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The prices apply to delivery transactions "ex works" (EXW) exclusive of packaging.

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Heidelberg, January 2013

Your Application, Our Solution. Welcome to ProMinent.



Quick orientation

We offer a compact product overview that provides a summary of our entire range to enable you to quickly and easily find the product information relevant to you and your application. Four separate product catalogues provide comprehensive and detailed information on our individual product ranges:

- Volume 1: Metering pumps, components and metering systems
- **Volume 2: Measuring, control and sensor technology**
- Volume 3: Motor-driven and process metering pumps
- Volume 4: Water treatment and water disinfection

You can decide for yourself in what format you would like to access the relevant information: the product overview and the four individual catalogues are available in a printed version and as a CD. They are also available as a download from our homepage and can also be installed as an app on your iPhone or iPad.

Precise measured values - simply essential

You can optimise your specific liquid chemical metering application using high-performance measuring and control technology together with precise and reliable online sensors, as only a closed control circuit ensures maximum safety and efficiency.

Our extensive product range offers you

- A wide range of sensors for precise measurement of diverse parameters in real time for the reliable monitoring or control of processes, all of which are of course supplied with the corresponding fittings.
- Measuring and control instruments, classified according to performance class, ranging from instruments to perform basic functions, such as the simple conversion of measuring signals, to

calibration-enabled measuring instruments with a display of the measured values and multifunctional controllers, thereby ensuring that there is always the right instrument to match the application.

- Complete ready-assembled measuring and control stations, especially for the measurement of potable water, cooling water and waste water, with perfectly coordinated components - connection-ready, plug & play modules for quick and easy installation.

First-class products, for a first-class performance

Absolute process safety is always at the very heart of all our development, whether custom-made individual products or large-scale complex projects. You will benefit from over 50 years of experience and the comprehensive knowledge and expertise of our experts across the globe. Our modular program, comprising individual products and system solutions, offers a maximum of flexibility and cost-effectiveness whenever and wherever required.

Our product range - the benefits for you:

- Global sales and service presence.
- Personal project care and application-specific advice.
- Optimum quality and reliability.
- Absolute problem-solving approach and optimisation of potential cost-savings.
- Complete range of innovative, high-performance and efficient products and systems solutions.



BCR 1

Amperometric DULCOTEST® sensor BCR 1

The new membrane-covered amperometric BCR 1 mA sensor was specially developed for the online measurement of the bromine concentration of organic disinfectants, such as BCDMH in contaminated water or water containing solid matter, such as cooling water and waste water. An innovative membrane/electrolyte system prevents the sensor membrane from being blocked prematurely and also ensures satisfactory sensor lifetimes even when used with biologically active media. The sensors are operated in a bypass to the main line up to a maximum back pressure of 1 bar and are compatible with ProMinent bypass fittings. The sensors can also be operated with the majority of ProMinent controllers.

For more information see page → 1-38



Sensoren

New DULCOTEST® pH and ORP sensors in the standard range

The following sensor types have been transferred from custom manufacture to the standard range:

pH and ORP sensors with sensor-side fixed cable connector for connection to various connectors on the measuring unit and different cable lengths.

pH sensors:

- PHES 112 FE 301 S
- PHES 112 FE 303 O
- PHEP 112 FE 305 O
- PHEP 112 FE 510 O
- PHER 112 FE 503 O
- PHEX 112 FE 510 S
- PHEX 112 FE 303 S
- PHEX 112 FE 302 O

ORP sensors:

- RHES-Pt-FE 301 B
- RHES-Pt-FE 303 B
- RHES-Pt-FE 301 S

RHES-Au-SE: ORP sensor with SN6 plug-in head for swimming pool applications using the open electrolysis disinfection process (without diaphragm)

For more information see page → 1-10 and → 1-19

All DULCOTEST® pH and ORP glass sensors made with lead-free glass (during the course of 2013)

According to the latest European REACH Directive, products with a lead content of higher than 1 % are classed as hazardous goods and must be labelled, handled and disposed of accordingly. Therefore all the glass sensors that ProMinent supplies to its customers will come with lead-free shaft glass to ensure trouble-free handling of these products and thus make an important contribution to the protection of our environment.

New Measuring, Control and Sensor Technology Products

pH sensors with fixed cable

- All new fixed cable electrodes with screw-in thread (type... FE ...) equipped with rotating threaded sleeve for easier installation in fittings
- PHEP 112 FE pressure-tight up to 6 bar
- PHER 112 FE with PTFE ring diaphragm
- PHEX 112 FE with solid electrolyte and annular gap diaphragm

For more information see page → 1-16

DULCOMETER® diaLog DAC



P_DM_0027_C

- The diaLog DACa controller completes the intelligent control circuit between ProMinent DULCOTEST® sensors and metering pumps
- Specially developed for the continuous measurement and control of liquid analysis parameters in water treatment processes, in environmental technology and industry
- Available in versions with one or two measuring channels; works with both conventional analogue sensors and actuators, as well as with digital sensors and actuators via a CANopen sensor/actuator bus
- Free combination of 14 selectable measured variables
- Saving of measured and calibration values plus device parameterisation using an easily accessible SD card
- Transfer of device parameters to other controllers is possible
- Communication with the control level via PROFIBUS® DP, Modbus RTU, LAN/WLAN (in progress)
- Integration of the diaLog DACa controller in a control cabinet is also possible using the optional kit
- 24 operating languages
- New ProMinent controller platform replaces D1Ca/D2Ca controllers
- Typical applications: Treatment of potable water and waste water; treatment of swimming pool water; preparation of industrial and process water

Available from March 2013

For more information see page → 2-25

DULCOMARIN® II DXCa F module (functional module)



- The functional extension for the DULCOMARIN® II DXCa measuring and control system combines all the existing functions of the A and P modules.
- Covers existing functions for the operation of swimming pools, such as circulating operation, automatic backwash, water level control, heating control and flow control
- New additional functions, such as for example the opening and closing of the swimming pool cover, control of the counterflow system and massage nozzles plus the switching on and off of the underwater light
- Includes supply voltage (90-253 VAC) for the controller
- Lower overall installation cost and simpler operation

For more information see page → 2-44

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ProMinent® Chemical Resistance List





1.0 Overview of DULCOTEST® Sensor Technology

1.0.1 Selection Guide

Selection guide for DULCOTEST® pH sensors

Medium	Temperature / pressure	Sensor type	Typical applications
Clear, pH 3 - 14	Max. 100 °C / 3 bar	PHEP-H	Chemical processes
	Max. 25 °C / 6 bar		
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 shafts
		PHEK	Swimming pools, aquaria, plastic shafts
	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. 80 °C / 6 bar	PHEX	Suspensions, sludge, emulsions
Clear, containing fluoride, pH < 5	Max. 50 °C / 7 bar	PHEF	Exhaust air scrubbers, semiconductor industry, electroplating

Selection guide for DULCOTEST® ORP sensors

Medium	Temperature / pressure	Sensor type	Typical applications
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 shafts
		RHEK	Swimming pools, aquaria, plastic shafts
	Max. 80 °C / 6 bar	RHEP-Pt	Process water
		RHEP-Au	Chemically contaminated water, e.g. CN ⁻ , ozone treatment
Solid matter, turbidity	Max. 80 °C / 6 bar	RHER	Cooling water, waste water
Solid matter, non-translucent	Max. 80 °C / 6 bar	RHEX	Suspensions, sludge, emulsions

Note: During the course of 2013, all DULCOTEST® pH and ORP glass sensors will be manufactured from lead-free glass.

1.0 Overview of DULCOTEST® Sensor Technology

Selection guide - Amperometric sensors

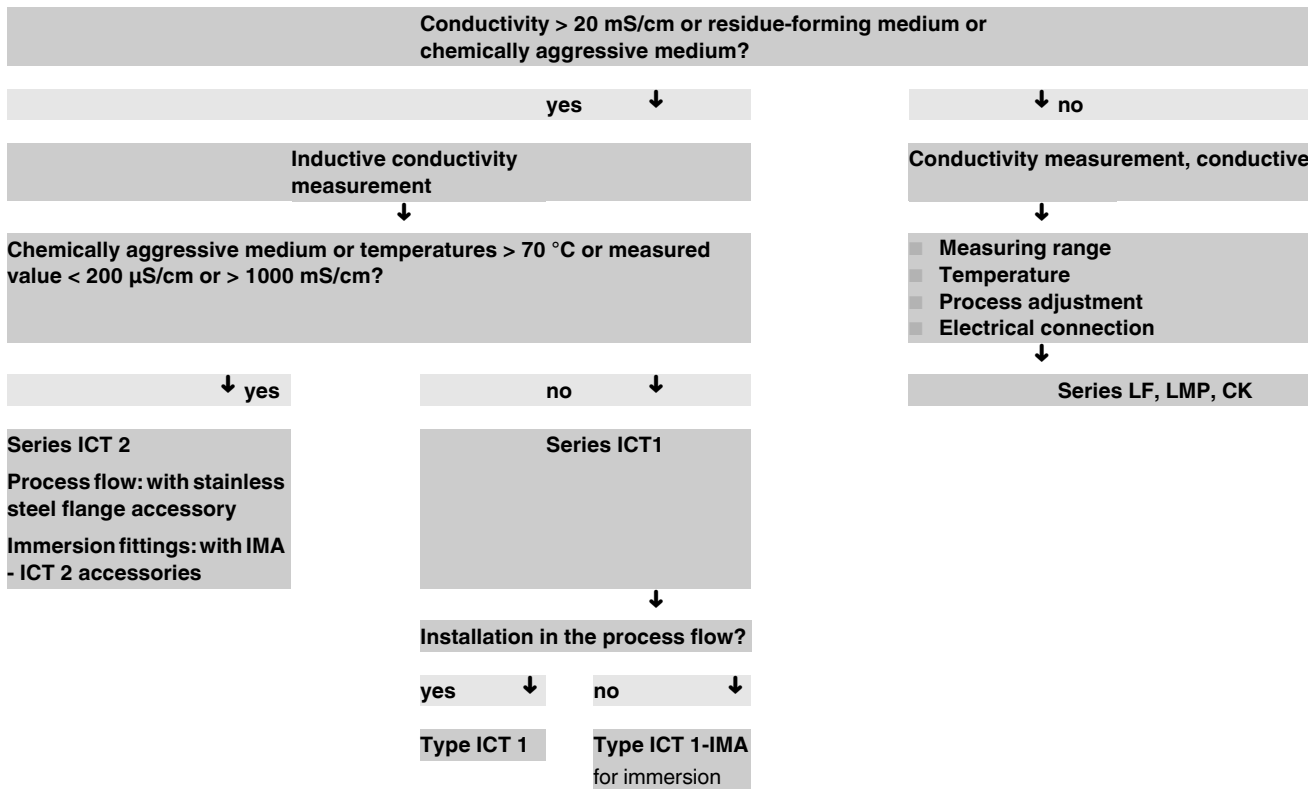
Measured variable	Applications	Graduated measuring range	Connection to DULCOMETER®	Sensor type	see page
Free chlorine	Potable water, swimming pool	0.01–100 mg/l	D1C, D2C, DAC	CLE 3-mA-xppm, CLE 3.1-mA-xppm	→ 1-28
Free chlorine	Potable water, swimming pool water	0.01 - 10 mg/l	DULCOMARIN® II	CLE 3-CAN-xppm, CLE 3.1-CAN-xppm	→ 1-30
Free chlorine	Potable water, swimming pool water, in situ electrolysis (without diaphragm)	0.02-10 mg/l	D1C, D2C, DAC	CLO 1-mA-xppm	→ 1-31
Free chlorine	Hot water up to 70 °C (legionella), in situ electrolysis (without diaphragm)	0.02-2 mg/l	D1C, D2C, DAC	CLO 2-mA-2ppm	→ 1-32
Free chlorine	Potable water, swimming pool	0.01–50 mg/l	DMT	CLE 3-DMT-xppm	→ 1-30
Free chlorine	Potable water, swimming pool	0.05-5 mg/l	COMPACT	CLB 2-µA-xppm	→ 1-32
Free chlorine	Potable water, swimming pool water	0.05-5 mg/l	COMPACT	CLB 3-µA-xppm	→ 1-33
Free chlorine	Cooling water, process water, waste water, water with higher pH values (stable)	0.01-10 mg/l	D1C, D2C, DAC	CBR 1-mA-xppm	→ 1-33, → 1-39
Total available chlorine	Swimming pool water with chlorine-organic disinfectants	0.02–10 mg/l	D1C, D2C, DAC	CGE 2-mA-xppm	→ 1-34
Total available chlorine	Swimming pool water with chlorine-organic disinfectants	0.01–10 mg/l	DULCOMARIN® II	CGE 2- CAN-xppm	→ 1-35
Total chlorine	Potable, service, process and cooling water	0.01–10 mg/l	D1C, D2C, DAC	CTE 1-mA-xppm	→ 1-35
Total chlorine	Potable, service, process and cooling water	0.01–10 mg/l	DMT	CTE 1-DMT-xppm	→ 1-36
Total chlorine	Potable, service, process and cooling water	0.01–10 mg/l	DULCOMARIN® II	CTE 1-CAN-xppm	→ 1-36
Combined chlorine	Swimming pool water	0.02–2 mg/l	D2C, DAC	CTE 1-mA-2 ppm + CLE 3.1-mA-2 ppm	→ 1-36
Combined chlorine	Swimming pool water	0.01–10 mg/l	DULCOMARIN® II	CTE 1-CAN-xppm + CLE 3.1-CAN-xppm	→ 1-36
Total available bromine	Cooling water, waste water, swimming pool water, whirlpool water, bromine with BCDMH	0.01-10 mg/l	D1C, D2C, DAC	BCR 1-mA-xppm, BRE 1-mA-xppm	→ 1-38
Total available bromine	Cooling water, swimming pool water, whirlpool water, bromine with inorganic bromine compounds (e.g. NaBr/HOCl)	0.04–10 mg/l	D1C, D2C, DAC	BRE 2-mA-xppm	→ 1-37
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	→ 1-38
Free and bound bromine	Cooling water, process water, waste water, water with higher pH values (stable)	0.02-20 mg/l	D1C, D2C, DAC	CBR 1-mA-xppm	→ 1-33, → 1-39
Chlorine dioxide	Potable water	0.01–10 mg/l	D1C, D2C, DAC	CDE 2-mA-xppm	→ 1-40
Chlorine dioxide	Bottle washer system	0.02–2 mg/l	D1C, D2C, DAC	CDP 1-mA	→ 1-41
Chlorine dioxide	Hot water up to 60 °C, cooling water, waste water, irrigation water	0.01-10 mg/l	D1C, D2C, DAC, DULCOMARIN® II	CDR 1-mA-xppm, CDR 1-CAN-xppm	→ 1-41
Chlorite	Potable, wash water	0.02–2 mg/l	D1C, DAC, DULCOMARIN® II	CLT 1-mA-xppm, CLT 1-CAN-xppm	→ 1-43
Ozone	Potable, service, process, swimming pool water	0.02–2 mg/l	D1C, DAC	OZE 3-mA-xppm	→ 1-44
Dissolved oxygen	Potable, surface water	2–20 mg/l	D1C, DAC	DO 1-mA-xppm	→ 1-45
Dissolved oxygen	Activated sludge tank, sewage treatment plant	0.1–10 mg/l	D1C, DAC	DO 2-mA-xppm	→ 1-46
Peracetic acid	CIP, antiseptic food filling process	1–2,000 mg/l	D1C, DAC	PAA 1-mA-xppm	→ 1-47
Hydrogen peroxide	Clear water, fast control	1–2,000 mg/l	D1CA..H1...	Perox sensor PEROX-H2.10-P	→ 1-48
Hydrogen peroxide	Process, swimming pool water	2–20,000 mg/l	D1C, DAC	PER1-mA-xppm	→ 1-48





1.0 Overview of DULCOTEST® Sensor Technology

Selection guide - DULCOTEST® Conductivity sensors

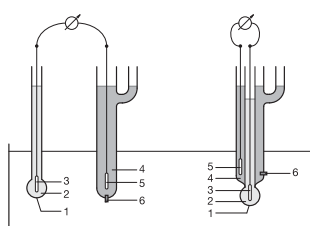


1.1 DULCOTEST® Sensor Technology Measuring Principles

1.1.1 Three Measuring Principles for Reliable Water Treatment

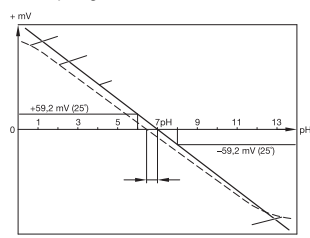
- Potentiometry is used to determine: pH value, ORP and fluoride concentration
- Amperometry is used to determine: chlorine, bromine, chlorine dioxide, ozone, hydrogen peroxide, peracetic acid
- Conductometry is used to determine electrolytic conductivity

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 = -log a_{H⁺}

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:

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

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 10⁰ = 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 (H₂O → 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.

The 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 DULCOTEST® Sensor Technology Measuring Principles

Measurement of the redox (ORP) voltage is also a potentiometric measurement

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

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

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

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

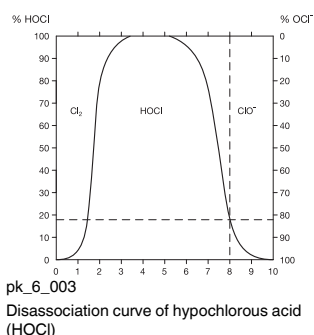
It should be noted that the redox (ORP) voltage varies with the pH value so that qualitative conclusions need to be made at a constant pH value.

Examples of typical applications for redox (ORP) 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



This type of current measurement concentrates on the nA (10^{-9} A) or μ A (10^{-6} A) range. With operating measurements in this range, open or membrane-covered 2 or 3-electrode sensors are used. 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 membrane covered 2-electrodes sensors.

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

The ProMinent® DULCOTEST® systems use 2-electrode sensors of gold or platinum as a 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 with a further rise 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, to obtain a value corresponding to the DPD comparison measurement on the measuring device display, this can be set up using a sensitivity (slope) comparison.

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



1.1 DULCOTEST® Sensor Technology Measuring Principles

The influence of temperature on chlorine measurement is significant, 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 $\text{Ca}(\text{OCl})_2$) 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 indicate false 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, but not, however, by dissolved oxygen. The presence of surfactants will block the working of the CLE sensor membrane for free chlorine. The sensor cannot then be used, by contrast, however, the CTE 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 and its temperature dependency is compensated. Dissolved oxygen and chlorite do not interfere with the measurement results. The presence of surfactants causes problems with CDE sensors. By contrast, CDP sensors can also be used in media containing surfactants.

In addition amperometric sensors can also be used to measure 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

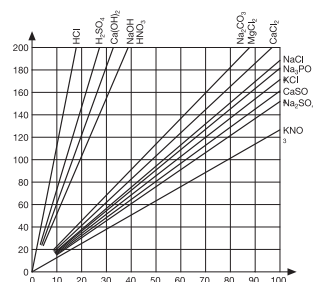




1.1 DULCOTEST® Sensor Technology Measuring Principles

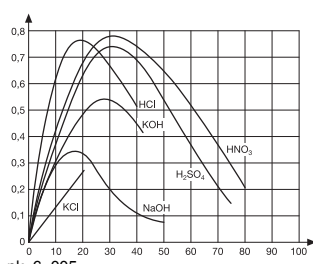
1.1.5

Conductometry – The Measurement of Electrolytic Conductivity



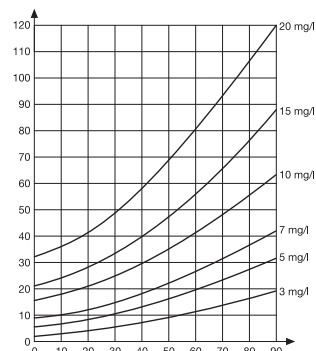
pk_6_004

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 $l = 1 \text{ cm}$ and cross section $q = 1 \text{ cm}^2$ has a cell constant of $k = 1 \text{ cm}^{-1}$. If the length $l = 10 \text{ cm}$ (or if the cross section $q = 0.1 \text{ cm}^2$), then the cell constant would be $k = 10 \text{ cm}^{-1}$. By contrast, if the cross section was increased to $q = 10 \text{ cm}^2$ (or l reduced to 0.1 cm), then a cell constant of $k = 0.1 \text{ cm}^{-1}$ 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. $k = 0.1 \text{ cm}^{-1}$) – or to reduce it at higher conductivities (e.g. $k = 10 \text{ cm}^{-1}$).

■ Sensor materials

The selection of the correct cell constant is just as important as the selection of a suitable electrode material. Stainless steel has shown its suitability in the lower range, up to approximately $500 \mu\text{S/cm}$. 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 DULCOTEST® pH, ORP, Fluoride and Temperature Sensors

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

For signal leads for pH/ORP measurement see psge → 1-64, and for pH quality buffer solutions see page → 1-67

Selection guide for DULCOTEST® pH sensors

Medium	Temperature / pressure	Sensor type	Typical application
Clear, pH 3 - 14	Max. 100 °C / 3 bar	PHEP-H	Chemical processes
	Max. 25 °C / 6 bar		
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 shafts
		PHEK	Swimming pools, aquaria, plastic shafts
	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. 80 °C / 6 bar	PHEX	Suspensions, sludge, emulsions
Clear, containing fluoride, pH < 5	Max. 50 °C / 7 bar	PHEF	Exhaust air scrubbers, semiconductor industry, electroplating

Note: During the course of 2013, all DULCOTEST® pH and ORP glass sensors will be manufactured from lead-free glass.

Selection guide for DULCOTEST® ORP sensors

Medium	Temperature / pressure	Sensor type	Typical application
	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 shafts

1.2 DULCOTEST® pH, ORP, Fluoride and Temperature Sensors

Clear, pH 2 - 12		RHEK	Swimming pools, aquaria, plastic shafts
	Max. 80 °C / 6 bar	RHEP-Pt	Process water
		RHEP-Au	Chemically contaminated water, e.g. CN-, ozone treatment
Solid matter, turbidity	Max. 80 °C / 6 bar	RHER	Cooling water, waste water
Solid matter, non-translucent	Max. 80 °C / 6 bar	RHEX	Suspensions, sludge, emulsions

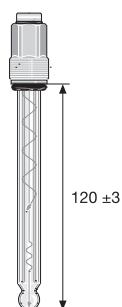
Note: During the course of 2013, all DULCOTEST® pH and ORP glass sensors will be manufactured from lead-free glass.



1.2 DULCOTEST® pH, ORP, Fluoride and Temperature Sensors

1.2.1 pH Sensors with SN6 or Vario Pin Plug-in Head

Series	
PHES	pH sensor
Properties	
X	with solid electrolyte and circular gap diaphragm
K	with insensitive plastic 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	
112	pH measuring range: 1 - 12
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 ceramics diaphragms

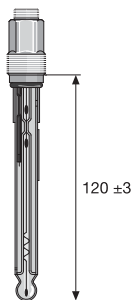


pk_6_016

PHES 112 SE

pH range	1 ... 12
Temperature	0 ... 60 °C
Max. pressure	3.0 bar
Min. conductivity	150 µS/cm
Diaphragm	Ceramic
Sensor shaft	Glass
Thread	PG 13.5
Typical applications	Swimming pools, whirlpools, potable water

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



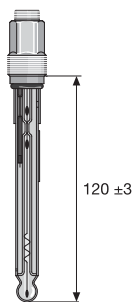
pk_6_019

PHEP 112 SE

pH range	1 ... 12
Temperature	0 ... 80 °C
Max. pressure	6.0 bar
Min. conductivity	150 µS/cm
Diaphragm	Ceramic
Sensor shaft	Glass
Fitting length	120 ± 3 mm
Thread	PG 13,5
Mounting hole Ø min.	14.5 mm
Typical applications	Swimming pools during pressurisation for higher temperatures and pressures, potable and industrial water, electroplating, chemical industries

	Order no.
PHEP 112 SE	150041

1.2 DULCOTEST® pH, ORP, Fluoride and Temperature Sensors



pk_6_019

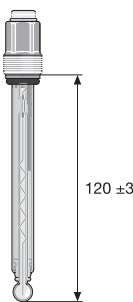
PHEP-H 314 SE

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
Diaphragm	Ceramic
Sensor shaft	Glass
Fitting length	120 ± 3 mm
Thread	PG 13.5
Stem diameter min.	12 mm
Typical applications	monitoring or control of chemical processes with neutral to highly-alkaline media and temperatures up to 100 °C

Order no.

PHEP-H 314 SE

1024882



pk_6_018

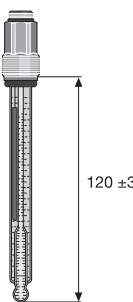
PHER 112 SE

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
Fitting length	120 ± 3 mm
Thread	PG 13.5
Typical applications	Municipal and industrial waste water, cooling water, industrial water, water in the chemicals industry and paper production, generally for water with a solid matter fraction, Water with low conductivity, e.g. from reverse osmosis.

Order no.

PHER 112 SE

1001586



pk_6_017

PHEX 112 SE

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
Diaphragm	Circular gap diaphragm (solid electrolyte)
Sensor shaft	Glass
Thread	PG 13.5
Typical applications	Waste water, industrial water, process chemistry, emulsions, suspensions, protein-containing media, sulphide-containing media (not for media containing chlorine-/fluoride and with temperature fluctuations), in general for water with a high solid fraction, not suitable for use in clear water.

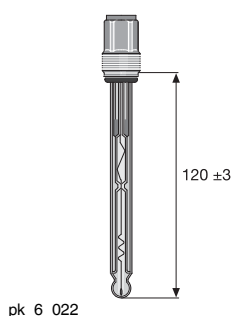
Fitting length Order no.

PHEX 112 SE	120 ± 3 mm	305096
PHEX 112 SE	225 ± 3 mm	150061

ex HD works



1.2 DULCOTEST® pH, ORP, Fluoride and Temperature Sensors



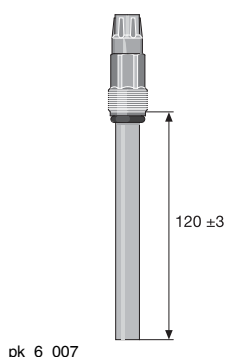
PHED 112 SE

pH range	1 ... 12
Temperature	0 ... 80 °C
Max. pressure	8.0 bar
Min. conductivity	150 µS/cm
Diaphragm	Double Junction
Sensor shaft	Glass
Fitting length	120 ± 3 mm
Thread	PG 13.5
Typical applications	Chemically loaded waste water, industrial water, Cooling water

Order no.

PHED 112 SE

741036



PHEF 012 SE

pH range	0 ... 12
Temperature	0 ... 50 °C
Max. pressure	7.0 bar
Min. conductivity	150 µS/cm
Diaphragm	HDPE ring diaphragm, flat (Double Junction)
Sensor shaft	Epoxy
Fitting length	120 ± 3 mm
Thread	PG 13.5
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

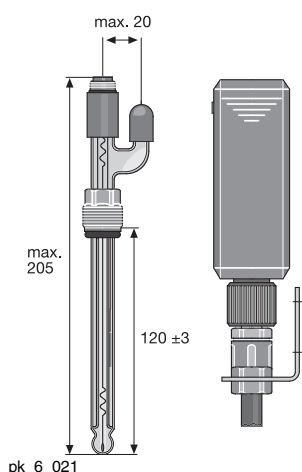
HF

The sensor is protected against dirt by the flat glass membrane and the circumferential flat PE diaphragm.

Order no.

PHEF 012 SE

1010511



PHEN 112 SE

pH range	1 ... 12
Temperature	0 ... 80 °C
Max. pressure	Atmospheric pressure
Min. conductivity	150 µS/cm
Diaphragm	Ceramic
Sensor shaft	Glass
Fitting length	120 ± 3 mm
Thread	PG 13.5
Typical applications	Waste water, cooling water

Supplied without PE storage tank and tube

Order no.

PHEN 112 SE

305090

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 DULCOTEST® pH, ORP, Fluoride and Temperature Sensors

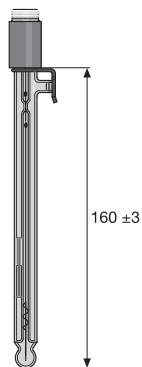
PHEN 112 SE 3D

pH range	1 ... 12
Temperature	0 ... 80 °C
Max. pressure	Atmospheric pressure
Min. conductivity	50 µS/cm
Diaphragm	3 ceramic diaphragms
Sensor shaft	Glass
Fitting length	120 ± 3 mm
Thread	PG 13.5
Typical applications	Waste water, water with low conductivity, e.g. from reverse osmosis.

Order no.

PHEN 112 SE 3D

150078



pk_6_020

PHEN 012 SL

pH range	0 ... 12
Temperature	0 ... 80 °C
Max. pressure	Atmospheric pressure
Min. conductivity	150 µS/cm
Diaphragm	Ceramic
Sensor shaft	Glass
Fitting length	160 ± 3 mm
Thread	–
Typical applications	Manual measurements in laboratories

Order no.

PHEN 012 SL

305078

PHEN 012 SL 3D

pH range	0 ... 12
Temperature	0 ... 80 °C
Max. pressure	Atmospheric pressure
Min. conductivity	50 µS/cm
Diaphragm	3 ceramic diaphragms
Sensor shaft	Glass
Fitting length	160 ± 3 mm
Thread	–
Typical applications	Laboratories, Water with low conductivity, e.g. from reverse osmosis.

Order no.

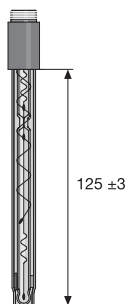
PHEN 012 SL 3D

791508



1.2 DULCOTEST® pH, ORP, Fluoride and Temperature Sensors

1



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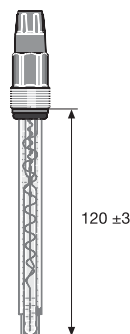
PHEK 112 S

pH range	1 ... 12
Temperature	0 ... 60 °C
Max. pressure	3.0 bar
Min. conductivity	150 µS/cm
Diaphragm	Glass fiber
Sensor shaft	Polycarbonate
Fitting length	125 ± 3 mm
Thread	–
Typical applications	Hand-held measurement in swimming pools, potable water

Order no.

PHEK-112-S

305051



pk_6_090

PHEK 112 SE

pH range	1 ... 12
Temperature	0 ... 60 °C
Max. pressure	3.0 bar
Min. conductivity	150 µS/cm
Diaphragm	Ceramic
Sensor shaft	Polycarbonate
Fitting length	120 ± 3 mm
Thread	PG 13.5
Stem diameter min.	12 mm
Typical applications	Swimming pools, potable water, aquaria

Order no.

PHEK 112 SE

1028457

ex HD works

PHEK-L 112 SE

pH range	1 ... 12
Temperature	0 ... 60 °C
Max. pressure	3.0 bar
Min. conductivity	150 µS/cm
Diaphragm	Ceramic
Sensor shaft	Polycarbonate
Fitting length	120 ± 3 mm
Fitting position	vertically to horizontally
Thread	PG 13.5
Stem diameter min.	12 mm
Typical applications	Swimming pools, potable water, aquaria. Horizontal installation possible.

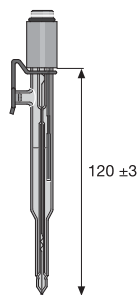
Order no.

PHEK-L 112 SE

1034918



1.2 DULCOTEST® pH, ORP, Fluoride and Temperature Sensors

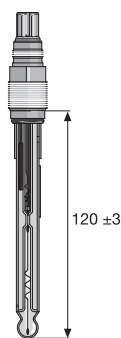


pk_6_025

PHEE 112 S

pH range	1 ... 12
Temperature	0 ... 60 °C
Max. pressure	Atmospheric pressure
Min. conductivity	–
Diaphragm	3 ceramic diaphragms
Sensor shaft	Glass
Fitting length	120 ± 3 mm
Thread	–
Typical applications	pH measurement in foodstuffs, e.g. meat, cheese, non sterilisable

	Order no.	
PHEE 112 S	791094	
	Capacity ml	Order no.
Cleaning fluid Pepsin/hydrochloric acid	250	791443



pk_6_068

PHEPT 112 VE

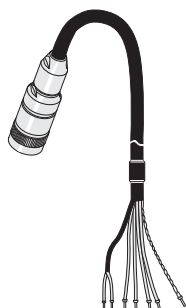
With Pt 100 integrated in the glass shaft for internal temperature compensation, plus Vario Pin plug-in head with gold-plated contacts.

pH range	1 ... 12
Temperature	0 ... 80 °C
Max. pressure	6.0 bar
Min. conductivity	150 µS/cm
Diaphragm	Ceramic
Sensor shaft	Glass
Fitting length	120 ± 3 mm
Thread	PG 13.5
Typical applications	Swimming pools during pressurisation for higher temperatures and pressures, potable and industrial water, electroplating, chemical industry, processes with a temperature change.

	Order no.
PHEPT 112 VE	1004571

Accessory signal leads for electrodes with Vario Pin plug

Pre-assembled 6-core signal leads with Vario Pin plug for connection to electrode 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 DULCOTEST® pH, ORP, Fluoride and Temperature Sensors

1.2.2 pH Sensors with Fixed Cable

Series	
PHES	pH sensor
Properties	
X	with solid electrolyte and annular gap diaphragms
K	with insensitive plastics 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

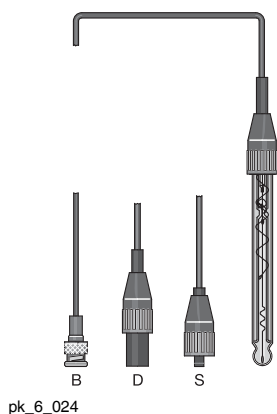
The technical data corresponds to pH sensors with SN6 plug-in head (see page → 1-10)

NEW: Fixed cable sensors with screw-in thread, type ... FE ... are equipped with a turning threaded sleeve; this simplifies installation in the fittings, as only the threaded sleeve needs to be turned during screwing in rather than the entire sensor.

Type PHES 112 F

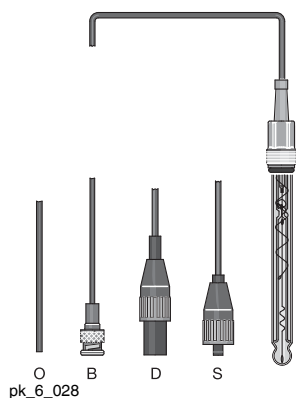
pH sensor, gel-filled, with fixed coaxial cable and device plug, without screw-in thread.

	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



1.2 DULCOTEST® pH, ORP, Fluoride and Temperature Sensors

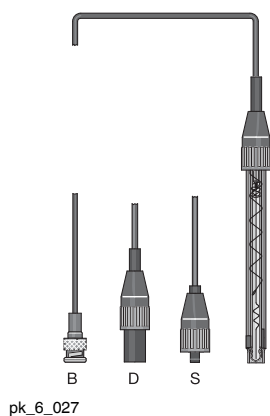
Type PHES 112 FE



	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	–	304990
PHES 112 FE 301 B	1	BNC	150079
PHES 112 FE 301 S	1	SN6	150926
PHES 112 FE 303 O	1	–	150101

Further types on request.

Type PHEK 112 F

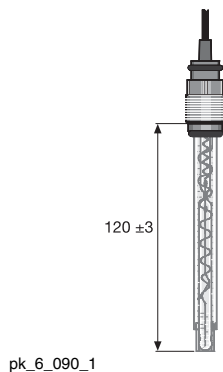


pH sensor with polycarbonate plastic shaft, glass membrane protection, with fixed coaxial cable and device plug, without screw-in thread.

	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.

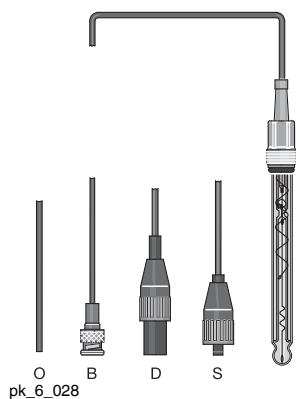
Type PHEK 112 FE



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

Type PHEP 112 FE



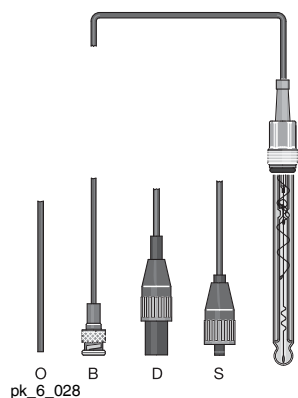
	Cable length m	Device plug	Order no.
PHEP 112 FE 303 S	3	SN 6	150673
PHEP 112 FE 305 O	–	–	150689
PHEP 112 FE 510 O	–	–	150929

Further types on request.



1.2 DULCOTEST® pH, ORP, Fluoride and Temperature Sensors

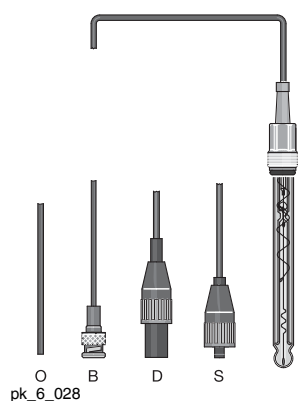
Type PHER 112 FE



	Cable length m	Device plug	Order no.
Type PHER 112 FE 503 O	3	–	150878
Type PHER 112 FE 510 O	10	–	150874

Further types on request.

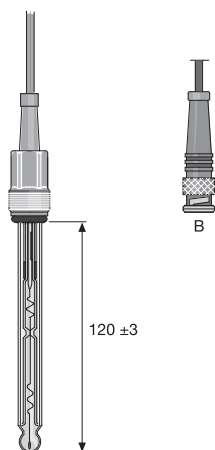
Type PHEX 112 FE



	Cable length m	Device plug	Order no.
Type PHEX 112 FE 510 S	10	SN 6	150025
Type PHEX 112 FE 510 O	10	–	150084
Type PHEX 112 FE 303 S	3	SN 6	150739
Type PHEX 112 FE 302 O	2	–	150086

Further types on request.

Type PHED 112 FE



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

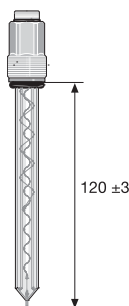
Further types on request.

1.2 DULCOTEST® pH, ORP, Fluoride and Temperature Sensors

1.2.3 ORP Sensors with SN6 Plug-in Head

Series			
RHES	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		

Selection guide for DULCOTEST® ORP sensors see page → 1-8



pk_6_031

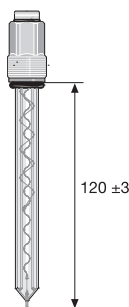
RHES-Pt-SE

Temperature	0 ... 60 °C
Max. pressure	3 bar
Min. conductivity	150 µS/cm
Diaphragm	Ceramic
Sensor shaft	Glass
Fitting length	120 ± 3 mm
Thread	PG 13.5
Typical applications	Swimming pools, whirlpools, potable water

Order no.

RHES-Pt-SE

150703



pk_6_031

RHES-Au-SE

Temperature	0 ... 60 °C
Max. pressure	3 bar
Min. conductivity	150 µS/cm
Diaphragm	Ceramic
Sensor shaft	Glass
Fitting length	120 ± 3 mm
Thread	PG 13.5
Typical applications	Swimming pools, whirlpools, potable water, with disinfectants from electrolysis processes (electrodes directly in the process water)

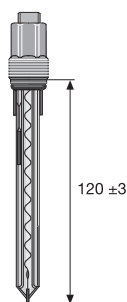
Order no.

RHES-Au-SE

1044544



1.2 DULCOTEST® pH, ORP, Fluoride and Temperature Sensors



pk_6_035

RHEP-Pt-SE

Temperature	0 ... 80 °C
Max. pressure	6.0 bar
Min. conductivity	150 µS/cm
Diaphragm	Ceramic
Sensor shaft	Glass
Fitting length	120 ± 3 mm
Thread	PG 13.5
Mounting hole Ø min.	15 mm
Typical applications	Swimming pools during pressurisation for higher temperatures and pressures, potable and industrial water, electroplating, chemical applications, for higher temperatures and pressures. Not suitable for media containing ozone

Order no.

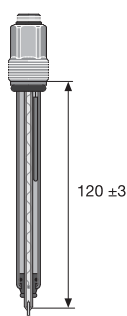
RHEP-Pt-SE	150094
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RHEP-Au-SE

Temperature	0 ... 80 °C
Max. pressure	6.0 bar
Min. conductivity	150 µS/cm
Diaphragm	Ceramic
Sensor shaft	Glass
Fitting length	120 ± 3 mm
Thread	PG 13.5
Mounting hole Ø min.	15 mm
Typical applications	Cyanide detoxification, ozone monitoring

Order no.

