, T-distributor M12 5-pin CAN

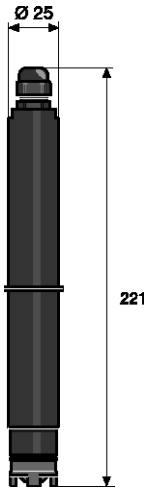
1.3.9 DULCOTEST® Sensors for Ozone

Ozone sensor OZE 3-mA

Standard sensor for measuring ozone in clear water. For operation on controllers with 4-20 mA input

Your benefits

- Measured variable: Ozone, without cross sensitivity to chlorine, hydrogen peroxide
- Diaphragm-covered sensor (encapsulated) minimises faults caused by changing flow or ingredients in the water



pk_6_039

Measured variable	Ozone (O_3)
Reference method	DPD4
pH range	4.0 … 11.0 Ozone stability range
Cross sensibility	Chlorine dioxide
Temperature	5 … 40 °C
Max. pressure	1.0 bar
Intake flow	30…60 l/h (in DGM or DLG III)
Supply voltage	16...24 V DC (two-wire technology)
Output signal	4…20 mA ≈ measuring range, temperature-compensated, uncalibrated, not electrically isolated
Selectivity	Ozone as against free chlorine, combined chlorine, hydrogen peroxide
Installation	Bypass: open sample water outlet
Sensor fitting	DGM, DLG III
Measuring and control equipment	D1C, DAC
Typical applications	Potable water and swimming pool water
Resistance to	Salts, acids, alkalis. Not surfactants
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
OZE 3-mA-2 ppm	0.02…2.0 mg/l	792957

Ozone sensor complete with 100 ml of electrolyte.

Note: A mounting kit (order no. 815079) is required for initial fitting of the ozone sensors in the in-line probe housing DLG III.

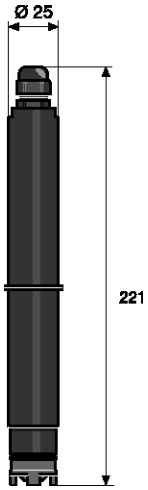
1.3 Amperometric Sensors DULCOTEST®

Ozone sensor OZR 1-mA

Sensor for measuring and monitoring the absence of ozone. For operation on controllers with 4-20 mA input

Your benefits

- Measured variable: Ozone, without cross sensitivity to chlorine, hydrogen peroxide
- Diaphragm-covered sensor (encapsulated) minimises faults caused by changing flow or ingredients in the water
- Suitable also for monitoring the absence of ozone (rupture monitoring on filters) and for discontinuous ozone treatment processes
- Resistance to films of dirt by pore-free diaphragm



pk_6_039

Measured variable	Ozone (O_3)
Reference method	DPD4
pH range	4.0 … 11.0 Stability range of ozone
Cross sensibility	Chlorine dioxide, bromine
Temperature	5 … 40 °C
Max. pressure	1.0 bar
Intake flow	30…60 l/h (in the DGM or DLG III)
Supply voltage	16...24 V DC (two-wire system)
Output signal	4…20 mA ≈ Measuring range, temperature-compensated, uncalibrated, not electrically isolated
Selectivity	Non-selective
Installation	Bypass: open sample water outlet
Sensor fitting	DGM, DLG III
Measuring and control equipment	D1C, DAC
Typical applications	Process, service or cooling water, monitoring the ozone breakdown of filters
Resistance to	Salts, acids, alkalis, surfactants, dirt films
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
OZR 1-mA-2 ppm	0.02…2.0 mg/l	1051647

Important note: A mounting kit (order no. 815079) is required for initial fitting of the ozone sensors in the in-line probe housing DLG III.

1.3 Amperometric Sensors DULCOTEST®

1.3.10 DULCOTEST® Sensors for Dissolved Oxygen

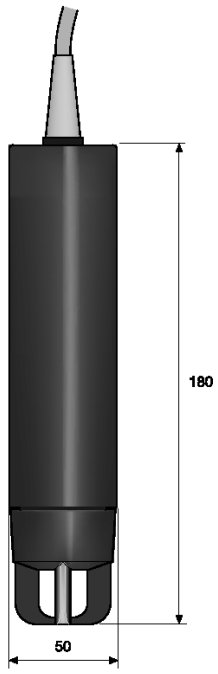
The measured variable "Dissolved oxygen" indicates the volume of gaseous oxygen physically dissolved in the aqueous phase in mg/l (ppm).

"Dissolved oxygen" is therefore an important parameter for assessing the quality of surface water and water that has to be treated for the breeding of livestock with the addition of oxygen. Dissolved oxygen is also used for controlling processes in clarification plants and waterworks.

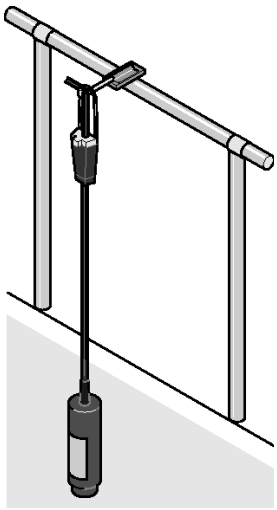
The following sensors are assigned to the different applications and can be offered separately as 4 - 20 mA encoders to central controls or as a decentralised solution along with D1C and DAC (measured variable: "Dissolved oxygen": X).

Oxygen Sensor DO 1-mA

Sensor for the measurement of the dissolved oxygen above 2 ppm to oxygen saturation. For installation in standard immersion pipes or in the bypass line. Use in waterworks, in fish breeding or to monitor surface water



pk_6_050_1



pk_6_011

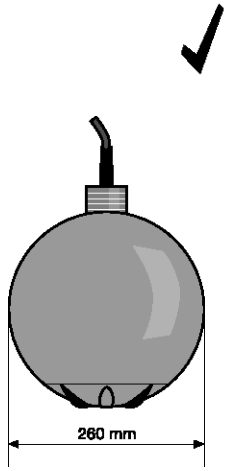
Your benefits

- Measured variable: dissolved oxygen, no interference by turbidity or discolouration by the amperometric measuring principle
- Rod-shaped construction for simple installation into standard immersion pipes and bypass lines
- Diaphragm-covered sensor minimises faults caused by changing flow or ingredients in the water
- Minimal maintenance and long service life due to encapsulated transducer (easily replaceable thanks to bayonet fitting)
- Measuring electrodes protected by pore-free, dirt-repellent diaphragm
- Long service life of the electrolyte at high oxygen concentrations through optimised membrane thickness
- Stable zero point by means of large diaphragm-covered electrodes

Measured variable	Dissolved oxygen
Calibration	Of oxygen in air
Measuring accuracy	±0.5% relative to final value of measuring range
Response time sensor	110 s
Temperature	0 … 50 °C
Max. pressure	1.0 bar
Intake flow	Minimum: 0.05 m/s
Supply voltage	12...30 V DC
Electrical connection	Fixed lead, 10 m
Output signal	4…20 mA ≈ measuring range, calibrated, temperature-compensated and electrically isolated
Enclosure rating	IP 68
Measuring and control equipment	D1Cb, DAC
Process integration	a) Immersion, suspended on cable with or without cable bracket (see accessories) b) Immersion with immersion pipe 1. Immersion pipe with 50 mm outside diameter and 1-1/4 inch internal thread (provided by the customer). The connection is possible via an immersion pipe adapter (see accessories). 2. PVC immersion pipe with 50 mm outside diameter (provided by the customer). The connection is made by adhesion via a standard PVC union (provided by the customer). c) In-flow operation on request
Measuring and control equipment	D1Cb, DAC
Typical applications	Fish and shrimp farming, conditioning of water in large aquaria in zoological parks, control of the oxygen input in waterworks, appraisal of the biological status of surface waters.
Resistance to	Ingredients in the water, dirt films
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered, encapsulated transducer

	Measuring range	Order no.
DO 1-mA-20 ppm	2.00…20.0 mg/l	1020532

1.3 Amperometric Sensors DULCOTEST®



pk_6_051

Oxygen Sensor DO 2-mA

Sensor for the measurement of the dissolved oxygen, specifically optimised for control above 0.1 ppm in the aeration tanks of clarification plants. Integrated in a floating ball with a cleaning function

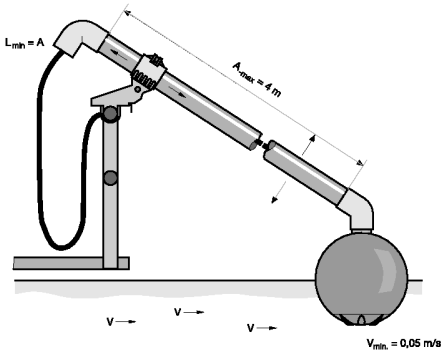
Your benefits

- Measured variable: dissolved oxygen, no interference by turbidity or discolouration by the amperometric measuring principle
- Integration of the encapsulated transducer in a specially-shaped floating ball., creating a Venturi flow, which helps to clean the sensor membrane
- Diaphragm-covered sensor minimises faults caused by changing flow or ingredients in the water
- Minimal maintenance and long service life due to encapsulated transducer (easily replaceable thanks to bayonet fitting)
- Measuring electrodes protected by pore-free, dirt-repellent diaphragm
- Long service life of the electrolyte at low to medium oxygen concentrations, as occur in the aeration tanks of clarification plants, by means of optimised membrane thickness
- Stable zero point by means of large diaphragm-covered electrodes

Measured variable	Dissolved oxygen
Calibration	Of oxygen in air
Measuring accuracy	±0.5% relative to final value of measuring range
Response time sensor	22 s
Temperature	0 … 50 °C
Max. pressure	1.0 bar
Intake flow	Minimum: 0.05 m/s
Supply voltage	12...30 V DC
Electrical connection	Fixed lead, 10 m
Output signal	4…20 mA measuring range calibrated, temperature-corrected and electrically isolated
Enclosure rating	IP 68
Measuring and control equipment	D1Cb, DAC
Process integration	As a float with venturi grooves to increase the flow of sample water for the self-cleaning of the sensor part. Supplied with adapter for connection to PVC pipes with outside diameter: 50 mm and railing bracket, also for PVC pipes with outside diameter: 50 mm (see accessories). The customer must provide the straight PVC tube and a 45 ° standard elbow for gluing to PVC pipes (outside diameter 50 mm).
Measuring and control equipment	D1Cb, DAC
Typical applications	Control of the oxygen input in activated sludge pools (sewage plant) for the purpose of energy conservation.
Resistance to	Ingredients in the water, dirt films
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered, encapsulated transducer integrated in ball float

For further information: Installation Fittings / Adapters see page → 1-126

	Measuring range	Order no.
DO 2-mA-10 ppm	0.10…10.0 mg/l	1020533



pk_6_012

1.3 Amperometric Sensors DULCOTEST®

1.3.11 DULCOTEST® Sensors for Peracetic Acid

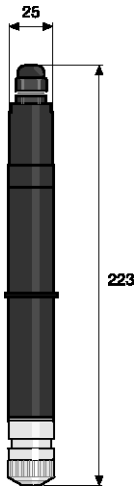
DULCOTEST® sensors of type PAA 1 are diaphragm-covered, amperometric 2-electrode sensors for the selective measurement of peracetic acid. Peracetic acid is particularly used in the food and beverage industry, but also for disinfection in the cosmetics, pharmaceutical and medical sectors. The continuous measurement and control of peracetic acid is therefore required when there are high demands in terms of disinfection and quality assurance. Commissioning and maintenance are significantly simplified. The sensor can also be used where there are surfactants.

Peracetic Acid Sensor PAA 1-mA

Sensor for the measurement of peracetic acid without cross-sensitivity towards hydrogen peroxide. For use in contaminated washing and waste water

Your benefits

- Measured variable: Peracetic acid, without cross-sensitivity towards the accompanying chemical, hydrogen peroxide
- Diaphragm-covered sensor minimises faults caused by changing flow or ingredients in the water
- Resistance to films of dirt by pore-free diaphragm



pk_6_083

Measured variable	Peracetic acid
Reference method	Titration
pH range	1.0 … 9.0 (peracetic acid stability range)
Cross sensibility	Ozone, chlorine dioxide, chlorine, bromine
Temperature	1 … 45 °C
Admissible temperature fluctuation	0.3 °C/min
Response time sensor	≈ 3 min
Max. pressure	3.0 bar, (30 °C, in DGM)
Intake flow	30…60 l/h (in in-line probe housing DGM or DLG III)
Supply voltage	16...24 V DC (two-wire technology)
Output signal	4…20 mA ≈ measuring range, temperature-compensated, uncalibrated, not electrically isolated
Selectivity	Peracetic acid selective towards hydrogen peroxide
Installation	Bypass: open sample water outlet
In-line probe fitting	DGM, DLG
Measuring and control equipment	D1C, DAC
Typical applications	Scouring in Cleaning in Place (CIP), rinsers, also suitable in the presence of cationic and anionic tensides. The selective measurement of peracetic acid and hydrogen peroxide is possible.
Resistance to	Salts, acids, alkalis, surfactants, dirt films
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
PAA 1-mA-200 ppm	1…200 mg/l	1022506
PAA 1-mA-2000 ppm	10…2,000 mg/l	1022507

Note: a mounting kit (order no. 815079) is required for initial fitting of the sensors in the in-line probe housing DLG III.

1.3 Amperometric Sensors DULCOTEST®

1.3.12 DULCOTEST® Sensors for Hydrogen Peroxide

DULCOTEST® sensors PEROX and PER1 are membrane-covered, amperometric sensors for the online concentration measurement of hydrogen peroxide. Due to its complete biodegradability, hydrogen peroxide is a disinfectant and oxidising agent frequently used in water treatment and production:

- chemical bleach in the wood, paper, textile and mineral compounds industries,
- organic synthesis in the chemical, pharmaceutical and cosmetics industries,
- oxidation of potable water, landfill seepage water, contaminated ground water,
- disinfection of cooling, process and production water in the pharmaceutical, food and beverage industries as well as in swimming pools,
- deodorisation (gas scrubbers) in municipal and industrial clarification plants,
- dechlorination in chemical processes.

Sensors are selected according to the following decision-making table:

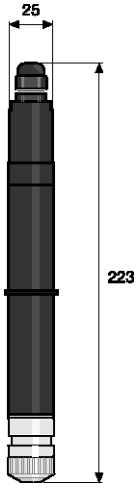
Requirement	Type PER1	PEROX
Sample matrix loaded with dirt and chemicals	Suitable due to water-impermeable diaphragm, however sensitive to the presence of hydrogen sulphide (H_2S), oxidant	Failure-prone due to water-permeable diaphragm
Electrical influence due to interference potential in the measurement medium	Insensitive because the counter electrode is separated from the process	More sensitive because counter electrode is in the medium
Temperature range	Up to 50 °C	Up to 40 °C
Simple handling during installation and maintenance	Suitable due to temperature compensation and transmitters integrated in the sensor	Separate temperature sensor and transmitter
Response time as t_{90}	480 s	20 s
Quick temperature changes	Slow due to integrated temperature sensor	Fast due to separate temperature sensor
Measuring intervals in the absence of H_2O_2	Unsuitable	Suitable due to pulsed polarisation technology
Measuring range can vary in phased approach due to orders of magnitude or is not clear in the order	Selection of a suitable sensor is necessary	Suitable because the measuring range can be manually switched on the sensor transducer

Hydrogen Peroxide Sensor PER1

Sensor for the measurement of hydrogen peroxide even in chemically contaminated and polluted water. Available with measuring ranges for extremely low or very high concentrations

Your benefits

- Measured variable hydrogen peroxide, with measuring ranges from 0.5 ppm to 100,000 ppm (10%) available
- Diaphragm-covered sensor minimises faults caused by changing flow or ingredients in the water
- Resistance to films of dirt by pore-free diaphragm
- Operating temperature up to 50 °C



pk_6_083

Measured variable	Hydrogen peroxide
Calibration	Photometric with manual DT3B photometer
pH range	2.5 … 11.0
Cross sensibility	Ozone, chlorine dioxide, peracetic acid, chlorine, bromine
Temperature	0 … 50 °C
Admissible temperature fluctuation	< 0.3 °C/min
Response time sensor	T_{90} approx. 480 sec
Measuring accuracy	≥ 1 ppm or better than ± 5% of measured value
Min. conductivity	0.05 … 5.00 mS/cm
Max. pressure	1.0 bar
Intake flow	20…100 l/h
Supply voltage	16...24 V DC (two-wire system)
Output signal	4…20 mA temperature-compensated, uncalibrated, not electrically isolated
Selectivity	Hydrogen peroxide selective towards sulphite
Installation	Bypass: open outlet or return of the sample water into the process line
In-line probe fitting	DGM, DLG
Measuring and control equipment	D1Cb, DAC
Typical applications	Swimming pools, treatment of contaminated waste waters, treatment of process media from production
Resistance to	Salts, acids, alkalis, surfactants, dirt films, not against hydrogen sulphide (H_2S)
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
PER 1-mA-50 ppm	0.50…50.0 mg/l	1030511
PER 1-mA-200 ppm	2.00…200.0 mg/l	1022509
PER 1-mA-2000 ppm	20.00…2,000.0 mg/l	1022510

Important note: Measuring ranges up to 100,000 ppm on request

Photometer → 4-14

Accessories

		Order no.
Photometer DT3B hydrogen peroxide	(for calibration)	1039317

Note: a mounting kit (order no. 815079) is required for initial fitting of the sensors in the in-line probe housing DLG III.

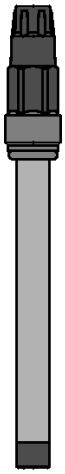
1.3 Amperometric Sensors DULCOTEST®

Hydrogen Peroxide Sensor PEROX

Sensor for the measurement of hydrogen peroxide without cross-sensitivity to chlorine. Can also be used for fast control processes in clear water

Your benefits

- Measured variable hydrogen peroxide without cross sensitivity to chlorine
- Diaphragm-covered sensor minimises faults caused by changing flow
- Control of fast processes through rapid response time by the sensor in conjunction with fast external temperature measurement for temperature correction
- Reliable measurement even after periods of absence of hydrogen peroxide by pulsed, self-regenerating measuring electrode



P_DT_0075_SW

Measured variable	Hydrogen peroxide
Calibration	Photometric with manual DT3B photometer
Measuring range	1… 20/10 … 200/100 … 2000 mg/l switchable
pH range	2.5 … 10.0
Temperature	0 … 40 °C
Admissible temperature fluctuation	< 1 °K/min (for external temp. measurement) see operating instructions
Response time sensor	T_{90} approx. 20 sec
Measuring accuracy	better than 2% referred to range full scale value
Min. conductivity	With 20 mg/l range: 5 µS/cm With 200 mg/l range: 200 µS/cm Up to 1,000 mg/l: 500 µS/cm Up to 2,000 mg/l: 1 mS/cm
Max. pressure	2.0 bar
Intake flow	30…60 l/h
Supply voltage	16...24 V DC (3-wire system)
Output signal	4…20 mA not temperature-compensated, uncalibrated, not electrically isolated
Selectivity	Hydrogen peroxide selective towards free chlorine
Installation	Bypass: open outlet or return of the sample water into the process line
In-line probe fitting	DGM, DLG
Measuring and control equipment	DAC
Typical applications	Treatment of clear and chemically uncontaminated waters, control with necessary short response times
Resistance to	Salts, acids, alkalis, surfactants, dirt films
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Order no.
PEROX sensor PEROX-H2.10 P	792976
PEROX transducer V1 for D1Ca	1034100
PEROX transducer V2 for DACa	1047979

Photometer → 4-14

Accessories

		Order no.
Photometer DT3B hydrogen peroxide	(for calibration)	1039317

1.4 DULCOTEST® Conductivity Sensors

1.4.1 Conductivity Sensors

The advantages at a glance:

- Large range of sensor types tailored to meet different requirements offering excellent value for money.
- Precise and reliable online measurement enables efficient processes and outstanding process reliability.
- Long service lives and short maintenance intervals reduce downtime and increase the availability of the measured information.
- Complete pre-assembled sets containing fittings and sensors for simple, fast and trouble-free installation.

Note the following points for optimum functioning of conductivity sensors:

- Install the sensors so that the electrodes are always covered by the measuring liquid.
- Keep measuring lines as short as possible
- Temperature compensation with fluctuating temperatures
- Regular cleaning depending on the application
- Ensure that the cell constant and measuring range match each other

Conductivity sensor selection guide

Conductivity > 20 mS/cm or residue-forming medium or chemically aggressive medium?

yes ↓ | ↓ **no**

Inductive conductivity measurement

↓

Do the following conditions exist?

- **Chemically corrosive medium or**
- **Temperatures > 70 °C or**
- **Measured value < 200 µS/cm or > 1000 mS/cm**

Yes ↓ | ↓ **No**

Series ICT 2

Installation in the process line: with stainless steel flange accessory

For immersion with accessory: Immersion fitting IMA - ICT 2

Series ICT1

↓

Installation in the process line?

Yes ↓ | ↓ **No**

Type ICT 1
For installation in a pipe

Type ICT 1-IMA
For immersion

Conductive conductivity measurement

↓

Further selection according to summary table:

- **Measuring range**
- **Temperature**
- **Process adjustment**
- **Electrical connection**

↓

Product ranges LF, LMP, CK

1.4 DULCOTEST® Conductivity Sensors

Overview Table for Conductivity Sensors

Type	Measuring range	Cell constant k	Medium temperature max.	Max. pressure	Shaft material	Temperature compensation	Process integration	Electrical connection on the measuring device
		cm^{-1}	°C	bar				
LMP 001 → 1-88	0,01…50 µS/cm	0.01 ±5%	70	16	PP	Pt 100	Flow, 3/4" outer thread	DIN 4-pin angle plug, on Compact; DMTa
LMP 001-HT → 1-89	0,01…50 µS/cm	0.01 ±5%	120	16	PVDF	Pt 100	Flow, 3/4" outer thread	DIN 4-pin angle plug, on Compact; DMTa
LMP 01 → 1-90	0,1…500 µS/cm	0.1 ±5%	70	16	PP	Pt 100	Flow, 3/4" outer thread	DIN 4-pin angle plug, on Compact; DMTa
LMP 01-HT → 1-92	0,1…500 µS/cm	0.1 ±5%	120	16	PVDF	Pt 100	Flow, 3/4" outer thread	DIN 4-pin angle plug, on Compact; DMTa
LMP 01-TA → 1-91	0,1…500 µS/cm	0.1 ±5%	70	16	PP	Pt 100	Immersion, including immersion fitting 1 m	5 m fixed cable, on Compact; DMTa
LFT 1 FE → 1-93	0.01…20 mS/cm	1 ±5%	80	16	Epoxy	Pt 100	PG 13.5, flow (length: 120 mm) or immersion	5 m fixed cable (4 x 0.5 mm^2), on DMTa
LFTK 1 FE-5m-shd → 1-94	0.01…20 mS/cm	1 ±5%	80	16	Epoxy	Pt 1000	PG 13.5, flow (length: 120 mm) or immersion	5 m fixed cable (4 x 0.25 mm^2), screened, on Compact; DMTa
LFTK 1 FE-3m-shd → 1-95	0.01…20 mS/cm	1 ±5%	80	16	Epoxy	Pt 1000	PG 13.5, flow (length: 120 mm) or immersion	3 m fixed cable (4 x 0.25 mm^2), screened, on Compact; DMTa
LF 1 DE → 1-96	0.01…20 mS/cm	1 ±5%	80	16	Epoxy	None, only for applications with constant temperature	PG 13.5, flow (length: 120 mm) or immersion	DIN 4-pin angle plug, on Compact; DMTa
LFT 1 DE → 1-97	0.01…20 mS/cm	1 ±5%	80	16	Epoxy	Pt 100	PG 13.5, flow (length: 120 mm) or immersion	DIN 4-pin angle plug, on Compact; DMTa
LFTK 1 DE → 1-98	0.01…20 mS/cm	1 ±5%	80	16	Epoxy	Pt 1000	PG 13.5, flow (length: 120 mm) or immersion	DIN 4-pin angle plug, on Compact; DMTa
LFT 1 1/2" → 1-99	0.01…20 mS/cm	1 ±5%	80	16	Epoxy	Pt 100	1/2 inch male thread, flow (length: 120 mm) or immersion	DIN 4-pin angle plug, on Compact; DMTa
LFTK 1 1/2" → 1-100	0.01…20 mS/cm	1 ±5%	80	16	Epoxy	Pt 1000	1/2 inch male thread, flow (length: 120 mm) or immersion	DIN 4-pin angle plug, on Compact; DMTa
CK 1 → 1-101	0.01…20 mS/cm	1 ±5%	150	16	PES	none, only for applications with constant temperature	Flow, 1" outer thread	DIN 4-pin angle plug, on Compact; DMTa
CKPt 1 → 1-102	0.01…20 mS/cm	1 ±5%	150	16	PES	Pt 100	Flow, 1" outer thread	DIN 4-pin angle plug, on Compact; DMTa
LM 1 → 1-103	0.1…20 mS/cm	1 ±5%	70	16	PP	–	Flow, 3/4" outer thread	DIN 4-pin angle plug, on Compact; DMTa
LM 1-TA → 1-104	0.1…20 mS/cm	1 ±5%	70	16	PP	–	Immersion, including immersion fitting 1 m	5 m fixed cable, screened, on Compact; DMTa
LMP 1 → 1-105	0.1…20 mS/cm	1 ±5%	70	16	PP	Pt 100	Flow, 3/4" outer thread	DIN 4-pin angle plug, on Compact; DMTa

1.4 DULCOTEST® Conductivity Sensors

Type	Measuring range	Cell constant k	Medium temperature max.	Max. pressure	Shaft material	Temperature compensation	Process integration	Electrical connection on the measuring device
		cm^{-1}	°C	bar				
LMP 1-HT → 1-107	0.1…20 mS/cm	1 ±5%	120	16	PVDF	Pt 100	Flow, 3/4" outer thread	DIN 4-pin angle plug, on Compact; DMTa
LMP 1-TA → 1-106	0.1…20 mS/cm	1 ±5%	70	16	PP	Pt 100	Immersion, including immersion fitting 1 m	5 m fixed cable, screened, on Compact; DMTa
LF 204 → 1-108	1µS/cm…500 mS/cm	0.48 ±1.5%	–	2	–	–	Manual immersion	On Portamess 911 Cond
ICT 1 → 1-108	0.2…1,000 mS/cm	8.5 ±5%	70	16	PP	Pt 100	Flow DN 50	7 m fixed cable, On Compact *
ICT 1-IMA → 1-109	0.2…1,000 mS/cm	8.5 ±5%	70	8	PP	Pt 100	Immersion including in-line probe fitting 1 m	7 m fixed cable, On Compact *
ICT 2 → 1-110	0.02…2,000 mS/cm	1.98	125	16	PFA	Pt 100, class A, completely extrusion-coated	Installation with SS flange, immersion with immersion pipe fixed cable (Accessories)	5 m fixed cable, On Compact *

General information:

1 The DMTa transducer is available for conversion of the measurement signal into a temperature compensated 4-20 mA signal (see Chapter 8).

2 Connections for the DIN-4 pole angle plug:
- Sensors: Earth and 2
- Pt 100/1000: 1 and 3

3 With DIN 4 pole angle plugs, the cable must be screened if the sensor is connected to the compact controller or DMTa.

4 An adapter set PG 13.5 / 1" (order no. 1002190) is necessary for installation in the in-line probe housing type DLG III (1"-hole).

Measuring line for conductive conductivity sensors see page → 1-114

1.4 DULCOTEST® Conductivity Sensors

1.4.2 2-Electrode Conductivity Sensors

Conductive conductivity sensors measure the electrolytic conductivity indirectly via the charge transfer between two electrodes immersed in the medium to be measured. The sensor types with cell constants k = 0.01 and k = 0.1 cm^{-1} are especially suitable for the measurement of the lowest electrolytic conductivities of < 1 µS/cm in pure and ultra-pure kinds of water.

The sensor types with cell constants k=1 cm^{-1} are used in numerous kinds of water without film-forming ingredients up to 20 mS/cm. The cost-effective sensor range LF(T) is used in clear, chemically uncontaminated water.

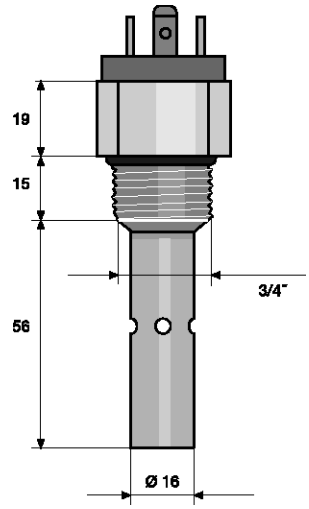
The sensor ranges LM(P), CK and CKPt can also be used in chemically contaminated kinds of water and a high temperatures.

Conductivity Sensor LMP 001

Sensor for the measurement of the lowest electrolytic conductivities for clear and also chemically contaminated water. With integrated temperature measurement and DIN 4-pin plug. For operation with the controllers Compact DCCa, DMTa, D1Ca

Your benefits

- Measured variable: electrolytic conductivity above 0.01 µS/cm
- Cost-effective sensor for clear, chemically contaminated water
- Integrated Pt 100 for temperature compensation replaces separate temperature sensor and the corresponding sensor fitting



pk_6_048

Measuring range	0.01…50 µS/cm
Cell constant k	0.01 cm^{-1} ±5%
Temperature measurement	Pt 100
Medium temperature	70 °C
Max. pressure	16.0 bar up to 50 °C,
Sensors	Stainless steel 1.4571
Shaft material	PP
Thread	3/4"
Length when fitted	71 mm
Installation	Inline: direct installation into the pipework, bypass: with or without return of the sample water into the process line
Electrical connection	DIN 4-pin angle plug
Enclosure rating	IP 65
Typical applications	Clean water applications, monitoring ion exchangers and reverse osmosis systems
Resistance to	Ingredients in the water of the target application, taking into account the compatibility of the material
Measuring and control equipment	Compact DCCa, DMTa, D1Ca
Measuring principle, technology	Conductive, 2 coils. Integrated temperature measurement

	Order no.
LMP 001	1020508

Please observe the general notes on p. → 1-86 (Overview Table for Conductivity Sensors)

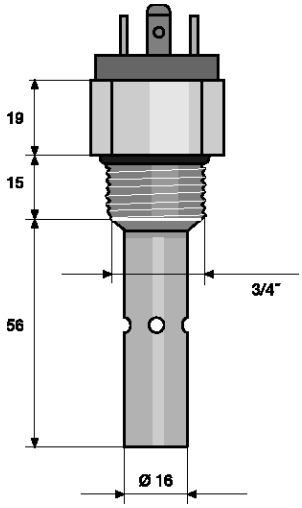
1.4 DULCOTEST® Conductivity Sensors

Conductivity Sensor LMP 001-HT

Sensor for the measurement of the lowest electrolytic conductivity for clear and also chemically contaminated water. For high temperatures, with integrated temperature measurement and DIN 4-pin plug. For operation with the controllers Compact DCCa, DMTa, D1Ca

Your benefits

- Measured variable: electrolytic conductivity above 0.01 µS/cm
- Cost-effective sensor for clear, chemically contaminated water
- Integrated Pt 100 for temperature compensation replaces separate temperature sensor and the corresponding sensor fitting
- Temperature resistance up to 100 °C



pk_6_048

Measuring range	0.01…50 µS/cm
Cell constant k	0.01 cm^{-1} ±5%
Temperature measurement	Pt 100
Medium temperature	120 °C
Max. pressure	16.0 bar up to 100 °C,
Sensors	Stainless steel 1.4571
Shaft material	PVDF
Thread	3/4"
Length when fitted	71 mm
Installation	Inline: direct installation into the pipework, bypass: with or without return of the sample water into the process line
Electrical connection	DIN 4-pin angle plug
Enclosure rating	IP 65
Typical applications	General applications at higher temperatures, clean water applications, condensate.
Resistance to	Ingredients in the water of the target application, taking into account the compatibility of the material
Measuring and control equipment	Compact DCCa, DMTa, D1Ca
Measuring principle, technology	Conductive, 2 coils. Integrated temperature measurement

	Order no.
LMP 001-HT	1020509

Please observe the general notes on p. → 1-86 (Overview Table for Conductivity Sensors)

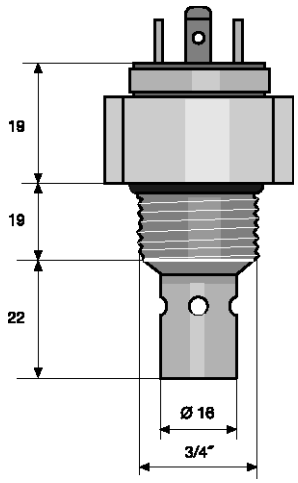
1.4 DULCOTEST® Conductivity Sensors

Conductivity Sensor LMP 01

Sensor for the measurement of low electrolytic conductivities for clear and also chemically contaminated water. With integrated temperature measurement and DIN 4-pin plug. For operation with the controllers Compact DCCa, DMTa, D1Ca

Your benefits

- Measured variable: electrolytic conductivity above 0.1 µS/cm
- Cost-effective sensor for clear, chemically contaminated water
- Integrated Pt 100 for temperature compensation replaces separate temperature sensor and the corresponding sensor fitting



pk_6_049

Measuring range	0.1…500 µS/cm
Cell constant k	0.10 cm^{-1} ±5%
Temperature measurement	Pt 100
Medium temperature	70 °C
Max. pressure	16.0 bar up to 50 °C,
Sensors	Stainless steel 1.4571
Shaft material	PP
Thread	3/4″
Length when fitted	46 mm
Installation	Inline: direct installation into the pipework, bypass: with or without return of the sample water into the process line
Electrical connection	DIN 4-pin angle plug
Enclosure rating	IP 65
Typical applications	Monitoring ion exchangers, reverse osmosis systems and desalination systems.
Resistance to	Ingredients in the water of the target application, taking into account the compatibility of the material
Measuring and control equipment	Compact DCCa, DMTa, D1Ca
Measuring principle, technology	Conductive, 2 coils. Integrated temperature measurement

	Order no.
LMP 01	1020510

Please observe the general notes on p. → 1-86 (Overview Table for Conductivity Sensors)

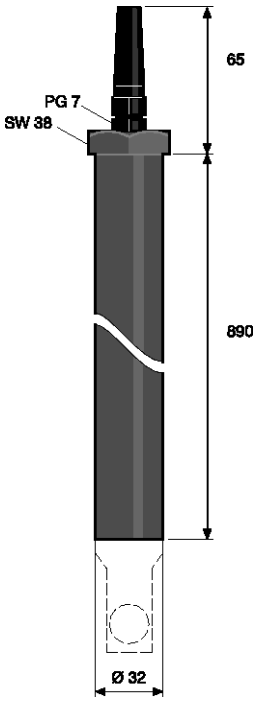
1.4 DULCOTEST® Conductivity Sensors

Conductivity Sensor LMP 01-TA

Sensor for the measurement of low electrolytic conductivities for clear and also chemically contaminated water. With integrated temperature measurement and DIN 4-pin plug. For operation with the controllers Compact DCCa, DMTa, D1Ca

Your benefits

- Measured variable: electrolytic conductivity above 0.1 µS/cm
- Cost-effective sensor for clear, chemically contaminated water
- Simple installation in tanks and containers by sensor ready mounted in the immersion tube
- Integrated Pt 100 for temperature compensation replaces separate temperature sensor and the corresponding sensor fitting



pk_6_053

Measuring range	0.1…500 µS/cm
Cell constant k	0.10 cm^{-1} ±5%
Temperature measurement	Pt 100
Medium temperature	70 °C
Max. pressure	16.0 bar up to 50 °C,
Sensors	Stainless steel 1.4571
Shaft material	PP
Thread	M 28 x 1.5 for immersion assembly TA-LM
Fitting length	Max. 1 m
Installation	Immersion through an immersion tube
Electrical connection	5 m fixed cable
Enclosure rating	IP 65
Typical applications	Monitoring ion exchangers, reverse osmosis systems and desalination systems.
Resistance to	Ingredients in the water of the target application, taking into account the compatibility of the material
Measuring and control equipment	Compact DCCa, DMTa, D1Ca
Measuring principle, technology	Conductive, 2 coils. Integrated temperature measurement

		Order no.
LMP 01-TA	Sensor integrated in immersion fitting	1020512
LMP 01-FE	Replacement sensor for LMP 01-TA with 5 m fixed cable	1020626

Please observe the general notes on p. → 1-86 (Overview Table for Conductivity Sensors)

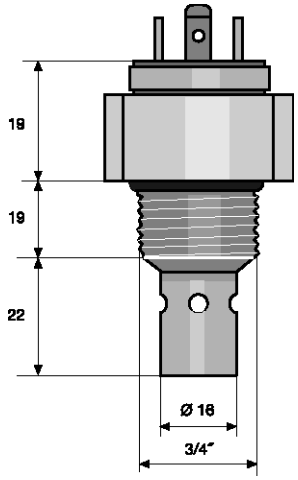
1.4 DULCOTEST® Conductivity Sensors

Conductivity Sensor LMP 01-HT

Sensor for the measurement of low electrolytic conductivities for clear and also chemically contaminated water. For high temperatures, with integrated temperature measurement and DIN 4-pin plug. For operation with the controllers DCCa, DMTa, D1Ca

Your benefits

- Measured variable: electrolytic conductivity above 0.1 µm/cm
- Cost-effective sensor for clear, chemically contaminated water
- Temperature resistance up to 100 °C
- Integrated Pt 100 for temperature compensation replaces separate temperature sensor and the corresponding sensor fitting



pk_6_049

Measuring range	0.1…500 µS/cm
Cell constant k	0.10 cm^{-1} ±5%
Temperature measurement	Pt 100
Medium temperature	120 °C
Max. pressure	16.0 bar up to 100 °C,
Sensors	Stainless steel 1.4571
Shaft material	PVDF
Thread	3/4"
Length when fitted	46 mm
Installation	Inline: direct installation into the pipework, bypass: with or without return of the sample water into the process line
Electrical connection	DIN 4-pin angle plug
Enclosure rating	IP 65
Typical applications	General applications at higher temperatures: industrial, process water, condensate
Resistance to	Ingredients in the water of the target application, taking into account the compatibility of the material
Measuring and control equipment	Compact DCCa, DMTa, D1Ca
Measuring principle, technology	Conductive, 2 coils. Integrated temperature measurement

	Order no.
LMP 01-HT	1020511

Please observe the general notes on p. → 1-86 (Overview Table for Conductivity Sensors)

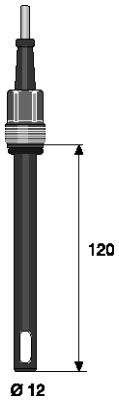
1.4 DULCOTEST® Conductivity Sensors

Conductivity Sensor LFT 1 FE

Cost-effective sensor for the measurement of electrolytic conductivity in clear, uncontaminated water. With integrated temperature measurement and fixed cable connector. For operation with controllers Compact D1Ca and DMTa

Your benefits

- Measured variable: electrolytic conductivity above 10 µS/cm
- Cost-effective sensor for all clear uncontaminated water
- Flexible process connection by the use of sensor fittings for standard pH sensors
- Special graphite electrodes, optimised for a highly dynamic measuring range: 0.01-20 mS/cm
- Integrated Pt 100 for temperature compensation replaces separate temperature sensor and the corresponding sensor fitting
- Fixed cable on the sensor head for difficult ambient conditions



pk_6_085

Measuring range	0.01…20 mS/cm
Cell constant k	1.00 cm^{-1} ±5%
Temperature measurement	Pt 100
Medium temperature	0 … 80 °C (at 1 bar)
Max. pressure	16.0 bar, (at 25 °C)
Sensors	Special graphite
Shaft material	Epoxy
Thread	PG 13.5
Fitting length	120 mm ±3 mm
Installation	Bypass: open outlet or return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Electrical connection	5 m fixed cable (4 x 0.5 mm^2)
Enclosure rating	IP 65
Typical applications	Potable, cooling, industrial water. Sensors of the LF series have only limited applicability for taking measurements in cleaning solutions containing surfactants and media containing solvents.
Resistance to	Unsuitable for chemically contaminated water and water containing film-forming ingredients
Measuring and control equipment	D1Ca, DMTa
Measuring principle, technology	Conductive, 2 coils. Integrated temperature measurement

	Order no.
LFT 1 FE	1001374

Please observe the general notes on p. → 1-86 (Overview Table for Conductivity Sensors)

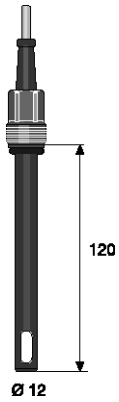
1.4 DULCOTEST® Conductivity Sensors

Conductivity Sensor LFTK 1 FE-5m-shd

Cost-effective sensor for the measurement of electrolytic conductivity in clear, uncontaminated water. With integrated temperature measurement and fixed cable connector (5 m). For operation with controllers Compact DCCa, DMTa

Your benefits

- Measured variable: electrolytic conductivity above 10 µS/cm
- Cost-effective sensor for all clear uncontaminated water
- Flexible process connection by the use of sensor fittings for standard pH sensors
- Special graphite electrodes, optimised for a highly dynamic measuring range: 0.01-20 mS/cm
- Integrated Pt 1000 for precise temperature compensation in limited temperature ranges replaces separate temperature sensor and the corresponding sensor fitting
- Fixed cable on the sensor head for difficult ambient conditions



pk_6_085

Measuring range	0.01…20 mS/cm
Cell constant k	1.00 cm^{-1} ±5%
Temperature measurement	Pt 1000
Medium temperature	0 … 80 °C (at 1 bar)
Max. pressure	16.0 bar, (at 25 °C)
Sensors	Special graphite
Shaft material	Epoxy
Thread	PG 13.5
Fitting length	120 mm ±3 mm
Installation	Bypass: with or without return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Electrical connection	5 m fixed cable (4 x 0.25 mm^2), screened
Enclosure rating	IP 65
Typical applications	Potable, cooling, industrial water.
Resistance to	Unsuitable for chemically contaminated water and water containing film-forming ingredients
Measuring and control equipment	Compact DCCa, DMTa
Measuring principle, technology	Conductive, 2 coils. Integrated temperature measurement

	Order no.
LFTK 1 FE-5m-shd	1046132

Please observe the general notes on p. → 1-86 (Overview Table for Conductivity Sensors)

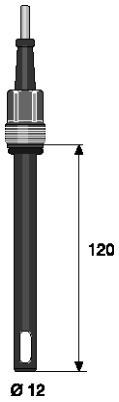
1.4 DULCOTEST® Conductivity Sensors

Conductivity Sensor LFTK 1 FE-3m-shd

Cost-effective sensor for the measurement of electrolytic conductivity in clear, uncontaminated water. With integrated temperature measurement and fixed cable connector (3 m). For operation with controllers Compact DCCa, DMTa

Your benefits

- Measured variable: electrolytic conductivity above 10 µS/cm
- Cost-effective sensor for all clear uncontaminated water
- Flexible process connection by the use of sensor fittings for standard pH sensors
- Special graphite electrodes, optimised for a highly dynamic measuring range: 0.01-20 mS/cm
- Integrated Pt 1000 for precise temperature compensation in limited temperature ranges replaces separate temperature sensor and the corresponding sensor fitting
- Fixed cable on the sensor head for difficult ambient conditions



pk_6_085

Measuring range	0.01…20 mS/cm
Cell constant k	1.00 cm^{-1} ±5%
Temperature measurement	Pt 1000
Medium temperature	0 … 80 °C (at 1 bar)
Max. pressure	16.0 bar, (at 25 °C)
Sensors	Special graphite
Shaft material	Epoxy
Thread	PG 13.5
Fitting length	120 mm ±3 mm
Installation	Bypass: with or without return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Electrical connection	3 m fixed cable (4 x 0.25 mm^2), screened
Enclosure rating	IP 65
Typical applications	Potable, cooling, industrial water. Sensors of the LF series have only limited applicability for taking measurements in cleaning solutions containing surfactants and media containing solvents.
Resistance to	Unsuitable for chemically contaminated water and water containing film-forming ingredients
Measuring and control equipment	Compact DCCa, DMTa
Measuring principle, technology	Conductive, 2 coils. Integrated temperature measurement

	Order no.
LFTK 1 FE-3m-shd	1046010

Please observe the general notes on p. → 1-86 (Overview Table for Conductivity Sensors)

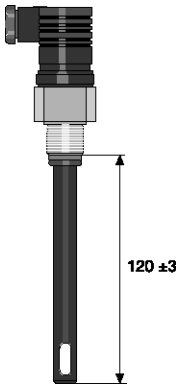
1.4 DULCOTEST® Conductivity Sensors

Conductivity Sensor LF 1 DE

Cost-effective sensor for the measurement of electrolytic conductivity in clear, uncontaminated water. For applications with a constant temperature, with DIN 4-pin plug. For operation with controllers Compact DCCa, DMTa, D1Ca

Your benefits

- Measured variable: electrolytic conductivity above 10 µS/cm
- Cost-effective sensor for all clear uncontaminated water
- Flexible process connection by the use of sensor fittings for standard pH sensors
- Special graphite electrodes, optimised for a highly dynamic measuring range: 0.01-20 mS/cm
- Cost-effective version without integral temperature measurement with constant temperature of the medium to be measured
- DIN 4-pin plug for simple installation



pk_6_086

Measuring range	0.01…20 mS/cm
Cell constant k	1.00 cm^{-1} ±5%
Temperature measurement	None, only for applications with constant temperature
Medium temperature	0 … 80 °C (at 1 bar)
Max. pressure	16.0 bar, (at 25 °C)
Sensors	Special graphite
Shaft material	Epoxy
Thread	PG 13.5
Fitting length	120 mm ±3 mm
Installation	Bypass: with or without return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Electrical connection	DIN 4-pin angle plug
Enclosure rating	IP 65
Typical applications	Potable, cooling, industrial water. Sensors of the LF series have only limited applicability for taking measurements in cleaning solutions containing surfactants and media containing solvents.
Resistance to	Unsuitable for chemically contaminated water and water containing film-forming ingredients
Measuring and control equipment	Compact DCCa, DMTa, D1Ca
Measuring principle, technology	Conductive, 2 electrodes

	Order no.
LF 1 DE	1001375

Please observe the general notes on p. → 1-86 (Overview Table for Conductivity Sensors)

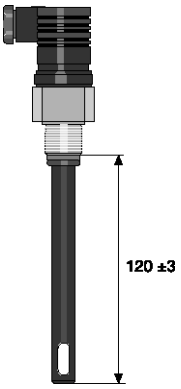
1.4 DULCOTEST® Conductivity Sensors

Conductivity Sensor LFT 1 DE

Cost-effective sensor for the measurement of electrolytic conductivity in clear, uncontaminated water. With integrated temperature measurement and DIN 4-pin plug. For operation with controllers Compact DCCa, DMTa, D1Ca

Your benefits

- Measured variable: electrolytic conductivity above 10 µS/cm
- Cost-effective sensor for all clear, uncontaminated types of water
- Flexible process connection by the use of sensor fittings for standard pH sensors
- Special graphite electrodes, optimised for a highly dynamic measuring range: 0.01-20 mS/cm
- Integrated Pt 100 for temperature compensation replaces separate temperature sensor and the corresponding sensor fitting
- DIN 4-pin plug for simple installation



pk_6_086

Measuring range	0.01…20 mS/cm
Cell constant k	1.00 cm^{-1} ±5%
Temperature measurement	Pt 100
Medium temperature	0 … 80 °C (at 1 bar)
Max. pressure	16.0 bar, (at 25 °C)
Sensors	Special graphite
Shaft material	Epoxy
Thread	PG 13.5
Fitting length	120 mm ±3 mm
Installation	Bypass: with or without return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Electrical connection	DIN 4-pin angle plug
Enclosure rating	IP 65
Typical applications	Potable, cooling, industrial water. Sensors of the LF series have only limited applicability for taking measurements in cleaning solutions containing surfactants and media containing solvents.
Resistance to	Unsuitable for chemically contaminated water and water containing film-forming ingredients
Measuring and control equipment	Compact DCCa, DMTa, D1Ca
Measuring principle, technology	Conductive, 2 coils. Integrated temperature measurement

	Order no.
LFT 1 DE	1001376

Please observe the general notes on p. → 1-86 (Overview Table for Conductivity Sensors)

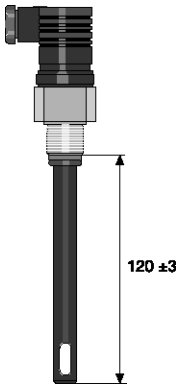
1.4 DULCOTEST® Conductivity Sensors

Conductivity Sensor LFTK 1 DE

Cost-effective sensor for the measurement of the electrolytic conductivity in clear, uncontaminated water with integral temperature measurement and DIN 4-pin plug. For operation with controllers Compact DCCa, DMTa

Your benefits

- Measured variable: electrolytic conductivity above 10 µS/cm
- Cost-effective sensor for all clear uncontaminated water
- Flexible process connection by the use of sensor fittings for standard pH sensors
- Special graphite electrodes, optimised for a highly dynamic measuring range: 0.01-20 mS/cm
- Integrated Pt 100 for temperature compensation replaces separate temperature sensor and the corresponding sensor fitting
- DIN 4-pin plug for simple installation



pk_6_086

Measuring range	0.01…20 mS/cm
Cell constant k	1.00 cm^{-1} ±5%
Temperature measurement	Pt 1000
Medium temperature	0 … 80 °C (at 1 bar)
Max. pressure	16.0 bar, (at 25 °C)
Sensors	Special graphite
Shaft material	Epoxy
Thread	PG 13.5
Fitting length	120 mm ±3 mm
Installation	Bypass: with or without return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Electrical connection	DIN 4-pin angle plug
Enclosure rating	IP 65
Typical applications	Potable, cooling, industrial water. Sensors of the LF series have only limited applicability for taking measurements in cleaning solutions containing surfactants and media containing solvents.
Resistance to	Unsuitable for chemically contaminated water and water containing film-forming ingredients
Measuring and control equipment	Compact DCCa, DMTa
Measuring principle, technology	Conductive, 2 coils. Integrated temperature measurement

	Order no.
LFTK 1 DE	1002822

Please observe the general notes on p. → 1-86 (Overview Table for Conductivity Sensors)

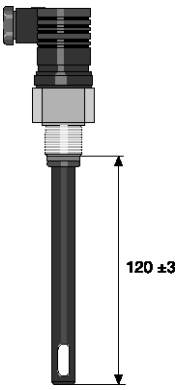
1.4 DULCOTEST® Conductivity Sensors

Conductivity Sensor LFT 1 1/2"

Cost-effective sensor for the measurement of electrolytic conductivity in clear, uncontaminated water. With integrated temperature measurement and DIN 4-pin plug and 1/2-inch screw thread. For operation with controllers Compact DCCa, DMTa, D1Ca

Your benefits

- Measured variable: electrolytic conductivity above 10 µS/cm
- Cost-effective sensor for all clear, uncontaminated types of water
- Hydraulic connector with 1/2″ thread as an alternative to the corresponding standard design with PG 13.5 thread
- Special graphite electrodes, optimised for a highly dynamic measuring range: 0.01-20 mS/cm
- Integrated Pt 100 for temperature compensation replaces separate temperature sensor and the corresponding sensor fitting
- DIN 4-pin plug for simple installation



pk_6_086

Measuring range	0.01…20 mS/cm
Cell constant k	1.00 cm^{-1} ±5%
Temperature measurement	Pt 100
Medium temperature	0 … 80 °C (at 1 bar)
Max. pressure	16.0 bar, (at 25 °C)
Sensors	Special graphite
Shaft material	Epoxy
Thread	1/2"
Fitting length	120 mm ±3 mm
Installation	Bypass: with or without return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Electrical connection	DIN 4-pin angle plug
Enclosure rating	IP 65
Typical applications	Potable, cooling, industrial water. Sensors of the LF series have only limited applicability for taking measurements in cleaning solutions containing surfactants and media containing solvents.
Resistance to	Unsuitable for chemically contaminated water and water containing film-forming ingredients
Measuring and control equipment	Compact DCCa, DMTa, D1Ca
Measuring principle, technology	Conductive, 2 coils. Integrated temperature measurement

	Order no.
LFT 1 1/2"	1001378

Please observe the general notes on p. → 1-86 (Overview Table for Conductivity Sensors)

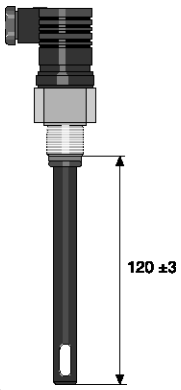
1.4 DULCOTEST® Conductivity Sensors

Conductivity Sensor LFTK 1 1/2"

Cost-effective sensor for the measurement of electrolytic conductivity in clear, uncontaminated water. With integrated temperature measurement and DIN 4-pin plug and 1/2-inch screw thread. For operation with controllers Compact DCCa, DMTa

Your benefits

- Measured variable: electrolytic conductivity above 10 µC/cm
- Cost-effective sensor for all clear, uncontaminated types of water
- Hydraulic connector with 1/2″ thread as an alternative to the corresponding standard design with PG 13.5 thread
- Special graphite electrodes, optimised for a highly dynamic measuring range: 0.01-20 mS/cm
- Integrated Pt 1000 for precise compensation in limited temperature ranges and with longer cables. Replaces separate temperature sensor and the corresponding sensor fitting
- DIN 4-pin plug for simple installation



pk_6_086

Measuring range	0.01…20 mS/cm
Cell constant k	1.00 cm^{-1} ±5%
Temperature measurement	Pt 1000
Medium temperature	0 … 80 °C (at 1 bar)
Max. pressure	16.0 bar, (at 25 °C)
Sensors	Special graphite
Shaft material	Epoxy
Thread	1/2"
Fitting length	120 mm ±3 mm
Installation	Bypass: with or without return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Electrical connection	DIN 4-pin angle plug
Enclosure rating	IP 65
Typical applications	Potable, cooling, industrial water. Sensors of the LF series have only limited applicability for taking measurements in cleaning solutions containing surfactants and media containing solvents.
Resistance to	Unsuitable for chemically contaminated water and water containing film-forming ingredients
Measuring and control equipment	Compact DCCa, DMTa
Measuring principle, technology	Conductive, 2 coils. Integrated temperature measurement

	Order no.
LFTK 1 1/2"	1002823

Please observe the general notes on p. → 1-86 (Overview Table for Conductivity Sensors)

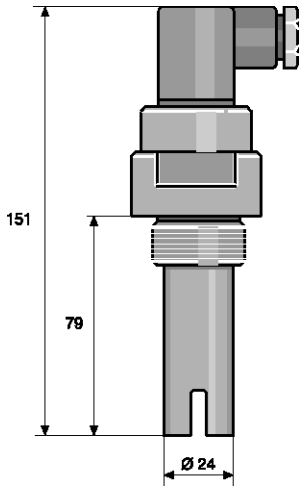
1.4 DULCOTEST® Conductivity Sensors

Conductivity Sensor CK 1

Sensor for the measurement of the electrolytic conductivity in clear, chemically contaminated water with high but constant temperature with DIN 4-pin plug. For operation with the controllers Compact DCCa, DMTa, D1Ca

Your benefits

- Measured variable: electrolytic conductivity above 10 µS/cm
- Resistant to water ingredients in target applications thanks to injection-moulded design without adhesive or seals
- High temperature resistance up to 150 °C



pk_6_046

Measuring range	0.01…20 mS/cm
Cell constant k	1.00 cm^{-1} ±5%
Temperature measurement	None, only for applications with constant temperature
Medium temperature	0 … 150 °C (at 1 bar)
Max. pressure	16.0 bar, (at 20 °C)
Sensors	Special graphite
Shaft material	PES
Thread	R 1"
Length when fitted	79 mm
Installation	Bypass: with or without return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Electrical connection	DIN 4-pin angle plug
Enclosure rating	IP 65
Typical applications	Cooling, industrial, process water, tank and pipe, cleaning systems in breweries, dairies, media separation.
Resistance to	Ingredients in the water of the target application, taking into account the compatibility of the material
Measuring and control equipment	Compact DCCa, DMTa, D1Ca
Measuring principle, technology	Conductive, 2 electrodes

	Order no.
CK 1	305605

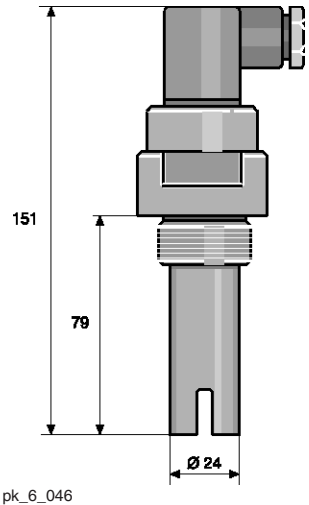
1.4 DULCOTEST® Conductivity Sensors

Conductivity Sensor CKPt 1

Sensor for the measurement of the electrolytic conductivity for clear, chemically contaminated water and higher temperatures. With integrated temperature measurement and DIN 4-pin plug. For operation with the controllers Compact DCCa, DMTa, D1Ca

Your benefits

- Measured variable: electrolytic conductivity above 10 µS/cm
- Resistant to water ingredients in target applications thanks to injection-moulded design without adhesive or seals
- High temperature resistance up to 150 °C
- Integrated Pt 100 for temperature compensation replaces separate temperature sensor and the corresponding sensor fitting



pk_6_046

Measuring range	0.01…20 mS/cm
Cell constant k	1.00 cm^{-1} ±5%
Temperature measurement	Pt 100
Medium temperature	0 … 150 °C (at 1 bar)
Max. pressure	16.0 bar, (at 20 °C)
Sensors	Special graphite
Shaft material	PES
Thread	R 1"
Length when fitted	79 mm
Installation	Bypass: with or without return of the sample water into the process line, inline: direct installation into the pipework; fixed or replaceable (replaceable fitting), tank, channel: Immersion in the immersion tube
Electrical connection	DIN 4-pin angle plug
Enclosure rating	IP 65
Typical applications	Cooling, industrial, process water, tank and pipe cleaning systems in breweries and dairies, separation of media.
Resistance to	Ingredients in the water of the target application, taking into account the compatibility of the material
Measuring and control equipment	Compact DCCa, DMTa, D1Ca
Measuring principle, technology	Conductive, 2 coils. Integrated temperature measurement

	Order no.
CKPt 1	305606

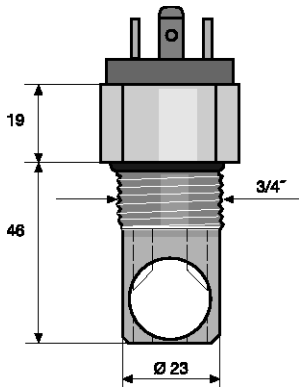
1.4 DULCOTEST® Conductivity Sensors

Conductivity Sensor LM 1

Sensor for the measurement of the electrolytic conductivity for clear and also chemically contaminated water. With DIN 4-pin plug. For operation with the controllers Compact DCCa, DMTa, D1Ca

Your benefits

- Measured variable: electrolytic conductivity above 0.1 mS/cm
- Cost-effective sensor for clear, chemically contaminated water
- Resistant to the constituents in the water of the target application



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Measuring range	0.1…20 mS/cm
Cell constant k	1.00 cm^{-1} ±5%
Temperature measurement	None, only for applications with constant temperature
Medium temperature	0 … 70 °C (at 1 bar)
Max. pressure	16.0 bar, (at 50 °C)
Sensors	Graphite
Shaft material	PP
Thread	3/4"
Length when fitted	46 mm
Installation	Inline: direct installation into the pipework, bypass: with or without return of the sample water into the process line
Electrical connection	DIN 4-pin angle plug
Enclosure rating	IP 65
Typical applications	Potable, cooling, industrial, process water, media separation
Resistance to	Ingredients in the water of the target application, taking into account the compatibility of the material
Measuring and control equipment	Compact DCCa, DMTa, D1Ca
Measuring principle, technology	Conductive, 2 electrodes

	Order no.
LM 1	740433

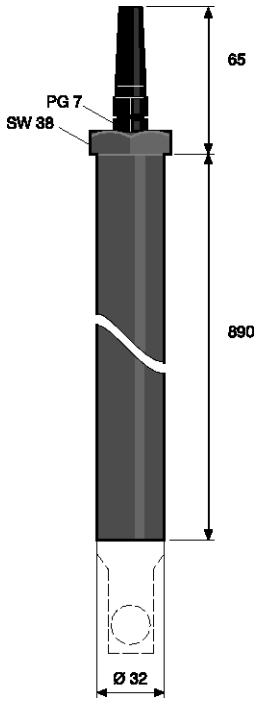
1.4 DULCOTEST® Conductivity Sensors

Conductivity Sensor LM 1-TA

Sensor for the measurement of the electrolytic conductivity for clear and also chemically contaminated water. Completely mounted in an immersion fitting. For operation with the controllers Compact DCCa, DMTa, D1Ca

Your benefits

- Measured variable: electrolytic conductivity above 0.1 mS/cm
- Cost-effective sensor for clear, chemically contaminated water
- Resistant to the ingredients in the water of the target applications
- Simple installation in tanks, containers etc. by sensor ready mounted in the immersion tube



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Measuring range	0.1…20 mS/cm
Cell constant k	1.00 cm^{-1} ±5%
Temperature measurement	None, only for applications with constant temperature
Medium temperature	0 … 70 °C (at 1 bar)
Max. pressure	16.0 bar, (at 50 °C)
Sensors	Graphite
Shaft material	PP
Thread	M 28 x 1.5 for TA-LM in-line probe fitting
Fitting length	Max. 1 m
Installation	Tank, channel: Immersion through an immersion tube
Electrical connection	5 m fixed cable, screened
Enclosure rating	IP 65
Typical applications	Potable, cooling, industrial, process water, media separation
Resistance to	Ingredients in the water of the target application, taking into account the compatibility of the material
Measuring and control equipment	Compact DCCa, DMTa, D1Ca
Measuring principle, technology	Conductive, 2 electrodes

		Order no.
LM 1-TA	Sensor integrated in immersion fitting	1020528
LM 1-FE	Replacement sensor for LM 1-TA	1020627

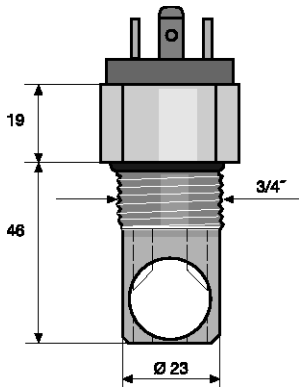
1.4 DULCOTEST® Conductivity Sensors

Conductivity Sensor LMP 1

Sensor for the measurement of the electrolytic conductivity for clear and also chemically contaminated water. With integrated temperature measurement with DIN 4-pin plug. For operation with the controllers Compact DCCa, DMTa, D1Ca

Your benefits

- Measured variable: electrolytic conductivity above 0.1 mS/cm
- Cost-effective sensor for clear, chemically contaminated water
- Resistant to the ingredients in the water of the target applications
- Integrated Pt 100 for temperature compensation replaces separate temperature sensor and the corresponding sensor fitting



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Measuring range	0.1…20 mS/cm
Cell constant k	1.00 cm^{-1} ±5%
Temperature measurement	Pt 100
Medium temperature	0 … 70 °C (at 1 bar)
Max. pressure	16.0 bar, (at 50 °C)
Sensors	Graphite
Shaft material	PP
Thread	3/4"
Length when fitted	46 mm
Installation	Inline: direct installation into the pipework, bypass: with or without return of the sample water into the process line
Electrical connection	DIN 4-pin angle plug
Enclosure rating	IP 65
Typical applications	Potable, cooling, industrial, process water, media separation
Resistance to	Ingredients in the water of the target application, taking into account the compatibility of the material
Measuring and control equipment	Compact DCCa, DMTa, D1Ca
Measuring principle, technology	Conductive, 2 coils. Integrated temperature measurement

	Order no.
LMP 1	1020513

Please observe the general notes on p. → 1-86 (Overview Table for Conductivity Sensors)

1.4 DULCOTEST® Conductivity Sensors

Conductivity Sensor LMP 1-TA

Sensor for the measurement of the electrolytic conductivity for clear and also chemically contaminated water. With integrated temperature measurement, ready mounted in an immersion fitting. For operation with the controllers Compact DCCa, DMTa, D1Ca

Your benefits

- Measured variable: electrolytic conductivity above 0.1 mS/cm
- Cost-effective sensor for clear, chemically contaminated water
- Resistant to the ingredients in the water of the target applications
- Integrated Pt 100 for temperature compensation replaces separate temperature sensor and the corresponding sensor fitting
- Simple installation in tanks, containers etc. by sensor ready mounted in the immersion tube

Measuring range	0.1…20 mS/cm
Cell constant k	1.00 cm^{-1} ±5%
Temperature measurement	Pt 100
Medium temperature	0 … 70 °C (at 1 bar)
Max. pressure	16.0 bar, (at 50 °C)
Sensors	Graphite
Shaft material	PP
Thread	M 28 x 1.5 for TA-LM in-line probe fitting
Length when fitted	1 m
Installation	Tank, channel: Immersion through an immersion tube
Electrical connection	5 m fixed cable, screened
Enclosure rating	IP 65
Typical applications	Potable, cooling, industrial, process water, media separation
Resistance to	Ingredients in the water of the target application, taking into account the compatibility of the material
Measuring and control equipment	Compact DCCa, DMTa, D1Ca
Measuring principle, technology	Conductive, 2 electrodes

		Order no.
LMP 1-TA	sensor integrated in immersion fitting	1020525
LMP 1-FE	Replacement sensor for LMP 1-TA	1020727

Please observe the general notes on p. → 1-86 (Overview Table for Conductivity Sensors)

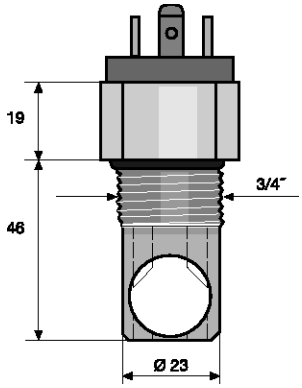
1.4 DULCOTEST® Conductivity Sensors

Conductivity Sensor LMP 1-HT

Sensor for the measurement of the electrolytic conductivity for clear and also chemically contaminated water. For high temperatures, with integrated temperature measurement and DIN 4-pin plug. For operation with the controllers Compact DCCa, DMTa, D1Ca

Your benefits

- Measured variable: electrolytic conductivity above 0.1 mS/cm
- Cost-effective sensor for clear, chemically contaminated water
- Resistant to the ingredients in the water of the target applications
- Integrated Pt 100 for temperature compensation replaces separate temperature sensor and the corresponding sensor fitting
- Temperature resistance up to 100 °C



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Measuring range	0.1…20 mS/cm
Cell constant k	1.00 cm^{-1} ±5%
Temperature measurement	Pt 100
Medium temperature	0 … 120 °C (at 1 bar)
Max. pressure	16.0 bar, (at 100 °C)
Sensors	Graphite
Shaft material	PVDF
Thread	3/4"
Length when fitted	46 mm
Installation	Inline: direct installation into the pipework, bypass: with or without return of the sample water into the process line
Electrical connection	DIN 4-pin angle plug
Enclosure rating	IP 65
Typical applications	General applications at higher temperaturesprocess water, process water from electroplating, media separation, with CIP (cleaning in place)
Resistance to	Ingredients in the water of the target application, taking into account the compatibility of the material
Measuring and control equipment	Compact DCCa, DMTa, D1Ca
Measuring principle, technology	Conductive, 2 coils. Integrated temperature measurement

	Order no.
LMP 1-HT	1020524

Please observe the general notes on p. → 1-86 (Overview Table for Conductivity Sensors)

1.4 DULCOTEST® Conductivity Sensors

1.4.3 Inductive Conductivity Sensors

Inductive conductivity sensors consist of a transducer, encapsulated in an inert material. The electrolytic conductivity is measured inductively without direct contact with the medium.

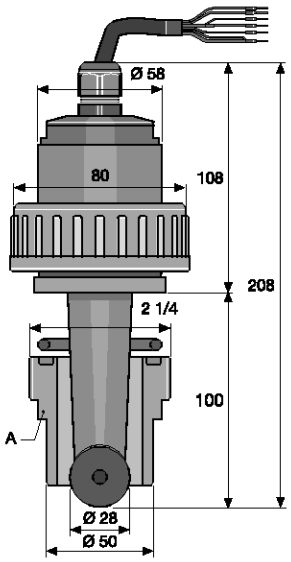
The sensors are used to measure electrolytic conductivity over a wide measuring range, even in heavily contaminated and/or aggressive media and, as such, offer particularly low maintenance operation. The sensors are particularly suitable for measuring high conductivities, as no electrode polarisation occurs. The inductive conductivity sensors are operated using the Compact controller DCCa xx L6 ... The controller includes the testing and calibration kit (Order no. 1026958).

Conductivity Sensor ICT 1

Cost-effective inductive conductivity sensor, suitable for high electrolytic conductivities above 200 µS/cm. Also suitable for chemically contaminated water and film-forming media. For installation in pipework

Your benefits

- Measured variable: electrolytic conductivity. The inductive (non-contact) measuring principle permits applications in chemically contaminated types of water and in film-forming media
- There is no need for adhesive or seals as the sensor is fully embedded in PP
- Measurements at high conductivity values of up to 1,000 mS/cm are possible without interfering polarisation by means of the high measuring range dynamics of the inductive measuring principle
- Simple installation in a PVC pipe by bonding the DN 40 adhesive connector supplied into a standard T-piece and screwing in the sensor using the union nut supplied. A DN 40 welded connector is optionally available for use in PP pipework



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A=Adhesive joints PVC, Fusion joints PP, DN 40

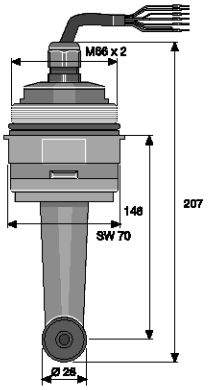
Measuring range	0.2…1,000 mS/cm
Cell constant k	8.5 cm^{-1} ±5%
Measuring accuracy	< 1% relative to final value of measuring range
Temperature compensation	Pt 100
Process chemical temperature	0…70 °C
Max. pressure	16.0 bar up to 40 °C, 1.0 bar up to 70 °C
Material	Sensor: PP Seals: FKM
Electrical connection	7 m fixed cable
Enclosure rating	IP 65
Typical applications	All types of soiled water, desalination control in cooling towers, control of electroplating baths, Cleaning in Place (CIP), product monitoringSeawater
Resistance to	PP-compatible chemicals, deposit-forming media
Installation	With union nut, 2 1/4 inch internal thread, DN 40, PVC incl. DN 40 bonded nozzle with 2 1/4 external thread for fitting in DN 40 PVC standard tube (within scope of supply). The corresponding set-in nozzle for fitting in PP standard tube is available as an accessory.
Measuring and control equipment	D1C for inductive conductivity
Measuring principle, technology	Inductive, 2 coils. Integrated temperature measurement

	Order no.
ICT 1	1023244

1.4 DULCOTEST® Conductivity Sensors

Conductivity Sensor ICT 1-IMA

Cost-effective inductive conductivity sensor, suitable for high electrolytic conductivities above 200 µS/cm. Also suitable for chemically contaminated water and film-forming media. Completely integrated in an immersion pipe



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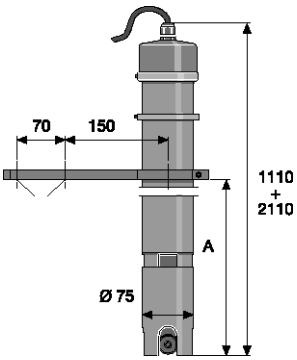

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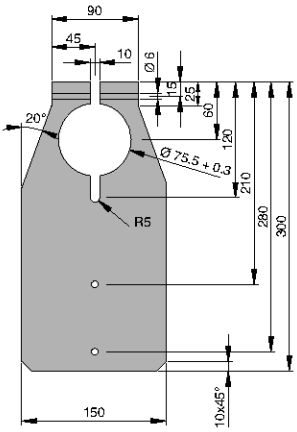
A = min. 155 mm / max. 1 m or 2 m



P_AC_0262_SW1

Your benefits

- Measured variable: electrolytic conductivity. The inductive (non-contact) measuring principle permits applications in chemically contaminated types of water and in film-forming media
- There is no need for adhesive or seals as the sensor is fully embedded in PP
- Measurements at high conductivity values of up to 1,000 mS/cm are possible without interfering polarisation by means of the high measuring range dynamics of the inductive measuring principle
- Simple installation in tanks, containers etc. thanks to sensor ready mounted in the immersion tube

Measuring range	0.2…1,000 mS/cm
Cell constant k	8.5 cm^{-1} ±5%
Measuring accuracy	< 1% relative to final value of measuring range
Temperature compensation	Pt 100
Process chemical temperature	0…70 °C
Max. pressure	8.0 bar up to 40 °C, 1.0 bar up to 70 °C
Material	Sensor and immersion tube: PP Seals: FKM
Long immersion pipe	1 m / 2 m
Electrical connection	7 m fixed cable
Enclosure rating	IP 65
Typical applications	All types of soiled water, desalination control in cooling towers, control of electroplating baths, Cleaning in Place (CIP), product monitoring
Resistance to	PP-compatible chemicals, deposit-forming media
Long immersion pipe	Immersion sensor complete with 1 m immersion pipe or 2 m immersion pipe. The fitting accessories for the immersion valve IPHa 3-PP can also be used for the immersion sensor.
Measuring and control equipment	Compact controller DCCa
Measuring principle, technology	Inductive, 2 coils. Integrated temperature measurement

	Order no.
ICT 1-IMA 1 m	1023349
ICT 1-IMA 2 m	1023351

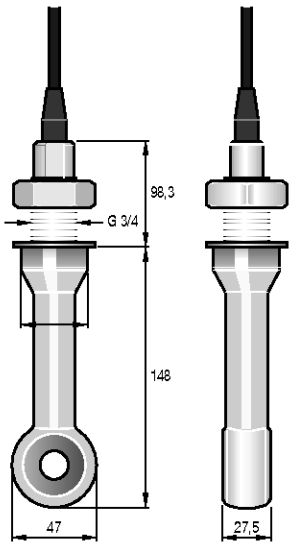
1.4 DULCOTEST® Conductivity Sensors

Conductivity Sensor ICT 2

High-performance inductive conductivity sensor with high dynamic measuring range. Also suitable for types of water with aggressive chemicals and film-forming components. Permitted temperatures up to 125 °C. For installation in pipework, tanks and for immersion in storage tanks

Your benefits

- Measured variable: electrolytic conductivity. The inductive (non-contact) measuring principle permits applications in chemically contaminated types of water and in film-forming media
- There is no need for adhesive or seals as the sensor is fully embedded in PFA
- Measurements at high conductivity values of up to 2,000 mS/cm are possible without interfering polarisation by means of the high measuring range dynamics of the inductive measuring principle
- Flexible connection to the processes is possible via a flange or immersion pipe with optional accessories



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Measuring range	0.02…2,000 mS/cm
Cell constant k	1.98 cm^{-1}
Measuring accuracy	± (5 µS/cm + 0.5% of the measured value) at T < 100 °C) ± (10 µS/cm + 0.5% of the measured value) at T > 100 °C)
Temperature compensation	Pt 100, class A, completely extrusion-coated
Process chemical temperature	0…125 °C for use together with D1C, temperature compensation is limited to 100 °C
Max. pressure	16.0 bar
Material	PFA, completely extrusion-coated
Electrical connection	5 m fixed cable
Enclosure rating	IP 67
Typical applications	Production processes in the chemical industry, phase separation of product mixtures, determination of concentrations of aggressive chemicals.
Resistance to	Electrolytic conductivity > 20 mS/cm, PFA-compatible aggressive chemicals, deposit-forming media
Installation	Fitting in pipes, tanks (sideways): G 3/4 stainless steel thread (1.4571) or flange fitting: With the accessories: Stainless steel flange ANSI 2 inch 300 lbs, SS 316L (adaptable to DIN counter flange DN 50 PN 16).
Measuring and control equipment	D1C
Measuring principle, technology	Inductive, 2 coils. Integrated temperature measurement

Installation kit for type ICT 2 sensors → 1-127

	Order no.
ICT 2	1023352

1.5 Turbidity Measuring Points DULCOTEST®

1.5.1 Turbidity Measuring Point DULCOTEST® DULCO® turb C

Reliable on-line measurement of turbidity with DULCOTEST® DULCO® turb C measuring points

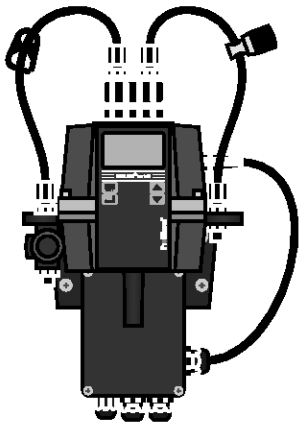
Measuring range 0 – 1,000 NTU

Turbidity measurements with DULCOTEST® DULCO® turb C: Compact measuring instrument that uses light scatter to measure turbidity, with a large measuring range and different designs to comply with ISO and EPA standards. Available with or without automatic cleaning.

The DULCOTEST® measuring points for turbidity in the DULCO® turb C range with versions TUC 1, TUC 2, TUC 3 and TUC 4, are compact online turbidity measuring points, consisting of a sensor, inline flow fitting and measuring device. The measuring device permits the measured value to be displayed, calibration, transmission of the measured value via a 4-20 mA signal and the indication of limit value transgressions and device faults. The measuring cuvette integrated in the measuring device enable the device to operate in the bypass of the process line. The visual measuring unit does not come into contact with the sampel medium.

The intended application is the treatment of potable water, with the DULCO® turb C able to be used in all treatment stages of raw water, from filter monitoring to measurement of fine turbidity in dispensed potable water. It is also possible to monitor the turbidity of slightly contaminated process water and waste water, as well as treated water from the food and beverage industry up to a turbidity value of 1,000 NTU. Compared with the TUC 1/TUC 2, the TUC 3 / TUC 4 measuring stations include an ultrasound-based self-cleaning function. This helps in particular to extend the service intervals particularly when used with the types of water that form films.

The measuring principle is identical to light scatter measurements. The light beam that is beamed into the measuring cuvette filled with sample water is dispersed on turbidity particles and the scattered light is measured at right angles (90°) to the beamed in light (Nephelometric measurement). The measuring unit for the turbidity measurement can be given as NTU (Nephelometric Turbidity Unit) or as FNU (Formazin Nephelometric Unit). The measuring process of types TUC 1/TUC 3 (infrared light) corresponds to the globally applicable standard ISO 7027 and the European Standard DIN EN 27027. The measuring process of types TUC 2/TUC 4 (white light) corresponds to the US American standard USEPA 180.1.



P_DMZ_0002_SW

Your benefits

- Compact turbidity measuring station with integrated sensor, flow cuvette and measuring instrument saves space and is simple to install and operate.
- High dynamic measuring range between 0.02 and 1,000 NTU permits broad-based use in all stages of potable water treatment. Also ideal for monitoring waste water from clarification plants and for monitoring ruptures with filters.
- Short response times thanks to small-volume measuring cuvette.
- Long-term stable measurements, even in contaminated water, by the optional ultrasonic cleaning of the measuring cuvette.
- Fast and simple calibration on site by optionally available, pre-assembled and time-stable calibration standards.

Technical details

- The measuring process in types TUC 1/TUC 3 (infrared light) corresponds to the global standard ISO 7027 and the European standard DIN EN 27027.
- The measuring process in types TUC 2/TUC 4 (white light) corresponds to the US standard USEPA 180.1.

Field of application

- Potable water treatment, for all treatment steps: from raw water and filter monitoring to measuring fine turbidity in the potable water that is to be discharged
- Monitoring of turbidity in slightly polluted industrial water, waste water and water requiring treatment in the food and beverage industry up to a turbidity value of 1,000 NTU

1.5 Turbidity Measuring Points DULCOTEST®

Technical Data

Measurement range	0 … 1,000 NTU
Accuracy	± 2% of the displayed value or ± 0.02 NTU below 40 NTU, depending on which value is the greater ± 5% of the displayed value above 40 NTU
Resolution	0.0001 NTU below 10 NTU
Response time	Configurable
Display	Multiple row LCD display with background lighting
Alarm relay	Two programmable alarms, 120-240 VAC, 2 A Form C relay
Output signal	4 ... 20 mA, 600 Ω, not electrically isolated: dual-isolated, degree of interference, overvoltage category II
Communication interface	Bi-directional RS-485, Modbus
Max. pressure	Integrated pressure regulating valve regulates 1380 kPa (200 psi), based on the flow rate
Flow	6 – 60 l/h
Temperature	1 … 50 °C
Materials in contact with the medium	Polyamide (PA), silicone, polypropylene (PP), stainless steel, borosilicate glass
Voltage supply	100 – 240 VAC, 47 – 63 Hz, 80 VA
Hydraulic connector	Black tube, inside 4.75 mm, outside 8 mm
Ambient conditions	Not suitable for operation outdoors. Maximum operating altitude 2000 m above sea level. Maximum 95% relative air humidity (non-condensing).
Enclosure rating	IP 66, NEMA 4x
Standard	ISO 7027 or DIN EN 27027 with the "Infrared" version, USEPA 180.1 with the "Achromatic light" version
Dimensions H x W x D	35 x 30 x 30 cm
Shipping weight	2.5 kg

	Standard	Ultrasonic cleaning	Order no.
TUC 1	Infrared light: ISO 7027, DIN EN 27027	No	1037696
TUC 2	White light: US EPA 180.1	No	1037695
TUC 3	Infrared light: ISO 7027, DIN EN 27027	Yes	1037698
TUC 4	White light: US EPA 180.1	Yes	1037697

Spare Parts

	Order no.
Drying agent	1037701
Cuvette TUC 1 / TUC 2	1037877
Cuvette TUC 3 / TUC 4	1037878
Infrared lamp TUC 1 / TUC 3	1037702
Achromatic light lamp TUC 2 / TUC 4	1037703
Hose kit	1037879
Pressure regulating valve	1037885

Accessories

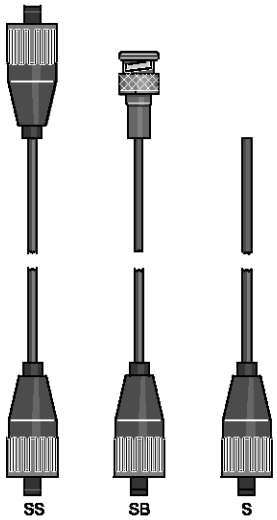
	Order no.
Calibration set	1037699
Flow control	1037880
Air bubble trap	1037700

1.6 Accessories Sensor Technology

1.6.1 Sensor Accessories

General guidelines:

- Ensure that signal leads are as short as possible.
- Ensure signal leads are separated from power cables running parallel to them.
- Use pre-assembled combined signal leads wherever possible.



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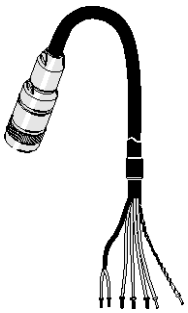
Measuring Lines for pH and ORP Measurement

- Pre-assembled to facilitate installation
- Factory tested to ensure function reliability
- IP 65

Type	Description	Order no.
2 x SN6	Coaxial cable, Ø 5 mm, 0.8 m – SS	305077
2 x SN6	Coaxial cable, Ø 5 mm, 2 m – SS	304955
2 x SN6	Coaxial cable, Ø 5 mm, 5 m – SS	304956
2 x SN6	Coaxial cable Ø 5 mm, 10.0 m - SS	304957
SN6 - open end	Cable combination coaxial 0.8 m - SN6 - pre-assembled	1024105
SN6 - open end	Cable combination Coaxial 2 m - SN6 (open end) - pre-assembled	1024106
SN6 - open end	Cable combination coaxial 5 m - SN6 - pre-assembled	1024107
SN6 - open end	Coaxial cable Ø 5 mm, 10.0 m - S	305040
SN6 - BNC	Coaxial cable Ø 3 mm, 10.0 m - SB	305099
SN6 - BNC	Coaxial cable Ø 5 mm, 0.8 m – SN6/BNC	1033988
SN6 - BNC	Coaxial cable, Ø 5 mm, 2.0 m – SB	1033011
SN6 - DIN	Coaxial cable Ø 5 mm, 0.8 m - SD	305098
SN6 - DIN	Coaxial cable Ø 5 mm, 2.0 m - SD	304810
SN6 - open end d5 (DSR)	Cable combination coax 2.0 m - S	1005672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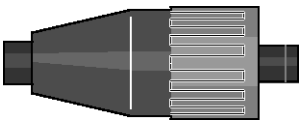
Measuring Line for Sensors with Vario Pin Plug-In Heads

Ready-made 6-conductor measuring line with Vario Pin plug for connection to sensor type PHEPT 112 VE.

	Length m	Order no.
Vario Pin signal lead VP 6-ST/ 2 m	2	1004694
Vario Pin signal lead VP 6-ST/ 5 m	5	1004695
Vario Pin signal lead VP 6-ST/10 m	10	1004696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SN6 Coax Connector

K 74 crimping pliers and a soldering iron are required for connecting coax connectors to cables.

	Order no.
SN6 coaxial plug for 5 mm Ø coaxial signal lead	304974
SN6 coaxial plug for 3 mm Ø coaxial signal lead	304975

pk_6_055

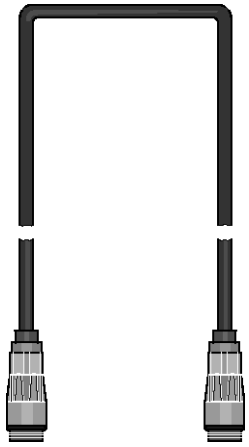
LK Coaxial Signal Cable

For pH and ORP measurements.

	Order no.
Coax low noise Ø 5 mm, black	723717
Coax low noise Ø 3 mm, black	723718

Please specify length with order.

1.6 Accessories Sensor Technology



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pk_1_085

Measuring lines for 4P type chlorine sensors

The measuring line is necessary for the connection of -4P sensors to the measuring/control device D_4a.

- Simple installation, as no self-assembly is required
- High operational safety due to factory functional testing
- IP 65

	Length m	Order no.
Measuring line for 4P type chlorine sensors	2	818455
Measuring line for 4P type chlorine sensors	5	818456
Measuring line for 4P type chlorine sensors	10	818470

Measuring Lines for DMT Type Chlorine Sensors

The measuring line is needed for connection of DMT type sensors to the DMT transducer.

	Length m	Order no.
5-core universal cable, 5-pin round plug	2	1001300
5-core universal cable, 5-pin round plug	5	1001301
5-core universal cable, 5-pin round plug	10	1001302

Cabling Accessories for CAN Type Chlorine Sensors

	Order no.
T-distributor M12 5 pole CAN	1022155
Termination resistor M12 coupling	1022154
Termination resistor M12 plug	1022592
Connecting cable - CAN M12 5-pole 0.5 m	1022137
Connecting cable - CAN M12 5-pole 1 m	1022139
Connecting cable - CAN M12 5-pole 2 m	1022140
Connecting cable - CAN M12 5-pole 5 m	1022141
Connecting cable - CAN, sold by the metre	1022160
Plug-CAN M12 5-pole screw terminal	1022156
Coupling-CAN M12 5-pole screw terminal	1022157

Measuring Lines for Pt 100 and Pt 1000

Measuring line: 2-core, conductor: 0.5 mm^2.

	Length m	Order no.
SN6 - open-ended	5	1003208
SN6 - open-ended	10	1003209
SN6 - open-ended	20	1003210

Measuring Line for Conductive Conductivity Sensors

4-core, conductor: 0.25 mm^2, cable diameter: 5.7 mm, screened

Type	Length m	Order no.
Measuring line for conductive conductivity sensors	1	1046024
	3	1046025
	5	1046026
	10	1046027

1.6 Accessories Sensor Technology

2-Wire Measuring Line

2-core, conductor: 0.25 mm², cable diameter: 4 mm

For mA type chlorine / bromine / chlorine dioxide / ozone sensors and pH, ORP, Pt 100, conductivity, hydrogen peroxide (PEROX) transducers.

	Order no.
Signal cable, sold by the metre 2 x 0.25 mm² Ø 4 mm	725122

Connector cable

For fluid voltage comparison in-line probe housing DLG III and DGMA with connector, 5 m.

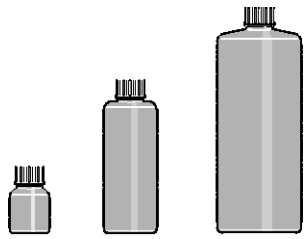
	Length m	Order no.
Connector cable	5	818438

Test and Calibration Kit for Inductive Conductivity

	Order no.
Test and calibration kit	1026958

1.6 Accessories Sensor Technology

1.6.2 Consumable Items for Sensors



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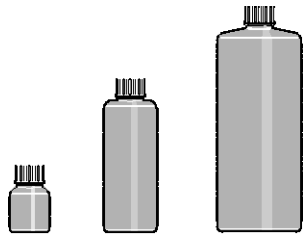
pH Quality Buffer Solutions

Accuracy ±pH 0.02 (±0.05 at pH 10). The shelf life depends upon frequency of use and the amount of chemical drag-in.

Alkaline buffer solutions can react with CO_2 if left open. This will affect their values, therefore close after use. Buffer solutions should be replaced a maximum of three months after opening. The solution contains a biocide to prevent bacteria forming.

	Capacity ml	Order no.
Buffer pH 4.0 – red	50	506251
Buffer pH 4.0 – red	250	791436
Buffer pH 4.0 – red	1,000	506256
Buffer pH 5.0 – colourless	50	506252
Buffer pH 7.0 – green	50	506253
Buffer pH 7.0 – green	250	791437
Buffer pH 7.0 – green	1,000	506258
Buffer pH 9.0 –	50	506254
Buffer pH 9.0 – colourless	1,000	506259
Buffer pH 10.0 – blue	50	506255
Buffer pH 10.0 – blue	250	791438
Buffer pH 10.0 – blue	1,000	506260



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ORP Quality Buffer Solutions

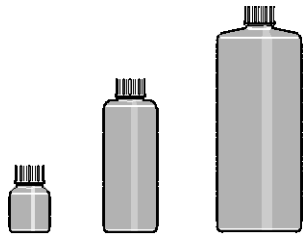
Accuracy to ±5 mV. Shelf life depends upon frequency of use and the strength of the chemicals in sample solutions.

Buffer solutions should be replaced a maximum of three months after opening.

Warning: The 465 mV ORP buffer solution is an irritant!

	Capacity ml	Order no.
ORP buffer 465 mV	50	506240
ORP buffer 465 mV	250	791439
ORP buffer 465 mV	1,000	506241
ORP buffer 220 mV	50	506244
ORP buffer 220 mV	1,000	506245

DPD-reagents for calibration of amperometric sensors s. p. → 2-101



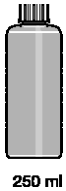
pk_6_058

3 Molar KCl Solutions

3-molar KCl solution is most suited for the storage of pH and ORP sensors (e.g. in sensor quills) and as an electrolyte for refillable sensors (e.g. PHEN, RHEN). We only recommend using the KCl solution saturated with AgCl for the old design of refillable sensors with reference electrodes without a large AgCl reservoir.

	Capacity ml	Order no.
KCl solution, 3 molar	50	505533
KCl solution, 3 molar	250	791440
KCl solution, 3 molar	1,000	791441
KCl solution, 3 molar, AgCl saturated	250	791442
KCl solution, 3 molar, AgCl saturated	1,000	505534

1.6 Accessories Sensor Technology



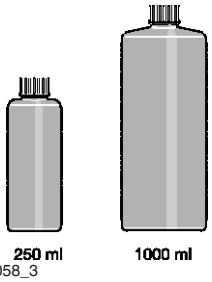
pk_6_058_2

Cleaning Solutions

Cleaning solution pepsin/hydrochloric acid:

for cleaning pH sensors, the membranes of which have been contaminated with protein.

Capacity	Order no.
250 ml	791443



pk_6_058_3

Conductivity Calibration Solution

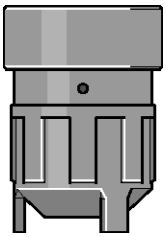
For the precise calibration of conductivity sensors.

	Capacity ml	Order no.
Conductivity calibration 1413 µS/cm	250	1027655
Conductivity calibration 1413 µS/cm	1,000	1027656
Conductivity calibration 12.88 mS/cm	250	1027657
Conductivity calibration 12.88 mS/cm	1,000	1027658

pk_6_061

Electrolyte for Amperometric Sensors

	Capacity ml	Order no.
Electrolyte for all chlorine sensors type CLE, CLR 1	100	506270
Electrolyte for CDM 1 and CDE 3 type chlorine dioxide sensors	100	506271
Electrolyte for CDE 2 and CDR 1 type chlorine dioxide sensors	100	506272
Electrolyte for OZE type ozone sensors	100	506273
Electrolyte for CGE/CTE/BRE type sensors	50	792892
Electrolyte for CDP type chlorine dioxide sensors	100	1002712
Electrolyte for peracetic acid sensors type PAA 1, OZR 1	100	1023896
Electrolyte for CLT 1 type chlorite sensors	50	1022015
Electrolyte for PER 1 type hydrogen peroxide sensors	50	1025774
Electrolyte for CLO 1 type chlorine sensor	100	1035191
Electrolyte for CLO 2 type chlorine sensor	100	1035480
Electrolyte for CBR 1 type chlorine/bromine sensor	100	1038017
Electrolyte for BCR 1 type bromine sensor	50	1044843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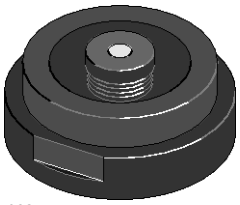
Spare Membrane Caps, Accessory Sets for Amperometric Sensors

	Capacity ml	Order no.
Membrane cap for types CLE II T, CDM 1 and OZE 1	–	790486
Membrane cap for types: CLE 2.2, CLE 3, CDE 1.2, CDE 2, OZE 2 and OZE 3	–	790488
Sensor cap for CLO 1	–	1035197
Sensor cap for CLO 2	–	1035198
Membrane cap for CGE/CTE 1 (2/5/10 ppm) and BRE 1 (10 ppm), BRE 2	–	792862
Membrane cap for CTE 1 (0.5 ppm), CBR 1, BCR 1	–	741274
Membrane cap for CDP 1, BRE 1 (0.5 / 2 ppm), CLT	–	1002710
Membrane cap for CDE 3	–	1026578
Diaphragm cap for PAA 1, CDR 1, CLR 1, OZR 1	–	1023895
Membrane cap for PER 1	–	1025776
Membrane cap for H2.10 P	–	792978
Accessory set for CGE 2/CTE 1 (2/5/10 ppm) and BRE 1 (10 ppm), BRE 2 (2 membrane caps + electrolyte)	50	740048

1.6 Accessories Sensor Technology

	Capacity ml	Order no.
Accessory set for CTE 1 (0.5 ppm) (2 membrane caps + electrolyte)	50	741277
Accessory set for CLE (2 membrane caps + electrolyte)	100	1024611
Accessory set for CDP 1 (2 membrane caps + electrolyte), BRE 1 (0.5 / 2 ppm), CLT	100	1002744
Accessory kit for PAA 1 (2 membrane caps + electrolyte)	100	1024022
Accessory kit for PER 1 (2 membrane cap + electrolyte)	50	1025881
Accessory set for CDE 3 (2 membrane caps + electrolyte)	100	1026361
Accessory set for CLO 1 (electrolyte, grinding disc, plug)	100	1035482
Accessory set for CLO 2 (electrolyte, grinding disc, plug)	100	1035483
Accessory set for CBR 1 (2 membrane caps + electrolyte)	100	1038984
Accessory set BCR 1 (2 membrane caps + electrolyte)	50	1044844

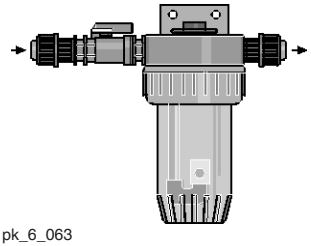


pk_6_062

Spare Parts for Dissolved Oxygen Sensors

	Measuring range	Order no.
Sensor insert for DO 1-mA-20 ppm: Membrane thickness 125 µm	2.00…20.0 mg/l	1020534
Sensor insert for DO 2-mA-10 ppm: Membrane thickness 50 µm	0.10…10.0 mg/l	1020535
Bracket for the sensor insert for DO 1-mA-20 ppm (with membrane protection for fish farming)		1020540
Bracket for the sensor insert for DO 2-mA-10 ppm		1020541

1.6.3 Bypass Fittings for Sensors



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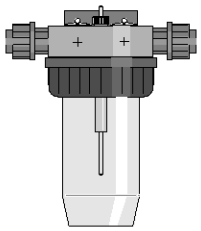
DLG III Type In-Line Probe Housing

To hold 2 sensors (conductivity, Pt 100, pH or ORP sensors) with PG 13.5 screw-in thread plus one sensor with R 1" screw-in thread (amperometric sensors) with integrated stainless steel pin as liquid reference potential.

On the inlet side the DLG III is equipped with a plastic ball valve for blocking and adjusting the sample water flow.

Material	Material: Rigid PVC Transparent housing cup: Polyamide Ball valve material: Rigid PVC
Max. pressure	1.0 bar
Max. temperature	55 °C
Typical applications	Cooling water, slightly contaminated waste water, turbid water, no sludge

	Type	Max. temperature °C	Order no.
DLG III A with PVC hose connectors	for PE line Ø 8/5 mm	55	914955
DLG III A with flushing connector and PVC hose connection	for PE line Ø 8/5 mm	55	1029096
DLG III B with PVC adhesive connectors	for pipe connection Ø 16 DN 10	55	914956
Assembly kit for fitting amperometric sensors	–	55	815079



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DLG IV Type In-Line Probe Housing

To hold 4 sensors (pH, ORP, Pt 100, conductivity) with PG 13.5 screw-in thread. With integrated stainless steel rod as liquid reference potential. Angle for wall mounting.

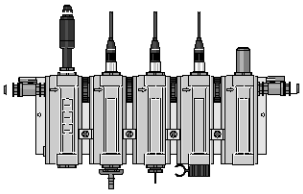
Material	Material: Hard PVC or PP Transparent housing cup: Polyamide
Max. pressure	1.0 bar
Connection for sample water line	Union with d 16/DN 10 insert

	Type	Max. temperature °C	Order no.
DLG IV PP	for Ø 16/DN 10 pipe work connector	80	1005331
DLG IV PVC	for Ø 16/DN 10 pipe work connector	55	1005332

DLG Sampling Water Cup

	Order no.
DLG III sampling water cup with back flush device	1029095

1.6 Accessories Sensor Technology



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DGM Modular In-Line Probe Housing

To hold conductivity, Pt 100, pH or ORP sensors with PG 13.5 screw-in thread or amperometric sensors with R 1" screw-in thread.

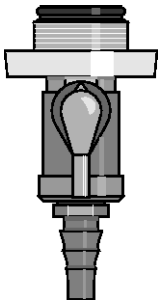
Advantages:

- Simple installation (completely ready-mounted on a panel); max. 7 modules on a panel
- Simple retrofit extension option (see extension modules)
- Module for sample water flow control
- Quick measurement recording due to low volume of sample water
- Each completely assembled DGM is equipped with a simple sampling tap

Ball valves on both sides for shutting off the flow and for flow adjustment

Material	All modules: Transparent PVC Seals: FKM Calibration cup: PP Mounting panel: PVC white
Max. temperature	60 °C
Max. pressure	6.0 bar up to 30 °C, 1.0 bar up to 60 °C
Max. flow rate	80 l/h
Recommended Flow volume	40 l/h
Flow sensor	Reed contact Max. switch power 3 W Max. switch voltage 175 V Max. switch current 0.25 A Max. operating current 1.2 A Max. contact resistance 150 mΩ
Switching hysteresis	20%
Enclosure rating	IP 65
Typical applications	Potable water, swimming pool water or water of similar quality with no suspended solids
Assembly	Max. 5 modules pre-assembled onto baseboard: more than 5 modules, pre-assembled onto baseboard as custom version, priced accordingly.

FKM = Fluorine Rubber



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Sampling Tap for DGM

For PG 13.5 and 25 mm modules designed as a convenient ball valve.

	Order no.
PG 13.5 sampling tap	1004737
25 mm sampling tap	1004739

Expansion Modules for DGM

For simple retrofit to an existing DGM.

	Order no.
Flow expansion module with scale in l/h	1023923
Flow expansion module with scale in gph	1023973
Flow sensor for flow expansion module (optional)	791635
Expansion module for PG 13.5 sensors	1023975
Expansion module for 25 mm sensors	1023976

Connecting Lead

For fluid voltage comparison in-line probe housing DLG III and DGMA with connector, 5 m.

	Order no.
Connector cable	818438

1.6 Accessories Sensor Technology

Isolation Ball Valve for DGM

To isolate the bypass from the process flow

	Order no.
Stopcock	1010380

Mounting Kit for Sensor/DGM

For mounting amperometric sensors with R 10 connection

	Order no.
Mounting kit for sensor/DGM	791818

Identity Code Ordering System for In-Line Probe Housing Modules

DGM	Series								
	A	Series Version							
		Flow monitor module							
		1	with l/h scale						
		2	with gph scale (US)						
		3	With flow monitor, l/h scale						
		4	with flow monitor, gph scale (US)						
			Number of PG 13.5 modules						
			0	without PG 13.5 modules					
			1	one PG 13.5 module					
			2	two PG 13.5 modules					
			3	three PG 13.5 modules					
			4	four PG 13.5 modules					
				Number of 25 mm modules					
				0	No 25 mm modules				
				1	One 25 mm module				
				2	Two 25 mm modules				
					Main material				
					T	Transparent PVC			
						Sealing material			
						0	FKM A		
							Hydraulic connectors		
							0	8 x 5 hose	
							1	PVC DN 10 threaded connector	
							4	Hose 12 x 6	
								Version	
								0	With ProMinent® logo
								1	Without ProMinent® logo
								2	With ProMinent® logo, without mounting plate
								3	Without ProMinent® logo, without mounting plate

Accessories supplied:

- Wall fastenings for PG 13.5 modules: Calibration plate, mounting kits for PG 13.5 probes

The identity code DGM A 3 2 1 T 0 0 0 describes, for example, a fully assembled configuration of a flow module with sensor, two PG 13.5 modules (e.g. for pH and ORP probes) and a 25 mm module (e.g. for CLE 3 chlorine sensor) 8 x 5 tube connectors are ready mounted.

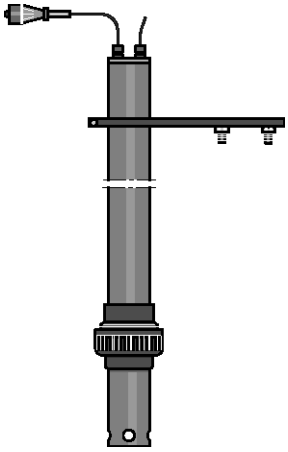
Recommended Accessories

		Order no.
for potential equalizer plug	–	791663
Flow sensor for flow expansion module (optional)	–	791635
additional calibration cup	–	791229
PG 13.5 sampling tap	for 13.5 module	1004737
25 mm sampling tap	for 25 mm module	1004739

- Max. 7 modules possible on a mounting plate
- More on request

FKM = Fluorine Rubber

1.6.4 Immersion Fittings for Sensors



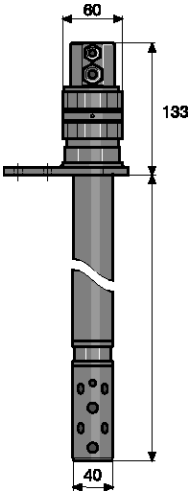
pk_6_064

PVC Immersion Assembly Type ETS 1 P

To hold **one** conductivity, Pt 100, pH or ORP sensor with SN6 plug-in head and PG 13.5 screw-in thread (with integrated stainless steel pin as liquid reference potential).

Sensor connector (inner)	SN6 connector
Signal lead connector (outer)	Coax SN6 male connector
Material	Rigid PVC
Type of fitting	Clamping flange with mounting plate
Immersion depth	Variable
Max. temperature	55 °C

	Order no.
ETS 1 P	914950



pk_6_080

PP Immersion Assembly Type IPHa 1-PP

To hold **one** sensor (e.g. pH, ORP) with PG 13.5 screw-in thread and standard 120 mm length. The inside diameter is sized so that either pH or ORP transducers can be installed. In addition, a stainless steel rod is incorporated as a liquid reference potential. The outside diameter is 40 mm. Immersion depths of 1 and 2 m are offered, however customers can independently lengthen or shorten the immersion pipe. The fitting head contains two cable connectors; measuring lines of 3-7 mm diameter can be led out. Measuring lines are not contained in the scope of supply.

Material	Probe housing material: PP Seal material: FKM
Max. temperature	80 °C
Pressure	Installation at atmospheric pressure
Immersion depth	Max. 1, or 2 m; variable
Immersion lance diameter	40 mm

Dimensions Table: Flange

Fixed flange	DN 40
Hole circle Ø K	110 mm
Bolts	4 x M16
Thickness d_2	18 mm
Diameter Ø D	150 mm

	Length when fitted m	Order no.
IPHa 1-PP	1	1008600
IPHa 1-PP	2	1008601

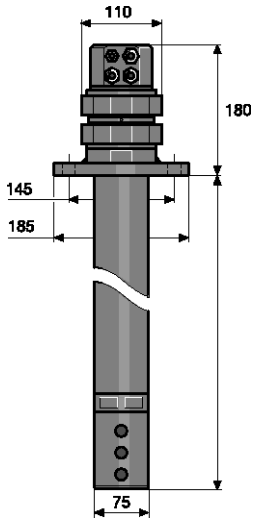
Other materials available on request.

FKM = Fluorine Rubber

Accessories for Fitting Type IPHa 1

	Order no.
Immersion pipe mounting for IPHa 1-PP	1008624
Clamped threaded connector with fixed flange DN 40 according to DIN 2642 for IPHa 1-PP	1008626
Clamped threaded connector for welding connection for IPHa 1-PP	1008628
Protective (weatherproofed) cover for assembly head for IPHa 1-PP	1008630
Water-retaining basin for IPHa 1-PP	1008632
Weatherproof cover PP	1023368

1.6 Accessories Sensor Technology



pk_6_081

PP Immersion Assembly Type IPHa 3 -PP

To hold up to **three** sensors (e.g. pH, ORP, temperature) with PG 13.5 screw-in thread and standard 120 mm length. The inside diameter is dimensioned so that up to three pH, ORP or temperature transducers can be installed. In addition a stainless steel rod is incorporated as a liquid reference potential. The outside diameter is 75 mm. Immersion depths of 1 and 2 m are offered, however, customers can independently lengthen or shorten the immersion pipe. The fitting head contains four cable connectors, measuring lines of 3-7 mm diameter can be led out. Measuring lines are not contained in the scope of supply. Technical data is as for fitting IPHa 1, except the immersion tube diameter is 75 mm.

Material	Probe housing material: PP Seal material: FKM
Max. temperature	80 °C
Pressure	Installation at atmospheric pressure
Immersion depth	Max. 1, or 2 m; variable
Immersion lance diameter	75 mm

Dimensions Table: Flange

Fixed flange	DN 65
Hole circle Ø K	145 mm
Screws	4 x M16
Thickness d_2	18 mm
Diameter Ø D	185 mm

	Length when fitted m	Order no.
IPHa 3-PP	1	1008602
IPHa 3-PP	2	1008603

Other materials available on request.

FKM = Fluorine Rubber

Accessories for Fitting Type IPHa 3

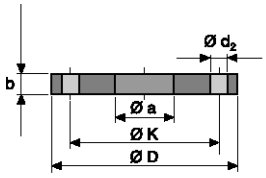
	Order no.
Immersion pipe mounting for IPHa 3-PP	1008625
Clamped threaded connector with fixed flange DN 65 according to DIN 2642 for IPHa 3-PP	1008627
Clamped threaded connector for welding connection for IPHa 3-PP	1008629
Protective (weatherproofed) cover for assembly head for IPHa 3-PP	1008631
Water-retaining basin for IPHa 3-PP	1008633
Weatherproof cover PP	1023368

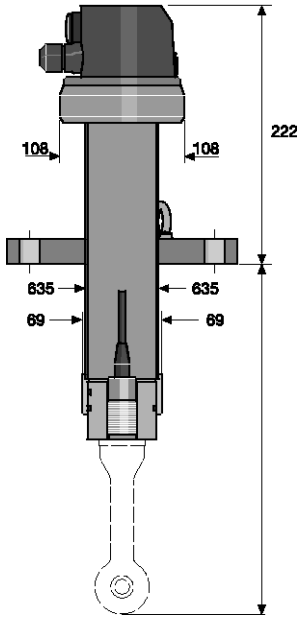
Weatherproof cover for in-line probe fitting type IMA-ICT 1

For use in immersion assembly, type IMA-ICT 1.

	Order no.
Weatherproof cover PP	1023368

1.6 Accessories Sensor Technology





pk_6_094

Immersion Assembly Type IMA-ICT 2

To hold one inductive conductivity sensor of type ICT 2.

Material	Fittings: Stainless steel 1.4404 Seal: FKM
Max. temperature	125 °C
Max. pressure	10 bar
Length when fitted	1 m
Immersion lance diameter	70 mm
Flange	Stainless steel flange DN 80 PN 16

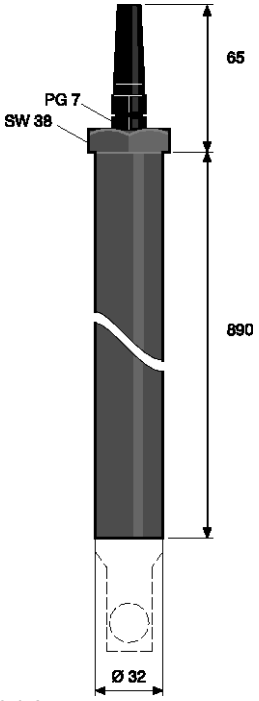
Dimensions Table: Flange

Flange	DN 65/PN 16
Ø D	200 mm
Ø K	160 mm
Ø d_2	8 x 18 mm
b	20 mm
Ø a	63.5 mm
Screws	M 16

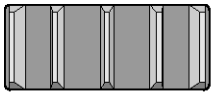
	Order no.
IMA-ICT 2	1023353

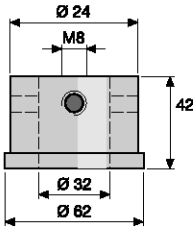
Adaptation to processes through flange installation in tank from top.

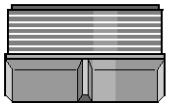
1.6 Accessories Sensor Technology



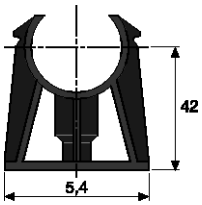
pk_6_053







pk_6_078



pk_6_079

Immersion assembly type TA-LM

To hold **one** conductivity sensor of type LM and LMP with M 28 thread for side fasting with pipe clips (2 contained in the scope of supply) or with union nut/collar bush/screw-in part for fastening in a tank cover.

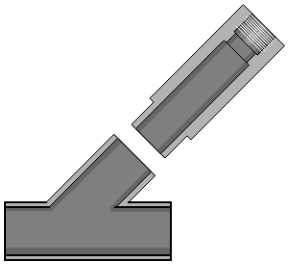
Union nut and screw-in part are to supplied by the customer (standard parts).

Material	PP
Max. temperature	70 °C
Enclosure rating	IP 68
Max. pressure	5.0
Immersion lance diameter	32 mm
Pipe length	890

	Length mm	Order no.
TA-LM	890	1020632
Headed bush d50	–	1020634
Extension tube 1000	910	1020633

1.6 Accessories Sensor Technology

1.6.5 Installation Fittings / Adapters

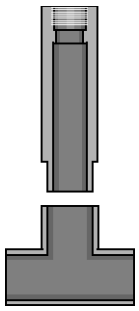


pk_6_059

Adapter set (T-piece and adapter)

For direct fitting of conductivity, Pt 100, pH or ORP sensors with PG 13.5 screw-in pipework:

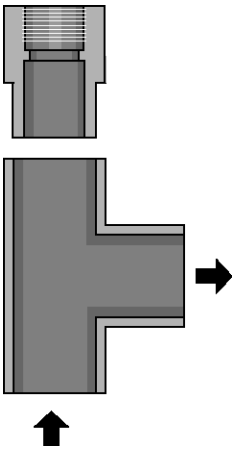
	Material	Order no.
90° T-piece DN 20	PVC	1001493
90° T-piece DN 25	PVC	1001494
45° T-piece DN 20	PVC	1001491
45° T-piece DN 25	PVC	1001492



pk_6_060

PVC adapter set for type LM sensors

For direct fitting of type LM conductivity sensors with 3/4" screw-in thread for measuring in the flow.

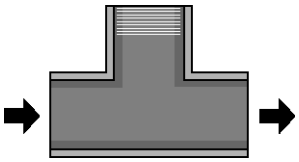


pk_6_090_2

For LM(P) 001 conductivity sensors

The sensors are fitted in the straight section of the T-piece.

	Material	Order no.
90° T-joint DN 25	PVC	356410
Adapter DN 25 with 3/4" thread	PVC	356923
90° T-joint DN 25	PP	358674
Adapter with 3/4" thread	PP	356953

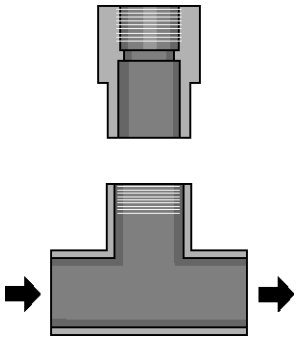


pk_6_091_2

For LM(P) 01 conductivity sensors

The sensors are fitted in the outlet of the T-piece.

	Material	Order no.
90° T-piece DN 20 - 3/4"	PVC	356455
90° T-piece DN 20 - 3/4"	PP	356471



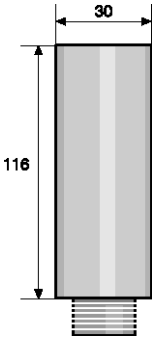
pk_6_092

For LM(P) 1 conductivity sensors

The sensors are fitted in the outlet of the T-piece.

	Material	Order no.
90° T-joint DN 25	PVC	356410
Inline fitting DN 25 - 3/4"	PVC	1020616

1.6 Accessories Sensor Technology



pk_6_065

Adapter PP, PG 13.5

For direct fitting of conductivity, Pt 100, pH or ORP sensors with PG 13.5 screw-in thread in, for example, pipework, tanks:

Max. temp: 80 °C (at atmospheric pressure)

EPDM sealing ring

	Material	Outer thread	Order no.
Adapter DN 20	PP	R 1/2"	1001834
Adapter DN 25	PP	R 3/4"	1001835

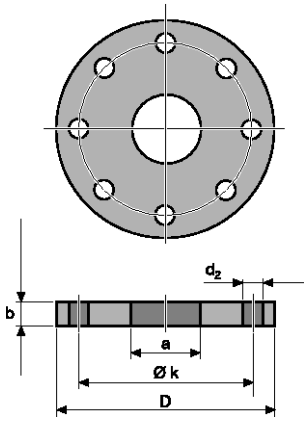
Adapter, stainless steel, PG 13.5

For direct fitting of conductivity, Pt 100, pH or ORP sensors with PG 13.5 screw-in thread in, for example, pipework, tanks:

Max. temp: 180 °C (at atmospheric pressure)

Sealing ring, FKM (fluorine rubber)

	Material	Outer thread	Order no.
Adapter DN 20	SS	R 1/2"	1020737
Adapter DN 25	SS	R 3/4"	1020738



pk_6_093

Fixed flange SS 316L	ANSI 2" 300 lbs	DN 50 PN 16
Pitch circle	127	125
Screws	M 16	M 16
Thickness	22.2	18
Diameter	165.1	165

Installation kit for type ICT 2 sensors

For direct fitting of the inductive conductivity sensor ICT 2 in pipework and tanks.

	Order no.
Installation kit for type ICT 2 sensors	1023364

Kit consisting of

- Stainless steel flange ANSI 2 inch 300 lbs, SS 316L (adaptable to DIN counter flange DN 50 PN 16)
- Nut 3/4" stainless steel

Parts that come into contact with the medium:

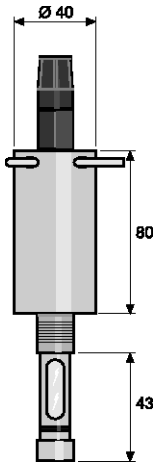
- Sealing disk, "2", / PTFE
- Spacer ring, PTFE
- Seal

Welding socket for T-piece (PP) type ICT 1

For connection of the inductive conductivity sensor ICT 1 in PP T-piece.

	Order no.
Welding socket G 2 1/4 inch DN40 PP incl. O-ring FKM	1023371

1.6 Accessories Sensor Technology



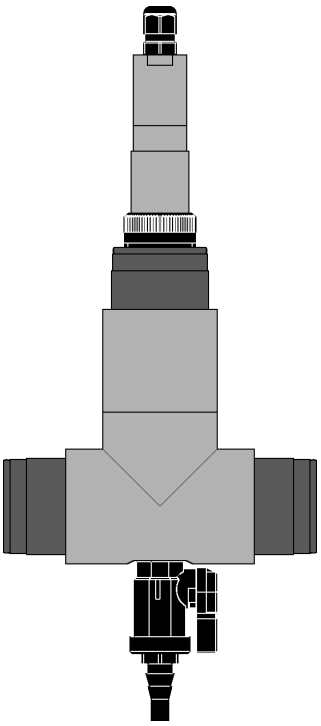
pk_6_013

Retractable sensor housing for pH, ORP sensors WA-PH 1

To hold **one** pH sensor with PG 13.5 screw-in thread and length of between 110-125 mm for fitting in the storage tank or in the flow. The sensor can be removed and fitted for calibration and cleaning without draining the liquid from the storage tank or without interrupting the process in the flow.

Material	PP
Max. temperature	70 °C
Max. pressure	5.0 bar
Thread	3/4"

	Order no.
WA-PH 1	1020631


pk_6_110

Installation fitting INLI for chlorine sensor CLO

The installation valve permits the installation of the sensor for free chlorine types CLO (part no. 1033870, 1033871, 1033878) for operation in the process line (G 1") or in the bypass to the process line. Use either with a free outlet or return of the sample water to the process line. Sample water temperature up to 70 °C/ 2 bar and 40 °C/7 bar. Keep the flow constant.

Max. temperature	70 °C (at 2 bar)
Max. pressure	7 bar (at 40 °C)
Flow for operation of the sensor CLO	400 - 800 l/h

Material

T-piece and fittings	PP
O-ring	EPDM
Sampling tap	PVDF/FPM
Stopcock	PVDF/FPM
Reducer	Stainless steel 1.4571

Connectors

Sensor	G 1"
Sampling tap	G 1/4"
Hose on sampling tap	6 x 4 mm
Sample water line	G 1"

	Order no.
Installation fitting for chlorine sensor CLO	1047238

Accessories

	Order no.
Stopcock	1048213

Spare Parts

	Order no.
Sampling tap	1047266

1.6 Accessories Sensor Technology

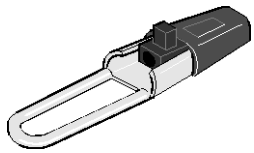
pk_6_072

Immersion pipe adapter for dissolved oxygen sensor DO 1-mA-20 ppm

PVC adapter for connection of the DO 1-mA-20 ppm dissolved oxygen sensor to an immersion pipe with 1-1/4 inch internal thread.

DULCOTEST® Sensors for Dissolved Oxygen See page → 1-79

	Order no.
Immersion tube adapter for DO 1-mA-20 ppm	1020537



pk_6_073

Mounting bracket for cable of dissolved oxygen sensor DO 1-mA-20 ppm

The stainless steel and polyamide cable bracket is used to guide and fix the sensor cable inside the DO 1-mA-20 ppm dissolved oxygen sensor.

DULCOTEST® Sensors for Dissolved Oxygen See page → 1-79

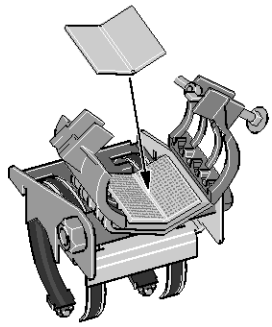
	Order no.
Cable bracket for DO 1-mA-20 ppm	1020539

Pipe adapter for dissolved oxygen sensor DO 2-mA-10 ppm

The PVC adapter is a spare part for the DO 2-mA-10 ppm dissolved oxygen sensor. The DO 2-mA-10 dissolved oxygen sensor can be adapted to fit metric or imperial tubing by fitting half of the adapter with 1-1/2 inch outside diameter, the other half with 50 mm outside diameter and at both ends with 1-1/4 inch internally threaded tube attached by means of a corresponding 45° standard angle piece (provided by the customer).

DULCOTEST® Sensors for Dissolved Oxygen See page → 1-79

	Order no.
Pipe adapter for DO 2-mA-10 ppm	1020538



pk_6_010

Railing bracket for plastic pipes

Stainless steel and plastic bracket for fixing of plastic tubes with 50 mm outside diameter to rails (e.g. on pools in sewage plants). Spare part for "dissolved oxygen" sensor: DO 2-mA-10 ppm.

DULCOTEST® Sensors for Dissolved Oxygen See page → 1-79

	Order no.
Railing bracket for DO 2-mA-10 ppm	1020536

1.7 Application Examples

Application and Ordering Examples for the DULCOMETER® Compact See page → 2-33

D1Cb and D1Cc Application and Ordering Examples See page → 2-24

DACa Application and Ordering Examples See page → 2-8

Application Examples: Treatment of Swimming Pool Water in Public Baths See page → 2-81

Application Example: Measurement of Key Chemical Water Parameters at Various Points in the Treatment of Drinking Water See page → 2-85

2.0 Measuring and Control Units DULCOMETER®

2.0.1 Measuring and Control Units DULCOMETER®

DULCOMETER® measuring and control units combine maximum process safety with a broad application spectrum. Different measured variables can be accurately determined. Depending on the application, the control behaviour of DULCOMETER® measuring and control units is adapted to meet the relevant application. Different designs permit flexible use.

Advantages at a glance:

- high measuring reliability, e.g. thanks to symmetrical input for pH/ORP
- high measuring accuracy, e.g. thanks high-impedance input for pH/ORP
- minimum disturbance, e.g. thanks to alternating current disturbance suppression
- two-wire technology for disturbance-resistant measurement
- highly versatile thanks to many options and different designs

DULCOMETER® measuring and control units, DULCOTEST® sensors with ProMinent® metering pumps - the complete control cycle, measuring-controlling-metering and recording, everything from one single source.