RHEP-Au-SE	1003875
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pk_6_034

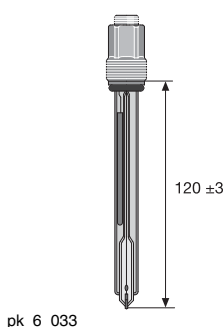
RHER-Pt-SE

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)
Diaphragm	PTFE ring diaphragm
Fitting length	120 ± 3 mm
Typical applications	Municipal and industrial waste water, cooling water, process water, chemical applications, paper manufacturing. In general for water with a noticeable solid fraction.

Order no.

RHER-Pt-SE	1002534
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1.2 DULCOTEST® pH, ORP, Fluoride and Temperature Sensors



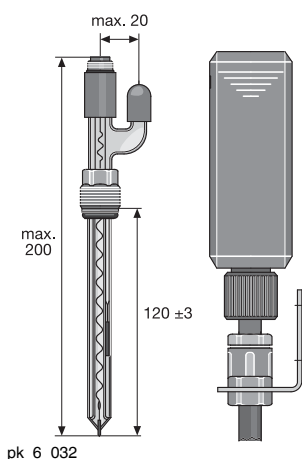
RHEX-Pt-SE

Temperature	0 ... 100 °C
Max. pressure	16 bar up to 25 °C 6 bar up to 100 °C
Min. conductivity	500 µS/cm
Diaphragm	circular gap (solid electrolyte)
Sensor shaft	Glass
Fitting length	120 ± 3 mm
Thread	PG 13.5
Typical applications	Waste water, industrial water, process chemistry, emulsions, suspensions, protein-containing media, sulphide-containing media (not for media containing chlorine-/fluoride and with temperature fluctuations). In general for water with a high solid fraction. Not suitable for clear media.

Order no.

RHEX-Pt-SE

305097



RHEN-Pt-SE

Temperature	0 ... 80 °C
Max. pressure	Operation at atmospheric pressure
Min. conductivity	150 µS/cm
Electrolyte	KCl electrolyte, refillable
Diaphragm	Ceramic
Sensor shaft	Glass
Fitting length	120 ± 3 mm
Thread	PG 13.5
Typical applications	Waste water, Cooling water

Order no.

RHEN-Pt-SE

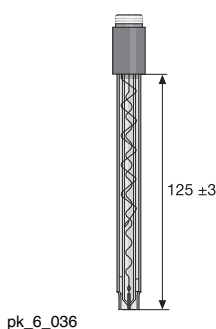
305091

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.



RHEK-Pt-S

Temperature	0 ... 60 °C
Max. pressure	Operation at atmospheric pressure
Min. conductivity	150 µS/cm
Diaphragm	Fibreglass
Sensor shaft	Polycarbonate
Thread	–
Fitting length	125 ± 3 mm
Typical applications	Manual measurements of swimming pools, potable water etc.

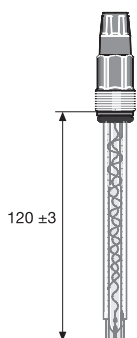
Order no.

RHEK-Pt-S

305052



1.2 DULCOTEST® pH, ORP, Fluoride and Temperature Sensors



pk_6_091

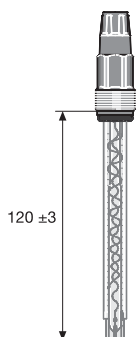
RHEK-Pt-SE

Temperature	0 ... 60 °C
Max. pressure	3.0 bar
Min. conductivity	150 µS/cm
Diaphragm	Ceramic
Sensor shaft	Polycarbonate
Thread	PG 13.5
Fitting length	120 ± 3 mm
Typical applications	Swimming pools at elevated sample water pressures, potable water, lightly contaminated waste water

RHEK-Pt-SE

Order no.

1028459



pk_6_091

RHEK-L Pt-SE

Temperature	0 ... 60 °C
Max. pressure	3.0 bar
Min. conductivity	150 µS/cm
Diaphragm	Ceramic
Sensor shaft	Polycarbonate
Fitting length	120 ± 3 mm
Fitting position	vertical to horizontal
Thread	PG 13.5
Stem diameter min.	12 mm
Typical applications	Swimming pools, potable water. Horizontal installation possible.

RHEK-L Pt-SE

Order no.

1034919



1.2 DULCOTEST® pH, ORP, Fluoride and Temperature Sensors

1.2.4 ORP Sensors with Fixed Cable

Series									
RHES	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						

NEW: Fixed cable sensors with screw-in thread, type ... FE ... are equipped with a turning threaded sleeve; this simplifies installation in the fittings, as only the threaded sleeve needs to be turned when screwing in rather than the entire sensor.

Type RHES-Pt-FE

ORP sensor with Pt rod electrode, gel filled with glass shaft, screw-in thread PG 13.5, with fixed coaxial cable and device plug.

	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

Type RHES-Pt-F

ORP sensor with Pt rod electrode, gel filled with glass shaft, with fixed coaxial cable and device plug, without screw-in thread.

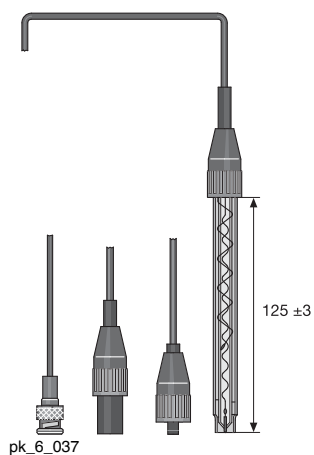
	Cable length m	Device plug	Order no.
RHES-Pt-F 303 B	3	BNC	304983

Type RHEK-Pt-F

ORP sensor with plastic shaft, Pt rod with protection, fixed coaxial cable and device plug, without screw-in thread.

	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 DULCOTEST® pH, ORP, Fluoride and Temperature Sensors

1.2.5

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.

FLEP 010-SE/FLEP 0100-SE

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

Measured variable	Fluoride ion concentration
Reference method	Photometric, see Chap. 8.9.3: Photometer DT2B
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)
Intake flow	10...200 l/h
Intake flow (recommended)	20 l/h
Min. conductivity	100 µS/cm
Response time T95 max.	30 s (for conc. > 0.5 ppm)
Enclosure rating	IP 65
Shelf life	6 months
Fitting length	120 mm
Thread	PG 13.5
Shaft diameter	12.0 mm
Typical applications	monitoring the fluoridation of potable water in waterworks
Measuring and control equipment	D1C/DAC
Electrical connection	SN6
In-line probe fitting	DLG IV

Order no.

FLEP 010-SE / FLEP 0100-SE

1028279

Accessories

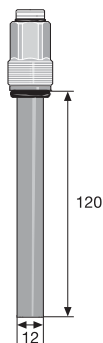
	Order no.
Measuring transducer 4-20 mA FPV1	1028280
Measuring transducer 4-20 mA FP 100 V1	1031331
Signal lead, sold by the meter 2 x 0.25 mm ² Ø 4 mm	725122
Reference electrode, REFP-SE	1018458
Pt 100 SE	305063
Polishing paste	559810

Panel-mounted measuring station

Panel-mounted measuring stations that were ordered to date with part no. 1010602 (230 V) and 1010603 (115 V) can now be ordered as DULCOTROL® PWCA measuring stations.

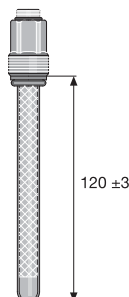
- 1 PWCA F000_1_0_A_0_0_0_0_x (230 V)
- 2 PWCA F000_1_0_C_0_0_0_0_x (115 V)

pk_6_095



1.2 DULCOTEST® pH, ORP, Fluoride and Temperature Sensors

1.2.6 Temperature Sensors



pk_6_026

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 DULCOTEST® Amperometric Sensors

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

The following points should be observed for optimum functioning of the amperometric sensors:

- Use of DULCOMETER® measuring and control devices
- Installation only in ProMinent® DGM or DLG III fittings
- Specified flow between 30...60 l/h
- Chlorine measurement only with a steady pH, see Chapter 6.5
- Regular calibration with a photometer (e.g. type DT 1)

Important:

All amperometric sensors do not have any galvanic isolation. When using with external devices (e.g. PLC), the supply voltage and analogue input signal must be galvanically isolated.

The advantages at a glance:

- High zero-point stability
- Compact design
- Integrated temperature correction
- Simple installation
- Simple maintenance
- Short run-in period
- Measurement signal largely flow-independent

Selection guide - 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, D2C, DAC	CLE 3-mA-xppm, CLE 3.1-mA-xppm	→ 1-28
Free chlorine	Potable water, swimming pools water	0.01 - 10 mg/l	DULCOMARIN® II	CLE 3-CAN-xppm, CLE 3.1-CAN-xppm	→ 1-30
Free chlorine	Potable water, swimming pools water, in situ electrolysis (without diaphragm)	0.02-10 mg/l	D1C, D2C, DAC	CLO 1-mA-xppm	→ 1-31
Free chlorine	Hot water up to 70 °C (legionella), in situ electrolysis (without diaphragm)	0.02-2 mg/l	D1C, D2C, DAC	CLO 2-mA-2ppm	→ 1-32
Free chlorine	Potable water, swimming pools	0.01–50 mg/l	DMT	CLE 3-DMT-xppm	→ 1-30
Free chlorine	Potable water, swimming pools	0.05-5 mg/l	COMPACT	CLB 2-µA-xppm	→ 1-32
Free chlorine	Potable water, swimming pools water	0.05-5 mg/l	COMPACT	CLB 3-µA-xppm	→ 1-33
Free chlorine	Cooling water, process water, waste water, water with higher pH values (stable)	0.01-10 mg/l	D1C, D2C, DAC	CBR 1-mA-xppm	→ 1-33, → 1-39
Total available chlorine	Swimming pool water with chlorine-organic disinfectants	0.02–10 mg/l	D1C, D2C, DAC	CGE 2-mA-xppm	→ 1-34
Total available chlorine	Swimming pool water with chlorine-organic disinfectants	0.01–10 mg/l	DULCOMARIN® II	CGE 2- CAN-xppm	→ 1-35
Total chlorine	Potable, service, process and cooling water	0.01–10 mg/l	D1C, D2C, DAC	CTE 1-mA-xppm	→ 1-35
Total chlorine	Potable, service, process and cooling water	0.01–10 mg/l	DMT	CTE 1-DMT-xppm	→ 1-36
Total chlorine	Potable, service, process and cooling water	0.01–10 mg/l	DULCOMARIN® II	CTE 1-CAN-xppm	→ 1-36
Combined chlorine	Swimming pool water	0.02–2 mg/l	D2C, DAC	CTE 1-mA-2 ppm + CLE 3.1-mA-2 ppm	→ 1-36
Combined chlorine	Swimming pool water	0.01–10 mg/l	DULCOMARIN® II	CTE 1-CAN-xppm + CLE 3.1-CAN-xppm	→ 1-36
Total available bromine	Cooling water, waste water, swimming pool water, whirlpools water, bromine with BCDMH	0.01-10 mg/l	D1C, D2C, DAC	BCR 1-mA-xppm, BRE 1-mA-xppm	→ 1-38



1.3 DULCOTEST® Amperometric Sensors

Measured variable	Applications	Graduated measuring range	Connection to DULCOMETER®	Sensor type	See page
Total available bromine	Cooling water, swimming pools water, whirlpool water, bromine with inorganic bromine compounds (e.g. NaBr/HOCl)	0.04–10 mg/l	D1C, D2C, DAC	BRE 2-mA-xppm	→ 1-37
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	→ 1-38
Free and bound bromine	Cooling water, process water, waste water, water with higher pH values (stable)	0.02-20 mg/l	D1C, D2C, DAC	CBR 1-mA-xppm	→ 1-33, → 1-39
Chlorine dioxide	Potable water	0.01–10 mg/l	D1C, D2C, DAC	CDE 2-mA-xppm	→ 1-40
Chlorine dioxide	Bottle washer systems	0.02–2 mg/l	D1C, D2C, DAC	CDP 1-mA	→ 1-41
Chlorine dioxide	Hot water up to 60 °C, cooling water, waste water, irrigation water	0.01-10 mg/l	D1C, D2C, DAC, DULCOMARIN® II	CDR 1-mA-xppm, CDR 1-CAN-xppm	→ 1-41
Chlorite	Potable, wash water	0.02–2 mg/l	D1C, DAC, DULCOMARIN® II	CLT 1-mA-xppm, CLT 1-CAN-xppm	→ 1-43
Ozone	Potable, service, process, swimming pool water	0.02–2 mg/l	D1C, DAC	OZE 3-mA-xppm	→ 1-44
Dissolved oxygen	Potable, surface water	2–20 mg/l	D1C, DAC	DO 1-mA-xppm	→ 1-45
Dissolved oxygen	Activated sludge tank, sewage treatment plants	0.1–10 mg/l	D1C, DAC	DO 2-mA-xppm	→ 1-46
Peracetic acid	CIP, antiseptic food filling process	1–2,000 mg/l	D1C, DAC	PAA 1-mA-xppm	→ 1-47
Hydrogen peroxide	Clear water, fast control	1–2,000 mg/l	D1CA..H1...	Perox sensor PEROX-H2.10-P	→ 1-48
Hydrogen peroxide	Process, swimming pool water	2–20,000 mg/l	D1C, DAC	PER1-mA-xppm	→ 1-48

1.3.2 Chlorine Sensors

Dissolved chlorine is present in different forms in water:

Free (effective) chlorine:	Recommended sensor for Cl ₂ , HOCl (hypochlorous acid), OCl ⁻ (hypochlorite): CLE, reference method: DPD1
Combined chlorine:	Mono-, di-/trichloroamine. The measuring result of the CLE type is subtracted from the measurement result of the CTE type. Reference method: DPD4 minus DPD1
Organic combined chlorine:	Combined chlorine, bound to isocyanuric acid/isocyanurate (total available chlorine) and the free (effective) chlorine resulting from it; recommended sensor: Type CGE, reference method DPD1
Total chlorine:	Total of free and combined chlorine; recommended sensor: Type CTE, reference method DPD4
Applications:	Chlorine measurement in potable, swimming pool, process and raw water or water of a comparable quality, as well as salt water/sea water with a 15% chloride content. For chlorine measurements at high pH values (8...9.5), we recommend chlorine sensors CGE and CTE or a system for metering the pH buffer solution into the sample water bypass (see Chapter 1.6.3)
Device connection:	CLE sensors should not be used in the presence of isocyanuric acid/ chlorine stabilisers! Sensors CLE 3.1, CTE and CGE operate incorrectly with chlorine produced by an electrolysis process with separation by a membrane. Sensors with the -mA type designation are used for D1C, D2C and DULCOMARIN® measuring and control devices. Sensors with the -4P type designation are used for the earlier WS controllers and for metering pumps with integral chlorine controllers. Sensors with the DMT type designation are used for DMT transducers. Sensors with the CAN type designation are used with the DULCOMARIN® II swimming pool controller.

1.3 DULCOTEST® Amperometric Sensors

Selection Guide

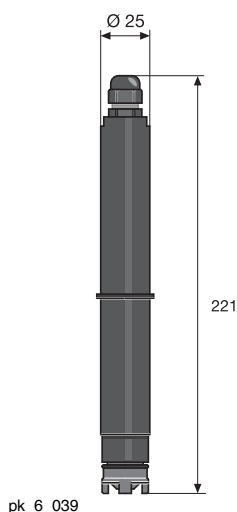
		CLE 3	CLE 3.1	CLO 1	CLO 2	CLB 2/ CLB 3	CBR 1	CGE 2	CTE 1	BCR1*
Measured variable	Free chlorine	x	x	x	x	x	x		x	x
	Total available chlorine (cyanuric acid derivatives)					(x)		x		
	Total chlorine								x	x
Selectivity of free chlorine	raised		x							
	yes	x		x	x	x	x			
	no							x	x	x
Application	Public swimming pools	x	x	(x)		x		(x)		
	Private swimming pools	x	x	x		x		x		
	Potable water	x	x		x	x			x	
	Cooling water						x		(x)	x
	Waste water						x		(x)	x
Disinfectant	chlorine gas, hypochlorite, electrolysis with diaphragm	x	x	x	x	x	x		x	
	electrolysis without diaphragm			x	x	x				
	chlorine-containing cyanuric acid derivatives					(x)		x		
	BCDMH							x	x	x
Specifications	Measuring range [ppm]	0.01-100	0.01-10	0.02-10	0.02-2	0.05-5	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				

*Sensor BCR1 available from the 1st quarter of 2013.

Measured variable free chlorine

CLE 3-mA

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
Typical applications	CLE 3-mA-0,5 ppm: potable water; CLE 3-mA-2.0/10 ppm: Swimming pools (surfactant-free)
Measuring and control equipment	D1C, D2C, DAC
In-line probe fitting	DGM, DLG III
Measuring principle	amperometric, 2 electrodes, diaphragm-covered

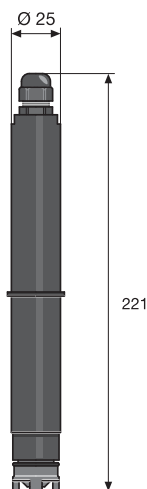


	Measuring range	Order no.
CLE 3-mA-0.5 ppm	0.01...0.5 mg/l	792927
CLE 3-mA-2 ppm	0.02...2.0 mg/l	792920
CLE 3-mA-5 ppm	0.01...5.0 mg/l	1033392
CLE 3-mA-10 ppm	0.10...10.0 mg/l	792919
CLE 3-mA-20 ppm	0.20...20.0 mg/l	1002964
CLE 3-mA-50 ppm	0.50...50.0 mg/l	1020531
CLE 3-mA-100 ppm	1.00...100.0 mg/l	1022786

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 DULCOTEST® Amperometric Sensors



pk_6_039

CLE 3.1-mA

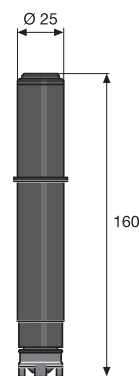
Measured variable	free chlorine (hypochlorous acid HOCl) with large proportions of bound chlorine; to detect bound chlorine using D2CA and Sensor for Total Chlorine type CTE 1-mA
Reference method	DPD1
pH range	5.5 ... 8.0
Temperature	5 ... 45 °C
Max. pressure	1.0 bar
Intake flow	30...60 l/h (in DGM or DLG III)
Supply voltage	16...24 V DC (two-wire technology)
Output signal	4...20 mA ≈ measuring range, temperature-compensated, uncalibrated, not electrically isolated
Typical applications	Swimming pools, potable water with higher proportions of bound chlorine
Measuring and control equipment	D1C, D2C, DAC
In-line probe fitting	DGM, DLG III
Measuring principle	amperometric, 2 electrodes, diaphragm-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. → 1-64



pk_6_042

CLE 2.2-4P

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)
Power supply	±7.5 V DC (4 P)
Output signal	4...20 mA, 0...2 V DC ≈ measuring range, temperature-compensated, uncalibrated, not electrically isolated
Typical applications	Swimming pools, potable water (surfactant-free)
Measuring and control equipment	D_4a (metering pump with integrated controller), CLWS
In-line probe fitting	DGM, DLG III
Measuring principle	amperometric, 2 electrodes, diaphragm-covered

	Measuring range	Order no.
CLE 2.2-4P	0.10...20.0 mg/l	914958

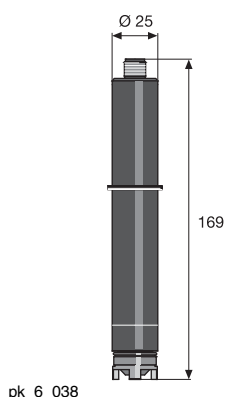
Chlorine sensors complete with 100 ml of electrolyte

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. → 1-64



1.3 DULCOTEST® Amperometric Sensors



CLE 3-DMT

Sensor for use with the DMT "chlorine" measuring transducer

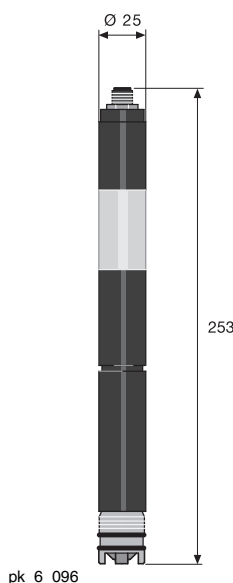
Measured variable	free chlorine (hypochlorous acid HOCl)
Reference method	DPD1
pH range	5.5 ... 8.0
Temperature	5 ... 45 °C
Max. pressure	1.0 bar
Intake flow	30...60 l/h (in DGM or DLG III)
Supply voltage	3.3 V DC (5 P)
Output signal	0...1 V DC, uncalibrated, not temperature compensated, not electrically isolated
Temperature measurement	about the integrated Pt 1000. The temperature compensation is carried out in DMT.
Typical applications	Swimming pools, potable water (surfactant-free)
Measuring and control equipment	DMT
In-line probe fitting	DGM, DLG III
Measuring principle	amperometric, 2 electrodes, diaphragm-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. → 1-64



CLE 3-CAN

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

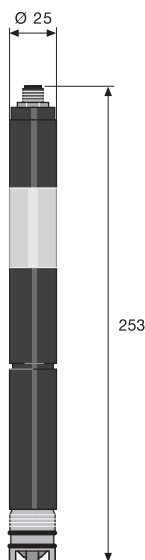
Measured variable	free chlorine (hypochlorous acid HOCl)
Reference method	DPD1
pH range	5.5 ... 8.0
Temperature	5 ... 45 °C
Max. pressure	1.0 bar
Intake flow	30...60 l/h (in DGM or DLG III)
Power supply	Via CAN interface (11 - 30 V)
Output signal	uncalibrated, temperature compensated, electrically isolated
Typical applications	swimming pool, potable water (surfactant-free)
Measuring and control equipment	DULCOMARIN® II
In-line probe fitting	DGM, DLG III
Compatibility	CANopen bus systems
Measuring principle	amperometric, 2 electrodes, diaphragm-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.

1.3 DULCOTEST® Amperometric Sensors



pk_6_096

CLE 3.1-CAN

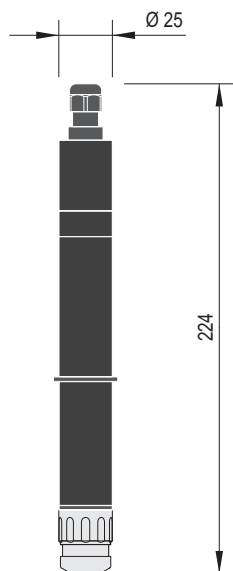
Sensor for connection to a CANopen interface (e.g. DULCOMARIN® II swimming pool controller)

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)
Power supply	Via CAN interface (11 – 30 V)
Output signal	uncalibrated, temperature compensated, electrically isolated
Typical applications	Swimming pools, potable water with a higher percentage of bound chlorine (surfactant-free)
Measuring and control equipment	DULCOMARIN® II
In-line probe fitting	DGM, DLG III
Compatibility	CANopen bus systems
Measuring principle	amperometric, 2 electrodes, diaphragm-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.



P_DT_0072_SW1

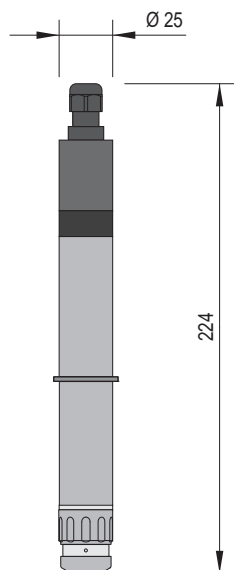
CLO 1-mA

Measured variable	free chlorine (hypochlorous acid HOCl)
Reference method	DPD1
pH range	5.0 ... 9.0
Temperature	5 ... 45 °C
Max. pressure	8.0 bar
Intake flow	30...60 l/h (in DGM or DLG III), constant flow as flow-dependent signal
Power supply	16...24 V DC (2-wire)
Output signal	4...20 mA = Measuring range, temperature-compensated, uncalibrated, not electrically isolated
Typical applications	Swimming pool, uncontaminated potable water and industrial service water, and can also be used together with diaphragm-free electrolysis processes
Measuring and control equipment	D1C, D2C, DAC
In-line probe fitting	DGM, DLG III to 60 °C, special fitting for 60 °C-70 °C (on request)
Measuring principle	amperometric, 3 electrodes, no diaphragm

	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 DULCOTEST® Amperometric Sensors

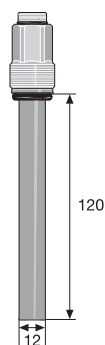


P_DT_0073_SW1

CLO 2-mA

Measured variable	free chlorine (hypochlorous acid HOCl)
Reference method	DPD1
pH range	5.0 ... 9.0
Temperature	5 ... 70 °C
Max. pressure	8.0 bar
Intake flow	30...60 l/h (in DGM or DLG III), constant flow as flow-dependent signal
Power supply	16...24 V DC (2-wire)
Output signal	4...20 mA = Measuring range, temperature-compensated, uncalibrated, not electrically isolated
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
Measuring and control equipment	D1C, D2C, DAC
In-line probe fitting	DGM, DLG III to 60 °C, special fitting for 60 °C-70 °C (on request)
Measuring principle	amperometric, 3 electrodes, no diaphragm

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



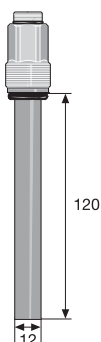
pk_6_095

CLB 2-µA

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
Max. pressure	3.0 bar
Intake flow	30...60 l/h (in DGMA), constant flow needed as flow-dependent signal
Power supply	only for compact controllers
Output signal	Non-amplified primary current signal, not temperature-compensated, uncalibrated, not electrically isolated
Temperature compensation	Pt 1000, integrated, calculation in the compact controller
Typical applications	Swimming pools, potable water, can also be used with membrane-free chlorine production electrolysis processes, even with varying media temperatures
Electrical connection	Fixed lead, 1 m
Measuring and control equipment	Compact controller
In-line probe fitting	DGM
Measuring principle	amperometric, 3 electrodes, no diaphragm

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

1.3 DULCOTEST® Amperometric Sensors

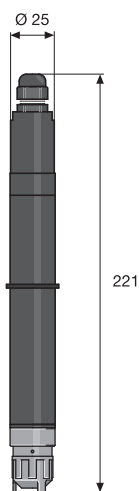


pk_6_095

CLB 3-µA

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
Max. pressure	3.0 bar
Intake flow	30...60 l/h (in DGMA), constant flow necessary, as flow-dependent signal
Power supply	only for compact controllers
Output signal	Non-amplified primary current signal, not temperature-compensated, uncalibrated, not electrically isolated
Temperature compensation	none
Typical applications	Swimming pools, potable water, can also be used with membrane-free chlorine production electrolysis processes
Electrical connection	Fixed lead, 1 m
Measuring and control equipment	Compact controller
In-line probe fitting	DGM
Measuring principle	amperometric, 3 electrodes, no diaphragm

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



pk_6_040

CBR 1-mA

Measured variable	free chlorine (hypochlorous acid HOCl, OCl ⁻), free bromine, bound bromine
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)
Power supply	16...24 V DC (2-wire)
Output signal	4...20 mA = Measuring range, temperature-compensated, uncalibrated, not electrically isolated
Typical applications	Cooling water, process water, waste water, water with higher pH values (stable pH)
Measuring and control equipment	D1C, D2C, DAC
In-line probe fitting	DGM, DLG III
Measuring principle	amperometric, 2 electrodes, diaphragm-covered

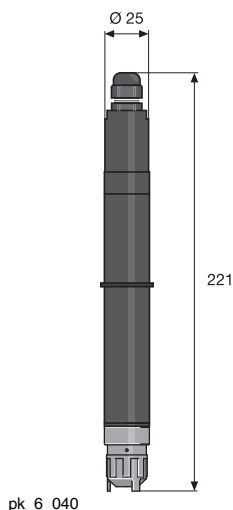
	Measuring range	Order no.
CBR 1-mA-0,5 ppm	0.01...0.5 mg/l...*	1038016
CBR 1-mA-2 ppm	0.02...2.0 mg/l...*	1038015
CBR 1-mA-10 ppm	0.10...10.0 mg/l...*	1038014

* Measuring range based on chlorine. The upper and lower limits of the measuring range are increased by a factor of 2.25 when measuring bromine, e.g. CBR 1-mA-0.5 ppm: 0.0225 ... 1.125 ppm.



1.3 DULCOTEST® Amperometric Sensors

Measured variable organic combined chlorine and free chlorine (total available chlorine)



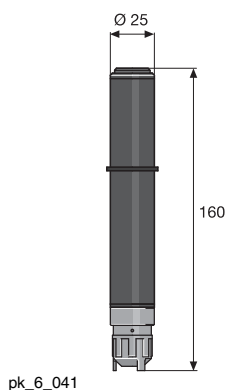
CGE 2-mA

Measured variable	total available chlorine: sum of organically combined chlorine (e.g. combined in 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 (two-wire system)
Output signal	4...20 mA ≈ measuring range, temperature-compensated, uncalibrated, not electrically isolated
Typical applications	Swimming pool water
Measuring and control equipment	D1C, D2C, DAC
In-line probe fitting	DGM, DLG III
Measuring principle	amperometric, 2 electrodes, diaphragm-covered

	Measuring range	Order no.
CGE 2-mA-2 ppm	0.02...2.0 mg/l	792843
CGE 2-mA-10 ppm	0.10...10.0 mg/l	792842

Chlorine sensors complete with 50 ml electrolyte

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



CGE 2-4P

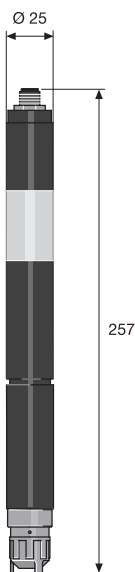
Measured variable	total available chlorine: sum of organically combined chlorine (e.g. combined in cyanuric acid) and free chlorine
Reference method	DPD1
pH range	5.5 ... 9.5
Temperature	5 ... 45 °C
Max. pressure	3.0 bar
Intake flow	30...60 l/h (in DGM or DLG III)
Power supply	±7.5 V DC (4 P)
Output signal	4...20 mA ≈ measuring range, temperature-compensated, uncalibrated, not electrically isolated
Typical applications	Swimming pool water
Measuring and control equipment	D_4a (metering pump with integrated controller)
In-line probe fitting	DGM, DLG III
Measuring principle	amperometric, 2 electrodes, diaphragm-covered

	Measuring range	Order no.
CGE 2-4P-10 ppm	0.10...10.0 mg/l	792838

Chlorine sensors complete with 50 ml 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 DULCOTEST® Amperometric Sensors



CGE 2 CAN

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

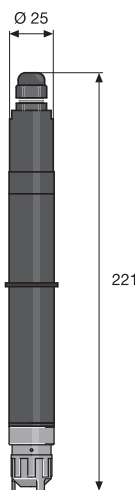
Measured variable	organic bound chlorine and free chlorine (e. g. trichlorinated isocyanuric acid)
Reference method	DPD1
pH range	5.5 ... 9.5
Temperature	5 ... 45 °C
Max. pressure	3.0 bar
Intake flow	30...60 l/h (in DGMa or DLG III)
Supply voltage	Via CAN interface (11 - 30 V)
Output signal	uncalibrated, temperature compensated, electrically isolated
Typical applications	Swimming pool water
Measuring and control equipment	D1C, D2C, DULCOMARIN® II
In-line probe fitting	DGM, DLG III
Compatibility	CANopen bus systems
Measuring principle	amperometric, 2 electrodes, diaphragm-covered

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

Chlorine sensors complete with 50 ml electrolyte

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

Measured variable total chlorine



CTE 1-mA

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
Typical applications	Potable, raw, process and cooling water:
Measuring and control equipment	D1C, D2C, DAC
In-line probe fitting	DGM, DLG III
Measuring principle	amperometric, 2 electrodes, diaphragm-covered

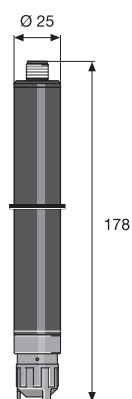
	Measuring range	Order no.
CTE 1-mA-0.5 ppm	0.01...0.5 mg/l	740686
CTE 1-mA-2 ppm	0.02...2.0 mg/l	740685
CTE 1-mA-5 ppm	0.05...5.0 mg/l	1003203
CTE 1-mA-10 ppm	0.10...10.0 mg/l	740684

Chlorine sensors complete with 50 ml 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 DULCOTEST® Amperometric Sensors



pk_6_015

CTE 1-DMT

Sensor for use with the DMT "chlorine" measuring transducer

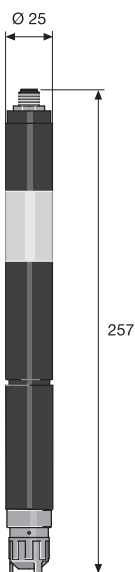
Measured variable	total chlorine
Reference method	DPD4
pH range	5.5 ... 9.5
Temperature	5 ... 45 °C
Max. pressure	3.0 bar
Intake flow	30...60 l/h (in DGM or DLG III)
Power supply	3.3 V DC (5 P)
Output signal	uncalibrated, not temperature-compensated, not electrically isolated
Typical applications	Potable water, raw water, process water, cooling water
Measuring and control equipment	DMT
In-line probe fitting	DGM, DLG III
Measuring principle	amperometric, 2 electrodes, diaphragm-covered

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

Chlorine sensors complete with 50 ml 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. → 1-64



pk_6_084

CTE 1-CAN

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

Measured variable	total chlorine
Reference method	DPD4
pH range	5.5 ... 9.5 (up to pH 8.5 with D1C pH correction)
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
Typical applications	CTE 1-mA-0.5 ppm: potable water, cooling water; CTE 1-mA-2/5/10 ppm: potable water, industrial, process, cooling water in swimming pools in combination with CLE 3.1 to determine combined chlorine.
Measuring and control equipment	DULCOMARIN® II, only for use together with another type CLE 3 sensor to detect bound chlorine
In-line probe fitting	DGM, DLG III
Compatibility	CANopen bus systems
Measuring principle	amperometric, 2 electrodes, diaphragm-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 DULCOTEST® Amperometric Sensors

1.3.3

Bromine Sensors

The following bromating agents are used as disinfectants:

Organic bromating agent

- a) DBDMH (1.3-DiBrom-5.5-DiMethyl-Hydantoin) e. g. sold as Albrom 100®
 - b) BCDMH (1-Bromine-3-Chlorine-5.5-DiMethyl-Hydantoin) e.g. sold as Brom-Sticks®
- These bromating agents are solid and metered as saturated solutions via brominators.

Inorganic free bromine

Free bromine is produced using the so-called Acti-Brom-Process® (Nalco) sodium-calcium hypochlorite + acid + sodium bromide.

The BRE 2-mA-10 ppm sensor and its calibration using the DPD1 method is recommended for measuring DBDMH or free bromine as a bromination agent in the measuring range: 0.2 - 10 ppm bromine.

By contrast, the BRE 1-mA-10 ppm sensor and its calibration using the DPD4 method is recommended for measuring BCDMH over the same measuring range.

Typical applications are in swimming pools, whirlpools 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) should be checked.

The photometric DPD measuring method recommends itself as a comparison method (e.g. with DT 1), 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".

Measured variable: Total available bromine

Free and bound bromine (as bromamine) and organic bromination agent.

Measured variable	Total available bromine
Bromine chemicals	DBDMH (1.3-dibromine 5.5 dimethyl hydantoin) BCDMH (1-bromine-3-chlorine-5.5-dimethyl hydantoin) free bromine (HOBr, OBr)
Reference method	DBDMH: free bromine: DPD1 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	16...24 V DC (two-wire technology)
Output signal	4...20 mA ≈ measuring range, temperature-compensated, uncalibrated, not electrically isolated
Typical applications	swimming pools/whirlpools and cooling water; can also be used in sea water
Measuring and control equipment	D1C, D2C, DAC
In-line probe fitting	DGM, DLG III
Measuring principle	amperometric, 2 electrodes, diaphragm-covered

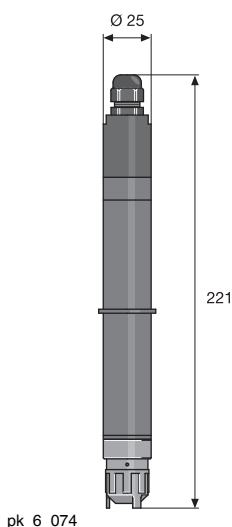
Bromine sensors complete with 50 ml electrolyte

	Measuring range	Order no.
BRE 1-mA-10 ppm	0.20...10.0 mg/l (BCDMH)	1006895
BRE 1-mA-2 ppm	0.04...2.0 mg/l (BCDMH)	1006894
BRE 1-mA-0,5 ppm	0.01...0.5 mg/l (BCDMH)	1033390
BRE 2-mA-2 ppm	0.04...2.0 mg/l (DBDMH, HOBr)	1033391
BRE 2-mA-10 ppm	0.20...10.0 mg/l (DBDMH, HOBr)	1020529

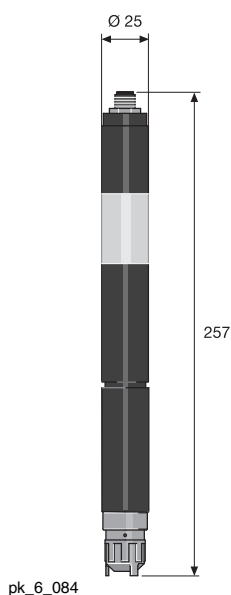
Bromine sensors complete with 50 ml electrolyte

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. → 1-64



1.3 DULCOTEST® Amperometric Sensors



BRE 3-CAN

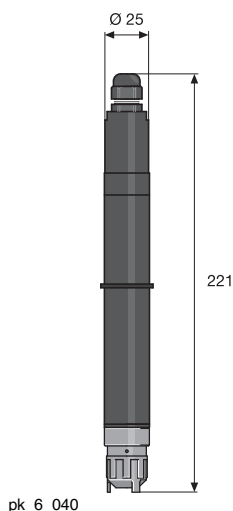
Sensor for connection to a CAN interface (e.g. DULCOMARIN® II swimming pool controller)

Measured variable	Total available bromine
Bromine chemicals	DBDMH (1.3-dibromine 5.5 dimethyl hydantoin) BCDMH (1-bromine-3-chlorine-5.5-dimethyl hydantoin) free bromine (HOBr, OBr)
Reference method	DBDMH, free bromine: DPD1 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
Typical applications	Swimming pools/whirlpools and cooling water; can also be used in sea water
Measuring and control equipment	DULCOMARIN® II
In-line probe fitting	DGM, DLG III
Measuring principle	amperometric, 2 electrodes, diaphragm-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. → 1-64



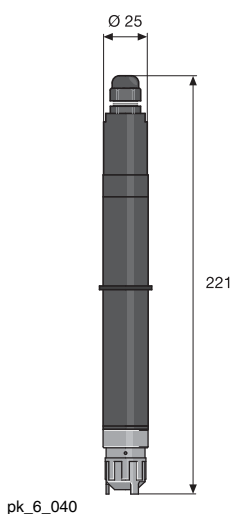
BCR 1-mA

Measured variable	Bromine from BCDMH (bromo-3-chloro-5.5-dimethylhydantoin) and N-bromamide sulphonate
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)
Power supply	16...24 V DC (two wire)
Output signal	4...20 mA = Measuring range, temperature-compensated, uncalibrated, not electrically isolated
Typical applications	Cooling water, process water, waste water, water with higher pH values (stable pH)
Measuring and control equipment	D1C, D2C, DAC
In-line probe fitting	DGM, DLG III
Measuring principle	amperometric, 2 electrodes, diaphragm-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

Available from the 1st quarter of 2013.

1.3 DULCOTEST® Amperometric Sensors



pk_6_040

CBR 1-mA

Measured variable	free chlorine (hypochlorous acid HOCl, OCl ⁻), free bromine, bound bromine
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)
Power supply	16...24 V DC (2-wire)
Output signal	4...20 mA = Measuring range, temperature-compensated, uncalibrated, not electrically isolated
Typical applications	Cooling water, process water, waste water, water with higher pH values (stable pH)
Measuring and control equipment	D1C, D2C, DAC
In-line probe fitting	DGM, DLG III
Measuring principle	amperometric, 2 electrodes, diaphragm-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-10 ppm	0.10...10.0 mg/l...*	1038014

* Measuring range based on chlorine. The upper and lower limits of the measuring range are increased by a factor of 2.25 when measuring bromine, e.g. CBR 1-mA-0.5 ppm: 0.0225 ... 1.125 ppm.



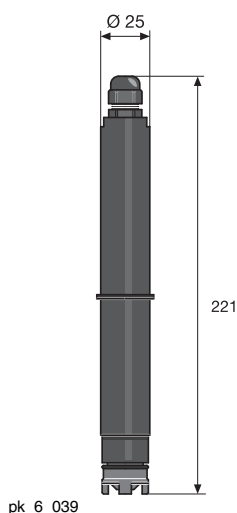
1.3 DULCOTEST® Amperometric Sensors

1.3.4 Chlorine Dioxide Sensors

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, compared with chlorine < 2 %	Ozone, chlorine	Ozone

CDE 2-mA

Measured variable	Chlorine dioxide (ClO ₂)
Reference method	DPD1
pH range	4.0 ... 11.0 ClO ₂ stability range
Cross sensibility	Ozone, compared with chlorine < 2 %
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
Typical applications	uncontaminated potable water (surfactant-free)
Measuring and control equipment	D1C, D2C, DAC
In-line probe fitting	DGM, DLG III
Measuring principle	amperometric, 2 electrodes, diaphragm-covered



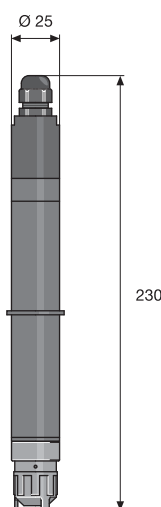
pk_6_039

	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 sensors in the in-line probe housing DLG III.

1.3 DULCOTEST® Amperometric Sensors



pk_6_047

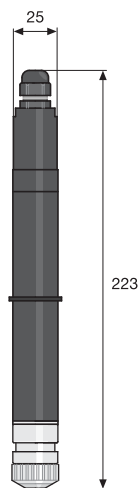
CDP 1-mA

Measured variable	Chlorine dioxide (ClO_2)
Reference method	DPD1
pH range	5.5 ... 10.5
Temperature	10 ... 45 °C (short-term periods 55 °C) with external temperature correction via Pt 100 (no internal temperature correction!)
Max. pressure	3.0 bar no surges
Intake flow	30...60 l/h
Supply voltage	16...24 V DC (two-wire technology)
Output signal	4...20 mA \approx measuring range, not temperature-compensated, uncalibrated, not electrically isolated
Typical applications	Process water containing surfactants (bottle washing machines)
Measuring and control equipment	only D1C with automatic temperature correction
In-line probe 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 principle	amperometric, 2 electrodes, diaphragm-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 sensors in the in-line probe housing DLG III.



pk_6_083

CDR 1-mA

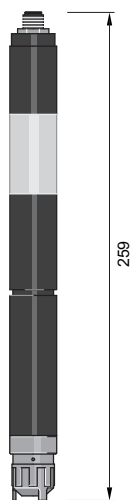
Measured variable	Chlorine dioxide (ClO_2)
Reference method	DPD1
pH range	1.0 ... 10.0
Temperature	1 ... 55 °C (short-term period 60 °C)
Max. pressure	3.0 bar (30 °C, in DGMA)
Response time sensor	$t_{90} \sim 3$ min.
Intake flow	30...60 l/h (in DGM or DLG III)
Supply voltage	16...24 V DC
Output signal	4...20 mA temperature-compensated, uncalibrated, not electrically isolated
Typical applications	contaminated industrial, process water, containing surfactants, cooling water, irrigation water, slightly contaminated waste water, warm water
Measuring and control equipment	D1C, D2C, DAC, DULCOMARIN® II
In-line probe fitting	DGMa / DLGIII
Measuring principle	amperometric, 2 electrodes, diaphragm-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 sensors in the in-line probe housing DLG III.



1.3 DULCOTEST® Amperometric Sensors



P_DT_0071_SW1

CDR 1-CAN

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

Measured variable	Chlorine dioxide (ClO ₂)
Reference method	DPD1
Measuring range	0.01 ... 10.0 mg/l
pH range	1.0 ... 10.0
Temperature	5 ... 45 °C
Max. pressure	1.0 bar
Intake flow	30 ... 60 l/h (in DGM or DLG III)
Power supply	via CAN interface (11-30 V)
Temperature measurement	via integral digital semiconductor device
Output signal	uncalibrated, temperature-compensated, electrically isolated
Compatibility	CANopen bus systems
Typical applications	contaminated industrial, process water, containing surfactants, cooling water, irrigation water, slightly contaminated waste water, warm water

	Order no.
CDR 1-CAN-10 ppm	1041155

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

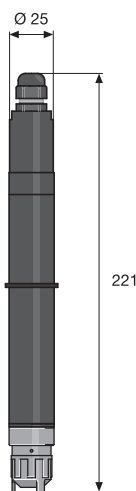




1.3 DULCOTEST® Amperometric Sensors

1.3.5

Chlorite Sensors



pk_6_040

DVGW
recommended

CLT 1-mA

Measured variable	Chlorite anion (ClO_2^-)
Reference method	DPD method Chlorite in presence of chlorine dioxide
pH range	6.5 ... 9.5
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 \approx measuring range, temperature-compensated, uncalibrated, not electrically isolated
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.
Measuring and control equipment	D1C, DAC, DULCOMARIN® II
In-line probe fitting	DGM, DLG III
Measuring principle	amperometric, 2 electrodes, diaphragm-covered

	Measuring range	Order no.
CLT 1-mA-0.5 ppm	0.02...0.50 mg/l	1021596
CLT 1-mA-2 ppm	0.10...2.00 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.

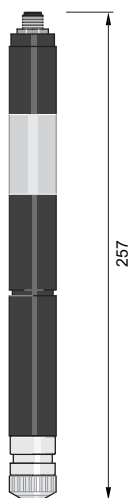
Panel-mounted measuring station

The panel-mounted measuring stations that could be ordered to date with part no. 1023062 (230 V) can now be ordered as DULCOTROL® PWCA measuring stations.

PWCA I000_1_9_A_0_0_0_0_x (230 V)_1

CLT 1-CAN

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



P_DT_0070_SW1

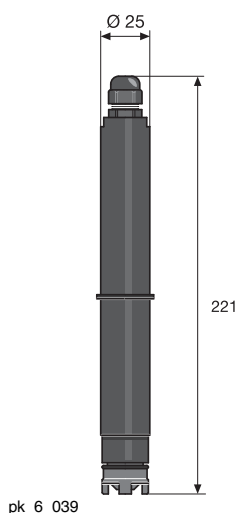
Measured variable	Chlorite anion (ClO_2^-)
Reference method	DPD method, chlorite together with chlorine dioxide
Measuring range	0.10...2.0 mg/l
pH range	6.5 ... 9.5
Temperature	1 ... 40 °C
Max. pressure	1.0 bar
Intake flow	30...60 l/h (in DGM or DLG III)
Power supply	via CAN interface (11-30 V)
Temperature measurement	via integral digital semiconductor device
Output signal	uncalibrated, temperature-compensated, electrically isolated
Compatibility	CANopen bus systems
Typical applications	Monitoring of potable water or similar waters treated with chlorine dioxide. Selective measurement of chlorite and chlorine dioxide, chlorine and chlorate is also possible.

	Order no.
CLT 1-CAN-2 ppm	1041156

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

1.3 DULCOTEST® Amperometric Sensors

1.3.6 Ozone Sensors



OZE 3-mA

Measured variable	Ozone (O ₃)
Reference method	DPD4
pH range	4.0 ... 11.0 Ozone stability range
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
Typical applications	Swimming pools, potable water, industrial, process water (surfactant-free)
Measuring and control equipment	D1C, DAC
In-line probe fitting	DGM, DLG III
Measuring principle	amperometric, 2 electrodes, diaphragm-covered

	Measuring range	Order no.
OZE 3-mA-2 ppm	0.02...2.00 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 DULCOTEST® Amperometric Sensors

1.3.7

Sensors for Dissolved Oxygen

The measured variable “dissolved oxygen” gives the quantity of gaseous physical dissolved oxygen in its aqueous phase in mg/l (ppm).

The “dissolved oxygen” is thereby an important parameter for controlling the quality of surface water and water which needs to be oxygenated for use in aqua culture and aqua zoos. The dissolved oxygen is also used to control processes in sewage plants and waterworks.

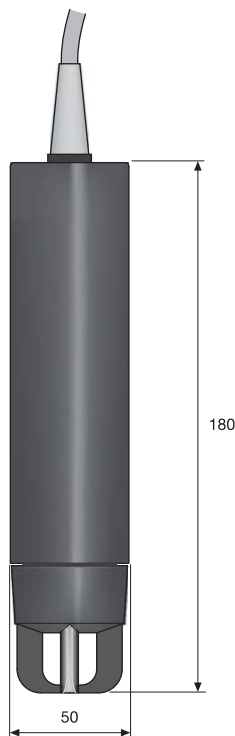
The following sensors are assigned to the different applications and can be supplied separately as 4-20 mA-transmitters for central controllers or together with the D1C as a stand alone solution (measured variable: “dissolved oxygen”: X).

DO 1-mA

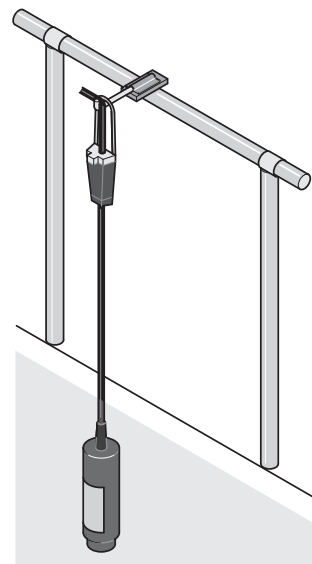
Measured variable	Dissolved oxygen
Calibration	of oxygen in air
Measurement accuracy	±0.5 % referred to final value of measuring range
Temperature	0 ... 50 °C
Max. pressure	1.0 bar
Intake flow	minimum: 0.05 m/s
Enclosure rating	IP 68
Supply voltage	12...30 V DC
Electrical connection	Fixed lead, 10 m
Output signal	4...20 mA ≈ measuring range, calibrated, temperature-compensated, and electrically isolated
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
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.
Measuring principle	amperometric, 2 electrodes, diaphragm-covered

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

For further information: Measured Variables Chlorine, Chlorine Dioxide, Chlorite, Bromine, Ozone, Dissolved Oxygen, Single-Channel Controller, Type D1Ca see page → 2-12; Immersion Probe Fittings/Adaptors see page → 1-77



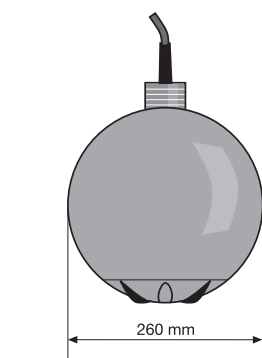
pk_6_050_1



pk_6_011



1.3 DULCOTEST® Amperometric Sensors



DO 2-mA

Measured variable	Dissolved oxygen
Calibration	of oxygen in air
Measuring accuracy	±0.5 % referred to final value of measuring range
Temperature	0 ... 50 °C
Max. pressure	1.0 bar
Intake flow	minimum: 0.05 m/s
Enclosure rating	IP 68
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

Process integration as 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).

Typical applications

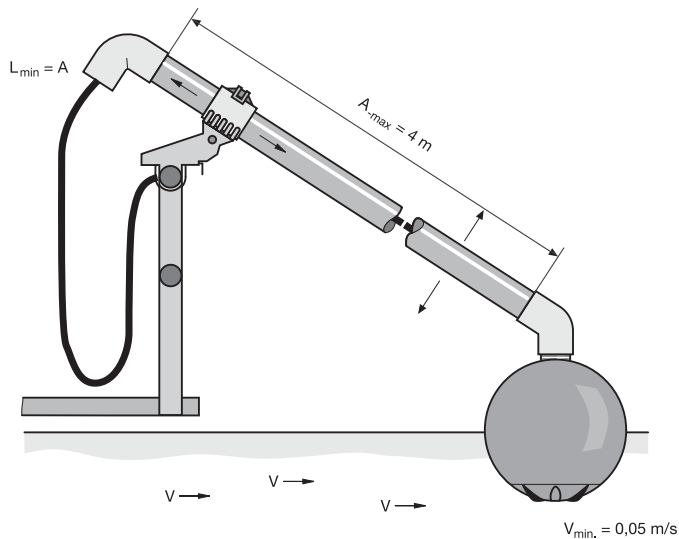
Control of the oxygen input in activated sludge pools (sewage plant) for the purpose of energy conservation.

Measuring principle

amperometric, 2 electrodes, diaphragm-covered

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

For further information: Immersion Probe Fittings/Adaptors see page → 1-77



pk_6_012

1.3 DULCOTEST® Amperometric Sensors

1.3.8 Sensors for Peracetic Acid

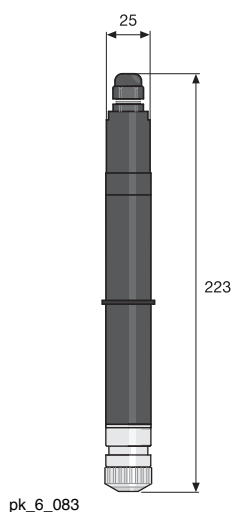
DULCOTEST® sensors of type PAA 1 are membrane-covered, amperometric 2-electrode sensors for selective measurement of peracetic acid. Peracetic acid is particularly used in the food and beverage industries, but also in cosmetics, pharmaceuticals and medicine for disinfection purposes. The continuous measurement and control of peracetic acid is therefore required when there are high demands with regard to disinfection and quality assurance. Sensor type PAA 1-mA can be operated using the D1Ca controller unlike the sensor in the preceding Perox PES system. Commissioning and maintenance are significantly simplified. The sensor can also be used in the presence of surfactants.

PAA 1-mA

Measured variable	Peracetic acid
Reference method	titration
pH range	1.0 ... 9.0 (peracetic acid stability range)
Temperature	1 ... 45 °C
Admissible temperature fluctuation	0.3 °C/min
Response time sensor	$t_{90} \approx 3 \text{ min}$
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 \approx measuring range, temperature-compensated, uncalibrated, not electrically isolated
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.
Measuring and control equipment	D1C, DAC
In-line probe fitting	DGM, DLG
Measuring principle	amperometric, 2 electrodes, diaphragm-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 DULCOTEST® Amperometric Sensors

1.3.9 Sensors for Hydrogen Peroxide

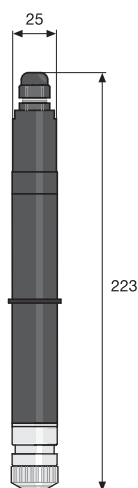
DULCOTEST® sensors PEROX and PER1 are membrane-covered, amperometric sensors for the online concentration measurement of hydrogen peroxide. Due to its complete biodegradability, hydrogen peroxide is a disinfectant and oxidising agent frequently used in water treatment and production:

- 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 membrane*	Failure-prone due to water-permeable membrane
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 measuring transducer integrated in the sensor	Separate temperature sensor and measuring transducer
H ₂ O ₂ response time for quick control	Slow T ₉₀ = 6-8 min	Fast: T ₉₀ = 20 s
Quick temperature changes	Slow due to integrated temperature sensor	Slow due to separate temperature sensor
Measuring intervals in the absence of H ₂ O 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

* sensitive to the presence of hydrogen sulphide (H₂S)



pk_6_083

PER1

Measured variable	hydrogen peroxide
Calibration	photometrically with hand-held photometer DT3
pH range	2.5 ... 11.0
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
Typical applications	swimming pool, treatment of contaminated waste waters, treatment of process media from production
Measuring and control equipment	D1Ca ... H7, DAC
In-line probe fitting	DGM, DLG
Measuring principle	amperometric, 2 electrodes, diaphragm-covered

Photometer → 2-82



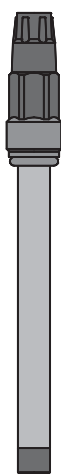
1.3 DULCOTEST® Amperometric Sensors

	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

	Order no.
Photometer DT3B (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.

PEROX



P_DT_0075_SW

Measured variable	hydrogen peroxide
Calibration	photometrically with hand-held photometer DT3
Measuring range	1... 20/10 ... 200/100 ... 2,000 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
Measurement 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
Typical applications	treatment of clear and chemically uncontaminated waters, control with necessary short response times
Measuring and control equipment	D1Ca ... H1
In-line probe fitting	DGM, DLG
Measuring principle	amperometric, 2 electrodes, diaphragm-covered

Photometer → 2-82

	Order no.
Perox sensor PEROX-H2.10-P	792976
Perox transducer V1	1034100

	Order no.
Photometer DT3B (for calibration)	1039317

1.4 DULCOTEST® Conductivity Sensors

1.4.1 Conductivity Sensors

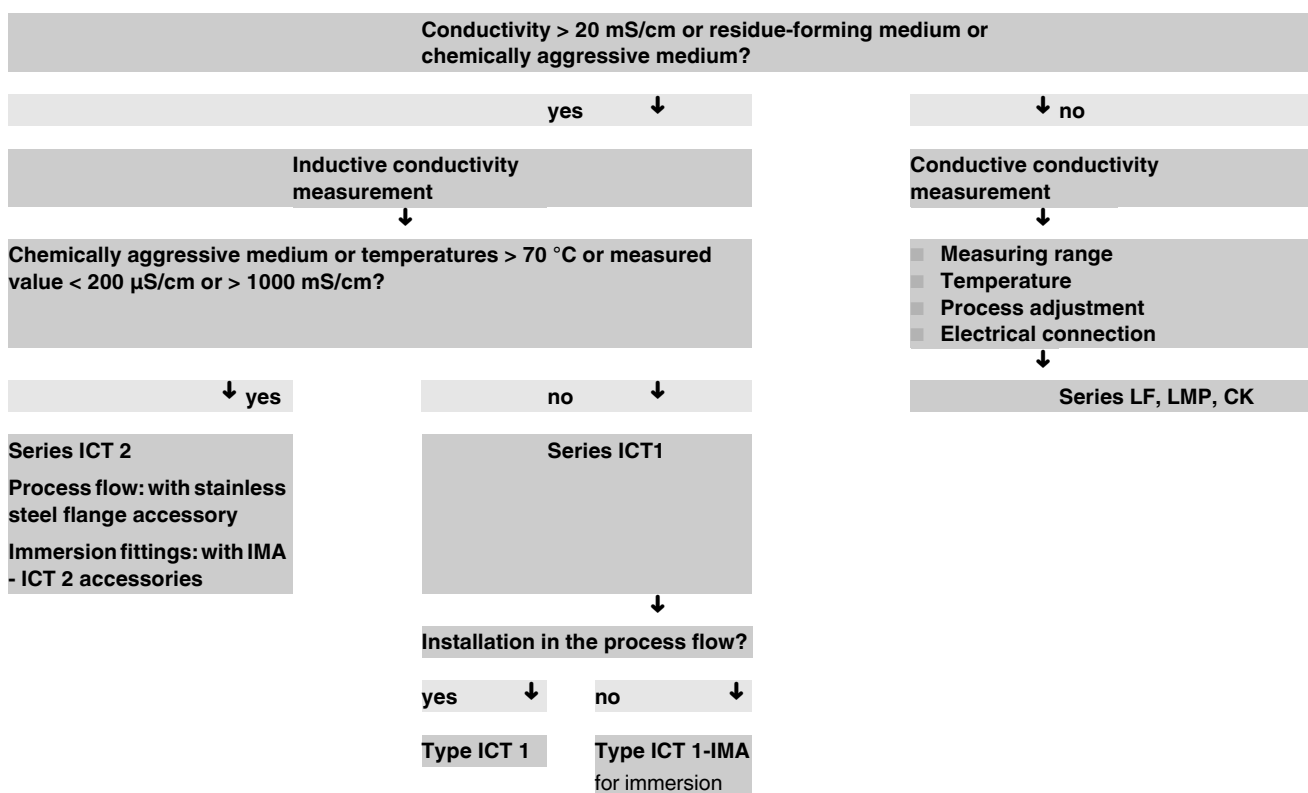
The following points should be noted for optimum functioning of conductivity sensors:

- The sensors should be installed so that the electrodes are always covered by the measurement liquid.
- Measuring lines should be as short as possible
- Temperature compensation with fluctuating temperatures
- Regular cleaning depending on the application
- Cell constant and measuring range should match each other

The advantages at a glance:

- Simple installation
- Reliable measurement
- Simple maintenance

Selection guide - 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
	mS/cm	cm ⁻¹	°C	bar				
LMP 001 → 1-52	0.01...50 µS/cm	0.01 ±5 %	70	16	PP	Pt 100	Flow, 3/4" outer thread	DIN 4 pin angle plug
LMP 001-HT → 1-52	0.01...50 µS/cm	0.01 ±5 %	120	16	PVDF	Pt 100	Flow, 3/4" outer thread	DIN 4 pin angle plug
LMP 01 → 1-53	0.1...500 µS/cm	0.1 ±5 %	70	16	PP	Pt 100	Flow, 3/4" outer thread	DIN 4 pin angle plug
LMP 01-HT → 1-54	0.1...500 µS/cm	0.1 ±5 %	120	16	PVDF	Pt 100	Flow, 3/4" outer thread	DIN 4 pin angle plug
LMP 01-TA → 1-53	0.1...500 µS/cm	0.1 ±5 %	70	16	PP	Pt 100	Immersion, including immersible in-line probe fitting, 1 m + 5 m cable	5 m fixed cable

1.4 DULCOTEST® Conductivity Sensors

Type	Measuring range	Cell constant k	Medium temperature max.	Max. pressure	Shaft material	Temperature compensation	Process integration	Electrical connection
	mS/cm	cm ⁻¹	°C	bar				
LF 1 FE → 1-54	0.01...20 mS/cm	1 ± 5 %	80	16	Epoxy	–	PG 13.5, flow (length: 120 mm) or immersion	5 m fixed cable (2 x 0.5 mm ²)
LFT 1 FE → 1-54	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 (2 x 0.5 mm ²)
LFTK 1 FE → 1-55	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 (2 x 0.5 mm ²)
LF 1 DE → 1-55	0.01...20 mS/cm	1 ± 5 %	80	16	Epoxy	–	PG 13.5, flow (length: 120 mm) or immersion	DIN 4 pin angle plug
LFT 1 DE → 1-55	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
LFTK 1 DE → 1-56	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
LF 1 1/2" → 1-56	0.01...20 mS/cm	1 ± 5 %	80	16	Epoxy	–	1/2 inch male thread, flow (length: 120 mm) or immersion	DIN 4 pin angle plug
LFT 1 1/2" → 1-56	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
LFTK 1 1/2" → 1-57	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
CK 1 → 1-57	0.01...20 mS/cm	1 ± 5 %	150	16	PES	–	Flow, 1" outer thread	DIN 4 pin angle plug
CKPt 1 → 1-57	0.01...20 mS/cm	1 ± 5 %	150	16	PES	Pt 100	Flow, 1" outer thread	DIN 4 pin angle plug
LM 1 → 1-58	0.1...20 mS/cm	1 ± 5 %	70	16	PP	–	Flow, 3/4" outer thread	DIN 4 pin angle plug
LM 1-TA → 1-58	0.1...20 mS/cm	1 ± 5 %	70	16	PP	–	Immersion, including immersible in-line probe fitting, 1 m + 5 m cable	5 m fixed cable
LMP 1 → 1-58	0.01...20 mS/cm	1 ± 5 %	70	16	PP	Pt 100	Flow, 3/4" outer thread	DIN 4 pin angle plug
LMP 1-HT → 1-59	0.1...20 mS/cm	1 ± 5 %	120	16	PVDF	Pt 100	Flow, 3/4" outer thread	DIN 4 pin angle plug
LMP 1-TA → 1-59	0.1...20 mS/cm	1 ± 5 %	70	16	PP	Pt 100	Immersion, including immersible in-line probe fitting 1 m + 5 m cable	5 m fixed cable
LF 204 → 2-86	1 µS/cm...500 mS/cm	0.48 ± 1.5 %	–	2	–	–	Manual immersion	–
ICT 1 → 1-60	0.2...1,000 mS/cm	8.5 ± 5 %	70	16	PP	Pt 100	Flow DN 50	7 m fixed cable
ICT 1-IMA → 1-61	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
ICT 2 → 1-61	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

General information:

- 1 The DMT 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:
 - Electrodes: Earth and 2
 - Pt 100/1000: 1 and 3
- 3 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).



1.4 DULCOTEST® Conductivity Sensors

1.4.2

2-Electrode Conductivity Sensors

LMP 001

Conductivity sensor with Pt 100 temperature compensation and cell constant 0.01 cm⁻¹.

Measuring range	0.01...50 µS/cm
Cell constant k	0.01 cm ⁻¹ ±5 %
Temperature compensation	Pt 100
Fluid temperature	70 °C
Max. pressure	16.0 bar up to 50 °C
Sensors	stainless steel 1.4571
Shaft material	PP
Thread	3/4"
Fitting length	71 mm
Electrical connection	DIN 4 pin angle plug
Typical applications	Clean water applications, monitoring ion exchangers and reverse osmosis systems

Order no.

LMP 001

1020508

Please observe the general notes on p. → 1-50 (Overview table for conductivity sensors)

LMP 001-HT

Conductivity sensor with Pt 100 temperature compensation and cell constant 0.01 cm⁻¹. Suitable for higher temperatures.

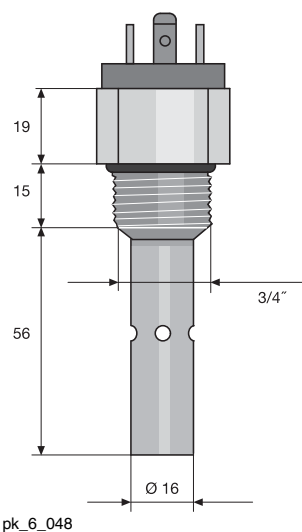
Measuring range	0.01...50 µS/cm
Cell constant k	0.01 cm ⁻¹ ±5 %
Temperature compensation	Pt 100
Fluid temperature	120 °C
Max. pressure	16.0 bar up to 100 °C
Sensors	stainless steel 1.4571
Shaft material	PVDF
Thread	3/4"
Fitting length	71 mm
Electrical connection	DIN 4 pin angle plug
Typical applications	General applications at higher temperatures, clean water applications, condensate.

Order no.

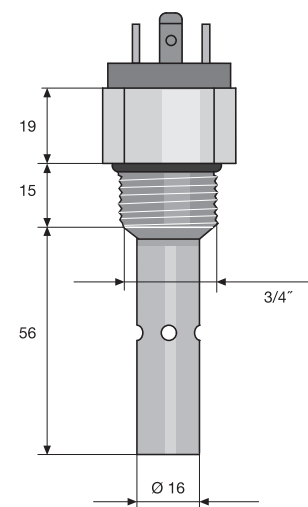
LMP 001-HT

1020509

Please observe the general notes on p. → 1-50 (Overview table for conductivity sensors)

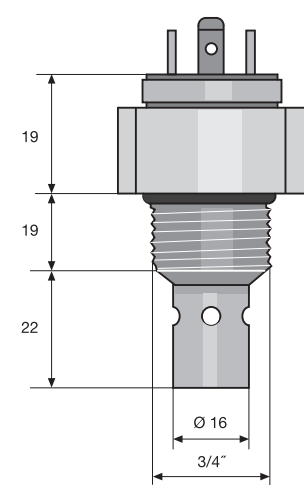


pk_6_048



pk_6_048

1.4 DULCOTEST® Conductivity Sensors



LMP 01

Conductivity sensor with Pt 100 temperature compensation and cell constant 0.1 cm^{-1} . LMP 01 is provided with a 4 pole plug and a 3/4" screw-in thread.

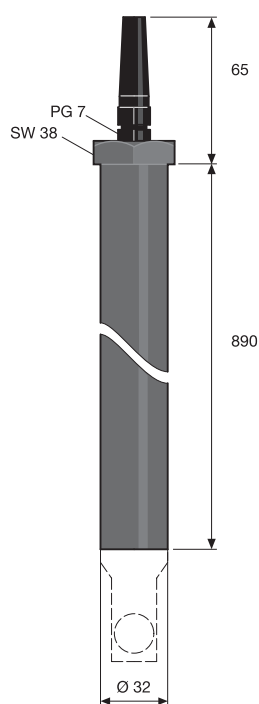
Measuring range	0.1...500 $\mu\text{S/cm}$
Cell constant k	$0.1 \text{ cm}^{-1} \pm 5 \%$
Temperature compensation	Pt 100
Fluid temperature	70 °C
Max. pressure	16.0 bar up to 50 °C
Sensors	stainless steel 1.4571
Shaft material	PP
Thread	3/4"
Fitting length	46 mm
Electrical connection	DIN 4 pin angle plug
Typical applications	Monitoring ion exchangers, reverse osmosis systems and desalination systems.

Order no.

LMP 01

1020510

Please observe the general notes on p. → 1-50 (Overview table for conductivity sensors)



LMP 01-TA

Conductivity sensor with Pt 100 temperature compensation and cell constant 0.1 cm^{-1} . LMP 01-TA is provided with a 5 m fixed cable and fitted in the TA-LM immersion fitting using an M 28 thread.

Immersion assembly Type TA-LM → 1-76

Measuring range	0.1...500 $\mu\text{S/cm}$
Cell constant k	$0.1 \text{ cm}^{-1} \pm 5 \%$
Temperature compensation	Pt 100
Fluid 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	
Electrical connection	5 m fixed cable
Typical applications	Monitoring ion exchangers, reverse osmosis systems and desalination systems.

Order no.

LMP 01-TA -

1020512

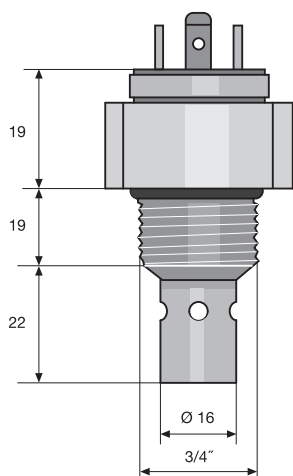
LMP 01-FE Replacement sensor for LMP 01-TA with 5 m fixed cable

1020626

Please observe the general notes on p. → 1-50 (Overview table for conductivity sensors)



1.4 DULCOTEST® Conductivity Sensors



LMP 01-HT

Conductivity sensor with Pt 100 temperature compensation and cell constant 0.1 cm^{-1} , suitable for higher temperatures.

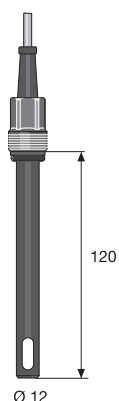
Measuring range	0.1...500 $\mu\text{S/cm}$
Cell constant k	$0.1 \text{ cm}^{-1} \pm 5 \%$
Temperature compensation	Pt 100
Fluid temperature	120 °C
Max. pressure	16.0 bar up to 100 °C
Sensors	stainless steel 1.4571
Shaft material	PVDF
Thread	3/4"
Fitting length	46 mm
Electrical connection	DIN 4 pin angle plug
Typical applications	General applications at higher temperatures: industrial, process water, condensate

Order no.

LMP 01-HT

1020511

Please observe the general notes on p. → 1-50 (Overview table for conductivity sensors)



LF 1 FE

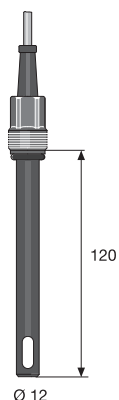
Measuring range	0.01...20 mS/cm
Cell constant k	$1 \text{ cm}^{-1} \pm 5 \%$
Temperature compensation	–
Fluid temperature	0...80 °C
Max. pressure	16.0 bar
Sensors	special graphite
Shaft material	Epoxy
Thread	PG 13.5
Fitting length	$120 \pm 3 \text{ mm}$
Electrical connection	5 m fixed cable (2 x 0.5 mm^2)
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.

Order no.

LF 1 FE

741152

Please observe the general notes on p. → 1-50 (Overview table for conductivity sensors)



LFT 1 FE

Measuring range	0.01...20 mS/cm
Cell constant k	$1 \text{ cm}^{-1} \pm 5 \%$
Temperature compensation	Pt 100
Fluid temperature	0...80 °C
Max. pressure	16.0 bar
Sensors	special graphite
Shaft material	Epoxy
Thread	PG 13.5
Fitting length	$120 \pm 3 \text{ mm}$
Electrical connection	5 m fixed cable (2 x 0.5 mm^2)
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.

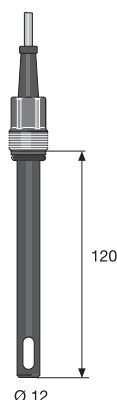
Order no.

LFT 1 FE

1001374

Please observe the general notes on p. → 1-50 (Overview table for conductivity sensors)

1.4 DULCOTEST® Conductivity Sensors



pk_6_085

LFTK 1 FE

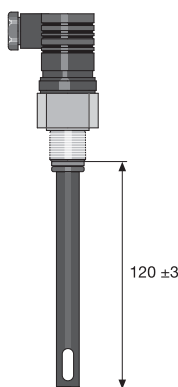
Measuring range	0.01...20 mS/cm
Cell constant k	1 cm ⁻¹ ±5 %
Temperature compensation	Pt 1000
Fluid temperature	0...80 °C
Max. pressure	16.0 bar
Sensors	special graphite
Shaft material	Epoxy
Thread	PG 13.5
Fitting length	120 ± 3 mm
Electrical connection	5 m fixed cable (2 x 0.5 mm ²)
Typical applications	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.

Order no.

LFTK 1 FE

1002821

Please observe the general notes on p. → 1-50 (Overview table for conductivity sensors)



pk_6_086

LF 1 DE

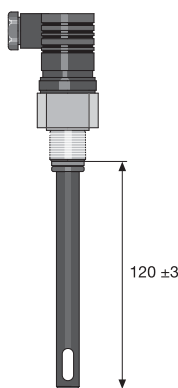
Measuring range	0.01...20 mS/cm
Cell constant k	1 cm ⁻¹ ±5 %
Temperature compensation	–
Fluid temperature	0...80 °C
Max. pressure	16.0 bar
Sensors	special graphite
Shaft material	Epoxy
Thread	PG 13.5
Fitting length	120 ± 3 mm
Electrical connection	DIN 4 pin angle plug
Typical applications	Potable, cooling, industrial water. Sensors of the LF series have only limited applicability for taking measurements in cleaning solutions containing surfactants and media containing solvents.

Order no.

LF 1 DE

1001375

Please observe the general notes on p. → 1-50 (Overview table for conductivity sensors)



pk_6_086

LFT 1 DE

Measuring range	0.01...20 mS/cm
Cell constant k	1 cm ⁻¹ ±5 %
Temperature compensation	Pt 100
Fluid temperature	0...80 °C
Max. pressure	16.0 bar
Sensors	special graphite
Shaft material	Epoxy
Thread	PG 13.5
Fitting length	120 ± 3 mm
Electrical connection	DIN 4 pin angle plug
Typical applications	Potable, cooling, industrial water. Sensors belonging to the LF series have only limited applicability for taking measurements in cleaning solutions containing surfactants and media containing solvents.

Order no.

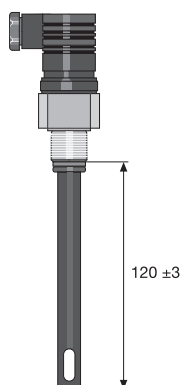
LFT 1 DE

1001376

Please observe the general notes on p. → 1-50 (Overview table for conductivity sensors)



1.4 DULCOTEST® Conductivity Sensors



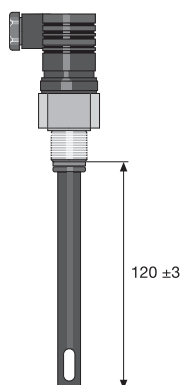
LFTK 1 DE

Measuring range	0.01...20 mS/cm
Cell constant k	1 cm ⁻¹ ± 5 %
Temperature compensation	Pt 1000
Fluid temperature	0...80 °C
Max. pressure	16.0 bar
Sensors	special graphite
Shaft material	Epoxy
Thread	PG 13.5
Fitting length	120 ± 3 mm
Electrical connection	DIN 4 pin angle plug
Typical applications	Potable, cooling, industrial water. Sensors belonging to the LF series have only limited applicability for taking measurements in cleaning solutions containing surfactants and media containing solvents.

Order no.

LFTK 1 DE	1002822
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Please observe the general notes on p. → 1-50 (Overview table for conductivity sensors)



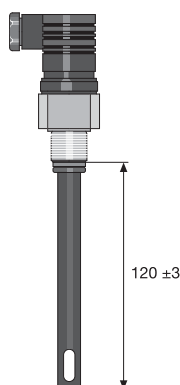
LF 1 1/2"

Measuring range	0.01...20 mS/cm
Cell constant k	1 cm ⁻¹ ± 5 %
Temperature compensation	–
Fluid temperature	0...80 °C
Max. pressure	16.0 bar
Sensors	special graphite
Shaft material	Epoxy
Thread	1/2"
Fitting length	120 ± 3 mm
Electrical connection	DIN 4 pin angle plug
Typical applications	Potable, cooling, industrial water. Sensors belonging to the LF series have only limited applicability for taking measurements in cleaning solutions containing surfactants and media containing solvents.

Order no.

LF 1 1/2"	1001377
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Please observe the general notes on p. → 1-50 (Overview table for conductivity sensors)



LFT 1 1/2"

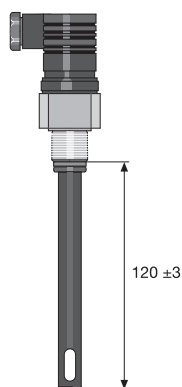
Measuring range	0.01...20 mS/cm
Cell constant k	1 cm ⁻¹ ± 5 %
Temperature compensation	Pt 100
Fluid temperature	0...80 °C
Max. pressure	16.0 bar
Sensors	special graphite
Shaft material	Epoxy
Thread	1/2"
Fitting length	120 ± 3 mm
Electrical connection	DIN 4 pin angle plug
Typical applications	Potable, cooling, industrial water. Sensors belonging to the LF series have only limited applicability for taking measurements in cleaning solutions containing surfactants and media containing solvents.

Order no.

LFT 1 1/2"	1001378
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Please observe the general notes on p. → 1-50 (Overview table for conductivity sensors)

1.4 DULCOTEST® Conductivity Sensors



pk_6_086

LFTK 1 1/2"

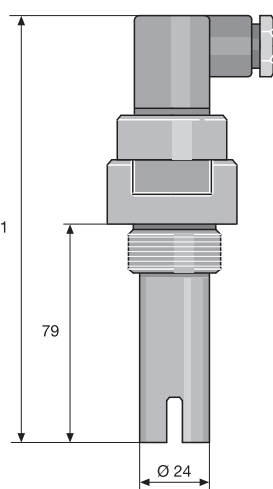
Measuring range	0.01...20 mS/cm
Cell constant k	1 cm ⁻¹ ± 5 %
Temperature compensation	Pt 1000
Fluid temperature	0...80 °C
Max. pressure	16.0 bar
Sensors	special graphite
Shaft material	Epoxy
Thread	1/2"
Fitting length	120 ± 3 mm
Electrical connection	DIN 4 pin angle plug
Typical applications	Potable, cooling, industrial water. Sensors belonging to the LF series have only limited applicability for taking measurements in cleaning solutions containing surfactants and media containing solvents.

Order no.

LFTK 1 1/2"

1002823

Please observe the general notes on p. → 1-50 (Overview table for conductivity sensors)



pk_6_046

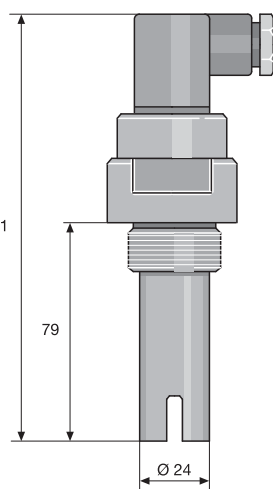
CK 1

Measuring range	0.01...20 mS/cm
Cell constant k	1 cm ⁻¹ ± 5 %
Temperature compensation	–
Fluid temperature	0...150 °C
Max. pressure	16.0 bar up to 20 °C
Sensors	special graphite
Shaft material	PES
Thread	R 1"
Fitting length	79 mm
Electrical connection	DIN 4 pin angle plug
Typical applications	Cooling, industrial, process water, tank and pipe, cleaning systems in breweries, dairies, media separation.

Order no.