Controller selection table

Function	DACa	Compact	D1Cb	D1Cc
Measured variablen				
pH	✔	✔	✔	✔
ORP	✔	✔	✔	✔
Chlorine	✔	✔	✔	✔
Chlorine dioxide	✔		✔	✔
Chlorite	✔		✔	✔
Bromine	✔		✔	✔
Conductivity, conductive		✔		
Conductivity, inductive		✔		
Conductivity via mA	✔		✔	✔
Peracetic acid	✔		✔	✔
Hydrogen peroxide	✔		✔	✔
Ozone	✔		✔	✔
Dissolved oxygen	✔		✔	✔
Fluoride	✔		✔	✔
0/4…20 mA standard signal general measured variables	✔		✔	✔
Power supply				
90–253 V	✔	✔	✔	✔
Method of installation, degree of protection				
Wall mounted IP 65			✔	
Control panel mounting IP 54, 1/4 DIN				✔
Combination housing (wall-mounting, control panel mounting, pillar assembly) IP 67, IP 54	✔	✔		
Measurement				
Number of measuring channels	**1/2 optionally selectable**	**1**	**1**	**1**
Sensor monitoring of pH	✔	✔	✔	✔
Temperature compensation for pH	✔	✔	✔	✔
Temperature compensation for conductivity		✔		
pH compensation for chlorine	✔			
Control				
PID controller	✔	✔	✔	✔
1 way controller (e.g. with pH acid or alkali)	✔	✔		
2 way controller (e.g. with pH acid and alkali)	✔		✔	✔

2.0 Measuring and Control Units DULCOMETER®

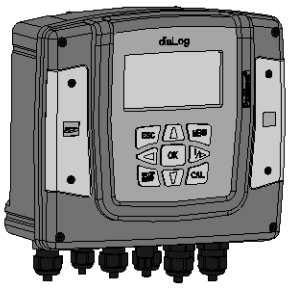
Function	DACa	Compact	D1Cb	D1Cc
Control inputs				
Digital control inputs	✔, 2/5	✔, 1	✔, 1	✔, 1
Control outputs				
Control of metering pump by pulse frequency	✔, 2/4	✔	✔, 2	✔, 2
Control of solenoid valve/motor-driven metering pump	✔	✔	✔	✔
Disturbance variable of flow via mA	✔			
Disturbance variable of flow via frequency (e.g. of contact water meter)	✔			
Metering time monitoring with deactivation of the control variable	✔	✔	✔	✔
Output relay configurable as limit value relay	✔, 2	✔, 1	✔, 2	✔, 2
Cycle timer	✔, 2		✔, 2	✔, 2
Real time timer	✔, 2			
Outputs				
Analogue output 0/4…20 mA	✔, 2/3	✔, 1	✔, 1	✔, 1
Special functions				
Data logger with SD card	✔			
Web server via LAN/WAN	✔			
Parameter set switch-over via timer	✔			
Parameter set switch-over via contact	✔			
PROFIBUS®-DP	✔			
Modbus RTU	✔			
Modbus TCP	✔			
Subsequent extension of functions via enabling code	✔		✔	✔
Operating hour counter	✔		✔	✔

2.1 Controller DULCOMETER® diaLog DACa

2.1.1 Controller DULCOMETER® diaLog DACa

Transparency of water analysis in the Dialog controller for one or two measuring points.

Transparent water analysis with the DULCOMETER® diaLog DACa - all combinations of relevant water treatment sensors can be freely evaluated and all actuators controlled.



P_DM_0031_SW1

The diaLog DACa controller uses intelligent controller functions to close the control circuit between ProMinent DULCOTEST® sensors and ProMinent® metering pumps. It offers special functions for water treatment, like the processing of disturbance variables and switch-over of control parameters.
The controller was developed for continuous measurement and control of the parameters necessary for this and can be configured for one of two measuring channels depending on the application. Sensors from 14 freely selectable measured variables can be connected per channel. The controller can communicate with analogue or digital sensors and actuators.
Popular field buses are available for communication with the control level. The data, calibration and event logger records all measured values, control variables, digital inputs, calibration values, warning and error messages with a time stamp on the SD card.

Your benefits

- Lower investment costs: through two independent PID controllers in one device
- Flexible selection and permits simple subsequent adjustments: 14 different measured variables per channel
- Ready for the world - offers 22 operating languages
- Transparency in troubleshooting: Event, calibration and measured data logger with easy-to-access SD memory card
- Ready for integration into your system: with various field bus systems, like PROFIBUS®-DP, PROFINET®, Modbus RTU and Modbus TCP

Technical details

- Measured variables: pH, ORP, chlorine, chlorine dioxide, chlorite, bromine, conductivity, peracetic acid, hydrogen peroxide, ozone, dissolved oxygen and fluoride
- Method of installation, degree of protection: Combination housing (wall mounting, control panel mounting, pillar assembly) IP 67, IP 54
- Measurement: 1 or 2 measuring channels, optional
- Temperature compensation for pH, pH compensation for chlorine
- Control: PID controller, monodirectional controller (e.g. with pH acid or alkali), bidirectional controller (e.g. with pH acid and alkali)
- Control inputs: 2 digital control inputs (5 control inputs with 2-channel controller)
- Control outputs: Feedforward control of flow via mA or frequency (e.g. of contact water meter)

Field of application

- Measurement and control of water parameters in industrial and process water treatment plants
- Measurement of the pH value and disinfection parameters in the food and beverage industry
- Monitoring of the chlorine dioxide concentration in systems for legionella control and prevention, for example in schools, hotels or hospitals
- Market gardening: Measurement of the disinfection parameters in irrigation and sprinkler irrigation water
- Monitoring of the water parameters in potable water circuits
- Measurement and control of the hygiene parameters in swimming pools

2.1 Controller DULCOMETER® diaLog DACa

Technical Data

Measuring range	**mV connection type:** pH: 0.00 ... 14.00 ORP voltage: -1500 ... +1500 mV **Connection type mA (amperometric measured variables, measuring ranges corresponding to the sensors):** Chlorine Chlorine dioxide Chlorite Bromine Ozone Hydrogen peroxide (PER sensor) Hydrogen peroxide (PEROX sensor with **PEROX transducer V2 Order No. 1047979**) Peracetic acid Dissolved oxygen **Connection type mA (potentiometer measured variables, measuring ranges corresponding to the transmitter):** pH ORP voltage Fluoride **Conductivity (measuring ranges corresponding to the transmitters):** via Transmitter 0/4 ... 20 mA **Temperature:** via Pt 100/Pt 1000, measuring range 0 ... 150 °C
Resolution	pH: 0.01 ORP voltage: 1 mV Temperature: 0.1 °C Amperometric analysis (chlorine etc.): 0.001/0.01 ppm, 0.01 vol.%, 0.1 vol.%
Accuracy	0.3% based on the full-scale reading
Measurement input	pH/ORP (input resistance > 0.5 x 10^{12} Ω)
Temperature compensation	Pt 100/Pt 1000 for pH, chlorine dioxide (CDP) sensor and fluoride
Correction range	0 … 100 °C
pH compensation range for chlorine	Sensor CLE 3 and CLE 3.1: 6.5 ... 8.5, sensor CBR: 6.5 ... 9.5
Disturbance signals	Flow via 0/4 … 20 mA or contact water meter, 1 - 500 Hz
Control characteristic	P/PID control
Control	2 x bidirectional control
Analogue outputs	2 (3) x 0/4 ... 20 mA electrically isolated, max. load 450 Ω, range and assignment (measured, correction, control variable) can be set
Control outputs	2 x 2 pulse frequency outputs for metering pump control 2 relays (limit value, 3-point step or pulse length control)
Alarm relay	250 V ~3 A, 700 VA contact type changeover contact
Digital control inputs	2 (5) as a remote control input for the functions pause control / sample water fault, parameter set switch-over, level monitoring of chemical tanks
Electrical connection	90-253 V, 50/60 Hz, 25 VA
Field bus connection	PROFIBUS®-DP, PROFINET, Modbus RTU, Modbus TCP/IP
Ambient temperature	0 ... 60 °C (for inside deployment or with a protective enclosure)
Enclosure rating	Wall mounted: IP 67 Control cabinet mounting: IP 54
Tests and approvals	CE, MET (corresponding to UL according to IEC 61010)
Housing material	PC with flame proofing equipment
Dimensions	250 x 220 x 122 mm (WxHxD)
Weight	1.3 kg

Standard equipment of the 1-channel design

- Measuring channel 1 with 14 freely selectable measured variables (via mV or mA). The measured variables conductive or inductive conductivity are provided by the Compact controllers COND_C (conductive) and COND_I (inductive).
- PID controller with pulse frequency-based metering pump control for 2 metering pumps.
- 2 analogue outputs for measured value, correction value or control variable (dependent on the optional equipment).

2.1 Controller DULCOMETER® diaLog DACa

- 2 digital inputs for sample water fault detection, pause and parameter switch-over.
- 2 output relays selectable as limit value, cycle timer, real-time timer or intermittent programmable control output (depending on the optional equipment).
- Measured variables and language selection during commissioning.
- Temperature compensation of the pH, chlorine dioxide (CDP) and fluoride measurement via Pt100/ Pt1000.
- 22 operating languages: all European languages as well as Chinese, Russian, Thai, Korean. The operating language is selected during commissioning and can be changed at any time by a keyboard shortcut. The documentation language is selected via the identity code. A data carrier is also supplied that contains all other languages.
- Saving and transfer of device parameterisation by means of the SD card.
- Calibration and event data logger (without SD card, data is saved in the controller).
- Interference variable processing (flow) via frequency (contact water meter).
- Subsequent upgrade of the software function by means of an activation key or firmware update.

Optional equipment of the 2-channel design

Package 2

- Interference variable processing (flow) via mA, or
- pH compensation for chlorine with pH control, or
- External remote setpoint via an analogue signal for channel 1.

Package 3

- Second, complete measuring and control channel with PID controller (replaces the D2Ca controller).
- 3. Analogue output for measured value, correction value or control variable (depending on the optional equipment).
- 3 additional digital inputs, e.g. for level monitoring, pause and sample water alarm for channel 2.
- Temperature compensation of the pH, chlorine dioxide (CDP) and fluoride measurement.

Package 4

- Combination of packages 2 and 3

Communication options

- Measurement data logger with SD card
- Visualisation of the measured data using a web server via LAN or WLAN and a PC/tablet PC and web browser
- PROFIBUS®-DP, Modbus RTU, Modbus TCP

Hardware extension

- Protective RC circuit for output relay: Protects the output relay if inductive loads are to be switched (e.g. solenoid valves or motors).

A complete measuring station comprises the following:

- Measuring transducer / Controller DACa (see identity code)
- Fitting: DGMa..., DLG III ..., immersible inline probe housing
- pH sensor (identity code-dependent)
- ORP sensor (identity code-dependent)
- Chlorine, chlorine dioxide, chlorite, bromine, dissolved oxygen sensor
- Transducer for pH or ORP dependent on the cable length (> 10 m)
- Sensor cable

(for further information: Immersion Fittings see page → 1-122; pH Sensors With SN6 or Vario Pin Plug-In Head see page → 1-10; ORP Sensors with Fixed Cable see page → 1-43; Sensors for Chlorite see page → 1-49; Transmitter 4 … 20 mA (Two-Wire System) see page → 2-102; Sensor Accessories see page → 1-113)

Accessories for Controller DULCOMETER® diaLog DACa

	Order no.
Cable combination coaxial 0.8 m - SN6 - pre-assembled	1024105
Cable combination Coaxial 2 m - SN6 (open end) - pre-assembled	1024106
Cable combination coaxial 5 m - SN6 - pre-assembled	1024107
SN6 coaxial connector, retrofit, D1Cb, DACa	1036885
Fitting kit for DAC control panel installation	1041095

2.1 Controller DULCOMETER® diaLog DACa

2.1.2 Identity Code Ordering System for diaLog DACa, Wall Mounting IP 67

DACa	Version													
	00	Wall mounted with ProMinent® logo												
	S0	With fitting kit for control cabinet mounting												
		Operating voltage												
		6	90 ... 253 V, 48/63 Hz											
			Channel 1 (the measured variable is selected during initial commissioning)											
			1	Measurement + control, 2 pumps, 2 digital inputs, 2 mA outputs										
				Channel 2 (the measured variable is selected during initial commissioning or software presetting.)										
				0	No 2nd channel									
				2	Package 2: Disturbance variable (mA) or external remote setpoint specification via mA or pH compensation for chlorine (all acting on channel 1)									
				3	Package 3: 2nd measurement + control, additionally 2 pumps, additionally 3 control inputs									
				4	Package 4: 2nd measurement + control, additionally 2 pumps, additionally 3 control inputs, disturbance variable (mA or frequency), pH compensation for chlorine									
					Software presets									
					0	No default settings								
					1	Batch neutralisation 2 x pH measurement with 1-2 sided controller and final checking								
					2	Batch neutralisation 2 x pH measurement with 1-2 sided controller, disturbance variable and final checking								
					3	pH-/ORP measurement/control (pH 2 way, ORP 1 way)								
					4	pH-/Cl_2 measurement/control (pH 2 way, chlorine 1 way)								
					5	pH-/ClO_2 measurement/control (pH 2 way, chlorine dioxide 1 way)								
					6	pH-/Cl_2 measurement/control with disturbance variable (pH 2 way, chlorine 1 way)								
					7	ClO_2-/ORP measurement/control (chlorine dioxide 1 way, ORP for monitoring)								
						Channel connections								
						0	Channel 1 / 2 via terminals (mA and mV)							
						1	Channel 1 via SN 6 coaxial connection (only for pH and ORP via mV)							
						2	Channel 2 via SN 6 coaxial connection (only for pH and ORP via mV)							
						3	Channel 1 and 2 via SN 6 coaxial connection (only for pH and ORP via mV)							
							Connection of digital sensors / actuators							
Documentation language							0	None						
DE	German							**Communication interface**						
EN	English							0	None					
ES	Spanish							A	Modbus RTU					
IT	Italian							A	PROFINET					
FR	French							4	PROFIBUS®-DP					
FI	Finish							6	Visualisation via web server/LAN M12 (external)					
BG	Bulgarian							8	Visualisation via web server/WiFi via access point					
CN	Chinese								**Data logger**					
CZ	Czech								0	No data logger				
DK	Danish								1	Data logger with measured value display and SD card				
EE	Estonian									**Hardware upgrade**				
GR	Greek									0	None			
HU	Hungarian									1	Protective RC circuit for power relay			
JP	Japanese										**Approvals**			
KR	Korean										01	None (CE is standard)		
LT	Lithuanian											**Certificates**		
LV	Latvian											0	None	
NL	Dutch													
PL	Polish													
PT	Portuguese													
RO	Romanian													
RU	Russian													
SE	Swedish													
SK	Slovakian													
SI	Slovenian													
SV	Swedish													
TH	Thai													

2.1.3 Retrospective Function Extension for the Controller diaLog DACa

Requirements:

Channel 2 must be available in the controller. Retrofitting of missing hardware must be performed in the factory.

Channel 2 can be enabled from either package 2 or package 3. The packages correspond to those that are also described in the identity code. The data logger function can always be enabled.

The activation code can only be used for the relevant controller with the specified serial number.

The activation code can be transmitted via email and is then read into the controller from the SD card or entered over the controller keypad. The enabled function is then available immediately and need only be activated and parameterised.

The following information must be available to determine the activation key:

- the serial number of the controller in question (see operating menu under <Diagnostics>, <Device information> and
- the desired upgrade packet.

		Order no.
Based on package 2	Upgrade: Package 2 to package 3	1047874
	Upgrade: Package 2 to package 4	1047875
Based on package 3	Upgrade: Package 3 to package 4	1047876

		Order no.
Based on 0=no data logger	Upgrade: Data logger	1047877

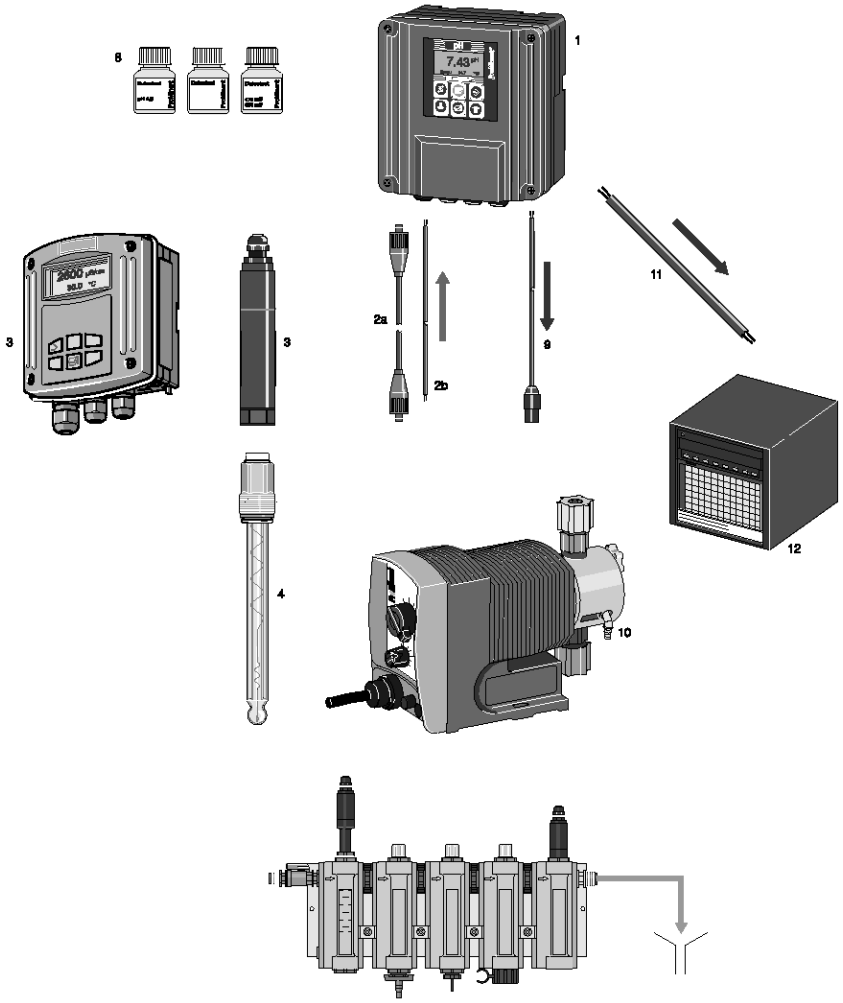
2.1 Controller DULCOMETER® diaLog DACa

2.1.4 DACa Application and Ordering Examples

The application examples contain typical combinations of components for measuring stations in applications in the areas of swimming pool, drinking water, waste water and the food industry.

Components of a complete measuring and control system

1 Measuring and control device e.g. DACa
2a Measuring line e.g. coaxial cable for pH and ORP sensors, Pt 100x
2b Measuring line 2-core for amperometric sensors with mA signal and transducer
3 Transducer 4 ... 20 mA (for two wire system), DMTa or pH V1
4 Sensor, e.g. pH single-rod sensor
5 Fitting e.g. in-line probe housing type DGMA
6 Stopcock sample water line
7 Sampling tap
8 Buffer solutions (pH/ORP)
9 Signal cable (metering pump control)
10 Actuator e.g. Beta® metering pump



AP_MSR_0006_SW3

Examples for:

1 Treatment of swimming pool water and decorative wells/fountains

2 Potable water monitoring

3 Monitoring of waste water (pH neutralisation)

4 Applications in the food industry

5 Odour reduction during exhaust air scrubbing

2.1 Controller DULCOMETER® diaLog DACa

2.1.5 Application Examples, Treatment of Swimming Pool Water

Private swimming pool with measurement and metering of acid and chlorine based on the ORP value

Tasks and applications

The pool water of a private outdoor swimming pool, used for only a short time every year, is to be treated. Sulphuric acid is used to correct the pH and sodium-calcium hypochlorite is used as a disinfectant. The disinfectant is to be regulated on the basis of the ORP value (a comparative calibration with a DPD 1 measurement should be carried out at regular intervals, likewise calibration of the pH sensor).

Type DF2a peristaltic pumps are to be controlled. The sample water flow is to be monitored and upon failure, the controller should stop.

Components of the measuring/control station

Quantity		See page	Order no.
1	2-channel controller for pH and ORP diaLog DACa with data logger and protective RC circuit	→ 2-3	DACa00613000011010EN
1	pH sensor PHES 112 SE	→ 1-11	150702
1	Cable combination coax 2 m - SN6, preconf.	→ 2-70	1024106
1	ORP sensor RHES-Pt-SE	→ 1-33	150703
1	Cable combination coax 2 m - SN6, preconf.	→ 2-70	1024106
1	In-line probe housing DGMa with sample water scale and limit switch	→ 1-120	DGMa320T000
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

Benefits

- Simple operation, controller with plain text operator guidance in 22 languages
- Recording of measured data
- Automatically correct pH value and correct concentration of disinfectant
- All products are matched

Private swimming pool with measurement and metering of acid and bromine

Tasks and applications

The pool water of a private outdoor swimming pool, used for only a short time every year, is to be treated. Sulphuric acid is used to correct the pH and bromine (BCDMH) is used as a disinfectant, that is dissolved and dosed via a bromine sluice. The disinfectant is to be regulated on the basis of a bromine measurement (a comparative calibration using a DPD 1 measuring unit should be carried out at regular intervals, likewise calibration of the pH sensor). The measured values are to be recorded. A DF2a peristaltic pump for pH correction and the solenoid valve of a bromine sluice are to be controlled. The sample water flow is to be monitored and upon failure, the controller should stop.

Components of the measuring/control station

Quantity		See page	Order no.
1	2-channel controller for pH and ORP diaLog DACa with data logger and protective RC circuit	→ 2-3	DACa00613000011010EN
1	pH sensor PHES 112 SE	→ 1-11	150702
1	Sensor connection cable, coaxial 2 m, SN 6 pre-assembled	→ 1-113	1005672
1	Bromine sensor BCR 1-mA-10 ppm	→ 1-68	1041698
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122
1	In-line probe housing DGMa with sample water scale and limit switch	→ 1-120	DGMa311T000
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

Benefits

- Simple operation, controller with plain text operator guidance in 22 languages
- Recording of measured data
- Automatically correct pH value and correct concentration of disinfectant
- All products are matched

2.1 Controller DULCOMETER® diaLog DACa

Private swimming pool with measurement of free chlorine and pH value

Tasks and applications

The pool water of a frequently-used private indoor swimming pool is to be treated. Sulphuric acid is used to correct the pH and sodium-calcium hypochlorite is used as a disinfectant. The disinfectant is to be regulated on the basis of the chlorine concentration (a comparative calibration with a DPD 1 measurement should be carried out at regular intervals, likewise calibration of the pH sensor). Beta® 4b metering pumps are to be controlled.

Components of the measuring/control station

Quantity		See page	Order no.
1	2-channel controller for pH and chlorine diaLog DACa with data logger	→ 2-3	DACa00613000010010EN
1	Chlorine sensor CLE 3-mA 2 ppm	→ 1-51	792920
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122
1	pH sensor PHES 112 SE	→ 1-11	150702
1	Cable combination coax 2 m - SN6, preconf.	→ 2-70	1024106
1	In-line probe housing DGMa with sample water scale and limit switch	→ 1-120	DGMa311T000
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

Benefits

- Simple operation, controller with plain text operator guidance
- Recording of measured data
- Automatically correct pH value and direct measurement and control of chlorine concentration
- All products are matched

Oxidation of well water with hydrogen peroxide

Tasks and applications

The water of a decorative well or fountain is to be disinfected/oxidised using hydrogen peroxide. The addition of hydrogen peroxide is to be measured. Metering is dependent on the measured value.

If with a control variable of 60% the setpoint is reached after 1 hour, then metering should enter the basic load settings and an alarm should be set (a calibration of the hydrogen peroxide sensor using a comparative measurement is required at regular intervals).

Components of the measuring/control station

Quantity		See page	Order no.
1	1-channel controller for hydrogen peroxide diaLog DACa with data logger	→ 2-3	DACa00610000010010EN
1	Hydrogen peroxide sensor PER 1-mA-50 ppm	→ 1-83	1030511
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122
1	DGMa in-line probe housing with sample water limit contact	→ 1-120	DGMa301T000
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

Benefits

- Simple operation, controller with plain text operator guidance
- Recording of measured data
- If the setpoint has not been reached within 1 hour, the dosing monitor signals via the alarm relay and sets control to an adjustable basic load
- All products are matched

2.1.6 Application Examples, Potable Water Monitoring

Measurement and control of ozone in water works for pre-oxidation of the raw water

Tasks and applications

In the treatment of potable water in a water works a measuring and control station is needed at the pre-oxidation stage at the inlet to the water works for the ozone oxidising and disinfectant agent used. With a constant flow, the fluctuating attrition of the ozone, caused by the changing quality of the raw water, is to be compensated on the basis of the measured variables. The following conditions must be met:

- Oxidising agent / disinfectant: Ozone with a concentration to be set to 0.2 ppm
- Raw water: Surface water with a pH of 7.3-7.6 and a temperature of 5 °C-17 °C
- Installation of the measuring station in the bypass of the process flow
- Alarm to signal transgression of upper and lower limit values
- Display of measured results and calibration via a measuring instrument in the proximity of the bypass installation and transmission of the measured value to the control desk via an electrically isolated 4-20 mA signal
- Alarm to signal lowering of sample water flow

Components of the measuring/control station

Quantity		See page	Order no.
1	1-channel controller for ozone diaLog DACa with data logger	→ 2-3	DACa00610000010010EN
1	Ozone sensor OZE 3-mA-2 ppm	→ 1-77	792957
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122
1	DGMa in-line probe housing with sample water limit contact	→ 1-120	DGMa301T000
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

Benefits

- Precise, self-regulating process management with changing raw water quality by the completely automated measuring and control station with variable-dependent control of ozone concentration
- Reliable, safe operation thanks to alarm signalling in the event of limit value transgression and lowering of sample water flow
- The control is monitored by transmission of the measured value as an electrically isolated 4-20 mA output signal by the controller to the control panel

Waterworks with control measurement of chlorine

Tasks and applications

The chlorine concentration in the outlet of a water works is to be monitored. Metering is performed with the volume proportional to the water flow. A MID in magnetic flow meter with a 4-20 mA output signal directly controls a metering pump.

If the setpoint is not reached for at least 5 minutes, then a limit value relay should switch and signal via a signal generator that the stroke length of the metering pump must be increased. Conversely, monitoring should also be performed to determine if too much chlorine has been dosed (calibration of the chlorine sensor should be performed at regular intervals by means of a DPD 1 comparative measurement).

Components of the measuring/control station

Quantity		See page	Order no.
1	1-channel controller for chlorine diaLog DACa with data logger	→ 2-3	DACa00610000010010EN
1	Chlorine sensor CLE 3-mA-0.5 ppm	→ 1-51	792927
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122
1	DGMa in-line probe housing with sample water limit contact	→ 1-120	DGMa301T000
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

Benefits

- Simple operation, controller with plain text operator guidance
- Recording of measured data
- Signalling via a limit value relay if the setpoint has been reached after 5 minutes.
- All products are matched

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Measurement and control of free chlorine with feedforward control in a waterworks

Tasks and applications

A measuring and control station is needed for the "free chlorine" disinfectant in the treatment of drinking water in a water works. Metering is largely proportional to the flow (4...20 mA). However control can also be proportionately variable-dependent to compensate for peaks of chlorine loss, for instance in the event of rainfall. The following conditions must be met:

- Disinfectant: free chlorine with an adjustable concentration of 0.2 mg/l
- Raw water: source water with a pH of 7.0-7.5 and a temperature of 1-13 °C
- Installation of the measuring station in the bypass of the process flow
- Display of measured results and calibration via a measuring instrument in the proximity of the bypass installation and transmission of the measured value and control variable to the control panel via PROFIBUS®-DP
- Alarm to signal lowering of sample water flow (via PROFIBUS®-DP)
- Alarm signalling the transgression of the preset upper and lower limit values (via PROFIBUS®-DP)
- The measured data are to be recorded in the controller.

Components of the measuring/control station

Quantity		See page	Order no.
1	1-channel controller for chlorine with feedforward control diaLog DACa with data logger	→ 2-3	DACa00612000410010EN
1	Chlorine sensor CLE 3-mA-0.5 ppm	→ 1-51	792927
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122
1	DGMa in-line probe housing with sample water limit contact	→ 1-120	DGMa301T000
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

Benefits

- Precise, self-regulating disinfection by a fully automated measuring and control station
- Flow-proportional control can be safeguarded by proportionate variable-dependent control to combat peaks of attrition
- Reliable, safe operation thanks to alarm signalling in the event of limit value transgression and lowering of sample water flow
- The control is monitored by transmission of the measured value and control variable via the PROFIBUS®-DP to the control panel

Waterworks with measurement of chlorine dioxide

Tasks and applications

The chlorine dioxide concentration in the outlet of a water works is to be monitored. Metering is in the first place performed with the volume proportional to the water flow. A flow meter with a 4-20 mA output signal is used.

If the proportionality is not sufficient, then up to 20% of the control variable is made available by the controller in an additive manner (a calibration of the chlorine dioxide sensor by means of a DPD 1 comparative measurement is required at regular intervals). The DACa controller pulse frequency is used to control the ProMinent Bello Zon® chlorine dioxide generation system.

Components of the measuring/control station

Quantity		See page	Order no.
1	2-channel controller for chlorine dioxide diaLog DACa with data logger	→ 2-3	DACa00610000010010EN
1	Chlorine dioxide sensor CDE 2-mA-0.5 ppm	→ 1-71	792930
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122
1	DGMa in-line probe housing with sample water limit contact	→ 1-120	DGMa301T000
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

Benefits

- Simple operation, controller with plain text operator guidance
- Recording of measured data
- Primarily, chlorine dioxide metering proportional to flow. Where this is not possible additive measured-value dependent control
- All products are matched

Legionella prevention in public buildings

Tasks and applications

The chlorine dioxide and the chlorite concentration are to be monitored and recorded in the fresh water distribution system of a public building for the prevention of Legionella. Chlorite is a disinfection by-product of chlorine dioxide that arises if germs have been killed. The chlorite concentration is limited using a limit value of 0.2 mg/l.

Components of the measuring/control station

Quantity		See page	Order no.
1	2-channel controller for pH and chlorine diaLog DACa with data logger	→ 2-3	DACa00613000010010EN
1	Chlorine dioxide sensor CDE 2-mA-0.5 ppm	→ 1-71	792930
5 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122
1	Chlorite sensor CLT 1-mA-0.5 ppm	→ 1-75	1021596
5 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122
1	DGMa in-line probe housing with sample water limit contact	→ 1-120	DGMa302T000
5 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

Benefits

- Simple operation, controller with plain text operator guidance
- Recording of all measured data
- Upon exceeding of the chlorite limit value, a limit value relay switches the chlorine dioxide metering off or to a basic load.
- All products are matched

Oxidation of well water with hydrogen peroxide

Tasks and applications

The water drawn from a deep well is to be oxidised using hydrogen peroxide. The addition of hydrogen peroxide is to be measured. Metering is dependent on the measured value.

If with a control variable of 60% the setpoint is reached after 1 hour, then metering should enter the basic load settings and an alarm should be set (a calibration of the hydrogen peroxide sensor using a comparative measurement is required at regular intervals).

Components of the measuring/control station

Quantity		See page	Order no.
1	1-channel controller for hydrogen peroxide diaLog DACa with data logger	→ 2-3	DACa00610000010010EN
1	Hydrogen peroxide sensor PER 1-mA-50 ppm	→ 1-83	1030511
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122
1	DGMa in-line probe housing with sample water limit contact	→ 1-120	DGMa301T000
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

Benefits

- Hygienic trouble-free well water
- Simple operation, controller with plain text operator guidance
- Recording of measured data
- If the setpoint has not been reached within 1 hour, the dosing monitor signals via the alarm relay and sets control to an adjustable basic load
- All products are matched

2.1.7 Application Examples, Waste Water Monitoring

Neutralisation of the waste water of an industrial plant (non-steady receipt of water)

Tasks and applications

Turbid waste water with a significantly fluctuating pH value and intermittent occurrence is to be neutralised in batch mode. The waste water is pumped into an intermediate tank and in the process is neutralised using acid and alkali. The pH value should be measured and regulated in a stirred batch tank. The pH sensor should be fitted at a typical position on the tank using an immersion fitting. Once it has been neutralised the water is pumped onwards and the pH value should be controlled again in this pipe.

The DACa controller data logger automatically records the pH values and temperatures of both pH measuring points. In parallel, a digital input is used to record the proximity switch of the storage tank outlet. In this way it can be precisely determined how high the pH value was at the time of draining. Any limit value transgressions that may have occurred are also recorded in the data logger. If a limit value transgression occurs, the shut-off valve closes automatically. Additionally, a neutral zone is defined in the controller. If the pH value comes within this neutral zone, no control takes place. There may be solids in the waste water.

Components of the pH measuring/control station in the collection tank

Quantity		See page	Order no.
1	2-channel controller for pH and ORP diaLog DACa with data logger and protective RC circuit	→ 2-3	DACa00613000011010EN
1	Cable combination coaxial 5 m - SN6 - pre-assembled	→ 1-113	1024107
1	DULCOTEST® pH sensor PHER 112 SE	→ 1-15	1001586
1	Temperature sensor Pt 100 SE	→ 1-46	305063
1	Cable combination controller cable 5 m - S SN6, open-ended (Pt 100, Pt 1000)	→ 1-114	1003208
1	Immersion fitting with 3 sensor slots IPHa 3-PP	→ 1-123	1008602
1	Cable combination coaxial 5 m - SN6 - pre-assembled	→ 1-123	1008633

Components of the measuring/control station in the outlet

Quantity		See page	Order no.
1	DULCOTEST® pH sensor PHER 112 SE	→ 1-15	1001586
1	Cable combination coaxial 5 m - SN6 - pre-assembled	→ 1-113	1024107
1	Retractable process assembly WA-PH 1	→ 1-128	1020631

Note: the use of other sensors is also possible depending on the quality of the waste water (see Selection Guide for pH Sensors DULCOTEST®)

With seriously contaminated waste water with solid matter content

Quantity	Name	See page	Order no.
1	pH sensor PHEX 112 SE	→ 1-16	305096

With clear waste water

Quantity	Name	See page	Order no.
1	pH sensor PHEP 112 SE	→ 1-13	150041

Benefits

- Simple operation, controller with plain text operator guidance in 22 languages
- Recording of all measured data and the opened or closed status of the shut-off valve
- pH limit value monitoring for the waste water
- pH control and final checking in a controller
- All products are matched

Neutralisation of the waste water of an industrial plant (continuous receipt of water)

Tasks and applications

In an industrial plant, waste water arises in a continuous manner (continuous production), and can be acidic or alkaline. The water runs through a manifold. The flow volume is measured using a MID in magnetic flow meter because the flow varies within wide limits. There is a pH sensor with a pH gate value and changeover valve in the pipe with which the pH value is adjusted. Further along the piping the pH value is used once again as a final check.

The flow signal of the MID is evaluated as a multiplicative disturbance variable in the DACa controller, i.e. this flow signal = disturbance variable is used to evaluate the controller control variable (control of the metering pumps) in a flow dependent manner. If a control deviation exists (deviation of the current value from the setpoint), for example, with a reduced flow less acid or alkali is necessary that with an increased flow. Provision of this information makes it easier for the controller to adhere to the setpoint. In the absence of such flow information, a PID controller alone could not perform such a task or could only perform it with great difficulty. Additionally, a neutral zone is defined in the controller. If the pH value comes within this neutral zone, no control takes place.

There may be solids in the waste water.

The DACa controller data logger automatically records the pH values and temperatures of both pH measuring points. Any limit value transgressions that may have occurred are also recorded in the data logger.

Components of the pH measuring/control station in the collection tank

Quantity		See page	Order no.
1	2-channel controller for 2 x pH and temperature diaLog DACa with data logger	→ 2-3	DACa00614000011010EN
1	DULCOTEST® pH sensor PHER 112 SE	→ 1-15	1001586
1	Cable combination coaxial 5 m - SN6 - pre-assembled	→ 1-113	1024107
1	Retractable process assembly WA-PH 1	→ 1-128	1020631

Components of the measuring/control station in the outlet

Quantity		See page	Order no.
1	DULCOTEST® pH sensor PHER 112 SE	→ 1-15	1001586
1	Cable combination coaxial 5 m - SN6 - pre-assembled	→ 1-113	1024107
1	Retractable process assembly WA-PH 1	→ 1-128	1020631

Note: the use of other sensors is also possible depending on the quality of the waste water (see Selection Guide for pH Sensors DULCOTEST®)

With seriously contaminated waste water with solid matter content

Quantity	Name	See page	Order no.
1	pH sensor PHEX 112 SE	→ 1-16	305096

With clear waste water

Quantity	Name	See page	Order no.
1	pH sensor PHEP 112 SE	→ 1-13	150041

Benefits

- Simple operation, controller with plain text operator guidance in 22 languages
- Processing of the flow signal as a disturbance variable
- Recording of all measured data and the opened or closed status of the shut-off valve
- pH limit value monitoring for the waste water
- pH control and final checking in a controller
- All products are selected to operate correctly with each other

2.1.8 Application Examples in the Food Industry

Bottler disinfection in the beverage industry

Tasks and applications

Continuous disinfection of the filler with disinfection solution means this sensitive part of the bottling process is reliably sterilised. Continuous spraying with disinfectant solution means high hygiene requirements are fulfilled,

The disinfectant solution comprises water with additional chlorine dioxide. The concentration of the chlorine dioxide is measured and set to the desired value using the DACa controller. From time to time the chlorine dioxide concentration must be increased.

An alternative parameter set can be activated in the DACa via a switch input. In this way a regularly required switchover can be smoothly implemented without the necessity for continual adaptation of the setpoint in the controller menu.

The measured data are to be recorded.

Components of the measuring/control station

Quantity		See page	Order no.
1	2-channel controller for chlorine dioxide diaLog DACa with data logger	→ 2-3	DACa00610000010010EN
1	Chlorine dioxide sensor CDR 1-mA-2 ppm	→ 1-73	1033393
1	DGMa in-line probe housing with sample water limit contact	→ 1-120	DGMa301T000
5 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

Benefits

- Simple operation, controller with plain text operator guidance in 22 languages
- Recording of all measured data
- Switchover of control parameters via an external potential-free contact
- All products are matched

Irrigation water disinfection for useful plants

Tasks and applications

The irrigation water from e.g. salad seedlings is drawn from a well. The water could contaminated with germs which could harm the salad seedlings. To prevent this, the irrigation water is disinfected using chlorine dioxide. The irrigation water requirement varies. Consequently, the irrigation water volume flow is measured. The irrigation water volume flow is used as an additive disturbance variable to control the adding of chlorine dioxide dependent on the required chlorine dioxide concentration and the irrigation water flow.

All measured data are to be recorded. The irrigation water may contain suspended matter.

Components of the measuring/control station

Quantity		See page	Order no.
1	2-channel controller for chlorine dioxide with additive feedforward control diaLog DACa with data logger	→ 2-3	DACa00612000010010EN
1	Chlorine dioxide sensor CDR 1-mA-2 ppm	→ 1-73	1033393
5 m	Coaxial cable, Ø 5 mm, 10.0 m – S	→ 1-113	305040
1	DGMa in-line probe housing with sample water limit contact	→ 1-120	DGMa301T000
5 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

Benefits

- Simple operation, controller with plain text operator guidance in 22 languages
- Processing of the irrigation water flow signal as a disturbance variable
- Recording of all measured data
- Switchover of control parameters via an external potential-free contact
- All products are matched

2.1.9 Odour Reduction Application Examples (Clarification Plants)

Exhaust air scrubbers, clarification plants or fragrance production

Tasks and applications

The odorous components of the exhaust air from a clarification plant are to be scrubbed out using an exhaust air scrubber and oxidised using hydrogen peroxide. Here the hydrogen peroxide concentration is to be regulated to maintain 100 mg/l. As the exhaust air is acidic, the pH value is to be regulated to maintain 7.2. The measured values are to be recorded. The scrubbing water temperature can vary widely in the range 5 - 35 °C. Beta® 4b metering pumps are to be pulse frequency controlled.

Components of the measuring/control station

Quantity		See page	Order no.
1	2-channel controller for pH and chlorine diaLog DACa with data logger	→ 2-3	DACa00613000010010EN
1	pH sensor PHES 112 SE	→ 1-11	150702
1	Sensor connection cable, coaxial 2 m, SN 6 pre-assembled	→ 1-113	1005672
1	H_2O_2 sensor PEROX-H2.10 P	→ 1-84	792976
1	PEROX transducer V2, measuring range switchable up to 20/200/2,000 mg/l	→ 1-84	1034100
5 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122
1	Temperature sensor Pt 100 SE	→ 1-46	305063
1	Cable combination controller cable 5 m - S SN6, open-ended (Pt 100, Pt 1000)	→ 1-114	1003208
1	Reference electrode REFP-SE	→ 1-46	1018458
1	DLG III A/B with PVC hose connection	→ 1-119	914955
1	Polishing paste (90 g tube)	→ 1-46	559810
1	Magnetic stirrer 100-240 V	–	790915
1	Magnetic stirring bar PTFE (magnetic stir bar)	–	790917
1	Photometer DT3B	→ 2-100	1039317

Benefits

- Simple operation, controller with plain text operator guidance in 22 languages
- Recording of all measured data
- Simultaneous measurement and control of the pH value and the hydrogen peroxide concentration
- All products are matched

2.2 Controller DULCOMETER® D1Cb/D1Cc

2.2.1 Controller DULCOMETER® D1Cb/D1Cc

The water analysis workhorse

The controller DULCOMETER® D1Cb/D1Cc can be used for control tasks in potable water treatment, waste water treatment and many other areas. Safe, convenient and clear, thanks to the large illuminated graphic display, plain text operating menu and pH sensor monitoring.

The D1Cb/D1Cc controller is a 1-channel P/PID controller for the measured variable pH, ORP, chlorine, chlorine dioxide, chlorite, ozone, bromine, peracetic acid, hydrogen peroxide, fluoride, dissolved oxygen and conductivity via mA. The sensors for pH and ORP can be directly connected via coaxial cable or using the 4-20 mA sensor input. The controller can bidirectionally control the measured variables, monitor limit values and transmit the measured value via an mA output, e.g. to a PLC. The mA output can optionally also be configured as a controlled variable output. The controller has two pulse frequency outputs to control two metering pumps (raise and lower). Two output relays can optionally be used as limit value relays or to control motor-driven pumps or solenoid valves. An alarm relay signals the occurrence of a fault. A digital input is used to switch off the control or to process a sample water limit contact by remote control. The impact of temperature on the measurements can be provided by temperature measurement or by manual input. Menu-driven operation is possible in 22 languages.

pk_5_002
D1Cb (top), D1Cc (bottom)

Your benefits

- Flexibility through free selection of variables from all measured variables
- Safety through sensor monitoring of pH for glass breakage and line breakage
- Flexibly upgradable, thanks to subsequent activation option of functions by means of an activation code
- Various installation options: wall-mounted or installation in a control cabinet

Technical details

- Measured variables: pH, ORP, chlorine, chlorine dioxide, chlorite, bromine, conductivity, peracetic acid, hydrogen peroxide, ozone, dissolved oxygen and fluoride
- Method of installation, degree of protection: D1Cb wall mounting IP 65, D1Cc control panel mounting IP 54, 1/4 DIN
- Measurement: 1 measuring channel, temperature compensation for pH
- Control: PID controller, bidirectional controller (e.g. with pH acid and alkali)
- Control inputs: 1 digital control input

Field of application

- Measurement and control of water parameters in industrial and process water treatment plants
- Waste water neutralisation
- Measurement of the pH value and the disinfection parameters in potable water treatment and in the food and beverage industry.
- Measurement and control of the hygiene parameters in swimming pools

Technical Data

Measuring range	**Type of connection mV:** pH 0.00 … 14.00 ORP - 1,000 … +1,000 mV **Type of connection mA:** Chlorine: 0.00...0.500/2.00/5.00/10.0/20.0/50.0/100.0 ppm Chlorine dioxide: 0.00...0.500/2.00/10.0/20.0 ppm Chlorite: 0.02...0.50/0.1...2 ppm Bromine: 0.02...2.0/0.1...10.0 ppm Ozone: 0.00...2.00 ppm Hydrogen peroxide, PER1 sensor : 2.0...200.0/20...2,000 ppm Peracetic acid: 1...20/10...200/100...2,000 mg/l Dissolved oxygen: 0.1...10/0.1...20 ppm pH: 0.00...14.00 ORP: 0...+1,000 mV Conductivity: 0...20/200/1,000 mS/cm Temperature: 0...100 °C via mA converter
Resolution	pH: 0.01 pH ORP: 1 mV Amperometric (e. g. chlorine): 0.001/0.01 ppm, 0.01 vol.%
Accuracy	0.5% of the upper measuring range value
Measurement input	SN6 (input resistance > 0.5 x 10^{12} Ω)

2.2 Controller DULCOMETER® D1Cb/D1Cc

Correction variable	Temperature via Pt 100/Pt 1000
Correction range temp.	0 … 100 °C
Control characteristic	P/PID control
Control	2-way control
Signal current output	1 x 0/4-20 mA galvanically isolated max. load 450 Ω Adjustable range and allocation (measured variable, correction variable, controlled variable)
Control outputs	2 pulse frequency outputs for metering pump actuation 2 relays (limit value or pulse length)
Alarm relay	250 V ~ 3 A, 700 VA changeover contact
Electrical connection	90 – 253 V, 50/60 Hz, 15 VA
Ambient temperature	-5 … 50 °C
Enclosure rating	Wall mounting: IP 65 Control panel version: IP 54
Dimensions	Wall mounting: 198 x 200 x 76 mm (WxHxD) Control panel version: 96 x 96 x 145 mm (WxHxD) (D1Cc)
Weight	0.8 kg

- Flexibly upgradable thanks to subsequent activation option for functions by means of activation key (see D1Ub/D1Uc upgrade identity code)
- Equipped for the most important basic requirements in water treatment
- Illuminated graphic display
- Operator guidance through clear text menu available in 22 languages in the controller
- Automatic buffer detection for pH calibration

D1Ub Identity Code Ordering System, Subsequent Function Upgrade for D1Cb see page → 2-23

A complete measurement station comes with:

- Measuring transducer/controller D1Cb/D1Cc (see Identity code)
- Fitting: DGMa..., DLG III ..., immersed fitting
- pH sensor (corresponding to Identity code)
- ORP sensor (corresponding to Identity code)
- Chlorine, chlorine dioxide, chlorite, bromine, dissolved oxygen sensor
- Transducer for pH or ORP (corresponding to Identity code)
- Sensor cable

Accessories for Controller DULCOMETER® D1Cb/D1Cc

Name of the item	Order no.
Cable combination coaxial 0.8 m - SN6 - pre-assembled *	1024105
Cable combination Coaxial 2 m - SN6 (open end) - pre-assembled *	1024106
Cable combination coaxial 5 m - SN6 - pre-assembled *	1024107
SN6 coaxial connector, retrofit, D1Cb, DACa	1036885
Protective RC circuit, retrofit kit for D1Cb	1034238
Spare parts kits D1Cc (frame, support brackets)	790130

* For measured variable connection = 5

2.2 Controller DULCOMETER® D1Cb/D1Cc

2.2.2 Identity Code Ordering System DULCOMETER® D1Cb, Wall Mounting

D1Cb	**Installation**																	
	W	Wall mounting (IP 65)																
		Version																
		00	With ProMinent logo															
			Power supply															
			6	90...253 V, 48/63 Hz (wide-range power supply)														
				Approvals														
				01	CE approval													
					Hardware add-on I													
					0	None												
						Hardware add-on II												
						0	None											
						1	RC protection for power relays											
							External connection											
							0	None										
								Software defaults										
								U	Software default setting (all of the following selection options are automatically set to the default setting)									
								V	Software pre-set (the following selection options must be evaluated)									
									Measured variable presetting									
									0	Universal (choice upon commissioning)								
									A	Peracetic acid								
									B	Bromine								
									C	Chlorine								
									D	Chlorine dioxide								
									F	Fluoride								
									H	Hydrogen peroxide (PER1)								
									I	Chlorite								
									P	pH								
									R	ORP								
									S	0/4...20 mA Standard signal, general								
									T	Temperature via mA transducer								
									X	Dissolved oxygen								
									Z	Ozone								
									L	Conductivity via mA transducer								
										Connection of the measured variable (presetting)								
										1	mA terminal can be switched to mV, all measured variables selectable							
										2	SN6 plug for P or R or standard signal 0/4-20 mA, all measured variables selectable							
										5	mV terminal can be switched to mA, all measured variables can be selected							
Language												**Correction variable**						
00	no default											0	None					
DE	German											2	Temperature Pt 100/1000 via terminal (for pH and conductivity)					
EN	English											4	Manual temperature entry (for pH and conductivity)					
ES	Spanish												**Control input**					
SV	Swedish												0	None				
PT	Portuguese												1	Pause control				
CN	Chinese													**Signal output**				
FR	French													0	None			
CZ	Czech													1	1 Analogue signal output 0/4...20 mA			
JP	Japanese														**Relay control**			
KR	Korean														G	Alarm and 2 limit value relays or 2 timer relays		
NO	Norwegian														M	Alarm and 2 solenoid valve relays or 2 timer relays		
NL	Dutch															**Pump control**		
PL	Polish															0	None	
RU	Russian															2	2 pumps via pulse frequency	
TH	Thai																**Control characteristic**	
HU	Hungarian																0	None
IT	Italian																1	P-control
DK	Danish																2	PID control
FI	Finish																	
GR	Greek																	

2.2 Controller DULCOMETER® D1Cb/D1Cc

2.2.3 Identity Code Ordering System DULCOMETER® D1Cb, Wall Mounting

D1Cc	**Type of mounting**																	
	D	Control panel installation (IP 54)																
		Design																
		00	With ProMinent logo															
			Operating voltage															
			6	90...253 V, 48/63 Hz (wide voltage power supply)														
				Certification														
				01	CE mark													
					Hardware extension I													
					0	None												
						Hardware extension II												
						0	None											
							External connection											
							0	None										
								Software default settings										
								U	Software basic setting (all of the following selection options are automatically set to the basic setting)									
								V	Software pre-set (the following selection options must be evaluated)									
									Measured variable default setting									
									0	Universal (choice upon commissioning)								
									A	Peracetic acid								
									B	Bromine								
									C	Chlorine								
									D	Chlorine dioxide								
									F	Fluoride								
									H	Hydrogen peroxide (PER1)								
									I	Chlorite								
									P	pH								
									R	ORP								
									S	0/4...20 mA standard signal, general								
									T	Temperature via mA transducer								
									X	Dissolved oxygen								
									Z	Ozone								
									L	Conductivity via mA transducer								
										Measured variable connection (default setting)								
										1	mA terminal can be switched to mV, all measured variables can be selected							
										5	mV terminal can be switched to mA, all measured variables can be selected							
Language											**Correction variable**							
00	no default setting										0	None						
DE	German										2	Temperature Pt 100/1000 via terminal (for pH and conductivity)						
EN	English										4	Manual temperature input (for pH and conductivity)						
ES	Spanish											**Control input**						
SV	Swedish											0	None					
PT	Portuguese											1	Pause control					
CN	Chinese												**Signal output**					
FR	French												0	None				
CZ	Czech												1	1 analog signal output 0/4...20 mA				
JP	Japanese													**Power activation**				
KR	Korean													G	Alarm and 2 limit value relays or 2 timer relays			
NO	Norwegian													M	Alarm and 2 solenoid valve relays or 2 timer relays			
NL	Dutch														**Pump activation**			
PL	Polish														0	None		
RU	Russian														2	2 pumps via pulse frequency		
TH	Thai															**Control characteristic**		
HU	Hungarian															0	None	
IT	Italian															1	Proportional control	
DK	Danish															2	PID control	
FI	Finish																	
GR	Greek																	

If software default setting **U** = software default setting is selected, the measured variables pH or ORP can be selected during commissioning. The menu language is automatically requested.

The connection of the measured variable is 5 = mV input for pH/ORP via shield clamp.

With all other options, the default settings (first option) are selected.

The controller with software with default settings can also be ordered with an order number.

	Order no.
Controller in basic setting D1CbW00601000U01000G0000	1036423

2.2 Controller DULCOMETER® D1Cb/D1Cc

Subsequent activation of functions is possible at any time using an activation key.

This activation key can only be used with the controller with the specified serial number. The activation code can be provided by phone, fax or e-mail and can be simply entered into the control keyboard. The new function is then available and need only be enabled and parametrised.

The following information is essential to obtain the activation code:

- Serial number of the controller (refer to nameplate or operator menu under "General Settings and Information")
- Current identity code of the controller (refer to operator menu under "General Settings and Information"
- Required identity code

2.2.4 D1Ub Identity Code Ordering System, Subsequent Function Upgrade for D1Cb

D1Ub	**Software defaults**										
		Software pre-set									
		Default - measured variable									
		0	Universal (choice of measured variable upon commissioning)								
			Connection of measured variable								
			1	Standard signal 0/4-20 mA, all measured variables and mV input for pH/ORP (standard)							
				Correction variable							
				0	None						
				2	Temperature Pt100/Pt1000 via terminal (for pH and conductivity)						
				4	Manual temperature entry (for pH and conductivity)						
					Control input						
					0	None					
					1	Pause control					
						Signal output					
						0	None				
						1	1 analogue signal output 0/4-20 mA				
							Power control				
							G	Alarm and 2 limit value relays or 2 timer relays			
							M	Alarm and 2 solenoid valve relays or 2 timer relays			
								Pump control			
								0	None		
								2	2 pumps via pulse frequency		
									Control modes		
									0	None	
									1	P control	
									2	PID control	
										Language	
										00	no default

2.2.5 Identity Code Ordering System D1Uc, Subsequent Function Upgrade for D1Cc

D1Uc	**Software defaults**										
		Software preset									
		Default - measured variable									
		0	Universal (choice of measured variable upon commissioning)								
			Connection of measured variable								
			1	Standard signal 0/4-20 mA, all measured variables and mV input for pH/ORP (standard)							
				Correction variable							
				0	None						
				2	Temperature Pt100/Pt1000 via terminal (for pH and conductivity)						
				4	Manual temperature input (for pH and conductivity)						
					Control input						
					0	None					
					1	Pause control					
						Signal output					
						0	None				
						1	1 Analogue signal output 0/4-20 mA				
							Power control				
							G	Alarm and 2 limit value relays or 2 timer relays			
							M	Alarm and 2 solenoid valve relays or 2 timer relays			
								Pump control			
								0	None		
								2	2 pumps via pulse frequency		
									Control modes		
									0	None	
									1	Proportional control	
									2	PID control	
										Language	
										00	no default setting

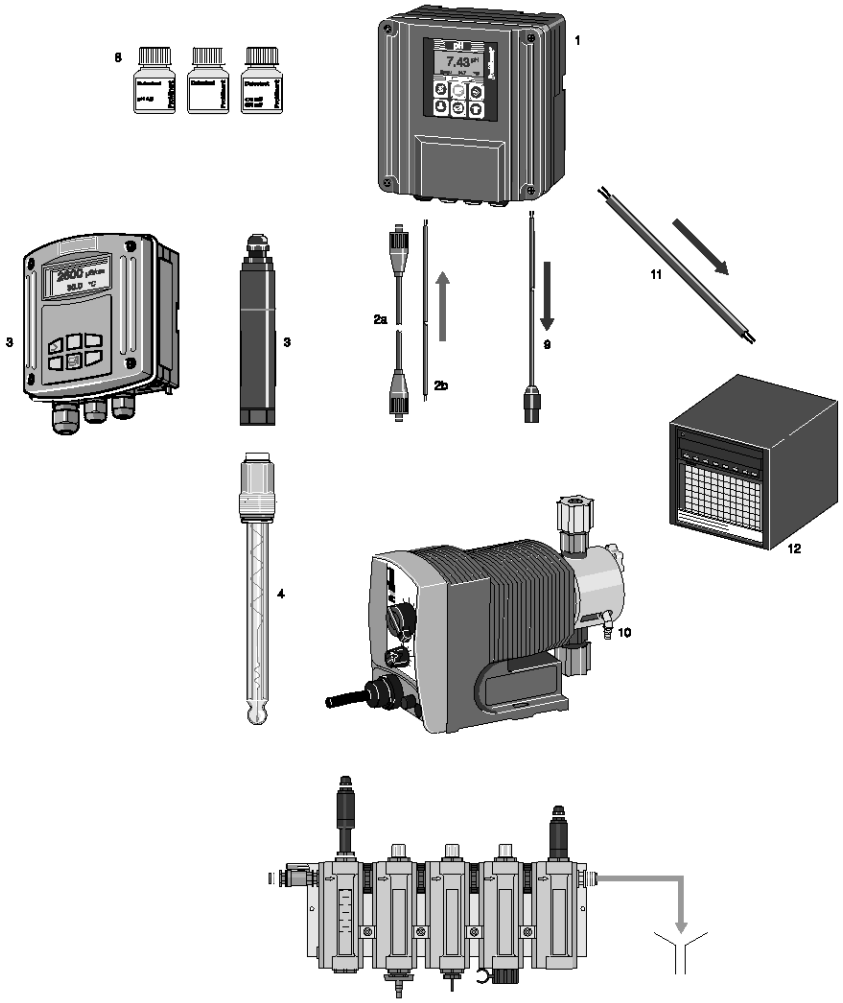
2.2 Controller DULCOMETER® D1Cb/D1Cc

2.2.6 D1Cb and D1Cc Application and Ordering Examples

The application examples contain typical combinations of components for measuring stations in applications in the areas of swimming pool, drinking water, waste water and the food industry.

Components of a complete measuring and control system

1 Measuring and control device e.g. DACa
2a Measuring line e.g. coaxial cable for pH and ORP sensors, Pt 100x
2b Measuring line 2-core for amperometric sensors with mA signal and transducer
3 Transducer 4 ... 20 mA (for two wire system), DMTa or pH V1
4 Sensor, e.g. pH single-rod sensor
5 Fitting e.g. in-line probe housing type DGMA
6 Stopcock sample water line
7 Sampling tap
8 Buffer solutions (pH/ORP)
9 Signal cable (metering pump control)
10 Actuator e.g. Beta® metering pump



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Examples for:

1 Treatment of swimming pool water and decorative wells/fountains

2 Potable water monitoring

3 Treatment and monitoring of waste water (pH neutralisation)

4 Applications in the food industry

2.2.7 Application Examples, Treatment of Swimming Pool Water

Private swimming pool with measurement and metering of acid and chlorine based on the ORP value

Tasks and applications

The pool water of a private outdoor swimming pool, used for only a short time every year, is to be treated. Sulphuric acid is used to correct the pH and sodium-calcium hypochlorite is used as a disinfectant. The disinfectant is to be regulated on the basis of the ORP value (a comparative calibration with a DPD 1 measurement should be carried out at regular intervals, likewise calibration of the pH sensor).

Type DF2a peristaltic pumps are to be controlled. The sample water flow is to be monitored and upon failure, the controller should stop.

Components of the measuring/control station

Quantity		See page	Order no.
1	1 channel controller D1Cb, pH	→ 2-18	D1CBW00601010VP5010M21EN
1	pH sensor PHES 112 SE	→ 1-11	150702
1	Cable combination coax 2 m - SN6, preconf.	→ 2-70	1024106
1	1 channel controller D1Cb, ORP	→ 2-18	D1CBW00601010VR5010M21EN
1	ORP sensor RHES-Pt-SE	→ 1-33	150703
1	Sensor connection cable, coaxial 2 m, SN 6 pre-assembled	→ 1-113	1005672
1	In-line probe housing DGMa with sample water scale and limit switch	→ 1-120	DGMa 320T000
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

Benefits

- Simple operation, controller with plain text operator guidance in 22 languages
- Automatically correct pH value and correct concentration of disinfectant
- All products are matched

Private swimming pool with measurement and metering of acid and bromine

Tasks and applications

The pool water of a private outdoor swimming pool, used for only a short time every year, is to be treated. Sulphuric acid is used to correct the pH and bromine (BCDMH) is used as a disinfectant, that is dissolved and dosed via a bromine sluice. The disinfectant is to be regulated on the basis of a bromine measurement (a comparative calibration using a DPD 1 measuring unit should be carried out at regular intervals, likewise calibration of the pH sensor). The measured values are to be recorded. A DF2a peristaltic pump for pH correction and the solenoid valve of a bromine sluice are to be controlled. The sample water flow is to be monitored and upon failure, the controller should stop.

Components of the measuring/control station

Quantity		See page	Order no.
1	1 channel controller D1Cb, pH	→ 2-18	D1CBW00601010VP5010M21EN
1	pH sensor PHES 112 SE	→ 1-11	150702
1	Sensor connection cable, coaxial 2 m, SN 6 pre-assembled	→ 1-113	1005672
1	1 channel controller D1Cb, bromine	→ 2-18	D1CBW00601010VB1010M21EN
1	Bromine sensor BCR 1-mA-10 ppm	→ 1-68	1041698
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122
1	In-line probe housing DGMa with sample water scale and limit switch	→ 1-120	DGMa311T000
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

2.2 Controller DULCOMETER® D1Cb/D1Cc

Benefits

- Simple operation, controller with plain text, operator guidance in 22 languages, display of measured data
- Automatically correct pH value and correct disinfectant concentration
- All products are selected to operate correctly with each other

Private swimming pool with measurement of free chlorine and pH value

Tasks and applications

The pool water of a frequently-used private indoor swimming pool is to be treated. Sulphuric acid is used to correct the pH and sodium-calcium hypochlorite is used as a disinfectant. The disinfectant is to be regulated on the basis of the chlorine concentration (a comparative calibration with a DPD 1 measurement should be carried out at regular intervals, likewise calibration of the pH sensor). Beta® 4b metering pumps are to be controlled.

Components of the measuring/control station

Quantity		See page	Order no.
1	1 channel controller D1Cb, pH	→ 2-18	D1CBW00601010VP5010M21EN
1	pH sensor PHES 112 SE	→ 1-11	150702
1	Sensor connection cable, coaxial 2 m, SN 6 pre-assembled	→ 1-113	1005672
1	1 channel controller D1Cb, chlorine	→ 2-18	D1CBW00601010VC5010M21EN
1	Chlorine sensor CLE 3-mA 2 ppm	→ 1-51	792920
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122
1	In-line probe housing DGMa with sample water scale and limit switch	→ 1-120	DGMa311T000
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

Benefits

- Simple operation, controller with plain text operator guidance
- Automatically correct pH value and direct measurement and control of chlorine concentration
- All products are matched

Oxidation of well water with hydrogen peroxide

Tasks and applications

The water of a decorative well or fountain is to be disinfected/oxidised using hydrogen peroxide. The addition of hydrogen peroxide is to be measured. Metering is dependent on the measured value.

If with a control variable of 60% the setpoint is reached after 1 hour, then metering should enter the basic load settings and an alarm should be set (a calibration of the hydrogen peroxide sensor using a comparative measurement is required at regular intervals).