CK 1

305605



pk_6_046

CKPt 1

Measuring range	0.01...20 mS/cm
Cell constant k	1 cm ⁻¹ ± 5 %
Temperature compensation	Pt 100
Fluid temperature	0...150 °C
Max. pressure	16.0 bar up to 20 °C
Sensors	special graphite
Shaft material	PES
Thread	R 1"
Fitting length	79 mm
Electrical connection	DIN 4 pin angle plug
Typical applications	Cooling, industrial, process water, tank and pipe cleaning systems in breweries and dairies, separation of media.

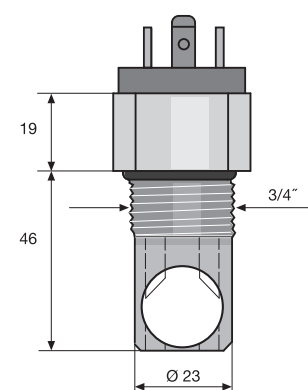
Order no.

CKPt 1

305606



1.4 DULCOTEST® Conductivity Sensors



pk_6_052

LM 1

Conductivity sensor is provided with a DIN 4-pole angle plug.

Measuring range	0.1...20 mS/cm
Cell constant k	1 cm ⁻¹ ±5 %
Temperature compensation	–
Fluid temperature	70 °C
Max. pressure	16.0 bar up to 50 °C
Sensors	graphite
Shaft material	PP
Thread	3/4"
Fitting length	46 mm
Electrical connection	DIN 4 pin angle plug
Typical applications	Potable, cooling, industrial, process water, media separation

Order no.

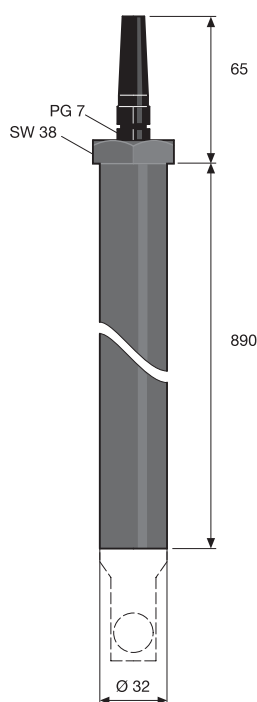
LM 1

740433

LM 1-TA

The conductivity sensor is provided with a 5 m fixed cable and inserted in the TA-LM immersion fitting.

Immersion assembly Type TA-LM → 1-76



pk_6_053

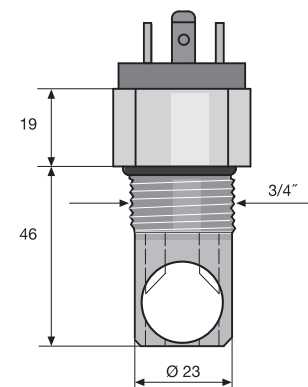
Measuring range	0.1...20 mS/cm
Cell constant k	1 cm ⁻¹ ±5 %
Temperature compensation	–
Fluid temperature	70 °C
Max. pressure	16.0 bar up to 50 °C
Sensors	graphite
Shaft material	PP
Thread	M 28 x 1.5 for TA-LM in-line probe fitting
Fitting length	
Electrical connection	5 m fixed cable
Typical applications	Potable, cooling, industrial, process water, media separation

Order no.

LM 1-TA	–	1020528
LM 1-FE	Replacement sensor for LM 1-TA	1020627

LMP 1

Conductivity sensor with DIN 4 pole plug and Pt 100 for temperature compensation.



pk_6_052

Measuring range	0.0...20 mS/cm
Cell constant k	1 cm ⁻¹ ±5 %
Temperature compensation	Pt 100
Fluid temperature	0...70 °C
Max. pressure	16.0 bar up to 50 °C
Sensors	graphite
Shaft material	PP
Thread	3/4"
Fitting length	46 mm
Electrical connection	DIN 4 pin angle plug
Typical applications	Potable, cooling, industrial, process water, media separation

Order no.

LMP 1

1020513

Please observe the general notes on p. → 1-50 (Overview table for conductivity sensors)

1.4 DULCOTEST® Conductivity Sensors

LMP 1-TA

The conductivity sensor is provided with a 5 m fixed cable and Pt 100 for temperature compensation and inserted in the TA-LM immersion fitting.

Immersion assembly Type TA-LM → 1-76

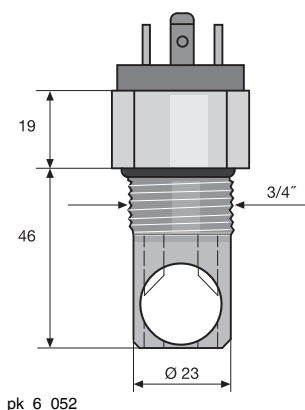
Measuring range	0.1...20 mS/cm
Cell constant k	1 cm ⁻¹ ±5 %
Temperature compensation	Pt 100
Fluid temperature	70 °C
Max. pressure	16.0 bar up to 50 °C
Sensors	graphite
Shaft material	PP
Thread	M 28 x 1.5 for TA-LM in-line probe fitting
Fitting length	
Electrical connection	5 m fixed cable
Typical applications	Potable, cooling, industrial, process water, media separation

		Order no.
LMP 1-TA	–	1020525
LMP 1-FE	Replacement sensor for LMP 1-TA	1020727

Please observe the general notes on p. → 1-50 (Overview table for conductivity sensors)

LMP 1-HT

Conductivity sensor for higher temperatures with a DIN 4-pole plug.



Measuring range	0.1...20 mS/cm
Cell constant k	1 cm ⁻¹ ±5 %
Temperature compensation	Pt 100
Fluid temperature	120 °C
Max. pressure	16.0 bar up to 100 °C
Sensors	graphite
Shaft material	PVDF
Thread	3/4"
Fitting length	46 mm
Electrical connection	DIN 4 pin angle plug
Typical applications	General applications at higher temperatures industrial, process water, media separation, CIP in breweries and dairies

	Order no.
LMP 1-HT	1020524

Please observe the general notes on p. → 1-50 (Overview table for conductivity sensors)



1.4 DULCOTEST® Conductivity Sensors

1.4.3 Inductive Conductivity Sensors

Electrode-free inductive conductivity sensors are used to measure electrolytic conductivity over a wide measuring range 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 D1Ca xx L6 controller. The controller includes the testing and calibration kit (1026958).

ICT 1

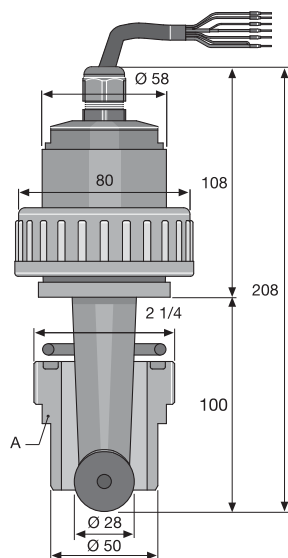
Economical inductive conductivity sensors for all types of contaminated water and for high conductivities. The sensor ICT 1 is intended for measuring in the flow for installation in DN 40 pipework (optionally PVC or PP).

Measuring range	0.2...1,000 mS/cm
Cell constant k	8.5 cm ⁻¹ ±5 %
Measuring accuracy	< 1 % referred 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: FPM
Electrical connection	7 m fixed cable
Enclosure rating	IP 65
Measuring and control equipment	D1C for inductive conductivity
Typical applications	All types of soiled water, desalination control in cooling towers, control of electroplating baths, Cleaning in Place (CIP), product monitoring

Assembly

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.

Welding socket for T-piece (PP) Type ICT 1 → 1-78, DULCOMETER® Single-channel Measuring and Control Unit, D1Cb/c, for all Measured Variables → 2-4



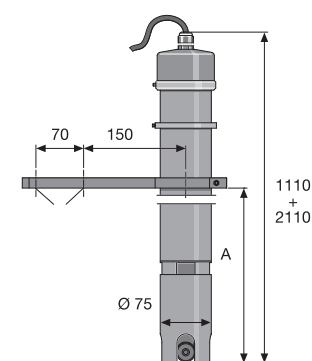
P_MSRZ_0013_SW1

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

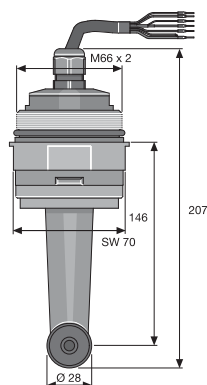
Order no.

ICT 1	—	1023244
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1.4 DULCOTEST® Conductivity Sensors



pk_6_088
A = min. 155 mm / max. 1 m or 2 m



pk_6_089

ICT 1-IMA

Economical inductive conductivity sensors for all types of contaminated water and for high conductivities. The immersion sensors ICT 1-IMA-1 m and ICT 1-IMA-2 m comprise the sensor ICT 1-IM and the fully assembled immersion pipe IMA-ICT1, either 1 m or 2 m in length respectively.

Measuring range	0.2...1,000 mS/cm
Cell constant k	8.5 cm ⁻¹ ±5 %
Measuring accuracy	< 1 % referred 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: PP, Seals: FPM
Electrical connection	7 m fixed cable
Enclosure rating	IP 65
Measuring and control equipment	D1C for inductive conductivity

Typical applications

All types of soiled water, desalination control in cooling towers, control of electroplating baths, Cleaning in Place (CIP), product monitoring

Assembly

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.

PP immersion assembly type IPHa 3-PP → 1-74, DULCOMETER® Single-channel Measuring and Control Unit, D1Cb/c, for all Measured Variables → 2-4

		Order no.
ICT 1-IMA 1 m	–	1023349
ICT 1-IMA 2 m	–	1023351
ICT 1-IM	Replacement sensors for ICT 1-IMA-1 m and ICT-IMA-2 m	1023245

ICT 2

High-performance sensor for aggressive media, maximum conductivity and high temperatures. Available for installation in tanks, pipes or the immersion assembly IMA-ICT 2.

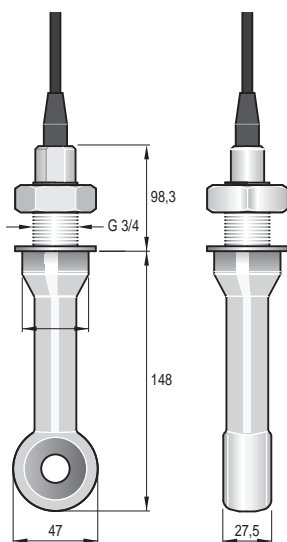
Measuring range	0.02...2,000 mS/cm
Cell constant k	1.98 cm ⁻¹
Measuring accuracy	± (5 µS/cm + 0.5 % of the measured value) at T < 100 °C ± (10 µS/cm + 0.5 % of the measured value) at T > 100 °C
Temperature compensation	Pt 100, class A, completely extrusion-coated
Process chemical temperature	0...125 °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
Measuring and control equipment	D1C
Typical applications	Production processes in the chemical industry, phase separation of product mixtures, determination of concentrations of aggressive chemicals.

Assembly

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).

Installation kit for sensors of type ICT 2 → 1-78

		Order no.
ICT 2	–	1023352



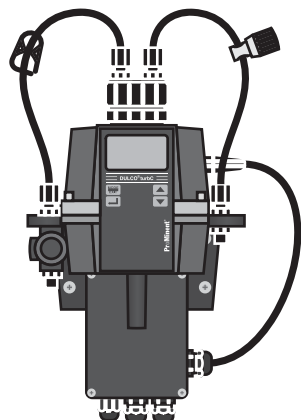
pk_6_082



1.5 DULCOTEST® Measuring Points For Turbidity

1.5.1

Measuring Points for Turbidity



P_DMZ_0002_SW

The new 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 sample 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.

Technical Data

Measuring range	0 ... 1,000.0 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 1,380 kPa (200 psi), based on the flow rate
Flow	6 – 60 l/h
Temperature	1 ... 50 °C
Material that comes into contact with the media	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 2,000 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

1.5 DULCOTEST® Measuring Points For Turbidity

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 Sensor Technology Accessories

1.6.1

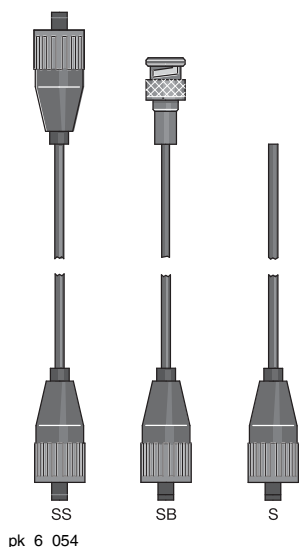
Sensor Accessories

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.

Signal leads for pH/ORP measurement

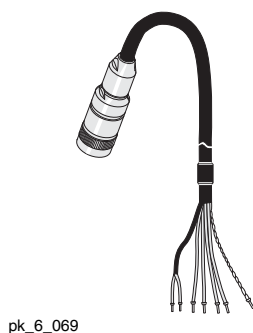
- Pre-assembled to facilitate installation
- Factory tested to ensure function reliability
- IP 65



Type	Description	Order no.
2 x SN6	Coaxial cable Ø 5 mm, 0.8 m - SS	305077
–	Coaxial cable Ø 5 mm, 2.0 m - SS	304955
–	Coaxial cable Ø 5 mm, 5.0 m - SS	304956
–	Coaxial cable Ø 5 mm, 10.0 m - SS	304957
SN6 - open end	Coaxial cable Ø 5 mm, 2.0 m - S	305030
–	Coaxial cable Ø 5 mm, 5.0 m - S	305039
–	Coaxial cable Ø 5 mm, 10.0 m - S	305040
–	Coaxial cable Ø 5 mm, 20.0 m - S	304952
SN6 - BNC	Coaxial cable Ø 3 mm, 10.0 m - SB	305099
–	Coaxial cable, Ø 5 mm, 0.8 m – SB	1033988
–	Coaxial cable, Ø 5 mm, 2.0 m – SB	1033011
SN6 - DIN	Coaxial cable Ø 5 mm, 0.8 m - SD	305098
–	Coaxial cable Ø 5 mm, 2.0 m - SD	304810
SN6 - open end d5 (DSR)	Cable combination coax 2.0 m - S	1005672

Measuring line for sensors with Vario Pin plug-in heads

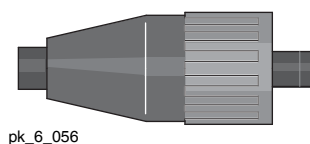
Ready-made 6-conductor measuring line with Vario Pin plug for connection to sensor type PHEPT 112 VE.



	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

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

LK coax 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

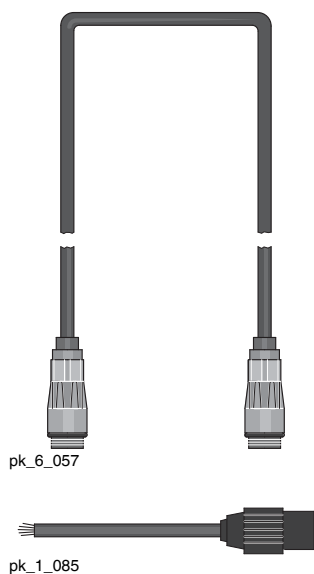
Please specify length with order.

1.6 Sensor Technology Accessories

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.

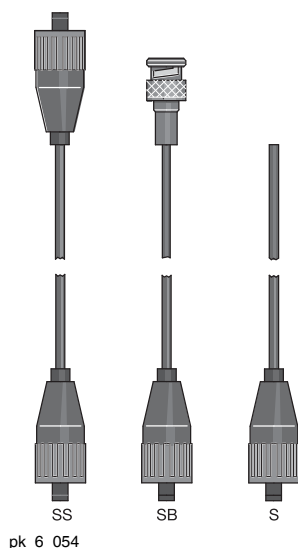
	Length m	Order no.
5-core universal cable, 5-pin round plug	2	1001300
5-core universal cable, 5-pin round plug	5	1001301
5-core universal cable, 5-pin round plug	10	1001302

Cabling accessories for CAN type chlorine sensors

	Order no.
T-distributor M12 5-pole CAN	1022155
Termination resistance M12 coupling	1022154
Termination resistance 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 (by the metre)	1022160
Plug-CAN M12 5-pole screw terminal	1022156
Coupling-CAN M12 5-pole screw terminal	1022157

Signal leads for Pt 100/Pt 1000 (2 x 0.5 mm²)

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



1.6 Sensor Technology Accessories



pk_6_055_2

LKT type measuring line for conductivity sensors

4-core, shielded, Ø 6.2 mm

Order no.**Please specify length with order.**

723712

Two-wire signal lead (2 x 0.25 mm²; Ø 4 mm)

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

Order no.**Please specify length with order.**

725122

Connector cable

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

	Length m	Order no.
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Connector cable	5	818438
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Test and calibration kit for inductive conductivity

Order no.**Test and calibration kit**

1026958





1.6 Sensor Technology Accessories

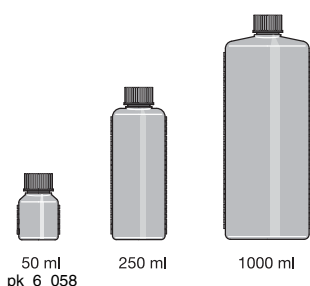
1.6.2

Consumable Items for Sensors

pH quality buffer solutions

Accuracy \pm pH 0.02 (\pm 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 CO₂ 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.



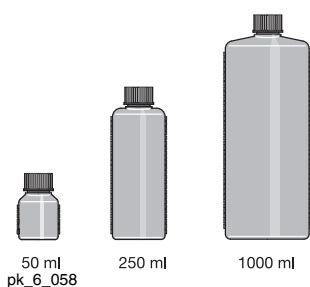
	Capacity ml	Order no.
Buffer pH 4.0 – red	50	506251
Buffer pH 4.0 – red	250	791436
Buffer pH 4.0 – red	1,000	506256
Buffer pH 5.0 – red	50	506252
Buffer pH 7.0 – green	50	506253
Buffer pH 7.0 – green	250	791437
Buffer pH 7.0 – green	1,000	506258
Buffer pH 9.0	50	506254
Buffer pH 9.0	1,000	506259
Buffer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

ORP quality buffer solutions

Accuracy to \pm 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!

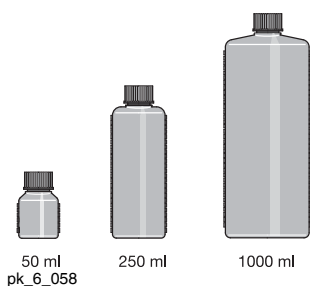


	Capacity ml	Order no.
ORP buffer 465 mV	50	506240
ORP buffer 465 mV	250	791439
ORP buffer 465 mV	1,000	506241
ORP buffer 220 mV	50	506244
ORP buffer 220 mV	1,000	506245

DPD-reagents for calibration of amperometric sensors s. p. → 2-83

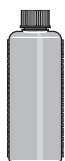
3 molar KCl solutions

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 Sensor Technology Accessories



250 ml

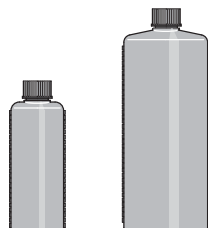
pk_6_058_2

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



250 ml

1000 ml

pk_6_058_3

Conductivity calibration solution

For the precise calibration of conductivity sensors.

	Capacity ml	Order no.
Conductivity calibration 1413 $\mu\text{S}/\text{cm}$	250	1027655
Conductivity calibration 1413 $\mu\text{S}/\text{cm}$	1,000	1027656
Conductivity calibration 12.88 mS/cm	250	1027657
Conductivity calibration 12.88 mS/cm	1,000	1027658



pk_6_061

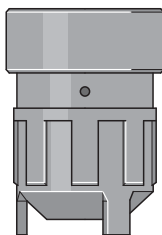
Electrolyte for amperometric sensors

	Capacity ml	Order no.
Electrolyte for all CLE type chlorine sensors	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 PAA 1 type peracetic acid sensors	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





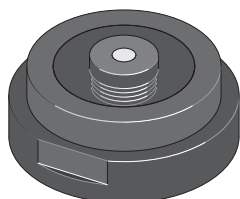
1.6 Sensor Technology Accessories



pk_6_075

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	–	741274
Membrane cap for CDP 1, BRE 1 (0.5 / 2 ppm), CLT	–	1002710
Membrane cap for CDE 3	–	1026578
Membrane cap for PAA 1, CDR 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
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



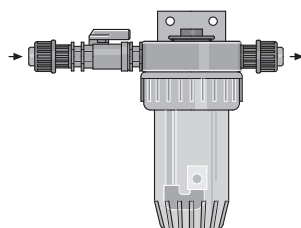
pk_6_062

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 Sensor Technology Accessories

1.6.3 Probe Fittings



pk_6_063

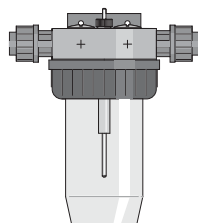
DLG III type in-line probe housing

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

	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



pk_6_070

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

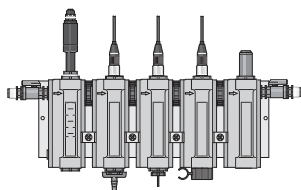
	Type	Max. temperature °C	Order no.
DLG IV PP	for Ø 16/DN 10 pipe work connector	80	1005331
DLG IV PVC	for Ø 16/DN 10 pipe work connector	55	1005332

DLG sampling water cup

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



1.6 Sensor Technology Accessories



pk_6_066

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.

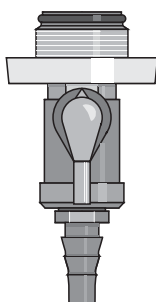
Advantages:

- Simple installation (completely 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: FPM 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.

FPM = fluoro rubber



pk_6_071

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 Sensor Technology Accessories

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

Identcode Ordering System For In-Line Probe Housing Modules

DGM	Series	Series Version
	A	
		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 FPM 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

FPM = fluoro rubber



1.6 Sensor Technology Accessories

1.6.4 Immersion Probe Fittings

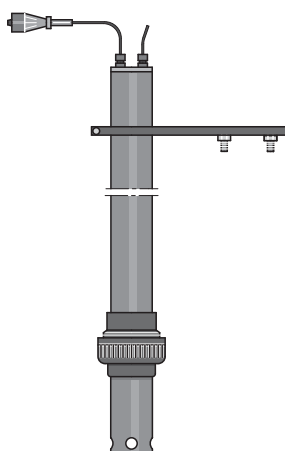
PVC immersion assembly, type ETS 1 P

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_064



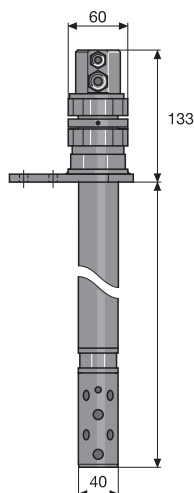
PP immersion assembly type IPHa 1-PP

To hold **one** sensor (e.g. pH, ORP) with PG 13.5 screw-in thread and standard 120 mm length. The inside diameter is dimensioned so that 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: FPM
Max. temperature	80 °C
Pressure	Installation at atmospheric pressure
Immersion depth	max. 1, or 2 m; variable
Immersion lance diameter	40 mm

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

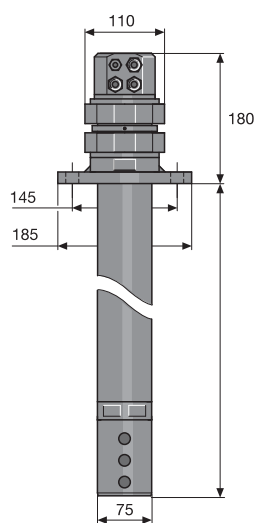
pk_6_080



Other materials available on request.

FPM = fluoro rubber

1.6 Sensor Technology Accessories



pk_6_081

Fixed flange	DN 40	DN65
Pitch circle	110 mm	145 mm
Screws	4 x M16	4 x M16
Thickness d ₂	18 mm	18 mm
Diameter	150 mm	185 mm

PP immersion assembly type IPHa 3 -PP

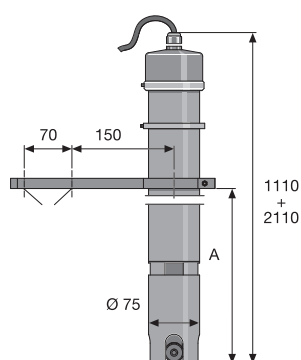
To hold up to **three** sensors (e.g. pH, ORP, temperature) with PG 13.5 screw-in thread and standard 120 mm length. The inside diameter is dimensioned so that up to three pH, ORP or temperature transducers can be installed. In addition a stainless steel rod is incorporated as a liquid reference potential. 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.

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

Other materials available on request.

Accessories for fitting type IPHa

	Order no.
Immersion pipe mounting for IPHa 1-PP	1008624
Immersion pipe mounting for IPHa 3-PP	1008625
Clamped threaded connector with fixed flange DN 40 according to DIN 2642 for IPHa 1-PP	1008626
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 1-PP	1008628
Clamped threaded connector for welding connection for IPHa 3-PP	1008629
Protective (weatherproofed) cover for assembly head for IPHa 1-PP	1008630
Protective (weatherproofed) cover for assembly head for IPHa 3-PP	1008631
Water-retaining basin for IPHa 1-PP	1008632
Water-retaining basin for IPHa 3-PP	1008633
Weatherproof cover PP	1023368



pk_6_088

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

Immersion assembly type IMA-ICT 1

To hold one inductive conductivity sensor of type ICT 1.

Material	Fittings: PP Seal: FPM
Max. temperature	70 °C
Pressure	Installation at atmospheric pressure
Immersion lance diameter	75 mm

	Order no.
IMA-ICT 1 - 1 m	1023366
IMA-ICT 1 - 2 m	1023367

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 Sensor Technology Accessories

Immersion assembly type IMA-ICT 2

To hold one inductive conductivity sensor of type ICT 2.

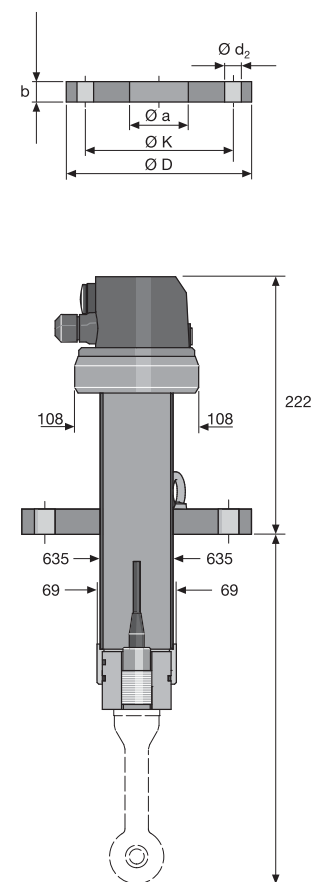
Material	Fittings: Stainless steel 1.4404 Seal: FPM
Max. temperature	125 °C
Max. pressure	10 bar
Length when fitted	1 m
Immersion lance diameter	70 mm
Flange	Stainless steel flange DN 80 PN 16

Order no.

IMA-ICT 2

1023353

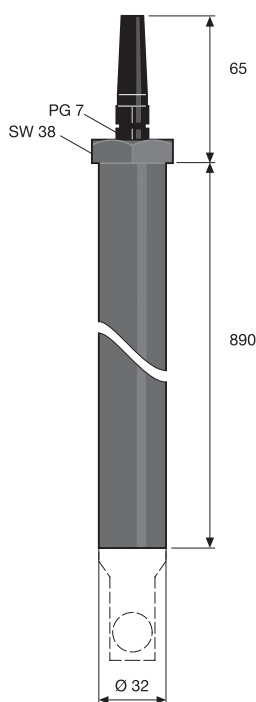
Adaptation to processes through flange installation in tank from top.



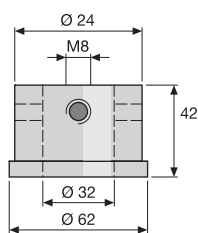
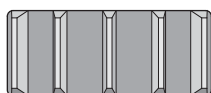
pk_6_094

Flange:	DN 80/PN 16
Ø D	200
Ø K	160
Ø d2	8 x 18
b	20
Ø a	63.5
Screws	M 16

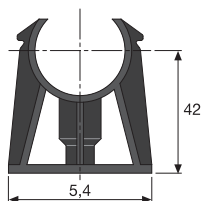
1.6 Sensor Technology Accessories



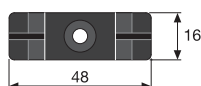
pk_6_053



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 fastening 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 Sensor Technology Accessories

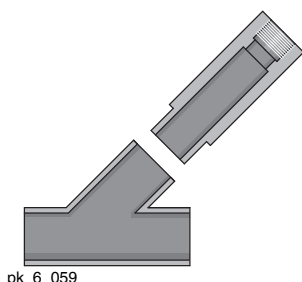
1.6.5

Immersion Probe Fittings/Adaptors

Adapter set (T-piece and adapter)

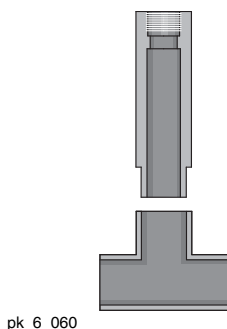
For direct fitting of conductivity, Pt 100, pH or ORP sensors with PG 13.5 screw-in pipework:

	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



PVC adapter set for type LM ... sensors

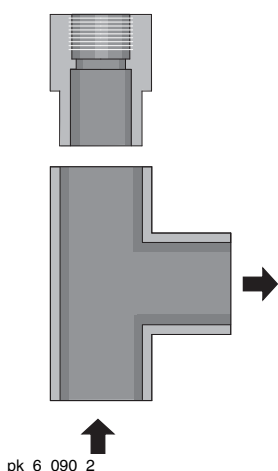
For direct fitting of type LM conductivity sensors with 3/4" screw-in thread in for measuring in the flow.



For LM(P) 001 conductivity sensors

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

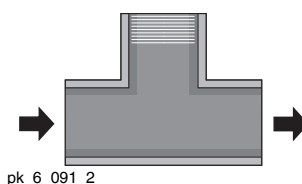
	Material	Order no.
90° T-joint DN 25	PVC	356410
Adapter DN 25 with 3/4" thread	PVC	356923
90° T-joint DN 25	PP	358674
Adapter with 3/4" thread	PP	356953



For LM(P) 01 conductivity sensors

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

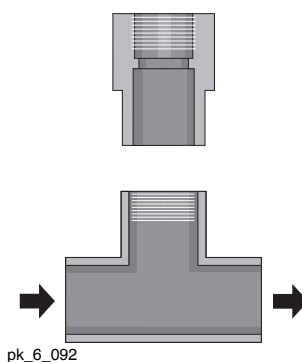
	Material	Order no.
90° T-piece DN 20 - 3/4"	PVC	356455
90° T-piece DN 20 - 3/4"	PP	356471



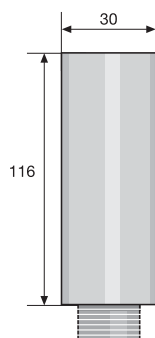
For LM(P) 1 conductivity sensors

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 Sensor Technology Accessories



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

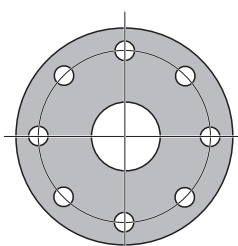
Adapter, stainless steel, PG 13.5

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, FPM (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

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

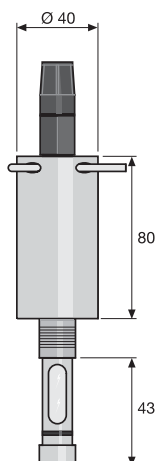
Fixed flange	ANSI 2"	DN 50
SS 316L	300 lbs	PN 16
Pitch circle	127	125
Screws	M 16	M 16
Thickness	22.2	18
Diameter	165.1	165

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 FPM	1023371

1.6 Sensor Technology Accessories



pk_6_013

Push-changeover fitting for pH, ORP sensors WA-PH 1

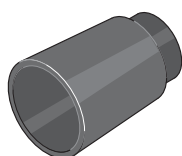
To hold **one** pH sensor with PG 13.5 screw-in thread and length of between 110-125 mm for fitting in the storage tank or in the flow. The sensor can be removed and fitted for calibration and cleaning without draining the liquid from the storage tank or without interrupting the process in the flow.

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

Order no.

WA-PH 1

1020631



pk_6_072

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

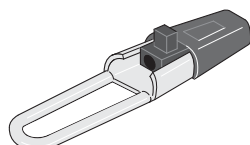
PVC adapter for connection of the DO 1-mA-20 ppm dissolved oxygen sensor to an immersion pipe with 1-1/4 inch internal thread.

Sensors for dissolved oxygen see p. → 1-45

Order no.

Immersion pipe 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.

Sensors for dissolved oxygen see p. → 1-45

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).

Sensors for dissolved oxygen see p. → 1-45

Order no.

Pipe adapter for DO 2-mA-10 ppm

1020538

Railing bracket for plastic pipes

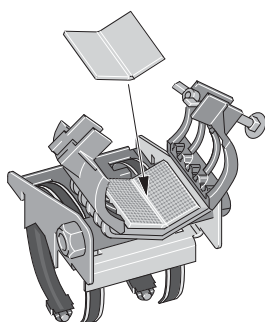
Stainless steel and plastic bracket for fixing of plastic tubes with 50 mm outside diameter to rails (e.g. on pools in sewage plants). Spare part for "dissolved oxygen" sensor: DO 2-mA-10 ppm.

Sensors for dissolved oxygen see p. → 1-45

Order no.

Railing bracket for DO 2-mA-10 ppm

1020536



pk_6_010



1.7 Application Examples

Application Examples see p. → 2-87





2.0 DULCOMETER® Measuring and Control Technology

2.0.1

DULCOMETER® Measuring and Control Units

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 unit 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, perfectly coordinated.

Controller selection table

Function	Compact controller	D1Cb	D1Cc	DACa*	D1Ca**	D2Ca**
Measured variablen						
pH	✓	✓	✓	✓	✓	✓
ORP	✓	✓	✓	✓	✓	✓
Chlorine	✓	✓	✓	✓	✓	✓
Chlorine dioxide		✓	✓	✓	✓	✓
Chlorite		✓	✓	✓	✓	
Bromine		✓	✓	✓	✓	
Bromide				✓	✓	
Conductivity, conductive	✓				✓	
Conductivity, inductive					✓	
Conductivity via mA		✓	✓	✓	✓	
Peracetic acid		✓	✓	✓	✓	
Hydrogen peroxide		✓	✓	✓	✓	
Ozone		✓	✓	✓	✓	
Dissolved oxygen		✓	✓	✓	✓	
Fluoride		✓	✓	✓	✓	
0/4...20 mA standard signal general measured variables		✓	✓	✓	✓	
Temperature				✓	✓	
Power supply						
115 V~					✓	✓
230 V~					✓	✓
90-253V ~	✓	✓	✓	✓	✓	✓
24 V =/~					✓	✓
Method of installation, degree of protection						
Wall mounted IP 65		✓			✓	✓
Panel mounted, IP 54			✓		✓	✓
Combination housing (wall-mounting, control panel installation, pillar assembly) IP 67, IP 54	✓			✓		
Measurement						
Number of measuring channels	1	1	1	1/2 selectable	1	2
Sensor monitoring	✓	✓	✓	✓		
Temperature compensation for pH	✓	✓	✓	✓	✓	✓
Temperature compensation for conductivity					✓	

2.0 DULCOMETER® Measuring and Control Technology

Function	Compact controller	D1Cb	D1Cc	DACa*	D1Ca**	D2Ca**
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)		✓	✓	✓	✓	
Control inputs						
Digital inputs (sample water, parameter switching)	✓, 1	✓, 1	✓, 1	✓, 5	✓, 1	✓, 2
Control outputs						
Control of metering pump by pulse frequency	✓	✓	✓	✓, 2/4	✓	✓
Control of solenoid valve/motor-driven metering pump	✓	✓	✓	✓	✓	✓
Control of servomotor 3-P with feedback signal					✓	
Control of servomotor 3-P no feedback signal				✓		
Feedforward control of flow via mA				✓	✓	
Feedforward control of flow via frequency (e.g. of contact water meter)				✓	✓	
Metering time monitoring with deactivation of the control variable	✓	✓	✓	✓	✓	✓
Limit value relay (for signalling limit value transgressions)	✓, 1	✓, 2	✓, 2	✓, 2	✓, 2	✓, 2
Timer relay (for time-dependent metering, optionally to limit value relay)		✓, 2	✓, 2	✓, 2	✓, 2	
Outputs						
Analogue output 0/4...20 mA	✓, 1	✓, 1	✓, 1	✓, 2	✓, 2	✓, 2
Special functions						
Data logger with SD card				✓		
Web server via LAN/WLAN				✓		
Favourites menu				✓		
Parameter set switchover via timer				✓		
Parameter set switchover via contact				✓		
PROFIBUS®-DP				✓		
Subsequent function upgrade via activation key		✓	✓	✓		
Operating hour counter		✓	✓	✓		
Approvals						
MET (such as UL according to IEC 60010)				✓		

* Available from March 2013

** Discontinued May 2013



2.1 DULCOMETER® Compact Single-channel Measuring and Control Unit for pH, ORP and Chlorine

2.1.1 DULCOMETER® Compact



P_DM_0025_SW1

NEW

The DULCOMETER® Compact measuring transducer with control function for the measured variables pH, ORP chlorine and conductive conductivity provides basic functions for water treatment applications. It has a fixed configuration with the following features:

- Measured variables pH and ORP (can be changed on the controller)
- Operation independent of the operating language (use of abbreviations, such as CAL, PARAM, CONFIG, ERROR)
- Illuminated display
- 3 LEDs indicate the operating states (relay 1 / 2 active, Error)
- Sensor monitoring of pH
- P and PID control characteristics
- Selectable control direction (raise or lower measured value)
- Pulse frequency relay for control of metering pump
- Output relay can be configured as an alarm, limit value or pulse width modulated control output for metering pumps (connection function or switch on operating voltage)
- Analogue output 0/4 ... 20 mA, configurable as plotter output or control output
- Digital input to switch off the controller or to process a sample water limit contact by remote control
- Temperature sensor input (Pt 1000) for temperature compensation of the pH and chlorine values

Applications

- Waste water treatment
- Potable water treatment
- Swimming pool water treatment

Technical Data

Measuring range	pH: 0.00 ... 14 ORP: -1,000 ... +1,000 mV Chlorine: 0.05 ... 5 ppm, intermittent metering up to 10 ppm, max. 12 h Conductive conductivity: 1 µS/cm ... 200 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)
Correction variable	Temperature for pH, chlorine and conductive conductivity using Pt 1000
Correction range	0 ... 120 °C
Control characteristic	P/PID Loop control
Control	1-way controller with selectable control direction (raise/lower)
Signal current output	1 x 0/4-20 mA galvanically isolated Max. load 400 Ω Range and assignment (measured or actuating variable) can be set
Control outputs	1 pulse frequency output for control of the metering pump 1 relay (alarm or limit value relay or pulse length control) 1 x analogue output 0/4...20 mA
Electrical connection	90 - 253 V ~
Ambient temperature	-10 ... +60 °C
Enclosure rating	IP 67
Dimensions	135 x 125 x 75 mm (H x W x D)
Weight	0.5 kg

	Order no.
Compact controller for pH/ORP	1035638
Compact controller for chlorine	1038546
Compact controller for conductive conductivity	1044468

Compact conductive conductivity controller available from the 2nd quarter of 2013.