Components of the measuring/control station

Quantity		See page	Order no.
1	1 channel controller D1Cb, bromine	→ 2-18	D1CBW00601010VH1010M21EN
1	Hydrogen peroxide sensor PER 1-mA-50 ppm	→ 1-83	1030511
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122
1	In-line probe housing DGMa with sample water scale and limit switch	→ 1-120	DGMa311T000
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

Benefits

- Simple operation, controller with plain text operator guidance
- If the setpoint has not been reached within 1 hour, the dosing monitor signals via the alarm relay and sets control to an adjustable basic load
- All products are matched

2.2.8 Application Examples, Potable Water Monitoring

Waterworks with control measurement of chlorine

Tasks and applications

The chlorine concentration in the outlet of a water works is to be monitored. Metering is performed with the volume proportional to the water flow. A MID in magnetic flow meter with a 4-20 mA output signal directly controls a metering pump.

If the setpoint is not reached for at least 5 minutes, then a limit value relay should switch and signal via a signal generator that the stroke length of the metering pump must be increased. Conversely, monitoring should also be performed to determine if too much chlorine has been dosed (calibration of the chlorine sensor should be performed at regular intervals by means of a DPD 1 comparative measurement).

Components of the measuring/control station

Quantity		See page	Order no.
1	1 channel controller D1Cb, chlorine	→ 2-18	D1CBW00601010VD1010G21EN
1	Chlorine sensor CLE 3-mA-0.5 ppm	→ 1-51	792927
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122
1	DGMa in-line probe housing with sample water limit contact	→ 1-120	DGMa301T000
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

Benefits

- Simple operation, controller with plain text operator guidance
- Signalling via a limit value relay if the setpoint has been reached after 5 minutes.
- All products are matched

Legionella prevention in public buildings

Tasks and applications

The chlorine dioxide and the chlorite concentration are to be monitored and recorded in the fresh water distribution system of a public building for the prevention of Legionella. Chlorite is a disinfection by-product of chlorine dioxide that arises if germs have been killed. The chlorite concentration is limited using a limit value of 0.2 mg/l.

Components of the measuring/control station

Quantity		See page	Order no.
1	1 channel controller D1Cb, chlorine dioxide	→ 2-18	D1CBW00601010VD1010M21EN
1	Chlorine dioxide sensor CDE 2-mA-0.5 ppm	→ 1-71	792930
1 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122
1	1 channel controller D1Cb, chlorite	→ 2-18	D1CBW00601010VI1010M21EN
1	Chlorite sensor CLT 1-mA-0.5 ppm	→ 1-75	1021596
1 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122
1	DGMa in-line probe housing with sample water limit contact	→ 1-120	DGMa302T000
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

Benefits

- Simple operation, controller with plain text operator guidance
- Upon exceeding of the chlorite limit value, a limit value relay switches the chlorine dioxide off or to a basic load.
- All products are matched

2.2 Controller DULCOMETER® D1Cb/D1Cc

Oxidation of well water with hydrogen peroxide

Tasks and applications

The water drawn from a deep well is to be oxidised using hydrogen peroxide. The addition of hydrogen peroxide is to be measured. Metering is dependent on the measured value.

If with a control variable of 60% the setpoint is reached after 1 hour, then metering should enter the basic load settings and an alarm should be set (a calibration of the hydrogen peroxide sensor using a comparative measurement is required at regular intervals).

Components of the measuring/control station

Quantity		See page	Order no.
1	1 channel controller D1Cb, hydrogen peroxide	→ 2-18	D1CBW00601010VH1010G21EN
1	Hydrogen peroxide sensor PER 1-mA-50 ppm	→ 1-83	1030511
2 m	Control line LiYY 2 x 0.25 mm^2 Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122
1	DGMa in-line probe housing with sample water limit contact	→ 1-120	DGMa301T000
2 m	Control line LiYY 2 x 0.25 mm^2 Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

Benefits

- Simple operation, controller with plain text operator guidance
- If the setpoint has not been reached within 1 hour, the dosing monitor signals via the alarm relay and sets control to an adjustable basic load
- All products are matched

2.2.9 Application Examples, Waste Water Monitoring

Neutralisation of the waste water of an industrial plant

Tasks and applications

In an industrial plant, waste water arises in an intermittent manner (batch production), and can be acidic or alkaline. The water is collected in a storage tank. There is a stirrer in the storage tank, a pH immersion fitting with wet holding cup, based on which the pH value is adjusted. The discharge connecting piece, which can be closed off using a shut-off valve with a limit switch, of a storage tank contains a pH sensor with a pH changeover device, which is used for the final check.

If a limit value transgression occurs, the shut-off valve closes automatically. Additionally, a neutral zone is defined in the controller. If the pH value comes within this neutral zone, no control takes place. There may be solids in the waste water.

Components of the pH measuring/control station in the collection tank

Quantity		See page	Order no.
1	1 channel controller D1Cb, pH	→ 2-18	D1CBW00601010VP5010M21EN
1	DULCOTEST® pH sensor PHER 112 SE	→ 1-15	1001586
1	Cable combination coaxial 5 m - SN6 - pre-assembled	→ 1-113	1024107
1	Temperature sensor Pt 100 SE	→ 1-46	305063
1	Cable combination controller cable 5 m - S SN6, open-ended (Pt 100, Pt 1000)	→ 1-114	1003208
1	Immersion fitting with 3 sensor slots IPHa 3-PP	→ 1-123	1008602
1	Cable combination coaxial 5 m - SN6 - pre-assembled	→ 1-123	1008633

Components of the measuring/control station in the outlet

Quantity		See page	Order no.
1	1 channel controller D1Cb, pH	→ 2-18	D1CBW00601010VP5010M21EN
1	DULCOTEST® pH sensor PHER 112 SE	→ 1-15	1001586
1	Cable combination coaxial 5 m - SN6 - pre-assembled	→ 1-113	1024107
1	Retractable process assembly WA-PH 1	→ 1-128	1020631

Note: The use of other sensors is also possible depending on the quality of the waste water (see Selection Guide for pH Sensors DULCOTEST®)

With seriously contaminated waste water with solid matter content

Quantity	Name	See page	Order no.
1	pH sensor PHEX 112 SE	→ 1-16	305096

With clear waste water

Quantity	Name	See page	Order no.
1	pH sensor PHEP 112 SE	→ 1-13	150041

Benefits

- The waste water pH value is within the specified limit values
- Simple operation, controller with plain text operator guidance in 22 languages
- pH limit value monitoring for the waste water
- All products are matched

2.2.10 Application Examples in the Food Industry

Bottler disinfection in the beverage industry

Tasks and applications

Continuous disinfection of the filler with disinfection solution means this sensitive part of the bottling process is reliably sterilised. Continuous spraying with disinfectant solution means high hygiene requirements are fulfilled.

The disinfectant solution comprises water with additional chlorine dioxide. The concentration of the chlorine dioxide is measured and set to the desired value using the D1Cb controller.

Components of the measuring/control station

Quantity		See page	Order no.
1	1 channel controller D1Cb, chlorine	→ 2-18	D1CBW00601010VD1010G21EN
1	Chlorine dioxide sensor CDR 1-mA-2 ppm	→ 1-73	1033393
5 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122
1	DGMa in-line probe housing with sample water limit contact	→ 1-120	DGMa301T000
5 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

Benefits

- Hygienic trouble-free bottling
- Simple operation, controller with plain text operator guidance in 22 languages
- All products are matched

Irrigation water disinfection for useful plants

Tasks and applications

The irrigation water from e.g. salad seedlings is drawn from a well. The water could be contaminated with germs which could harm the salad seedlings. To prevent this, the irrigation water is disinfected using chlorine dioxide. The irrigation water requirement is always constant.

The irrigation water may contain suspended matter.

Components of the measuring/control station

Quantity		See page	Order no.
1	1 channel controller D1Cb, chlorine	→ 2-18	D1CBW00601010VD1010G21EN
1	Chlorine dioxide sensor CDR 1-mA-2 ppm	→ 1-73	1033393
5 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122
1	DGMa in-line probe housing with sample water limit contact	→ 1-120	DGMa301T000
5 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

Benefits

- Irrigation water does not harm the seedlings
- Simple operation, controller with plain text operator guidance in 22 languages
- Switchover of control parameters via an external potential-free contact
- All products are matched

2.3 Controller DULCOMETER® Compact

2.3.1 Controller DULCOMETER® Compact

Compact yet fully equipped - the basic water analysis unit

As a controller in water analysis, the DULCOMETER® Compact is the correct controller for control tasks that require only a 1 way control.

The DULCOMETER® Compact controller is a one-channel PID controller for the measured variables pH, ORP, chlorine and inductive conductivity. It can monodirectionally control the measured variable, monitor limit values and transmit the measured value via an mA output, e.g. to a PLC. The mA output can optionally also be configured as a controlled variable output. The controller has one pulse frequency output to control one metering pump. One output relay can optionally be used as an alarm or limit value or to control motor-driven metering pumps or solenoid valves. A digital input is used to switch off the control or to process a sample water limit contact by remote control. The impact of temperature on the measurements can be provided by temperature measurement or by manual input. Menu-driven operation is language-independent.

Your benefits

- Flexibility in the choice of measured variable with pH and ORP
- Always the optimum measured value resolution by auto-ranging with conductivity measurement
- Depending on the requirement, various display options for conductivity, such as: Conductivity, TDS (Total Dissolved Solids), salinity and specific resistance
- Safety through sensor monitoring of pH for glass breakage and line breakage
- Various installation options: wall-mounted, installation on an upright or in a control cabinet

P_DM_0025_SW1

Technical details

- Measured variables: pH, ORP, chlorine, conductive and inductive conductivity
- Method of installation, degree of protection: Combination housing (wall mounting, control panel mounting, pillar assembly) IP 67, control panel IP 54
- Measurement: 1 measuring channel, temperature compensation for conductivity and pH
- Control: PID controller, monodirectional controller (e.g. with pH acid or alkali)
- Control inputs: 1 digital control input

Field of application

- Measurement and control of water parameters in industrial and process water treatment plants
- Permeate monitoring in reverse osmosis systems
- Measurement and control of the hygiene parameters in swimming pools

Technical Data

Measuring range	pH: 0.00 ... 14 ORP: -1000 ... +1000 mV Chlorine: 0.05 ... 5 ppm, intermittent metering up to 10 ppm, max. 12 h Conductive conductivity: 0.5 µS/cm ... 20 mS/cm (auto-ranging) Inductive conductivity with ICT 1: 200 µS/cm ... 1000 mS/cm (auto-ranging) Inductive conductivity with ICT 2: 20 µS/cm ... 2000 mS/cm (auto-ranging)
Resolution	pH: 0.01 pH ORP: 1 mV Chlorine: 0.01 ppm Conductivity: 0.1 µS/cm (depends on the measuring range)
Accuracy	0.5% of the upper range value
Temperature compensation range	0 ... 120 °C, chlorine 1 ... 45 °C
Control	Monodirectional PID control with selectable control direction
Inputs	Sensor input for the relevant measured variable Temperature sensor input: pH: Pt 1000, chlorine and conductivity: Pt 100/ Pt 1000 1 digital input as a remote control input for the functions pause control / sample water fault

2.3 Controller DULCOMETER® Compact

Outputs	1 pulse frequency output for the control of metering pumps 1 active 0/4…20 mA output configurable as a measured or control variable, max. load: 400 Ω 1 output relay used as a changeover contact, can be configured as an alarm, limit value or pulse width-modulated control output for motor-driven metering pumps
Cell constant, conductive conductivity	0.05 ... 12.0 cm^{-1}
Voltage supply	100-240 V ±10%, 50/60 Hz, 5 W
Permissible operating temperature	-10 ... +60 °C
Enclosure rating	IP 67, based on NEMA4X
Dimensions	135 x 125 x 75 mm (H x W x D)
Weight	0.5 kg

2.3.2 Identity Code Ordering System DULCOMETER® Compact, Wall Mounting IP 67

DCCa	Type of mounting								
	W	Wall/pipe mounting IP 67							
	S	With fitting kit for control panel mounting IP 54							
		Design							
		00	With ProMinent® logo						
			Operating voltage						
			6	90 … 253 V, 48/63 Hz					
				Measured variable					
				C0	Free chlorine				
				PR	pH/ORP (switchable)				
				L3	Conductive conductivity (unit designation: COND_C)				
				L6	Inductive conductivity (unit designation: COND_I)				
					Hardware extension				
					0	None			
						Certifications			
						01	CE (Standard)		
							Certificates		
							0	None	
								Documentation language	
								DE	german
								EN	english
								ES	spanish
								IT	italian
								FR	french
								FI	finnish
								BG	bulgarian
								CN	chinese
								CZ	czech
								GR	greek
								HU	hungarian
								JP	japanese
								KR	korean
								LT	lithuanian
								LV	latvian
								NL	dutch
								PL	polish
								PT	portuguese
								RO	romanian
								RU	russian
								SE	swedish
								SK	slovakian
								SI	slovenian
								SV	Swedish
								TH	thai

Accessories

Name of the item	Order no.
Cable combination coaxial 0.8 m - SN6 - pre-assembled *	1024105
Cable combination Coaxial 2 m - SN6 (open end) - pre-assembled *	1024106
Cable combination coaxial 5 m - SN6 - pre-assembled *	1024107
Panel mounting kit DCCa	1037273
Chlorine sensor CLB 2-µA-5 ppm	1038902
Chlorine sensor CLB 3-µA-5 ppm	1041696

2.3 Controller DULCOMETER® Compact

2.3.3 Application and Ordering Examples for the DULCOMETER® Compact

The application examples contain typical combinations of components for measuring stations in applications in the areas of swimming pool, drinking water and waste water.

Components of a complete measuring and control system

1 Treatment of swimming pool water and decorative wells/fountains

2 Potable water monitoring

3 Treatment and monitoring of waste water (pH neutralisation)

2.3.4 Application Examples, Treatment of Swimming Pool Water

Private swimming pool with measurement and metering of acid and chlorine based on the ORP value

Tasks and applications

The pool water of a private outdoor swimming pool, used for only a short time every year, is to be treated. Sulphuric acid is used to correct the pH and sodium-calcium hypochlorite is used as a disinfectant. The disinfectant is to be regulated on the basis of the ORP value (a comparative check with a DPD 1 measurement should be carried out at regular intervals, likewise calibration of the pH sensor).

Type DF2a peristaltic pumps are to be controlled. The sample water flow is to be monitored and upon failure, the controller should stop.

Components of the measuring/control station

Quantity		See page	Order no.
1	Compact controller for pH	→ 2-31	DCCaW006PR0010EN
1	pH sensor PHES 112 SE	→ 1-11	150702
1	Cable combination coax 2 m - SN6, preconf.	→ 2-70	1024106
1	Compact controller for ORP	→ 2-31	DCCaW006PR0010EN
1	ORP sensor RHES-Pt-SE	→ 1-33	150703
1	Sensor connection cable, coaxial 2 m, SN 6 pre-assembled	→ 1-113	1005672
1	In-line probe housing DGMa with sample water scale and limit switch	→ 1-120	DGMa 320T000
4 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

Benefits

- Operation is simple and independent of the operating language
- Automatically correct pH value and correct concentration of disinfectant
- All products are matched

Private swimming pool with measurement of free chlorine and pH value

Tasks and applications

The pool water of a frequently-used private indoor swimming pool is to be treated. Sulphuric acid is used to correct the pH and sodium-calcium hypochlorite is used as a disinfectant. The disinfectant is to be regulated on the basis of the chlorine concentration (a comparative calibration with a DPD 1 measurement should be carried out at regular intervals, likewise calibration of the pH sensor). Beta® 4b metering pumps are to be controlled.

2.3 Controller DULCOMETER® Compact

Components of the measuring/control station

Quantity		See page	Order no.
1	Compact controller for pH	→ 2-31	DCCaW006PR0010EN
1	pH sensor PHES 112 SE	→ 1-11	150702
1	Sensor connection cable, coaxial 2 m, SN 6 pre-assembled	→ 1-113	1005672
1	Compact controller for chlorine	→ 2-31	DCCaW006C00010EN
1	CLB 2-µA-5 ppm	→ 1-58	1038902
1	In-line probe housing DGMa with sample water scale and limit switch	→ 1-120	DGMa 320T000
4 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

Benefits

- Operation is simple and independent of the operating language
- Automatically correct pH value and direct measurement and control of chlorine concentration
- All products are matched

2.3.5 Application Examples, Potable Water Monitoring

Waterworks with control measurement of chlorine and pH

Tasks and applications

The chlorine concentration in the outlet of a water works is to be monitored. Metering is performed with the volume proportional to the water flow. A magnetically induced flow meter with a 4-20 mA output signal directly controls a metering pump.

If the setpoint is not reached for at least 5 minutes, then a limit value relay should switch and signal via a signal generator that the stroke length of the metering pump must be increased. Conversely, monitoring should also be performed to determine if too much chlorine has been dosed (calibration of the chlorine sensor should be performed at regular intervals by means of a DPD 1 comparative measurement).

Components of the chlorine measuring/control station

Quantity		See page	Order no.
1	Compact controller for chlorine	→ 2-31	DCCaW006C00010EN
1	CLB 2-µA-5 ppm	→ 1-58	1038902
1	DGMa in-line probe housing with sample water limit contact	→ 1-120	DGMa 310T000
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

Components of the pH measuring/control station

Quantity		See page	Order no.
1	Compact controller for pH	→ 2-31	DCCaW006PR0010EN
1	DULCOTEST® pH-Sensor PHEP-112-SE	→ 1-13	150041
1	Sensor connection cable, coaxial 2 m, SN 6 pre-assembled	→ 1-113	1005672
1	DGMa in-line probe housing with sample water limit contact	→ 1-120	DGMa 310T000
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

Benefits

- Operation is simple and independent of the operating language
- Signalling via a limit value relay if the setpoint has been reached after 5 minutes.
- All products are matched

Waterworks with control measurement of conductivity

Tasks and applications

The conductive conductivity in the outlet of a water works is to be monitored. The measured value is to be transmitted to a PLC via a 4-20 mA analogue signal.

Components of the measuring/control station

Quantity		See page	Order no.
1	Compact controller for conductive conductivity	→ 2-31	DCCaW006L30010EN
1	Conductivity sensor measuring range 20 mS/cm, type LFTK 1	→ 1-98	1002822
1	Screened sensor cable LF, 5 m	→ 1-114	1046026
1	DGMa in-line probe housing with sample water limit contact	→ 1-120	DGMa 310T000
2 m	Control line LiYY 2 x 0.25 mm² Ø 4 mm 2 m (e.g.: flow sensor)	→ 1-115	725122

Benefits

- Operation is simple and independent of the operating language
- Signalling via a limit value relay if the setpoint has been reached after 5 minutes.
- All products are matched

2.3.6 Application Examples, Waste Water Monitoring

Neutralisation of the waste water of an industrial plant

Tasks and applications

In an industrial plant, waste water arises in an intermittent manner (batch production), the water is always acidic (or always alkaline). The water is collected in a storage tank. There is a stirrer in the storage tank, a pH immersion fitting with wet holding cup, based on which the pH value is adjusted. The storage tank discharge connecting piece contains a pH sensor with a pH changeover device, which is used for the final check.

The control is one-way, i.e. acidic or alkaline. There may be solids in the waste water. The measured values are transferred via the 4-20 mA analogue signal.

Components of the pH measuring/control station in the collection tank

Quantity		See page	Order no.
1	Compact controller for pH	→ 2-31	DCCaW006PR0010EN
1	DULCOTEST® pH sensor PHER 112 SE	→ 1-15	1001586
1	Cable combination coaxial 5 m - SN6 - pre-assembled	→ 1-113	1024107
1	Pt 1000 Temperature sensor	→ 1-46	1002856
1	Cable combination controller cable 5 m - S SN6, open-ended (Pt 100, Pt 1000)	→ 1-114	1003208
1	Immersion fitting with 3 sensor slots IPHa 3-PP	→ 1-123	1008602

Components of the measuring/control station in the outlet

Quantity		See page	Order no.
1	Compact controller for pH	→ 2-31	DCCaW006PR0010EN
1	DULCOTEST® pH sensor PHER 112 SE	→ 1-15	1001586
1	Cable combination coaxial 5 m - SN6 - pre-assembled	→ 1-113	1024107
1	Retractable process assembly WA-PH 1	→ 1-128	1020631

Note: The use of other sensors is also possible depending on the quality of the waste water (see Selection Guide for pH Sensors DULCOTEST®)

2.3 Controller DULCOMETER® Compact

For seriously contaminated waste water with solid matter content

Quantity	Name	See page	Order no.
1	pH sensor PHEX 112 SE	→ 1-16	305096

For clear waste water

Quantity	Name	See page	Order no.
1	pH sensor PHEP 112 SE	→ 1-13	150041

Benefits

- Operation is simple and independent of the operating language
- pH limit value monitoring for the waste water
- All products are matched

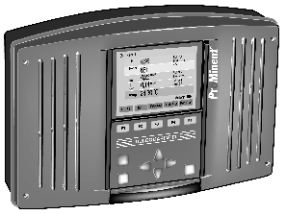
2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

2.4.1 Controller DULCOMARIN® II

Transparency in water analysis in the Dialog controller for up to 16 x 10 measuring points.

Controller DULCOMARIN® II for water analysis: Green technology with energy and chemical saving function. Control of circulating pumps and filter backwash is possible.

The ProMinent DULCOMARIN® II control system manages your entire swimming pool and your hot tub: from water treatment to filter control, pool cover, attractions, water heating, solar control, pool and external lighting. System information and messages are clearly and graphically visualised on the coloured display. At the same time, the information can also be transmitted via the internet to a tablet PC or smartphone. Coupling to a building bus is simply possible via KNX, PROFIBUS®-DP, Modbus RTU or OPC. Based on the modern bus technology DULCO®-NET, the system is capable of growing to meet requirements and can be extended at any time. The application can be used in high-end private pools, school or hotel swimming pools or even in public leisure pools. Depending on requirements, a potable water treatment system or legionella prevention system can also be integrated. Almost all customer requirements can be met thanks to the integral SoftPLC. The DISINFECTION controller version can be used for general water treatment tasks.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Your benefits

- Visualisation made simple: with the embedded web server and a standard web browser
- Simple connection to your PC or PC network or the internet via a LAN interface
- Operation via Apple® iPod, iPad (WLAN access point necessary)
- Control of up to 16 sub-systems, each with 10 measuring parameters, in potable water systems or filter circuits in swimming pools or with general water treatment tasks
- Customer-specific adjustments are possible: A SoftPLC conforming to IEC 61131 also enables customer-specific process control to be integrated in addition to integral processing.
- View current and historical measured data directly on the controller: the integral data logger with screen plotter permits this
- Simply transmit measured data to a PC as standard: SD card and card reader for PC always included
- Simple wiring and subsequent expandability thanks to DULCO°NET bus system
- Intelligent sensors: save sensor data and always be in the optimum measuring range with auto-ranging
- Intelligent metering pumps: find information on operating parameters, such as: Chemical level status and pump capacity in the metering range of 0.74 l/h to 1,030 l/h
- Coupling to a PLC via a PROFIBUS°-DP and Modbus RTU

Technical details

- Measured variables: pH, ORP, free chlorine, total chlorine, combined chlorine, bromine, chlorine dioxide, chlorite anion and temperature
- Accuracy: 0.5% of the upper range value
- Control characteristic: P/PI/PID control
- Digital inputs: 5 potential-free inputs
- Signal current output: 4 x 0/4-20 mA
- Interfaces: LAN, SD expansion slot

Field of application

- Measurement and control of the hygiene parameters in swimming pools
- Monitoring of the water parameters in potable waterworks
- Monitoring of the chlorine dioxide concentration in systems for legionella control and prevention, for example in schools, hotels or hospitals

The applications are defined in the identity code

Every potable water system or every filtration circuit has a proprietary on-site calibration option for all measured variables.

What is the Eco!Mode operating mode?

Eco!Mode permits lowering of the circulation capacity when the DIN hygiene parameters pH, ORP, free chlorine and combined chlorine are within the permitted limits.

A circulating pump with frequency converter with analogue input is needed for this.

The reduction can be activated via a remote control, dependent on the DIN hygiene parameters being observed, the time and appropriate activation. A combination of criteria is also possible. If the DIN hygiene parameters are no longer adhered to, then the circulation capacity is again raised to the nominal power.

Lowering pump capacity saves energy and, in so doing, reduces CO_2 emissions.

In addition, upon reaching an adjustable redox potential, e.g. 780 mV, which signals effective disinfection of the water, chlorine metering is reduced either gradually or in one step. If the DIN hygiene parameters are no longer adhered to, then the chlorine metering is again raised to the normal setpoint.

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

What is a web server?

A web server is a software application executed by the DULCOMARIN® II.

The web server delivers web pages with information about measurements, control, sensor calibration and control configuration to a PC with a web browser (e.g. Microsoft® Internet Explorer).

The web server enables simple and straightforward visualisation of the DULCOMARIN® II, without special visualisation software being required on the PC. The web server is independent of the PC's operating system.

The DULCOMARIN® II is connected to a PC via a LAN/Ethernet interface. This connection can be made directly, via a network or via the internet. The cables needed for direct connection to a PC or network connection are included in the option.

Standard commercially available network components can be used as accessories for cables, routers and WLAN access points etc.

The same information can be accessed via the web server as is available on the DULCOMARIN® II itself, for instance changing setpoints for all control variables, switching off the different controllers and entering names for the pools/systems. The exceptions are the control settings and bus configuration that can only be entered directly on the controller.

What is OPC?

OPC stands for Openness, Productivity, Collaboration (formerly OLE for Process Control) and is used to describe a uniform software interface independent of specific manufacturers. OPC Data Access (OPC DA) is based on Windows COM (Component Object Model) and DCOM (Distributed Component Object Model) technology. OPC XML, in contrast, is based on the internet standards XML, SOAP and HTTP.

OPC is used wherever sensors, controllers and controls supplied by different manufacturers are used to create a common, flexible network. Without OPC, two devices would require precise knowledge about the communication options of the other device to be able to exchange data and extensions and exchanges would be correspondingly difficult. With OPC it is sufficient to write an OPC-compliant driver just once for each device. Ideally this is provided by the manufacturer. An OPC driver can be integrated without extensive adaptation into any large control and monitoring systems.

ProMinent supplies an OPC server/driver, such as this, for the multi-channel control system DULCOMARIN® II.

The examples shown in the following are suitable for applications in potable water treatment and in swimming pool technology.

Technical Data

Measuring range	pH -1...15 ORP: -1,200 ... +1,200 mV Chlorine, free 0.01...10 ppm/100 ppm Chlorine, total 0.01...10 ppm Chlorine, combined 0.01... 2.00 ppm Bromine: 0.01...10 ppm Chlorine dioxide: 0.01...10 ppm Chlorite anion: 0.10...2 ppm
Temperature	-20 … 150 °C Pt 100 or Pt 1000
Resolution	0.01 pH / 1 mV / 0.01 ppm / 0.1 °C
Accuracy	0.5% of the final value of the measuring range (at 25 °C)
Measurement input	ph and ORP via terminal mV Chlorine via CANopen bus
Control characteristic	P/PI/PID control, intelligent control
Control	Acid and/or alkali and chlorine (2 control circuits), temperature
Digital inputs	5 potential-free inputs (sample water, pause, 3 pump failures, 2nd parameter set)
Signal current output	4 x 0/4-20 mA max. load 600 Ω range adjustable. **Important: An isolating amplifier, e.g. part no. 1033536, is required for connecting to devices that are not electrically isolated.**
Control outputs	3 reed contacts for acid, alkali or flocculants and chlorine (pulse frequency to control metering pumps) 3 relays (pulse length) contact type changeover to control solenoid valves or peristaltic pumps
Alarm relay	250 V ~3 A, 700 VA contact type, changeover
Interfaces	LAN, SD-expansion slot

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

Electrical connection	100...240 V~, 50/60 Hz
Permissible ambient temperature	-5…45 °C
Storage temp.	-10…70 °C
Enclosure rating	IP 65
Climate	Permissible relative humidity: 95% non-condensing DIN IEC 60068-2-30
Dimensions H x W x D	227 x 342 x 78 mm

Compliance of all devices with CANopen specifications:

On the hardware side, all devices comply with the harmonised CAN specification 2.0 (ISO99-1, ISO99-2). This includes the CAN protocol (ISO 11898-1) and details on the physical layer in compliance with ISO 11898-2 (high speed CAN up to 1 Mbit/sec) and ISO 11898-3 (low speed CAN up to 125 kBit/sec). The unit complies with the CAN-Open specification CIA-DS401 that forms the basis of the European standard EN50325-4 and also complies with the controller device profile CiA-404.

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

2.4.2 Controller DULCOMARIN® II

The DULCOMARIN® II multi-channel measuring and control system is suitable for 1 to 16 filtration circuits or potable water systems. The following bus modules are available for the control:

M module (measurement and control):

- Measurement and control of the pH value
- Measurement and display (optional control) of the ORP
- Measurement and display of the temperature of the sample water
- Sample water monitoring
- Measurement of free chlorine
- Measurement of combined chlorine (optional, calculated from total chlorine and free chlorine)

Chlorine sensors:

- Measurement of free chlorine and temperature
- Measurement of total available chlorine and temperature
- Measurement of combined chlorine as differential chlorine measurement

A module (control of metering pumps, analogue outputs):

- 3 frequency outputs to control metering pumps for pH correction, disinfection and flocculant metering
- 3 contact inputs to process pump alarm relays or tank fill level monitoring
- 4 freely programmable analogue outputs 0/4…20 mA for pH, ORP, free chlorine, combined chlorine or temperature

P module (controlling of peristaltic pumps, power supply of bus modules):

- Power relay pulse length control for pH value (e.g. control of the peristaltic pump)
- Power relay pulse length control of disinfectant (e.g. control of the chlorine electrolysis plant)
- Power relay limit value output to minimise combined chlorine
- Alarm relay
- Power supply of bus modules

N module (power supply of bus modules):

- Power supply of bus modules with no further function

R module (control of the chlorine gas metering units):

- Control of a chlorine gas metering unit and processing of a position feedback potentiometer (0…10 kΩ) (only possible as external module)

Metering pumps with CANopen interface of type Beta®, delta®, Sigma/ 1, Sigma/ 2, and Sigma/ 3

- Direct connection to the bus
- When using Beta/4aCANopen metering pumps, the A module is not required (provided no current outputs are required).

I module (current input module)

- 2 active/passive current inputs (e.g. for the connection of 2-wire transmitters)
- 1 passive current input (e.g. for the connection of a magnetic-inductive flow meter)
- 2 digital inputs for sample water alarm and pause control
- 1 channel with controller function

F module (functional module)

The F module consolidates functions and also extends these functions

The following functions can be provided by the F module (you can find details on this in the individual application examples in the assembly and operating instructions):

- Control of circulation operation (depending on the weekday and the time of day)
- Automatic backwashing (depending on the weekday and the time of day)
- Discharge of first filtrate
- Lowering of the water level during idle operation
- Circulation flow control (Flowcontrol)
- IO module for SoftPLC
- Water level control
- Sample water valve
- Heating function
- Gutter cleaning function
- Attractions
- Flow control
- Control variables

PROFIBUS®-DP V1 gateway

Modbus RTU gateway

KNX gateway

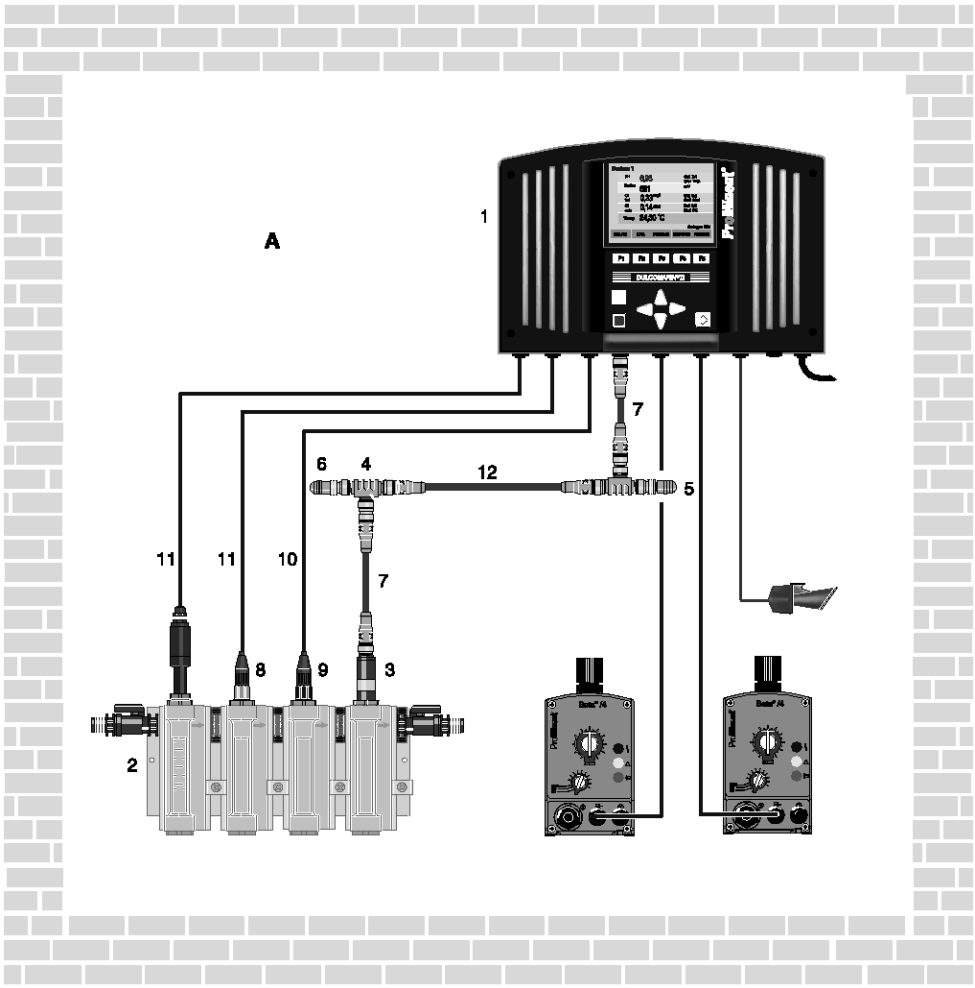
SMS, email alarm signalling via mobile phone GPRS/EDGE – LAN router with web server visualisation

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

Configuration example: 1-pool system

This example of a measuring and control system for pH, ORP, free chlorine and temperature shown for a filter circuit consists of the following components (without chemical fluid handling):

A Plant room



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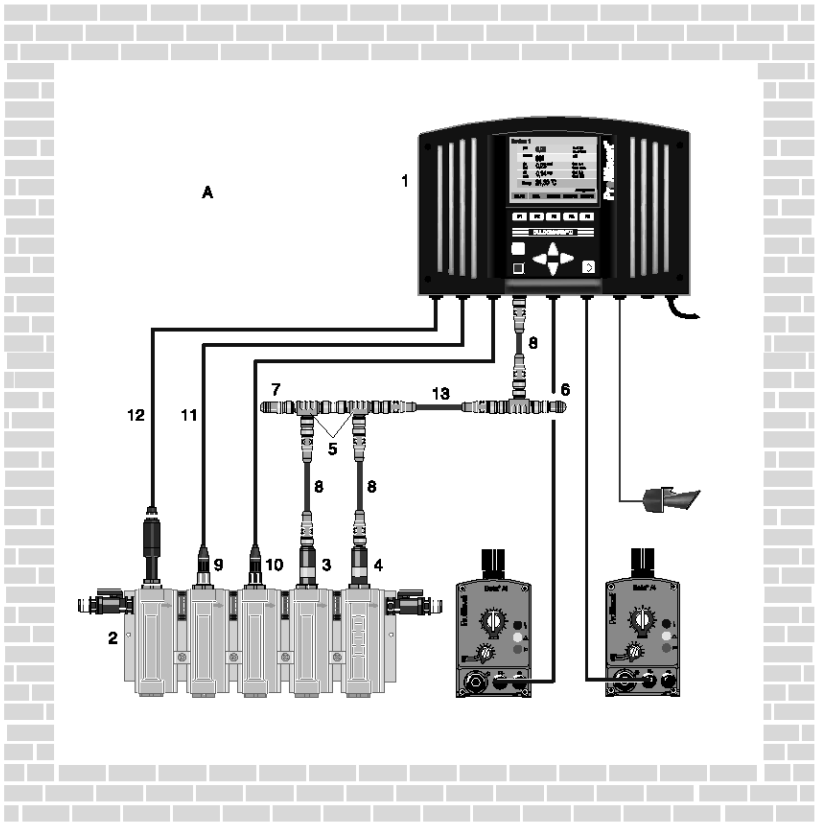
Item	Quantity	Name	Order no.
1	1	DULCOMARIN® II central unit with measuring and control modules DXCa W 0 0 1 M A P S EN 01	–
2	1	DULCOTEST® in-line probe housing DGMa 3 2 1 T 0 0 0	–
3	1	Chlorine sensorCLE 3-CAN-10 ppm	1023425
4	3	T-distributor M12 5 pol. CAN	Included in delivery
5	1	Temination resistance M12 connector	Included in delivery
6	1	Temination resistance M12 plug	Included in delivery
7	3	Connection cable - CAN M12 5 way 0.5 m	Included in delivery
8	1	pH sensor PHES 112 SE	150702
9	1	ORP sensor RHES-Pt-SE	150703
10	2	Cable combination Coaxial 2 m - SN6 (open end) - pre-assembled	1024106
11	2 m	Signal cable, sold by the metre 2 x 0.25 mm^2 Ø 4 mm	725122
12	–	Connecting cable - CAN, sold by the metre	1022160

Example 2

This example of a measuring and control system for pH, ORP, free and combined chlorine and temperature shown for a filter circuit consists of the following components (without chemical fluid handling):

A Plant room



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Item	Quantity	Name	Order no.
1	1	DULCOMARIN® II central unit with measurement and actuation modules DXCa W 0 0 1 M A P S EN 01	–
2	1	DULCOTEST® in-line probe housingDGMa 3 2 2 T 0 0 0	–
3	1	Chlorine sensor CTE 1-CAN-10 ppm	1023427
4	1	Chlorine sensor CLE 3.1-CAN-10 ppm	1023426
5	3	T-distributors M12 5 pole CAN	Included in delivery
6	1	Load resistor M12-coupler	Included in delivery
7	1	Load resistor M12-plug	Included in delivery
8	3	Connecting cable - CAN M12 5 pole 0.5 m	Included in delivery
9	1	pH sensor PHES 112 SE	150702
10	1	ORP sensor RHES-Pt-SE	150703
11	2	Cable combination Coaxial 2 m - SN6 (open end) - pre-assembled	1024106
12	2 m	Signal cable, sold by the metre 2 x 0.25 mm^2 Ø 4 mm	725122
13	1	CAN Connection cable	As required

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

2.4.3 Identity Code Ordering System DULCOMARIN® II

DULCOMARIN®II DXC range

DXCa	**Installation**										
	W	Wall mounting (IP 65)									
	S	Control cabinet (IP 54)									
		Version									
		0	With controls								
		D	with operating elements for use in potable water/disinfection applications								
			Communication interfaces								
			0	None							
			5	Embedded web server, LAN including 5 m LAN patch cable 1:1, LAN coupling, 5 m crossover cable [1)]							
			6	OPC server + embedded web server, LAN including 5 m LAN patch cable 1:1, LAN coupling, 5 m crossover cable [1)]							
				Option (the corresponding communications modules are required, see accessories)							
				0	None						
				1	Videographic recorder with data logger including SD card and USB card reader for PC						
				2	SoftPLC function (communication option 5 or 6 needed)						
				3	KNX function (communication option 5 or 6 needed)						
				4	Alarm signalling via text, e-mail (communication option 5 or 6 needed)						
				5	SoftPLC function + KNX function + alarm signalling via text, e-mail (communication option 5 or 6 needed)						
				6	SoftPLC function + alarm signalling via text, e-mail (communication option 5 or 6 needed)						
				7	SoftPLC function + KNX function (communication option 5 or 6 needed)						
				8	KNX function + alarm signalling via text, e-mail (communication option 5 or 6 needed)						
					Module 1						
					M	M module, measuring module for pH, ORP, temperature					
					A	A module, control module: 3 pump and 4 analogue outputs					
					I	I module, current input module, 3 mA, 2 digital inputs					
						Module 2					
						0	Not used				
						A	A module, control module: 3 pump and 4 analogue outputs				
						M	M module, measuring module pH, ORP, temperature				
						I	I module, current input module, 3 mA, 2 digital inputs				
						F	F module, module for filter and attraction control				
							Module 3				
							P	P module, mains power module, 1 alarm relay, 3 solenoid valve relays			
							N	N module, mains power module without relay			
							1	F module occupies module position 3			
								Application			
								S	Swimming pool		
								D	Potable water/disinfection		
									Language default		
									00	no operation	
									DE	German	
									EN	English	
									ES	Spanish	
									FR	French	
									IT	Italian	
									PL	Polish	
									NL	Dutch	
									CZ	Czech	
										Approvals	
										01	CE mark

The identity code describes the **DULCOMARIN® II** controller.

1 The supplied cable is for connection to a hub, switch, router or an intranet.
For direct connection of the DULCOMARIN® II to a PC/MAC, the supplied LAN coupling and category 5 cross-over cable are required.
The maximum LAN cable length is approximately 100 m.
To operate the web server on a PC we recommend Microsoft® Internet Explorer 5 or higher as the browser.
The scope of supply of the DXCa includes:
1 T-coupler, 1 CAN connection cable
1 terminating resistance coupling and
1 terminating resistance plug,
1 SD card, 1 card reader suitable for PCs.

Important note when ordering multi-channel measuring and control systems for potable water and pool water applications:

Potable water applications: In the identity code, a "D" for "Potable water/disinfection" must be selected under "Version" and "Application". The description "System" will appear in the controller menu for the different potable water lines.

Swimming pool water applications: In the identity code, a "0" for "with operating elements" must be selected under "Version" and then an "S" for "Swimming pool" under "Application". The description "Tank" will appear in the controller menu for the different filter circuits.

All adjustment options and the use of the different modules are identical with both applications.

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

2.4.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

The multi-channel multi-parameter measuring and control system DULCOMARIN® II DULCO® Net can, in its top-of-the-range optional version, control 16 potable water systems/filtration circuits, i.e. the necessary external modules for 16 tanks can be connected to and operated by the central unit. The following options are available

Measurement and control of:

Up to 16 times:

- pH value
- ORP potential
- Free chlorine
- Combined chlorine (calculated)
- Temperature of the sample water

Also in potable water applications (using the I module):

- Flow (as disturbance variable for pH and chlorine control)
- UV intensity
- Conductivity
- Chlorine dioxide
- Chlorite
- Ammonia
- Fluoride
- Pt100/Pt1000 resistance thermometer via a transducer

Other inputs and outputs:

Up to 16 times:

- 3 frequency outputs for control of metering pumps for pH-correction, disinfectant and flocculent metering
- 3 contact inputs for processing of pump fault signal relays or container level monitoring
- 4 freely programmable analogue outputs 0/4 … 20 mA (for pH, ORP, free chlorine, combined chlorine or temperature)
- 3 output relays pulse length control of the pH value, the disinfectant and minimisation of the combined chlorine (e.g. control of a peristaltic pump and chlorine electrolysis system and UV system)
- Control of a chlorine gas metering device
- 3 Beta®/4 CANopen metering pumps
- Up to 2 F modules per filter circuit are possible

The CAN bus with CANopen protocol is used as a data transfer medium between the various bus modules. This extremely interference-proof technology was developed by Bosch and is well known from its use in automotive applications. The maximum length of the bus backbone is 400 metres.

A T-coupler is used for connection of one of each bus module (M module, A module, P module, N module, Beta® 4 CANopen metering pumps and CAN chlorine sensors), which connects the devices to the bus backbone via a branching cable.

T-coupler and branching cable are part of the scope of supply of the modules.

All bus modules are supplied via the CAN bus with 24 V operating voltage (with the exception of Beta®/4 CANopen metering pumps, P modules, N modules. These require a separate mains voltage supply).

For this reason, depending on the size of the installation (number of filtration circuits to be controlled), additional P or N modules are required that feed the operating voltage for the bus modules into the bus. The central unit always contains a power supply (N or P module).

How many additional N or P modules do you require?

Number of filtration circuits	Additional N or P modules	Number of filtration circuits	Additional N or P modules
1	–	9	4
2	–	10	5
3	1	11	5
4	2	12	6
5	2	13	6
6	3	14	7
7	3	15	7
8	4	16	8

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

The DULCOMARIN® II can be easily extended by the connection of bus modules.

Which components can a DULCOMARIN® II system comprise?
A DULCOMARIN® II DULCO® Net system comprises:

- DXCa central unit with operating elements

and a customised combination of the following components:

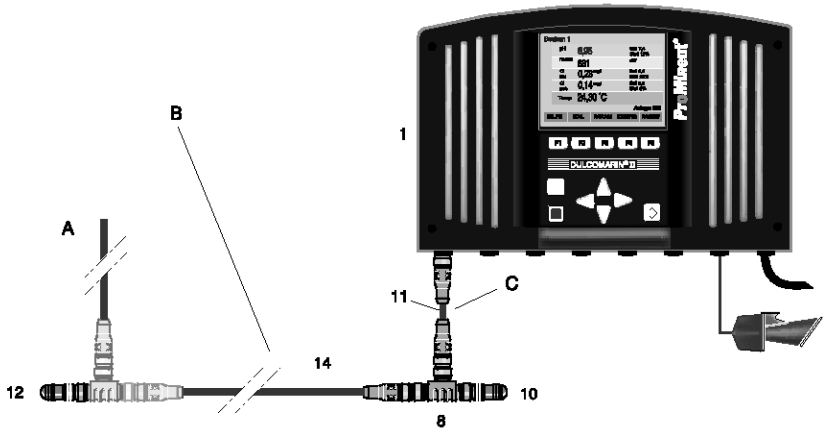
- M module, DXMaM (measuring and control)
- A module, DXMaA (control of metering pumps, analogue outputs)
- P module (module in the DXCa housing for power supply to the modules and alarm relays, output relays for control of, for example, peristaltic pumps)
- N module, DXMaN (power supply to external modules with no other function)
- R module, DXMaR (control of chlorine gas metering devices with response signal processing)
- I module (processing of sensor signals via 0/4...20 mA)
- F module (filter and attraction control)

The maximum bus backbone length is approximately 400 m!

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

2.4.5 Central Unit

A Stub cable
B Main BUS cable
C Stub cable



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The central unit can be installed anywhere, for example in the control room. It serves as an I/O unit (view measuring data, parameterise and configure individual modules). It includes the following functions: standard screen recorder/data logger function, interfaces*, embedded Web server* and power supply. As an option, the central unit can also include an M and an A module if the central unit is also located in the control room. The central unit is connected to other units via the main bus train.

For this connection, the T-distributor and the CAN connecting cable 0.5 m included in the scope of delivery are used.

The main bus train must be fitted with termination resistors at either end.

These components are included in the scope of delivery.

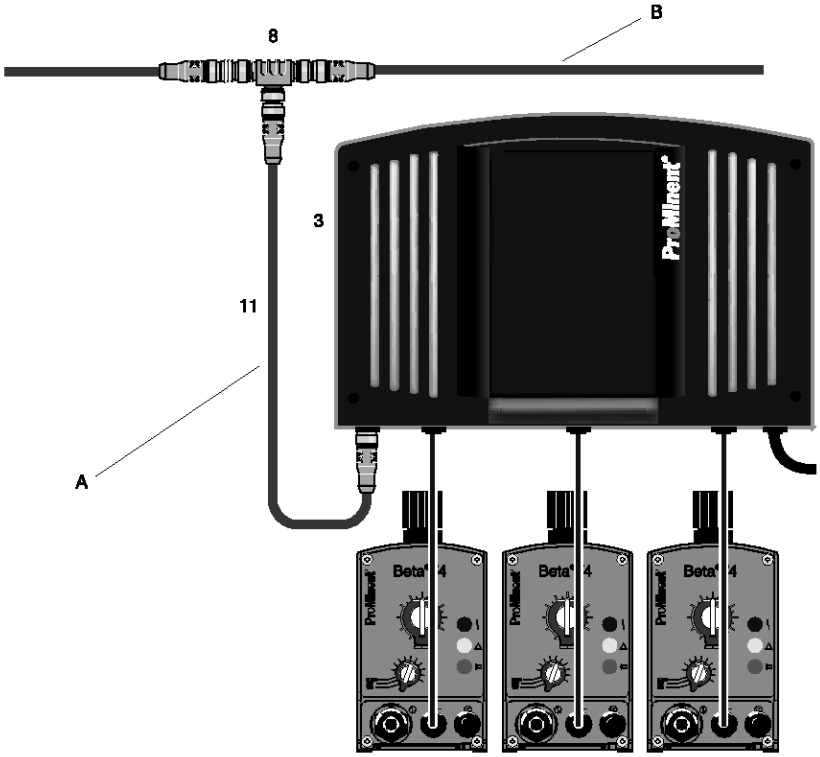
The central unit in the above example consists of the following components:

Item	Quantity	Name	Order no.
1	1	DULCOMARIN® II central unit DXCa W 0 0 1 0 0 P S EN 01	–
8	1	T-distributor M12 5 pol. CAN	Included in delivery
11	1	Connection cable - CAN M12 5 way 0.5 m	Included in delivery
14	1	CAN Connection cable	As required
10	1	Temination resistance M12 connector	Included in delivery
12	1	Temination resistance M12 plug	Included in delivery

* optional

2.4.6 Combination Module

A Stub cable
B Main BUS cable



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Combination of M, A, I-module and F, P, N module

Up to three different modules can be accommodated by the combination module (DXCa without control elements). The function of the combination module results from the function of the individual modules (see above description). The modules in the combination module are operated via the DXCa central unit.

The module is connected to other bus modules via the main bus line.

See the table below for the various equipment options.

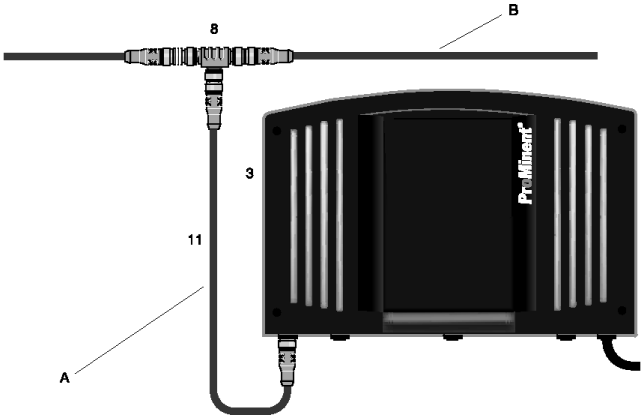
Module position 1	Module position 2	Module position 3
M, A, I module	M, A, I module	P, N module
M, A, I module	F module	Occupied by the F module

The combination in the above example consists of the following components (without chemical fluid handling):

Item	Quantity	Name	Order no.
3	1	Control module DXCa W 2 0 0 0 A P S 00 01	–
8	1	T-distributor M12 5 pol. CAN	Included in delivery
11	1	Connection cable - CAN M12 5 way 0.5 m	Included in delivery

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

2.4.7 Functional Module (F Module)



P_DC_0009_SW

The F module combines functions that were until now available in the A and P module combination and also extends these functions. It includes the supply voltage (90 – 253 VAC) for the controller. The F module is selected for the 2nd module position and also occupies the 3rd module position. The following functions can be provided by the F module (you can find details for this in the individual application examples in the assembly and operating instructions). The F module also acts as an input/output module for the SoftPLC.

Hydraulic functions:

- Control of circulation operation (depending on the weekday and the time of day)
- Automatic backwashing
- Route first filtrate through the internal circuit (electrical backflow shut-off valve)
- Lowering of the water level during idle operation
- Circulation flow control
- Water level control
- Sample water valve
- Heating function
  - Heating control heat exchanger
  - Solar heating
- Gutter cleaning function

Attractions:

- Open/Close cover
- Counterflow system/JetStream
- Flood/Neck shower
- Massage nozzle
- Underwater light

Monitoring:

- Flow control
  - Current circulation flow recording
  - Fresh water top-up recording
  - Cover
  - Massage pump active
  - 1, 2 or 4-stage level functions
- Control variables for:
  - Disinfection
  - pH (+/-)
  - Flocculation
  - UV system
  - Backwashing emergency-off, if water alarm emitted

2.4.8 Identity Code Ordering System Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II (Central Unit and Combination Module)

DXCa	**Installation**										
	W	Wall mounting (IP 65)									
	S	Control cabinet (IP 54)									
		Version									
		0	With controls								
		2	Without controls								
		D	With operating elements for use in potable water/disinfection applications								
			Communication interfaces								
			0	None							
			5	Embedded web server, LAN including 5 m LAN patch cable 1:1, LAN coupling, 5 m crossover cable							
			6	OPC server + embedded web server, LAN including 5 m LAN patch cable 1:1, LAN coupling, 5 m crossover cable							
				Option (the corresponding communications modules are required, see accessories)							
				0	none						
				1	Videographic recorder with data logger including SD card and USB card reader for PC						
				2	SoftPLC function (communication option 5 or 6 needed)						
				3	KNX function (communication option 5 or 6 needed)						
				4	Alarm signalling via text, e-mail (communication option 5 or 6 needed)						
				5	SoftPLC function + KNX function + alarm signalling via text, e-mail (communication option 5 or 6 needed)						
				6	SoftPLC function + alarm signalling via text, e-mail (communication option 5 or 6 needed)						
				7	SoftPLC function + KNX function (communication option 5 or 6 needed)						
				8	KNX function + alarm signalling via text, e-mail (communication option 5 or 6 needed)						
					Module 1						
					0	Not used					
					M	M module, measuring module: pH, ORP, temperature					
					A	A module, control module: 3 pump and 4 analogue outputs					
					I	I module, current input module, 3 mA inputs, 2 digital inputs					
						Module 2					
						0	Not used				
						A	A module, control module: 3 pump and 4 analogue outputs				
						M	M module, measuring module: pH, ORP, temperature				
						I	I module, current input module, 3 mA inputs, 2 digital inputs				
						F	F module, module for filter and attraction control				
							Module 3				
							P	P module, mains power module, 1 alarm relay, 3 solenoid valve relays			
							N	N module, mains power module unit without relay			
							1	F module occupies module position 3			
								Application			
								S	Swimming pool		
								D	Potable water/disinfection		
									Language default		
									DE	German	
									EN	English	
									ES	Spanish	
									FR	French	
									IT	Italian	
									PL	Polish	
									NL	Dutch	
									CZ	Czech	
										Approvals	
										01	CE mark

Please note the following:

Upgrade modules for existing systems require a software update for the existing system. A Software Update Kit is needed to avoid any possible incompatibility between the different modules.

The update kit is free of charge and one is also needed when ordering more than one upgrade module. The kit includes an SD memory card with the current software for the DULCOMARIN® II and a description about how to perform the software update.

	Order no.
Update kit/DXC and modules	1031284

The Identity code describes the complete **DULCOMARIN®II DULCO®-Net** central unit.

The peripheral components mentioned in the above item list, however, are not included. If modules are assigned to the central unit, the following applies:

Module 1 preferably assigned as M module

Module 2 preferably assigned as A module

Module 3 must always be assigned as P module or N module.

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

Important note when ordering multi-channel measuring and control systems for potable water and pool water applications:

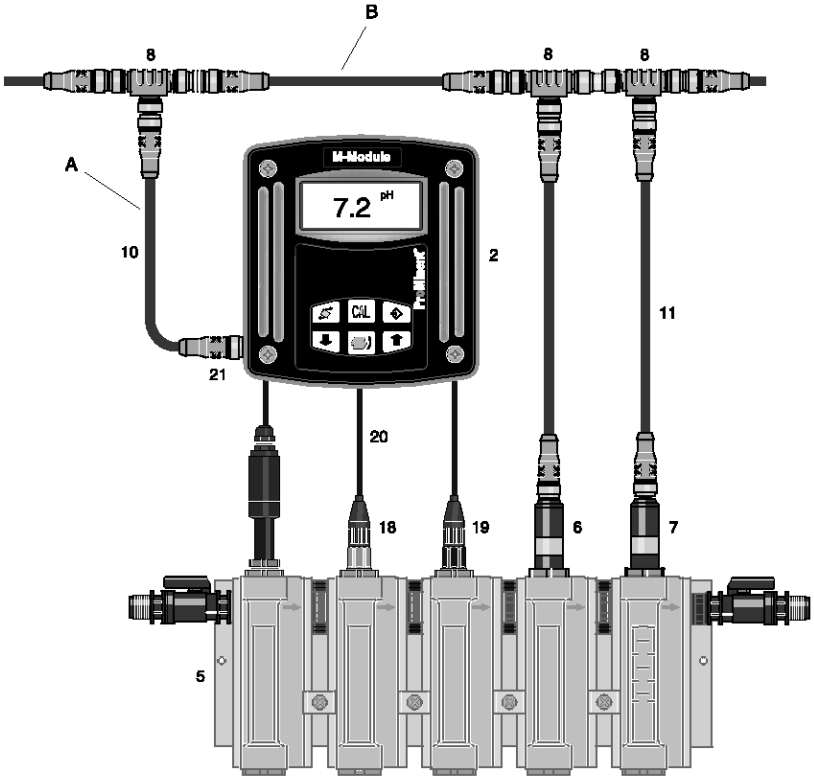
Potable water applications: In the identity code, a "D" for "Potable water/disinfection" must be selected under "Version" and "Application". The description "System" will appear in the controller menu for the different potable water lines.

Swimming pool water applications: In the identity code, a "0" for "with operating elements" must be selected under "Version" and then an "S" for "Swimming pool" under "Application". The description "Tank" will appear in the controller menu for the different filter circuits.

All adjustment options and the use of the different modules are identical with both applications.

2.4.9 Measuring Module (M module)

A Stub cable
B Main BUS cable



pk_5_042

The M module with its illuminated graphic display and keypad displays the measured values and allows all sensors for the corresponding filter circuit to be calibrated on site.

The following measurements can be taken:

- pH value
- ORP potential
- Free chlorine and
- Total available chlorine (optional or combined chlorine is calculated) and
- Sample water temperature using the temperature probe in the chlorine sensor or optionally using a separate Pt100/Pt1000 resistance thermometer

The M module has 3 digital inputs for:

- Sample water monitoring
- Controlling breaks in filter backwashing
- Parameter changeover for Eco!Mode

The M module is connected to the other bus modules via the main bus cable, using the T-distributor supplied and the 0.5 m CAN connection cable.

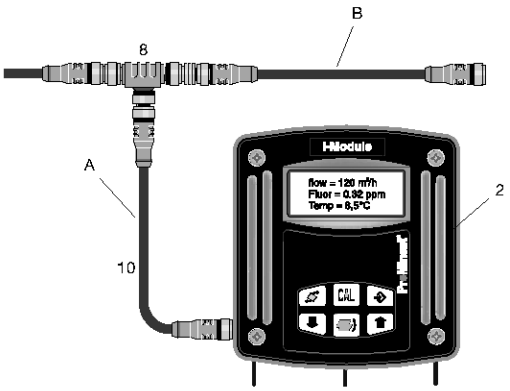
The M module in the above example consists of the following components:

Item	Quantity	Name	Order no.
2	1	M module DXMa M W 0 S EN 01	DXMa M W 0 S DE 01
5	1	In-line probe housing DGMa 3 2 2 T 0 0 0	DGMa 3 2 2 T 0 0 0
6	1	Chlorine sensor CTE 1-CAN-10 ppm	1023427
7	1	Chlorine sensor CLE 3.1-CAN-10 ppm	1023426
8	3	T-distributor M12 5 pole CAN	Included in delivery
10	1	Connection cable - CAN M12 5-pole 0.5 m	Included in delivery
11	2	Connection cable - CAN M12 5-pole 0.5 m	Included in delivery
18	1	pH sensor PHES 112 SE	150702
19	1	ORP sensor RHES-Pt-SE	150703
20	2	Cable combination Coaxial 2 m - SN6 (open end) - pre-assembled	1024106
21	2 m	Signal cable, sold by the metre 2 x 0.25 mm² Ø 4 mm	725122

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

2.4.10 Current Input Module (I module)

A Stub cable
B Main BUS cable



AP_DC_0011_SW

This I module with its illuminated graphic display and keypad is a current input module capable of processing 3 standard signals from sensors and two digital signals.

It can be used together with the multi-channel controller DULCOMARIN® II in potable water and swimming pool applications. All measured variables are available in the screen plotter and web and OPC® server.

Two analogue inputs are provided as 2-wire inputs and one as passive input. All channels have pre-selected measured variables. However the identifier and units can also be edited. Channel 1 acts as an interference variable channel for channel 2. Channel 3 acts as the temperature compensation channel for channel 2 when the measured variable is fluoride. Channel 2 has a control function.

The inputs can process the following values as 0/4... 20 mA standard signals:

- Turbidity
- Flow (can also be used as the disturbance variable)
- UV intensity
- Conductivity (via DMTa transmitter)
- Chlorine dioxide
- Chlorite
- Ammonia
- Fluoride
- Pt100 resistance thermometer via a transducer
- Dissolved oxygen
- Hydrogen peroxide
- Editable designation and unit for all 3 channels

The I module has 2 digital inputs for:

- Sample water monitoring and
- Pause control

The flow information can be used as a disturbance variable for the control of chlorine, pH correction and chlorine dioxide.

The I module is connected to other bus modules via the main bus cable using the T-distributor and 0.5 m CAN connection cable supplied as part of the delivery.

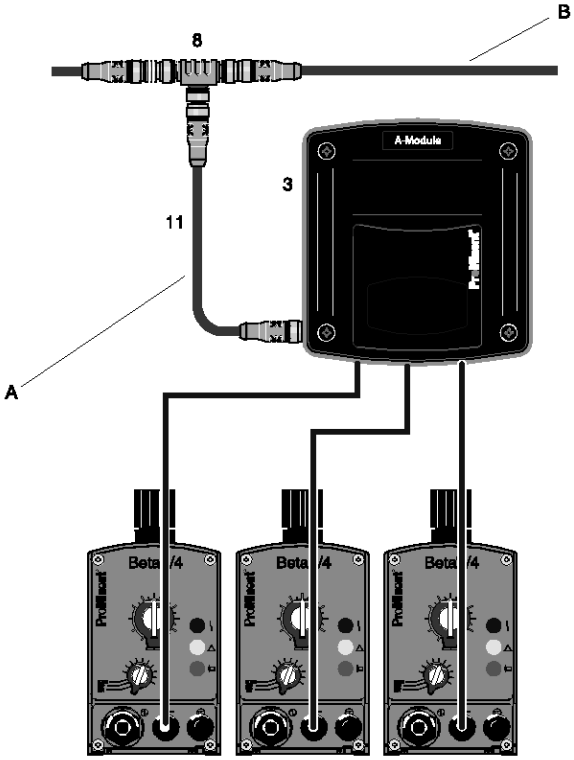
The I module in the above example consists of the following components:

Item	Quantity	Name	Order no.
2	1	I module DXMa I W 0 D EN 01	–
8	1	T-distributor M12 5P CAN	Included in delivery
10	1	Connecting cable - CAN, M12, 5P, 0.5 m	Included in delivery

* Order the gateways/routers separately. Communication option 5 or 6 is always needed.