Accessories

	Order no.
Cable combination coax 0.8 m - pre-assembled*	1024105
Cable combination coax 2 m- SN6 - pre-assembled*	1024106
Cable combination coax 5 m- SN6 - pre-assembled*	1024107
Panel mounting kit DDCA	1037273
Chlorine sensor CLB 2-µA-5 ppm	1038902
Chlorine sensor CLB 3-µA-5 ppm	1041696

2.2 DULCOMETER® D1Cb/c Single-channel Measuring and Control Unit for all Measured Variables

2.2.1 D1Cb/D1Cc Single-channel Controller for all Measured Variables

- flexibly upgradable thanks to subsequent activation option for functions by means of activation code (see D1Ub/D1Uc upgrade identity code)
- equipped for the essential basic requirements in water treatment
- large, illuminated graphic display
- operator guidance with clear text menu available in 14 languages in the controller
- automatic buffer detection for pH

Identity code ordering system D1Ub, subsequent function upgrade for D1Cb see page → 2-8

Standard configuration

The following functions are included in the D1Cb/D1Cc controller (the measured variables depend on the type of connection of the measured variable)

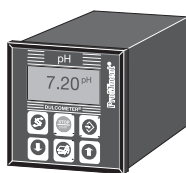
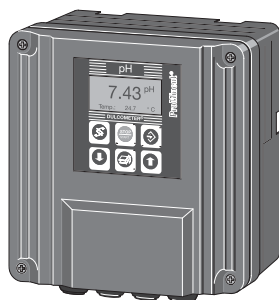
- Sensor monitoring for pH
- All 22 operator languages in the memory
- Switchable between all measured variables via mV or mA
- 2 power relays for limit value monitoring or timer functions
- Metering time monitoring with switch-off of the control variable
- Extended range voltage supply: 90-253 V, 50/60 Hz
- mA sensor input safely protected against short-circuit and polarisation reversal
- Method of installation, wall mounting: D1Cb
- Method of installation, control panel: D1Cc

Applications

- Waste water treatment
- Cooling water treatment
- Treatment of potable water
- Neutralisation



2.2 DULCOMETER® D1Cb/c Single-channel Measuring and Control Unit for all Measured Variables



pk_5_002

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 measuring range

Measurement input

SN6 (input resistance > 0.5 x 10¹² Ω)

Correction variable

Temperature via Pt 100/Pt 1000

Correction range

0 ... 100 °C

Disturbance signals

-

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)
1 x 0/4 ... 20 mA

Alarm relay

250 V ~ 3 A, 700 VA changeover contact

Electrical connection

90 - 253 V, 50/60 Hz

Ambient temperature

Wall mounting: -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 (BxHxT) (D1Cc)

Order no.

Mounting kit for control panel installation D1Cb

792908

A complete measurement station comprises the following¹²:

- Measuring transducer/controller D1Cb/D1Cc (see Identcode)
- Fitting: DGMa..., DLG III ..., immersed fitting
- pH sensor (corresponding to Identcode)
- ORP sensor (corresponding to Identcode)
- Chlorine, chlorine dioxide, chlorite, bromine, dissolved oxygen sensor
- Transducer for pH or ORP (corresponding to Identcode)
- Sensor cable

Accessories

Order no.

Cable combination coax 0.8 m - pre-assembled*

1024105

Cable combination coax 2 m- SN6 - pre-assembled*

1024106

Cable combination coax 5 m- SN6 - pre-assembled*

1024107

SN6 connection, refitting, D1Cb

1036885

Protective RC circuit, retrofit kit for D1Cb

1034238

* for measured variable connection = 5



2.2 DULCOMETER® D1Cb/c Single-channel Measuring and Control Unit for all Measured Variables

2.2.2 D1Cb Identity Code Ordering System, Wall-mounted, all Measured Variables

DULCOMETER® D1Cb controller product range, wall-mounted

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 0/4-20mA, all measured variables selectable
5	mV terminal switchable to standard signal 0/4-20mA, all measured variables selectable
Correction variable	
0	None
2	Temperature Pt 100/1000 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
Relay 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 characteristic	
0	None
1	P-control
2	PID control
Language	
00	no default
DE	German
EN	English
ES	Spanish
SV	Swedish
PT	Portuguese
CN	Chinese
FR	French
CZ	Czech
JP	Japanese
KR	Korean
NO	Norwegian
NL	Dutch
PL	Polish
RU	Russian
TH	Thai
HU	Hungarian
IT	Italian
DK	Danish
FI	Finish
GR	Greek

2.2 DULCOMETER® D1Cb/c Single-channel Measuring and Control Unit for all Measured Variables

DULCOMETER® D1Cc controller product range, control panel installation

D1Cc	Type of mounting
D	Control panel installation (IP 54)
Design	
00	With ProMinent logo
Operating voltage	
4	24 V AC/DC
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 selectable
5	mV terminal can be switched to standard signal 0/4-20mA, all measured variables can be selected
Correction variable	
0	None
2	Temperature Pt 100/1000 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 activation	
G	Alarm and 2 limit value relays or 2 timer relays
M	Alarm and 2 solenoid valve relays or 2 timer relays
Pump activation	
0	none
2	2 pumps via pulse frequency
Control characteristic	
0	none
1	Proportional control
2	PID control
Language	
00	no default setting
DE	German
EN	English
ES	Spanish
SV	Swedish
PT	Portuguese
CN	Chinese
FR	French
CZ	Czech
JP	Japanese
KR	Korean
NO	Norwegian
NL	Dutch
PL	Polish
RU	Russian
TH	Thai
HU	Hungarian
IT	Italian
DK	Danish
FI	Finish
GR	Greek



2.2 DULCOMETER® D1Cb/c Single-channel Measuring and Control Unit for all Measured Variables

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

Subsequent activation of functions is possible at any time using an activation code.

This activation code 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 identcode of the controller (refer to operator menu under "General Settings and Information")
- Required identcode

2.2.3 D1Ub Identity Code Ordering System, Subsequent Function Upgrade for D1Cb

DULCOMETER® D1Ub software upgrade

D1Ub	Software defaults
	Software pre-set
	Default - measured variable
0	Universal (choice upon commissioning)
A	PES
B	Bromine
C	Chlorine
D	Chlorine dioxide
F	Fluoride
H	H ₂ O ₂
I	Chlorite
P	pH
R	ORP
S	0/4-20 mA standard signal, general
T	Temperature
X	O ₂
Z	O ₃
L	Conductivity via mA transducer
	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 controll
2	PID controll
	Language
00	no default



2.2 DULCOMETER® D1Cb/c Single-channel Measuring and Control Unit for all Measured Variables

2.2.4

D1Ub Identity Code Ordering System, Subsequent Function Upgrade for D1Cc

DULCOMETER® D1Uc software upgrade

D1Uc	Software defaults
	Software preset
	Default - measured variable
0	Universal (choice upon commissioning)
A	PES
B	Bromine
C	Chlorine
D	Chlorine dioxide
F	Fluoride
H	H ₂ O ₂
I	Chlorite
P	pH
R	ORP
S	0/4-20 mA standard signal general
T	Temperature
X	O ₂
Z	O ₃
L	Conductivity via mA transducer
	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

2.3 DULCOMETER® D1Ca Single-channel Measuring and Control Unit

Discontinued! Available until the end of May 2013. Replaced by the DACa controller.

D1Ca transmitters/controllers are only available in identcode versions not possible with the D1Cb.

The advantages of the D1Cb are as follows:

- Familiar operation: operation is identical to that of the D1Ca
 - Versatility of menu languages: all listed languages are available in the transducer/control and can be selected manually
 - Flexibility with selection of the measured variable: option to switch between pH and ORP and within the variables using the mA connection
 - Flexibility of voltage supply: international due to wide range power supply
- Our sales team would be pleased to assist you with any queries you may have.

2.3.1

Measured Variables, pH and ORP Single Channel Controller, Type D1Ca

- A range of fully expanded options means optimised adaptation to process requirements
- Large clear graphic display of measuring and correction signals
- Full text user guidance
- Automatic buffer recognition
- Monitors limit values as standard and limits metering times
- Disturbance-free two-wire sensor connector
- 2 electrically isolated 0/4-20 mA signal outputs
- A range of wall and control panel mounted versions
- 2 timers on limit valve relays

Applications:

- waste water treatment
- cooling water treatment
- potable water treatment
- neutralisation
- process control in the chemical industry, food industry, paper manufacture, pharmaceutical industry
- ...

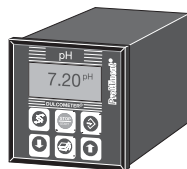
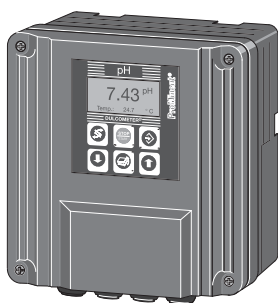
Technical Data

Measuring range	pH 0.00...14.00 ORP - 1,000...+1,000 mV
Resolution	pH: 0.01 ORP voltage: 1 mV
Accuracy	0.5 % from measurement value
Measuring input	SN6 (Input resistance > 10 ¹² Ω) Terminal mV (Input resistance > 5 x 10 ¹¹ Ω) Terminal - standard signal 0/4...20 mA
Correction variable	Temperature via Pt 100 (pH version only)
Correction range	0 ... 100 °C
Disturbance signals	additional/multiplicative
Control characteristic	P/PID control
Control	2-way control
Signal current output	2 x electrically isolated 0/4-20 mA max. load 450 Ω (400 Ω 2nd output) Adjustable range and direction (measurement, correction and control variable)
Control outputs	2 reed contacts (pulse rate, for pump control) 2 relays (pulse length, 3P or limit value, timer) 2 x 0/4...20 mA
Alarm relay	250 V ~3 A, 700 VA changeover contact
Electrical connection	24 V ~/100 V~/115 V~/200 V~/230 V~ ±10 %
Ambient temperature	Control panel version: 0...50 °C (0...45 °C with fully expanded units) Wall mounted: -5...50 °C (-5...40 °C with fully expanded units)
Enclosure rating	Control panel version: IP 54 Wall mounted: IP 65
Dimensions	Control panel version: 96 x 96 x 140 mm (WxHxD) Wall mounted: 198 x 200 x 76 mm (WxHxD)

Order no.

D1Cb mounting kit for control panel installation

792908



pk_5_002



2.3 DULCOMETER® D1Ca Single-channel Measuring and Control Unit

A complete measuring station comprises the following:

- D1Ca measuring transducer /controller (see Identcode)
- In-line probe housing: DGMa..., DLG III ..., immersible in-line probe housing
- pH sensor (dependent on Identcode)
- ORP sensor (dependent on Identcode)
- Transducer for pH and/or ORP (dependent on Identcode)
- Sensor cable

(For further information: Immersion Probe Fittings see p. → 1-73; pH sensors with SN6 or Vario Pin plug-in head see p. → 1-10; ORP sensors with fixed cable see p. → 1-23; Measuring Transducer 4...20 mA (Two Wire) see p. → 2-85; Sensor Accessories see p. → 1-64)

2.3.2 Identcode Ordering System for pH and ORP Single-channel Controller

DULCOMETER® D1Ca Controller

D1Ca	Installation	W	Wall mounted (IP 65)
D	Control panel version 96 x 96 mm (IP 54)		
Operating voltage			
0	230 V, 50/60 Hz	3	100 V, 50/60 Hz (only with control panel installation)
1	115 V, 50/60 Hz	4	24 V, AC/DC
2	200 V, 50/60 Hz (only with control panel installation)		
Measured variable			
P	pH 0-14	R	ORP - 1000...+1000 mV
Measured variable connection			
1	0/4-20 mA standard signal terminal *		
2	SN6 plug		
5	mV terminal		
Correction variable (temperature)			
0	None		
2	Temperature for P, via terminal (Pt 100)		
3	Temperature for P, via 0/4-20 mA standard signal *		
4	Manual temperature input for P		
Disturbance variable			
0	None		
1	Flow as 0/4-20 mA standard signal		
2	Flow as frequency 0-500Hz		
3	Flow as frequency 0-10 Hz		
Control input			
0	None		
1	Pause		
Signal output			
0	none		
1	Standard signal 0/4-20 mA measured value		
2	Standard signal 0/4-20 mA control variable		
3	Standard signal 0/4-20 mA correction variable		
4	2 standard signal outputs, 0/4-20 mA freely programmable		
Relay control			
G	Alarm, timer relay and 2 limit value relays		
M	Alarm and 2 solenoid valve relays (pulse length control)		
R	Alarm relay and servo motor with feedback signal (3P)		
Pump control			
0	None		
2	2 pumps		
Control characteristic			
0	None		
1	Proportional control		
2	PID control		
Protocol output			
0	None		
Language			
A	Swedish (E, P, U)		
B	Portuguese (E, F, S)		
C	Chinese (E)		
D	German (E, F, N)		
E	English (D, F, N)		
F	French (D, E, N)		
G	Czech (D, E, J)		
I	Italian (D, E, S)		
U	Hungarian (A, E, P)		
T	Thai (E)		
S	Spanish (B, E, F)		
R	Russian (E, P, G)		
P	Polish (A, E, U)		
N	Dutch (D, E, F)		
K	Korean (E)		

* Measuring Transducer 4...20 mA (Two Wire) see p. → 2-85

2.3 DULCOMETER® D1Ca Single-channel Measuring and Control Unit

Discontinued! Available until the end of May 2013. Replaced by the DACa controller.

D1Ca transmitters/controllers are only available in identcode versions not possible with the D1Cb.

The advantages of the D1Cb are as follows:

- Familiar operation: operation is identical to that of the D1Ca
- Versatility of menu languages: all listed languages are available in the transducer/control and can be selected manually
- Flexibility with selection of the measured variable: option to switch between pH and ORP and within the variables using the mA connection
- Flexibility of voltage supply: international due to wide range power supply

Our sales team would be pleased to assist you with any queries you may have.

2.3.3

Measured Variables Chlorine, Chlorine Dioxide, Chlorite, Bromine, Ozone, Dissolved Oxygen, Single-Channel Controller, Type D1Ca

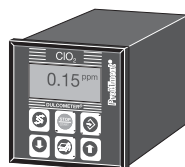
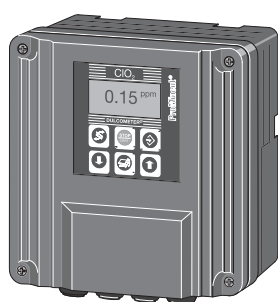
- A range of fully expanded options means optimised adaptation to process requirements
- Large clear graphic display of measured and correction variables
- Full text user guidance
- Monitors limit values as standard and limits metering times
- Disturbance free 2-wire probe connector
- 2 electrically isolated 0/4-20 mA signal outputs
- A range of wall and panel mounted versions
- 2 timers on limit valve relays

Applications:

- potable water treatment
- cooling water treatment
- potable water treatment
- process control (disinfection) in the chemical industry, food industry, paper manufacture, pharmaceutical industry
- ...

Technical Data

Measuring range	Cl ₂ : 0.00...0.500/2.00/5.00/10.0/20.0/50.0/100.0 ppm ClO ₂ : 0.00...0.500/2.00/10.0/20.0 ppm Br ₂ : 0.02...2.00/0.1...10.0 ppm O ₃ : 0.00...2.00 ppm Dissolved oxygen 0.1...10/0.1...20 ppm Chlorite: 0.02...0.50/0.1...2 ppm
Resolution	0.001/0.01 ppm/l/0.1 %
Accuracy	0.5 % from measurement range
Measurement input	Standard signal terminal 0/4...20 mA
Correction variable	pH (Cl ₂ version only) Temperature via Pt 100 (only for ClO ₂ CDP sensor)
Correction range temp.	10 ... 45 °C (only for ClO ₂)
Correction range pH	7.0 ... 8.5 pH (only for Cl ₂)
Disturbance signals	Additive/multiplicative
Control characteristic	P/PID control
Control	2-way control
Signal current output	2 x electrically isolated 0/4-20 mA max. load 600 Ω (400 Ω 2nd output) Adjustable range and direction (measured, correction and control variable)
Control outputs	2 reed contacts (pulse rate, for pump control) 2 relays (pulse length, 3P or limit value) 2 x 0/4...20 mA
Alarm relay	250 V ~ 3 A, 700 VA changeover contact
Electrical connection	24 V ~/100 V~/115 V~/200 V~/230 V ~ ±10 %



pk_5_004

2.3 DULCOMETER® D1Ca Single-channel Measuring and Control Unit

Ambient temperature	Control panel version 0...50 °C (0...45 °C with fully expanded units) Wall mounted: -5...50 °C (-5...40 °C with fully expanded units)
Enclosure rating	Control panel installation: IP 54 Wall mounting: IP 65
Dimensions	Control panel version: 96 x 96 x 140 mm (WxHxD) Wall mounted: 189 x 200 x 76 mm (WxHxD)

	Order no.
D1Cb mounting kit for control panel installation	792908

A complete measuring station comprises the following:

- D1Ca measuring transducer /controller (see Identcode)
- In line probe housing: DGMa..., DLG III ...,
- Chlorine, chlorine dioxide, chlorite, bromine, dissolved oxygen sensor
- Sensor cable

(For further information: Probe Fittings see p. → 1-70; DULCOTEST® Amperometric Sensors see p. → 1-26; Sensor Accessories see p. → 1-64)



2.3 DULCOMETER® D1Ca Single-channel Measuring and Control Unit

2.3.4

Identcode Ordering System Cl₂, ClO₂, O₃, Br₂, Dissolved Oxygen Single Channel Controller

DULCOMETER® D1Ca Controller Series

D1Ca	Installation	
D	Control panel version 96 x 96 mm (IP 54)	
W	Wall mounted (IP 65)	
	Operating voltage	
0	230 V, 50/60 Hz	
1	115 V, 50/60 Hz	
2	200 V, 50/60 Hz (only with control panel installation)	
3	100 V, 50/60 Hz (only with control panel installation)	
4	24 V, AC/DC	
	Measured variable	
B	Bromine (0-10 ppm)	
C	Chlorine (0-0.5/2/5/10/20/50/100 ppm)	
D	Chlorine dioxide (0-0.5/2/10/20 ppm)	
I	Chlorite (0-0.5/2 ppm)	
X	Dissolved oxygen (0.1-10/20 ppm)	
Z	Ozone (0-2 ppm)	
	Measured variable connection	
1	0/4-20 mA standard signal terminal	
	Correction variable (temperature)	
0	None	
1	pH for chlorine via standard signal (0/4-20 mA)	
2	Temperature via terminal (Pt 100) only for ClO ₂ with CDP 1 sensor	
3	Temperature via standard signal 0/4-20 mA only for ClO ₂ with CDP 1 sensor	
4	Manual temperature entry with CDP 1 sensor	
	Disturbance variable	
0	None	
1	Flow as 0/4-20 mA standard signal	
2	Flow as frequency 0-500 Hz	
3	Flow as frequency 0-10 Hz	
	Control input	
0	None	
1	Pause	
	Signal output	
0	none	
1	Standard signal 0/4-20 mA measured value	
2	Standard signal 0/4-20 mA control variable	
3	Standard signal 0/4-20 mA correction variable	
4	2 standard signal outputs, 0/4-20 mA freely programmable	
	Relay control	
G	Alarm, timer and 2 limit value relays	
M	Alarm and 2 solenoid valve relays (pulse length control)	
R	Alarm relay and servo motor with feedback signal (3P)	
	Pump control	
0	None	
2	2 pumps	
	Control characteristic	
0	None	
1	Proportional control	
2	PID control	
	Protocol output	
0	None	
	Language	
A	Swedish (E, P, U)	
B	Portuguese (E, F, S)	
C	Chinese (E)	
D	German (E, F, N)	
E	English (D, F, N)	
F	French (D, E, N)	
G	Czech (D, E, J)	
I	Italian (D, E, S)	
U	Hungarian (A, E, P)	
T	Thai (E)	
S	Spanish (B, E, F)	
R	Russian* (E, P, G)	
P	Polish (A, E, U)	
N	Dutch (D, E, F)	
K	Korean (E)	

* not for measured values: D, Z, X und I

2.3 DULCOMETER® D1Ca Single-channel Measuring and Control Unit

D1Ca transmitters/controllers are only available in identcode versions not possible with the D1Cb.

The advantages of the D1Cb are as follows:

- Familiar operation: operation is identical to that of the D1Ca
- Versatility of menu languages: all listed languages are available in the transducer/control and can be selected manually
- Flexibility with selection of the measured variable: option to switch between pH and ORP and within the variables using the mA connection
- Flexibility of voltage supply: international due to wide range power unit

Our sales team will be pleased to assist you with any queries you may have.

2.3.5

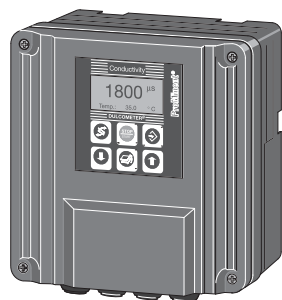
Measured Variable, Conductivity Single Channel Controller, Type D1Ca

- Optimum adaptation to process requirements using various extension stages
- Large, easy-to-read graphic display for measured and correction variables
- Clear text operator guidance
- 2 parameter sets for inductive conductivity
- Connection of 2 and 4 electrode sensors or inductive sensors
- Limit value monitoring as standard and metering time limitation
- Sensor connection insensitive to interference using 2-wire system
- 2 signal outputs 0/4 ... 20 mA galvanically isolated
- Different mountings for wall and control panel installation

Applications:

- Cooling water treatment
- Reverse osmosis
- Ion exchangers
- Process control in the chemical, food, paper manufacturing and pharmaceutical industries ...

Technical Data



pk_5_006

Measuring range	0...20/200/2,000 µS/cm, 0...20/200 mS/cm measured variable L3 0...20/50/200/500/2,000/5,000 µS/cm, 0...200/0...2,000 µS/cm, 0...20/200/2,000 mS/cm measured variable L6
Cell constant	0.006...12.0 (dependent on measuring range)
Resolution	0.0625 % of input range
Accuracy	0.5 % from measurement range
Measuring frequency	56 Hz ... 2.7 kHz
Measurement input	L3: Terminal (conductive 2-electrode and 4-electrode sensors) L6: Terminal, inductive with ICT 1 or ICT 2 sensors
Correction variable	Temperature via Pt 100
Correction range	0 ... 100 °C
Control characteristic	P/PID control
Control	bidirectional control
Signal current output	2 x electrically isolated 0/4-20 mA max. load 600 Ω (400 Ω 2nd output) Adjustable measured, correction and control variable
Control outputs	2 reed contacts (pulse rate, for pump control) 2 relays (pulse length, 3P or limit values with open/close time delay) 2 x 0/4...20 mA
Alarm relay	250 V ~ 3 A, 700 VA changeover contact
Electrical connection	24 V ~/100 V~/115 V~/200 V~/230 V~ ±10 %
Ambient temperature	Control panel version: 0...50 °C (0...45 °C with fully expanded unit) Wall mounted: -5...50 °C (-5...40 °C with fully expanded unit)
Enclosure rating	Control panel installation: IP 64 Wall mounting: IP 65
Dimensions	Control panel version: 96 x 96 x 140 mm (WxHxD) Wall mounted: 189 x 200 x 76 mm (WxHxD)

Order no.

D1Cb mounting kit for control panel installation

792908



2.3 DULCOMETER® D1Ca Single-channel Measuring and Control Unit

A complete measuring station comprises the following:

- D1Ca measuring transducer /controller (see Identcode)
- In-line probe housing: DGMa..., DLG III ..., immersible in-line probe housing
- Conductivity sensor
- Sensor cable

(For further information: Immersion Probe Fittings see p. → 1-73; DULCOTEST® conductivity sensors see p. → 1-50; Sensor Accessories see p. → 1-64)





2.3 DULCOMETER® D1Ca Single-channel Measuring and Control Unit

2.3.6

Identcode Ordering System for Conductivity Single Channel Controller

DULCOMETER® D1Ca Controller Series

D1Ca	Installation
D	Control panel version 96 x 96 mm (IP 54)
W	Wall mounted (IP 54)
Operating voltage	
0	230 V, 50/60 Hz
1	115 V, 50/60 Hz
2	200 V, 50/60 Hz (only with control panel installation)
3	100 V, 50/60 Hz (only with control panel installation)
4	24 V, AC/DC
Measured variable	
L	Conductivity
Measured variable connection	
3	Terminal conductive conductivity sensors
6	Terminal inductive conductivity sensors
Correction variable (temperature)	
0	None
2	Temperature via terminal (Pt 100 of conductivity sensor LFT, LMP, ICT)
3	Temperature via 0/4-20 mA standard signal
4	Manual temperature input
Disturbance variable	
0	None
1	Flow as 0/20 mA standard signal
2	Flow as frequency 0-500 Hz
3	Flow as frequency 0-10 Hz
4	Flow as 0/4-20 mA, standard signal, parameter set switching (Limits)*
5	Parameter set switching (Limits)*
Control input	
0	None
1	Pause
Signal output	
0	none
1	Standard signal 0/4-20 mA measured value
2	Standard signal 0/4-20 mA control variable
3	Standard signal 0/4-20 mA correction variable
4	2 standard signal outputs, 0/4-20 mA freely programmable
Relay control	
G	Alarm, timer and 2 limit value relays
M	Alarm and 2 solenoid valve relays (pulse length control)
R	Alarm relay and servo motor with feedback signal (3P)
Pump control	
0	None
2	2 pumps
Control characteristic	
0	None
1	Proportional control
2	PID control
Protocol output	
0	None
Language	
A	Swedish (E, P, U)
B	Portuguese (E, F, S)
C	Chinese (E)
D	German (E, F, N)
E	English (D, F, N)
F	French (D, E, N)
G	Czech (D, E, J)
I	Italian (D, E, S)
U	Hungarian (A, E, P)
T	Thai (E)
S	Spanish (B, E, F)
P	Polish (A, E, U)
N	Dutch (D, E, F)
K	Korean (E)

* only for measured variable L6

2.3 DULCOMETER® D1Ca Single-channel Measuring and Control Unit

Discontinued! Available until the end of May 2013. Replaced by the DACa controller.

D1Ca transmitters/controllers are only available in identcode versions not possible with the D1Cb.

The advantages of the D1Cb are as follows:

- Familiar operation: operation is identical to that of the D1Ca
- Versatility of menu languages: all listed languages are available in the transducer/control and can be selected manually
- Flexibility with selection of the measured variable: option to switch between pH and ORP and within the variables using the mA connection
- Flexibility of voltage supply: international due to wide range power supply

Our sales team would be pleased to assist you with any queries you may have.

2.3.7

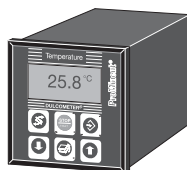
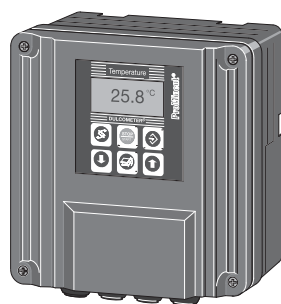
Measured Variable, Temperature, Standard Signal Single Channel Controller, Type D1Ca

- A range of fully expanded elements means optimised adaptation to process requirements
- Large clear graphic display of measured variables
- Pressure, flow, fluid level, turbidity, humidity units (mA-devices)
- full text user guidance
- Monitors limit values as standard and limits metering times
- Probes connected via disturbance-resistant two-wire connector
- 2 electrically isolated 0/4-20 mA signal outputs
- A range of wall and control panel mounted versions
- 2 timers on limit value relays

Applications:

- process control in the chemical industry
- food industry
- paper manufacture
- pharmaceutical industry
- ...

Technical Data



pk_5_008

Measuring range	Temp. 0 ... 100 °C/32-212 °F Standard 0/4 ... 20 mA signal
Resolution	0.1 °C/0.1 °F/0.01 mA
Accuracy	0.5 % from measurement range
Measurement input	Pt 100 temperature terminal 0/4- 20 mA standard signal terminal
Disturbance signals	Additive/multiplicative
Control characteristic	P/PID control
Control	Bidirectional control
Signal current output	2 x electrically isolated 0/4-20 mA max. load 600 Ω (400 Ω 2nd output) Adjustable measured, correction and control variables
Control outputs	2 reed contacts (pulse rate, for pump control) 2 relays (pulse length, 3P or limit value with open/close delay) 2 x 0/4...20 mA
Alarm relay	250 V ~3 A, 700 VA changeover contact
Electrical connection	24 V ~/100 V~/115 V~/200 V~/230 V~
Ambient temperature	Control panel version: 0...50 °C (0...45 °C if fully expanded unit) Wall mounted: -5...50 °C (-5...40 °C if fully expanded unit)
Enclosure rating	Control panel version: IP 54 Wall mounted: IP 65
Dimensions	Control panel version: 96 x 96 x 140 mm (WxHxD) Wall mounted: 189 x 200 x 76 mm (WxHxD)

Order no.

D1Cb mounting kit for control panel installation

792908



2.3 DULCOMETER® D1Ca Single-channel Measuring and Control Unit

A complete measuring station comprises the following:

- D1Ca measuring transducer /controller (see Identcode)
- In-line probe housing: DGMa..., DLG III ..., immersible in-line probe housing
- Pt 100 temperature sensor or on-site standard signal
- Sensor cable

(for further informations: Immersion Probe Fittings see p. → 1-73; Temperature Sensors see p. → 1-25; Sensor Accessories see p. → 1-64)

2.3.8 Identcode Ordering System for Temperature, Standard Signal Single Channel Controller

DULCOMETER® D1Ca Controller Series

D1Ca	Installation
D	Control panel version 96 x 96 mm (IP 54)
W	Wall mounted (IP 54)
Operating voltage	
0	230 V, 50/60 Hz
1	115 V, 50/60 Hz
2	200 V, 50/60 Hz (only with control panel installation)
3	100 V, 50/60 Hz (only with control panel installation)
4	24 V, AC/DC
Measured variable	
S	Standard signal (0/4-20 mA)
T	Temperature (0-100 °C)
Measured variable connection	
1	0/4-20 mA standard signal terminal
4	Pt100 terminal for temperature
Correction variable (temperature)	
0	None
Disturbance variable	
0	None
1	Flow as 0/4-20 mA standard signal
2	Flow as frequency 0-500 Hz
3	Flow as frequency 0-10 Hz
Control input	
0	None
1	Pause
Signal output	
0	none
1	Standard signal 0/4-20 mA measured value
2	Standard signal 0/4-20 mA control variable
3	Standard signal 0/4-20 mA correction variable
4	2 standard signal outputs, 0/4-20 mA freely programmable
Relay control	
G	Alarm, timer and 2 limit value relays
M	Alarm and 2 solenoid valve relays (pulse length control)
R	Alarm relay and servo motor with feedback signal (3P)
Pump control	
0	None
2	2 pumps
Control characteristic	
0	None
1	Proportional control
2	PID control
Protocol output	
0	None
Language	
A	Swedish (E, P, U)
B	Portuguese (E, F, S)
C	Chinese (E)
D	German (E, F, N)
E	English (D, F, N)
F	French (D, E, N)
G	Czech (D, E, J)
I	Italian (D, E, S)
U	Hungarian (A, E, P)
T	Thai (E)
S	Spanish (B, E, F)
P	Polish (A, E, U)
N	Dutch (D, E, F)
K	Korean (E)

2.3 DULCOMETER® D1Ca Single-channel Measuring and Control Unit

Discontinued! Available until the end of May 2013. Replaced by the DACa controller.

D1Ca transmitters/controllers are only available in identcode versions not possible with the D1Cb.

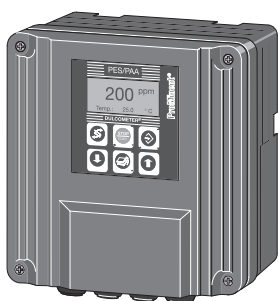
The advantages of the D1Cb are as follows:

- Familiar operation: operation is identical to that of the D1Ca
- Versatility of menu languages: all listed languages are available in the transducer/control and can be selected manually
- Flexibility with selection of the measured variable: option to switch between pH and ORP and within the variables using the mA connection
- Flexibility of voltage supply: international due to wide range power supply

Our sales team would be pleased to assist you with any queries you may have.

2.3.9

Measured Variable H₂O₂ and Peracetic Acid Single-Channel Controller, Type D1Ca



pk_5_010

- Optimised adaptation to process requirements through different expansion levels
- Large, easy-to-read graphic display for measured variables
- Plain text user guidance
- Limit value monitoring as standard and metering time limit
- Interference immunity through 2-wire probe connection
- 2 electrically-isolated 0/4...20 mA signal outputs
- Various versions for wall and control panel mounting
- 2 timers for limit value relay

H₂O₂ applications:

- Chemical bleaching in the timber, paper, textile and mineral salt industries
- Organic synthesis in the chemical, pharmaceutical and cosmetics industries
- Oxidation of potable water, landfill seepage water, contaminated ground water
- Disinfection of cooling water, service water and production water in the pharmaceutical and food and beverage industries and in swimming pools
- Deodorisation (gas scrubber) in municipal and industrial wastewater purification plants
- Dechlorination in chemical processes

Peracetic acid applications:

- Disinfection in the food and beverage sector
- Disinfection in the cosmetics, pharmaceutical and medicine sectors
- CIP processes

The measurement can even be used where surfactants (tensides) are present.

The H₂O₂ sensors are selected using the selection table in Chap. Sensors For Hydrogen Peroxide (→ 2-23)

Technical Data

Hydrogen peroxide H₂O₂:

Sensor type	PER 1	PEROX
Ranges	2.0...200.0 mg/l 20...2,000 mg/l different sensors	1...20/10...200/100...2,000 mg/l selectable

Peracetic acid applications:

Sensor type	PAA 1
Range	0...20/200/2,000 mg/l 0...1 Vol. % different sensors

Additional technical data on the sensors: Sensors for hydrogen peroxide see p. → 1-48; Sensors for peracetic acid see p. → 1-47

2.3 DULCOMETER® D1Ca Single-channel Measuring and Control Unit

Resolution	0.01 ppm
Accuracy	0.5 % of range
Measurement input	0/4 ... 20 mA standard signal terminal
Disturbance signals	Additive/multiplicative
Control characteristic	P/PID control
Control	Bidirectional control
Signal current output	2 x 0/4-20 mA electrically isolated max. load 600 Ω (400 Ω 2nd output) adjustable measured variable range
Control outputs	2 reed contacts (pulse frequency for pump control) 2 relays (pulse length, 3P or limit value) 2 x 0/4 ... 20 mA
Alarm relay	250 V ~ 3 A, 700 VA changeover contact
Electrical connection	24 V ~/100 V~/115 V~/200 V~/230 V~
Ambient temperature	Control panel version: 0 ... 50 °C (0 ... 45 °C with fully expanded unit) Wall mounted: -5 ... 50 °C (-5 ... 40 °C with fully expanded unit)
Enclosure rating	Control panel version: IP 54 Wall mounted: IP 65
Dimensions	Control panel version: 96 x 96 x 140 mm (WxHxD) Wall mounted: 189 x 200 x 76 mm (WxHxD)

Order no.

D1Cb mounting kit for control panel installation
792908

A complete channel consists of:

- Transmitter /controller D1Ca (see Identcode)
- Housing: DGMa..., DLG III...
- H₂O₂ sensor or
- Peracetic acid sensor
- Transducer for H₂O₂ PEROX sensor
- Sensor cable

(for further information: Immersion Probe Fittings see p. → 1-73; Sensors for hydrogen peroxide see p. → 1-48; Sensors for peracetic acid see p. → 1-47; Measurement Transducer 4...20 mA (Two Wire) see p. → 2-85; Sensor Accessories see p. → 1-64)



2.3 DULCOMETER® D1Ca Single-channel Measuring and Control Unit

2.3.10

Identcode Ordering System for H₂O₂ And Peracetic Acid Single-Channel Controller

DULCOMETER® D1Ca controller range

D1Ca	Installation	
D	Control panel version 96 x 96 mm (IP 54)	
W	Wall mounted (IP 54)	
	Operating voltage	
0	230 V, 50/60 Hz	
1	115 V, 50/60 Hz	
2	200 V, 50/60 Hz (only with control panel installation)	
3	100 V, 50/60 Hz (only with control panel installation)	
4	24 V, AC/DC	
	Measured variable	
A	Peracetic acid	
H	Hydrogen peroxide	
	Measured variable connection	
1	0/4-20 mA standard signal terminal for sensors with PEROX micro-transducer	
7	0/4-20 mA standard signal terminal for PAA 1 and PER 1 sensors	
	Correction variable (temperature)	
0	None	
2	Temperature Pt100 via terminal*	
3	Temperature via 0/4-20 mA standard signal (DULCOTEST® transducer)*	
4	Manual temperature input*	
	* only with measured variable connection option 1	
	Disturbance variable	
0	None	
1	Flow as 0/4-20 mA standard signal	
2	Flow as frequency 0-500 Hz	
3	Flow as frequency 0-10 Hz	
	Control input	
0	None	
1	Pause	
	Signal output	
0	none	
1	Standard signal 0/4-20 mA measured value	
2	Standard signal 0/4-20 mA control variable	
3	Standard signal 0/4-20 mA correction variable	
4	2 standard signal outputs, 0/4-20 mA freely programmable	
	Relay control	
G	Alarm, timer and 2 limit value relays	
M	Alarm and 2 solenoid valve relays (pulse length control)	
R	Alarm relay and servo motor with feedback signal (3P)	
	Pump control	
0	None	
2	2 pumps	
	Control characteristic	
0	None	
1	Proportional control	
2	PID control	
	Protocol output	
0	None	
	Language	
D	German (E, F, N)	
E	English (D, F, N)	
F	French (D, E, N)	
I	Italian (D, F, S)	
N	Dutch (D, E, F)	



2.3 DULCOMETER® D1Ca Single-channel Measuring and Control Unit

2.3.11 Sensors for Hydrogen Peroxide

The 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

The sensors are selected using the following decision table:

Requirement	Type PER1	PEROX
Sensor matrix contaminated by dirt or chemicals	Suitable due to impermeable diaphragm	More susceptible due to permeable diaphragm
Electrical interference due to interference potentials in the sample medium	Immune as counter electrode is separated from process	More susceptible as counter electrode is in the medium
Temperature range	Up to 50 °C	Up to 40 °C
Ease of handling during installation and maintenance	Suitable because temperature compensation and measuring transducer are integrated in the sensor	Separate temperature sensor and measuring transducer
Response time for H ₂ O ₂ for fast controll	Inert T ₉₀ = 6-8 min	Fast: T ₉₀ = 20 s
Fast temperature changes	Inert because of integrated temperature sensor	Fast because of separate temperature sensor
Long process cycles without presence of H ₂ O ₂	unsuitable	Suitable because of pulsed polarisation technology
Measuring range can vary from time to time because of size arrangements or is not clear at time of ordering	Selection of a suitable sensor necessary	Suitable because measuring range can be selected manually at the sensor transducer
Price of the measuring station	lower	higher

Operating conditions

Requirement	Type PER1	PEROX
Measured variable	Hydrogen peroxide	Hydrogen peroxide
Calibration	Photometric with manual DT3 photometer *	Photometric with manual DT3 photometer *
Measuring range	0 ... 20/200/2,000 mg/l 0 ... 1 Vol. % different sensors	1 ... 20/10 ... 200/100 ... 2,000 mg/l switchable
pH range	2.5...11	2.5...10
Temperature	0 ... 50 °C	0 ... 40 °C (at > 1,000 ppm 0 ... 30 °C)
Permissible temperature changes	< 0.3 °K/min	< 1 °K/min (with external T measurement) see Op. Instructs
Response time of sensor	T ₉₀ approx. 480 sec	T ₉₀ approx. 20 sec.
Reproducible measuring accuracy	1 ppm or better than ± 5 % of the measured value	better than 2 % based on the full-scale reading
Min. conductivity	0.05 ... 5.00 mS/cm	for measuring range 20 mg/l: 5 µS/cm Measuring range 200 mg/l: 200 µS/cm up to 1,000 mg/l: 500 µS/cm up to 2,000 mg/l: 1 mS/cm
Sample water flow	20 ... 100 l/h in the DGMA	Recommended 60 l/h
Max. operating pressure	0 ... 1 bar	2 bar
Supply voltage	16...24 VDC (2-wire)	16...24 VDC (3-wire)
Output signal	4 ... 20 mA, temperature-compensated, uncalibrated, not galvanically isolated	4 ... 20 mA, temperature-compensated, uncalibrated, not galvanically isolated
Typical application	Swimming pool, treatment of contaminated waste water, treatment of process media from production	Treatment of clear and chemically uncontaminated water, controls with the necessary short reaction times
Measuring and control device	D1Ca...H 7	D1Ca...H 1
Fittings	DGM, DLG	DGM, DLG

* Photometer → 2-82

2.3 DULCOMETER® D1Ca Single-channel Measuring and Control Unit

Accessories

	Order no.
Perox sensor PEROX-H2.10-P	792976
Perox transducer V1	1034100
PER 1-mA-200 ppm	1022509
PER 1-mA-2,000 ppm	1022510

Possible configurations

Example of the components of a PEROX H₂O₂ measuring

Item	Name	see page	Order no.
1	H ₂ O ₂ controller D1Ca##H1...	→ 2-22	–
2.1	PEROX-H2.10-P perox sensor	→ 1-49	792976
2.2	Pt 100 SE temperature sensor	→ 1-25	305063
3	Perox transducer V1 three switchable measuring ranges 20/200/2,000 mg/l	→ 1-49	1034100
4	Polishing paste (90 g tube)	–	559810
5	Magnetic stirring rod 15x6 PTFE (magnetic “fish”)	–	790917
7	Magnetic stirrer 100 ... 240 V	–	790915
6	Test lead, 3-core (3 x 0.25 mm ² , 5 mm diam.), state length	–	791948
7	SN6 - open ended (Cable PT 100 with D1C, 5 m)	→ 1-65	1003208
8	DLG III A with PVC hose connectors	→ 1-70	914955
8.1	Alternatively for water containing impurities: DLG IV PVC with four slots for sensors, connection: DN 10	→ 1-70	1005332
9	Photometer DT3B, compl. in case	→ 2-82	1039317

Example of the components of a PER1 H₂O₂ measuring point

Item	Name	see page	Order no.
1	H ₂ O ₂ controller D1Ca##H7...	→ 2-22	–
2	PER 1-mA-200 ppm	→ 1-48	1022509
2.1	Alternatively: PER 1-mA-2,000 ppm	→ 1-48	1022510
3	Signal lead, sold by the metre 2 x 0.25 mm ² Ø 4 mm	→ 1-66	725122
4	DLG III A with PVC hose connectors	→ 1-70	914955
4.1	DLG III B with PVC adhesive connectors, for installation of two sensors PG 13.5 and one amperometric sensor, connection DN 10	→ 1-70	914956
4.1.1	Assembly kit for fitting amperometric sensors in DLG III B	→ 1-70	815079
5	Photometer DT3B, compl. in case	→ 2-82	1039317

Example of the components of a PAA 1 peracetic acid measuring point

Item	Name	see page	Order no.
1	PAA controller D1Ca##A7...	→ 2-22	–
2.1	PAA 1-mA-200 ppm	→ 1-47	1022506
2.1	Alternatively: PAA 1-mA-2,000 ppm	→ 1-47	1022507
3	Signal lead, sold by the metre 2 x 0.25 mm ² Ø 4 mm	→ 1-66	725122
4	DLG III A with PVC hose connectors	→ 1-70	914955
4.1	DLG III B with PVC adhesive connectors, for installation of two sensors PG 13.5 and one amperometric sensor, connection DN 10	→ 1-70	914956
4.1.1	Assembly kit for fitting amperometric sensors in DLG III B	→ 1-70	815079

2.4 DULCOMETER® diaLog DACa Multi-parameter Controller

2.4.1

diaLog DACa Multi-parameter Controller



P_DM_0027_C

NEW

The DULCOMETER® diaLog DACa multi-parameter controller is the new controller platform from ProMinent. It replaces the D1Ca/D2Ca controllers. The diaLog DACa can also be installed in a control cabinet using the optional mounting kit. The diaLog DACa has been specifically developed for the continuous control of liquid analysis parameters in water treatment processes, environmental technology and industry.