2.4.11 Control Module (A module)

A Stub cable
B Main BUS cable



pk_5_043

The A module permits the control of up to three metering pumps via pulse frequency. Possible metering combinations are:

- pH lowering and disinfectant and flocculant or
- pH raising and disinfectant and flocculant or
- pH lowering and pH raising and disinfectant

It includes 3 digital inputs to evaluate the alarm relay of metering pumps, 4 freely programmable standard signal outputs 0/4…20 mA to document measured values, or as control outputs.

The T-distributor and 0.5 m CAN connecting cable included in the scope of delivery are used for this connection.

Note: No A modules are required if Beta®/4CANopen metering pumps are used!

The A module in the above example consists of the following components (without metering technology):

Item	Quantity	Name	Order no.
3	1	A module DXMa A W 2 0 00 01	–
8	1	T-distributor M12 5 pol. CAN	Included in delivery
11	1	Connection cable - CAN M12 5 way 0.5 m	Included in delivery

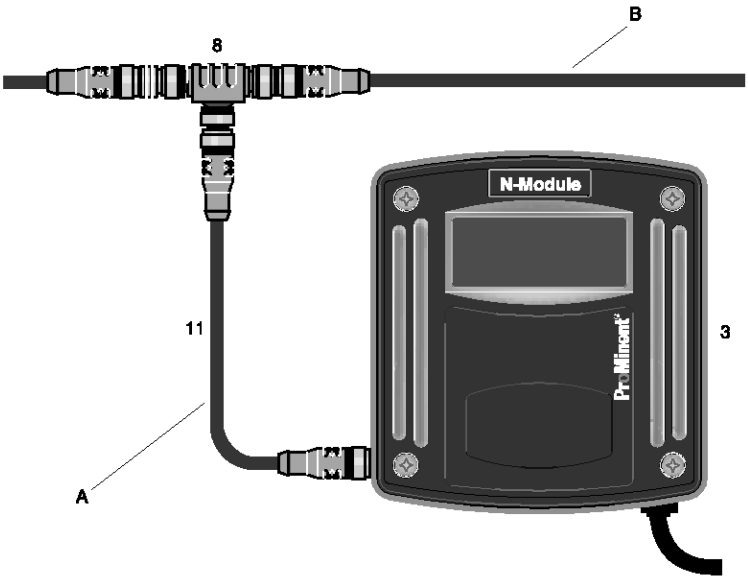
The A module is connected to other units via the main bus train.

An isolating amplifier, e.g. order no. 1033536 is required for connection to units which are not electrically isolated (e.g. PLC)!

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

2.4.12 Power Supply Module (N module)

A Stub cable
B Main BUS cable



pk_5_043_C_power

The N module (power supply) is used to supply the bus modules with power and has no further function.

The number of N modules required can be seen from the table below. If P modules are used in a system, the number of N modules is reduced accordingly. The central unit always includes a power supply unit (N or P module)

How many additional N or P modules do you require?

Number of filtration circuits	Additional N or P modules	Number of filtration circuits	Additional N or P modules
1	-	9	4
2	-	10	5
3	1	11	5
4	2	12	6
5	2	13	6
6	3	14	7
7	3	15	7
8	4	16	8

The N module requires a power supply for operation and is connected to the other bus modules via the main bus train. The T-distributor and 0.5 m CAN connecting cable included in the scope of delivery are used for this connection.

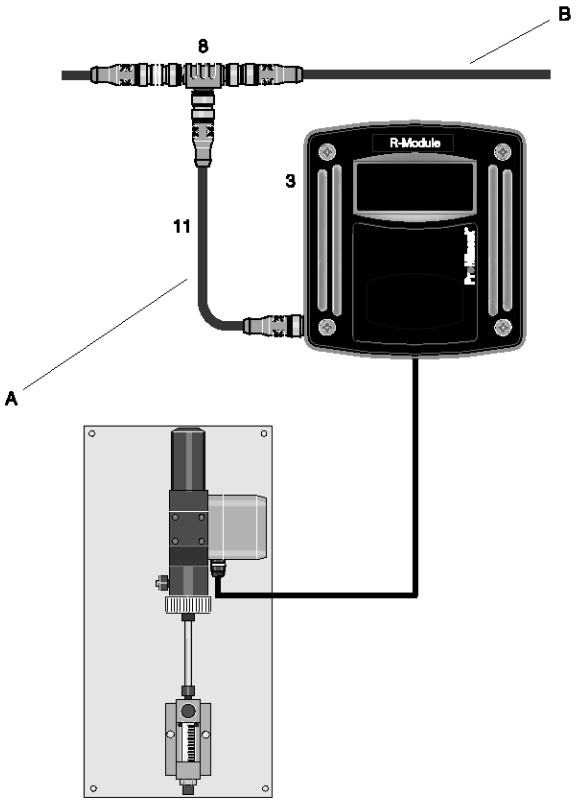
The N module in the above example consists of the following components:

Item	Quantity	Name	Order no.
3	1	N module DXMa N W 2 0 00 01	–
8	1	T-distributor M12 5 pol. CAN	Included in delivery
11	1	Connection cable - CAN M12 5 way 0.5 m	Included in delivery

Our Sales department would be glad to assist with any questions you may have.

2.4.13 Control Module for Chlorine Gas Metering Devices (R module)

A Stub cable
B Main BUS cable



pk_5_043_C

The R module permits the control of chlorine gas metering units equipped with a position feedback potentiometer.

It includes 2 power relays for opening and closing and an input for a position feedback potentiometer 1 ... 10 kΩ

The R module is connected to other units via the main bus train.

The T-distributor and 0.5 m CAN connecting cable included in the scope of delivery are used for this connection.

The R module in the above example consists of the following components (without the chlorine gas metering device):

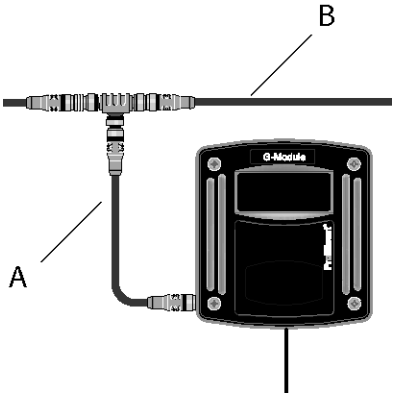
Item	Quantity	Name	Order no.
3	1	R module DXMa R W 2 0 00 01	–
8	1	T-distributor M12 5 pol. CAN	Included in delivery
11	1	Connection cable - CAN M12 5 way 0.5 m	Included in delivery

Our Sales department would be glad to assist with any questions you may have.

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

2.4.14 Limit Value and Alarm Module (G module)

A Stub cable
B Bus main cable



P_DM_0024_SW3

The G-module is a limit value and alarm emitting module with 2 potential-free changeover relays to signal alarm states. Each of the two relays has ten different setting options to monitor measured values for minimum and maximum values and, should the values exceed or fall below these limits, this then triggers the relay. Both relays have the same setting options, thereby enabling signals for pre-warnings or shutdowns to be generated by the use of different delay periods.

The G module is connected to the other units via the main bus cable using the T-distributor and 0.5 m CAN connection cable supplied.

The G module in the above example consists of the following components:

Item	Quantity	Name	Order no.
3	1	G module DXMa G W 2 0 00 01	–
8	1	T-distributor M12 5 pol. CAN	Included in delivery
11	1	Connection cable - CAN M12 5 way 0.5 m	Included in delivery

Our Sales department would be glad to assist with any questions you may have.

2.4.15 Identity Code Ordering System for CANopen Modules

Modules for the DULCOMARIN® II, DXM product range

DXMa	Module						
	M	M module, measuring module: pH, ORP, temperature					
	A	A module, control module: 3 pump and 4 analogue outputs					
	R	R module, control module: chlorine gas metering unit with feedback [1), 2)]					
	N	N module, mains power module without relay [1), 2)]					
	P	P module, mains power module with relay, only mounting type "0" [1), 2)]					
	I	I module, current input module, 3 mA inputs, 2 digital inputs					
		Installation					
		0	No housing, only P module (IP 00)				
		W	Wall mounting (IP 65)				
		E	Retrofit module (installation module for DXCa, IP 20)				
			Version				
			0	With controls (only M module, mounting type W)[1]			
			2	Without controls			
			3	Without contols (only mounting type “E” and “H”)			
				Application			
				0	Standard		
				S	Swimming pool (only M-module)		
				D	Potable water/disinfection (only I module)		
					Language default		
					00	No controls [2)]	
					DE	German	
					EN	English	
					ES	Spanish	
					FR	French	
						Approvals	
						00	No approval, only P-module without housing
						01	CE mark

Please note the following:

Upgrade modules for existing systems require a software update for the existing system. A Software Update Kit is needed to avoid any possible incompatibility between the different modules.

The update kit is free of charge and one is also needed when ordering more than one upgrade module. The kit includes an SD memory card with the current software for the DULCOMARIN® II and a description about how to perform the software update.

	Order no.
Update kit/DXC and modules	1031284

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

2.4.16 Spare Parts and Upgrade Sets

Internal spare parts and upgrade sets for the DULCOMARIN® II cannot be ordered using the part number printed on the modules!

Modules have to be fully replaced (the exception to this is the N module).

The electrical unit for the central unit can only be replaced by a complete processor spare part.

Please use only the following identity codes when ordering:

Replacement central units

- Replacement central unit: DXCAC001000#DE01 (without communication interface, # = please state "S" for applications in swimming pools and "D" for applications relating to potable water).
- Replacement central unit: DXCAC051000#DE01 (with web server, # = please state "S" for applications in swimming pools and "D" for applications relating to potable water).
- Replacement central unit: DXCAC061000#DE01 (with OPC and web server, # = please state "S" for applications in swimming pools and "D" for applications relating to potable water).

External modules (replacement or upgrade modules):

- M module: DXMa M W 0 S EN 01 (with display)
- A module: DXMa AW2 0 00 01 (without display)
- N module: DXMa N W 2 0 00 01 (without display)
- R module: DXMa R W2 0 00 01 (without display)
- G module: DXMa G W2 0 00 01 (without display)
- P module: DXCa W 2 00 00 PS 00 01 (without display in large DXC housing)
- I module: DXMa I W 0 D D E 01 (with display)
- I module: DXMa I W 2 D 0 0 0 1 (without display)

Internal modules (replacement or upgrade modules):

- M module: DXMa M E3S 00 01
- A module: DXMa A E30 00 01
- P module: DXMa P03 00 00
- I module: DXMa I E 3 D 00 01
- N module: Order no. 732485, electrical set DXMaN 24 V/1A

2.4.17 Retrofit Kits for DULCOMARIN® II DXC

The DULCOMARIN® II can be upgraded in-situ with the web server and OPC server functions. The upgrade is implemented by entry of an activation key. The activation key can be entered either manually via the keyboard into the DULCOMARIN® II or via an SD card. The SD card is supplied.

The following information is required to determine the device-specific activation key.

1 Serial number of the DULCOMARIN® II. This can be found under F1 HELP.

2 The actual identity code. This can be found under F1 HELP.

3 Desired upgrade.

The DULCOMARIN® II can be upgraded in-situ with the web server and OPC server functions. The upgrade is implemented by entry of an activation key. The activation key can be entered either manually via the keyboard into the DULCOMARIN® II or via an SD card. The SD card is supplied.

The following information is required to determine the device-specific activation key.

1 Serial number of the DULCOMARIN® II. This can be found under F1 HELP.

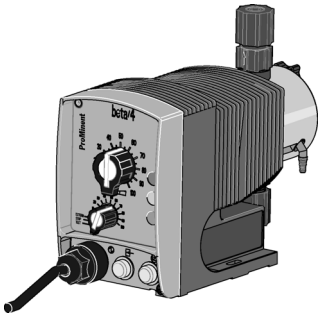
2 The actual identity code. This can be found under F1 HELP.

3 Desired upgrade.

	Order no.
DXC retrofit kit on web server, including LAN cable and instructions	1029466
DXC retrofit kit on web server + OPC server, including LAN cable and instructions	1029465
DXC retrofit kit on web server + OPC server, including instructions and OPC CD-ROM	1029467
DXC retrofit kit SoftPLC	1049734
DXC retrofit kit KNX*	1049735
DXC retrofit kit SMS_EMAIL*	1049736
DXC retrofit kit SoftPLC, KNX, SMS_EMAIL*	1049737
DXC retrofit kit SoftPLC, SMS_EMAIL*	1049738
DXC retrofit kit SoftPLC, KNX*	1049739
DXC retrofit kit KNX, SMS_EMAIL*	1049740

* Order the gateways/routers separately. Communication option 5 or 6 is always needed.

2.4.18 Diaphragm Metering Pumps with CANopen Bus Interface



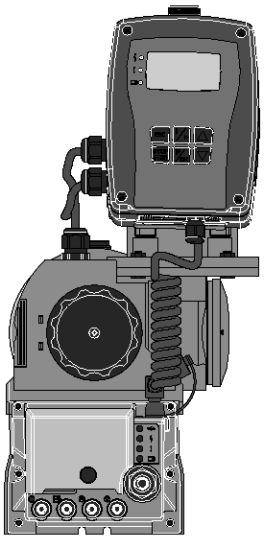
P_BE_0002_SW
Beta®

- CANopen bus interface for DULCOMARIN® II
- Pump capacity 0.2-1,030 l/h
- Stroke length continuously adjustable between 0 - 100% (recommended 30 - 100%)
- Transmission of the stroke length setting from the DULCOMARIN® II
- Material designs PP, clear acrylic/PVC
- Patented coarse/fine bleed valve for PP and clear acrylic/PVC
- Self-bleeding dosing head design in PP and clear acrylic/PVC
- Connector for 2-stage level switch
- Design for low voltage 12-24 V DC, 24 V AC
- 4 LED display for operation, warning and error messages
- Alarm in the event of stroke length changes of > ± 10%
- Transmission of level alarm without alarm relay via the bus

Diaphragm metering pumps are contained in Volume 1 on the following pages: Solenoid Driven Metering Pump Beta®, Solenoid Driven Metering Pump delta®.

Process metering pumps are contained in Volume 3 on the following pages: Motor Driven Metering Pump Sigma/ 1 (Basic Type), Motor Driven Metering Pump Sigma/ 2 (Basic Type), Motor Driven Metering Pump Sigma/ 3 (Basic Type)

P_DE_0002_SW
delta®

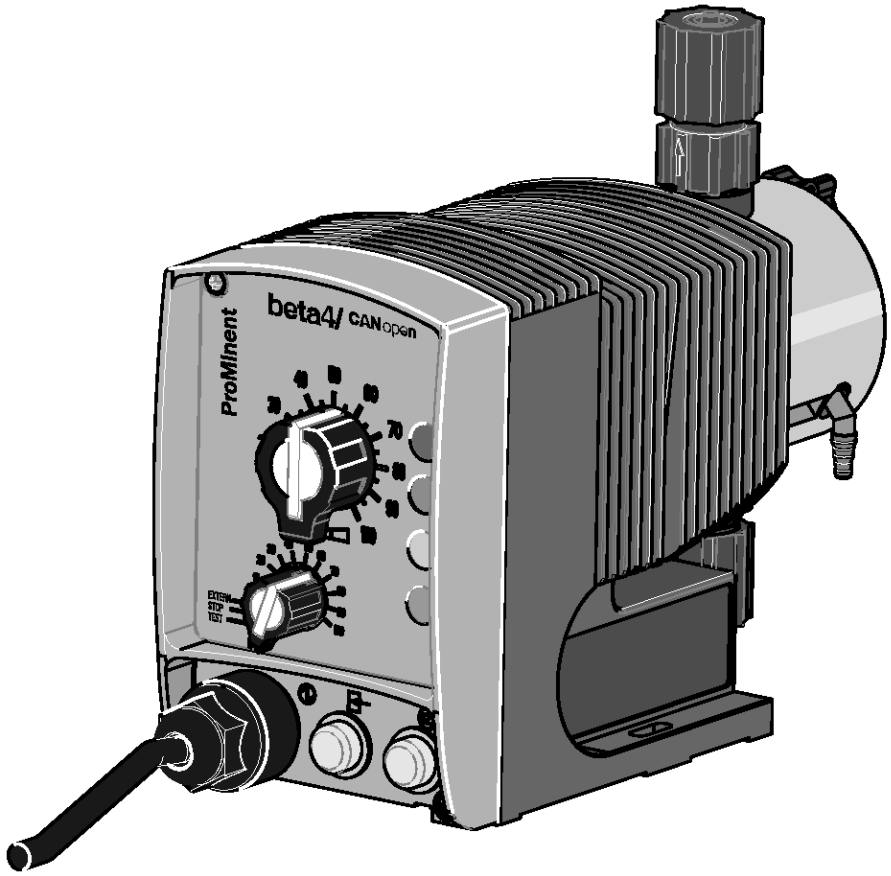


P_SI_0129_SW
Sigma/ 1 control type

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

2.4.19 Solenoid Driven Metering Pumps Beta®

- CANopen bus interface for DULCOMARIN® II
- Feed rate range of 0.74 - 32 l/h, 16 - 2 bar
- Stroke length continuously adjustable between 0 - 100% (recommended 30 - 100%)
- Transmission of the stroke length setting from the DULCOMARIN® II
- Material versions PP, clear acrylic/PVC
- Patented coarse / fine bleed valve for PP and clear acrylic/PVC
- Self-bleeding dosing head version in PP and clear acrylic/PVC
- Connection for 2-stage level switch
- Version for low voltage 12-24 V DC, 24 V AC
- 4 LED display for operation, warning and error messages



pk_1_004_2

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

Technical Data

Pump type	Delivery rate at max. back pressure			Delivery rate at medium back pressure			Number of strokes	Connection size o Ø x i Ø	Suction lift	Shipping weight PP, NP, PV, TT
	bar	l/h	ml/ stroke	bar	l/h	ml/ stroke	Strokes/ min	mm	mWC	kg
Beta®										
BT4a 1000***	10	0.74	0.07	5.0	0.82	0.08	180	6 x 4	6.0**	2.9
BT4a 1601***	16	1.10	0.10	8.0	1.40	0.13	180	6 x 4	6.0**	2.9
BT4a 1602***	16	2.10	0.19	8.0	2.50	0.24	180	6 x 4	6.0**	2.9
BT4a 1005***	10	4.40	0.41	5.0	5.00	0.46	180	8 x 5****	6.0**	3.1
BT4a 0708***	7	7.10	0.66	3.5	8.40	0.78	180	8 x 5	6.0**	3.1
BT4a 0413	4	12.30	1.14	2.0	14.20	1.31	180	8 x 5	3.0**	3.1
BT4a 0220	2	19.00	1.76	1.0	20.90	1.94	180	12 x 9	2.0**	3.3
Beta® metering pumps with self-bleeding dosing head*										
BT4a 1601	16	0.59	0.06	8.0	0.78	0.07	180	6 x 4	1.8**	2.9
BT4a 1602	16	1.40	0.13	8.0	1.70	0.16	180	6 x 4	2.1**	2.9
BT4a 1005	10	3.60	0.33	5.0	4.00	0.37	180	8 x 5	2.7**	3.1
BT4a 0708	7	6.60	0.61	3.5	7.50	0.69	180	8 x 5	2.0**	3.1
BT4a 0413	4	10.80	1.00	2.0	12.60	1.17	180	8 x 5	2.0**	3.1
BT4a 0220	2	16.20	1.50	1.0	18.00	1.67	180	12 x 9	2.0**	3.3

* The given performance data constitutes assured minimum values, calculated using medium water at room temperature. The bypass connection with a self-bleeding dosing head is 6x4 mm.

** Suction lift with a filled dosing head and filled suction line, for a self-bleeding dosing head with air in the suction line.

*** For special applications, e.g. in the swimming pool sector, pressure-reduced pump types are available in the pressure ratings 4, 7 and 10 bar. More detailed information is available upon request.

**** For stainless steel version 6 mm connector width.

Materials in Contact With the Medium

	Dosing head	Suction/discharge connector	Seals	Valve balls
PPE	Polypropylene	Polypropylene	EPDM	ceramic
PPB	Polypropylene	Polypropylene	FKM	ceramic
NPE	Clear acrylic	PVC	EPDM	ceramic
NPB	Clear acrylic	PVC	FKM	ceramic

Only the self-bleeding version in PP and NPE material versions with a valve spring made of Hastelloy C and a valve insert in PVDF. Metering diaphragm with a PTFE coating.

FKM = Fluorine Rubber

Repeatability of metering ±2% when used according to the operating instructions.

Permissible ambient temperature -10 °C to +45 °C

Mean power consumption Type 1000-0220 17 W
Degree of protection: IP 65, insulation class F

Scope of supply: Metering pump with mains cable (2 m) and plug, connector kit for hose/pipe connection as per table, connecting cable CAN M12 5 pole. 1 m, T-coupler M12 5-pole CAN.

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

Beta® product range, Version a

BT5a	Type	Capacity bar	Capacity l/h
	1605	16	4.10
	1008	10	6.80
	0713	7	11.00
	0420	4	17.10
	0232	2	32.00
BT4a			
	1000	10	0.74
	1601	16	1.10
	1602	16	2.10
	1005	10	4.40
	0708	7	7.10
	0413	4	12.30
	0220	2	19.00

Liquid end/valve material

PP	Polypropylene/polypropylene
NP	Clear acrylic/PVC
PV	PVDF/PVDF
TT	PTFE/PTFE
SS	Stainless steel 1.4404/1.4404

Seal/diaphragm material

E	EPDM/PTFE coated, only for PP and NP
B	FKM-B/PTFE coated, only for PP and NP
T	PTFE/PTFE coated, only for PV, TT and SS
S	Diaphragm with additional FKM coating for media containing silicate, FKM-B seals for PP and NP, PTFE for TT, PV and SS

Liquid end version

0	Without bleed, without valve spring only for TT, SS and type 0232 NP, PP and PC
1	Without bleed, with valve spring only for TT, SS and type 0232 NP, PP and PC
2	With bleed, without valve spring only for PP, PV, NP not for type 0232
3	With bleed, with valve spring only for PP, PV, NP not for type 0232
4	Version for higher-viscosity media only for PVT, type 1005, 1605, 0708, 1008, 0413, 0713, 0220, 0420
9	Self-bleeding only for PP/NP, not for types 1000 and 0232

Hydraulic connections

0	Standard connection according to technical data
5	Connector for 12/6 tube, discharge side only
9	Connector for 10/4 tube, discharge side only

Version

0	With ProMinent® logo

Power supply

A	200 – 230 V ± 10%, 50/60 Hz
B	100 – 115 V ± 10%, 50/60 Hz
U	100-230 V ± 10%, 50/60 Hz
M	12 – 24 V DC ± 10%, only type 1000-0220 \only with 2 m connecting cable open end
N	24 V DC ± 10%, only type 1605-0232 \only with 2 m connecting cable open end
P	24 V AC ± 10% all types

Cable and plug

A	2 m Europe
B	2 m Swiss
C	2 m Australia
D	2 m USA
1	2 m open end

Relay

0	No relay
1	Fault indicating relay NC, (change-over relay)
3	Fault indicating relay NO, (change-over relay)
4	As 1 + pacing relay, (each 1xON)
5	As 3 + pacing relay, (each 1xON)

Accessories

0	No accessories
1	With foot and injection valve, 2 m PVC suction line, 5 m PE metering line

Control type

0	No lock
1	With lock: manual operation blocked when external cable plugged in

Control Variants

D	With CANopen interface for DULCOMARIN® II

Options on request

0 0	No option

2.4.20 Multi-Channel Measuring and Control System DULCOMARIN® II, Module Combinations

Number and type of modules required for a given number of pools

Number of filtration circuits	Central unit DXCa	P module	M module	A module*	Additional N or P module (power supply unit)	Free chlorine sensor	Total chlorine sensor (optional)
1	1	1	1	1	-	1	1
2	1	1	2	2	-	2	2
3	1	1	3	3	1	3	3
4	1	1	4	4	2	4	4
5	1	1	5	5	2	5	5
6	1	1	6	6	3	6	6
7	1	1	7	7	3	7	7
8	1	1	8	8	4	8	8
9	1	1	9	9	4	9	9
10	1	1	10	10	5	10	10
11	1	1	11	11	5	11	11
12	1	1	12	12	6	12	12
13	1	1	13	13	6	13	13
14	1	1	14	14	7	14	14
15	1	1	15	15	7	15	15
16	1	1	16	16	8	16	16

* No A module if metering pumps with CANopen are used.
The above modules include all CAN bus connecting elements (T-distributor and spur line).
The T-distributors can also be directly coupled.
For distributed systems, the CAN cable must be ordered by the metre with the by-the-metre connecting kit.

	Order no.
CAN bulk cable connection kit*	1026589
Connecting cable - CAN, sold by the metre*	1022160

* The CAN by-the-metre connecting kit consists of a CAN coupling M12 5P and a CAN connector M12 5P and a wiring diagram.
The by-the-metre connecting cable can be configured into a cable of individual length using the CAN by-the-metre connecting kit.
One CAN by-the-metre connecting kit is required for each cable to be configured.
The connecting cables CAN M12 5P 0.5 m (pump 1 m) supplied with the sensors and modules should be used for the spur lines.

If you have any questions, please contact our sales department.

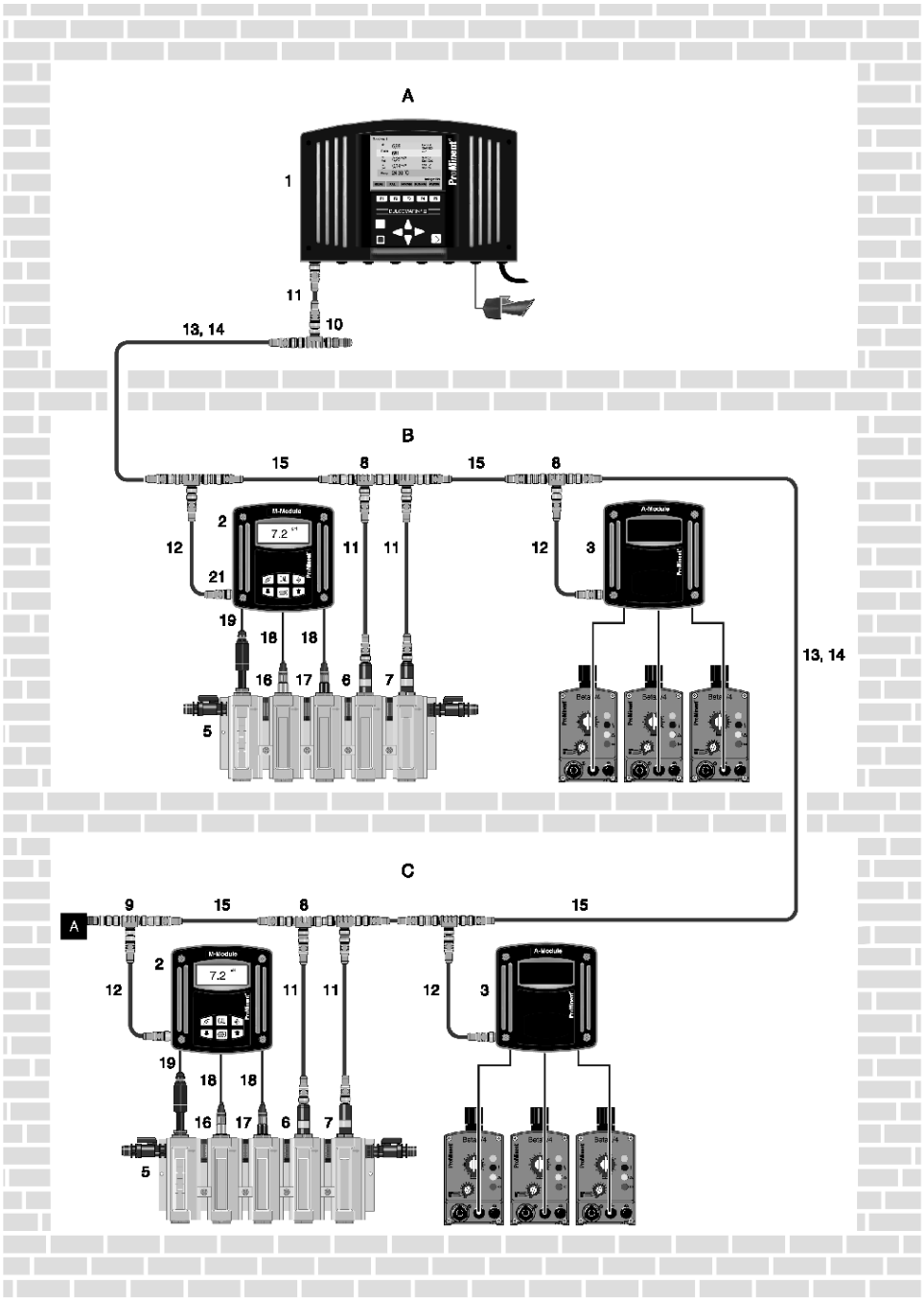
Caution:

The maximum main bus length (not including stubs) should be at most 400 m.

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

2.4.21 Configuration Example 1

A Pool attendant's room
B Plant room pool 1
C Plant room pool 2



pk_5_022_1

Attention:

It is very important that you adhere precisely to the principle of the design shown above because otherwise correct function is not guaranteed!

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

Measuring and control system for two potable water systems/filtration circuits consisting of the following components:

Item	Quantity	Name	Order no.
1	1	DULCOMARIN® II central unit DXCa W 0 0 1 0 0 P S EN 01	–
2	2	M module DXMa M W 0 S EN 01	–
3	2	A module DXMa A W 2 0 00 01	–
5	2	DULCOTEST® in-line probe housing DGMa 3 2 2 T 0 0 0	–
6	2	Chlorine sensor CTE 1-CAN-10 ppm	1023427
7	2	Chlorine sensor CLE 3.1-CAN-10 ppm	1023426
8	9	T-distributor M12 5-pole CAN	Included in delivery
9	1	Termination resistance M12 coupling	Included in delivery
10	1	Termination resistance M12 plug	Included in delivery
11	5	Connection cable - CAN M12 5-way 0.5 m	Included in delivery
12	5	Connection cable - CAN M12 5-way 0.3 m	Included in delivery
13	–	Connecting cable - CAN, sold by the metre	1022160
14	–	CAN bulk cable connection kit	1026589
15	–	CAN M12 5-pole connection cable - length as required	–
–	–	–	–
16	2	pH sensor PHES 112 SE	150702
17	2	ORP sensor RHES-Pt-SE	150703
18	4	Cable combination Coaxial 2 m - SN6 (open end) - pre-assembled	1024106
19	4 m	Signal cable, sold by the metre 2 x 0.25 mm^2 Ø 4 mm	725122

* The CAN by-the-metre connecting kit consists of a CAN coupling M12 5P and a CAN connector M12 5P and a wiring diagram.
The by-the-metre connecting cable can be configured into a cable of individual length using the CAN by-the-metre connecting kit.
One CAN by-the-metre connecting kit is required for each cable to be configured.
The connecting cables CAN M12 5P 0.5 m (pump 1 m) supplied with the sensors and modules should be used for the spur lines.

Caution:

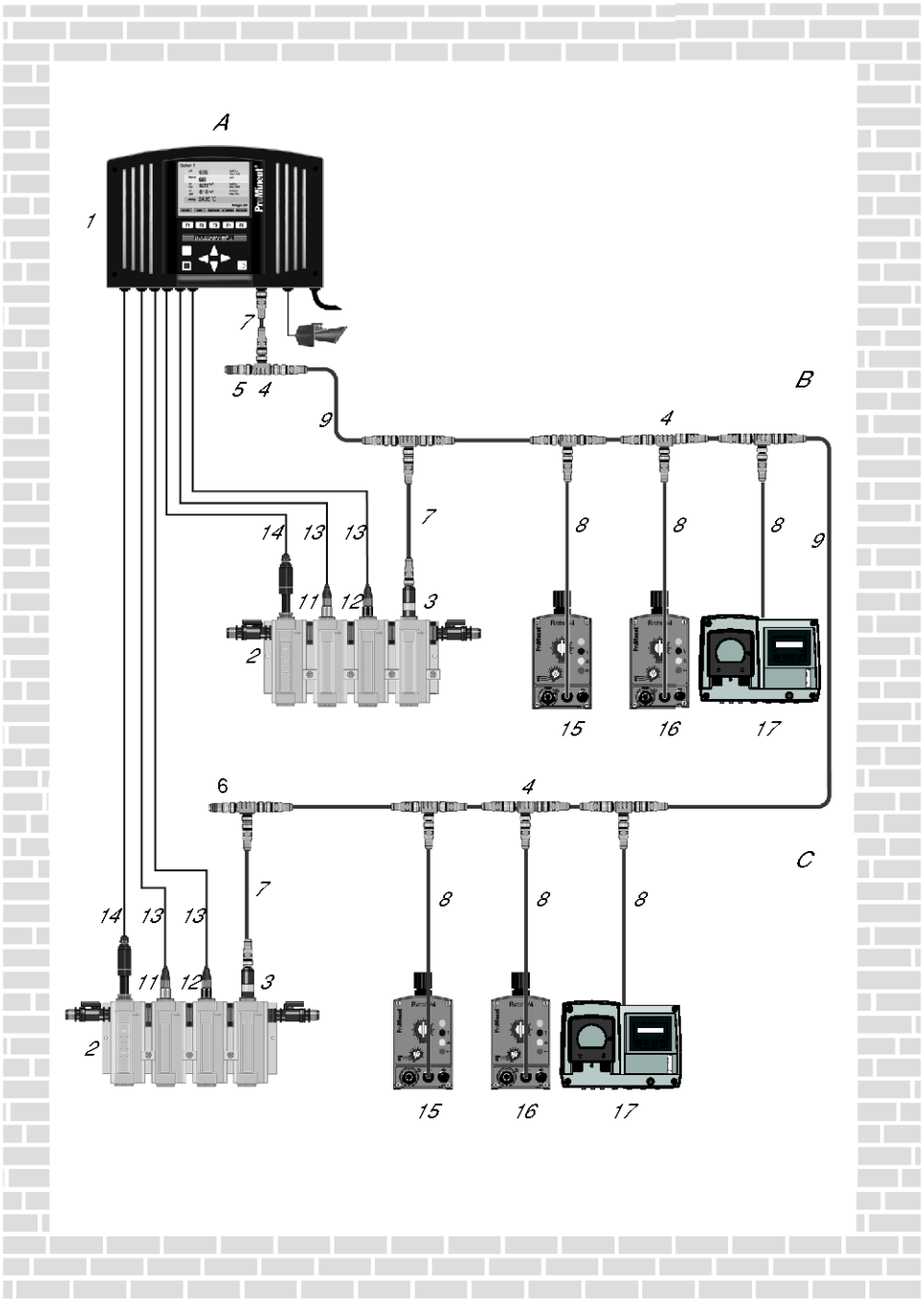
The maximum main bus length (not including spur lines) should be at most 400 m.

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

2.4.22 Configuration Example: 2-Pool System

Two M modules in a central unit, use of metering pumps with CANopen bus.

A Plant room
B Pool 1
C Pool 2



pk_5_022_neu

Attention:

It is very important that you adhere precisely to the principle of the design shown above because otherwise correct function is not guaranteed!

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

Measuring and control system for two filter circuits consisting of the following components:

Item	Quantity	Name	Order no.
1	1	DULCOMARIN®II central unit DXCa W 0 0 1 M M P S EN 01	–
2	2	DULCOTEST® in-line probe housing DGMa 3 2 2 T 0 0 0	–
3	2	Chlorine sensorCLE 3-CAN-10 ppm	1023425
4	9	T-distributor M12 5 pole CAN	Included in delivery
5	1	Termination resistor M12 connector	Included in delivery
6	1	Termination resistor M12 plug	Included in delivery
7	5	Connection cable - CAN M12 5-pole 0.5 m	Included in delivery
8	6	Connection cable - CAN M12 5-pole 0.3 m	Included in delivery
9	–	Connecting cable - CAN M12 5-pin 10 m	1046383
11	2	pH sensor PHES 112 SE	150702
12	2	ORP sensor RHES-Pt-SE	150703
13	4	Cable combination Coaxial 2 m - SN6 (open end) - pre-assembled	1024106
14	4 m	Signal cable, sold by the metre 2 x 0.25 mm^2 Ø 4 mm	725122
15	2	Beta®/ 4 CANopen for pH correction BT4A0402PVT290UA000D00**	–
16	2	Beta®/ 4 CANopen for disinfectant BT4A0402PVT290UA000D00**	–
17	2	DF4a CAN for flocculant DF4aFW004015P9UA00001D10	–

* Up to 3 can be coupled from the connecting cable CAN M 12 5-pin 10 m.

** Suggested configuration

Caution:

Do not allow the maximum main bus length (without branch cables) to exceed 400 m.

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

2.4.23 Accessories for the DULCOMARIN® II Measuring and Control System

	Order no.
CLE 3-CAN-10 ppm	1023425
CLE 3.1-CAN-10 ppm	1023426
CTE 1-CAN-10 ppm	1023427
BRE 3-CAN-10 ppm	1029660
T-distributor M12 5 pole CAN	1022155
Termination resistor M12 coupling	1022154
Termination resistor M12 plug	1022592
Connecting cable - CAN M12 5 pole 0.3 m	1024568
Connecting cable - CAN M12 5-pole 0.5 m	1022137
Connecting cable - CAN M12 5-pole 1 m	1022139
Connecting cable - CAN M12 5-pole 2 m	1022140
Connecting cable - CAN M12 5-pole 5 m	1022141
Connecting cable - CAN M12 5-pin 10 m	1046383
Connecting cable - CAN, sold by the metre	1022160
CAN bulk cable connection kit	1026589
PHES 112 SE	150702
RHES-Pt-SE	150703
Cable combination coaxial 0.8 m - SN6 - pre-assembled	1024105
Cable combination Coaxial 2 m - SN6 (open end) - pre-assembled	1024106
Cable combination coaxial 5 m - SN6 - pre-assembled	1024107
Signal cable, sold by the metre 2 x 0.25 mm² Ø 4 mm	725122
Connecting cable LAN M12 - RJ45 5.0 m	1026715
Cross-over patch cable 2x RJ45 connector 5 m	1027859
LAN coupling 2x RJ45 socket 1:1	1027860
USB 2.0 SD card reader	732981
SD memory card/DXC measuring data archiving	1027470
Isolating amplifier 4-channel for mA outputs of the A module	1033536

* Up to 3 cables, each 10 m, can be coupled

The CAN bulk cable connection kit comprises a 5-pin M12 CAN coupling and a 5-pin M12 CAN plug and a wiring diagram.
The CAN bulk cable connection kit can be used to configure the connecting cable to form a cable of any required length.
One CAN bulk cable connection kit is required for each cable to be assembled.
The 0.5 m (1 m pump) 5-pin M 12 CAN connecting cables supplied with the sensors and modules have to be used as branch cables.

Caution:

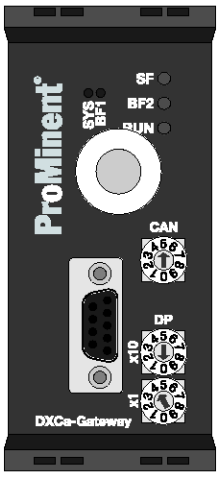
Do not allow the maximum main bus length (excluding branch cables) to exceed 400 m!

Sensor selection table (swimming pool)

Sensor	Measurement task				
	Free chlorine **for a small percentage of** combined chlorine. Calibration method DPD 1	**Free** chlorine **for a large percentage of** combined chlorine. Calibration method DPD 1	**Combined** chlorine **and free chlorine** (differential chlorine measurement) Calibration method DPD 1+3	**Total available** chlorine (e.g. trichlorinated isocyanuric acid) Calibration method DPD 1	**Bromine** BCDMH, DBDMH Calibration method DPD1 or DPD1+3
CLE3-CAN-10 ppm (Order no.: 1023425)	X				
CLE3.1-CAN-10 ppm (Order no.: 1023426)		X	X		
CTE1-CAN-10 ppm * (Order no.: 1023427)			X		
CGE2-CAN-10 ppm (Order no.: 1024420)				X	
BRE3-CAN-10 ppm (Order no. 1029660)					X

* the CTE1-CAN-10 ppm sensor only works together with the CLE3.1-CAN-10 ppm sensor

PROFIBUS®-DP V1 Gateway



P_MSRZ_0014_SW

The CANopen - PROFIBUS®-DP V1 gateway is an interface based on CANopen, which connects the DULCOMARIN® II swimming pool controller or disinfection controller to a PROFIBUS® DP network. Here the DULCOMARIN® II is configured as the slave and the PLC is the master. Data traffic can be cyclic or acyclic. The measured values are transmitted cyclically. Setpoints can be changed, the system can be set to pause control and Eco!Mode operation can be activated in acyclic traffic. The corresponding GSD file can be loaded from the ProMinent homepage and is also contained on the enclosed data carrier.

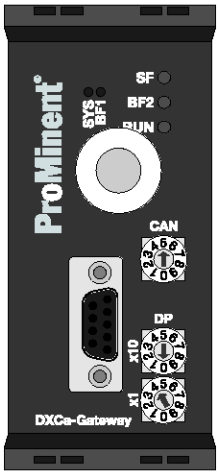
The module is intended for installation in a control cabinet (top hat rail) and is connected to the CAN bus in the same way as other modules. The DULCOMARIN® II Controller must have software version 3022 or greater. No specific identity code is needed.

A separate 24 VDC power supply is required.

Voltage supply	24 V DC
Typical power consumption approx.	500 mA
Max. number of measured values	116
Weight	250 g
Dimensions L x W x H (mm)	117.2 x 45 x 113.5 mm
RoHS (Restriction of Hazardous Substances)	Yes
CE conformity	Yes
Enclosure rating	IP 20

	Order no.
CANopen - PROFIBUS®-DP V1 gateway complete	1044462

Modbus RTU Gateway



P_MSRZ_0014_SW

The CANopen - Modbus RTU gateway is an interface based on CANopen, which connects the DULCOMARIN® II swimming pool controller or disinfection controller to a Modbus RTU network. Here the DULCOMARIN® II is configured as the slave and the PLC is the master. Data traffic can be cyclic or acyclic. The measured values are transmitted cyclically. Setpoints can be changed, the system can be set to pause control and Eco!Mode operation can be activated in acyclic traffic. The corresponding description table can be found in the operating instructions. It can be downloaded from the ProMinent homepage and is also contained on the enclosed data carrier.

The module is intended for installation in a control cabinet (top hat rail) and is connected to the CAN bus in the same way as other modules. No specific identity code is needed.

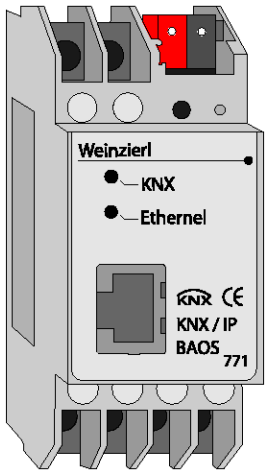
A separate 24 VDC power supply is required.

Voltage supply	24 V DC
Typical power consumption approx.	500 mA
Max. number of measured values	116
Weight	250 g
Dimensions L x W x H (mm)	117.2 x 45 x 113.5 mm
RoHS (Restriction of Hazardous Substances)	Yes
CE conformity	Yes
Enclosure rating	IP 20

	Order no.
Gateway CANopen - Modbus RTU	1047247

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

Ethernet KNX Gateway



P_MSRZ_0017_SW1

The Ethernet – KNX gateway is an Ethernet based interface that connects the DULCOMARIN® II swimming pool controller or disinfection controller to a KNX building control system. It can transmit the measured values and status messages from up to 2 systems/pools. No feedback effect from the KNX network is possible.

The module is intended for installation in a control cabinet (top hat rail) and is connected to the LAN/ Ethernet connector of the DXCa. The DXCa needs to have communication option 5 = web server or 8 = web server + OPC server for this.

A separate 24 VDC power supply is required.

Voltage supply	12 – 24 V DC
Typical power consumption approx.	500 mA
Max. number of measured values (max. 2-pool system)	20
Weight	100 g
Dimensions L x W x H (mm)	117.2 x 60 x 113.5 mm
RoHS (Restriction of Hazardous Substances)	Yes
CE conformity	Yes
Enclosure rating	IP 20

	Order no.
Gateway Ethernet-KNX	1047326

ER75i Mobile Phone Router (GSM/GPRS/EDGE)

Important for operation of the mobile communications router:

- The products do not include a mobile communications data contract, which has to be concluded separately with a mobile communications provider.
- Please check in advance the network coverage of your mobile communications provider
- Make sure that the installation can be installed in a place whether the received signal has sufficient strength and there is also a power supply

P_MSRZ_0018_SW1

You can connect to your DULCOMARIN® II Disinfection Controller using the mobile phone router ER75i irrespective of the separation.

Mobile Ethernet makes it possible to use the available infrastructure for location-independent Ethernet communication.

In addition to GSM and GPRS, EDGE technology can also be used for data transfer. Stable and permanent connections are monitored and maintained through continuous control. An integrated DHCP server makes possible simple installation and fast Internet access. The ideal device for alarm signalling, remote control and remote service.

The mobile phone router ER75i is specially configured for the DULCOMARIN® II / Disinfection Controller.

The DULCOMARIN® II Disinfection Controller must have at least communications option 5 = web server. This DXCa option does not include the mobile phone router.

Scope of supply: Router, CD, patch cable, magnetic foot aerial, plug-in power pack.

GPRS/EDGE (class 10) mobile phone router for industrial applications (max. download 236 Kbit/s, max. upload 118.4 Kbit/s)

Single web-interface, DHCP, DynDNS, VRRP, NTP, dial-in router control via SMS

Data volume / roaming control via SMS

Status Information via SNMP and SMS

LED status display

Frequency bands:	850/900/1800/1900 MHz
Interfaces:	Ethernet 10/100
External GSM aerial:	FME - 50 Ω
Power supply:	10 ... 30 V DC
Working temperature range:	-30 °C ... +60 °C
Dimensions:	30 x 90 x 102 mm, plastic housing, also for wall mounting
Weight:	190 g (without aerial and plug-in power pack)
Degree of protection:	IP 44, for use in dry rooms or offices

	Order no.
GSM/GPRS/EDGE mobile phone router ER75i	1047329

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

UR5i Mobile Phone Router (UMTS/HSPA+)

Important for operation of the mobile communications router:

- The products do not include a mobile communications data contract, which has to be concluded separately with a mobile communications provider.
- Please check in advance the network coverage of your mobile communications provider
- Make sure that the installation can be installed in a place whether the received signal has sufficient strength and there is also a power supply

P_MSRZ_0019_SW1

You can connect to your DULCOMARIN® II/disinfection controller using the mobile phone router UR5i via UMTS/HSPA+ irrespective of distance.

Mobile Ethernet makes it possible to use the available infrastructure for location-independent Ethernet communication.

UMTS/HSPA+ technology can be used for data transfer. Stable and permanent connections are monitored and maintained through continuous control. An integrated DHCP server makes possible simple installation and fast Internet access. The ideal device for alarm signalling, remote maintenance and remote service.

With WLAN access. The WLAN access has no bridge function for connection to another WLAN network.

The mobile phone router is specially configured for the DULCOMARIN® II/disinfection controller.

The DULCOMARIN® II/disinfection controller must have at least option 4 = alarm signalling via SMS / email or higher. This DXCa option does not include the mobile phone router.

<emphasis>Scope of delivery:</emphasis> Router, CD, patch cable, magnetic foot aerial, plug-in power pack. Degree of protection: IP 44, for use in dry rooms or offices.

UMTS/HSPA+ Tri-Band (max. download 14.4 Mbit/s, max. upload 5.7 Mbit/s)
WLAN supported NAT/PAT and X.509
Integrated firewall (SPI)
Single web-interface, DHCP, DynDNS, VRRP, dial-in router control via SMS
Data volume / roaming control via SMS
Status information via SNMP and SMS
Extensive mobile connection statistics options
LED status display

Frequency bands:	GSM/GPRS/EDGE: 850/900/1800/1900 MHz UMTS: 850/900/1900/2100 MHz
External GSM aerial:	SMA - 50 Ω
Power supply:	10 ... 30 V DC
Working temperature range:	-30 °C ... +60 °C
Dimensions:	50 x 84 x 117 mm, DIN top hat rail 35 mm
Weight:	207 g
Degree of protection:	IP 44

	Order no.
UMTS/HSPA+ mobile phone router UR5i v2F	1047330

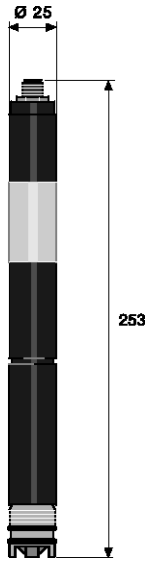
2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

Sensor for Free Chlorine CLE 3-CAN

Standard sensor for measuring free chlorine in clear water. For use on controllers with CAN-bus connection

Your benefits

- Measured variable: free chlorine, no significant cross sensitivity to combined chlorine (chloramines)
- Diaphragm-covered sensor (encapsulated) minimises faults caused by changing flow or ingredients in the water
- Operation on the CAN-bus with all the associated benefits



pk_6_096

Measured variable	Free chlorine (hypochlorous acid HOCl)
Reference method	DPD1
pH range	5.5 … 8.0
Temperature	5 … 45 °C
Max. pressure	1.0 bar
Intake flow	30…60 l/h (in the DGM or DLG III)
Supply voltage	Via CAN interface (11 - 30 V)
Output signal	Uncalibrated, temperature compensated, electrically isolated
Selectivity	Free chlorine as against combined chlorine, even if there is not an excess of it
Disinfection process	Chlorine gas, hypochlorite, electrolysis with diaphragm, disinfectants with organic chlorine, e. g. based on cyanuric acid, are unsuitable
Installation	Bypass: open sample water outlet
Sensor fitting	DGM, DLG III
Measuring and control equipment	DULCOMARIN® II
Typical applications	CLE 3-mA-0,5 ppm: potable water; CLE 3-mA-2.0/10 ppm: swimming pools (surfactant-free)
Resistance to	Salts, acids, alkalis. Not surfactants
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CLE 3-CAN-10 ppm	0.01…10.0 mg/l	1023425

Chlorine sensors complete with 100 ml of electrolyte

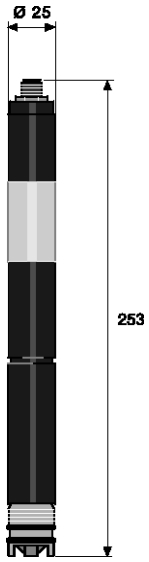
A mounting kit, order no. 815079, is required for initial fitting of the chlorine sensors in the in-line probe housing DLG III.

Sensor for Free Chlorine CLE 3.1-CAN

Sensor for the measurement of free chlorine in clear water with higher selectivity towards combined chlorine. For use on controllers with CAN-bus connection

Your benefits

- Measured variable: free chlorine, no cross sensitivity to combined chlorine (chloramines) even if there is an excess of it
- Diaphragm-covered sensor (encapsulated) minimises faults caused by changing flow or ingredients in the water
- Operation on the CAN-bus with all the associated benefits



pk_6_096

Measured variable	Free chlorine (hypochlorous acid HOCl) with large proportions of bound chlorine; to detect bound chlorine using DULCOMARIN® II and Sensor for Total Chlorine type CTE 1-CAN
Reference method	DPD1
pH range	5.5 … 8.0
Temperature	5 … 45 °C
Max. pressure	1.0 bar
Intake flow	30…60 l/h (in DGMa or DLG III)
Supply voltage	Via CAN interface (11 – 30 V)
Output signal	Uncalibrated, temperature compensated, electrically isolated
Selectivity	Free chlorine
Disinfection process	Chlorine gas, hypochlorite, electrolysis with diaphragm, disinfectants with organic chlorine, e. g. based on cyanuric acid, are unsuitable
Installation	Bypass: open sample water outlet
Sensor fitting	DGM, DLG III
Measuring and control equipment	DULCOMARIN® II
Typical applications	Potable water with higher percentages of combined chlorine;Swimming pools.To determine the combined chlorine from the difference: Total chlorine minus free chlorine in the controller DULCOMARIN® II
Resistance to	Salts, acids, alkalis. Not surfactants
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CLE 3.1-CAN-10 ppm	0.01…10.0 mg/l	1023426

Chlorine sensors complete with 100 ml of electrolyte

A mounting kit, order no. 815079, is required for initial fitting of the chlorine sensors in the in-line probe housing DLG III.

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

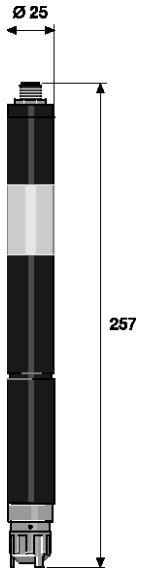
Sensor for Total Chlorine CTE 1-CAN

Sensor for total chlorine, including, for example, free chlorine, chloramines etc. even with high pH values in different kinds of water. For use on controllers with CAN-bus connection

Your benefits

- Measured variable: Total chlorine, chlorine compounds, in which chlorine acts as an oxidising agent, e.g. free chlorine (HOCl and OCl^-), chloramines etc.
- Diaphragm-covered sensor (encapsulated) prevents faults caused by changing flow or ingredients in the water
- Hydrophilic diaphragm guarantees permeability for different water-soluble oxidising agents towards the measuring electrodes
- The special reaction system of the electrolyte allows components containing oxidising chlorine to be determined and used at a high pH of up to 9.5
- Operation on the CAN-bus with all the associated benefits

Sensor for connection to a CAN interface (e.g. DULCOMARIN® II swimming pool controller)



pk_6_084

Measured variable	Total chlorine
Reference method	DPD4
pH range	5.5 … 9.5
Temperature	5 … 45 °C
Max. pressure	3.0 bar
Intake flow	30…60 l/h (in DGMa or DLG III)
Supply voltage	Via CAN interface (11 - 30 V)
Output signal	Uncalibrated, temperature-compensated, electrically isolated
Selectivity	Non-selective, cross-sensitive towards many oxidation agents
Disinfection process	Chlorine gas, hypochlorite, electrolysis with diaphragm, monochloramine
Installation	Bypass: open sample water outlet
Sensor fitting	DGM, DLG III
Measuring and control equipment	DULCOMARIN® II
Typical applications	CTE 1-mA-0.5 ppm: Potable water; CTE 1-mA-2/5/10 ppm: Potable, industrial, process, waste water. In swimming pools combined with CLE 3.1 to detect combined chlorine
Resistance to	surfactants
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CTE 1-CAN-10 ppm	0.01…10.0 mg/l	1023427

Chlorine sensors complete with 100 ml of electrolyte

A mounting kit, order no. 815079, is required for initial fitting of the chlorine sensors in the in-line probe housing DLG III.

Sensor for Total Available Chlorine CGE 2-CAN

Sensor for total available chlorine, such as derivatives of chloro(iso)cyanuric acid when used in swimming pools. For use on controllers with CAN-bus connection

Your benefits

- Measured variable: total available chlorine, for instance disinfectant with organic chlorine, such as derivatives of chloro(iso)cyanuric acid
- Diaphragm-covered sensor (encapsulated) minimises faults caused by changing flow or ingredients in the water
- Hydrophilic diaphragm guarantees the permeability of chloro(iso)cyanuric acid derivatives towards the measuring electrodes
- The special reaction system of the electrolyte allows the total available chlorine to be determined and use at a high pH of up to 9.5
- Operation on the CAN-bus with all the associated benefits

Measured variable	Total available chlorine: Total of organic combined chlorine (e.g. bound to cyanuric acid) and free chlorine
Reference method	DPD1
pH range	5.5 … 9.5
Temperature	5 … 45 °C
Max. pressure	3.0 bar
Intake flow	30…60 l/h (in the DGM or DLG III)
Supply voltage	Via CAN interface (11 – 30 V DC)
Output signal	Uncalibrated, temperature-compensated, electrically isolated
Selectivity	Only limited against combined chlorine (chloramines)
Disinfection process	Disinfectants with organic chlorine, e.g. based on cyanuric acid
Installation	Bypass: open sample water outlet
Sensor fitting	DGM, DLG III
Measuring and control equipment	DULCOMARIN® II
Typical applications	Swimming pool water, Disinfection processes with chloro(iso)cyanuric acid derivatives
Resistance to	surfactants
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CGE 2-CAN-10 ppm	0.01…10.0 mg/l	1024420

A mounting kit, order no. 815079, is required for initial fitting of the chlorine sensors in the in-line probe housing DLG III.

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

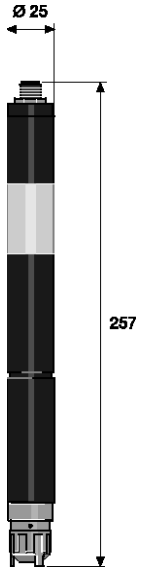
Sensor for Total Available Bromine BRE 3-CAN

Sensor for free and combined bromine, also for use with slightly contaminated water. For use on controllers with CAN-bus connection

Your benefits

- Measured variable: total available bromine from BCDMH and other oxidative-acting bromine organic disinfectants
- Diaphragm-covered sensor minimises faults caused by changing flow or ingredients in the water
- Use with high pH values by optimisation of the electrolyte diaphragm system
- Operation on the CAN-bus with all the associated benefits

Sensor for connection to a CAN interface (e.g. DULCOMARIN® II swimming pool controller)



pk_6_084

Measured variable	Total available bromine
Reference method	For DBDMH, free bromine: DPD1.For BCDMH: DPD4
pH dependence	If the pH changes from pH 7 to pH 8, the sensor sensitivity is reduced a) in the case of DBDMH and free bromine by approx. 10% b) in the case of BCDMH by approx. 25%
Temperature	5 … 45 °C
Max. pressure	3.0 bar
Intake flow	30…60 l/h (in DGM or DLG III)
Supply voltage	Via CAN interface (11 – 30 V)
Output signal	Uncalibrated, temperature-compensated, electrically isolated
Selectivity	Non-selective, cross-sensitive towards many oxidation agents
Disinfection process	DBDMH (1,3-dibromo-5,5-dimethyl-hydantoin), BCDMH (1-bromo-3-chloro-5,5-dimethyl-hydantoin), free bromine (HOBr, OBr^-)
Installation	Bypass: open sample water outlet
Sensor fitting	DGM, DLG III
Measuring and control equipment	DULCOMARIN® II
Typical applications	Swimming pools/whirlpools and cooling water; can also be used in sea water
Resistance to	surfactants
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
BRE 3-CAN-10 ppm	0.02…10.0 mg/l	1029660

Note: a mounting kit (order no. 815079) is required for initial fitting of the bromine sensors in the in-line probe housing DLG III.

Signal leads see Sensor Accessories, p. → 1-113

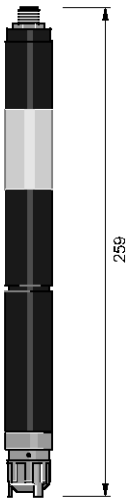
Chlorine Dioxide Sensor CDR 1-CAN

Sensor for the measurement of chlorine dioxide for all kinds of water, including hot and contaminated water. Without cross-sensitivity by free chlorine. For operation on controllers with 4-20 mA input

Your benefits

- Measured variable: Chlorine dioxide, without cross sensitivity to free chlorine
- Diaphragm-covered sensor minimises faults caused by changing flow or ingredients in the water
- Resistance to films of dirt by pore-free diaphragm
- Operating temperature up to 60 °C (short term) by appropriate sensor materials
- Operation on the CAN-bus with all the associated benefits

Sensors for connection to a CAN interface (e.g. Disinfection Controller)



P_DT_0071_SW1

Measured variable	Chlorine dioxide (ClO_2)
Reference method	DPD1
pH range	1.0 … 10.0
Cross sensibility	Ozone
Temperature	5 … 45 °C
Max. pressure	1.0 bar
Intake flow	30…60 l/h (in DGM or DLG III)
Supply voltage	Via CAN interface (11-30 V)
Output signal	Uncalibrated, temperature-compensated, electrically isolated
Response time sensor	t_{90}~ 3 min.
Selectivity	Chlorite, Chlorate, Free chlorine
Installation	Bypass: open sample water outlet
Sensor fitting	DGMa/DLGIII
Measuring and control equipment	DULCOMARIN® II
Typical applications	Contaminated industrial, process water, containing surfactants, cooling water, irrigation water, slightly contaminated waste water, warm water
Resistance to	Surfactants, water-soluble pollutants, solids/dirt, biofilms
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CDR 1-CAN-10 ppm	0.01…10.0 mg/l	1041155

* Complete with 100 ml of electrolyte, connecting cable - CAN M12 5-pin 0.5 m, T-distributor M12 5-pin CAN

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

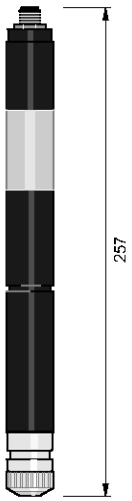
Chlorite Sensor CLT 1-CAN

Sensor for monitoring the disinfection by-product chlorite in compliance with potable water regulations. Without cross-sensitivity towards chlorine dioxide, chlorate and chlorine. For use on controllers with CAN-bus connection

Your benefits

- Online monitoring of the disinfection by-product chlorite
- Diaphragm-covered sensor minimises faults caused by changing flow or ingredients in the water
- No interference by chlorine dioxide/chlorine/chlorate
- Online monitoring improves process reliability
- Online monitoring replaces expensive laboratory analysis
- Operation on the CAN-bus with all the associated benefits

Sensors for connection to a CAN interface (e.g. Disinfection Controller)



P_DT_0070_SW1

Measured variable	Chlorite anion (ClO_2^-)
Reference method	DPD method, chlorite together with chlorine dioxide
pH range	6.5 … 9.5
Cross sensibility	Ozone
Temperature	1 … 40 °C
Max. pressure	1.0 bar
Intake flow	30…60 l/h (in DGM or DLG III)
Supply voltage	Via CAN interface (11-30 V)
Output signal	Uncalibrated, temperature-compensated, electrically isolated
Response time sensor	3 min.
Selectivity	Chlorite selective towards chlorine dioxide, chlorate and free chlorine
Installation	Bypass: open sample water outlet
Parts number/Identity code	DGM, DLG III
Measuring and control equipment	DULCOMARIN® II
Typical applications	Monitoring of potable water or similar water treated with chlorine dioxide. Selective measurement of chlorite and chlorine dioxide, chlorine and chlorate is also possible.
Resistance to	surfactants
Measuring principle, technology	Amperometric, 2 electrodes, membrane-covered

	Measuring range	Order no.
CLT 1-CAN-2 ppm	0.05…2.0 mg/l	1041156

* Complete with 100 ml of electrolyte, connecting cable - CAN M12 5-pin 0.5 m, T-distributor M12 5-pin CAN

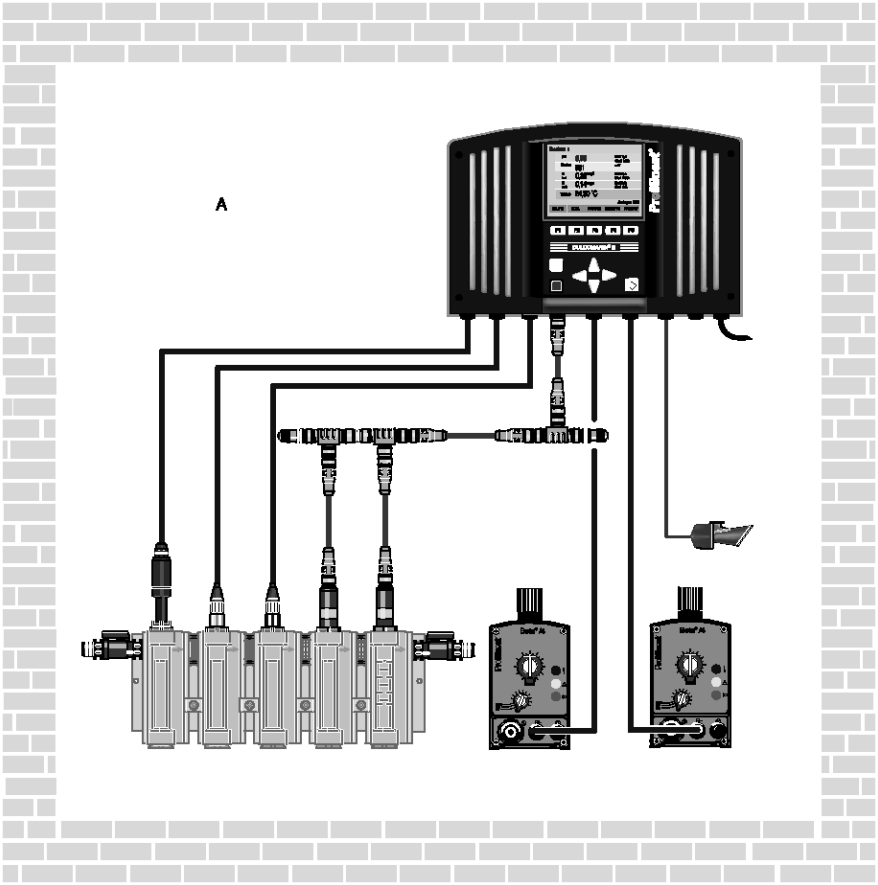
2.4.24 Application Examples: Treatment of Swimming Pool Water in Public Baths

A public swimming pool with measurement of free and combined chlorine

Tasks and applications

The pool water of a frequently-used indoor swimming pool in a hotel is to be treated. Sulphuric acid is used to correct the pH and sodium-calcium hypochlorite is used as the disinfectant. The disinfectant is to be regulated on the basis of the concentration of chlorine. The filters and pool are older, which is why the percentage of combined chlorine has to be continuously measured for safety reasons (regular calibration with a DPD 1+3 measuring unit is necessary). Document all measured values with a recorder.

A Plant room



pk_5_020_1_SW3

Components of the measuring/control station

Quantity	Name	See page	Order no.
1	DULCOMARIN® II central unit with measuring and control modules and integral screen writer	→ 2-48	DXCaW001MAPSDE01
1	Chlorine sensor CLE 3.1-CAN-10 ppm	→ 2-75	1023426
1	Chlorine sensor CTE 1-CAN-10 ppm	→ 2-76	1023427
2	Cable combination Coaxial 2 m - SN6 (open end) - pre-assembled	→ 2-70	1024106
1	pH sensor PHEP 112 SE	→ 1-13	150041
1	ORP sensor RHES-Pt-SE	→ 1-33	150703
2 m	Signal cable, sold by the metre 2 x 0.25 mm² Ø 4 mm	→ 1-115	725122
1	Bypass fitting DGMa with sample water limit contact	→ 1-120	DGMa322T000

All cables, T-pieces and termination resistors needed to connect the sensors are supplied.

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

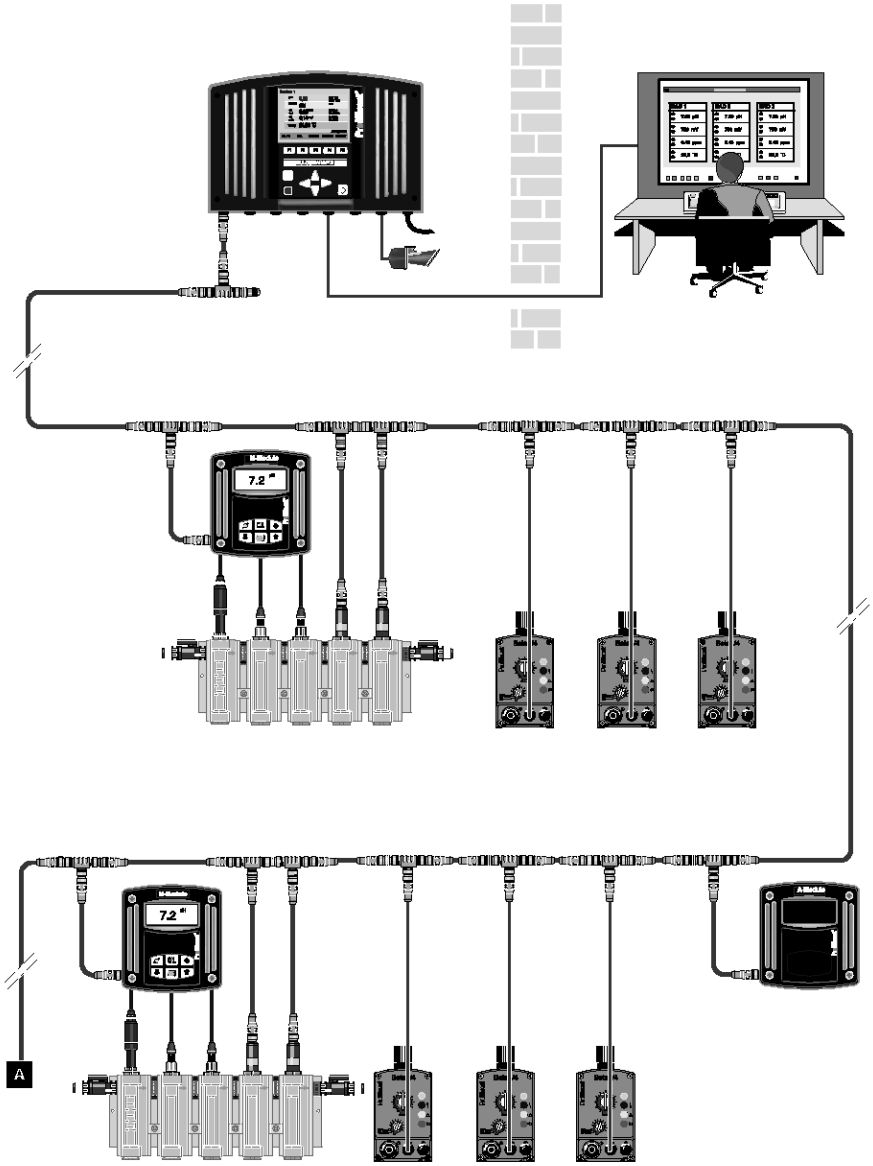
Benefits

- The integral data logger and screen writer document the hygiene parameters required by law
- Continuous measurement of the bound chlorine provides information about the water quality
- The measuring and control system can be subsequently extended, for instance if a whirlpool is planned

Public swimming pool with several pools

Tasks and applications

The pool water in 5 filtration circuits in a frequently-used leisure and adventure pool is to be treated. Sulphuric acid is used to correct the pH and sodium-calcium hypochlorite is used as the disinfectant. The disinfectant is to be regulated on the basis of the concentration of chlorine. Owing to the fact that the pool is heavily used, the percentage of combined chlorine is to be continuously measured for safety reasons (regular calibration with a DPD 1+3 measuring unit is necessary). Document all measured values with a recorder and transmit the measured values via OPC for process visualisation on the control panel. Metering pumps with a CAN bus connector are used. The filtration circuits each lie 50 m apart from each other.



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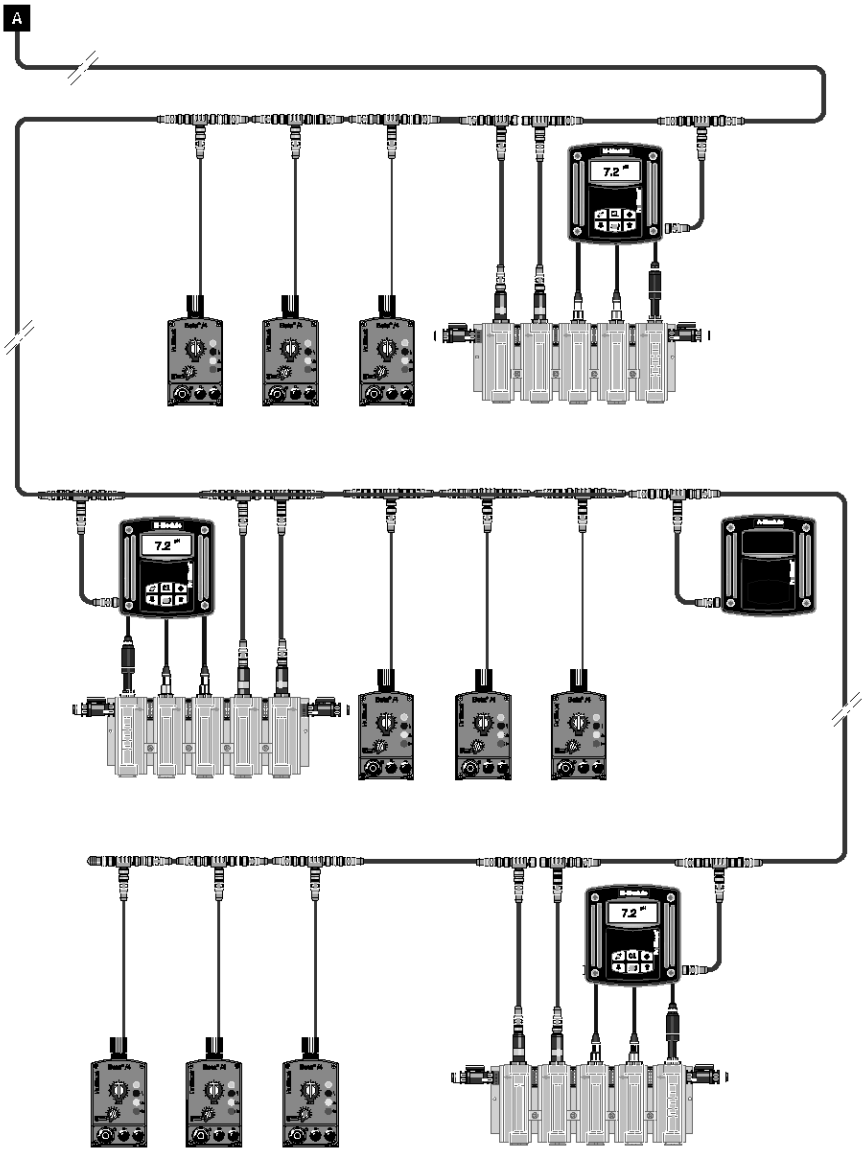
2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II



pk_5_051

Components of the measuring/control station

Quantity	Name	See page	Order no.
1	DULCOMARIN® II central unit with screen writer, LAN connector and web+OPC server	→ 2-48	DXCaW06100PSDE01
5	DXMa measuring module, measurement and control of pH, ORP, free and bound chlorine and temperature	→ 2-56	DXMAMW0SDE01
5	Chlorine sensor CLE 3.1-CAN-10 ppm	→ 2-75	1023426
5	Chlorine sensor CTE 1-CAN-10 ppm	→ 2-76	1023427
10	Cable combination Coaxial 2 m - SN6 (open end) - pre-assembled	→ 2-70	1024106
5	pH sensor PHEP 112 SE	→ 1-13	150041
5	ORP sensor RHES-Pt-SE	→ 1-33	150703
10 m	Signal cable, sold by the metre 2 x 0.25 mm^2 Ø 4 mm	→ 1-115	725122
5	Bypass fitting DGMa with sample water limit contact	→ 1-120	DGMa322T000
2	Power supply modules DXMaN	→ 2-56	DXMANW300001
300 m	Connecting cable - CAN, sold by the metre	→ 2-70	1022160
5	CAN bulk cable connection kit	→ 2-70	1026589

All cables, T-pieces and termination resistors needed to connect the sensors are supplied.

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

Benefits

- All hygiene parameters in the five filtration circuits, together with all key parameters, such as air conditioning or heating parameters in the building management system, can be displayed by the PLC server
- Monitoring of all measured values and control parameters from one central location, such as the pool plant room
- The integral data logger and screen writer document the hygiene parameters required by law

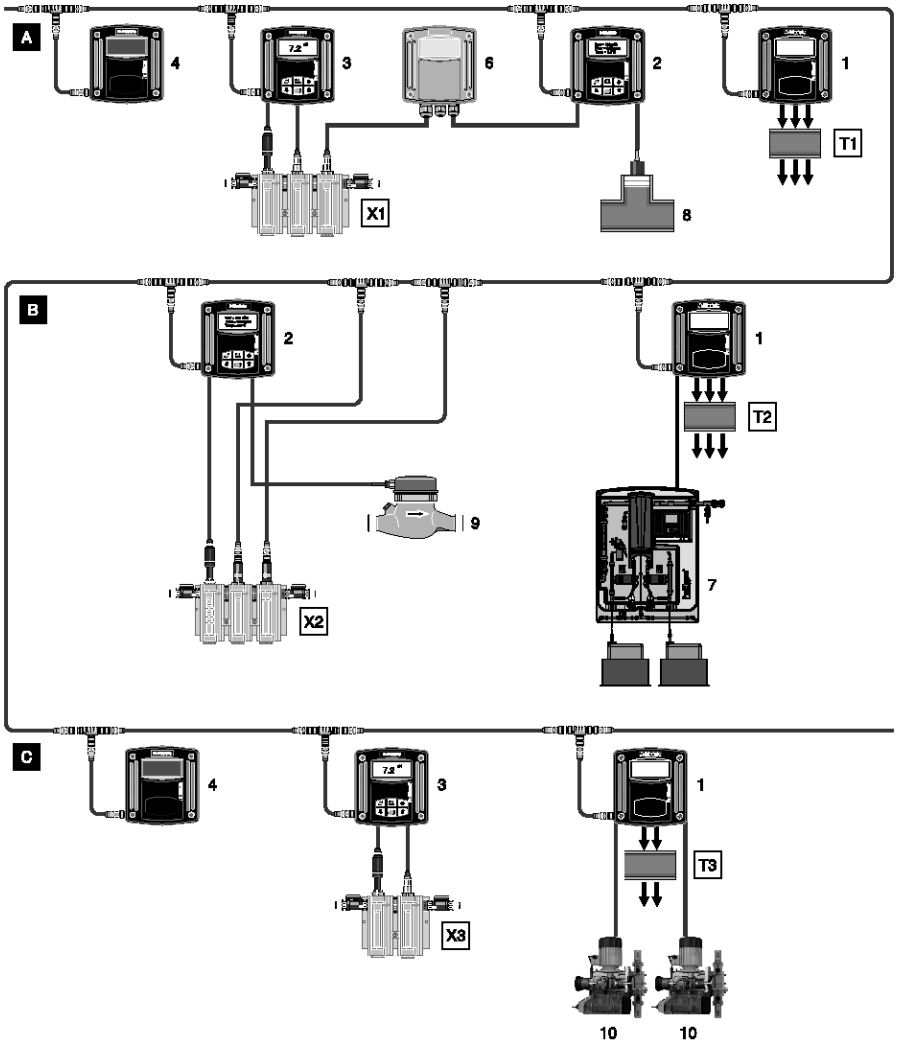
2.4.25 Application Example: Measurement of Key Chemical Water Parameters at Various Points in the Treatment of Drinking Water

Tasks and applications

Measuring and control stations are needed at the following points in the treatment cycle and in the control room in the treatment of potable water in a water works:

- Assessment of the raw water at the inlet of the water works: pH, electrolytic conductivity, turbidity
- Intermediate oxidation/disinfection of the raw water with chlorine dioxide by combined flow- and variable-dependent control
- Control of the pH value on the basis of variable-dependent metering of lime milk
- Disinfection of the treated water to protect the distribution system network by the flow-proportional metering of chlorine dioxide
- Measuring stations for final inspection of the treated water: pH, electrolytic conductivity, turbidity, chlorine dioxide and chlorite and ORP

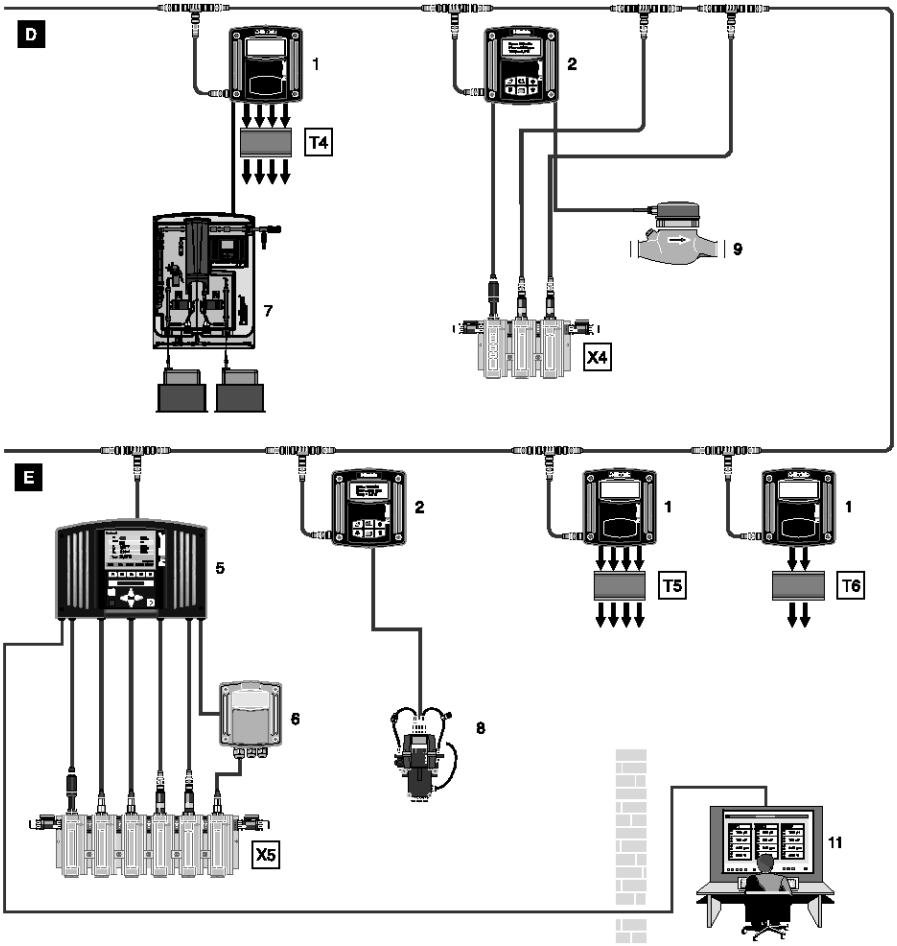
A	Raw water inlet control
B	Intermediate oxidation/disinfection with chlorine dioxide
C	pH adjustment
1	A module
2	I module
3	M module
4	N module
5	Disinfection Controller
6	DMT transmitter
7	Chlorine dioxide generator
8	Turbidity
9	Flow sensor
T1	Isolating amplifier with signal outputs for pH, conductivity and temperature
T2	Isolating amplifier with signal outputs for chlorine dioxide, chlorite and flow in the process line
T3	Isolating amplifier with signal outputs for pH measurement and pH control variable
X1	DGMA with flow control, pH sensor and conductivity sensor
X2	DGMA with flow control, chlorine dioxide sensor and chlorite sensor
X3	DGMA with flow control and pH sensor



AP_PTW_0003_1_SW3

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

D	ClO_2 disinfection
E	Final inspection
1	A module
2	I module
3	M module
4	N module
5	Disinfection Controller
6	DMT transmitter
7	Chlorine dioxide generator
8	Turbidity
9	Flow sensor
T4	Isolating amplifier with signal outputs for chlorine dioxide measurement, control variable, chlorite, flow
T5	Isolating amplifier with signal outputs for pH, ORP, chlorine dioxide and chlorite
T6	Isolating amplifier with signal outputs for turbidity and conductivity
X4	DGMA with flow control, chlorine dioxide sensor and chlorite sensor
X5	DGMA with flow control, pH, ORP, chlorine dioxide, chlorite and conductivity sensors
11	Control panel (OPC server)



AP_PTW_0003_2_SW3

The following conditions must be met:

- Disinfectant: free chlorine with an adjustable concentration of 0.2 ppm
- Raw water: surface water with a pH of 7.0-7.5 and a temperature of 5 °C-17 °C
- Installation of the measuring stations in the bypass of the process flow
- Distributed system at a distance of 300 m with bidirectional communication between
  - **a** The central unit located in the plant monitoring room at the outlet of the water works and used to display, register and transmit all measured values and actuating variables to the control panel via the OPC server. Optionally all measured values can be transmitted via 4-20 mA signals to the control panel.
  - **b** Modular measuring and control units located adjacent to the relevant bypass installation to connect the sensors, display the measured value, calibrate the measuring station and transmit the measured value to the central unit and via an electrically isolated 4-20 mA signal to the control panel.
- Alarm signalling the infringement of preset upper and lower limit values and ingress of the sample water flow

2.4 Multi-Channel Multi-Parameter Measuring and Control System DULCOMARIN® II

Components of the measuring/control station

Quantity	Name	See page	Order no.
Measuring and control units			
1	DULCOMARIN® II multi-channel measuring and control system for the treatment of potable water	→ 2-37	DXCA WD61MINDDE01
2	M module	→ 2-53	DXMA MW0DDE01
6	A module	→ 2-55	DXMa AW0DDE01
3	I module	→ 2-54	DXMa IW0DDE01
3	N module	→ 2-56	DXMa NW200001
6	Isolating amplifier 4-channel for mA outputs of the A module	→ 2-70	1033536
Sensors			
3	pH sensor PHEP 112 SE	→ 1-13	150041
1	RHEP-Pt-SE	→ 1-35	150094
3	CDR 1-CAN-10 ppm	→ 2-79	1041155
2	Conductivity LFT 1 DE	→ 1-97	1001376
2	Turbidity	–	External unit with 4-20 mA signal
2	CLT 1-CAN-2 ppm	→ 2-80	1041156
Connecting cable			
300 m	Connecting cable - CAN, sold by the metre	→ 2-70	1022160
5	CAN bulk cable connection kit	→ 2-70	1026589
5	Signal cable, sold by the metre 2 x 0.25 mm² Ø 4 mm	→ 1-115	725122
4	Cable combination Coaxial 2 m - SN6 (open end) - pre-assembled	→ 2-70	1024106
2	Measuring line type LKT for conductivity sensors Ø 6.2 mm	→ 1-114	1046024
Fitting			
1	Bypass fitting DGMA	→ 1-120	DGMA 320T000
2	Bypass fitting DGMA	→ 1-120	DGMA 302T000
1	Bypass fitting DGMA	→ 1-120	DGMA 332T000
1	Bypass fitting DGMA	→ 1-120	DGMA 301T000

Benefits

- Cost-savings due to distributed system with only one central unit
- Cost-savings and enhanced cabling safety by means of a BUS system
- Improved process safety by the permanent and reliable availability of digital measured data and operating statuses, as well as automated process management and alarm signalling by bidirectional BUS intercommunication of all measuring and control units and communication to the higher-order control system via the OPC server
- Excellent data transparency at field level by the registration, display and traceability of all relevant measured and operating data in the central unit

2.5 Controller AEGIS II/Cool Control Pro

2.5.1 Controller AEGIS II/Cool Control Pro

Control of cooling water in open cooling circuits and boiler feed water from steam generators

The controller AEGIS II/Cool Control Pro continuously measures and regulates the conductivity and controls the biocide concentration to keep pipework and heat exchangers clean.

AEGIS II/Cool Control Pro records all the necessary measuring parameters for cooling water and steam generator water treatment and controls the functions necessary for smooth operation:

- Electrolytic conductivity – controls bleeding
- Corrosion measurement – determines whether enough corrosion inhibitor is being metered
- pH measurement – measures and controls pH
- Biocide measurement (e.g. chlorine) – measures and controls the biocide concentration

P_AE_0002_SW1

Your benefits

- Biocide metering is timer-controlled
- The online measurement and control of biocide concentration takes place continuously if required
- Remote maintenance via web interface with web server
- Blowdown lock: blocks blowdown after biocide metering takes place
- Forced blowdown: performs blowdown before biocide metering
- Operating status shown by 10 status LEDs

Technical details

- Protection class: IP 65
- 8 digital status inputs
- mA input for flow signal and temperature input
- 2 serial sensor inputs
- 3 plug-in module positions: Plug-in modules for 2 each of mA outputs, pH/ORP inputs, mA inputs for amperometric sensors and serial sensor inputs
- 5 outputs for output relay
- 4 pulse frequency outputs

Field of application

- Control of blowdown in evaporator cooling circuits
- Volume-proportional control or regulation of the metering of corrosion inhibitors, de-foamers and dispersants
- Measurement and control of inhibitor concentration through the use of a fluorescence sensor
- pH measurement and optional pH control
- Metering of up to 2 biocides based on time or measured values

* Available from 3rd quarter of 2016.

2.5.2 Identity Code Ordering System for AEGIS II/Cool Control Pro

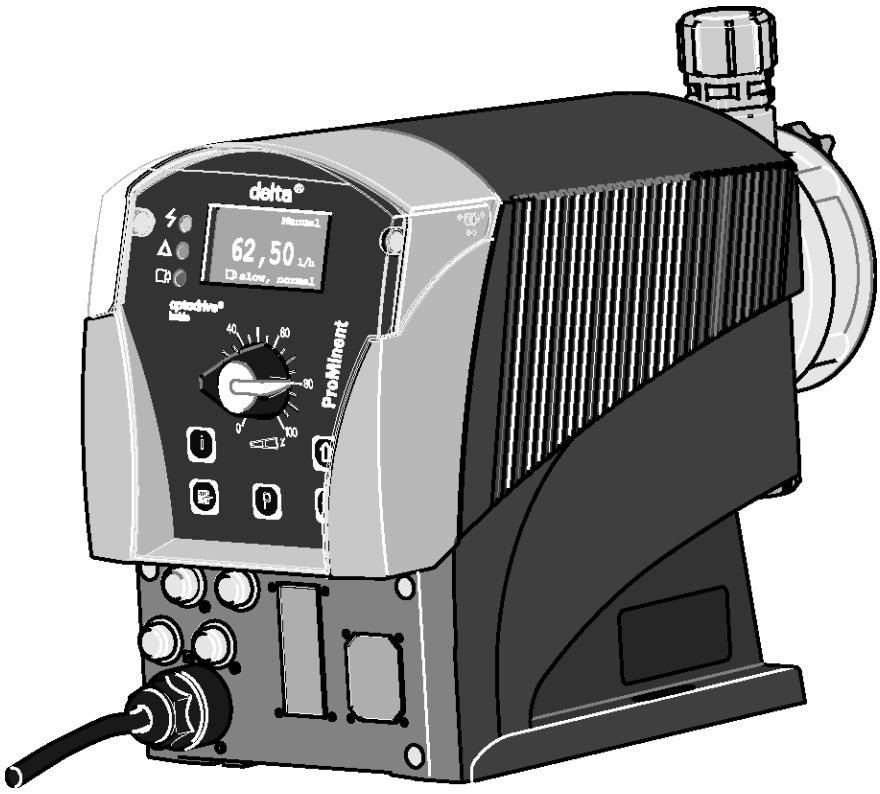
AEGIS II/Cool Control Pro product range AGIB

AGIB	Design															
	00	Wall mounted with ProMinent logo														
		Operating voltage														
		6	100 – 240 V, 50/60 Hz													
			Communication interface													
			LO	LAN												
			BL	LAN and Bluetooth												
			WO	LAN and WLAN												
			BW	LAN and WLAN and Bluetooth												
				Connector of serial sensors input A												
				0	none											
				S1	Cooling tower CTF at input A											
				C1	Corrosion at input A											
					Connector of serial sensors input B											
					0	none										
					S1	Cooling tower CTF at input B										
					C1	Corrosion at input B										
						Extension slot (Input C/D)										
						0	not assigned									
						CI	2-channel mA input module									
						OP	2-channel mV input module (pH/ORP)									
						IO	2-channel mA output module									
						CN	Conductivity, condensate temperature									
						B2	Conductivity steam boiler (without temperature)									
						CO	Conductivity, temperature									
						SS	Serial sensor module 1-channel									
							Extension slot (Input E/F)									
							0	not assigned								
							CI	2-channel mA input module								
							OP	2-channel mV input module (pH/ORP)								
							IO	2-channel mA output module								
							CN	Conductivity, condensate temperature								
							B2	Conductivity steam boiler (without temperature)								
							CO	Conductivity, temperature								
							SS	Serial sensor module 1-channel								
								Extension slot (Input I/J)								
								0	not assigned							
								CI	2-channel mA input module							
								OP	2-channel mV input module (pH/ORP)							
								IO	2-channel mA output module							
								CN	Conductivity, condensate temperature							
								B2	Conductivity steam boiler (without temperature)							
								CO	Conductivity, temperature							
								SS	Serial sensor module 1-channel							
									Pump activation							
									0	Relay without presetting						
									P	Supplied (115/230 V), relay (R1+R2)						
									V	Pulse frequency (P6 to P9)						
									X	Combination of option P+V						
										Pre-wired relay outputs						
										0	Only for use outside Europe					
											Pre-wired output relay					
											0	Only for use outside Europe				
												Inhibitor metering outputs				
												0	none			
												1	one			
												2	two			
													Biocide metering outputs			
													0	none		
													1	one		
													2	two		
													3	three		
														Hardware extension		
														0	none	
															Approvals	
															0	UL/MET/CSA

2.6 Controller with Integral Metering Pump

2.6.1 Controller with Integral Metering Pump

You can find the Solenoid Driven Metering Pump delta® with controller module in Volume 1, see page → 1-20



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delta®

2.7 DULCOMETER® Transmitters

2.7.1 Transmitter DULCOMETER® DMTa

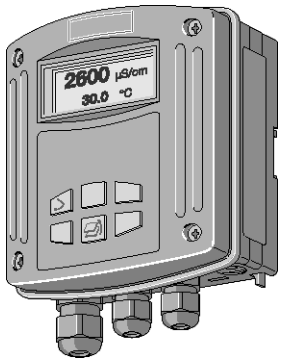
The compact 2-wire transmitter – the link to the PLC and DULCOMETER®.

The transmitter DULCOMETER® DMTa converts the sensor signals for pH, ORP value, chlorine concentration and conductivity into an interference-insensitive 4-20 mA analogue signal. Flexible, safe and always the optimum resolution of measured value.

The 2-wire transmitter DMTa converts the following sensor signals into an interference-insensitive 4-20 mA analogue signal: pH, ORP, temperature, chlorine and conductivity.

It is fed via the 2-wire analogue input of a PLC or via a 2-wire analogue input of a ProMinent controller. The 4-20 mA analogue current proportional to the measured value is transmitted via the same two lines.

The DMTa offers an on-site calibration option of the sensor and galvanic separation between the sensor input and measured value output.



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Your benefits

- Flexibility in the choice of measured variable with pH, ORP and temperature
- Excellent operational safety, thanks to sensor monitoring (pH)
- Galvanic isolation between the sensor and supply
- Always the optimum measured value resolution by auto-ranging with conductivity measurement
- Safety through sensor monitoring of pH for glass breakage and line breakage
- Various installation options: wall-mounted, installation on an upright or in a control cabinet

Technical details

- Measured variables: pH, ORP, chlorine, temperature and conductivity
- Accuracy: 0.5% of the upper range value
- Correction variable: Temperature via Pt 100/Pt 1000 (pH, chlorine, conductivity)
- Communication interface: PROFIBUS®-DP (wall-mounted only)
- Protection class: IP 65 (wall-mounted, pipe installation), IP 54 (installation in a control cabinet)
- Display: Graphic display

Field of application

Measuring technology in water treatment in the following sectors:

- Processes and process technology
- Food and beverage industry
- Chemical industry
- Pharmaceuticals
- Waste water treatment
- Power station technology

Technical Data

Measuring range	pH - 1.00 … 15.00 - 1200 … +1200 mV ORP voltage 0.01 … 5.0 mg/l chlorine -20 … +150 °C 1 µS/cm … 200 mS/cm (autoranging), corresponding to cell constant
Cell constant	0.006 … 12.0/cm for conductivity
Resolution	0.01 pH 1 mV 0.1% from measurement range for chlorine 0.1 °C Conductivity 1/1000 of display value (min. 0.001 µS/cm)
Accuracy	0.5% from measurement range
Measurement input	mV terminal (pH, ORP); imput resistance > 5 x 10^{11} Ω Chlorine terminal (DMT chlorine sensors) Pt 100/1000 terminal Conductivity terminal (2 or 4 wire connector)
Correction variable	Temperature via Pt 100/1000 (pH, chlorine, conductivity)
Correction range	Chlorine: 5 … 45 °C, pH: 0 … 100 °C, conductivity: 0 … 100 °C
Current output	4…20 mA
Fault current	23 mA

2.7 DULCOMETER® Transmitters

Feed voltage	2-wire transmitter, 16 … 40 V DC, nominal 24 V PROFIBUS®-DP version, 16 … 30 V DC, nominal 24 V
Communication interface	PROFIBUS®-DP (wall-mounted version only)
Permissible ambient temperature	0…55 °C
Climate	Relative humidity up to 95% (non-condensing)
Enclosure rating	IP 65 (wall/pipe mounted) IP 54 (control panel installation)
Display	graphical display
Housing material	PPE
Dimensions H x W x D	135 x 125 x 75 mm
Weight	0.45 kg

A complete measuring station comprises the following:

- DMTa measuring transducer (see Identity code)
- In-line probe fitting: DGMa..., DLG III ..., immersible in-line probe fitting
- Chlorine sensor (dependent on Identity code)
- Assembly set for chlorine sensor
- pH sensor (dependent on Identity code)
- ORP sensor (dependent on Identity code)
- Temperature sensor Pt 100 /Pt 1000 (dependent on Identity code)
- Conductivity sensor
- Sensor cable
- PROFIBUS® DP connection accessories

(for further information: Immersion Fittings see page → 1-122; Sensors for Chlorite see page → 1-49; pH Sensors with SN6 or Vario Pin Plug-In Head see page → 1-10; ORP Sensors with Fixed Cable see page → 1-43; DULCOTEST® Temperature Sensors see page → 1-46; Conductivity Sensors see page → 1-85; Sensor Accessories see page → 1-113;
Metering Monitor, Signal Cable see volume 1 page)

2.7.2 Identity Code Ordering System for Transmitter DMTa

DULCOMETER® Transmitters

DMT	Series											
	A	Version										
		Installation										
		W	Wall mounted (also pillar mounted)									
		S	Control panel installation[1)]									
			Version									
			0	With ProMinent® logo								
				Power supply								
				9	Current loop 4-20 mA (two wire technology), operating voltage 16...40 V DC, nominal 24 V DC (only if communication point = none)							
				5	PROFIBUS® DP, operating voltage 16…30 V DC, nominal 24 V DC (only if communication interface = PROFIBUS® DP)							
					Communication interfaces							
					0	None						
					4	PROFIBUS® DP (assembly type W only)						
						Measured variable 1						
						P	pH					
						R	ORP					
						T	Temperature					
						C	Chlorine					
						L	Conductivity					
							Measured variable 2 (Correction variable)					
							1	Temperature Pt 1000/Pt 100				
							0	None (in the case of measured variable T)				
								Enclosure rating				
								0	Standard			
									Language			
									D	german		
									E	english		
									F	french		
									S	spanish		
									I	italian		
										Presetting A, probe		
										0	Standard ProMinent® buffer solution pH 4-7-10	
										D	Ref. buffer DIN 19266 pH 4-7-9	
										V	Variable buffer recognition	
											Presetting B, probe	
											0	Autom. temperature measurement (standard)
											1	Manual temperature measurement
											2	Autom./manual temperature measurement
											9	No temperature measurement
												Presetting C, output
												0 Prop. measured variable (standard)
												1 Manual adjustable current value
												2 Proportional or manual
												3 Proportional or manual hold
												4 4 mA constant current

The last four figures in the identity code represent the software defaults, e.g. cell constants for conductivity, temperature compensation, etc.

0 = standard parameters

The measuring transducer can be factory-set. The defaults can be easily changed in the operating menu.

Note:

[1] The rear housing part is omitted for control panel mounting.

2.7 DULCOMETER® Transmitters

2.7.3 Application Example: Measurement of Free Chlorine with Connection to a PLC

Tasks and applications

In the treatment of drinking water in a water works with a PLC as the higher-order control system, simple measuring stations are needed to measure the disinfectant "free chlorine" at the outlet of the water works and thereafter to monitor protection of the network in the distribution system. Metering is proportional to the flow and is controlled by the PLC. The following conditions must be met:

- Disinfectant: free chlorine with an adjustable concentration of 0.1 ppm
- Raw water: groundwater with a pH of 7.5 and a temperature of 8-13 °C
- Installation of the measuring station in the bypass of the process flow
- Display of the measurement result and calibration by a measuring instrument in the proximity of the bypass installation and transmission of the measured value to the PLC via an electrically isolated 4-20 mA signal
- Power supply to the measuring instrument via the PLC (two wire instrument)

Components of the measuring/control station

Quantity	Name	See page	Order no.
1	Transmitter DMTa	→ 2-91	DMTa W090C00D0000
1	Sensor for free chlorine CLE 3-DMT-5 ppm	→ 1-53	1005511
1	5-core universal cable, 5-pin round plug	→ 1-114	1001300
1	Bypass fitting DGMA	→ 1-120	DGMa 101T000

Benefits

- Simple, compact and cost-effective measuring station close to the bypass installation
- Electrical installation cost-savings due to power supply over a two wire system
- No need for electrical isolation of the output signal by electrical isolation integral to the DMT

2.7 DULCOMETER® Transmitters

2.7.4 Transmitter DULCOMETER® DULCOPAC

The compact transmitter for installation in control cabinets.

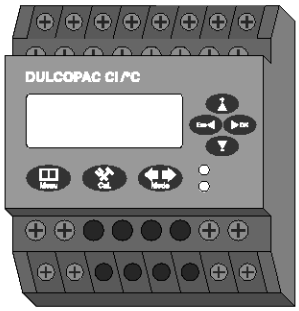
The transmitter DULCOMETER® DULCOPAC is a complete PID controller for the key measuring parameters in water treatment. It can be installed on a top hat rail inside a control cabinet.

The DULCOPAC transmitter in a DIN housing is intended for installation on a top hat rail (in a control cabinet). It measures and regulates the measured variables in aqueous solutions: pH, ORP, chlorine, bromine, peracetic acid, hydrogen peroxide and conductivity.

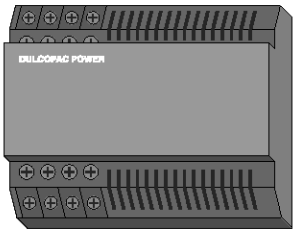
With the measured variables pH and ORP, it is possible to select between a DULCOPAC transmitter with a highly-ohmic coaxial input (direct connection of a pH/ORP sensor) or a 4-20 mA two-wire input. A transmitter is also needed when connecting pH or ORP via 4-20 mA (part no. 809126 for pH and part no. 809127 for ORP).

Two analogue outputs (0/4...20 mA) are available for recording purposes and two potential-free low voltage relays with a changeover contact for control of metering pumps. The analogue outputs are electrically isolated. The DULCOPAC is operated and configured using buttons and the integrated LC display via codes.

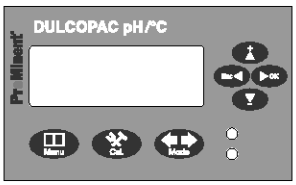
The power supply is provided via a special DULCOPAC power supply and can feed up to 10 DULCOPAC units. It provides the requisite galvanic isolation to the mains power supply.



P_DM_0023_SW



P_DM_0021_SW



P_DM_0022_SW

Your benefits

- Space-saving: Direct installation in a control cabinet
- Safe measuring technology: galvanic isolation between the sensor and power supply

Technical details

- Measured variables: pH, ORP, chlorine, bromine, conductivity, hydrogen peroxide, peracetic acid and temperature
- Correction variable: Temperature for pH and conductivity via Pt 100
- Control characteristic: P/PID control
- Control: Bidirectional control
- Signal current output: 2 x 0/4-20 mA electrically isolated
- Protection class: IP 20

Field of application

- Measurement and control of water parameters in industrial and process water treatment plants
- Processes and process technology
- Electroplating
- Waste water treatment

Technical Data

Measuring range	pH: 2.00 ... 14 ORP: -1,500 ... +1,500 mV Chlorine, bromine: 2 ppm to 100 ppm in 6 ranges Conductivity: 2 electrodes 100 µS/cm-10 mS/cm, k=0.1 to 10 cm^{-1} Hydrogen peroxide: 0-200 to 50,000 ppm Peracetic acid: 0-50 to 5,000 ppm Temperature
Correction variable	Temperature for pH and conductivity via Pt 100
Correction range	0 ... 100 °C
Control characteristic	P/PID control
Control	2-sided control
Signal current output	2 x 0/4-20 mA electrically isolated, range and assignment (measured or actuating variable) can be set
Control outputs	2 extra low voltage relays, 48 V with 1 A as a control output with pulse width modulation or limit value output
Electrical connection	24V DC, 3W, via DULCOPAC power supply unit
Permissible ambient temperature	-10…50 °C
Dimensions	60 x 90 x 55 mm (H x W x D)
Enclosure rating	IP 20
Weight	0.3 kg

2.7 DULCOMETER® Transmitters

	Order no.
DULCOPAC pH (mV)	1036425
DULCOPAC pH (mA)	1036426
DULCOPAC ORP/redox (mV)	1036427
DULCOPAC ORP/redox (mA)	1036428
DULCOPAC Chlorine	1036429
DULCOPAC Conductivity (mA)	1036430
DULCOPAC Conductivity (direct)	1036431
DULCOPAC PAA (peracetic acid)	1036432
DULCOPAC PEROX	1036433
DULCOPAC Bromine	1036434
DULCOPAC power supply unit, 230 V AC - 24 V DC	1036436

2.7.5 Application Examples for DULCOPAC

This chapter describes typical combinations of components for measuring stations with DULCOPAC transducers.

Measurement of pH with connection to a PLC

Tasks and applications

The pH value is to be measured in the bypass of a process water pipe, temperature 35 °C, pressure 3 bar, no solid matter content The transducer is located in a control cabinet and the converted measuring signal is transmitted to a PLC as an analogue signal.

Components of the measuring/control station

Quantity	Name	See page	Order no.
1	DULCOPAC pH (mV)	→ 2-95	1036425
1	DULCOPAC power supply unit, 230 V AC - 24 V DC	→ 2-95	1036436
2 m	Coaxial cable Ø 5 mm, 10.0 m - S	→ 1-113	305040
1	pH sensor PHEP 112 SE	→ 1-13	150041
1	Bypass fitting DGMA with sample water limit contact	→ 1-120	DGMa310T000

Measurement of free chlorine with connection to a PLC

Tasks and applications

The concentration of chlorine is to be measured in the bypass of a process water pipe. Chlorine concentration approx. 0.6 ppm, water temperature approx. 35 °C, total pressure approx. 1 bar, no solid matter. The transducer is located in a control cabinet and the converted measuring signal is transmitted to a PLC as an analogue signal.

Components of the measuring/control station

Quantity	Name	See page	Order no.
1	DULCOPAC Chlorine	→ 2-95	1036429
1	DULCOPAC power supply unit, 230 V AC - 24 V DC	→ 2-95	1036436
2 m	Signal cable, sold by the metre 2 x 0.25 mm^2 Ø 4 mm	→ 1-115	725122
1	Chlorine sensor CLE 3-mA-2 ppm	→ 1-51	792920
1	Bypass fitting DGMA	→ 1-120	DGMa 301T000

Measurement of conductive conductivity with connection to a PLC

Tasks and applications

The electrolytic conductivity is to be measured in the bypass of a process water pipe. Conductivity approx. 7500 µS/cm, water temperature approx. 35 °C, total pressure approx. 1 bar, no solid matter. The transducer is located in a control cabinet and the converted measuring signal is transmitted to a PLC as an analogue signal.

Components of the measuring/control station

Quantity	Name	See page	Order no.
1	DULCOPAC Conductivity (direct)	→ 2-95	1036431
1	DULCOPAC power supply unit, 230 V AC - 24 V DC	→ 2-95	1036436
1	Measuring line type LKT for conductivity sensors Ø 6.2 mm	→ 1-114	1046024
1	Conductivity LFT 1 DE	→ 1-97	1001376
1	Bypass fitting DGMA with sample water limit contact	→ 1-120	DGMa310T000

2.8 Measuring and Test Systems

2.8.1 Portable Meter Portamess® – Measured Variable pH/ORP

Robust manual measuring instrument to withstand the most severe mechanical and chemical loading.

Measuring range pH -2.00 to + 16.00, ORP -1,300 … +1,300 mV

pH and ORP measurement with Portamess® pH/ORP - battery-powered, hand-held meter with automatic or manual temperature compensation.

pk_5_099

The Portamess® pH/ORP is used to measure the pH and ORP value in the industrial, environmental, food and waste water sectors. The unit complies with the requirements of the EMC Act and the NAMUR NE 21 recommendations. Calibration can be done with buffer solutions made of different, pre-selectable buffer sets.

Your benefits

- Robust and protected against ingress (IP 66 protection)
- Long lifespan: Over 2,000 h operating time with only 3 x AA batteries
- Always in sight: Large LC display
- Hard-wearing membrane keypad
- Integrated sensor quiver to protect the sensor
- Robust, watertight, gold-plated sockets

Technical details

- **Measuring ranges** pH: -2.00 … +16.00, ORP: -1,300 … +1,300 mV
- **Measuring errors** pH: < 0.01, ORP: < 0.1% of the measured value ±0.3 mV
- **Sensor adaptation:** 8 buffer sets to choose from
- **Temperature compensation:** manual
- **Protection class:** IP 66
- **Operating time:** 2,000 hours with 3 x AA cells
- **Dimensions:** H x W x D 160 x 133 x 30
- **Weight:** 560 g with batteries
- **Scope of delivery:** Measuring instrument, field case, operating instructions in German, English and French.

Field of application

- Industry
- Environmental protection
- Food production
- Water or waste water inspection

	Order no.
Portamess® 911 pH	1008710

Accessories

	Capacity ml	Order no.
PHEKT-014F	–	1036537
Coaxial cable Ø 5 mm, 0.8 m - SD*	–	305098
Buffer pH 7.0	50	506253
Buffer pH 4.0	50	506251

* Fitting for all ProMinent® pH sensors with SN6 connection

Sensor quiver see p. → 2-104

2.8 Measuring and Test Systems

2.8.2 Portable Meter Portamess® – Measured Variable Conductivity

Robust measuring instrument to withstand the most severe mechanical and chemical loading.

Measuring range 0.01 µS/cm – 1,000 mS/cm

The measuring instrument Portamess® conductivity is a robust, leak-tight and battery-operated hand-held measuring instrument with a large measuring range and automatic or manual temperature compensation, which can be used in the industrial, environmental, food and waste water sectors.

pk_5_098

The Portamess® conductivity is used to measure conductivity and temperature in the industrial, environmental, food and waste water sectors. The unit complies with the requirements of the EMC Act and the NAMUR NE 21 recommendations. Calibration can be done with buffer solutions made of different, pre-selectable buffer sets.

Your benefits

- Robust and leak-tight
- Long lifespan: Over 1,000 h operating time with only 3 x AA batteries
- Always in sight: Large LC display

Technical details

Measuring ranges:

- Conductivity instrument: 0.01 µS/cm ... 1,000 mS/cm, with sensor LF204: 1 µS/cm ... 500 mS/cm
- Temperature: -20 … 120 °C
- Salinity: 0.0 … 45.0 g/kg (0 … 30 °C)
- TDS: 0 … 1,999 mg/l (10 … 40 °C)

Measuring error:

- Conductivity < 0.5% of the measured value (with conductivities of > 500 mS/cm < 1% of the measured value) ±1 digit
- Temperature < 0.3 K ±1 digit

Sensor adaptation:

- Direct input of the cell constants, automatic establishment of the cell constants with KCl solution 0.01 or 0.1 mol/l, cell adaptation with any known solutions

Cell constant k:

- 0.010 … 199.9 cm-1 (adjustable)

Temperature compensation:

- Configurable, manual or measured

Protection class:

- IP 66

Operating time:

- Approx. 1,000 hours with 3 x AA cells

Dimensions:

- 160 x 133 x 30 mm (H x W x D)

Weight:

- 560 g with batteries

Scope of delivery:

- Measuring instrument, field case, conductivity sensor LF 204, operating instructions in German, English and French

Field of application

- Industry
- Environmental protection
- Food production
- Water or waste water inspection

	Order no.
Portamess® 911 Cond	1008713

Note:

The scope of delivery does include the conductivity sensor LF 204.

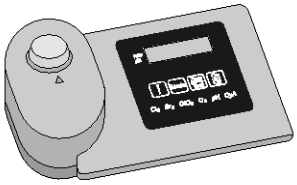
Conductivity sensor LF 204 see p. → 2-104, Sensor quiver see p. → 2-104

2.8 Measuring and Test Systems

2.8.3 Photometer

Precise measurement results through high-quality interference filters

Fotometer messen nach dem fotometrischen Prinzip nahezu alle Desinfektionsmittel und den pH-Wert. Sie sind transportabel, kompakt und machen eine sichere, einfache Messung möglich.



P_DT_0074_SW
Photometer

The photometers DT1B, DT2C, DT3B and DT4B are used, among other things, as a reference method for calibrating the electrochemical sensors for chlorine, chlorine dioxide, fluoride, chlorite, H_2O_2, bromine and ozone. They have been adapted to today's requirements and can be used in almost all areas of water analysis. High-quality interference filters and long-term stable LEDs are used as the light source in the high-precision optics. The entire measuring unit is maintenance-free. Precise and reproducible analysis results are achieved with minimum time and effort. The units are winning customers over with their excellent operating convenience, ergonomic design, compact dimensions and ease of use.

Your benefits

- Portable and compact
- Simple to operate with text support
- Safe, simple measurement of chlorine, chlorine dioxide, fluoride, chlorite, H_2O_2, bromine, ozone, pH and trichloroisocyanuric acid
- Can be calibrated
- Memory function for the last measurements
- Backlit display
- Real-time clock
- Countdown
- Watertight, degree of protection IP 68

Technical details

Measuring ranges of the DT1B:

- 0.05 ... 6.0 mg/l free chlorine (DPD1) + total chlorine (DPD1+3)
- 5 ... 200 mg/l free chlorine (high range)
- 0.1 … 13.0 mg/l bromine (DPD1)
- 0.05 … 11 mg/l chlorine dioxide (DPD1)
- 0.03 … 4.0 mg/l ozone (DPD4)
- 6.5 … 8.4 pH (phenol red)
- 1 … 80 mg/l cyanuric acid

Measuring ranges of the DT2C:

- 0.05 … 2.0 mg/l fluoride
- 0.05... 6.0 mg/l free chlorine and total chlorine
- 0.05 … 11.0 mg/l chlorine dioxide

Measuring ranges of the DT3B:

- 1 … 50 / 40 … 500 mg/l hydrogen peroxide (H_2O_2)

Measuring ranges of the DT4B:

- 0.03 … 2.5 mg/l chlorite
- 0.05 … 11 mg/l chlorine dioxide
- 0.05 … 6 mg/l chlorine

Measuring tolerance: Depending on the measured value and measuring method

Battery: 4 x AA/LR6 batteries

Permissible ambient temperature range: 5…40 °C

Relative humidity: 30 ... 90% (non-condensing)

Protection class: IP 68

Housing material: ABS

Keypad: Polycarbonate film

Dimensions: 190 x 110 x 55 mm (L x W x H)

Weight: 0.4 kg

Field of application

- Swimming pools
- Potable water
- Process water

2.8 Measuring and Test Systems

	Order no.
Photometer DT1B	1039315
Photometer DT2C	1039316
Photometer DT3B hydrogen peroxide	1039317
Photometer DT4B	1039318

Photometers supplied with accessories, container vessels and reagents.

Consumable items

	Order no.
DPD 1 buffer, 15 ml	1002857
DPD 1 reagent, 15 ml	1002858
DPD 3 solution, 15 ml	1002859
DPD1 tablets 100 no.	1061892
DPD3 tablets 100 no.	1061893
Glycine tablets 100 no.	1061944
Phenol red tablets R 175 (100 in each)	305532
Cyanuric acid tablets (100 in each)	1039744
SPADNS reagent, 250 ml for fluoride detection	1010381
Calibration standard fluoride 1 mg/l, for calibration of the photometer during fluoride determination	1010382
3 spare cells: round cells with covers for DPD phenol red and cyanuric acid detection (DT1 and DT2B)	1007566
3 spare cells for fluoride detection (DT2A and B)	1010396
DPD reagent set, 15 ml each: 3 x DPD 1 buffer, 1 x DPD 1 reagent, 2 x DPD 3 solution	1007567
Chlorine dioxide tablets no. 1	1039732
Chlorine dioxide tablets no. 2	1039733
Chlorine HR tablets (100 off)	Tabletten_Chlor
ACIDIFYING tablets (100 no.)	Tabletten_AC

Spare parts

Chlorite Photometer

	Order no.
Stirrer for purging of chlorine dioxide (DT4)	1022754
3 spare cells: round cells with covers for DPD phenol red and cyanuric acid detection (DT1 and DT2B)	1007566

H_2O_2 measurement

	Order no.
Reagent for H_2O_2 (DT3), 15 ml	1023636
Spare cell, 5x , for H_2O_2 (DT3)	1024072

2.9 Accessories for Measuring and Control Devices

2.9.1 Transmitter 4 … 20 mA (Two-Wire System)

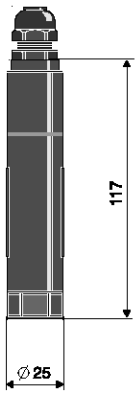
Benefits:

- Reliable signal transmission, even over large distances
- Interference-resistant 4 ... 20 mA signal
- Simple installation directly on the sensor

Typical applications:

Transmission of the measuring signal even over long distances and/or transmission of interference-resistant measured signals (e.g. pH, ORP) in conjunction with controllers type D1C, D2C and DULCOMARIN® or direct connection to PCs and/or a PLC. If using a PLC, it has to have an electrically isolated input.

pH measuring transducer 4 ... 20 mA type pH V1



pk_5_064

Measuring range	pH 0 … 14
Measuring error	Better than 0.1 pH (typical ±0.07 pH)
Socket	SN6
Input resistance	> 5 x 10^{11} Ω
Signal current output	4 … 20 mA ≈ -500 … +500 mV ≈ pH 15.45 … -1.45 not calibrated, not electrically isolated
Power supply DC	18...24 V DC
Ambient temperature	-5…50 °C, non-condensing
Enclosure rating	IP 65
Dimensions	141 mm (length), 25 mm (Ø)

	Order no.
pH measuring transducer 4 ... 20 mA type pH V1	809126

ORP measuring transducer 4 ... 20 mA type RH V1

Measuring range	0 … 1000 mV
Measuring error	Better than ±5 mV (typical ±3 mV)
Socket	SN6
Input resistance	> 5 x 10^{11} Ω
Signal current output	4 … 20 mA ≈ 0 … +1000 mV not electrically isolated
Power supply DC	18...24 V DC
Ambient temperature	-5…50 °C, non-condensing
Enclosure rating	IP 65
Dimensions	141 mm (length), 25 mm (Ø)

	Order no.
ORP measuring transducer 4 ... 20 mA type RH V1	809127

Temperature measuring transducer 4 ... 20 mA type Pt100 V1

Measuring range	0 … 100 °C
Measuring error	Better than ±0,5 °C (typical ±0,3 °C)
Socket	SN6
Input resistance	~ 0 Ω
Signal current output	4 … 20 mA ≈ 0 … +100 °C not electrically isolated
Power supply DC	18...24 V DC
Ambient temperature	-5…50 °C, non-condensing
Enclosure rating	IP 65
Dimensions	141 mm (length), 25 mm (Ø)

	Order no.
Temperature measuring transducer 4 ... 20 mA type Pt 100 V1	809128

PEROX transducer

The microprocessor-based PEROX transducer is used to control and activate the PEROX sensor and to evaluate the sensor signal. It is screwed directly on to the sensor head. The transducer can be directly connected to the D1C controller via a 3-core signal cable.

The PEROX transducer is approx. 205 mm long with a diameter of 32 mm.

PEROX transducer for H_2O_2 measurement

Contains an internal selector switch for the three ranges:

1 … 20, 10 … 200 and 100 … 2,000 mg/l H_2O_2

	Order no.
PEROX transducer V2 for DACa	1047979

PEROX transducer V1 for D1Ca on request.

Accessory:

	Order no.
Signal cable, sold by the metre 2 x 0.25 mm² Ø 4 mm	725122

2.9 Accessories for Measuring and Control Devices

2.9.2 Accessories for Portable Meters Portamess®

Sensor quiver

Set of 5, for water tight storage of sensors. For Portamess® pH and Cond

	Order no.
Sensor quiver	1008716

Conductivity sensor LF 204

pk_5_093

Number of electrodes	4
Sensor shaft	Black epoxy
Sensors	Graphite
Shaft length	120 mm
Shaft diameter	15.3 mm
Cable length	1.5 m
Temperature sensor	NTC (30 kΩ) -5 … 100 °C
Immersion depth min.	36 mm
Max. pressure	2 bar
Temperature	0 … 90 °C
Cell constant	0.475 cm^{-1} ±1.5%
Measuring range	1 µS/cm…500 mS/cm

	Order no.
Conductivity sensor LF 204	1008723

3.0 Overview of Ordering System for Measuring and Control Points DULCOTROL® DWCa

3.0.1 Selection Guide

Measuring, control and monitoring tasks in water treatment

DULCOTROL® DWCa_P potable water/F&B	DULCOTROL® DWCa_W waste water
Treatment of potable water, water similar to potable water and treatment of rinsing water, industrial and process water in the food and beverage industry ■ Disinfection ■ Cleaning In Place (CIP) ■ pH adjustment ■ Monitoring	Treatment of industrial and municipal waste water ■ pH neutralisation ■ Disinfection ■ Detoxification ■ Desalination of process water ■ Control of dissolved oxygen ■ Monitoring

3.0.2 Description of the Identity Code Specifications in the DULCOTROL® DWCa Ordering System

The measuring and control stations can be configured using the respective identity code ordering system. With the "Panel-mounted" design, all the components except the sensors are mounted on a polypropylene panel. With the "Assembly kit" design, all components are supplied loose in a package. The DULCOTROL® ordering system works with user-based selection criteria so that you can select the most appropriate measuring and control station, largely without any serious technical understanding. One or two measured variables can be configured in each product range. The identity code specifications are explained in more detail below. The content and scope of delivery contained in the specifications is described in Chapter 3.1.3 (Technical Description of the Scope of Delivery).

Specification: "Application"

The "Application" specification is used to define the application ("potable water", "waste water") in which the measuring and control station is deployed. This defines the types of sensors and fittings.

Specification: "Water to be measured"

This is used to further characterise the sample water (e.g. "clear water" or "turbid water") selected via the main application (e.g. potable water, waste water). The sensor type, measuring range (e.g. CLE 3-mA-2ppm) and fitting (e.g. DGMA) are defined in conjunction with the main application.

Specification: "Measured variable 1" and "Measured variable 2"

They are used to determine the measured variable to be measured or controlled (e.g. pH or chlorine). Up to two measured variables can be simultaneously selected within the scope of the specified options. This defines the sensor class (e.g. pH sensor or chlorine sensor) and the controller suitable for the measured variable and the appropriate measuring cable. We use the diaLog DACa controller for all measured variables except conductivity. We configure the Compact conductivity controller for the measured variable conductivity. The possible combinations of measured variables are listed in the tables in the "Technical Description of the Scope of Delivery" chapter.

Specification: "Measurement and control"

This determines whether only the measuring function or the complete bidirectional control function for the selected measured variable is available on the measuring/-control instrument.

Specification: "Communication interface"

This specification defines whether a PROFIBUS® DP interface is fitted on the controller.