The DULCOMETER® diaLog DACa multi-parameter controller is available in a version with one or two measuring channels and can work with conventional analogue sensors and actuators. It is also equipped to communicate with digital sensors and actuators via the CANopen sensor/actuator bus.

The diaLog DACa controller intelligently closes the control circuit between ProMinent® DULCOTEST® sensors and ProMinent® metering pumps offering special functions, as required in water treatment.

Typical applications

- Potable water treatment
- Waste water treatment
- Industrial and process water treatment
- Swimming pool water treatment

Standard equipment

- 1 measuring channel with 14 freely selectable measured variables (via the mV or mA input. The measured variables conductive and inductive conductivity are currently only available with the D1Ca).
- PID controller with frequency-based metering pump control for 2 metering pumps.
- 2 analogue outputs for measured value, correction variable or control variable (dependent on the optional equipment).
- 2 digital inputs for sample water fault detection, pause and parameter switching.
- 2 relays with limit value functions, timer and non-continuous control, 3-point step control (dependent on the optional equipment).
- Measured variables and language selection during commissioning.
- Temperature compensation for the pH and fluoride measured variables.
- 22 operating languages: Bulgarian, Chinese, Danish, German, English, Finnish, French, Greek, Italian, Korean, Dutch, Norwegian, Polish, Portuguese, Russian, Romanian, Swedish, Slovak, Spanish, Thai, Czech, Hungarian.
- Saving and transfer of device parameterisation using the SD card.
- Subsequent upgrade of the software functions by means of an activation key or firmware update.

Optional accessories

- Second, complete measuring and control channel with second PID controller.
- PC configuration software*.
- Data and event logger with SD card.
- Measured value tendency display via controller display.
- Disturbance variable processing (flow) via mA or frequency.
- Compensation of the pH influence on chlorine measurement.
- 3 additional inputs, e.g. for level monitoring.
- PROFIBUS® DP*.
- ModBus RTU*.
- Visualisation via LAN/WLAN web access*.

* in preparation

diaLog DACa Controller available from March 2013



2.4 DULCOMETER® diaLog DACa Multi-parameter Controller

Technical Data

Measuring range	mV connection type: pH: 0.00 ... 14.00 ORP voltage: -1,500 ... +1,500 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 converter) 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)
Correction variable	Temperature via Pt 100/Pt 1000
Correction range	0 ... 100 °C
pH compensation range for chlorine	6.5 ... 8.5
Disturbance signals	Flow via mA or frequency
Control characteristic	P/PID control
Control	2 x bidirectional control
Signal current output	,2 x 0/4 ... 20 mA electrically isolated, max. load 450 Ω, range and allocation (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) 2 x 0/4 ... 20 mA
Alarm relay	250 V ~3 A, 700 VA contact type changeover contact
Electrical connection	90-253 V, 50/60 Hz, 25 VA
Ambient temperature	0 ... 55 °C (for indoor installation or with protective housing)
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

A complete measuring station comprises the following:

- DACa measuring transducer /controller (see identity code)
- Valve: DGMa..., DLG III ..., immersible valve
- pH sensor (identity code dependent)
- ORP sensor (identity code dependent)
- Chlorine, chlorine dioxide, chlorite, bromine, dissolved oxygen sensor
- Transducers for pH and/or ORP (identity code dependent)
- Sensor cable

(for further information: Immersion Probe Fittings see p. → 1-73; pH sensors with SN6 or Vario Pin plug-in head see p. → 1-10; ORP sensors with fixed cable see p. → 1-23; Chlorine sensors see p. → 1-27; Measuring Transducer 4...20 mA (Two Wire) see p. → 2-85; Sensor Accessories see p. → 1-64)



2.4 DULCOMETER® diaLog DACa Multi-parameter Controller

Accessories

	Order no.
Cable combination coax 0.8 m - pre-assembled*	1024105
Cable combination coax 2 m- SN6 - pre-assembled*	1024106
Cable combination coax 5 m- SN6 - pre-assembled*	1024107
SN6 connection, refitting, D1Cb	1036885
Coaxial cable Ø 5 mm, 0.8 m - SS	305077
Coaxial cable Ø 5 mm, 2.0 m - SS	304955
Coaxial cable Ø 5 mm, 5.0 m - SS	304956
Fitting kit for DAC control panel installation	1041095



2.4 DULCOMETER® diaLog DACa Multi-parameter Controller

2.4.2 diaLog DACa Identcode Ordering System

DULCOMETER® diaLog DACa range, wall-mounted IP 67

DACa	Version	
00	Wall mounted with ProMinent® logo	
S0	With fitting kit for control cabinet	
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 control 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 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		
0	none	
Communication		
0	none	
Data logger		
0	No data logger	
1	Data logger with measured value display and SD card	
Hardware upgrade		
0	none	
1	Protective RC circuit for power relay	
Approvals		
0	none (CE standard)	
Certificates		
0	none	
Documentation language		
DE	German	
EN	English	
ES	Spanish	
FR	French	

2.5 DULCOMETER® DSRa Two-channel Measuring and Control Unit for the Treatment of Pool Water

2.5.1

DULCOMETER® DSRa Two-channel Controller

DULCOMETER® DSRa transducers with control function are intended for the simultaneous measurement and control of the measured variables pH and ORP. They provide basic functions for applications in the treatment of swimming pool water.

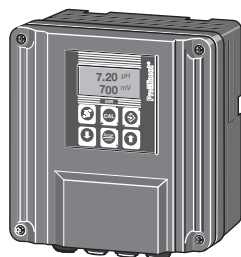
Features

- Large, easily readable illuminated display for display of measured values and parameterisation/configuration
- Plain text operator guidance in 8 selectable languages
- 2 digital inputs for pause or sample water errors or level switch-off
- Two power actuating outputs for control of the metering pumps by pulse width modulation (direct switching of operating voltage)
- Control characteristics: Proportional control for both measured variables
- One control direction (raise or lower measured value, selectable)
- Protective RC circuit to protect the power relays when switching inductive loads, such as motor-driven metering pumps
- The display can be switched to ppm chlorine, with control being based on ORP

Applications

- Swimming pool water treatment

Technical Data



P_DM_0020_SW

Measuring range	pH: 2.00 ... 12 ORP: 100 ... 1,000 mV
Resolution	pH: 0.01 pH ORP: 1 mV
Control characteristic	P control
Control	Two 1-way controllers with selectable control direction (raise/lower)
Control outputs	2 power relays under operating voltage with pulse length control outputs
Electrical connection	115 V~/230 V~
Ambient temperature	-5 ... 50 °C
Enclosure rating	Wall mounted: IP 65
Dimensions	Wall mounted: 189 x 200 x 76 mm (WxHxD)

A complete pool measuring and control system includes the following components (without metering pumps). The lengths of the cables depend on the respective installation:

- 1 Transducer with control function, type DSRa, identcode DSRaW20PR5020N010D1
- 1 DULCOTEST® flow meter DGMa120T000
- 1 pH sensor, PHES 112 SE, part no. 150702
- 1 ORP sensor, RHES-Pt-SE, part no. Nr. 150703
- 2 Cable combinations coax 2 m - SN6 precon., part no. 1005672



2.5 DULCOMETER® DSRa Two-channel Measuring and Control Unit for the Treatment of Pool Water

2.5.2 Identcode Ordering System Two-Channel Controller

DULCOMETER® DSRa controller series

DSRa	Version	
W	Wall -mounted(IP 65)	
	Version	
0	Housing colour RAL 7035, light grey	
2	Housing colour, RAL 5003, blue	
	Operating voltage	
0	230 V, 50/60 Hz	
1	115 V, 50/60 Hz	
	Measured variable	
PR	ph/ORP	
	Connection of measured variable	
5	mV terminal (for pH or ORP)	
	Correction variable	
0	None	
	Control input	
2	2 Pause / Contact inputs	
	Signal output	
0	None	
	Power control	
N	Switch on operating voltage (relay with operating voltage)	
	Pump control	
0	no frequency control	
	Control characteristic	
0	Proportional control	
	Communication interface	
0	None	
	Language	
D	german	
E	english	
F	french	
G	czech	
I	italian	
R	russian	
N	dutch	
S	spanish	
	Default setting	
1	Optional display in ppm (not enabled on delivery)	
	Approval	
01	CE approval	

2.6 DULCOMETER® D2Ca Two-Channel Measuring and Control Unit

2.6.1

Combined Controller for pH/Chlorine, pH/ORP, Chlorine/Chlorine, pH/Chlorine Dioxide and pH/pH, Two-Channel Controller, Type D2Ca

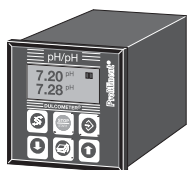
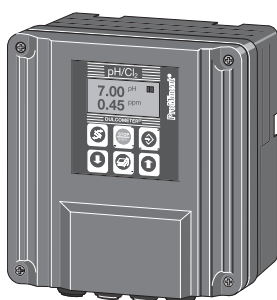
Discontinued! Available until the end of May 2013. Replaced by the DACa controller.

- different configurations mean optimised adaptation to process requirements
- large, clear graphic display for the measured values
- full text user guidance
- limit value monitoring with controller output deactivation as standard
- disturbance-free two-wire sensor connector
- 2 signal outputs 0/4...20 mA, electrically isolated
- different designs for wall and control panel mounting
- 2 digital inputs for pause and error sample water
- differential pH measurement (sensor monitoring)
- differential chlorine measurement
- control output to minimise combined chlorine

Applications:

- Waste water treatment
- Cooling water treatment
- Potable water treatment
- Neutralisation
- Swimming pool water treatment
- All applications which have to be equipped with a redundant pH measurement for safety reasons.

Technical Data



pk_5_015

Measuring range	pH 0.00 ... 14.00 ORP 0 ... +1,000 mV Chlorine 0 ... 0,5/2/10/20/50/100 ppm Chlorine dioxide 0.00 ... 0.500/2.00/10.0/20.0 ppm Chlorine/Chlorine 0 ... 2/5/10 ppm
Resolution	0.01 pH/1 mV/0.001 ppm/0.01 ppm
Accuracy	0.5 % from measurement range
Measurement input	pH/ORP (input resistance > 10 ¹² Ω) measured variable 1: mV terminal (input resistance > 5 x 10 ¹¹ Ω) or Standard 4 ... 20 mA signal terminal measured variable 2: Standard 4 ... 20 mA signal terminal
Correction variable	Temperature via Pt 100 (pH only)
Correction range temp.	0 ... 100 °C
Control characteristic	P/PID control
Control	unidirectional (pH/ORP and pH/chlorine)
Signal current output	2 x electrically isolated 0/4-20 mA max. load 600 Ω (400 Ω 2nd output) Adjustable range and direction (measured, correction and control variable)
Control outputs	2 reed contacts (pulse frequency, pump actuation) 2 relays (pump impulse, 3P or limit value) 2 x 0/4 ... 20 mA
Control input	Voltage free (electrically isolated) – pause – error, water sample (or superchlorination or basic load chlorine)
Alarm relay	250 V ~3 A, 700 VA changeover contact
Electrical connection	24 V ~/115 V~/230 V~
Ambient temperature	Control panel version: 0 ... 45 °C Wall mounted: -5 ... 40 °C
Enclosure rating	Control panel version: IP 54 Wall mounted: IP 65
Dimensions	Control panel version: 96 x 96 x 140 mm (WxHxD) Wall mounted: 189 x 200 x 76 mm (WxHxD)

Note:

The pH/pH and chlorine/chlorine versions include only one 2-way controller for measuring channel 1.

Measured variable 2 can only be used for monitoring tasks or to calculate the difference. Measuring channel 2 with chlorine/chlorine can only display the bound chlorine.



2.6 DULCOMETER® D2Ca Two-Channel Measuring and Control Unit

A complete measuring station comprises the following:

- D2Ca measuring transducer /controller (see Identcode)
- In-line probe housing: DGMa..., DLG III ..., immersible in-line probe housing
- Chlorine sensor
- Chlorine dioxide
- Assembly set for chlorine/chlorine dioxide sensor
- pH sensor
- ORP sensor
- Transducer for pH and/or ORP (dependent on Identcode)
- Sensor cable

(For further informations: Immersion Probe Fittings see p. → 1-73; Chlorine sensors see p. → 1-27; Chlorine dioxide sensors see p. → 1-40; pH sensors with SN6 or Vario Pin plug-in head see p. → 1-10; ORP sensors with fixed cable see p. → 1-23; Measurement Transducer 4...20 mA (Two Wire) see p. → 2-85; Sensor Accessories see p. → 1-64)





2.6 DULCOMETER® D2Ca Two-Channel Measuring and Control Unit

2.6.2

Identcode Ordering System for Two-Channel Controller

DULCOMETER® D2Ca Controller range

D2Ca	Installation
D	Control panel version 96 x 96 mm (IP 54)
W	Wall mounted (IP 65)
Power supply	
0	230 V, 50/60 Hz
1	115 V, 50/60 Hz
4	24 V, AC/DC
Measured variable	
PC	pH/chlorine (0-14 pH; 0-0.5/2/5/10/20/50/100 ppm)
PR	ph/ORP (0-14 pH; 0-1,000 mV)
PP	pH/pH (0-14 pH) ¹
CC	Chlorine/Chlorine (0-2/5/10 ppm)
PD	pH/Chlorine dioxide (0-0.5/2/10/20 ppm)
Measured variable 1 connection (measured variable 2 is always mA)	
1	Standard 0/4-20 mA terminal *
2	SN6 plug
5	mV terminal
Correction variable (temperature compensation for pH)	
0	None
2	Temperature for P via terminal (Pt 100) for pH only
4	Manual temperature input for P for pH only
Disturbance variable	
0	None
Signal output	
0	None
4	2 programmable 0/4-20 mA standard signal outputs
Relay control	
G	Alarm and 2 limit value relays
M	Alarm and 2 solenoid valve relays (pulse length control)
Control characteristic	
1	Proportional control
2	PID control
Protocol output	
0	None
Language	
D	German
E	English
F	French
I	Italian (only PC and PR)
S	Spanish
A	Swedish
N	Dutch
P	Polish (only PC and PR)

Note:

The pH/pH and chlorine/chlorine versions include only one 2-way controller for measuring channel 1.

Measured variable 2 can only be used for monitoring tasks or to calculate the difference. Measuring channel 2 with chlorine/chlorine can only display the bound chlorine.

* Measured Variables pH, ORP, Chlorine, Temperature, Conductivity, Measuring Transducer DMTa see p. → 2-75, Measurement Transducer 4...20 mA (Two Wire) see p. → 2-85

2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment



pk_5_045



The DULCOMARIN® II multi-channel measuring and control system is impressive, thanks to the following features:

- 5.7", 1/4 VGA colour display for simple operation
- Integral data logger with screen plotter: view measured data directly on the controller
- SD card and card reader for PC included: simply transfer measured data to your PC as standard
- Control of one to 16 potable water systems or filtration circuits in swimming pools
- CAN bus system: Simple to wire, subsequently extendable
- Visualisation*: simple with embedded web server* and standard web browser
- LAN interface*: simple connection to your PC, PC network or the internet
- Operation via Apple® iPod, iPad (WLAN access point necessary)
- Intelligent sensors: save sensor data with CANopen bus and ensure you always remain within the optimum measuring range with auto ranging
- Intelligent metering pumps: use CANopen bus to obtain 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
- Standby metering pump for disinfectants (automatic switchover in the event of low fluid level and pump malfunction)
- PROFIBUS® DP V1 gateway

Potable water applications (and general applications)

- Measure and display the following measuring parameters using 0/4...20 mA with a current input module (I-module). These values are also available on the data logger/screen plotter, the web and OPC server:
 - Flow (as disturbance variable control for pH and chlorine regulation)
 - UV intensity
 - Conductivity
 - Chlorine dioxide
 - Chlorite
 - Ammonia
 - Fluoride
 - Pt100 resistance thermometer via a transducer
- Display and control of free chlorine and total available chlorine
- OPC server*: Simple connection to higher-level visualisation systems

*optional

Swimming pool applications

- Remote calibration via Apple® iPod, iPad or smart phone (web server option and WLAN access point necessary)
- Power and chemical savings with the new Eco!Mode
- Filter control and control of attractions
- Combined chlorine: reliably reduced by the control output and corresponding systems
- OPC server*: Simple connection to higher-level visualisation systems
- Regulate the pool temperature using standard temperature controllers (Pt100x necessary)
- Superchlorination or off-peak reduction by contact via second parameter set
- The decentralised modular DULCOMARIN® II system is designed for use in DIN 19643-compliant public swimming pools. The system can be configured to meet requirements as the compact system DULCOMARIN® II Compact or as the decentralised modular system DULCOMARIN® II DULCO® Net.

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 and analogue input are necessary 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 CO₂ emissions.

In addition, upon reaching an adjustable ORP potential, e.g. 780 mV, which signals effective disinfection of the water, chlorine metering is reduced either in one step or in steps. If the DIN hygiene parameters are no longer adhered to, then chlorine metering is again raised to the normal setpoint.



2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

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 technology COM (Component Object Model) and DCOM (Distributed Component Object Model). 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 precisely once for each device and 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 DULCOMARIN® II multi-channel measuring and control system.

The examples shown in the following are suitable for applications in potable water treatment and in swimming pool technology.

2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

2.7.1

DULCOMARIN® II compact Multi-channel Multi-parameter Measuring and Control System

The DULCOMARIN® II multi-channel measuring and control system is suitable for the control of 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 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 current inputs active/passive (e.g. to connect 2-wire measuring transducers)
- 1 current input passive (e.g. to connect a magnetically-inductive flow meter)
- 2 digital inputs for sample water alarm and pause control

F module (functional mode)

The F module consolidates functions and also extends these functions

The following functions can be provided using the F module (you can find details for this in the individual application examples of the assembly and operating instructions):

- Control of circulating 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 standby operation
- Circulation flow control (Flowcontrol)
- Water level control
- Sample water valve
- Heating function
- Gutter cleaning function
- Attractions
- Flow control
- Control variables

PROFIBUS® DP V1 gateway



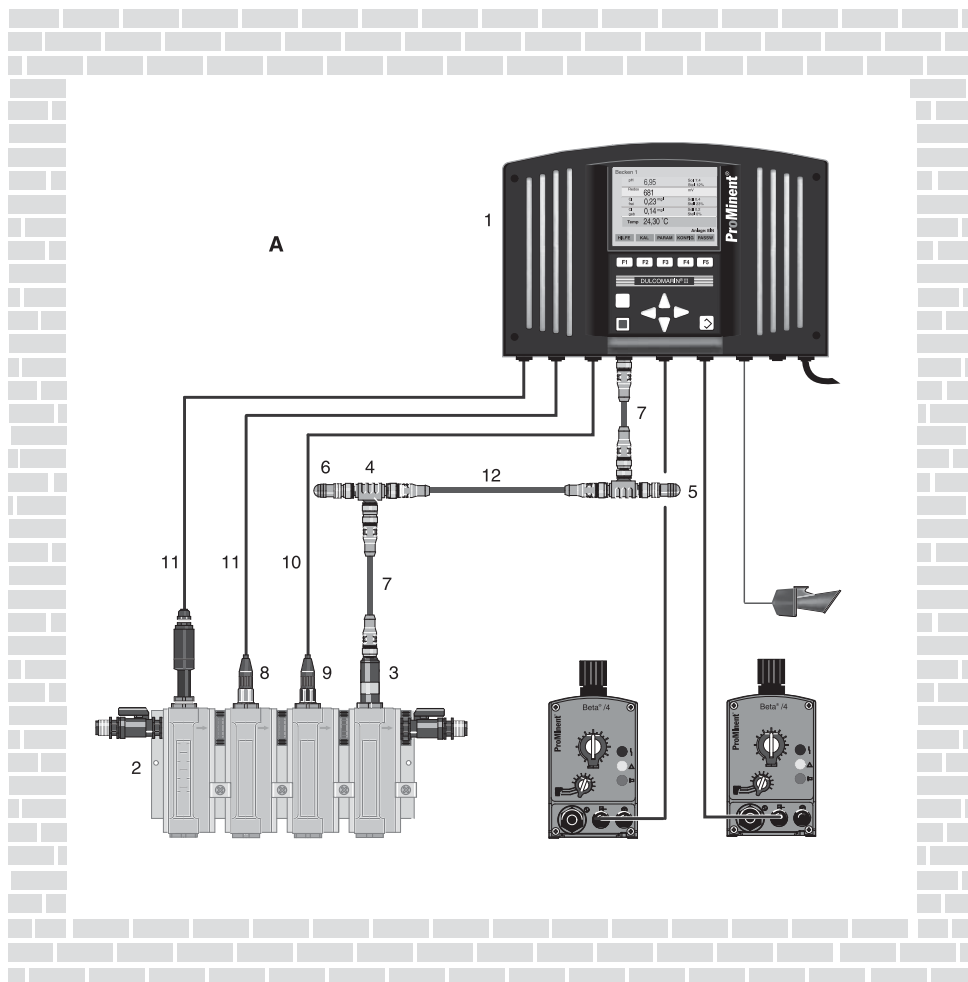


2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

Example 1

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



pk_5_020

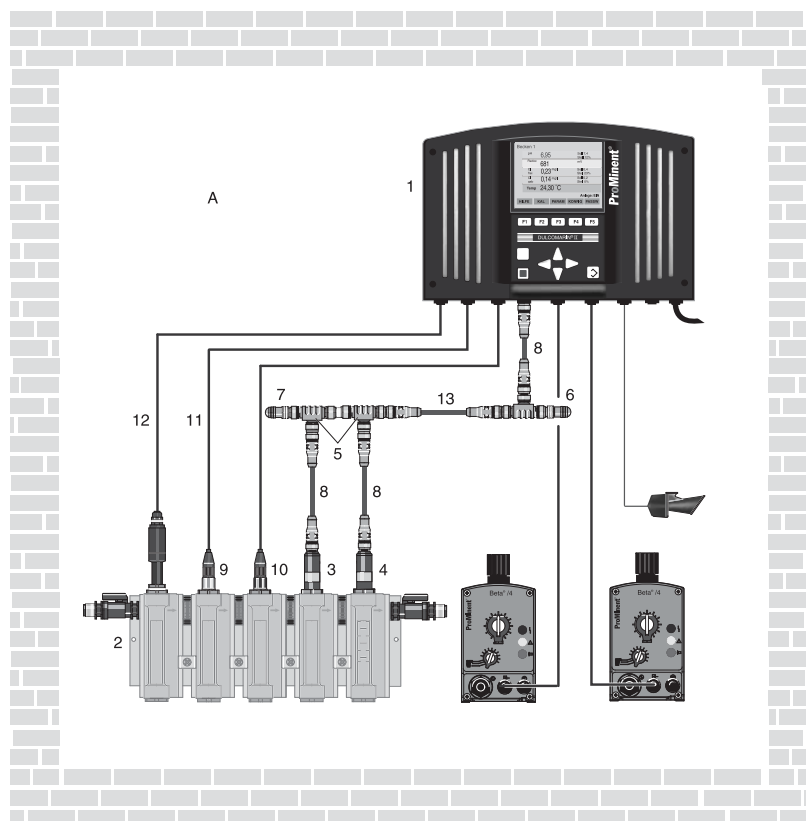
Item	Quantity	Name	Order no.
1	1	DULCOMARIN® II central unit with measuring and actuation modules DXCa W 0 0 1 M A P S EN 01	–
2	1	DULCOTEST® in-line probe housing DGMa 3 2 1 T 0 0 0	–
3	1	Chlorine sensor CLE 3-CAN-10 ppm	1023425
4	3	T-distributor M12 5 pol. CAN	included in delivery
5	1	Termination resistance M12 connector	included in delivery
6	1	Termination 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	1	Cable combination coax 2 m- SN6 - pre-assembled*	1024106
11	2 m	Signal lead, sold by the metre 2 x 0.25 mm² Ø 4 mm	725122
12	–	Connection cable CAN	as required

2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

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 Plants room



pk_5_020_1

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 housing DGMa 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	1	Cable combination coax 2 m- SN6 - pre-assembled*	1024106
12	2 m	Signal lead, sold by the metre 2 x 0.25 mm ² Ø 4 mm	725122
13	1	CAN connection cable	as required



2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

2.7.2

DULCOMARIN®II compact Identcode Ordering System

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 5m LAN patch cable 1:1, LAN coupling, 5m crossover cable ¹⁾
Options	
1	Videographic recorder with data logger including SD card and USB card reader for PC
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 Identcode describes the **DULCOMARIN®II compact** controller.

- ¹⁾ The cable supplied is intended for connection to a hub, switch, router or Intranet.
The maximum LAN cable length is approx. 100 m.
To operate the Web server on a PC we recommend using Microsoft®Internet Explorer 5 or higher as your browser.
The following components are supplied in the DXCa package:
1 T-distributor, 1 CAN connecting cable,
1 termination resistor coupling and
1 termination resistor plug,
1 SC card, 1 card reader for PC.

Important note when ordering multi-channel measuring and control systems for potable water and pool water applications:

Potable water applications: In the identcode, 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 identcode, 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.

2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

2.7.3

DULCOMARIN® II DULCO®-Net multi-channel-multi-parameter Measuring and Control System

The DULCOMARIN® II DULCO® Net multi-channel measuring and control system 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 control for pH and chlorine regulation)
- 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 of disinfectant and flocculant 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 each bus module (M module, A module, P module, N module, Beta®/4 CANopen metering pumps and CAN chlorine sensors) to the bus backbone using 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

The DULCOMARIN® II Compact and DULCO® Net can be easily extended by the connection of bus modules.



2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

Which components can a DULCOMARIN® II DULCO® Net system consist of?

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 position feedback processing)
- I module (processing of sensor signals via 0/4...20 mA)
- F module (filter and attraction control)

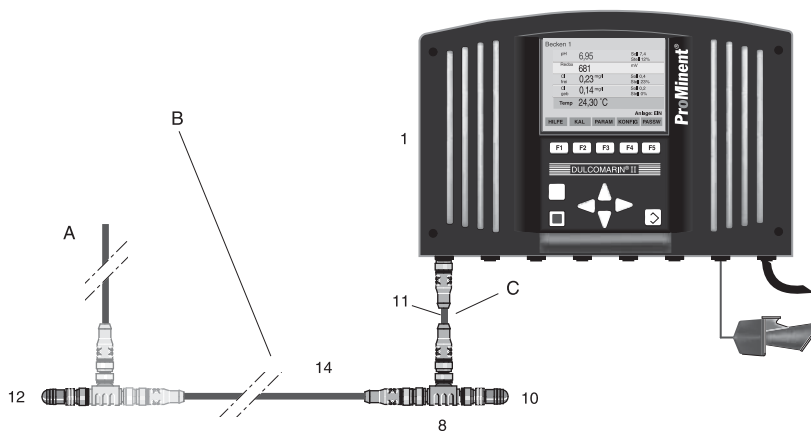
The maximum bus backbone length is approximately 400 m!



2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

2.7.4 The Central Unit

- A Stub cable
- B Main BUS cable
- C Stub cable



pk_5_041_2

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 in the scope of delivery.

The central unit in the above example consists of the following components:

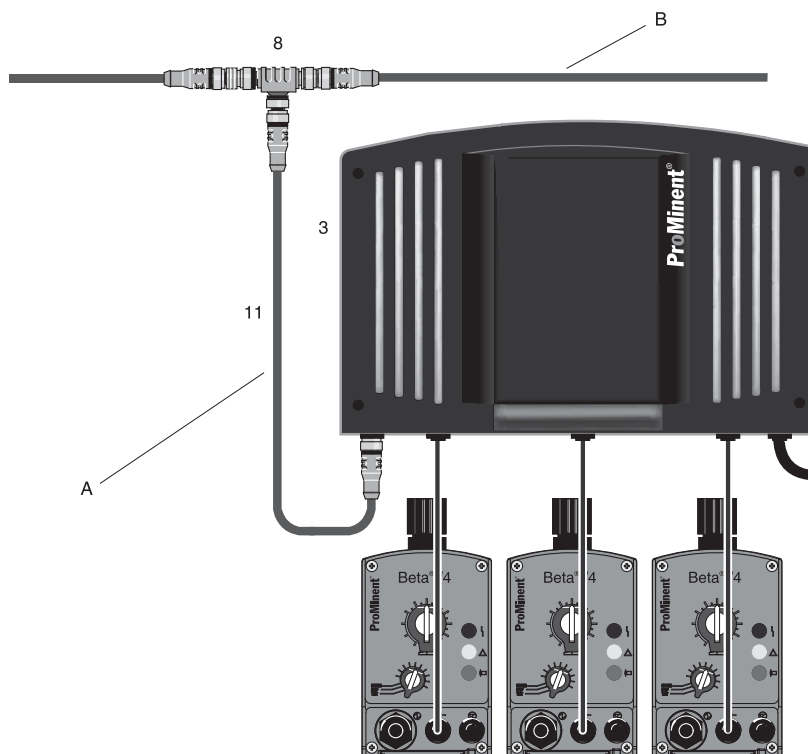
Item	Quantity	Name	Order no.
1	1	DULCOMARIN® II central unit DXCa W 0 0 1 0 0 P S EN 01	–
8	1	T-distributor M12 5 pol. CAN	included in delivery
11	1	Connection cable - CAN M12 5 way 0.5 m	included in delivery
14	1	CAN connection cable	as required
10	1	Termination resistance M12 connector	included in delivery
12	1	Termination resistance M12 plug	included in delivery

* optional

2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

2.7.5 The Combination Module

- A Stub cable
B Main BUS cable



pk_5_044

Combination of M, A, I module and 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 central DXCa unit.

The module is connected to other bus modules via the bus backbone.

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):

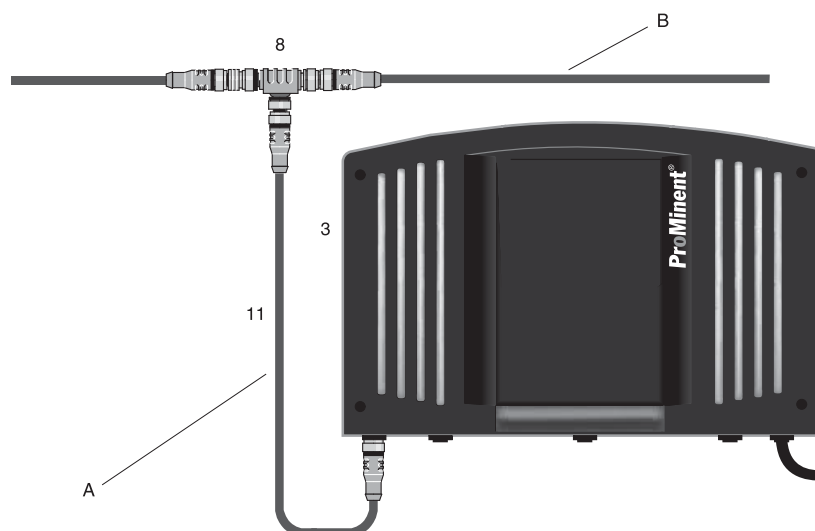
Item	Quantity	Name	Order no.
3	1	Control module DXCa W 2 0 0 0 A P S 00 01	–
8	1	T-distributor M12 5 pol. CAN	included in delivery
11	1	Connection cable - CAN M12 5 way 0.5 m	included in delivery



2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

2.7.6

F Module (Functional 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 chosen for the 2nd module position and additionally 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 of the assembly and operating instructions):

- Control of circulating operation (depending on the weekday and the time of day)
- Automatic backwashing
- Routing of first filtrate through the internal circuit (electrical backflow shut-off valve)
- Lowering of the water level during standby 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
- Flow control
 - Actual circulation flow measurement
 - Fresh water top-up measurement
- Control variables for:
 - Disinfection
 - pH (+/-)
 - Flocculation
 - UV system
 - Backwashing emergency-off, if water-alarm



2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

2.7.7

DULCOMARIN®II DULCO-Net identity Code Ordering System for Multi-channel Multi-parameter Measuring and Control System (Central Unit and Combination Module)

DULCOMARIN®II DXC range

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
Options	
1	Videographic recorder with data logger including SD card and USB card reader for PC
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.

Update kit/DXC and modules	Order no.
	1031284

The Identcode 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.

Important note when ordering multi-channel measuring and control systems for potable water and pool water applications:

Potable water applications: In the identcode, 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.

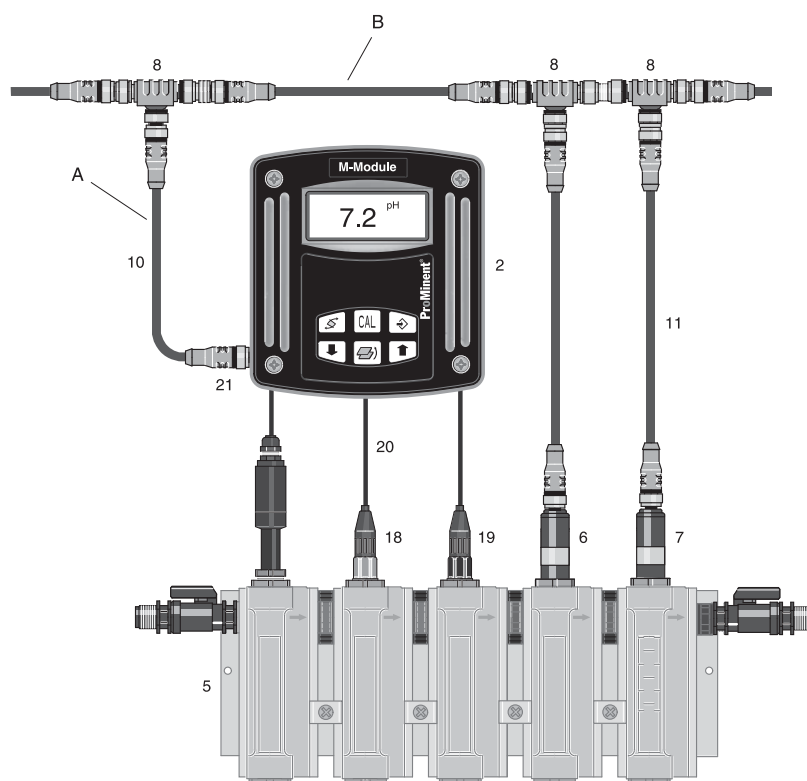
Swimming pool water applications: In the identcode, a "0" for "with operating elements" must be selected under "Version" and an "S" for "Swimming pool" under "Application". The description "Tank" will appear in the controller menu for the different filter circuits.

All adjustment options and the use of the different modules are identical with both applications.

2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

2.7.8 M Module (Measuring 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:

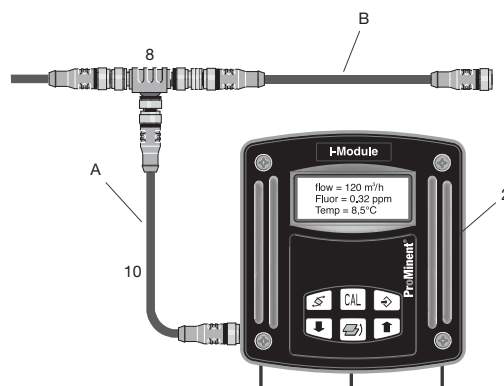
Item	Quantity	Name	Order no.
2	1	M module DXMa M W 0 S EN 01	DXMa M W 0 S DE 01
5	1	In-line probe housing DGMa 3 2 2 T 0 0 0	DGMa 3 2 2 T 0 0 0
6	1	Chlorine sensor CTE 1-CAN-10 ppm	1023427
7	1	Chlorine sensor CLE 3.1-CAN-10 ppm	1023426
8	3	T-distributor M12 5 pole CAN	included in delivery
10	1	Connection 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	1	Cable combination coax 2 m- SN6 - pre-assembled*	1024106
21	2 m	Signal lead, sold by the metre 2 x 0.25 mm ² Ø 4 mm	725122

2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

2.7.9

I Module (Current Input Module)

- A Stub cable
B Main BUS cable



AP_DC_0011_SW

The 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 writer and web and OPC® server.

Two analogue inputs are provided as 2-wire inputs and one as passive input. All channels have made pre-selected measured variables. However the identifier and units can be edited. Channel 1 acts as the disturbance variable channel for channel 2. Channel 3 is the temperature compensation channel for channel 2 when the measured variable is fluoride.

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 measuring transducer)
- Chlorine dioxide*
- Chlorite
- Ammonia
- Fluoride
- Pt100 resistance thermometer via a transducer
- Dissolved oxygen
- Hydrogen peroxide *
- Editable identifier and units

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.

* these measured variables can also be controlled

The I module is connected to other bus modules via the main bus cable. The T-distributor and 0.5 m CAN connection cable supplied are used.

The I module in the above example consists of the following components:

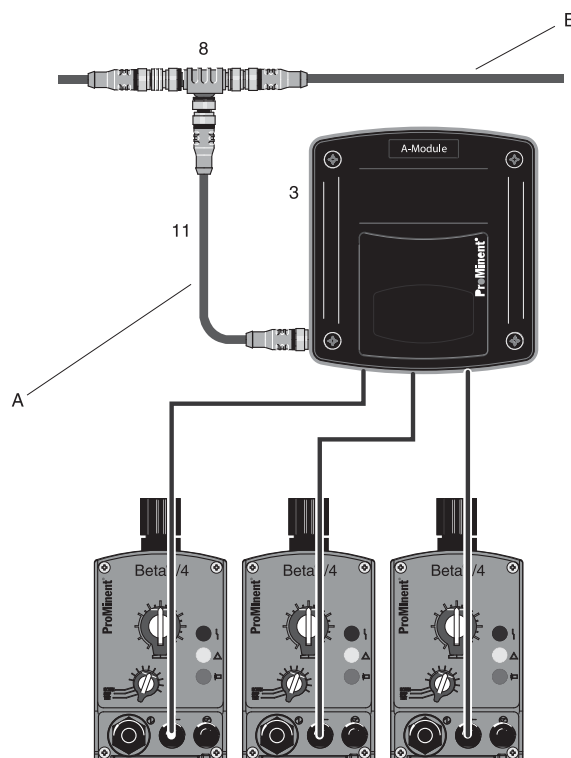
Item	Quantity	Name	Order no.
2	1	I module DXMa I W 0 D EN 01	–
8	1	T-distributor M12 5P CAN	included in delivery
10	1	Connecting cable - CAN, M12, 5P, 0.5 m	Included in delivery



2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

2.7.10 A Module (Control 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 the CAN connecting cable included in the scope of delivery are used 0.5 m.