Specification: "Data logger"

This specification defines whether a data logger is contained within the controller.

Specification: "Hardware expansion"

This specification defines whether a protective RC circuit is fitted to protect relays exposed to high loads.

3.0 Overview of Ordering System for Measuring and Control Points DULCOTROL® DWCa

Specification: "Sensor equipment"

This specification determines whether the measuring/control panel is supplied with or without sensors. If "with sensors" is selected, the sensors are also supplied in the original packaging. Select "without sensors" if the types of sensor supplied cannot be used as standard (see chapter 3.1.3: Technical Description of the Scope of Delivery) (for example: Inapplicable measuring range) or if the measuring plates are to be stored.

Specification: "Design"

This specification defines whether the measuring and control station is to be supplied as a completely assembled panel or an assembly kit and which label the panel is to have.

Specification: "Sample water preparation"

This specification defines whether a filter is fitted (for panel-mounted measuring and control points) or is supplied ready for connection (for assembly kits).

Specification: "Certification"

This specification defines the approvals and certificates.

Specification: "Documentation"

This specification defines the operating language of the controller and the operating instructions.

3.1 Measuring and Control Points DULCOTROL® DWCa_P Potable Water/F&B

3.1.1 Overview of DULCOTROL® PWC_P Potable Water/F&B

The compact measuring and control system for the reliable monitoring and treatment of potable and similar types of water.

✓ Monitoring and treatment of potable and similar types of water with DULCOTROL® DWCa P – the compact measuring and control system specially designed for water treatment in waterworks and in the food and beverage industry

Measuring and control systems DULCOTROL® for the potable water/F&B application are specially tailored to the potable water sector and the food and beverage industry. In addition, they also meet the particular requirements within these sectors: on the one hand, for potable water/product water treatment and, on the other hand, for the treatment of rinsing water, industrial water and process water. The measuring and control systems can be configured using the relevant identity code ordering system. With the "panel-mounted" version, all the components except the sensors are mounted on a polypropylene panel. In the "assembly kit" version, all components are supplied loose in a package. The DULCOTROL® ordering system works with user-based selection criteria so that you can select the most appropriate measuring and control system, largely without technical knowledge. One or two measured variables can be configured in each product range.

Your benefits

- Availability of all key chemical measured parameters for water treatment
- Application-optimised configuration of the components by user-based order criteria
- Configuration of 1 or 2 complete measuring and control points on a plate or as an assembly
- The equipment on the controllers can be selected
- Flexible use by designing the measuring and control point fully assembled or as an assembly
- Flexible adaptation to special applications and measuring ranges by designing the measuring and control points without sensors and ordering the sensor type and measuring range separately
- Ready-to-connect plug-and-play measuring and control points for quick, easy installation and commissioning
- Extensive optional accessories (pressure reducers, filters, heat exchangers, sample water pump)

Technical details

- Installation in the bypass of the main water line through which the medium flows
- Max. pressure, depending on design: 1 bar/3 bar/6 bar
- Flow, depending on design: 15...40 l/h/ 40...65 l/h/
- Max. medium temperature: 45 °C
- Ambient temperature: +5...50 °C
- Degree of protection: IP65
- Power supply: 90-240 V, 50/60 Hz

Field of application

- Treatment of potable and product water (e.g. disinfection) in waterworks and domestic water installations
- Treatment of product water in the food and beverage industry
- Treatment of rinsing / industrial / process water for the food and beverage industry, e.g. cleaning and disinfection of pipework, vessels and machinery (cleaning in place)
- Monitoring of potable water distribution

3.1 Measuring and Control Points DULCOTROL® DWCa_P Potable Water/F&B

3.1.2 Permissible measured variable combinations for DULCOTROL® DWCa_P Potable water/F&B

Sample water 1: Potable water, product water

Measured variable 1 (channel 1)		Measured variable 2 (channel 2)													
		00	C0	C1	G0	P0	R0	D0	I0	L0	Z0	F0	H0	A0	X0
Free chlorine < pH 8	C0	x			x	x	x	x							
Free chlorine < pH 8 and stable	C1	x			x	x	x	x							
Total chlorine (free and combined chlorine)	G0	x				x	x								
pH	P0	x				x									
ORP	R0	x				x									
Chlorine dioxide	D0	x				x	x		x						
Chlorite	I0	x													
Conductivity	L0	x				x	x								
Ozone	Z0	x				x	x								
Fluoride	F0	x				x									
Hydrogen peroxide	H0	x				x									
Peracetic acid	A0	x				x				x					
Dissolved oxygen	X0	x				x									

Sample water 2: Rinsing water, process water, industrial process water

Measured variable (channel 1)		Measured variable (channel 2)													
		00	C0	C1	G0	P0	R0	D0	I0	L0	Z0	F0	H0	A0	X0
Free chlorine < pH 8	C0	x				x	x								
Free chlorine < pH 8 and stable	C1	x				x	x								
Total chlorine (free and combined chlorine)	G0	x				x	x								
pH	P0	x				x									
ORP	R0	x				x									
Chlorine dioxide	D0	x				x	x								
Chlorite	I0	x													
Conductivity	L0	x				x	x								
Ozone	Z0	x				x	x								
Fluoride	F0	x				x									
Hydrogen peroxide	H0	x				x									
Peracetic acid	A0	x				x				x					

When ordering, state the identity code with the above order of measured variable 1/measured variable 2 i.e. DWCa P... C0_P0... and not DWCa P... P0_C0...

Other measured variable combinations on request.

3.1.3 Identity Code Ordering System for DULCOTROL® DWCa_P Potable Water/F&B

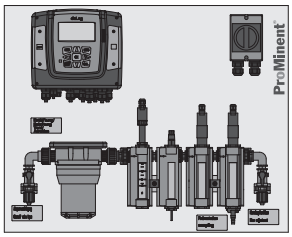
DWCa	**Application**												
	P	Potable water											
		Water to be measured											
		1	Potable water/product water										
		2	Rinsing water/industrial water/process water										
			Channel 1, measured variable 1										
			C0	Free chlorine < pH 8									
			C1	Free chlorine pH value > 8 and stable									
			G0	Total chlorine (free and combined chlorine)									
			P0	pH									
			R0	ORP									
			D0	Chlorine dioxide									
			I0	Chlorite									
			L0	Conductivity									
			Z0	Ozone									
			F0	Fluoride									
			H0	Hydrogen peroxide									
			A0	Peracetic acid									
			X0	Dissolved oxygen									
				Channel 2, measured variable 2 (optional)									
				00	none								
				C0	Free chlorine < pH 8								
				C1	Free chlorine pH value > 8 and stable								
				G0	Total chlorine (free and combined chlorine)								
				P0	pH								
				R0	ORP								
				D0	Chlorine dioxide								
				I0	Chlorite								
				L0	Conductivity								
				Z0	Ozone								
				F0	Fluoride								
				H0	Hydrogen peroxide								
				A0	Peracetic acid								
				X0	Dissolved oxygen								
					Measuring - Controlling								
					0	All measured variables measurable							
					9	All measured variables bidirectionally controllable							
						Communication interface							
						0	Without						
						4	PROFIBUS®-DP*						
Documentation language							**Data logger**						
DE	English						0	Without					
EN	English						1	Data logger with measured value display on SD card					
ES	Spanish							**Hardware expansion**					
IT	Italian							0	Without				
FR	French							1	Protective RC circuit for output relay				
FI	Finish								**Sensor equipment**				
BG	Bulgarian								0	With sensors			
CN	Chinese								1	Without sensors			
CZ	Czech									**Version**			
DK	Danish									0	Panel-mounted with ProMinent Logo		
EE	Estonian									B	Assembly kit without panel with ProMinent logo		
GR	Greek										**Sample water treatments**		
HU	Hungarian										0	Without	
JP	Japanese										1	With filter	
KR	Korean											**Certifications**	
LT	Lithuanian											01	CE (Standard)
LV	Latvian												
NL	Dutch												
PL	Polish												
PT	Portuguese												
RO	Romanian												
RU	Russian												
SE	Swedish												
SK	Slovakian												
SL	Slovenian												
SV	Swedish												
TH	Thai												

DWCa	P	1	C0	P0	9	0	1	0	0	0	1	01	EN	Identity code as a representative example

Permissible measured variable combinations for DULCOTROL® DWCa_P Potable water/F&B see → 3-4

3.1 Measuring and Control Points DULCOTROL® DWCa_P Potable Water/F&B

3.1.4 Examples of DULCOTROL® DWCa_P Potable Water/F&B



P_DCT_0035_SW1
similar figure

Example 1: DWCa_P_1_D0_I0_0_0_0_0_0_0_0_01_EN

Application in potable water/F&B:

Measurement of chlorine dioxide and chlorite in potable water/product water with an integrated data logger.

Controller

- DACa PA 6 1 4 0 0 0 0 1 0 01 0 EN

Fitting

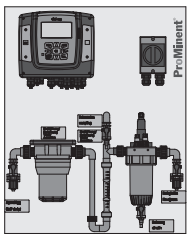
- DGM_A_3_2_0_T_0_0_2:
  - 1 measuring module: Chlorine dioxide sensor
  - 1 measuring module: Chlorite sensor
  - 1 flow control module

Sensors

- CDE-2-mA 0.5 ppm
- CLT1-mA-0.5 ppm

Panel-mounted water treatment system

- Filter



P_DCT_0036_SW1
similar figure

Example 2: DWCa_P_2_P0_C0_9_0_0_1_0_0_0_01_EN

Application in potable water/F&B:

Two-way control of pH and chlorine in rinsing water. The sample water is filtered through a 100 µm filter. The controller contains a relay protective RC circuit.

Controller

- DACa PA 6 1 4 0 0 0 0 0 1 01 0 EN

Fitting

- DLG III for pH and chlorine monitoring + flow control

Sensors

- CBR1-mA 2ppm
- PHER 112-SE

Panel-mounted water treatment system

- Filter

3.2 Measuring and Control Points DULCOTROL® DWCa_W Waste Water

3.2.1 Overview of DULCOTROL® DWCa_W Waste Water

The compact measuring and control system for the reliable monitoring and treatment of waste water.

Monitoring and treatment of waste water with DULCOTROL® DWCa_W – the compact measuring and control system specially designed for applications in municipal and industrial waste water treatment

The measuring and control systems DULCOTROL® waste water are used in all branches of industry where waste water is treated. All the necessary components are mounted on a polypropylene panel and ready to connect. The choice of components is matched to the application. The measuring and control systems can be configured using the relevant identity code ordering system. With the "panel-mounted" version, all the components except the sensors are mounted on a polypropylene panel. In the "assembly kit" version, all components are supplied loose in a package. The DULCOTROL® ordering system works with user-based selection criteria so that you can select the most appropriate measuring and control system, largely without technical knowledge. One or two measured variables can be configured in each product range.

Your benefits

- Availability of all key chemical measured parameters for water treatment
- Application-optimised configuration of components by user-based order criteria
- Configuration of 1 or 2 complete measuring and control points on a plate or as an assembly
- The equipment on the controllers can be selected
- Flexible use by designing the measuring and control point fully assembled or as an assembly
- Flexible adaptation to special applications and measuring ranges by designing the measuring and control points without sensors and ordering the sensor type and measuring range separately
- Ready-to-connect plug-and-play measuring and control points for quick, easy installation and commissioning
- Extensive optional accessories (pressure reducers, filters, heat exchangers, sample water pump)

Technical details

- Installation in the bypass of the main water line through which the medium flows
- Max. pressure, depending on design: 1 bar/3 bar/6 bar
- Flow, depending on design: 15...40 l/h/ 40...65 l/h/ 300...500 l/h
- Max. medium temperature: 45 °C
- Ambient temperature: +5...50 °C
- Degree of protection: IP65
- Power supply: 90-240 V, 50/60 Hz

Field of application

- Treatment of industrial and municipal waste water
- pH neutralisation
- Disinfection
- Detoxification
- Desalination of process water
- Control of dissolved oxygen
- Monitoring

3.2 Measuring and Control Points DULCOTROL® DWCa_W Waste Water

3.2.2 Permissible measured variable combinations for DULCOTROL® DWCa_W Waste water

Sample water 4,5,7: clear and turbid waste water

Measured variable 1 (channel 1)		Measured variable 2 (channel 2)													
		00	C0	C1	G0	P0	R0	D0	I0	L0	Z0	F0	H0	A0	X0
Free chlorine < pH 8 and stable	C1	x				x	x								
Total chlorine (free and combined chlorine)	G0	x				x	x								
pH	P0	x				x									
ORP	R0	x				x									
Chlorine dioxide	D0	x				x	x								
Chlorite	I0	x													
Conductivity	L0	x				x	x								
Ozone	Z0	x				x	x								
Fluoride	F0	x				x									
Hydrogen peroxide	H0	x				x									
Peracetic acid	A0	x				x				x					

With sample water 6: waste water containing sludge

Measured variable 1 (channel 1)		Measured variable 2 (channel 2)													
		00	C0	C1	G0	P0	R0	D0	I0	L0	Z0	F0	H0	A0	X0
Free chlorine < pH 8 and stable	C1														
Total chlorine (free and combined chlorine)	G0														
pH	P0	x				x	x								
ORP	R0	x				x									
Chlorine dioxide	D0														
Chlorite	I0														
Conductivity	L0	x				x	x								x
Ozone	Z0														
Fluoride	F0														
Hydrogen peroxide	H0														
Peracetic acid	A0														
Dissolved oxygen	X0	x				x									

When ordering, state the identity code with the above order of measured variable 1/measured variable 2 i.e. DWCa W... C0_P0... and not DWCa W... P0_C0...

Other measured variable combinations on request.

3.2.3 Identity Code Ordering System for DULCOTROL® DWCa_W Waste Water

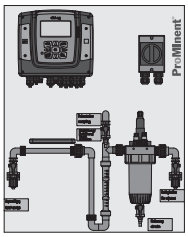
DWCa	Application													
	W	Waste water												
		Water to be measured												
		4	Clear waste water											
		5	Waste water with solid particle fraction, turbid											
		6	Waste water with solid particle fraction, containing sludge											
		7	Waste water, clear or turbid, with fluoride content and pH < 7											
			Channel 1, measured variable 1											
			C1	Free chlorine										
			G0	Total chlorine (free and combined chlorine)										
			P0	pH										
			R0	ORP										
			D0	Chlorine dioxide										
			I0	Chlorite										
			L0	Conductivity										
			Z0	Ozone										
			F0	Fluoride										
			H0	Hydrogen peroxide										
			A0	Peracetic acid										
			X0	Dissolved oxygen										
				Channel 2, measured variable 2 (optional)										
				00	none									
				C1	Free chlorine									
				G0	Total chlorine (free and combined chlorine)									
				P0	pH									
				R0	ORP									
				D0	Chlorine dioxide									
				I0	Chlorite									
				L0	Conductivity									
				Z0	Ozone									
				F0	Fluoride									
				H0	Hydrogen peroxide									
				A0	Peracetic acid									
				X0	Dissolved oxygen									
					Measuring - Controlling									
					0	All measured variables measurable								
					9	All measured variables bidirectionally controllable								
						Communication interface								
						0	Without							
						4	PROFIBUS®-DP*							
Documentation language								**Data logger**						
DE	English							0	Without					
EN	English							1	Data logger with measured value display on SD card					
ES	Spanish								**Hardware expansion**					
IT	Italian								0	Without				
FR	French								1	Protective RC circuit for output relay				
FI	Finish									**Sensor equipment**				
BG	Bulgarian									0	With sensors			
CN	Chinese									1	Without sensors			
CZ	Czech										**Version**			
DK	Danish										0	Panel-mounted with ProMinent Logo		
EE	Estonian										B	Assembly kit without panel with ProMinent logo		
GR	Greek										(M)	Modified design		
HU	Hungarian											**Sample water treatments**		
JP	Japanese											0	Without	
KR	Korean											1	With filter(not with waste water = 6)	
LT	Lithuanian												**Certifications**	
LV	Latvian												01	CE (Standard)
NL	Dutch													
PL	Polish													
PT	Portuguese													
RO	Romanian													
RU	Russian													
SE	Swedish													
SK	Slovakian													
SL	Slovenian													
SV	Swedish													
TH	Thai													

DWCa	W	1	C0	P0	9	0	1	0	0	0	1	01	EN	Identity code as a representative example

Permissible measured variable combinations for DULCOTROL® DWCa_W Waste water see → 3-8

3.2 Measuring and Control Points DULCOTROL® DWCa_W Waste Water

3.2.4 Examples of DULCOTROL® DWCa_W Waste Water



P_DCT_0037_SW1
Similar figure

Example 3: DWCa_W_5_H0_00_9_0_0_0_0_1_1_01_EN

Waste water application:

Two-way control of the hydrogen peroxide in turbid waste water. The controller contains a relay protective RC circuit and a data logger.

Controller

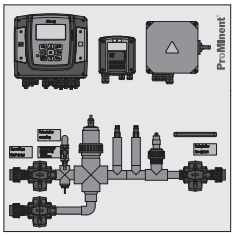
- DACa PA 6 1 0 0 0 0 0 1 1 01 0 EN

Fitting

- DLG III for hydrogen peroxide monitoring + flow control

Sensors

- PER1-mA-50 ppm



P_DCT_0038_SW1
similar figure

Example 4: DWCa_W_6_P0_L0_9_0_0_0_0_1_1_01_EN

Waste water application:

Bidirectional control of pH and measurement of conductivity in waste water containing sludge. The controller contains a relay protective RC circuit and a data logger.

Controller

- For pH: DACa PA 6 1 4 0 0 0 0 1 1 01 0 EN
- For conductivity: Compact controller

Fitting

- Piping + flow control

Sensors

- ICT 1
- PHEX 112-SE

3.3 Technical Description of the Scope of Delivery of Measuring and Control Points DULCOTROL® DWCa

3.3.1 Technical Description of Controllers

(For detailed information see chap. Measuring and Control Technology)

The DULCOMETER® dialog DACa controller is used for measuring all measured variables with the exception of conductivity. The Compact controller is configured for conductivity measurement.

The DULCOMETER® diaLog DACa Controller used with the DULCOTROL® DWCa is available as a single or two-channel measuring and control device. The following versions of the device can be separately selected using the DULCOTROL® identity code ordering system:

- Specification: **Communication interface**
  This specification defines whether a PROFIBUS® DP interface should be available on the measuring and control device. This interface is available from the 2nd quarter of 2014.
- Specification: **Data logger**
  This specification defines whether a data logger should be available on the measuring and control device.
- Specification: **Hardware expansion**
  This specification defines whether a protective RC circuit is to be available for the protection of relays subject to higher loading.

Hardware version and identity code of diaLog DACa controllers:

Hardware version	Identity code for diaLog DACa controller
1-channel device without RC, without data logger	DACa PA 6 1 0 0 0 0 0 0 0 01 0 EN
1-channel device with RC, without data logger	DACa PA 6 1 0 0 0 0 0 0 1 01 0 EN
2-channel device without RC, without data logger	DACa PA 6 1 4 0 0 0 0 0 0 01 0 EN
2-channel device with RC, without data logger	DACa PA 6 1 4 0 0 0 0 0 1 01 0 EN
1-channel device without RC, with data logger	DACa PA 6 1 0 0 0 0 0 1 0 01 0 EN
1-channel device with RC, with data logger	DACa PA 6 1 0 0 0 0 0 1 1 01 0 EN
2-channel device without RC, with data logger	DACa PA 6 1 4 0 0 0 0 1 0 01 0 EN
2-channel device with RC, with data logger	DACa PA 6 1 4 0 0 0 0 1 1 01 0 EN
1-channel device, PROFIBUS® DP	DACa PA 6 1 0 0 0 0 4 0 0 01 0 EN
2-channel device, PROFIBUS® DP	DACa PA 6 1 4 0 0 0 4 0 0 01 0 EN
1-channel device with RC, PROFIBUS® DP	DACa PA 6 1 0 0 0 0 4 0 1 01 0 EN
2-channel device with RC, PROFIBUS® DP	DACa PA 6 1 4 0 0 0 4 0 1 01 0 EN
1-channel device, PROFIBUS® DP, with data logger	DACa PA 6 1 0 0 0 0 4 1 0 01 0 EN
1-channel device with RC, PROFIBUS® DP, with data logger	DACa PA 6 1 0 0 0 0 4 1 1 01 0 EN
2-channel device, PROFIBUS® DP, with data logger	DACa PA 6 1 4 0 0 0 4 1 0 01 0 EN
2-channel device with RC, PROFIBUS® DP, with data logger	DACa PA 6 1 4 0 0 0 4 1 1 01 0 EN

	Order no.
Compact controller for conductive conductivity	DCCaW006L30010EN
Compact controller for inductive conductivity	DDCaW006L60010EN

3.3 Technical Description of the Scope of Delivery of Measuring and Control Points DULCOTROL® DWCa

3.3.2 Technical Description of Sensors

(For detailed information see chap. Sensor Technology DULCOTEST®)

The identity code specifications "Application", "Measured variable" and "Water to be measured" define the sensor type to be used as specified below in the tables.

If another sensor type is necessary, the measuring/control panel can also be supplied without sensors (see identity code specification: "Sensor equipment"). The desired sensor should then be ordered separately.

Sensor types for the defined specifications "measured variable" and "water to be measured" for the potable water ("P") application

Measured variable		Sample water	Sensor type	Order no.
Free chlorine with pH value < 8	C0	1	CLE 3-mA-0.5 ppm	792927
Free chlorine with pH value > 8	C1	1	CBR 1-mA-0,5 ppm	1038016
Free chlorine	C1	2	CBR 1-mA-2 ppm	1038015
Total chlorine	G0	1	CTE 1-mA-0.5 ppm	740686
Total chlorine	G0	2	BCR 1-mA-2 ppm	1040115
pH	P0	1	PHEP 112 SE	150041
pH	P0	2	PHER 112 SE	1001586
ORP	R0	1	RHEP-Pt-SE	150094
ORP	R0	2	RHER-Pt-SE	1002534
ORP combined with ozone: R0 Z0	Z0	1/2	RHEP-Au-SE	1003875
Chlorine dioxide	D0	1	CDE 2-mA-0.5 ppm	792930
Chlorine dioxide (temperature-corrected)	D0	2	CDR 1-mA-2 ppm	1033393
Chlorite	I0	1/2	CLT 1-mA-0.5 ppm	1021596
Conductivity, conductive	L0	1	LFTK 1 DE	1002822
Conductivity, inductive	L0	2	ICT 1	1023244
Ozone	Z0	1/2	OZE 3-mA-2 ppm	792957
Fluoride (temp.corr.)	F0	1/2	FLEP 010-SE / FLEP 0100-SE	1028279
			Reference electrode, REFP-SE	1018458
			Pt 100 SE	305063
			Measuring transducer 4-20 mA FPV1	1028280
Hydrogen peroxide	H0	1	PER 1-mA-200 ppm	1022509
Hydrogen peroxide	H0	2	PER 1-mA-2000 ppm	1022510
Peracetic acid	A0	1	PAA 1-mA-200 ppm	1022506
Peracetic acid	A0	2	PAA 1-mA-2000 ppm	1022507
Dissolved oxygen	X0	1/2	DO 1-mA-20 ppm	1020532

3.3 Technical Description of the Scope of Delivery of Measuring and Control Points DULCOTROL® DWCa

Sensor types for the defined specifications "measured variable" and "water to be measured" for the waste water ("W") application

Measured variable		Sample water	Sensor type	Order no.
pH	P0	4	PHEP 112 SE	150041
pH	P0	5	PHER 112 SE	1001586
pH	P0	6	PHEX 112 SE	305096
pH	P0	7	PHEF 012 SE	1010511
ORP	R0	4	RHEP-Pt-SE	150094
ORP	R0	5	RHER-Pt-SE	1002534
ORP	R0	6	RHEX-Pt-SE	305097
ORP combined with ozone: R0 Z0	Z0	1/2	RHEP-Au-SE	1003875
Fluoride (temp.corr.)	F0	4/5/7	FLEP 010-SE / FLEP 0100-SE	1028279
			Measuring transducer 4-20 mA FP 100 V1	1031331
			Reference electrode, REFP-SE	1018458
Conductivity, inductive	L0	4/5/6/7	ICT 1	1023244
Total chlorine	G0	4/5	BCR 1-mA-2 ppm	1040115
Free chlorine	C1	4/5	CBR 1-mA-2 ppm	1038015
Hydrogen peroxide	H0	4/5	PER 1-mA-50 ppm	1030511
Dissolved oxygen	X0	4/5	DO 1-mA-20 ppm	1020532
Ozone	Z0	4/5	OZE 3-mA-2 ppm	792957
Chlorine dioxide (temperature-corrected)	D0	4/5	CDR 1-mA-2 ppm	1033393
Peracetic acid	A0	4/5	PAA 1-mA-200 ppm	1022506

3.3 Technical Description of the Scope of Delivery of Measuring and Control Points DULCOTROL® DWCa

3.3.3 Technical Description of Sensor Fittings

(For detailed information see chap. Sensor Technology DULCOTEST®)

The bypass fitting used depends in particular on the water to be measured but sometimes also on the measured variable or the combination of measured variables.

Sensor fittings in DULCOTROL® DWCa_P Potable water/F&B

Fitting type DGMa is used in the DULCOTROL® DWCa_P Potable water/F&B for all clear types of water similar to potable water. Fitting type DLG III is used for rinsing/industrial/process water with a turbid appearance in application "P".

Measured variable	Sample water	Sensor type
Free chlorine	1	DGMA
Total chlorine	1	DGMA
pH	1	DGMA
ORP	1	DGMA
Chlorine dioxide (CDE 2)	1	DGMA
Chlorite	1	DGMA
Conductivity	1	DGMA
Ozone	1	DGMA
Hydrogen peroxide	1	DGMA
Peracetic acid	1	DGMA
Temperature	1	DGMA
Free chlorine	2	DLGIII
Total chlorine	2	DLGIII
pH	2	DLGIII
ORP	2	DLGIII
Chlorine dioxide (CDR)	2	DLGIII
Chlorite	2	DLGIII
Ozone	2	DLGIII
Hydrogen peroxide	2	DLGIII
Peracetic acid	2	DLGIII
Temperature	2	DLGIII
Conductivity, inductive	2	ICT 3 in T-piece
Fluoride (temp.corr.)	1/2	DLGIV
Dissolved oxygen (DO1)	1	Adapter d75 pipe

Sensor fittings in DULCOTROL® DWCa_W Waste Water

Fitting type DLGIII is used in the DULCOTROL® DWCa_W Waste Water for all clear water or water with a minimal solid fraction. For sludge containing water in the "W" application the sensors are, wherever possible, fitted directly using adapters in the DN 40 PVC sample water line.

Measured variable	Sample water	Sensor type
Chlorine dioxide (CDR)	4/5	DLGIII
Fluoride	4/7	DLG IV (PVC) + magnetic stirrer
Dissolved oxygen (DO1)	4/5	Adapter for PVC pipe d75
Dissolved oxygen (DO2)	6	With pipe adapter for immersion pipe
Total chlorine	4/5	DLGIII
Conductivity, inductive (ICT 1)	4/5/6	Adapter for PVC pipe DN 40 (bypass on plate)
Ozone	4/5	DLGIII
ORP	6	T-piece / DN 40
ORP	4/5	DLGIII
Temperature	6	T-piece / DN 40
Temperature	4/5	DLGIII
Hydrogen peroxide	4/5	DLGIII
pH	6	T-piece / DN 40
pH	4/5/7	DLGIII

3.3 Technical Description of the Scope of Delivery of Measuring and Control Points DULCOTROL® DWCa

3.3.4 Technical Description of the Hydraulic Connector/Pipework

An 8 x 5 mm hose connector is used as the hydraulic connection for the sample water with "Water to be measured" 1, 2, 4, 5, 7 and a DN 25 connector for the "Water to be measured" 6 (containing sludge). Generally there is a shut-off ball valve fitted upstream and downstream of the bypass fitting. If ordered, a sample water filter is fitted upstream of the bypass fitting. The bypass fittings each contain a sampling tap. A metal pin is incorporated in the bypass fittings for potential equalisation.

3.3.5 Technical Description of Optional Accessories

Type		Sample water	Order no.
Pressure reducer DO 6F 1/2"	0,5 – 10 bar	1	302104
Pressure reducer V 82	0,5 – 10 bar	2	1031212
Sample water pump vonTaine® 0502 PP/FPM	Maximum flow, 1800 l/h; max. capacity: 4.5 m	1, 2, 4, 5, 7	1023089

4.0 Measuring Control and Metering Systems for Swimming Pool Water Treatment

4.0.1 DULCODOS® Pool Swimming Pool Metering Systems

The metering systems DULCODOS® Pool ensure the best water quality. The systems are available in four different designs. It is easy to work out which type is best suited to your requirements.

Chlorine or active oxygen?

Historically, swimming pool water has always been treated with chlorine. Because it is an effective disinfectant and is highly oxidising, chlorine is also the chemical of choice for public pools. Clear and hygienically safe water is guaranteed.

The metering systems DULCODOS® Pool reliably keep the operating parameters in an optimum range and unpleasant side-effects, such as the smell of chlorine or burning eyes, are very rare.

Active oxygen is less effective than chlorine. It can be used for very gentle and environmentally-sound water treatment in pools with fewer users.

- **Soft**

DULCODOS® Pool Soft is especially suited to private pools used by a small number of people. It works with active oxygen substances, which are less effective than chlorine. Water treatment with active oxygen is a good alternative for ecologically-minded pool owners or if users are allergic to chlorine. DULCODOS® Pool Soft uses no chlorine chemicals.

- **Basic**

DULCODOS® Pool Basic regulates the pH and chlorine content using the redox potential. This is the direct measurement of effective oxidation in the water and is therefore an indication of the disinfectant effect and concentration of the metered chlorine. The concentration of chlorine cannot be determined with accuracy with this process. ORP measurements allow a particular range of chlorine to be set. DULCODOS® Pool Basic is robust and requires little maintenance.

- **Comfort**

DULCODOS® Pool Comfort uses highly specific chlorine sensors to measure the chlorine content. The concentration of chlorine in the water can be determined and set with accuracy. The effectiveness of the pool filter is boosted by an integrated feeder assembly for flocculant, resulting in crystal-clear water! Numerous features to enhance operating convenience, such as measured values being mapped by a screen plotter or remote control from your PC, iPad or other tablet device using an integrated web server, make the metering system very popular with customers.

- **Professional**

In addition to the features described above, DULCODOS® Pool Professional also measures the combined chlorine. This is an important parameter in public pools. It can be incorporated in the building management system via OPC and KNX and alarm messages can be sent by text or e-mail. Eco!Mode operating mode reduces the energy consumption of the filter pumps. The integrated soft PLC control can be used to operate several peripheral devices and functions. The swimming pool controller becomes the central control unit for all the swimming pool technology.

4.0 Measuring Control and Metering Systems for Swimming Pool Water Treatment

Choice of pumps

The metering systems DULCODOS® Pool allow you to choose which metering pump to fit on your complete system. The choice of pump depends entirely on the size of your pool and how often it is used.

- **Peristaltic pumps DULCO®flex** are suited to applications requiring few chemicals, such as small pools or those used infrequently. The pump reliably eliminates bubbles of gas formed during periods of non-use. Depending on the amount of use, the metering hose has to be replaced once or twice a year.
- **Motor-driven metering pumps alpha** have a higher capacity and longer maintenance intervals. Like peristaltic pumps, they are silent.
- **Solenoid metering pumps Beta®** are not controlled by switching them on and off, like DULCO®flex or alpha, instead, their metering frequency is adjusted continuously, enabling the pump to have an extremely precise control action.
- Pumps with **CAN bus system** can be used in the DULCODOS® Pool Professional series. They communicate all operating messages, such as two-stage monitoring of the chemical reservoir, to the control.

Accessories

Whether you are looking for collecting pans for chemical tanks or portable test devices for measurement parameters – or even software for digital control: optional accessories make it even easier for you to operate the system.

Service

Installation, commissioning, training in how the system works, operation and maintenance: When you buy a DULCODOS® Pool system, it comes with service you can rely on – even if your pool is already quite old.

4.1 Metering System DULCODOS® Pool Soft

4.1.1 Metering System DULCODOS® Pool Soft

Ecologically convincing: chlorine-free water treatment with active oxygen in private swimming pools.

For swimming pools with volumes up to 100 m³

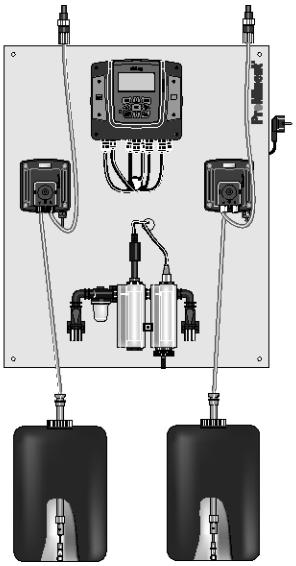
Chlorine-free water treatment system for environmentally operated private pools. Safe water disinfection with active oxygen as a turnkey complete solution.

Complete system DULCODOS® Pool Soft for pH adjustment and chlorine-free disinfection with active oxygen. To prevent any germs in the pool from building up resistance to active oxygen, it is not metered continuously, but injected at intervals controlled by a timer.

Peristaltic pumps of the product range DULCO®flex, motor driven metering pumps type alpha or solenoid metering pumps type Beta® are used, depending on demand and the circulation volume.

Sensors, controllers and metering pumps form a unit with the chemical storage tanks, which can become operational without major installation work on your part.

The control device offers many deluxe functions, such as the recording of measured values on an SD memory card or remote access via the integral WEB server and LAN interface (optional).



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Your benefits

- Simple, quick assembly
- Simple, menu-driven operation
- Chlorine-free
- Constantly good water quality
- Versatile monitoring functions

Technical details

- 2-channel controller DULCOMETER® diaLog DACa with measurement/control of the pH value and metering of active oxygen using an integrated timer function, mounted on a wall plate ready for use.
- In-line probe housing with sample water monitoring, sample water filter and sensor for pH value
- Monitoring of the chemical reservoir
- Metering monitor to protect against over-metering
- Data logger with SD card
- Embedded web server with LAN interface (optional)
- Metering pumps alpha, DULCO®flex or Beta® to control the pH value and active oxygen content.
- Connector for point of injection: Injection valves with 1/2" screw thread
- Connectors for metering pumps/points of injection: PVC hose 10x4 mm
- Sample water connector: PE hose 8x5 mm
- Digital pause input
- Alarm relay output
- Electrical connection: 230 VAC, 50/60 Hz
- Dimensions with metering pumps alpha or Beta®:
  - 595 x 745 x 150 mm (W x H x D) mounting plate for measuring technology
  - 595 x 400 x 150 mm (W x H x D) mounting plate for pumps
- Dimensions with metering pumps DULCO®flex: 595 x 745 x 150 mm (W x H x D)
- Weight: approx. 10 kg or 6 kg (without pumps)

Field of application

- Private swimming pool

4.1 Metering System DULCODOS® Pool Soft

Identity Code Ordering System for DULCODOS® Pool Soft

DSPa	**Measured variable**														
	DO2	pH / Timer control H_2O_2													
		Hardware-additional functions													
		0	Standard												
			Software-additional functions												
			1	Archiving of measured data including SD card											
				Communication interfaces											
				0	none										
				5	Embedded web server, LAN										
					Electrical connection										
					A	230 V, 50/60 Hz, European standard plug									
					B	230 V, 50/60 Hz, Swiss plug									
						Sensor equipment									
						0	with sensors								
						1	without sensors								
							Version								
							0	with ProMinent® logo							
							1	without ProMinent® Logo							
								Language							
								A	Swedish						
								D	German						
								E	English						
								F	French						
								G	Czech						
								I	Italian						
								N	Dutch						
								P	Polish						
								R	Russian						
								S	Spanish						
									Metering pumps for acids/alkalis						
									0	without metering pumps					
									1	0.8 l/h (DULCO®flex DF2a 0208)					
									2	1.6 l/h (DULCO®flex DF2a 0216)					
									3	2.4 l/h (DULCO®flex DF2a 0224)					
									4	1.8 l/h (alpha ALPc 1002 PVT)					
									5	3.5 l/h (alpha ALPc 1004 PVT)					
									6	1.5 l/h (Beta® BT4b 0401 PVT)					
									7	2.8 l/h (Beta® BT4b 0402 PVT)					
									8	4.5 l/h (Beta® BT4b 0404 PVT)					
										Multifunctional valve for acid/alkali pump					
										0	without				
										1	with MFV (only for alpha and Beta®)				
											Metering pumps for disinfection				
											0	without metering pumps			
											1	0.8 l/h (DULCO®flex DF2a for 0208) for pools up to a volume of 20 m^3			
											2	1.6 l/h (DULCO®flex DF2a for 0216) for pools up to a volume of 40 m^3			
											3	2.4 l/h (DULCO®flex DF2a for 0224) for pools up to a volume of 60 m^3			
											4	1.8 l/h (alpha ALPc 1002 PVT) for pools up to a volume of 45 m^3			
											5	3.5 l/h (alpha ALPc 1004 PVT) for pools up to a volume of 90 m^3			
											6	1.5 l/h (Beta® BT4b 0401 PVT) for pools up to a volume of 25 m^3			
											7	2.8 l/h (Beta® BT4b 0402 PVT) for pools up to a volume of 50 m^3			
											8	4.5 l/h (Beta® BT4b 0404 PVT) for pools up to a volume of 100 m^3			
												Multifunctional valve for disinfection pump			
												0	without		
												1	with MFV (only for alpha and Beta®)		
													Installation		
													0	supplied loose without mounting plate	
													1	assembled on a base plate	
														Approvals	
														0	with CE certification

DSPa	DO2	0	1	0	A	0	0	E	2	0	2	0	1	0	Identity code as a representative example

4.2 Metering System DULCODOS® Pool Basic

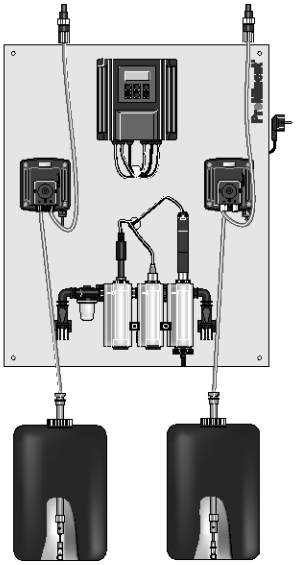
4.2.1 Metering System DULCODOS® Pool Basic

Convenient and simple: pure water in private swimming pools – fully automatically and correctly.

For swimming pools with a circulation capacity of up to 200 m³/h

The chlorine metering system DULCODOS® Pool Basic is a complete solution for private swimming pools where the chlorine content is controlled using the low-maintenance measurement of the redox potential.

Complete system for the fully automatic adjustment of pH and chlorine content (using the measured variable redox potential) in swimming pool water. Peristaltic pumps of the product range DULCO®flex or motor-driven metering pumps type alpha are used, depending on demand and the circulation volume. Sensors, controllers and metering pumps form a single perfectly coordinated unit with the chemical storage tanks, which can reliably get to work without a lot of installation effort on your part.



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Your benefits

- Simple, quick assembly
- Simple, menu-driven operation
- Constantly good water quality
- Versatile monitoring functions

Technical details

- 2 -channel swimming pool controller Splash Control PPCa with measurement, control and metering functions for pH and redox potential (chlorine metering)
- In-line probe housing with sample water monitoring, sample water filter and measuring probe for pH value and redox potential, fitted on a wall panel.
- 2 metering pumps alpha or DULCO®flex
- Monitoring of the chemical reservoir
- Dosing monitor to protect against over-metering
- Connectors for points of injection: Injection valves with 1/2" screw thread
- Connectors for metering pumps/points of injection: PVC hose 10 x 4 mm
- Sample water connector: PE hose 8 x 5 mm
- Digital pause input
- Alarm relay output
- Electrical connection: 230 VAC, 50/60 Hz
- Dimensions: 595 x 745 x 150 mm (W x H x D)
- Weight: approx. 10 kg or 6 kg (without pumps)

Field of application

- Private swimming pool

4.2 Metering System DULCODOS® Pool Basic

Identity Code Ordering System for DULCODOS® Pool Basic

DSPa	**Measured variable**														
	PR0	pH / ORP													
		Hardware-additional functions													
		0	Standard												
			Software-additional functions												
			0	none											
				Communication interfaces											
				0	none										
					Electrical connection										
					A	230 V, 50/60 Hz, European standard plug									
					B	230 V, 50/60 Hz, Swiss plug									
						Sensor equipment									
						0	with sensors								
						A	without sensors								
							Version								
							0	with ProMinent® logo							
							1	without ProMinent® Logo							
								Language							
								D	German						
								E	English						
								F	French						
								G	Czech						
								I	Italian						
								N	Dutch						
								R	Russian						
								S	Spanish						
									Metering pumps for acids/alkalis						
									0	without metering pumps					
									1	0,8 l/h (DULCO®flex DF2a 0208)					
									2	1,6 l/h (DULCO®flex DF2a 0216)					
									3	2,4 l/h (DULCO®flex DF2a 0224)					
									4	1,8 l/h (alpha ALPc 1002 PVT)					
									5	3,5 l/h (alpha ALPc 1004 PVT)					
										Multifunctional valve for acid/alkali pump					
										0	without				
										1	with MFV (alpha only)				
											Metering pumps for disinfection				
											0	without metering pumps			
											1	0.8 l/h DULCO®flex for up to 45/10 m³/h circulation HB/FB*			
											2	1.6 l/h DULCO®flex for up to 90/20 m³/h circulation HB/FB*			
											3	2.4 l/h DULCO®flex for up to 140/30 m³/h circulation HB/FB*			
											4	1.8 l/h alpha for up to 100/20 m³/h circulation HB/FB*			
											5	3.5 l/h alpha for up to 200/40 m³/h circulation HB/FB*			
												Multifunctional valve for disinfection pump			
												0	without		
												0	with MFV (alpha only)		
													Installation		
													0	supplied loose without mounting plate	
													1	assembled on a base plate	
														Approvals	
														0	with CE certification

DSPa	PRO	0	0	0	A	0	0	E	2	0	2	0	1	0	Identity code as a representative example

* Calculated for 12 percent sodium-calcium hypochlorite
HB = Indoor swimming pool
FB = Outdoor swimming pool

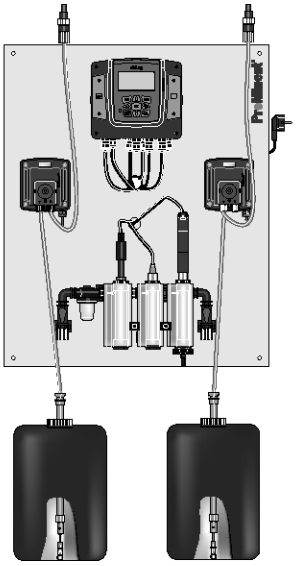
4.3 Metering System DULCODOS® Pool Comfort

4.3.1 Metering System DULCODOS® Pool Comfort

Convenient and simple: crystal-clear water in private swimming pools.

For swimming pools with a circulation capacity of up to 225 m³/h

The chlorine metering system DULCODOS® Pool Comfort is the convenient solution for pH adjustment and disinfection of swimming pools with liquid chlorine products. Remote access is possible via LAN interface.



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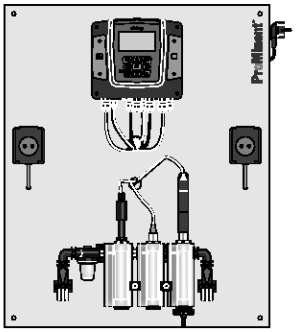

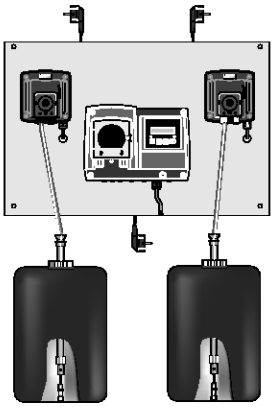

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Your benefits

Complete system DULCODOS® Pool Comfort for pH adjustment and disinfection with liquid chlorine products. Peristaltic pumps of the product range DULCO®flex, motor driven metering pumps type alpha or solenoid metering pumps type Beta® are used, depending on demand and the circulation volume.

An integrated flocculant metering station (optional) ensures crystal-clear water.

Sensors, controllers and metering pumps form a unit with the chemical storage tanks, which can become operational without major installation work on your part.

The control device offers many deluxe functions, such as the recording of measured values on an SD memory card or remote access via the integral WEB server and LAN interface (optional).

- Simple, quick assembly
- Simple, menu-driven operation
- Brilliant water quality
- Versatile monitoring functions

Technical details

- 2-channel controller DULCOMETER® diaLog DACa with measurement/control and metering functions for pH and chlorine concentration, mounted on a wall plate ready for use
- Integrated flocculant metering station (optional)
- In-line probe housing with sample water monitoring, sample water filter and measuring probes for pH and chlorine content (DC2 for free chlorine, DC4 for free chlorine in the presence of isocyanuric acid stabiliser)
- Monitoring of the chemical reservoir
- Metering monitor to protect against over-metering
- Data logger with SD card
- Embedded web server with LAN interface (optional)
- Metering pumps alpha, DULCO®flex or Beta® to control the pH value and chlorine content, DULCO®flex for metering flocculant (optional).
- Connector for point of injection: Injection valves with 1/2" screw thread
- Connectors for metering pumps/points of injection: PVC hose 10x4 mm
- Sample water connector: PE hose 8x5 mm
- Digital pause input
- Alarm relay output
- Electrical connection: 230 VAC, 50/60 Hz
- Dimensions with metering pumps alpha or Beta® and/or with "flocculant metering" option:
  - 595 x 745 x 150 mm (W x H x D) mounting plate for measuring technology
  - 595 x 400 x 150 mm (W x H x D) mounting plate for pumps
- Dimensions with metering pumps DULCO®flex: 595 x 745 x 150 mm (W x H x D)
- Weight: approx. 10 kg or 6 kg (without pumps)

Field of application

- High-end private pool

4.3 Metering System DULCODOS® Pool Comfort

Identity Code Ordering System for DULCODOS® Pool Comfort

DSPa	**Measured variable**														
	DC2	pH / free chlorine (chlorine sensor CLE 3-mA-2ppm)													
	DC4	pH / free chlorine in the presence of the stabiliser isocyanuric acid (chlorine sensor CGE 2-mA-2ppm)													
		Hardware-additional functions													
		0	Standard												
			Software-additional functions												
			1	Archiving of measured data including SD card											
				Communication interfaces											
				0	none										
				5	Embedded web server, LAN										
					Electrical connection										
					A	230 V, 50/60 Hz, European standard plug									
					B	230 V, 50/60 Hz, Swiss plug									
						Sensor equipment									
						0	with sensors								
						B	Measured variable DC2 without sensors								
						C	Measured variable DC4 without sensors								
							Version								
							0	with ProMinent® logo							
							1	without ProMinent® Logo							
								Language							
								A	Swedish						
								D	German						
								E	English						
								F	French						
								G	Czech						
								I	Italian						
								N	Dutch						
								P	Polish						
								R	Russian						
								S	Spanish						
									Metering pumps for acids/alkalis						
									0	without metering pumps					
									1	0,8 l/h (DULCO®flex DF2a 0208)					
									2	1,6 l/h (DULCO®flex DF2a 0216)					
									3	2,4 l/h (DULCO®flex DF2a 0224)					
									4	1,8 l/h (alpha ALPc 1002 PVT)					
									5	3,5 l/h (alpha ALPc 1004 PVT)					
									6	1,5 l/h (Beta® BT4b 0401 PVT)					
									7	2,8 l/h (Beta® BT4b 0402 PVT)					
									8	4,5 l/h (Beta® BT4b 0404 PVT)					
										Multifunctional valve for acid/alkali pump					
										0	without				
										1	with MFV (only for alpha and Beta®)				
											Metering pumps for disinfection				
											0	without metering pumps			
											1	0.8 l/h DULCO®flex for up to 45/10 m³/h circulation HB/FB*			
											2	1.6 l/h DULCO®flex for up to 90/20 m³/h circulation HB/FB*			
											3	2.4 l/h DULCO®flex for up to 140/30 m³/h circulation HB/FB*			
											4	1.8 l/h alpha for up to 100/20 m³/h circulation HB/FB*			
											5	3.5 l/h alpha for up to 200/40 m³/h circulation HB/FB*			
											6	1.5 l/h Beta® for up to 85/20 m³/h circulation HB/FB*			
											7	2.8 l/h Beta® for up to 160/35 m³/h circulation HB/FB*			
											8	4.5 l/h Beta® for up to 260/55 m³/h circulation HB/FB*			
												Multifunctional valve for disinfection pump			
												0	without		
												1	with MFV (only for alpha and Beta®)		
													Installation		
													0	supplied loose without mounting plate	
													1	assembled on a base plate	
													B	Base plate with flocculant pump DF4a fitted	
														Approvals	
														0	with CE certification

DSPa	DC4	0	1	0	A	0	0	E	2	0	2	0	1	0	Identity code as a representative example

* Calculated for 12 percent sodium-calcium hypochlorite
HB = Indoor swimming pool
FB = Outdoor swimming pool

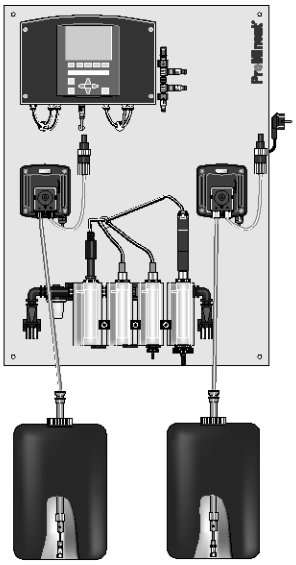
4.4 Metering System DULCODOS® Pool Professional

4.4.1 Metering System DULCODOS® Pool Professional

Professional and demanding: crystal-clear water in public swimming pools.

For swimming pools with a circulation capacity of up to 350 m³/h

Chlorine metering system for individual adjustment and monitoring of all common hygiene auxiliary parameters in public pools. DULCODOS® Pool Professional ensures crystal-clear water quality and lowers operating costs thanks to Eco!Mode.



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Complete system DULCODOS® Pool Professional for individual adjustment and monitoring of all common hygiene auxiliary parameters in public pools, such as pH, redox potential and free and combined chlorine. Peristaltic pumps of the product range DULCO®flex, motor-driven metering pumps type alpha or solenoid metering pumps type Beta® are used, depending on demand and the circulation volume.

An integrated flocculant metering station (optional) ensures crystal-clear water.

In Eco!Mode, the circulating volume of the swimming pool pumps is optimised depending on the water quality, enabling you to efficiently save energy.

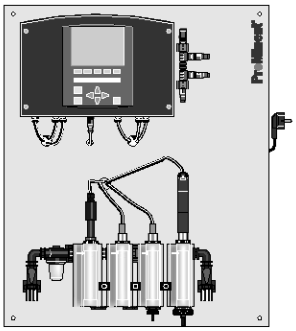
The integrated SoftPLC allows the system to control optional peripheral devices and functions, such as UV systems, water attractions, lighting, heating and water top-up.

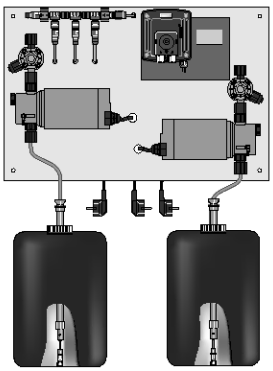
The system has many different communication interfaces that enable it to be integrated in networks or a building management system and it can also be remotely monitored and controlled with an Apple® iPad or tablet PC.

Sensors, controllers, metering pumps and the process chemical storage tanks form a single unit with the other peripheral swimming pool technology used, which can handle your work without a lot of installation effort on your part.

Your benefits

- Simple, quick assembly
- Brilliant water quality
- Eco!Mode helps cut operating costs
- Versatile communication interfaces
- Central control of peripheral devices and functions too





pk_7_105_SW1

Technical details

- Multi-channel, multi-parameter controller DULCOMETER® DULCOMARIN® II with measuring, control and metering functions for pH, redox potential, free and combined chlorine in various combinations depending on the type, ready-wired for use and mounted on a wall panel
- Optional integrated flocculant metering station
- In-line probe housing with sample water monitoring, sample water filter and all sensors
- Monitoring of the chemical reservoir with a pre-alarm (options A and F)
- Dosing monitor to protect against over-metering
- Screen plotter for graphic mapping of measured values, data logger with SD card
- Embedded web server with LAN interface (optional)
- OPC and KNX for integration in building management systems, alarm functionby text or e-mail (optional)
- Integrated SoftPLC for control of peripheral devices (option F)
- Metering pumps alpha, DULCO®flex or Beta® to control the pH value and chlorine content, DULCO®flex for metering flocculant (optional)
- Connector for point of injection: Injection valves with 1/2" screw thread
- Connectors for metering pumps/points of injection: PVC hose 10 x 4 mm
- Sample water connector: PE hose 8 x 5 mm.
- Digital pause input
- 3 contact inputs, freely configurable (option A)
- 5 contact inputs, freely configurable (option F)
- CAN bus for connection of chlorine measuring cells and metering pumps Beta® and DULCO®flex DF4a
- Temperature measuring input Pt 100/Pt 1000
- 3 output relay outputs, freely configurable
- 3 relay outputs for the control of metering pumps (option A)
- 6 output relay outputs, freely configurable (option F)
- 4 analogue outputs 0/4-20 mA, freely configurable (option A)
- 2 analogue outputs 0/4-20 mA, freely configurable (option F)
- Electrical connection: 230 VAC, 50/60 Hz.
- Dimensions with metering pumps alpha, Beta® or DULCO®flex DF4a and/or with "flocculant metering" option:
  - 595 x 745 x 150 mm (W x H x D) mounting plate for measuring technology
  - 595 x 400 x 150 mm (W x H x D) mounting plate for pumps
- Dimensions with metering pumps DULCO®flex DF2a: 595 x 745 x 150 mm (W x H x D)
- Weight: approx. 12 kg or 7 kg (without pumps)

4.4 Metering System DULCODOS® Pool Professional

Field of application

- High-end private pool
- Public swimming pool
- Therapy pool

Type	pH	ORP	Measured variables: Chlorine	Chlorine/isocyanuric acid	Combined chlorine
PC5	x	x			
PC6	x		x		
PC7	x	x	x		
PC8	x	x	x		x
PC9	x			x	
PCA	x	x		x	
PCD	x	x		x	x

Type PC5: pH and redox potential (chlorine metering)

Type PC6: pH and free chlorine

Type PC7: pH, redox potential and free chlorine

Type PC8: pH, redox potential, free chlorine and combined chlorine

Type PC9: pH and free chlorine in the presence of the stabiliser isocyanuric acid

Type PCA: pH, redox potential and free chlorine in the presence of the stabiliser isocyanuric acid

Type PCD: pH, redox potential, free chlorine in the presence of the stabiliser isocyanuric acid and combined chlorine

4.4 Metering System DULCODOS® Pool Professional

Identity Code Ordering System for DULCODOS® Pool Professional

DSPa — Measured variable

- PC5 pH / ORP
- PC6 pH / free chlorine (chlorine sensor CLE 3.1-CAN)
- PC7 pH / ORP / free chlorine (chlorine sensor CLE 3.1-CAN)
- PC8 pH / ORP / free chlorine / total chlorine (chlorine sensors CLE 3.1-CAN and CTE 1-CAN)
- PC9 pH / total chlorine (chlorine sensor CGE 2-CAN)
- PCA pH / ORP / total chlorine (chlorine sensor CGE 2-CAN)
- PCD pH / ORP / free chlorine / total chlorine (chlorine sensors CGE 2-CAN and CTE 1-CAN)

Hardware-additional functions

- 0 Standard
- A 4 standard signal outputs, 0/4-20 mA measured value (A module)
- F Functional module (F-module)

Software-additional functions

- 1 Screen plotter with measured data backup including SD card

Communication interfaces

- 0 none
- 5 Embedded web server, LAN
- 6 OPC server + Embedded web server + KNX function + alarm by text or e-mail

Electrical connection

- A 230 V, 50/60 Hz, European standard plug
- B 230 V, 50/60 Hz, Swiss plug

Sensor equipment

- 0 with sensors
- A Measured variable PC5 without sensors
- E Measured variable PC6 without sensors
- F Measured variable PC7 without sensors
- G Measured variable PC8 without sensors
- H Measured variable PC9 without sensors
- I Measured variable PCA without sensors
- L Measured variable PCD without sensors

Version

- 0 with ProMinent® logo
- 1 without ProMinent® Logo

Language

- D German
- E English
- F French
- I Italian
- P Polish
- S Spanish

Metering pumps for acids/alkalis

- 0 without metering pumps
- 1 0,8 l/h (DULCO®flex DF2a 0208)
- 2 1,6 l/h (DULCO®flex DF2a 0216)
- 3 2,4 l/h (DULCO®flex DF2a 0224)
- 4 1,8 l/h (alpha ALPc 1002 PVT)
- 5 3,5 l/h (alpha ALPc 1004 PVT)
- A 1.5 l/h (Beta® CANopen BT4a 0401 PVT)
- B 2.8 l/h (Beta® CANopen BT4a 0402 PVT)
- C 5.3 l/h (Beta® CANopen BT4a 0405 PVT)
- D 1.5 l/h (DULCO®flex DF4a 04015 CAN Bus)
- E 6.0 l/h (DULCO®flex DF4a 03060 CAN Bus)
- F 8.3 l/h (Beta® CANopen BT4a 0408 PVT)

Multifunctional valve for acid/alkali pump

- 0 without
- 1 with MFV (only for alpha and Beta®)

Metering pumps for disinfection

- 0 without metering pumps
- 1 0.8 l/h DULCO®flex DF2a for up to 45/10 m^3/h circulation HB/FB*
- 2 1.6 l/h DULCO®flex DF2a for up to 90/20 m^3/h circulation HB/FB*
- 3 2.4 l/h DULCO®flex DF2a for up to 140/30 m^3/h circulation HB/FB*
- 4 1.8 l/h alpha for up to 100/20 m^3/h circulation HB/FB*
- 5 3.5 l/h alpha for up to 200/40 m^3/h circulation HB/FB*
- A 1.5 l/h Beta® CANopen for up to 85/20 m^3/h circulation HB/FB*
- B 2.8 l/h Beta® CANopen for up to 160/35 m^3/h circulation HB/FB*
- C 5.3 l/h Beta® CANopen for up to 300/65 m^3/h circulation HB/FB*
- D 1.5 l/h DULCO®flex DF4a CANopen for up to 85/20 m^3/h circulation HB/FB*
- E 6.0 l/h DULCO®flex DF4a CANopen for up to 340/70 m^3/h circulation HB/FB*
- F 19.5 l/h Beta® CANopen for up to 1050/225 m^3/h circulation HB/FB*

Multifunctional valve for disinfection pump

- 0 without
- 1 with MFV (only for alpha and Beta®)

Installation

- 0 supplied loose without mounting plate
- 1 assembled on a base plate
- B Base plate with flocculant pump DF4a fitted

Approvals

- 0 with CE certification

DSPa	PC7	A	1	5	A	0	0	E	B	0	B	0	1	0	Identity code as a representative example

* Calculated for 12% sodium-calcium hypochlorite HB = Indoor swimming pool FB = Outdoor swimming pool

4.5 Maintenance Kits

The following are needed for the maintenance of a measuring, control and metering system DULCODOS® Pool:

- 2 no. maintenance kits for metering pumps
- 1 no. maintenance kit for the measured variable

4.5.1 Maintenance Kits for Metering Pumps

The following table shows the assignment of the maintenance kits to the types of metering pumps used.

	Product range	Type	Order no.
Hose, complete 4.8 x 8.0 PharMed	DF2a	0208, 0216, 0224	1009480
Hose, complete 1.6 x 4.8 PharMed	DF4a	04015	1030722
Hose, complete 3.2 x 6.4 PharMed	DF4a	03060	1030723
Spare parts kit 1005-2/1605-2 PVT	ALPc, BT4a	1002PVT/ 1004PVT (ALPc), 0405PVT (BT4a)	1023110
Spare parts kits 1601 – 2 PVT, PPT, NPT	BT4a, BT4b	0401PVT (BT4a), 0401PVT (BT4b)	1023108
Spare parts kits 1602 – 2 PVT, PPT, NPT	BT4a, BT4b	0402PVT (BT4a), 0402PVT (BT4b)	1023109
Spare parts kits 0708 – 2/1008 – 2 PVT, PPT, NPT	BT4a	0408PVT	1023111
Spare parts kit 9.2/33.5/12 x 9 PVT	BT4a	0220PVT	1023113
Spare parts kits 1604 – 2 PVT, PPT, NPT	BT4b	0404PVT	1035332

4.5.2 Maintenance Kits for Measured Variables

The following table shows the assignment of the maintenance kits to the types of DULCODOS® Pool.

Maintenance kits are put together for the measured variables of the DSPa. Depending on the measured variable, the maintenance kits consist of:

- Buffer solutions
- Electrolytes
- Diaphragm caps
- 1 stainless steel screen 300 µm for the water filter
- 1 NBR flat seal for the water filter

	Type	Order no.
DSPA maintenance kit PR0, PC5, 333, 335, 735, 736	Basic, Professional PC5	1050631
DSPA maintenance kit DO2	Soft	1050632
DSPA maintenance kit DC2, PC6, 640, 645, 745	Comfort DC2, Professional PC6	1050633
DSPA maintenance kit DC4, PC9	Comfort DC4, Professional PC9	1050644
DSPA maintenance kit PC7, PCB, 781, 785, 786	Professional PC7	1050645
DSPA maintenance kit PC8	Professional PC8	1050646
DSPA maintenance kit PCA	Professional PCA	1050647
DSPA maintenance kit PCD	Professional PCD	1050648

4.5.3 Buffer Solutions

Quality buffer solutions are provided for calibration of pH and ORP sensors.

The following table shows the assignment of the buffer solutions to the sensors.

	Measured variable	Order no.
Buffer solution pH 4, 50 ml, red	pH	506251
Buffer solution pH 7, 50 ml, green	pH	506253
Buffer solution ORP 465 mV, 50 ml	ORP	506240

4.6 Test Equipment

4.6.1 Portable Meter Portamess® – Measured Variable pH/ORP

Robust manual measuring instrument to withstand the most severe mechanical and chemical loading.