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 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)!

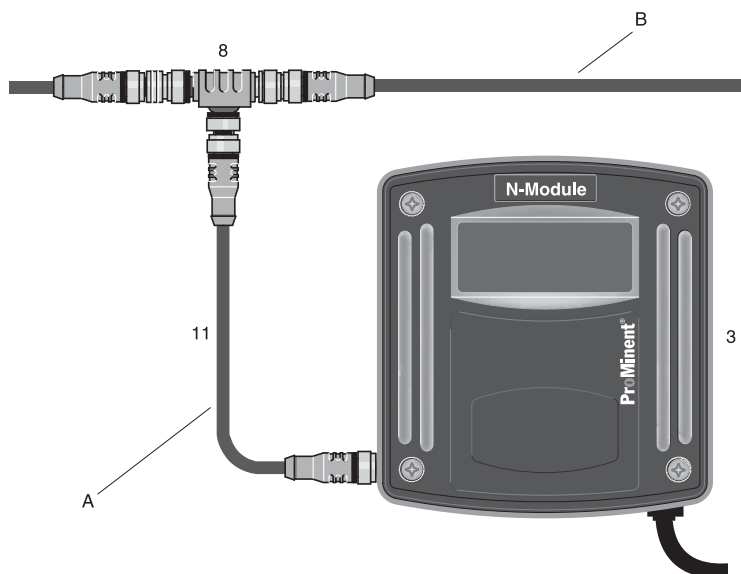


2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

2.7.11

N Module (Power Supply 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

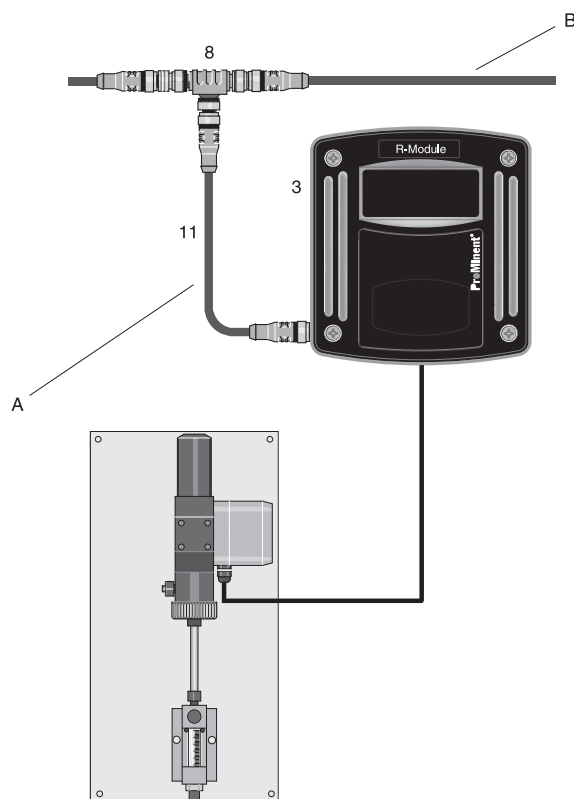
Our Sales department would be glad to assist with any questions you may have.

2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

2.7.12

R Module (Control Module for Chlorine Gas Metering Units)

- 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.

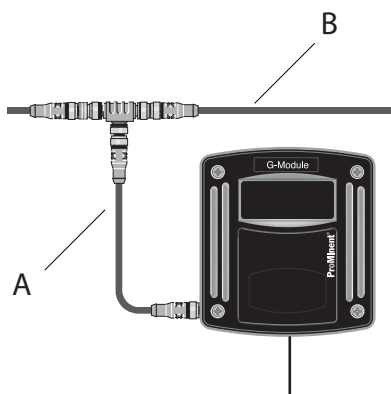


2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

2.7.13

G-Module (Limit Value and Alarm 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.

2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

2.7.14

Identcode 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 controls (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



2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

2.7.15 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 identcodes 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

2.7.16 Software Upgrades

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 needed to determine the device-specific activation key.

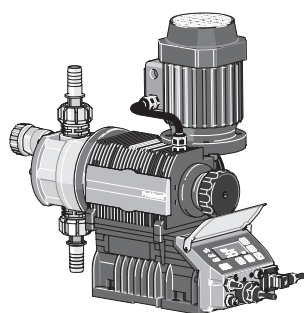
- 1 Serial number of the DULCOMARIN® II. This can be found under F1 HELP.
- 2 The actual identity code. This can be found under F1 HELP.
- 3 Desired upgrade.

	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

2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

2.7.17

Diaphragm Metering Pumps with CANopen Bus Interface

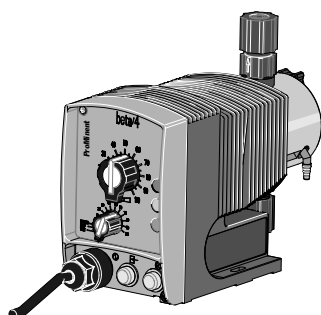


pk_2_001
Sigma/ 1

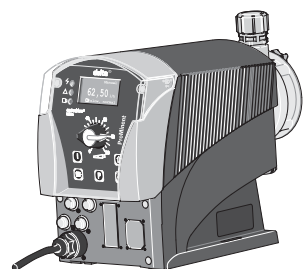
- CANopen bus interface for DULCOMARIN®II
- Feed rate range 0.74...32 l/h, 16...2 bar
- Stroke length continuously adjustable between 0 - 100 % (recommended 30 - 100 %)
- Transmission of the stroke length setting from the DULCOMARIN® II
- Material versions PP, plexiglass/PVC
- Patented coarse / fine bleed valve for PP and plexiglass/PVC
- Self-bleeding liquid end version in PP and plexiglass/PVC
- Port for 2-phase level switch
- Version for extra-low voltage 12/24 V DC, 24 V AC
- 4 LED display for operation, warning and error messages
- Alarm for stroke length changes $> \pm 10\%$
- Transmission of level alarm without alarm relay via the bus

Diaphragm metering pumps are contained in Volume 1 on the following pages: Beta® b Solenoid Diaphragm Metering Pumps → 1-7, delta® Solenoid-Driven Diaphragm Metering Pumps → 1-19.

Process metering pumps are contained in Volume 3 on the following pages: Sigma/ 1 Diaphragm Metering Pumps → 1-7, Sigma/ 2 Diaphragm Metering Pumps → 1-18, Sigma/ 3 Diaphragm Metering Pumps → 1-29



P_BE_0002_SW
Beta®



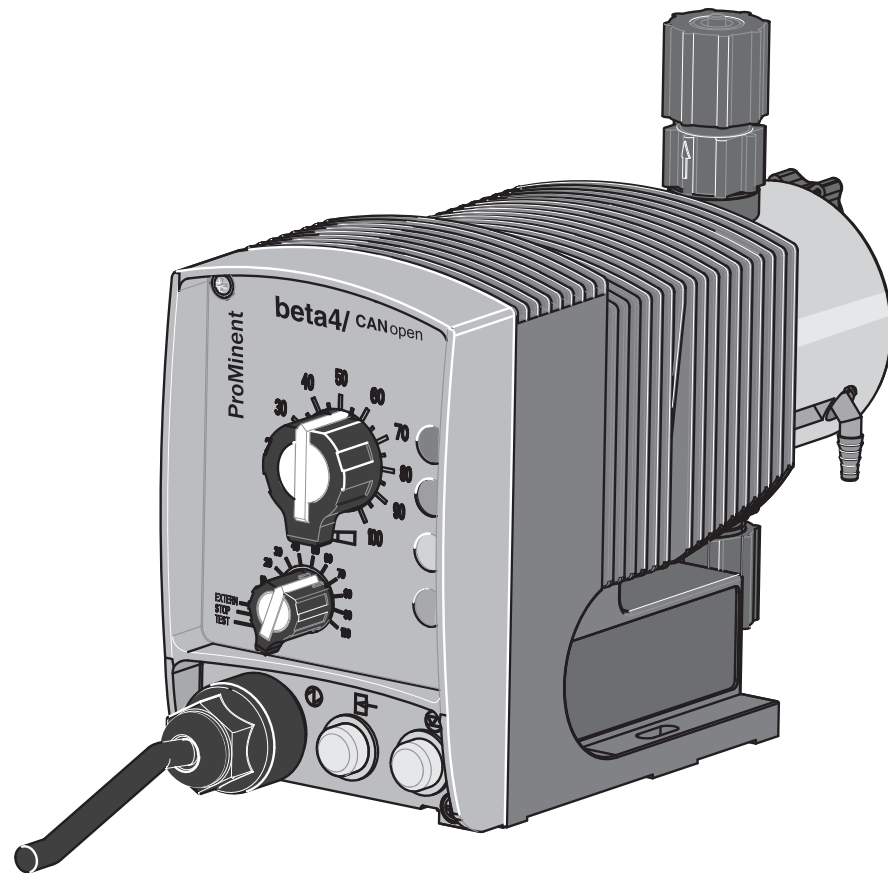
P_DE_0002_SW
delta®

2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

2.7.18

Beta® Solenoid Diaphragm Metering Pumps

- 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



2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

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 kg
	bar	l/h	ml/stroke	bar	l/h	ml/stroke	Strokes/min	mm	mWC	
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 medium

	Dosing head	Suction/discharge connector	Seals	Valve balls
PPE	Polypropylene	Polypropylene	EPDM	ceramic
PPB	Polypropylene	Polypropylene	FPM	ceramic
NPE	Clear acrylic	PVC	EPDM	ceramic
NPB	Clear acrylic	PVC	FPM	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.

FPM = fluoro 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, connecting kit for hose/pipe connection as per table. CAN M12 5 pin connection cable 1m. CAN M12 5 pin T-coupler.



2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

Beta® Product range, Version a

BT5a	Type	Capacity
		bar l/h
	1605	16 4.10
	1008	10 6.80
	0713	7 11.00
	0420	4 17.10
	0323	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	FPM-B/PTFE coated, only for PP and NP
	T	PTFE/PTFE coated, only for PV, TT and SS
	S	Diaphragm with additional FPM coating for media containing silicate, FPM-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 1000, 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 \pm 10 %, 50/60 Hz
	B	100-115 V \pm 10 %, 50/60 Hz
	U	100-230 V \pm 10 %, 50/60 Hz
	M	12-24 V DC \pm 10 %, Only type 1000-0220 \only with 2 m connecting cable open end
	N	24 V DC \pm 10 %, Only type 1605-0232 \only with 2 m connecting cable open end
	P	24 V AC \pm 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	
	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

2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

2.7.19

System DULCOMARIN®II DULCO®-Net Multi-Channel Measuring and Control System 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	Free 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 (by the metre) – connection kit*	1026589
Connecting cable - CAN (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:

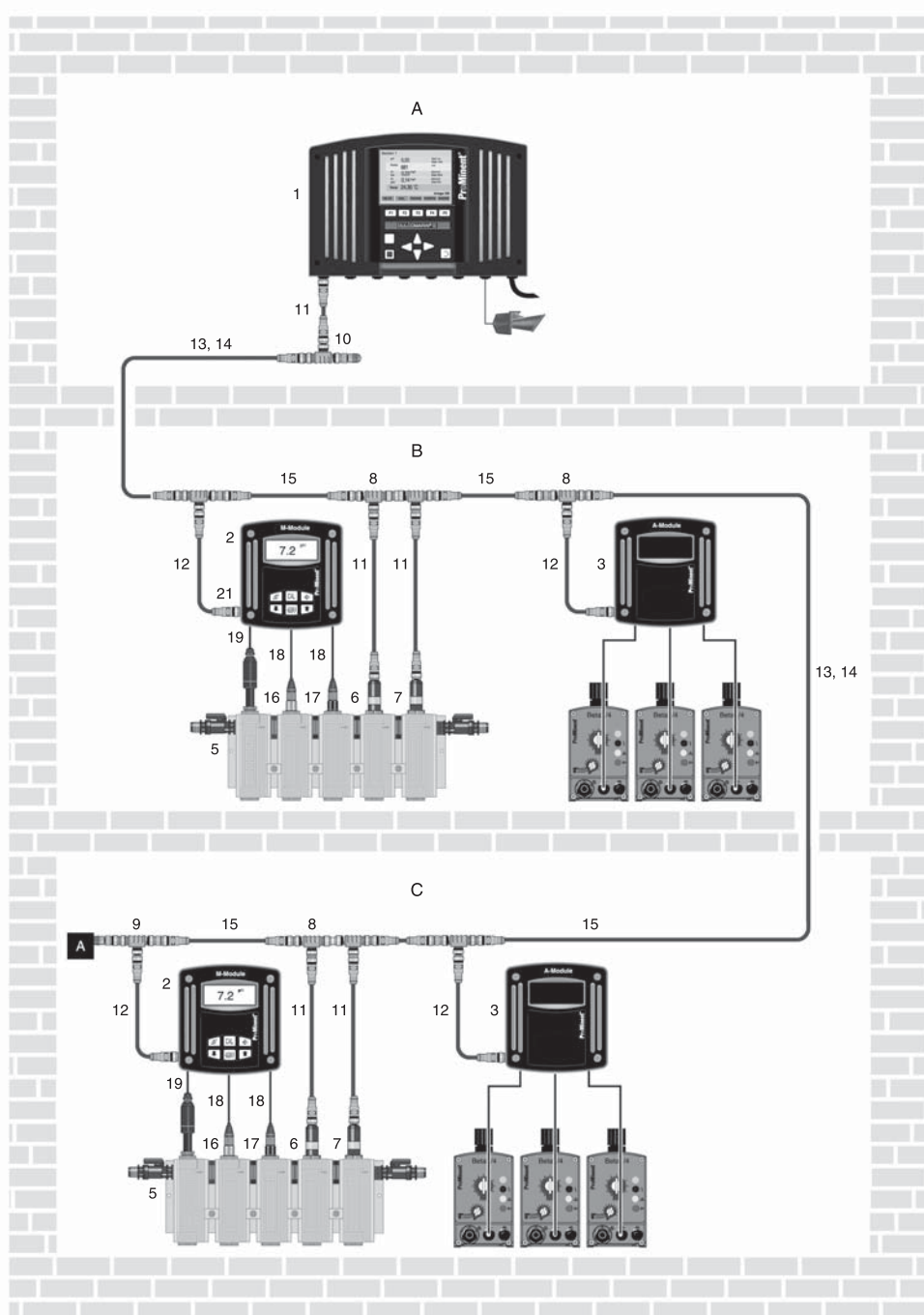
The maximum main bus length (not including stubs) should be at most 400 m.

2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

2.7.20

Configuration Example 1

- A Pool attendant's room
- B Plant room Pool 1
- C Plant room Pool 2



pk_5_022_1



2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

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	supplied
9	1	Termination resistance M12 coupling	supplied
10	1	Termination resistance M12 plug	supplied
11	5	Connection cable - CAN M12 5-way 0.5 m	supplied
12	5	Connection cable - CAN M12 5-way 0.3 m	supplied
13	–	Connecting cable - CAN (by the metre)	1022160
14	–	CAN (by the metre) – 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 coax 2 m- SN6 - pre-assembled*	1024106
19	4 m	Signal lead, 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.

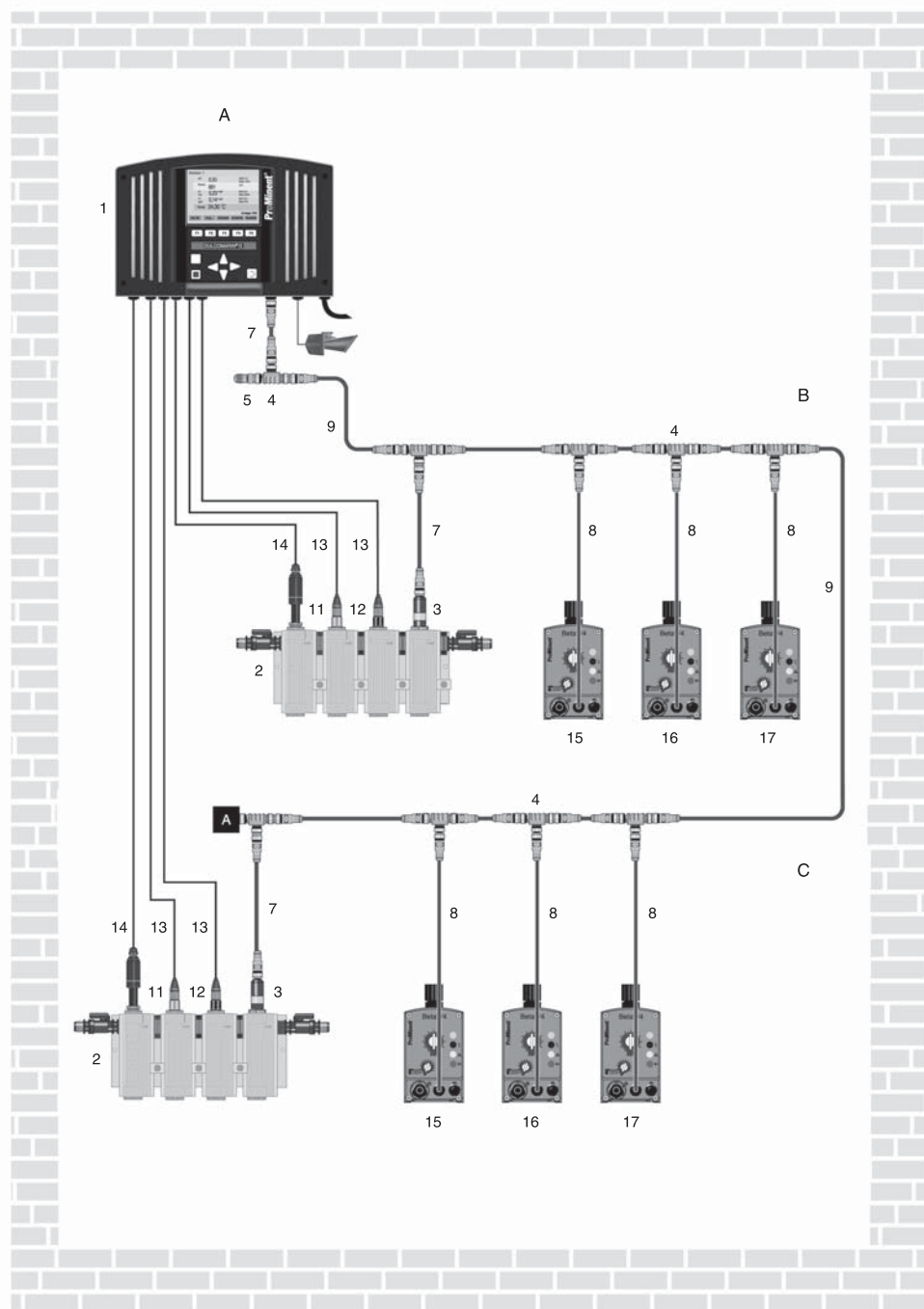
2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

2.7.21

Configuration Example 2

Two M modules in a central unit, use of metering pumps with CANopen bus.

- A Swimming pool attendant's room
- B Plant room/Pool 1
- C Plant room/Pool 2



pk_5_022_2



2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

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 sensor CLE 3-CAN-10 ppm	1023425
4	9	T-distributor M12 5 pole CAN	included
5	1	Termination resistor M12 connector	included
6	1	Termination resistor M12 plug	included
7	5	Connection cable - CAN M12 5-pole 0.5 m	included
8	6	Connection cable - CAN M12 5-pole 0.3 m	included
9	–	Connecting cable - CAN (by the metre)	1022160
10	–	CAN (by the metre) – connection kit	1026589
11	2	pH sensor PHES 112 SE	150702
12	2	ORP sensor RHES-Pt-SE	150703
13	4	Cable combination coax 2 m- SN6 - pre-assembled*	1024106
14	4 m	Signal lead, sold by the metre 2 x 0.25 mm ² Ø 4 mm	725122
15	2	Beta®/4CANopen for pH adjustment BT4A0402PPE200UA000D00**	–
16	2	Beta®/4CANopen for disinfectant BT4A0402NPB900UA000D00**	–
17	2	Beta®/4CANopen for flocculant BT4A0400PPE200UA000D00**	–

* 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.

** Suggested configurations

Caution:

The maximum main bus length is 400 m.



2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

2.7.22

Accessories for the DULCOMARIN® II compact and DULCOMARIN® II DULCO®-Net 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
CGE 2-CAN-10 ppm	1024420
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 (by the metre)	1022160
CAN (by the metre) – connection kit	1026589
PHES 112 SE	150702
RHES-Pt-SE	150703
Cable combination coax 0.8 m - pre-assembled*	1024105
Cable combination coax 2 m- SN6 - pre-assembled*	1024106
Cable combination coax 5 m- SN6 - pre-assembled*	1024107
Signal lead, sold by the metre 2 x 0.25 mm ² 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

* 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 must be used for the spur lines.

Caution:

The maximum main bus length is 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-10ppm sensor

2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment



P_MSRZ_0014_SW

PROFIBUS® DP V1 gateway

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 as the master. Data traffic can be cyclic or acyclic. The measured values are transmitted cyclically. Setpoints can be changed in acyclic traffic, the system can be placed in pause control and Eco!Mode operation can be activated. The corresponding GSD file can be loaded from the ProMinent home page, and it is also contained on the enclosed data medium.

The module is intended 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 should have software version 3022 or greater.

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

CLE 3-CAN

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

Measured variable	free chlorine (hypochlorous acid HOCl)
Reference method	DPD1
Measuring range	0.01...10 mg/l (auto ranging)
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)
Power supply	via CAN-interface (11 – 30 V)
Temperature measurement	via integrated digital semiconductor element
Output signal	uncalibrated, temperature compensated, electrically isolated
Compatibility	CANopen bus systems
Typical applications	swimming pools, potable water (surfactant-free)

Order no.

CLE 3-CAN-10 ppm*

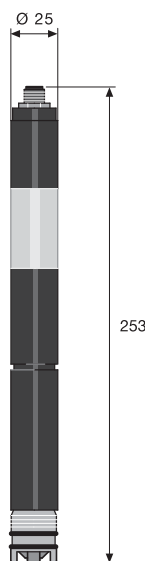
1023425

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

CLE 3.1-CAN

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

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
Measuring range	0.01...10.0 mg/l
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)
Power supply	via CAN-interface (11 – 30 V)



pk_6_096

2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

Temperature measurement	via integrated digital semiconductor element
Output signal	uncalibrated, temperature compensated, electrically isolated
Compatibility	CANopen bus systems
Typical applications	swimming pools, potable water with a higher percentage of bound chlorine (surfactant-free)

	Order no.
CLE 3.1-CAN-10 ppm*	1023426

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

CTE 1-CAN

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

Measured variable	total chlorine
Reference method	DPD4
Measuring range	0.01...10.0 mg/l
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)
Power supply	via CAN interface (11 – 30 V)
Temperature measurement	via built-in semiconductor device
Output signal	uncalibrated, temperature-compensated, electrically isolated
Compatibility	CANopen bus systems
Typical applications	CTE 1-mA-0.5 ppm: potable water, cooling water; CTE 1-mA-2/5/10 ppm: potable water, industrial, process, cooling water in swimming pools in combination with CLE 3.1 to determine combined chlorine.

Note: The CTE1-CAN-10 ppm sensor only works together with the CLE3.1-CAN-10 ppm sensor

	Order no.
CTE 1-CAN-10 ppm*	1023427

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

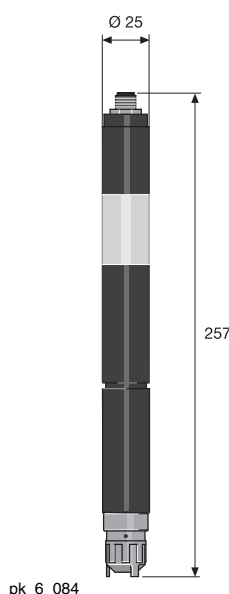
CGE 2- CAN

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

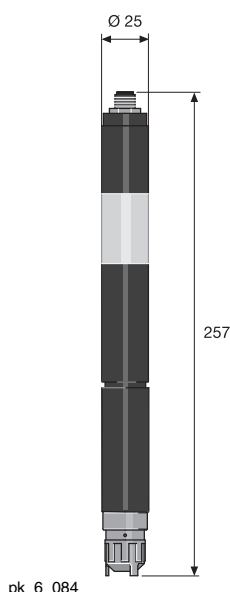
Measured variable	organic bound chlorine and free chlorine (e. g. trichlorinated isocyanuric acid)
Reference method	DPD1
Measuring range	0.01...10.0 mg/l
pH range	5.5 ... 9.5
Temperature	5 ... 45 °C
Max. pressure	3.0 bar
Intake flow	30...60 l/h (in DGMa or DLG III)
Power supply	via CAN interface (11 – 30 V)
Temperature measurement	via built-in semiconductor device
Output signal	uncalibrated, temperature compensated, electrically isolated
Compatibility	CANopen bus systems
Typical applications	Swimming pool water

	Order no.
CGE 2-CAN-10 ppm*	1024420

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



2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment



BRE 3-CAN

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

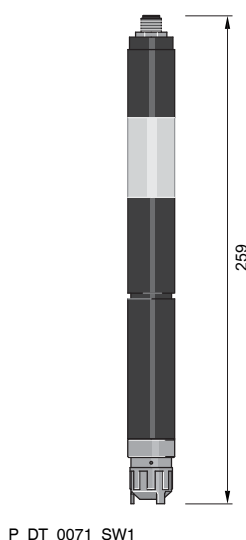
Measured variable	Total available bromine
Reference method	DBDMH, free bromine: DPD1 BCDMH: DPD4
Measuring range	0.02...10.0 mg/l
Temperature	5 ... 45 °C
Max. pressure	3.0 bar
Intake flow	30...60 l/h (in DGM or DLG III)
Power supply	via CAN interface (11 – 30 V)
Output signal	uncalibrated, temperature-compensated, electrically isolated
Compatibility	CANopen bus systems
Typical applications	Swimming pools/whirlpools and cooling water; can also be used in sea water

Order no.

BRE 3-CAN-10 ppm

1029660

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



CDR 1-CAN

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

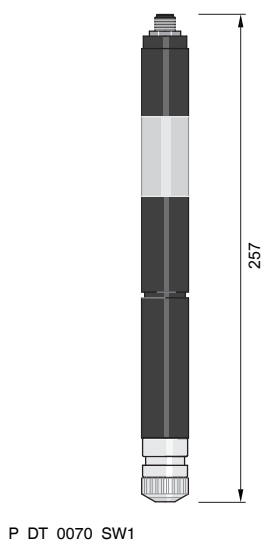
Measured variable	Chlorine dioxide (ClO_2)
Reference method	DPD1
Measuring range	0.01...10.0 mg/l
pH range	1.0 ... 10.0
Temperature	5 ... 45 °C
Max. pressure	1.0 bar
Intake flow	30...60 l/h (in DGM or DLG III)
Power supply	via CAN interface (11-30 V)
Temperature measurement	via integral digital semiconductor device
Output signal	uncalibrated, temperature-compensated, electrically isolated
Compatibility	CANopen bus systems
Typical applications	contaminated industrial, process water, containing surfactants, cooling water, irrigation water, slightly contaminated waste water, warm water

Order no.

CDR 1-CAN-10 ppm

1041155

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



CLT 1-CAN

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

Measured variable	Chlorite anion (ClO_2^-)
Reference method	DPD method, chlorite together with chlorine dioxide
Measuring range	0.10...2.0 mg/l
pH range	6.5 ... 9.5
Temperature	1 ... 40 °C
Max. pressure	1.0 bar
Intake flow	30...60 l/h (in DGM or DLG III)
Power supply	via CAN interface (11-30 V)
Temperature measurement	via integral digital semiconductor device
Output signal	uncalibrated, temperature-compensated, electrically isolated
Compatibility	CANopen bus systems
Typical applications	Monitoring of potabewater or similar waters treated with chlorine dioxide. Selective measurement of chlorite and chlorine dioxide, chlorine and chlorate is also possible.

Order no.

CLT 1-CAN-2 ppm

1041156

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



2.7 Multi-channel Multi-parameter Measuring and Control System for Water Treatment

2.7.23

Technical Data for the DULCOMARIN®II compact and DULCO®-Net Multi-Channel Measuring and Control System

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. An isolating amplifier, e.g. order no. 1033536, is required for connection to units which 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
Electrical connection	85...265 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.

2.8 Controller With Integral Metering Pump

2.8.1 Controller with Integral Metering Pump

Controllers with integral metering pump for pH, ORP, type D_4a are no longer available and have been superseded by delta® metering pumps with control modules.

Information about the delta® metering pump with control module can be found in Chapter delta® Solenoid-Driven Diaphragm Metering Pumps, see page → 1-19



pk_1_131_2
delta®

2.9 Cooling Tower And Boiler Controller

2.9.1 Cooling Water Treatment

Cooling circuits are used in diverse industries, in office buildings and shopping malls around the world.

If flow-type cooling with fresh water is not feasible, a circulating cooling system is used.

In this respect, the cooling water consumption has to be reduced.

From the operator's point of view it is necessary to protect the heat exchanger and the entire pipework against corrosion and deposits to maximise the availability of the system.

Deposits and biological growth reduce the efficiency of the heat exchanger and increase the consumption of cooling water and thus also the operating costs.

Negative effects on the environment and the formation of legionella must be prevented.

In circulating cooling, losses caused by evaporation and exhaust air are replaced by top-up water.

The increase in salt concentration caused by evaporation is compensated for by bleeding and addition of make-up water. The bleed is controlled on the basis of the conductivity in the circulating water.

The deposition of biofilms is prevented by metering of biocides.

Corrosion is prevented by the volume-proportional metering of corrosion inhibitors and dispersants to the make-up water.

Functional description

DULCOMETER® Cool Control and MultiFlex M10 are compact systems for cooling tower control.

They include all necessary functions to control blowdown, metering of up to two biocides and corrosion inhibitors.

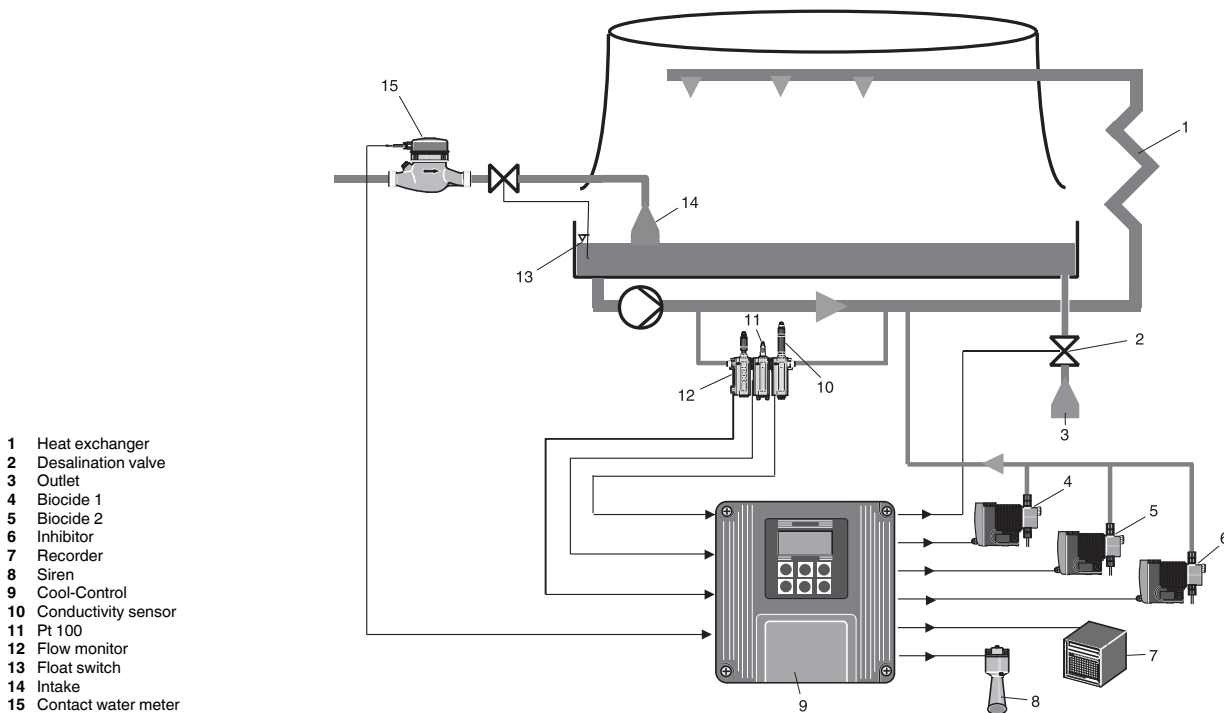
Blowdown is controlled based on the conductivity measured in the circulating water

The inhibitor pump is controlled according to the make-up water volume detected by a contact water meter.

The desired concentration of the inhibitor is determined by the cooling tower control based on the operating time of the metering pumps.

The controls can control up to two biocide pumps independently of each other via a timer.

Wet cooling tower



pk_5_011



2.9 Cooling Tower And Boiler Controller

The controls include the following basic functions:

- Pre-bleed prior to planned biocide metering. Biocides with an oxidising effect increase conductivity in the cooling systems.
- Bleed lock-out on completion of biocide metering to let the biocide take effect
- Limitation of maximum duration of desalination
- Emergency mode in the event of failure of the conductivity measurement

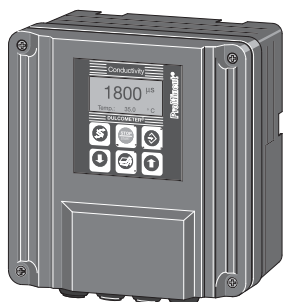
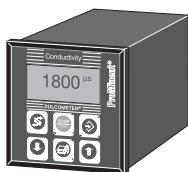
Function	Cool Control	Multiflex M10T
Blowdown based on measured variables using:		
Conductivity, conductive	✓	✓
Conductivity, inductive	✓	✓
Power supply		
115 V~	✓	✓
230 V~	✓	✓
Method of installation, degree of protection		
Wall mounting, IP 65	✓	✓
Panel mounting, IP 54	✓	
Number of cooling towers/steam generators		
One cooling tower	✓	
Up to 4 cooling towers or steam generators		✓
Metering of biocides		
up to 2 biocides	✓	✓, per cooling tower
Inhibitor		
1 inhibitor	✓	✓, per cooling tower
Pre-bleed		
	✓, dependent on measured value	✓, dependent on measured value
Control		
Control of second measured variable, such as pH, ORP, bromine or chlorine		✓
Activation of bleed valve		
1 relay output for solenoid valve or motor-driven actuator with automatic reset	✓, with two biocides	✓
2 relay outputs OPEN/CLOSED for motor-driven actuators	✓	✓
Corrosion measurement		
Various metals, for instance stainless steel, copper, mild steel, admiralty metal		✓
Outputs		
Analogue output 0/4...20 mA	✓, 1	✓, up to 5
Special functions		
Subsequent function extension via plug-in modules		✓
LAN connector with web server		✓, standard
"Trackster" PC operating and configuration software		✓



2.9 Cooling Tower And Boiler Controller

2.9.2

Cool-Control Cooling Tower Controller, Type D1Ca



pk_5_006_1

- Control of bleed
- Metering of inhibitor
- Metering of up to 2 biocides via metering pump or bromine lock
- Daily and 2-weekly timer
- Pre-bleed and bleed lock-out
- Calibration function for metering pumps
- Water meter input with adjustable pulse spacing
- Pause input to lock the measuring in-line measuring probe
- Signal output for conductivity 0/4...20 mA, electrically isolated
- Alarm relay for alarm signalling
- Adjustable alarm limit values for measured value conductivity
- Wall and control panel mounting housing

Applications:

- cooling towers,
- air scrubbers
- air condition systems

A complete measuring station comprises the following:

- D1Ca measuring transducer /controller (see Identcode)
- In-line probe housing: DGMa..., DLG III ..., immersible in-line probe housing
- Conductivity sensor
- Sensor cable

(For further information: Immersion Probe Fittings see p. → 1-73; DULCOTEST® conductivity sensors see p. → 1-50; Sensor Accessories see p. → 1-64)

2.9.3

Identcode Ordering System Cool-Control, Type D1Ca

DULCOMETER® Cool-Control, type D1Ca

D1Ca	Installation
D	Control panel version 96 x 96 mm (IP 54)
W	Wall mounted (IP 54)
	Operating voltage
0	230 V, 50/60 Hz
1	115 V, 50/60 Hz
4	24 V, AC/DC
	Measured variable
K	Conductivity for cooling tower control
	Measured variable connection
3	Terminal conductive conductivity sensors
6	Terminal inductive conductivity sensors
	Correction variable (temperature)
0	None
2	Temperature via terminal (Pt 100 of conductivity sensor LFT, LMP, ICT)
4	Manual temperature input
	Disturbance variable
0	None
2	Flow as frequency 0-500 Hz (contact water meter)
	Control input
0	None
1	Pause
	Signal output
0	none
1	Standard signal 0/4-20 mA measured value
	Relay control
G	Alarm, timer and 2 output relays (bleed valve and biocide 2)
S	Alarm and servomotor (bleed valve only)
	Pump control
2	2 pumps (inhibitor and biocide 2)
	Control characteristic
0	2-point control with hysteresis/bleed
	Protocol output
0	None
	Language
D	German
E	English
F	French
G	Czech
S	Spanish



2.9 Cooling Tower And Boiler Controller

2.9.4

Technical Data

Measuring range	0...500/2,000/5,000 µS/cm, 20 mS/cm measured variable L3 0...200/0...2,000 µS/cm, 0...20/200/2,000 mS/cm measured variable L6
Cell constant	0.006 ... 12.0 (depends on measurement range)
Resolution	0.0625 % of input range
Accuracy	0.5 % from measurement range
Measuring frequency	56 Hz ... 2.7 kHz
Measuring input	terminal (conductive 2- and 4-electrode sensors or/inductive conductivity sensors)
Correction variable	temperature
Correction range	0 ... 100 °C
Control characteristic	2-point control with hysteresis
Signal current output	1 x 0/4-20 mA electrically isolated max. load 600 Ω adjustable measured variable range
Control outputs	2 reed contacts for control for inhibitor and biocide pump 1 2 relays for control of biocide pump 2 and desalination valve
Alarm relay	250 V ~3 A, 700 VA contact type make/break
Electrical connection	24 V ~/115 V~/230 V~ ±10 %
Ambient temperature	Panel mounted: 0...50 °C (0...45 °C fully dismantled) Wall mounted: -5...50 °C (-5...40 °C fully dismantled)
Enclosure rating	panel mounted: IP 54 wall mounted: IP 65
Dimensions	panel mounted: 96 x 96 x 140 mm (WxHxD) wall mounted: 189 x 200 x 76 mm (WxHxD)

Order no.

Mounting kit for D1Cb control panel installation

792908

A complete measuring station comprises the following:

- D1Ca measuring transducer /controller (see Identcode)
- Conductivity sensor
- In-line probe housing: DGMa..., DLG III ..., immersible in-line probe housing
- Pt 100 temperature sensor or on-site standard signal
- Sensor cable

(For further information: DULCOTEST® conductivity sensors see p. → 1-50; Immersion Probe Fittings see p. → 1-73; Temperature Sensors see p. → 1-25; Sensor Accessories see p. → 1-64)

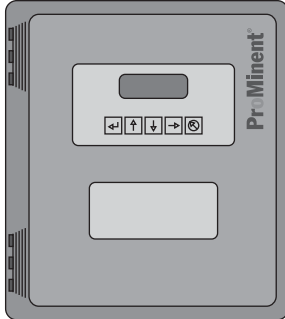




2.9 Cooling Tower And Boiler Controller

2.9.5

MultiFlex M10 Cooling Tower/Boiler Controller



P_DM_0017_SW

The high-performance features

- Simultaneous control of up to 4 cooling towers and/or steam generators
- Configuration via display and keyboard using a standard web server (operated via a web browser, e.g. Internet Explorer, no special software required)
- LAN/Ethernet interface
- Up to 14 analogue inputs and outputs
- 12 digital inputs (standard)
- 10 relay outputs (standard)

Simple to operate

- 5-key universal keyboard
- Illuminated display with 4 lines, each with 20 characters
- Simple to upgrade with I/O plug-in modules
- Free adaptation to the process thanks to flexible programmability
- Comprehensive flexibility of the control permits cooling towers or steam generators (e.g. 1 steam generator and 3 cooling towers) to be controlled
- Standard built-in Ethernet/LAN interface with user-specified IP address

Applications

- Cooling tower
- Boilers

Trackster 3 software (optional)

Convenient configuration and remote control using Trackster 3 software.