Measuring range pH -2.00 to + 16.00, ORP -1,300 … +1,300 mV

pH and ORP measurement with Portamess® pH/ORP - battery-powered, hand-held meter with automatic or manual temperature compensation.

pk_5_099

The Portamess® pH/ORP is used to measure the pH and ORP value in the industrial, environmental, food and waste water sectors. The unit complies with the requirements of the EMC Act and the NAMUR NE 21 recommendations. Calibration can be done with buffer solutions made of different, pre-selectable buffer sets.

Your benefits

- Robust and protected against ingress (IP 66 protection)
- Long lifespan: Over 2,000 h operating time with only 3 x AA batteries
- Always in sight: Large LC display
- Hard-wearing membrane keypad
- Integrated sensor quiver to protect the sensor
- Robust, watertight, gold-plated sockets

Technical details

- **Measuring ranges** pH: -2.00 … +16.00, ORP: -1,300 … +1,300 mV
- **Measuring errors** pH: < 0.01, ORP: < 0.1% of the measured value ±0.3 mV
- **Sensor adaptation:** 8 buffer sets to choose from
- **Temperature compensation:** manual
- **Protection class:** IP 66
- **Operating time:** 2,000 hours with 3 x AA cells
- **Dimensions:** H x W x D 160 x 133 x 30
- **Weight:** 560 g with batteries
- **Scope of delivery:** Measuring instrument, field case, operating instructions in German, English and French.

Field of application

- Industry
- Environmental protection
- Food production
- Water or waste water inspection

	Order no.
Portamess® 911 pH	1008710

Accessories

	Capacity ml	Order no.
PHEKT-014F	–	1036537
Coaxial cable Ø 5 mm, 0.8 m - SD*	–	305098
Buffer pH 7.0	50	506253
Buffer pH 4.0	50	506251

* Fitting for all ProMinent® pH sensors with SN6 connection

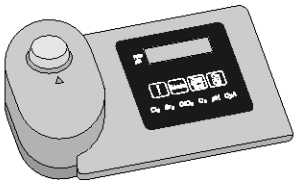
Sensor quiver see p. → 2-104

4.6 Test Equipment

4.6.2 Photometer

Precise measurement results through high-quality interference filters

Photometers measure nearly all disinfectants and the pH value based on the photometric principle. They are portable, compact and make safe, simple measurement possible.



P_DT_0074_SW
Photometer

The photometers DT1B, DT2C, DT3B and DT4B are used, among other things, as a reference method for calibrating the electrochemical sensors for chlorine, chlorine dioxide, fluoride, chlorite, H_2O_2, bromine and ozone. They have been adapted to today's requirements and can be used in almost all areas of water analysis. High-quality interference filters and long-term stable LEDs are used as the light source in the high-precision optics. The entire measuring unit is maintenance-free. Precise and reproducible analysis results are achieved with minimum time and effort. The units are winning customers over with their excellent operating convenience, ergonomic design, compact dimensions and ease of use.

Your benefits

- Portable and compact
- Simple to operate with text support
- Safe, simple measurement of chlorine, chlorine dioxide, fluoride, chlorite, H_2O_2, bromine, ozone, pH and trichloroisocyanuric acid
- Can be calibrated
- Memory function for the last measurements
- Backlit display
- Real-time clock
- Countdown
- Watertight, degree of protection IP 68

Technical details

Measuring ranges of the DT1B:

- 0.05 ... 6.0 mg/l free chlorine (DPD1) + total chlorine (DPD1+3)
- 5 ... 200 mg/l free chlorine (high range)
- 0.1 … 13.0 mg/l bromine (DPD1)
- 0.05 … 11 mg/l chlorine dioxide (DPD1)
- 0.03 … 4.0 mg/l ozone (DPD4)
- 6.5 … 8.4 pH (phenol red)
- 1 … 80 mg/l cyanuric acid

Measuring ranges of the DT2C:

- 0.05 … 2.0 mg/l fluoride
- 0.05... 6.0 mg/l free chlorine and total chlorine
- 0.05 … 11.0 mg/l chlorine dioxide

Measuring ranges of the DT3B:

- 1 … 50 / 40 … 500 mg/l hydrogen peroxide (H_2O_2)

Measuring ranges of the DT4B:

- 0.03 … 2.5 mg/l chlorite
- 0.05 … 11 mg/l chlorine dioxide
- 0.05 … 6 mg/l chlorine

Measuring tolerance: Depending on the measured value and measuring method

Battery: 4 x AA/LR6 batteries

Permissible ambient temperature range: 5…40 °C

Relative humidity: 30 ... 90% (non-condensing)

Protection class: IP 68

Housing material: ABS

Keypad: Polycarbonate film

Dimensions: 190 x 110 x 55 mm (L x W x H)

Weight: 0.4 kg

Field of application

- Swimming pools
- Potable water
- Process water

4.6 Test Equipment

	Order no.
Photometer DT1B	1039315
Photometer DT2C	1039316
Photometer DT3B hydrogen peroxide	1039317
Photometer DT4B	1039318

Photometers supplied with accessories, container vessels and reagents.

Consumable items

	Order no.
DPD 1 buffer, 15 ml	1002857
DPD 1 reagent, 15 ml	1002858
DPD 3 solution, 15 ml	1002859
Phenol red tablets R 175 (100 in each)	305532
Cyanuric acid tablets (100 in each)	1039744
SPADNS reagent, 250 ml for fluoride detection	1010381
Calibration standard fluoride 1 mg/l, for calibration of the photometer during fluoride determination	1010382
3 spare cells: round cells with covers for DPD phenol red and cyanuric acid detection (DT1 and DT2B)	1007566
3 spare cells for fluoride detection (DT2A and B)	1010396
DPD reagent set, 15 ml each: 3 x DPD 1 buffer, 1 x DPD 1 reagent, 2 x DPD 3 solution	1007567
Chlorine dioxide tablets no. 1	1039732
Chlorine dioxide tablets no. 2	1039733
Chlorine HR tablets (100 off)	Tabletten_Chlor
ACIDIFYING tablets (100 no.)	Tabletten_AC

Spare parts

Chlorite Photometer

	Order no.
Stirrer for purging of chlorine dioxide (DT4)	1022754
3 spare cells: round cells with covers for DPD phenol red and cyanuric acid detection (DT1 and DT2B)	1007566

H_2O_2 measurement

	Order no.
Reagent for H_2O_2 (DT3), 15 ml	1023636
Spare cell, 5x , for H_2O_2 (DT3)	1024072

ProMinent® Chemical Resistance List

Resistance of Materials Used in Liquid Ends to the Chemicals Most Frequently Used

The data apply to standard conditions (20 °C, 1,013 mbar).

s	=	saturated solution in water
+	=	resistant
+/o	=	largely resistant
o	=	conditionally resistant
-	=	not resistant
n	=	resistance not known
=>	=	see
*	=	for bonded connections, the resistance of the adhesive (e.g. Tangit) is to be considered. (Materials of the types 'o' and '-' are not recommended !)
**	=	does not apply to glass fibre reinforced material

Concentration data are stated in weight percent, relative to aqueous solutions. If percentages are stated for the level of resistance, this level of resistance is only valid up to this concentration.

NOTE:

The elastomers **CSM (Hypalon®)** and **IIR (butyl rubber)** used as diaphragm materials in pulsation dampers have properties similar to **EPDM**.

PTFE is resistant to all chemicals in this list.

PTFE filled with carbon,however, is attacked by strong oxidants such as bromine (anhydrous) or concentrated acids (phosphoric acid, sulphuric acid, chromic acid).

The resistance of PVC-U adhesive joints with Tangit deviates from the list below with regard to the following chemicals:

Medium	Concentration range
Sulfochromic acid	≥ 70 % H_2SO_4+ 5 % $K_2Cr_2O_7$/$Na_2Cr_2O_7$
Chromic acid	≥ 10 % CrO_3
Hydrochloric acid	≥ 25 % HCl
Hydrogen peroxide	≥ 5 % H_2O_2
Hydrofluoric acid	≥ 0 % HF

Explanation of abbreviations used as column headings:

PMMA:	Polymethylmethacrylate (Acrylic) resistance
PVC:	Polyvinylchloride, rigid, (PVC-U) resistance
PP:	Polypropylene resistance
PVDF:	Polyvinylidene fluoride
1.4404:	Stainless steel 1.4404 & 1.4571 resistance
FKM:	Fluorine Rubber (e.g. Viton® A & B) resistance
EPDM:	Ethylene-Propylene-Dien-rubber resistance
PharMed®:	Pharmed® resistance
PE:	Polyethylene resistance
2.4819:	Hastelloy C-276 resistance
WPC:	water endangering class

Viton® is a registered trademark of DuPont Dow Elastomers

Water endangering classes (WGK):

1	=	slightly hazardous to water
2	=	hazardous to water
3	=	severely hazardous to water
(X)	=	no classification. Classification according to conclusion by analogy. To be used under reserve.

Safety data sheets

Safety data sheets on our products in a number of different languages are provided on our website.

www.prominent.com/MSDS

ProMinent® Chemical Resistance List

The data has been taken from relevant manufacturer´s documentation and our own tests. Resistance of materials is also dependant on other factors, e.g. operating conditions, conditions of surfaces etc, and so this list must be treated as an initial guide only. It cannot claim to offer any guarantees. It should be taken into consideration in particular that usual dosing media are compounds, and their corrosiveness cannot be deducted simply by adding the corrosiveness of each single component. In such cases the chemical producers' data of the material compatibility are to be considered as a matter of prime importance for the material choice. A safety data sheet does not give this data and therefore cannot take the place of the technical documentation on the application.

Chemical	Formula	Conc	PMMA	PVC	PP	PVDF	1.4404	FKM	EPDM	PharMed®	PE	2.4819	WPC
Acetaldehyde	CH_3CHO	100%	-	-	o	-	+	-	+/o	-	+	+	2
Acetamide	CH_3CONH_2	s	+	+	+	+	+	o	+	+/o	+	+	1
Acetic Acid	CH_3COOH	100%	-	50%	+	+	+	-	o	60%	70%	+	1
Acetic Anhydride	$(CH_3CO)_2O$	100%	-	-	o	-	+	-	+/o	+	o	+	1
Acetic Ether => Ethyl Acetate													
Acetone	CH_3COCH_3	100%	-	-	+	-	+	-	+	-	+	+	1
Acetophenone	$C_6H_5COCH_3$	100%	-	n	+	-	+	-	+	n	+	+	
Acetyl Chloride	CH_3COCl	100%	-	+	n	-	o	+	-	o	n	+	1
Acetylacetone	$CH_3COCH_2COCH_3$	100%	-	-	+	-	+	-	+	n	+	+	1
Acetylene Dichloride => Dichloro Ethylene													
Acetylene Tetrachloride => Tetrachloro Ethane													
Acrylonitril	CH_2=CH-CN	100%	-	-	+	+	+	-	-	-	+	+	3
Adipic Acid	$HOOC(CH_2)_4COOH$	s	+	+	+	+	+	+	+	+/o	+	+	1
Allyl Alcohol	CH_2CHCH_2OH	96%	-	o	+	+	+	-	+	o	+	+/o	2
Aluminium Acetate	$Al(CH_3COO)_3$	s	+	+	+	+	+	+	+	+	+	+/o	1
Aluminium Bromide	$AlBr_3$	s	+	+	+	+	n	+	+	+	+	+	2
Aluminium Chloride	$AlCl_3$	s	+	+	+	+	-	+	+	+	+	+	1
Aluminium Fluoride	AlF_3	10%	+	+	+	+	-	+	+	+	+	+/o	1
Aluminium Hydroxide	$Al(OH)_3$	s	+	+	+	+	+	+	+	+	+	+	1
Aluminium Nitrate	$Al(NO_3)_3$	s	+	+	+	+	+	+	+	+	+	+	1
Aluminium Phosphate	$AlPO_4$	s	+	+	+	+	+	+	+	+	+	+	1
Aluminium Sulphate	$Al_2(SO_4)_3$	s	+	+	+	+	+	+	+	+	+	+	1
Ammonium Acetate	CH_3COONH_4	s	+	+/o	+	+	+	+	+	+	+	+	1
Ammonium Bicarbonate	NH_4HCO_3	s	+	+	+	+	+	+	+	+	+	+	1
Ammonium Carbonate	$(NH_4)_2CO_3$	40%	+	+	+	+	+	+	+	+	+	+	1
Ammonium Chloride	NH_4Cl	s	+	+	+	+	-	+	+	+	+	+/o	1
Ammonium Fluoride	NH_4F	s	+	o	+	+	o	+	+	+	+	+	1
Ammonium Hydroxide	"NH_4OH"	30%	+	+	+	+ (25 °C)	+	-	+	+	+	+	2
Ammonium Nitrate	NH_4NO_3	s	+	+	+	+	+	+	+	+	+	+	1
Ammonium Oxalate	$(COONH_4)_2 * H_2O$	s	+	+	+	+	+	+	+	+	+	+	1
Ammonium Perchlorate	NH_4ClO_4	10%	+	+	+	+	+	+	+	+	+	+	1
Ammonium Peroxodisulphate	$(NH_4)_2S_2O_8$	s	+	+	+	+	5%	+	+	+	+	5%	2
Ammonium Phosphate	$(NH_4)_3PO_4$	s	+	+	+	+	10%	+	+	+	+	10%	1
Ammonium Sulphate	$(NH_4)_2SO_4$	s	+	+	+	+	10%	+	+	+	+	10%	1
Ammonium Sulphide	$(NH_4)_2S$	s	+	+	+	+	n	+	+	n	+	n	2
Ammoniumaluminium Sulphate	$NH_4Al(SO_4)_2$	s	+	+	+	+	+	+	+	+	+	+	1
Amyl Alcohol	$C5H_{11}OH$	100%	+	+	+	+	+	-	+	-	+	+	1
Aniline	$C_6H_5NH_2$	100%	-	-	+	+	+	-	+/o	o	+	+	2
Aniline Hydrochloride	$C_6H_5NH_2 * HCl$	s	n	+	+	+	-	+/o	+/o	o	+	+	2
Antimony Trichloride	$SbCl_3$	s	+	+	+	+	-	+	+	+	+	n	2
Aqua Regia	$3\ HCl + HNO_3$	100%	-	+	-	+	-	-	o	-	-	-	2
Arsenic Acid	H_3AsO_4	s	+	+	+	+	+	+	+	o	+	+	3
Barium Carbonate	$BaCO_3$	s	+	+	+	+	+	+	+	+	+	+	1
Barium Chloride	$BaCl_2$	s	+	+	+	+	-	+	+	+	+	+	1
Barium Hydroxide	$Ba(OH)_2$	s	+	+	+	+	+	+	+	+	+	+	1
Barium Nitrate	$Ba(NO_3)_2$	s	+	+	+	+	+	+	+	+	+	+	1
Barium Sulphate	$BaSO_4$	s	+	+	+	+	+	+	+	+	+	+	1
Barium Sulphide	BaS	s	+	+	+	+	+	+	+	+	+	+	(1)
Benzaldehyde	C_6H_5CHO	100%	-	-	+	-	+	+	+	-	o	+	1
Benzene	C_6H_6	100%	-	-	o	+	+	o	-	-	o	+	3
Benzene Sulphonic Acid	$C_6H_5SO_3H$	10%	n	n	+	+	+	+	-	-	n	+	2
Benzoic Acid	C_6H_5COOH	s	+	+	+	+	+	+	+	+/o	+	+	1
Benzoyl Chloride	C_6H_5COCl	100%	-	n	o	n	o	+	+	n	o	+	2

ProMinent® Chemical Resistance List

Chemical	Formula	Conc	PMMA	PVC	PP	PVDF	1.4404	FKM	EPDM	PharMed®	PE	2.4819	WPC
Benzyl Alcohol	$C_6H_5CH_2OH$	100%	-	-	+	+	+	+	-	+	+	+	1
Benzyl Benzoate	$C_6H_5COOC_7H_7$	100%	-	-	+	o	+	+	-	-	+	+	2
Benzyl Chloride	$C_6H_5CH_2Cl$	90%	-	n	o	+	+	+	-	-	o	+	2
Bitter Salt => Magnesium Sulphate													
Bleach => Sodium Hypochlorite													
Blue Vitriol => Copper Sulphate													
Borax => Sodium Tetraborate													
Boric Acid	H_3BO_3	s	+	+	+	+	+	+	+	+	+	+	1
Brine		s	+	+/o	+	+	+/o	+	+	+	+	+	1
Bromine (dry)	Br_2	100%	-	-	-	+	-	-	-	-	-	+	2
Bromine Water	$Br_2 + H_2O$	s	-	+	-	+	-	-	-	n	-	n	(2)
Bromo Benzene	C_6H_5Br	100%	n	n	o	+	+	o	-	-	o	+	2
Bromochloro Methane	CH_2BrCl	100%	-	-	-	+	+	n	+/o	-	o	+	2
Bromochlorotrifluoro Ethane	$HCClBrCF_3$	100%	-	-	o	+	+	+	-	+	o	+	(3)
Butanediol	HOC_4H_8OH	10%	n	+	+	+	+	o	+	+	+	+	1
Butanetriol	$C_4H_{10}O_3$	s	+	+	+	+	+	o	+	+	+	+	1
Butanol	C_4H_9OH	100%	-	+	+	+	+	o	+/o	-	+	+	1
Butyl Acetate	$C_7H_{13}O_2$	100%	-	-	+	+	+	-	-	+/o	+	+	1
Butyl Acetate	$CH_3COOC_4H_9$	100%	-	-	o	+	+	-	+/o	+/o	-	+	1
Butyl Alcohol => Butanol													
Butyl Amine	$C_4H_9NH_2$	100%	n	n	n	-	+	-	-	n	+	+	1
Butyl Benzoate	$C_6H_5COOC_4H_9$	100%	-	-	o	n	+	+	+	-	o	+	2
Butyl Mercaptane	C_4H_9SH	100%	n	n	n	+	n	+	-	n	n	n	3
Butyl Oleate	$C_{22}H_{42}O_2$	100%	n	n	n	+	+	+	+/o	n	n	+	1
Butyl Stearate	$C_{22}H_{44}O_2$	100%	o	n	n	+	+	+	-	n	n	+	1
Butyraldehyde	C_3H_7CHO	100%	-	n	+	n	+	-	+/o	-	+	+	1
Butyric Acid	C_3H_7COOH	100%	5%	20%	+	+	+	+	+	+/o	+	+	1
Calcium Acetate	$(CH_3COO)_2Ca$	s	+	+	+	+	+	+	+	+	+	+	1
Calcium Bisulphite	$Ca(HSO_3)_2$	s	+	+	+	+	+	+	+	+	+	+	(1)
Calcium Carbonate	$CaCO_3$	s	+	+	+	+	+	+	+	+	+	+	1
Calcium Chloride	$CaCl_2$	s	+	+	+	+	-	+	+	+	+	+	1
Calcium Cyanide	$Ca(CN)_2$	s	+	+	+	+	n	+	+	+	+	n	3
Calcium Hydroxide	$Ca(OH)_2$	s	+	+	+	+	+	+	+	+	+	+	1
Calcium Hypochlorite	$Ca(OCl)_2$	s	+	+	o	+	-	o	+	+	+	+	2
Calcium Nitrate	$Ca(NO_3)_2$	s	+	50%	50%	+	+	+	+	+	+	+	1
Calcium Phosphate	$Ca_3(PO_4)_2$	s	+	+	+	+	+	+	+	+	+	+	1
Calcium Sulphate	$CaSO_4$	s	+	+	+	+	+	+	+	+	+	+	1
Calcium Sulphide	CaS	s	+	+	+	+	n	+	+	+	+	+	(2)
Calcium Sulphite	$CaSO_3$	s	+	+	+	+	+	+	+	+	+	+	(1)
Calcium Thiosulphate	CaS_2O_3	s	+	+	+	+	-	+	+	+	+	+	1
Carbolic Acid => Phenole													
Carbon Disulphide	CS_2	100%	-	-	o	+	+	+	-	-	o	+	2
Carbon Tetrachloride	CCl_4	100%	-	-	-	+	+	+	-	-	o	+	3
Carbonic Acid	"H_2CO_3"	s	+	+	+	+	+	+	+	+	+	+	1
Caustic Potash => Potassium Hydroxide													
Caustic Soda => Sodium Hydroxide													
Chloric Acid	$HClO_3$	20%	+	+	-	+	-	o	o	+	10%	+	2
Chlorinated Lime => Calcium Hypochlorite													
Chlorine Dioxide Solution	$ClO_2 + H_2O$	0.5%	o	+	o	+	-	o	-	-	o	+	
Chlorine Water	$Cl_2 + H_2O$	s	+	+	o	+	-	+	+	-	o	+	
Chloro Benzene	C_6H_5Cl	100%	-	-	+	+	+	+	-	-	o	+	2
Chloro Ethanol	$ClCH_2CH_2OH$	100%	-	-	+	o	+	-	o	+	+	+	3
Chloro Ethylbenzene	$C_6H_4ClC_2H_5$	100%	-	-	o	n	+	o	-	-	o	+	(2)
Chloro Phenole	C_6H_4OHCl	100%	-	n	+	+	+	n	-	-	+	+	2
Chloro Toluene	C_7H_8Cl	100%	-	-	n	+	+	+	-	-	n	+	2
Chloroacetone	$ClCH_2COCH_3$	100%	-	-	n	n	+	-	+	-	n	+	3
Chlorobutadiene	C_4H_5Cl	100%	-	-	n	n	+	+	-	-	n	+	1
Chloroform	$CHCl_3$	100%	-	-	o	+	+	+	-	o	-	+	2
Chlorohydrin	C_3H_5OCl	100%	-	n	+	-	+	+	o	+	+	+	3
Chloroprene => Chlorobutadiene													
Chlorosulphonic Acid	$SO_2(OH)Cl$	100%	-	o	-	+	-	-	-	-	-	o	1
Chrome-alum => Potassium Chrome Sulphate													
Chromic Acid	H_2CrO_4	50%	-	+*	o	+	10%	+	-	o	+	10%	3

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Chromic-Sulphuric Acid	$K_2CrO_4 + H_2SO_4$	s	-	+*	-	+	n	n	n	-	-	n	3
Chromium Sulphate	$Cr_2(SO_4)_3$	s	+	+	+	+	+	+	+	+	+	+	1
Citric Acid	$C_6H_8O_7$	s	+	+	+	+	+	+	+	+	+	+	1
Cobalt Chloride	$CoCl_2$	s	+	+	+	+	-	+	+	+	+	+	2
Copper-II-Acetate	$Cu(CH_3COO)_2$	s	+	+	+	+	+	+	+	+	+	+	3
Copper-II-Arsenite	$Cu_3(AsO_3)_2$	s	+	+	+	+	+	+	+	+	+	+	3
Copper-II-Carbonate	$CuCO_3$	s	+	+	+	+	+	+	+	+	+	+	2
Copper-II-Chloride	$CuCl_2$	s	+	+	+	+	1%	+	+	+	+	+	2
Copper-II-Cyanide	$Cu(CN)_2$	s	+	+	+	+	+	+	+	+	+	+	(3)
Copper-II-Fluoride	CuF_2	s	+	+	+	+	+	+	+	+	+	+	(2)
Copper-II-Nitrate	$Cu(NO_3)_2$	s	+	+	+	+	+	+	+	+	+	+/o	2
Copper-II-Sulphate	$CuSO_4$	s	+	+	+	+	+	+	+	+	+	+	2
Cresols	$C_6H_4CH_3OH$	100%	o	o	+	+	+	+	-	-	+	+	2
Crotonaldehyde	$CH_3C_2H_2CHO$	100%	n	-	+	+	+	-	+	-	+	+	3
Cubic Nitre => Sodium Nitrate													
Cumene => Isopropyl Benzene													
Cyclo Hexane	C_6H_{12}	100%	+	-	+	+	+	+	-	-	+	o	1
Cyclohexanole	$C_6H_{11}OH$	100%	o	+/o	+	+	+	+	-	-	+	+	1
Cyclohexanone	$C_6H_{10}O$	100%	-	-	+	-	+	-	+/o	-	+	+	1
Cyclohexyl Alcohol => Cyclohexanol													
Cyclohexylamine	$C_6H_{11}NH_2$	100%	n	n	n	n	+	-	n	n	n	+	2
Decahydronaphthaline	$C_{10}H_{18}$	100%	-	+/o	o	+	n	o	-	-	o	+	2
Decaline => Decahydronaphthalene													
Dextrose => Glucose													
Diacetonalcohol	$C_6H_{12}O_2$	100%	-	-	+	o	+	-	+	-	+	+	1
Dibromoethane	$C_2H_4Br_2$	100%	-	-	n	+	+	+	-	-	-	+	3
Dibutyl Ether	$C_4H_9OC_4H_9$	100%	-	-	+	+	+	-	o	-	+	+	2
Dibutyl Phthalate	$C_{16}H_{22}O_4$	100%	-	-	+	+	+	+	+/o	+	o	+	2
Dibutylamine	$(C_4H_9)_2NH$	100%	n	n	+	+	+	-	-	n	+	+	1
Dichloro Acetic Acid	$Cl_2CHCOOH$	100%	-	+	+	+	+	-	+	o	+	+	1
Dichloro Benzene	$C_6H_4Cl_2$	100%	-	-	o	+	+	+	-	-	o	+	2
Dichloro Butan	$C_4H_8Cl_2$	100%	-	-	o	+	+	+	-	-	o	+	3
Dichloro Butene	$C_4H_6Cl_2$	100%	-	-	o	+	+	o	-	-	o	+	3
Dichloro Ethane	$C_2H_4Cl_2$	100%	-	-	o	+	+	+	-	o	-	+	3
Dichloro Ethylene	$C_2H_2Cl_2$	100%	-	-	o	+	+	o	-	o	-	+	2
Dichloro Methane	CH_2Cl_2	100%	-	-	o	o	o	+	-	o	-	+	2
Dichloroisopropyl Ether	$(C_3H_6Cl)_2O$	100%	-	-	o	n	+	o	o	-	o	+	(2)
Dicyclohexylamine	$(C_6H_{12})_2NH$	100%	-	-	o	n	+	-	-	-	o	+	2
Diethyleneglycol	$C_4H_{10}O_3$	s	+	+	+	+	+	+	+	+	+	+	1
Diethyleneglycolethyl Ether	$C_8H_{18}O_3$	100%	n	n	+	+	+	n	+/o	o	+	+	1
Diethylether	$C_2H_5OC_2H_5$	100%	-	-	o	+	+	-	-	o	o	+	1
Diglycolic Acid	$C_4H_6O_5$	30%	+	+	+	+	+	+	n	+/o	+	+	3
Dihexyl Phthalate	$C_{20}H_{26}O_4$	100%	-	-	+	+	+	-	n	+	+	+	(1)
Diisobutylketone	$C_9H_{18}O$	100%	-	-	+	+	+	-	+	-	+	+	1
Di-iso-nonyl Phthalate	$C_{26}H_{42}O_4$	100%	-	-	+	+	+	n	n	+	+	+	1
Diisopropylketone	$C_7H_{14}O$	100%	-	-	+	+	+	-	+	-	+	+	1
Dimethyl Carbonate	$(CH_3O)_2CO$	100%	n	n	+	+	+	+	-	n	+	+	1
Dimethyl Ketone => Acetone													
Dimethyl Phthalate	$C_{10}H_{10}O_4$	100%	-	-	+	+	+	-	+/o	+	+	+	1
Dimethylformamide	$HCON(CH_3)_2$	100%	-	-	+	-	+	-	+	+/o	+	+	1
Dimethylhydrazine	$H_2NN(CH_3)_2$	100%	n	n	+	n	+	-	+	n	+	+	3
Dioctyl Phthalate	$C_4H_4(COOC_8H_{17})_2$	100%	-	-	+	+	+	-	+/o	+	+	+	1
Dioxane	$C_4H_8O_2$	100%	-	-	o	-	+	-	+/o	-	+	+	1
Disodium Hydrogenphosphate	Na_2HPO_4	s	+	+	+	+	+	+	+	+	+	+	1
Disulfur Acid -- Oleum													
Disulphur Dichloride	S_2Cl_2	100%	n	n	n	+	n	+	-	-	n	n	
DMF => Dimethylformamide													
Engine Oils		100 %	n	+/o	+	+	+	+	-	-	+	+	2
Epsom salts => Magnesium Sulphate													
Ethanol	C_2H_5OH	100%	-	+	+	+	+	-	+	+	+	+	1
Ethanol Amine	$HOC_2H_4NH_2$	100%	o	n	+	-	+	-	+/o	o	+	+	1
Ethyl Acetate	$CH_3COOC_2H_5$	100%	-	-	35%	+	+	-	+/o	+/o	+	+	1
Ethyl Acrylate	$C_2H_3COOC_2H_5$	100%	-	-	+	o	+	-	+/o	-	+	+	2

ProMinent® Chemical Resistance List

Chemical	Formula	Conc	PMMA	PVC	PP	PVDF	1.4404	FKM	EPDM	PharMed®	PE	2.4819	WPC
Ethyl Benzene	C_6H_5-C_2H_5	100%	-	-	o	+	+	o	-	-	o	+	1
Ethyl Benzoate	$C_6H_5COOC_2H_5$	100%	n	-	+	o	+	+	-	-	+	+	1
Ethyl Bromide	C_2H_5Br	100%	-	n	+	+	n	+	-	o	+	+	2
Ethyl Chloroacetate	$ClCH_2COOC_2H_5$	100%	-	o	+	+	+	+	-	-	+	+	2
Ethyl Chlorocarbonate	$ClCO_2C_2H_5$	100%	n	n	n	n	n	+	-	n	n	n	(2)
Ethyl Cyclopentane	$C5H_4C_2H_5$	100%	+	+	+	+	+	+	-	-	+	+	(1)
Ethylacetoacetate	$C_6H_{10}O_3$	100%	n	-	+	+	+	-	+/o	+/o	+	+	1
Ethylacrylic Acid	C_4H_7COOH	100%	n	n	+	+	+	n	+/o	n	+	+	(1)
Ethylene Diamine	$(CH_2NH_2)_2$	100%	o	o	+	-	o	-	+	n	+	o	2
Ethylene Dibromide => Dibromoethane													
Ethylene Dichloride => Dichloro Ethane													
Ethylene Glycol => Glycol													
Ethylenglycol Ethylether	$HOC_2H_4OC_2H_5$	100%	n	n	+	+	+	n	+/o	o	+	+	1
Ethylhexanol	$C_8H_{16}O$	100%	n	+/o	+	+	+	+	+	-	+	+	2
Fatty Acids	R-COOH	100%	+	+	+	+	+	+	o	o	+	+	1
Ferric Chloride	$FeCl_3$	s	+	+	+	+	-	+	+	+	+	+/o	1
Ferric Nitrate	$Fe(NO_3)_3$	s	+	+	+	+	+	+	+	+	+	+	1
Ferric Phosphate	$FePO_4$	s	+	+	+	+	+	+	+	+	+	+	1
Ferric Sulphate	$Fe_2(SO_4)_3$	s	+	+	+	+	o	+	+	+	+	+	1
Ferrous Chloride	$FeCl_2$	s	+	+	+	+	-	+	+	+	+	+/o	1
Ferrous Sulphate	$FeSO_4$	s	+	+	+	+	+	+	+	+	+	+	1
Fixing Salt => Sodium Thiosulphate													
Fluoro Benzene	C_6H_5F	100%	-	-	+	+	+	o	-	-	o	+	2
Fluoroboric Acid	HBF_4	35%	+	+	+	+	o	+	+	-	+	+	1
Fluorosilicic Acid	H_2SiF_6	100%	+	30%	30%	+	o	+	+	o	40%	+/o	2
Formaldehyde	CH_2O	40%	+	+	+	+	+	-	+/o	-	+	+	2
Formalin => Formaldehyde													
Formamide	$HCONH_2$	100%	+	-	+	+	+	+	+	n	+	+	1
Formic Acid	HCOOH	s	-	+/o	+	+	+	-	-	+/o	+	+	1
Furane	C_4H_4O	100%	-	-	+	-	+	-	n	-	+	+	3
Furane Aldehyde	$C_5H_5O_2$	100%	n	n	n	o	+	-	+/o	-	n	n	2
Furfuryl Alcohol	$OC_4H_3CH_2OH$	100%	-	-	+	o	+	n	+/o	-	+	+	1
Gallic Acid	$C_6H_2(OH)_3COOH$	5%	+	+	+	+	+	+	+/o	+	+	+	1
Gasoline		100 %	-	-	+	+	+	+	-	-	+	+	2
Glauber´s Salt => Sodium Sulphate													
Glucose	$C_6H_{12}O_6$	s	+	+	+	+	+	+	+	+	+	+	1
Glycerol	$C_3H_5(OH)_3$	100%	+	+	+	+	+	+	+	+	+	+	1
Glycerol Triacetate	$C_3H_5(CH_3COO)_3$	100%	n	n	+	+	+	-	+	n	+	+	1
Glycine	NH_2CH_2COOH	10%	+	+	+	+	+	+	+	+	+	+	1
Glycol	$C_2H_4(OH)_2$	100%	+	+	+	+	+	+	+	+	+	+	1
Glycolic Acid	$CH_2OHCOOH$	70%	+	37%	+	+	+	+	+	+/o	+	+	1
Gypsum => Calcium Sulphate													
Heptane	C_7H_{16}	100%	+	+	+	+	+	+	-	-	+	+	1
Hexachloroplatinic Acid	H_2PtCl_6	s	n	+	+	+	-	n	+	n	+	-	
Hexanal	$C_5H_{11}CHO$	100%	n	n	+	+	+	-	+/o	-	+	+	1
Hexane	C_6H_{14}	100%	+	+	+	+	+	+	-	-	+	+	1
Hexanol	$C_6H_{13}OH$	100%	-	-	+	+	+	n	+	o	+	+	1
Hexantriol	$C_6H_9(OH)_3$	100%	n	n	+	+	+	+	+	n	+	+	1
Hexene	C_6H_{12}	100%	n	+	+	+	+	+	-	-	+	+	1
Hydrazine Hydrate	$N_2H_4 * H_2O$	s	+	+	+	+	+	n	+	o	+	+	3
Hydrobromic Acid	HBr	50%	+	+	+	+	-	-	+	-	+	o	1
Hydrochloric Acid	HCl	38%	32%	+ *	+	+	-	+	o	o	+	o	1
Hydrofluoric Acid	HF	80%	-	40% *	40% **	+	-	+	o	-	40%	+/o	1
Hydrogen Cyanide	HCN	s	+	+	+	+	+	+	+	+	+	+	3
Hydrogen Peroxide	H_2O_2	90%	40%	40%*	30%	+	+	30%	30%	+	+	+	1
Hydroiodic Acid	HI	s	+	+	+	+	-	-	n	-	+	n	1
Hydroquinone	$C_6H_4(OH)_2$	s	o	+	+	+	+	+	-	+/o	+	+	2
Hydroxylamine Sulphate	$(NH_2OH)_2 * H_2SO_4$	10%	+	+	+	+	+	+	+	+	+	+	2
Hypochlorous Acid	HOCl	s	+	+	o	+	-	+	+/o	+	o	+	(1)
Iodine	I_2	s	o	-	+	+	-	+	+/o	+	o	+/o	
Iron Vitriol => Ferrous Sulphate													
Isobutanol => Isobutyl Alcohol													
Isobutyl Alcohol	$C_2H_5CH(OH)CH_3$	100%	-	+	+	+	+	+	+	o	+	+	1

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Chemical	Formula	Conc	PMMA	PVC	PP	PVDF	1.4404	FKM	EPDM	PharMed®	PE	2.4819	WPC
Isopropanol => Isopropyl Alcohol													
Isopropyl Acetate	$CH_3COOCH(CH_3)_2$	100%	-	-	+	+	+	-	+/o	+/o	+	+	1
Isopropyl Alcohol	$(CH_3)_2CHOH$	100%	-	+/o	+	+	+	+	+	o	+	+	1
Isopropyl Benzene	$C_6H_5CH(CH_3)_2$	100%	-	-	o	+	+	+	-	-	o	+	1
Isopropyl Chloride	$CH_3CHClCH_3$	80%	-	-	o	+	+	+	-	o	o	+/o	2
Isopropyl Ether	$C_6H_{14}O$	100%	-	-	o	+	+	-	-	o	o	+	1
Kitchen Salt => Sodium Chloride													
Lactic Acid	$C_3H_6O_3$	100%	-	+	+	+	+/o	+	10%	+/o	+	+	1
Lead Acetate	$Pb(CH_3COO)_2$	s	+	+	+	+	+	+	+	+	+	+	2
Lead Nitrate	$Pb(NO_3)_2$	50%	+	+	+	+	+	+	+	+	+	+	2
Lead Sugar => Lead Acetate													
Lead Sulphate	$PbSO_4$	s	+	+	+	+	+	+	+	+	+	+	(2)
Lead Tetraethyl	$Pb(C_2H_5)_4$	100%	+	+	+	+	+	+	-	n	+	+	3
Lime Milk => Calcium Hydroxide													
Liquid Ammonia => Ammonium Hydroxide													
Lithium Bromide	LiBr	s	+	+	+	+	+	+	+	+	+	+	1
Lithium Chloride	LiCl	s	+	+	+	+	-	+	+	+	+	n	1
Lunar Caustic => Silver Nitrate													
Magnesium Carbonate	$MgCO_3$	s	+	+	+	+	+	+	+	+	+	+/o	1
Magnesium Chloride	$MgCl_2$	s	+	+	+	+	o	+	+	+	+	+	1
Magnesium Hydroxide	$Mg(OH)_2$	s	+	+	+	+	+	+	+	+	+	+	1
Magnesium Nitrate	$Mg(NO_3)_2$	s	+	+	+	+	+	+	+	+	+	+	1
Magnesium Sulphate	$MgSO_4$	s	+	+	+	+	+	+	+	+	+	+/o	1
Maleic Acid	$C_4H_4O_4$	s	+	+	+	+	+	+	+	o	+	+	1
Malic Acid	$C_4H_6O_5$	s	+	+	+	+	+	+	+	+	+	+	1
Manganese-II-Chloride	$MnCl_2$	s	+	+	+	+	-	+	+	+	+	+	1
Manganese-II-Sulphate	$MnSO_4$	s	+	+	+	+	+	+	+	+	+	+	1
MEK => Methyl Ethyl Ketone													
Mercury	Hg	100%	+	+	+	+	+	+	+	+	+	+	3
Mercury-II-Chloride	$HgCl_2$	s	+	+	+	+	-	+	+	+	+	+	3
Mercury-II-Cyanide	$Hg(CN)_2$	s	+	+	+	+	+	+	+	+	+	+	3
Mercury-II-Nitrate	$Hg(NO_3)_2$	s	+	+	+	+	+	+	+	+	+	+	3
Mesityl Oxide	$C_6H_{10}O$	100%	-	-	n	n	+	-	+/o	-	n	+	1
Methacrylic Acid	C_3H_5COOH	100%	n	n	+	+	+	o	+/o	+/o	+	+	1
Methanol	CH_3OH	100%	-	-	+	+	+	o	+	+/o	+	+	1
Methoxybutanol	$CH_3O(CH_2)_4OH$	100%	-	-	+	+	+	+	o	o	+	+	(1)
Methyl Acetate	CH_3COOCH_3	60%	-	-	+	+	+	-	+/o	+/o	+	+	2
Methyl Acrylate	$C_2H_3COOCH_3$	100%	-	-	+	+	+	-	+/o	o	+	+	2
Methyl Benzoate	$C_6H_5COOCH_3$	100%	-	-	+	o	+	+	-	-	+	+	2
Methyl Catechol	$C_6H_3(OH)_2CH_3$	s	+	+	+	+	+	+	-	+o	+	+	(1)
Methyl Cellulose		s	+	+	+	+	+	+	+	+	+	+	1
Methyl Chloroacetate	$ClCH_2COOCH_3$	100%	-	o	+	+	+	o	-	-	+	+	2
Methyl Cyclopentane	$C_5H_9CH_3$	100%	+	+	+	+	+	+	-	-	+	+	(1)
Methyl Dichloroacetate	$Cl_2CHCOOCH_3$	100%	-	-	+	n	+	-	n	-	+	+	2
Methyl Ethyl Ketone	$CH_3COC_2H_5$	100%	-	-	+	-	+	-	+	-	+	+	1
Methyl Glycol	$C_3H_8O_2$	100%	+	+	+	+	+	-	+/o	+	+	+	1
Methyl Isobutyl Ketone	$CH_3COC_4H_9$	100%	-	-	+	-	+	-	o	-	+	+	1
Methyl Isopropyl Ketone	$CH_3COC_3H_7$	100%	-	-	+	-	+	-	+/o	-	+	+	1
Methyl Methacrylate	$C_3H_5COOCH_3$	100%	-	-	+	+	+	-	-	-	+	+	1
Methyl Oleate	$C_{17}H_{33}COOCH_3$	100%	n	n	+	+	+	+	+/o	n	+	+	1
Methyl Salicylate	$HOC_6H_4COOCH_3$	100%	-	-	+	+	+	n	+/o	-	+	+	1
Methylacetyl Acetate	$C_5H_8O_3$	100%	-	-	+	+	+	-	+/o	o	+	+	2
Methylamine	CH_3NH_2	32%	+	o	+	o	+	-	+	+	+	+	2
Methylene Chloride => Dichloro Methane													
Mirabilit => Sodium Sulphate													
Morpholine	C_4H_9ON	100%	-	-	+	-	+	n	n	-	+	+	2
Muriatic Acid => Hydrochloric Acid													
Natron => Sodium Bicarbonate													
Nickel-II-Acetate	$(CH_3COO)_2Ni$	s	+	+	+	+	+	-	+	+	+	+	(2)
Nickel-II-Chloride	$NiCl_2$	s	+	+	+	+	-	+	+	+	+	+	2
Nickel-II-Nitrate	$Ni(NO_3)_2$	s	+	+	+	+	+	+	+	+	+	+/o	2
Nickel-II-Sulphate	$NiSO_4$	s	+	+	+	+	+	+	+	+	+	+/o	2
Nitrate of Lime => Calcium Nitrate													

ProMinent® Chemical Resistance List

Chemical	Formula	Conc	PMMA	PVC	PP	PVDF	1.4404	FKM	EPDM	PharMed®	PE	2.4819	WPC
Nitric Acid	HNO_3	99%	10%	10%*	50%	65%	50%	65%	10%	35%	50%	65%	1
Nitro Methane	CH_3NO_2	100%	-	-	+	o	+	-	+/o	-	+	+	2
Nitro Propane	$(CH_3)_2CHNO_2$	100%	-	-	+	n	+	-	+/o	-	+	+	2
Nitro Toluene	$C_6H_4NO_2CH_3$	100%	-	-	+	+	+	o	-	-	+	+	2
Octane	C_8H_{18}	100%	o	+	+	+	+	+	-	-	+	+	1
Octanol	$C_8H_{17}OH$	100%	-	-	+	+	+	+	+	-	+	+	1
Octyl Cresol	$C_15H_{24}O$	100%	-	-	+	+	+	o	n	-	+	+	(1)
Oil => Engine Oils													
Oleum	$H_2SO_4 + SO_3$	s	n	-	-	-	+	+	-	+	-	+	2
Orthophosphoric Acid => Phosphoric Acid													
Oxalic Acid	$(COOH)_2$	s	+	+	+	+	10%	+	+	+/o	+	+/o	1
Pentane	C_5H_{12}	100%	+	+	+	+	+	+	-	-	+	+	1
Pentanol => Amyl Alcohol													
Perchloric Acid	$HClO_4$	70%	n	10%	10%	+	-	+	+/o	+	+	n	1
Perchloroethylene => Tetrachloro Ethylene													
Perhydrol => Hydrogen Peroxide													
Petroleum Ether	CnH_{2n+2}	100%	+	+/o	+	+	+	+	-	-	+	+	1
Phenole	C_6H_5OH	100%	-	-	+	+	+	+	-	+	+	+	2
Phenyl Ethyl Ether	$C_6H_5OC_2H_5$	100%	-	-	+	n	+	-	-	-	+	+	2
Phenyl Hydrazine	$C_6H5NHNH_2$	100%	-	-	o	+	+	o	-	-	o	+	2
Phosphoric Acid	H_3PO_4	85%	50%	+	+	+	+	+	+	+	+	+	1
Phosphorous Oxychloride	$POCl_3$	100%	-	-	+	+	n	+	+	n	+	+	1
Phosphorous Trichloride	PCl_3	100%	-	-	+	+	+	o	+	+/o	+	+	1
Phthalic Acid	$C_6H_4(COOH)_2$	s	+	+	+	+	+	+	+	+	+	+	1
Picric Acid	$C_6H_2(NO_3)_3OH$	s	+	+	+	+	+	+	+	-	+	+	2
Piperidine	$C_5H_{11}N$	100%	-	-	n	n	+	-	-	-	n	+	2
Potash Alum => Potassium Aluminium Sulphate													
Potassium Acetate	CH_3COOK	s	+	+	+	+	+	+	+	+	+	+	1
Potassium Aluminium Sulphate	$KAl(SO_4)_2$	s	+	+	+	+	+	+	+	+	+	+	1
Potassium Bicarbonate	$KHCO_3$	40%	+	+	+	+	+	+	+	+	+	+/o	1
Potassium Bifluoride	KHF_2	s	n	+	+	+	+	+	+	+	+	+	1
Potassium Bisulphate	$KHSO_4$	5%	+	+	+	+	+	+	+	+	+	+	1
Potassium Bitartrate	$KC_4H_5O_6$	s	+	+	+	+	+	+	+	+	+	+	1
Potassium Borate	KBO_2	s	+	+	+	+	+	+	+	+	+	+	(1)
Potassium Bromate	$KBrO_3$	s	+	+	+	+	+	+	+	+	+	+	2
Potassium Bromide	KBr	s	+	+	+	+	10%	+	+	+	+	0,1	1
Potassium Carbonate	K_2CO_3	s	+	+	+	+	+	+	+	55%	+	+	1
Potassium Chlorate	$KClO_3$	s	+	+	+	+	+	+	+	+	+	+	2
Potassium Chloride	KCl	s	+	+	+	+	-	+	+	+	+	+/o	1
Potassium Chromate	K_2CrO_4	10%	+	+	+	+	+	+	+	+	+	+	3
Potassium Chrome Sulphate	$KCr(SO_4)_2$	s	+	+	+	+	+	+	+	+	+	+	1
Potassium Cyanate	KOCN	s	+	+	+	+	+	+	+	+	+	+	2
Potassium Cyanide	KCN	s	+	+	+	+	5%	+	+	+	+	5%	3
Potassium Cyanoferrate II	$K_4Fe(CN)_6$	s	+	+	+	+	+	+	+	+	+	+	1
Potassium Cyanoferrate III	$K_3Fe(CN)_6$	s	+	+	+	+	+	+	+	+	+	+	1
Potassium Dichromate	$K_2Cr_2O_7$	s	+	+	+	+	25%	+	+	+	+	10%	3
Potassium Fluoride	KF	s	+	+	+	+	+	+	+	+	+	+	1
Potassium Hydroxyde	KOH	50%	+	+	+	+ (25 °C)	+	-	+	10%	+	+	1
Potassium Iodide	KI	s	+	+	+	+	+	+	+	+	+	+	1
Potassium Nitrate	KNO_3	s	+	+	+	+	+	+	+	+	+	+	1
Potassium Perchlorate	$KClO_4$	s	+	+	+	+	n	+	+	+	+	+	1
Potassium Permanganate	$KMnO_4$	s	+	+	+	+	+	+	+	6%	+	+	2
Potassium Persulphate	$K_2S_2O_8$	s	+	+	+	+	+	+	+	+	+	+	1
Potassium Phosphate	KH_2PO_4	s	+	+	+	+	+	+	+	+	+	+	1
Potassium Pyrochromate => Potassium Dichromate													
Potassium Sulphate	K_2SO_4	s	+	+	+	+	+	+	+	+	+	+	1
Potassium Sulphite	K_2SO_3	s	+	+	+	+	+	+	+	+	+	+	1
Propionic Acid	C_2H_5COOH	100%	o	+	+	+	+	+	+	+/o	+	+	1
Propionitrile	CH_3CH_2CN	100%	n	n	+	+	+	+	-	-	+	+	2
Propyl Acetate	$CH_3COOC_3H_7$	100%	-	-	+	+	+	-	+/o	-	+	+	1
Propylene Glycol	$CH_3CHOHCH_2OH$	100%	+	+	+	+	+	+	+	+	+	+	1
Prussic Acid => Hydrogen Cyanide													
Pyridine	C_5H_5N	100%	-	-	o	-	+	-	-	o	+	+	2

ProMinent® Chemical Resistance List

Chemical	Formula	Conc	PMMA	PVC	PP	PVDF	1.4404	FKM	EPDM	PharMed®	PE	2.4819	WPC
Pyrrole	C_4H_4NH	100%	n	n	+	n	+	-	-	-	+	+	2
Roman Vitriol => Copper Sulphate													
Salicylic Acid	HOC_6H_4COOH	s	+	+	+	+	+	+	+	+	+	+/o	1
Salmiac => Ammonium Chloride													
Saltpeter => Potassium Nitrate													
Silic Acid	$SiO_2 * x H_2O$	s	+	+	+	+	+	+	+	+	+	+	1
Silver Bromide	AgBr	s	+	+	+	+	+/o	+	+	+	+	+	1
Silver Chloride	AgCl	s	+	+	+	+	-	+	+	+	+	+/o	1
Silver Nitrate	$AgNO_3$	s	+	+	+	+	+	+	+	+	+	+/o	3
Slaked Lime => Calcium Hydroxide													
Soda => Sodium Carbonate													
Sodium Acetate	$NaCH_3COO$	s	+	+	+	+	+	+	+	+	+	+	1
Sodium Benzoate	C_6H_5COONa	s	+	+	+	+	+	+	+	+	+	+	1
Sodium Bicarbonate	$NaHCO_3$	s	+	+	+	+	+	+	+	+	+	+	1
Sodium Bisulphate	$NaHSO_4$	s	+	+	+	+	+	+	+	+	+	+	1
Sodium Bisulphite	$NaHSO_3$	s	+	+	+	+	+	+	+	+	+	+	1
Sodium Borate	$NaBO_2$	s	+	+	+	+	+	+	+	+	+	+	1
Sodium Bromate	$NaBrO_3$	s	+	+	+	+	+	+	+	+	+	+	3
Sodium Bromide	NaBr	s	+	+	+	+	+	+	+	+	+	+	1
Sodium Carbonate	Na_2CO_3	s	+	+	+	+	+/o	+	+	+	+	+	1
Sodium Chlorate	$NaClO_3$	s	+	+	+	+	+	+	+	+	+	+	2
Sodium Chloride	NaCl	s	+	+	+	+	-	+	+	+	+	+	1
Sodium Chlorite	$NaClO_2$	24%	+	+	+	+	10%	+	+	+	+	10%	2
Sodium Chromate	Na_2CrO_4	s	+	+	+	+	+	+	+	+	+	+	3
Sodium Cyanide	NaCN	s	+	+	+	+	+	+	+	+	+	+	3
Sodium Dichromate	$Na_2Cr_2O_7$	s	+	+	+	+	+	+	+	+	+	+	3
Sodium Dithionite	$Na_2S_2O_4$	s	+	10%	10%	+	+	n	n	+	10%	+/o	1
Sodium Fluoride	NaF	s	+	+	+	+	10%	+	+	+	+	+	1
Sodium Hydrogen Sulphate => Sodium Bisulphate													
Sodium Hydroxide	NaOH	50%	+	+	+	+ (60%/ + 25 °C)		-	+	30%	+	+	1
Sodium Hypochlorite	NaOCl + NaCl	12%	+	+	o	+	-	+	+	+	o	> 10%	2
Sodium Iodide	NaI	s	+	+	+	+	+	+	+	+	+	+	1
Sodium Metaphosphate	$(NaPO_3)_n$	s	+	+	+	+	+	+	+	+	+	+	1
Sodium Nitrate	$NaNO_3$	s	+	+	+	+	+	+	+	+	+	+	1
Sodium Nitrite	$NaNO_2$	s	+	+	+	+	+	+	+	+	+	+	2
Sodium Oxalate	$Na_2C_2O_4$	s	+	+	+	+	+	+	+	+	+	+	1
Sodium Perborate	$NaBO_2*H_2O_2$	s	+	+/o	+	+	+	+	+	+	+	+/o	1
Sodium Perchlorate	$NaClO_4$	s	+	+	+	+	10%	+	+	+	+	10%	1
Sodium Peroxide	Na_2O_2	s	+	+	+	+	+	+	+	n	-	+	1
Sodium Persulphate	$Na_2S_2O_8$	s	n	+	+	+	+	+	+	+	+	+	1
Sodium Pyrosulphite	$Na_2S_2O_5$	s	+	+	+	+	+	n	n	+	+	+	1
Sodium Salicylate	$C_6H_4(OH)COONa$	s	+	+/o	+	+	+	+	+	+	+	+	1
Sodium Silicate	Na_2SiO_3	s	+	+	+	+	+	+	+	+	+	+	1
Sodium Sulphate	Na_2SO_4	s	+	+	+	+	+	+	+	+	+	+	1
Sodium Sulphide	Na_2S	s	+	+	+	+	+	+	+	+	+	+	2
Sodium Sulphite	Na_2SO_3	s	+	+	+	+	50%	+	+	+	+	50%	1
Sodium Tetraborate	$Na_2B_4O_7 * 10 H_2O$	s	+	+	+	+	+	+	+	+	+	+	1
Sodium Thiosulphate	$Na_2S_2O_3$	s	+	+	+	+	25%	+	+	+	+	25%	1
Sodium Tripolyphosphate	$Na_5P_3O_{10}$	s	+	+	+	+	+	+/o	+	+	+	+	1
Starch	$(C_6H_{10}O_5)_n$	s	+	+	+	+	+	+	n	+	+	+	1
Starch Gum		s	+	+	+	+	+	+	+	+	+	+	1
Styrene	$C_6H_5CHCH_2$	100%	-	-	o	+	+	o	-	-	o	+	2
Sublimate => Mercury-II-Chloride													
Succinic Acid	$C_4H_6O_4$	s	+	+	+	+	+	+	+	+	+	+	1
Sugar Syrup		s	+	+	+	+	+	+	+	+	+	+	1
Sulphur Chloride => Disulphur Dichloride													
Sulphuric Acid	H_2SO_4	98%	30%	50%	85%	+	20%	+	+	30%	80%	+	1
Sulphuric Acid, fuming --> Oleum													
Sulphurous Acid	H_2SO_3	s	+	+	+	+	10%	+	+	+	+	+	(1)
Sulphuryl Chloride	SO_2Cl_2	100%	-	-	-	o	n	+	o	-	-	n	1
Tannic Acid	$C_{76}H_{52}O_{46}$	50%	+	+	+	+	+	+	+	+	+	+	1
Tartaric Acid	$C_4H_6O_6$	s	50%	+	+	+	+	+	+/o	+	+	+	1
Tetrachloro Ethane	$C_2H_2Cl_4$	100%	-	-	o	+	+	o	-	o	o	+	3

ProMinent® Chemical Resistance List

Chemical	Formula	Conc	PMMA	PVC	PP	PVDF	1.4404	FKM	EPDM	PharMed®	PE	2.4819	WPC
Tetrachloro Ethylene	C_2Cl_4	100%	-	-	o	+	+	o	-	o	o	+	3
Tetrachloromethane => Carbon Tetrachloride													
Tetrahydro Furane	C_4H_8O	100%	-	-	o	-	+	-	-	-	o	+	1
Tetrahydro Naphthalene	$C_{10}H_{12}$	100%	-	-	-	+	+	+	-	-	o	+	3
Tetralin => Tetrahydro Naphthalene													
THF => Tetrahydrofurane													
Thionyl Chloride	$SOCl_2$	100%	-	-	-	+	n	+	+	+	-	n	1
Thiophene	C_4H_4S	100%	n	-	o	n	+	-	-	-	o	+	3
Tin-II-Chloride	$SnCl_2$	s	+	o	+	+	-	+	+	+	+	+/o	1
Tin-II-Sulphate	$SnSO_4$	s	n	+	+	+	+	+	+	+	+	+/o	(1)
Tin-IV-Chloride	$SnCl_4$	s	n	+	+	+	-	+	+	+	+	+	1
Titanium Tetrachloride	$TiCl_4$	100%	n	n	n	+	n	o	-	n	n	n	1
Toluene	$C_6H_5CH_3$	100%	-	-	o	+	+	o	-	-	o	+	2
Toluene Diisocyanate	$C_7H_3(NCO)_2$	100%	n	n	+	+	+	-	+/o	n	+	+	2
Tributyl Phosphate	$(C_4H_9)_3PO_4$	100%	n	-	+	+	+	-	+	+	+	+	1
Trichloro Ethane	CCl_3CH_3	100%	-	-	o	+	+	+	-	o	o	+	3
Trichloro Ethylene	C_2HCl_3	100%	-	-	o	+	+/o	o	-	o	o	+	3
Trichloro Methane => Chloroform													
Trichloroacetaldehyde Hydrate	$CCl_3CH(OH)_2$	s	-	-	o	-	+	o	o	n	+	+	2
Trichloroacetic Acid	CCl_3COOH	50%	-	+	+	+	-	-	o	+/o	+	+	1
Tricresyl Phosphate	$(C_7H_7)_3PO_4$	90%	-	-	+	n	+	o	+	+	+	+	2
Triethanol Amine	$N(C_2H_4OH)_3$	100%	+	o	+	n	+	-	+/o	o	+	+	1
Trilene => Trichloro Ethane													
Trioctyl Phosphate	$(C_8H_{17})_3PO_4$	100%	n	-	+	+	+	o	+	+	+	+	2
Trisodium Phosphate	Na_3PO_4	s	+	+	+	+	+	+	+	+	+	+	1
Urea	$CO(NH_2)_2$	s	+	+/o	+	+	+	+	+	20%	+	+	1
Vinyl Acetate	$CH_2=CHOOCCH_3$	100%	-	-	+	+	+	n	n	+/o	+	+	2
Water Glass => Sodium Silicate													
Xylene	$C_6H_4(CH_3)_2$	100%	-	-	-	+	+	o	-	-	o	+	2
Zinc Acetate	$(CH_3COO)_2Zn$	s	+	+	+	+	+	-	+	+	+	+	1
Zinc Chloride	$ZnCl_2$	s	+	+	+	+	-	+	+	+	+	n	1
Zinc Sulphate	$ZnSO_4$	s	+	+	+	+	+	+	+	+	+	+/o	1

ProMinent® Chemical Resistance List

Overview of the Resistance of Soft PVC Hoses (Guttasyn®) to the Most Common Chemicals

This data applies to standard conditions (20 °C, 1013 mbar).

+	=	resistant
o	=	conditionally resistant
-	=	not resistant

The data has been taken from relevant manufacturers' literature and supplemented by our own tests and experience. As the resistance of a material also depends on other factors, especially pressure and operating conditions etc, this list should merely be regarded as an initial guide and does not claim to offer any guarantees. Take into consideration the fact that conventional dosing agents are largely compounds, the corrosiveness of which cannot simply be calculated by adding together the corrosiveness of each individual component. In cases such as these the material compatibility data produced by the chemical manufacturer must be read as a matter of priority when selecting a material. Safety data sheets do not provide this information and cannot therefore replace application-specific documentation.

Corrosive agent	Concentration in %	Evaluation
Acetic acid	50	o
Acetic acid (wine vinegar)		o
Acetic acid anhydride	100	-
Acetic acid, aqueous	10	+
Acetic ester	100	-
Acetone	all	-
Acetylene tetrabromide	100	-
Aluminium salts, aqueous	all	+
Alums of all kinds, aqueous	all	+
Ammonium salts	all	+
Ammonium, aqueous	15	-
Ammonium, aqueous	saturated	-
Aniline	100	-
Benzene	100	-
Bisulphite, aqueous	40	+
Borax solution	all	+
Boric acid, aqueous	10	+
Bromine, vaporous and liquid		-
Butanol	100	+
Butyl acetate	100	-
Butyric acid, aqueous	20	+
Butyric acid, aqueous	conc.	-
Calcium chloride, aqueous	all	+
Carbon disulphide	100	-
Carbonic acid	all	+
Caustic potash	15	+
Chlorinated hydrocarbons	all	-
Chrome-alum, aqueous	all	+
Chromic acid, aqueous	50	-
Copper sulphate, aqueous	all	+
Creosote		-
Dextrin, aqueous	saturated	+
Diesel oils, compressed oils	100	o
Diethyl ether	100	-
Difluorodichloromethane	100	-
Ethanol	96	-
Ethyl acetate	100	-
Ethylene glycol	30	+
Ferric chloride, aqueous	all	+
Fertilizing manure salt, aqueous	all	+
Formaldehyde, aqueous	30	o
Glacial acetic acid	100	-
Glucose, aqueous	saturated	+
Glycerol	100	-
Halogens	all	-

ProMinent® Chemical Resistance List

Corrosive agent	Concentration in %	Evaluation
Hydrochloric acid	15	+
Hydrogen bromide	10	+
Hydrogen peroxide	to 10	+
Hydrogen sulphide, gaseous	100	-
Ink		+
Magnesium salts, aqueous	all	+
Methyl alcohol	100	+
Methylene chloride	100	-
Nitric acid, aqueous	25	+
Oils => fats, diesel oil, Lubricating oil and similar		
Perchloric acid	all	o
Phenol, aqueous	all	o
Phosphoric acid, aqueous	100	-
Potassium bichromate, aqueous	saturated	+
Potassium persulphate, aqueous	saturated	+
Silver nitrate	10	+
Sodium chloride, aqueous	all	+
Sodium hydroxide	aqueous	+
Sodium hypochlorite	15	+
Sodium salts => sodium chloride		
Sulphur dioxide, gaseous	all	+
Sulphuric acid	30	+
Tetrachloromethane	100	-
Toluene	100	-
Trichloroethylene	100	-
Urea, aqueous	all	+
Xylene	100	-
Zinc salts	all	+

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