Together with the embedded web server, Trackster 3 software is the programming and control software for Multiflex controllers for cooling towers and steam boilers. Trackster 3 offers you the tools for real-time visualisation of simple to complex water treatment systems. Trackster 3 permits time- or event-controlled report generation, data import and export, manual data input, alarm logging and tools for controller networks.

Housing

- Enclosure rating: NEMA4X, IP65, fibreglass housing with two spring locks
- 230 V AC or 115 V AC selectable via a switch
- Approvals: CE, CSA, UL

The MultiFlex M10 controller is not listed in our price list and we would be pleased to send you a separate quotation on request.

	Description	Remarks
Inputs and outputs		
Analogue inputs and outputs	14 analogue inputs and outputs for sensors or measuring units	Automatic configuration and driver installation or deactivation
Digital inputs	12 units (standard)	User-definable as a contact water meter input or as a contact input to activate functions
Relay outputs	10 units: 2 as closers, 8 as changeovers (standard)	Protection in groups of up to 5 relays
Alarm relay	Potential-free, without protection	Can be configured by the user as NO or NC
Communication / User interface		
Keypad and LCD display	Universal keypad with 5 keys 4 lines x 20 characters with illumination	Sample rate of 100 mS (nominal) User-adjustable contrast
10Base T, TCP/IP Ethernet / LAN	HTML, Telnet micro web server Fixed adjustable IP address and & port settings	The embedded web server displays the control values in real time and permits the unit to be configured
Data logging	600 memories for each of the 26 inputs & 10 relays, saved in XML format	Recording rate adjustable from 5 to 1,440 minutes
Operating language	English, other languages available on request	

2.9 Cooling Tower And Boiler Controller

	Description	Remarks
Control / Controller		
ON/OFF relay	ON / OFF control	Each individual relay can be freely assigned to a function
Proportional output 4-20 mA (optional)	User-defined setting by sensor or relay controller	Adjustment of zero point and range transmission value
Cooling tower: volumetric desalination	User-definable volume unit of measure & metering pumps ON time	Periodic desalination: measures the make-up water volume and then initiates volume-dependent desalination based on user specifications
Boiler: Captured sample	Cycle sampling / measurement / blow-down / repeated sampling based on user specification	Any sensor can be used
Locking	1 to 12 contact input, AND & OR linking	Relay OFF if contact input open
Lock	If relays 1 to 10 are activated, every other relay can be locked (e.g. desalination lock)	Supports the combined metering of oxidising agent and inhibitor
Alarm - Metering time limit	Time per actuation and day	User-defined metering time limitation
Metering monitor (optional)	Concentration calculated on the basis of metering quantity & concentration factor	The metering monitor responds if, for instance, no chemical flow can be measured after 30 seconds of metering pump operation

	Description	Remarks
System		
Electrical data	115 / 230 V AC, 50/60 Hz	Voltage range can be switched
Fuse	7.3 A at 120 V AC 4.15 A at 240 V AC	Relay protection: Relay 1-5 and relay 6-10 each with 6.3 A
Over-voltage protection	Relay 2-5 and 7-10 NO contact, snubber with 0.1 µF	The processor is electrically isolated from the voltage supply
Supply voltage of accessories	15-22 V DC, unregulated, thermally protected with 200 mA	
Housing	Plastic, NEMA4X, IP65	W x H x D = 30 x 35 x 18 cm

	Description	Remarks
Certification		
CSA: 1523642	CSA-tested, complies with CE guidelines	CSA tested to comply with UL 61010C-1

2.10 DULCOMETER® Transmitters

2.10.1

DMTa Measuring Transducer-Measured Variables pH, ORP, Chlorine, Temperature, Conductivity



DULCOMETER® DMT type transmitters are compact 2-wire transmitters for measured variables pH, ORP, chlorine, conductive conductivity, temperature. Easily combined with programmable memory controllers.

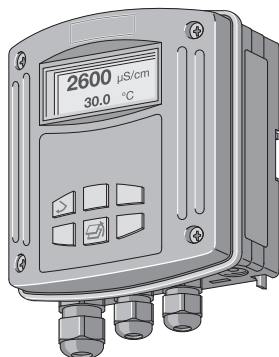
Summary of advantages

- Reliable measurement due, e.g., to symmetrical input for pH and ORP signals
- High level of operating safety, e.g. sensor monitoring (pH), electrical isolation
- Simple flexible installation
- Full text user guidance
- Automatic buffer recognition (pH)
- Autoranging (conductivity)
- Compact design
- Switch between pH, ORP and temperature

Applications

- process control
- food and beverage industry
- chemical industry
- pharmaceutical industry
- water treatment
- waste water treatment
- power stations

Technical Data



pk_5_001

Measuring range

pH - 1.00 ... 15.00
 - 1,200 ... +1,200 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 1/1,000 of display value (min. 0.001 µS/cm)

Accuracy

0.5 % from measurement range

Measurement input

mV terminal (pH, ORP); input resistance $> 5 \times 10^{11} \Omega$
 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, LF: 0 ... 100 °C

Current output

4...20 mA

Fault current

23 mA

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

up to 95 % relative humidity (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



2.10 DULCOMETER® Transmitters

A complete measuring station comprises the following:

- DMTa measuring transducer (see Identcode)
- In-line probe fitting: DGMa..., DLG III ..., immersible in-line probe fitting
- Chlorine sensor (dependent on Identcode)
- Assembly set for chlorine sensor
- pH sensor (dependent on Identcode)
- ORP sensor (dependent on Identcode)
- Temperature sensor Pt 100 /Pt 1000 (dependent on Identcode)
- Conductivity sensor
- Sensor cable
- PROFIBUS®-DP connection accessories

(For further information: Immersion Probe Fittings see p. → 1-73; Chlorine sensors see p. → 1-27; pH sensors with SN6 or Vario Pin plug-in head see p. → 1-10; ORP sensors with fixed cable see p. → 1-23; Temperature Sensors see p. → 1-25; DULCOTEST® conductivity sensors see p. → 1-50; Sensor Accessories see p. → 1-64; Metering Monitor, Signal Cable see p. → 1-72)





2.10 DULCOMETER® Transmitters

2.10.2 Identcode Ordering System for DMTa Measuring Transducer

DULCOMETER® Transmitters

DMT	Series	Version
	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 Identcode 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.

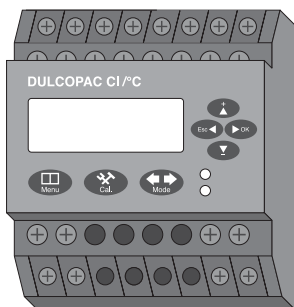
Note:

¹ The rear housing part is omitted for control panel mounting.

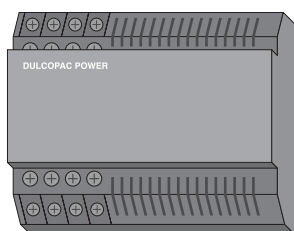
2.10 DULCOMETER® Transmitters

2.10.3

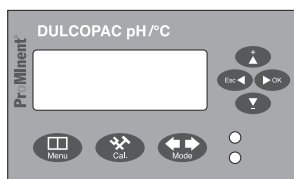
DULCOMETER® DULCOPAC



P_DM_0023_SW



P_DM_0021_SW



P_DM_0022_SW

DULCOPAC transmitter/controller in a DIN housing for installation on a top hat rail (in the control cabinet)

DULCOPAC measures and controls the measured variables: pH, ORP, chlorine, bromine, peracetic acid, hydrogen peroxide and conductivity in aqueous solutions. Applications include the general treatment of water and waste water.

The transmitter/controller has a sensor input for the relevant measured variable. With pH and ORP, it is possible to select between a DULCOPAC transducer with a highly-ohmic coaxial input (direct connection of a pH/ORP sensor) or a 4-20 mA 2-wire input. A transducer is also needed when connecting pH or ORP via 4-20 mA (part no. 809126 for pH and part no. 809127 for ORP). One input for temperature measurement (Pt 100) for temperature compensation is provided for the measured variables pH and conductivity (direct).

Two analogue outputs (0/4...20 mA) and two potential-free extra low voltage relays with a changeover contact are available; the analogue outputs are electrically isolated. Either the main value (pH or ORP voltage) or temperature can be assigned to the relay contact.

DULCOPAC transmitters/controllers are operated and configured by push buttons and an integral LCD display.

DULCOPAC transmitters/controllers are generally housed in control cabinets. They can be used in applications where measured values do not need to be continuously read and where constant operation is not necessary. They convert measured values into a standardised and calibrated active 0/4...20 mA measuring signal that can then be transmitted to a PLC for instance (in which case a passive input should be used on the PLC).

A DULCOPAC power supply unit provides voltage for up to 10 DULCOPAC transmitters/controllers and also provides electrical isolation from the 230 V mains, also assuring correct voltage supply to amperometric sensors (e.g. chlorine sensors).

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

	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, 230V AC	1036436



2.10 DULCOMETER® Transmitters

2.10.4

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)	→ 2-78	1036425
1	DULCOPAC Power supply unit, 230V AC	→ 2-78	1036436
2 m	Coaxial cable Ø 5 mm, 10.0 m - S	→ 1-64	305040
1	pH sensor PHEP 112 SE	→ 1-10	150041
1	Bypass fitting DGMA with sample water limit contact	→ 1-71	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	→ 2-78	1036429
1	DULCOPAC Power supply unit, 230V AC	→ 2-78	1036436
2 m	Signal lead, sold by the metre 2 x 0.25 mm ² Ø 4 mm	→ 1-66	725122
1	Chlorine sensor CLE 3-mA-2 ppm	→ 1-28	792920
1	Bypass fitting DGMA with sample water limit contact	→ 1-71	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)	→ 2-78	1036431
1	DULCOPAC Power supply unit, 230V AC	→ 2-78	1036436
1	Signal lead type LKT for conductivity sensor Ø 6.2 mm	→ 1-66	723712
1	Conductivity LFT 1 DE	→ 1-55	1001376
1	Bypass fitting DGMA with sample water limit contact	→ 1-71	DGMa310T000

2.11 Measuring and Test Systems

2.11.1

Portamess Portable Meters, Measured Variable pH

- Hard-wearing membrane keypad
- Large, easy-to-read LCD display
- Integrated sensor quiver to protect the sensor
- Sturdy housing (IP 66 degree of protection)
- Robust, watertight, gold-plated sockets

Applications

- In industry
- In environmental protection
- In food production
- In water or waste water inspection

Technical Data



pk_5_099

Measuring range	pH: -2.00 ... +16.00 mV: -1,300 ... +1,300
Measuring error	pH: < 0.01 mV: < 0.1 % of measured value ±0.3 mV
Sensor adjustment	8 buffer sets
Temperature compensation	manual
Enclosure rating	IP 66
Operating life	2,000 hours with 3 AA batteries
Dimensions H x W x D	160 x 133 x 30
Weight	560 g with batteries
Included in delivery	Measuring device, carrying case, operating manual in German, English and French

	Order no.
Portamess® 911 pH	1008710

Note:

The scope of delivery does not include any pH sensor.

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. → 2-86



2.11 Measuring and Test Systems

2.11.2

Portamess Portable Meters, Measured Variable, Conductivity

- Connection of the LF 204 4-electrode sensor
- LF 204 4-electrode sensor in the scope of supply
- Hard-wearing membrane keypad
- Large, easy-to-read LCD display
- Integrated sensor quiver to protect the sensor
- Sturdy housing (IP 66 degree of protection)
- Robust, watertight, gold-plated sockets

Applications:

- In industry
- In environmental protection
- In food production
- In water or waste water inspection.

Technical Data



pk_5_098

Measuring range	Unit 0.01 $\mu\text{S}/\text{cm}$... 1,000 mS/cm, with sensor LF204: 1 $\mu\text{S}/\text{cm}$... 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 measured value (at conductivity levels > 500 mS/cm < 1 % of measured value) ± 1 digit Temperature < 0.3 K ± 1 digit
Sensor adjustment	Direct input of cell constants, automatic detection of cell constants with KCl solution 0.01 or 0.1 mol/l, cell adjustment with any known solution
Cell constant	0.010 ... 199.9 cm^{-1} (adjustable)
Temperature compensation	configurable
Enclosure rating	IP 66
Operating life	Approx. 1,000 hours with 3 AA batteries
Dimensions H x W x D	160 x 133 x 30
Weight	560 g with batteries
Included in delivery	Measuring unit, field case, conductivity sensor LF 204, operating instructions in the German, English, and French language

	Order no.
Portamess® 911 Cond	1008713

Note:

The scope of delivery does include the conductivity sensor LF 204.
Conductivity sensor see p. → 2-86, Sensor quiver see p. → 2-86

2.11 Measuring and Test Systems

2.11.3

Photometer

DT1B, DT2C, DT3B and DT4B photometers

- Transportable, compact photometer
- Simple to operate with help text support
- Safe, simple measurement of chlorine, chlorine dioxide, fluoride, chlorite, H₂O₂, bromine, ozone, pH and trichloroisocyanuric acid
- Can be calibrated
- Memory function
- Backlit display
- Real-time clock
- Countdown
- Watertight, degree of protection IP 68

Applications:

- Swimming pools
- Potable water
- Process water

Technical Data

Measuring range

DT1: 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
DT2B: 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
DT3: 1 ... 50 / 40 ... 500 mg/l hydrogen peroxide
DT4: 0.03 ... 2.5 mg/l chlorite, 0.05 ... 11 mg/l chlorine dioxide, 0.05 ... 6 mg/l chlorine

Measuring tolerance

Dependent upon measured value and measuring method

Battery

4 AA/LR6 batteries

Permissible ambient temperature

5...40 °C

Relative humidity

30 ... 90 % (non-condensing)

Enclosure rating

IP 68

Material

Housing material: ABS
 Keypad: Polycarbonate

Dimensions L x W x H (mm)

190 x 110 x 55

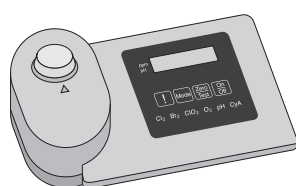
Weight

0.4 kg

Order no.

Photometer DT1B	1039315
Photometer DT2C	1039316
Photometer DT3B	1039317
Photometer DT4B	1039318

Photometers supplied with accessories, container vessels and reagents.



P_DT_0074_SW
Photometer

2.11 Measuring and Test Systems

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 photometer (fluoride detection)	1010382
3 off spare cells: round cells with covers for DPD phenol red and cyanuric acid detection (DT1 and DT2B)	1007566
3 off 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)	Chlorine_tablets
ACiDiTYiNG tablets (100 off)	AC_tablets

Spare parts

Chlorite Photometer

	Order no.
Foamer for expulsion of chlorine dioxide (DT4)	1022754
3 off spare cells: round cells with covers for DPD phenol red and cyanuric acid detection (DT1 and DT2B)	1007566

H₂O₂ measurement

	Order no.
Reagent for H ₂ O ₂ (DT3), 15 ml	1023636
Spare cell, 5x , for H ₂ O ₂ (DT3)	1024072



2.11 Measuring and Test Systems

2.11.4

DULCOMETER® Simulator (pH/mV/mA/Pt 100/Pt 1000)

- Simulation of pH and mV signals
- Simulation of Pt 100/Pt 1000 (25 °C and 80 °C)
- Simulation and measurement of mA signals (3-conductor connector)

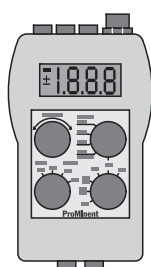
Applications:

Checking of DULCOMETER® devices, service use, laboratory

Works with the following devices:

D1Ca, D1Cb, D1Cc, D2Ca, DXCa, DXMa, DACa, DCMa, DCMb

Technical Data



pk_5_108

Measuring range U₊	5 ... 30 V DC (measurement of supply voltage for external passive 4 ... 20 mA transducers)
Simulation	pH 2,00 ... 12,00 ±2,000 mV 0...20 mA Pt 100, Pt 1000 (25 °C, 80 °C)
Simulation output	SN6, banana jack
Battery	9 V monobloc battery (not included in the scope of supply)
Operating life	approx. 150 h
Weight	approx. 265 g (with battery)
Enclosure rating	IP 20
Permissible ambient temperature	0...40 °C
Accessories	Measuring cable set mA, Pt100x, coaxial SN6

Order no.

DULCOMETER® Simulator

1004042



2.12 Accessories for Measuring and Control Devices

2.12.1 Measuring Transducer 4...20 mA (Two Wire)

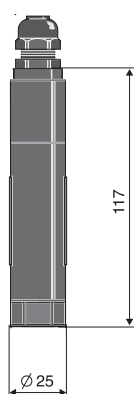
Advantages:

- Safer signal transfer, even across large distances
- Interference free 4-20 mA signal
- Simple installation directly onto sensor

Typical applications:

Measuring signal transfer over large distances or to transfer signals subject to disturbance (e.g. pH, redox) in conjunction with D1C, D2C and DULCOMARIN® measuring and control systems, or for direct connection to PC/PLC.

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	$> 5 \times 10^{11} \Omega$
Signal current output	4 ... 20 mA \approx -500 ... +500 mV \approx 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 (\varnothing)

Order no.

pH measuring transducer 4 ... 20 mA type pH V1

809126

ORP measuring transducer 4 ... 20 mA type RH V1

Measuring range	0 ... 1,000 mV
Measuring error	better than ± 5 mV (typical ± 3 mV)
Socket	SN6
Input resistance	$> 5 \times 10^{11} \Omega$
Signal current output	4 ... 20 mA \approx 0 ... +1,000 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 (\varnothing)

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 $\pm 0,5$ °C (typical $\pm 0,3$ °C)
Socket	SN6
Input resistance	$\sim 0 \Omega$
Signal current output	4 ... 20 mA \approx 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 (\varnothing)

Order no.

Temperature measuring transducer 4 ... 20 mA type Pt 100 V1

809128

2.12 Accessories for Measuring and Control Devices

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 H₂O₂ measurement

contains an internal selector switch for the three ranges:

1 ... 20, 10 ... 200 and 100 ... 2,000 mg/l H₂O₂

Order no.

Perox transducer V1

1034100

Accessory:

Order no.

Test lead, 3-core (3 x 0.25 mm², 5 mm diam.)

791948

2.12.2

Accessories for Portamess® Portable Meters

Sensor quiver

Set of 5, for water-tight storage of sensors. For Portamess® pH and Cond

Order no.

Sensor quiver

1008716

Conductivity sensor



pk_5_093

	Conductivity sensor LF 204
Number of electrodes	4
Sensor shaft	Black Epoxy
Sensor	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



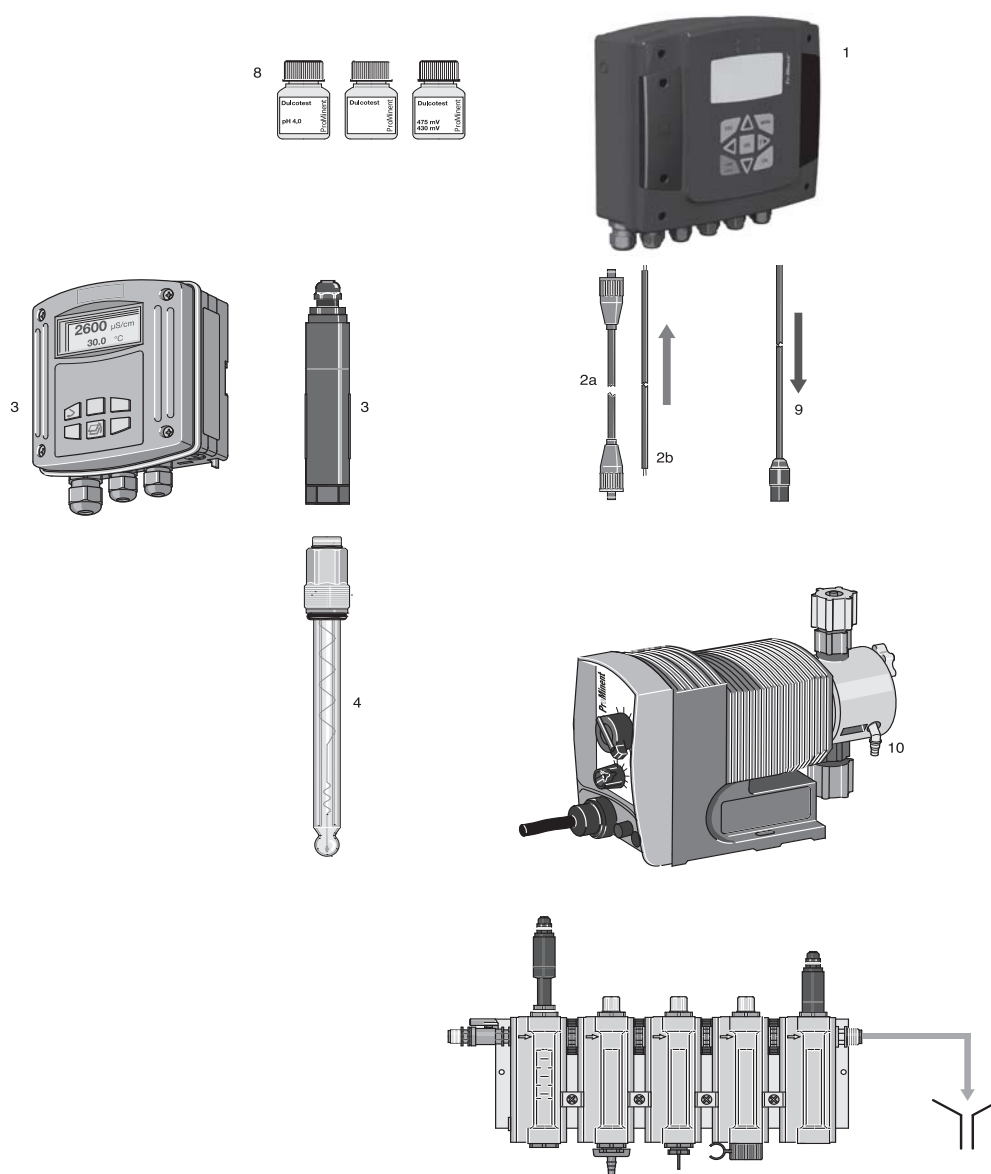
2.13 Application Examples

2.13.1 Introduction

This chapter describes typical combinations of components for measuring stations in applications in the potable water, cooling water, waste water and swimming pool water sectors. Pre-installed measuring systems are also available for these applications.

Panel-Mounted Measuring/Control Stations see p. → 3-1, DULCODOS® Pool swimming pool metering systems see p. → 3-21

2.13.2 Measuring and Control Systems Consist of



AP_0002_SW_1

- 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 2-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 solution (pH/ORP)
- 9 Signal cable (metering pump control)
- 10 Actuator e.g. Beta® metering pump

2.13 Application Examples

2.13.3 Disinfection of Potable Water

Measurement of free chlorine with connection to a PLC

Tasks and applications

In the treatment of potable 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 °C-13 °C
- Installation of the measuring station in the bypass of the process flow
- Display of the measured 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
- Voltage supply to the measuring instrument by the PLC (2-wire instrument)

Components of the measuring/control station

Quantity	Name	see page	Order no.
1	Transmitter DMTa	→ 2-75	DMTa W090C00E0000
1	Sensor for free chlorine CLE 3-DMT-5 ppm	→ 1-30	1005511
1	5-core universal cable, 5-pin round plug	→ 1-65	1001300
1	Bypass fitting DGMA	→ 1-71	DGMA 101T000

Benefits

- Simple, compact and cost-effective measuring station close to the bypass installation
- Electrical installation cost-savings due to voltage supply by a 2-wire system
- No need for electrical isolation of the output signal by electrical isolation integral to the DMT

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

Tasks and applications

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

- Oxidising agent / disinfectant: Ozone with an adjustable concentration of 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 ingress of sample water flow

Components of the measuring/control station

Quantity	Name	see page	Order no.
1	Controller D1Cb	→ 2-4	D1Cb W00601010VZ1011 M22EN
1	Sensor for ozone OZE 3-mA-2 ppm	→ 1-44	792957
2 m	Signal lead, sold by the metre 2 x 0.25 mm ² Ø 4 mm	→ 1-66	725122
1	Bypass fitting DGMA with sample water limit contact	→ 1-71	DGMA 301T000

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 infringement of limit values and ingress 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 control to the control panel





2.13 Application Examples

Measurement and control of free chlorine with feed-forward control

Tasks and applications

A measuring and control station is needed for the "free chlorine" disinfectant in the treatment of potable water in a water works. Metering is largely proportional to the flow (MID 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 ingress of sample water flow (via PROFIBUS®-DP)
- Alarm signalling transgression of the preset upper and lower limit values (via PROFIBUS®-DP)

Components of the measuring/control station

Quantity	Name	see page	Order no.
1	Controller DACa with feed-forward control	→ 2-10	DACa 00612000000010DE
1	Sensor for free chlorine CLE 3-mA-0.5 ppm	→ 1-28	792927
2 m	Signal cable, sold by the metre 2 x 0.25 mm ² Ø 4 mm	→ 1-66	725122
1	Bypass fitting DGMA with sample water limit contact	→ 1-71	DGMA 301T000

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 of limit value transgressions and ingress 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

Measurement and control of free chlorine in water works with high pH values

Tasks and applications

A measuring and control station is needed at the end of the treatment cycle for "free chlorine" disinfectant in the treatment of potable water in a water works. Metering is largely proportional to the flow, although control can also be proportionately variable-dependent to compensate for peaks of chlorine attrition, for instance in the event of rainfall. Unusually there is a fluctuating and high pH value of 7.8 to 9.2 that does not permit the direct measurement of free chlorine. The pH value is to be measured at the same time.

Further conditions must be met:

- Disinfectant: free chlorine with an adjustable concentration of 0.4 ppm
- Raw water: source water with a pH of 7.8 to 9.2 and a temperature of 1 °C to 13 °C.
- Installation of the measuring station in the bypass of the process flow
- Alarm signalling transgression of the preset upper and lower limit values and ingress of sample water flow
- Display of the measured result and calibration via a measuring instrument in the proximity of the bypass installation and transmission of the measured value and actuating variable to the control panel each via an electrically isolated 4-20 mA signal

Components of the measuring/control station

Quantity	Name	see page	Order no.
1	DULCOTROL: free chlorine measurement - pH-independent	→ 3-33	FCCA CP010A000CDE

Benefits

- Reliable measurement of free chlorine even with high and fluctuating pH values
- Precise, self-regulating disinfection by the fully automated measuring and control station, even in the event of peaks of attrition by combined flow- and variable-dependent control
- The control is monitored by transmission of the measured value and actuating variable to the control panel as two electrically isolated 4-20 mA output signals

2.13 Application Examples

Measurement of key chemical water parameters at various points in the treatment of potable water

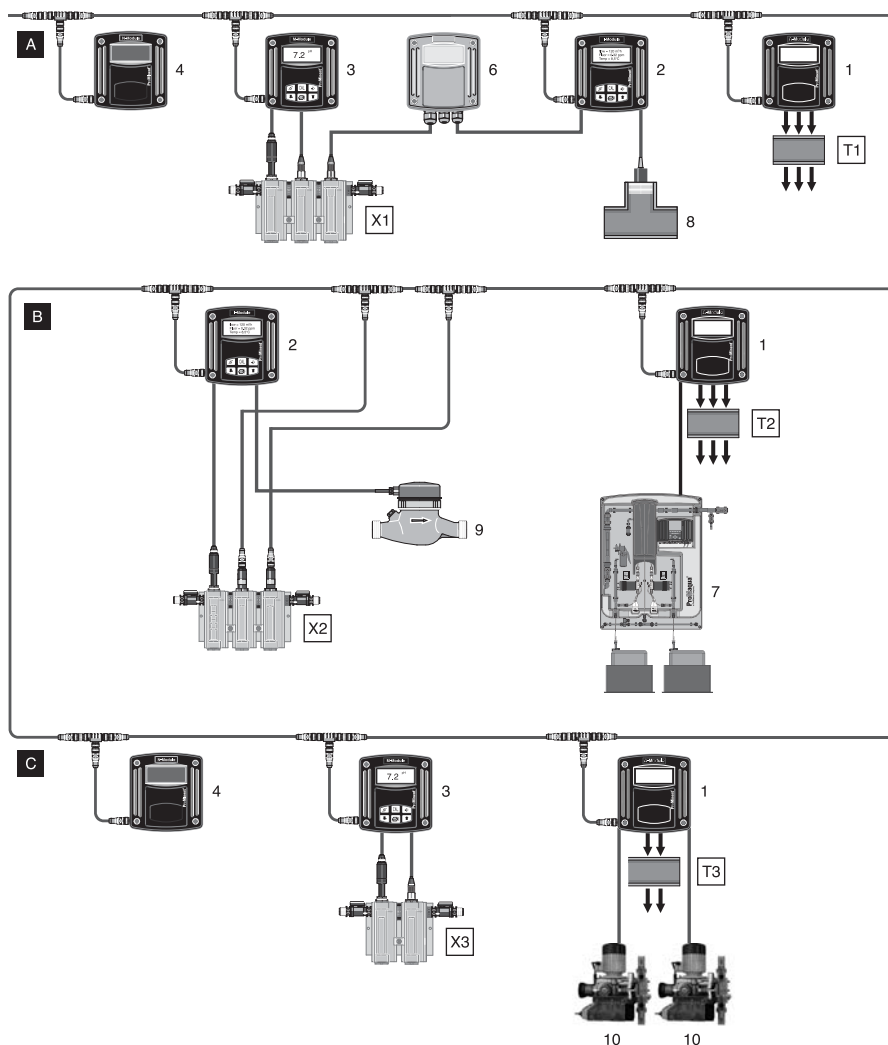
Tasks and applications

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
Intermediate oxidation/disinfection
B with chlorine dioxide
C pH setting

- 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
- DGMA with flow control, pH sensor and conductivity sensor
X1
X2 DGMA with flow control, chlorine dioxide sensor and chlorite sensor
X3 DGMA with flow control and pH sensor



AP_PTW_0003_1_SW3

2.13 Application Examples

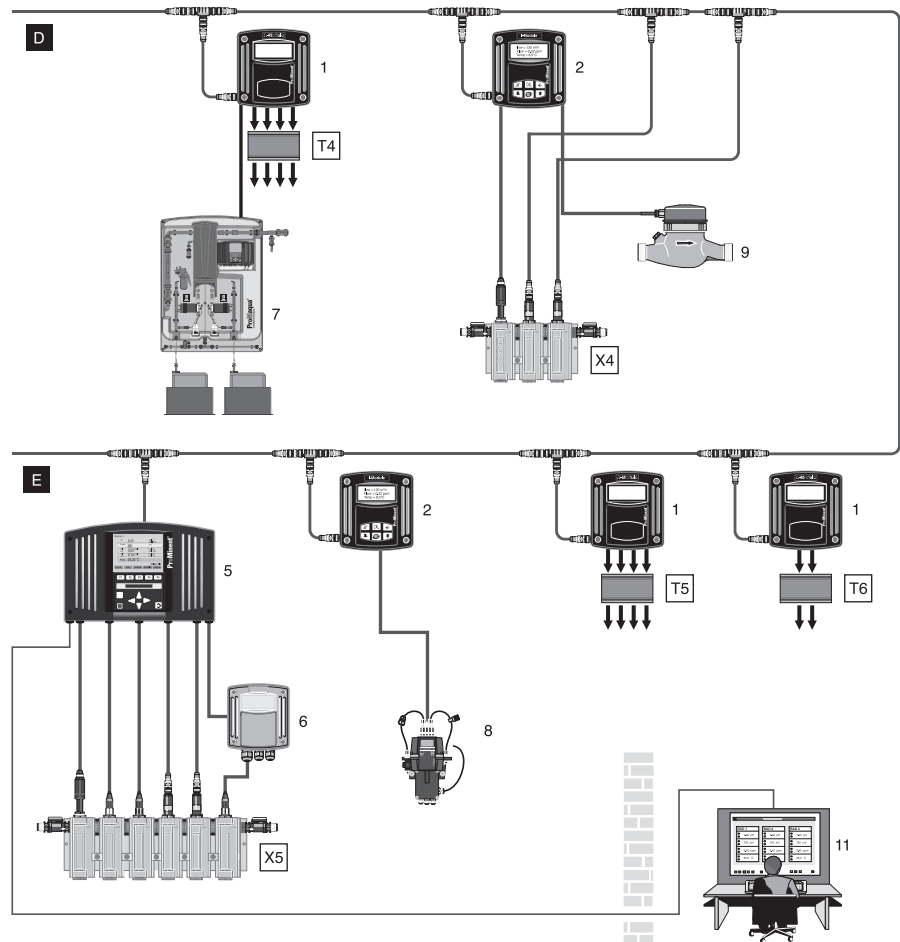
- D ClO₂ disinfection
E Final inspection

- 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

- Isolating amplifier with signal outputs for chlorine dioxide measurement, control variable, chlorite and flow
T4
Isolating amplifier with signal outputs for pH, ORP, chlorine dioxide and chlorite
T5
Isolating amplifier with signal outputs for turbidity and conductivity
T6

- 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



2.13 Application Examples

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	→ 2-36	DXCA WD61MINDEN01
2	M module	→ 2-46	DXMA MW0DEN01
6	A module	→ 2-48	DXMa AW0DEN01
3	I module	→ 2-47	DXMa IW0DENE01
3	N module	→ 2-49	DXMa NW200001
6	Isolating amplifier 4-channel for mA outputs of the A module	→ 2-63	1033536
Sensors			
3	pH sensor PHEP 112 SE	→ 1-10	150041
1	RHEP-Pt-SE	→ 1-20	150094
3	CDR 1-CAN-10 ppm	→ 1-42, → 2-66	1041155
2	Conductivity LFT 1 DE	→ 1-55	1001376
2	Turbidity	–	External unit with 4-20 mA signal
2	CLT 1-CAN-2 ppm	→ 1-43, → 2-66	1041156
Connecting cable			
300 m	Connecting cable - CAN (by the metre)	→ 2-63	1022160
5	CAN (by the metre) – connection kit	→ 2-63	1026589
5	Signal cable, sold by the metre 2 x 0.25 mm ² Ø 4 mm	→ 1-66	725122
4	Cable combination coax 2 m- SN6 - pre-assembled*	→ 2-63	1024106
2	Signal lead type LKT for conductivity sensor Ø 6,2 mm	→ 1-66	723712
Fitting			
1	Bypass fitting DGMA	→ 1-71	DGMA 320T000
2	Bypass fitting DGMA	→ 1-71	DGMA 302T000
1	Bypass fitting DGMA	→ 1-71	DGMA 332T000
1	Bypass fitting DGMA	→ 1-71	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



2.13 Application Examples

2.13.4 Cooling Water Treatment

A cooling circuit with measurement of inductive conductivity

Tasks and applications

Automated treatment of cooling water is required. Desalination is initiated on the basis of the conductivity measured in the circulating water. The circulating water is often seriously polluted water, necessitating the use of inductive conductivity measuring. Time- and demand-controlled metering of biocides and corrosion inhibitors must be ensured.

Components of the measuring/control station

Quantity	Name	see page	Order no.
1	D1Ca Cool Control	→ 2-71	D1CaW0K62011G200E
1	Inductive conductivity sensor ICT 1	→ 1-60	1023244
1	Inline fitting DN 25 - 3/4"	→ 1-77	1020616

Benefits

- Compact system suitable for use with contaminated cooling water
- Bleed is controlled on the basis of the conductivity measured in the circulating water
- Up to two biocide pumps can be controlled independently of each other by means of a programmable day and week controller
- Additional corrosion inhibitors are metered in a volume-proportional functional mode
- More cost-effective handling of biocides can be achieved thanks to programmable desalination and the option of bleed lock-out following metering.

Multifunctional control for multiple cooling towers

Tasks and applications

The cooling circuit of two cooling towers is to be controlled. The cooling towers' process parameters are monitored and the circulating water is regulated according to the limit values. Should the set-up of the system change, the control can be adapted by simply changing the configuration or by modular upgrades. Corrosion inhibitors are to be metered according to the corrosion measured in the cooling tower.

Components of the measuring/control station

Quantity	Name	see page	Order no.
1	M10T	→ 2-73	M10T-C02-T22-TF2-IC2-TC1002-CR/CN2-EU

Explanation of the identcode:

M10T	MultiFLEX Tower Controller
CO2	Two measurements of conductivity including conductivity sensors
T22	Two biocide controls with pre-desalination and locking function
TF2	Two flow measurements including sensors
IC2	Two 4-20 mA outputs to emit the conductivity value
TC1002	Inductive conductivity measurement
CR /CN2	Two corrosion measurements including sensors
EU	European Devices version

Benefits

- Cost-savings due to the use of a multi-channel control for multiple cooling towers
- The high number of inputs (analogue and digital) and relay outputs enables complex control systems to be provided
- Versatile adaptation of control to the respective application by the freely configurable linking of inputs to outputs
- Convenient configuration of the control thanks to the integral web server with TCP/IP Ethernet interface
- The optional visualisation and configuration software (Trackster3) enables the total system to be visualised in real-time and freely definable reports to be created detailing the history of measured data and occurrence of alarms
- Corrosion inhibitors can be economically metered on the basis of actual demand according to the corrosion rate measured online

2.13 Application Examples

2.13.5

Neutralisation of Industrial Waste Water

pH control with one control direction

Tasks and applications

Turbid waste water with a relatively constant pH value that is either always too high or always too low and a constant flow is to be continuously neutralised. The required pH value can be precisely set by the addition of acid or alkali. The pH sensor is to be fitted directly into the PVC pipe.

Components of the measuring/control station

Quantity	Name	see page	Order no.
1	Compact controller for pH/ORP	→ 2-3	1035638
1	pH sensor PHER 112 SE	→ 1-11	1001586
1	Coaxial cable Ø 5 mm, 2.0 m - S	→ 1-64	305030
1	90° T-piece DN 25	→ 1-77	1001494

Note: The use of other sensors is also possible depending on the quality of the waste water (see Selection guide for DULCOTEST® pH sensors → 1-1)

with seriously contaminated waste water with solid matter content

Quantity	Name	see page	Order no.
1	pH sensor PHEX 112 SE	→ 1-11	305096

with clear waste water

Quantity	Name	see page	Order no.
1	pH sensor PHEP 112 SE	→ 1-10	150041

Benefits

- Ultra-compact control design
- Automatically precise pH value and economical metering of chemicals
- Simple, language-independent operator guidance of control
- Precisely coordinated components

pH control with two control directions

Tasks and applications

Turbid waste water with a slightly fluctuating pH value and relatively constant flow is to be continuously neutralised. The pH sensor is to be fitted directly into the PVC pipe. If the temperature of the waste water fluctuates, the pH measurement should be temperature-compensated. The control should be interrupted if no waste water is flowing.

Components of the measuring/control station

Quantity	Name	see page	Order no.
1	Single-channel controller D1Cb	→ 2-4	D1CbW00601000V P5211G22EN
1	pH sensor PHER 112 SE	→ 1-11	1001586
1	Coaxial cable Ø 5 mm, 2.0 m - S	→ 1-64	305030
1	Temperature sensor Pt 100 SE	→ 1-25	305063
1	SN6 - open ended (Cable PT 100 with D1C, 5 m)	→ 1-65	1003208
1	90° T-piece DN 25	→ 1-77	1001494

with seriously contaminated waste water with solid matter content

Quantity	Name	see page	Order no.
1	pH sensor PHEX 112 SE	→ 1-11	305096

with clear waste water

Quantity	Name	see page	Order no.
1	pH sensor PHEP 112 SE	→ 1-10	150041



2.13 Application Examples

Benefits

- Reliable and precise pH control of exacting continuous neutralisation by the simultaneous metering of alkali and acid and PID control characteristics
- Reduction in the consumption of chemicals
- Operating menu in national language
- Precisely coordinated components

pH control with two control directions and control measurement

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 an agitated batch container. A 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.

Components of the measuring/control station

Quantity	Name	see page	Order no.
1	diaLog DACa multi-parameter Controller	→ 2-25	DACa 00613000010010 DE
2	pH sensor PHER 112 SE	→ 1-11	1001586
2	Coaxial cable Ø 5 mm, 2.0 m - S	→ 1-64	305030
1	Immersion valve IPHa 1-PP	→ 1-73	1008601
1	90° T-piece DN 25	→ 1-77	1001494

with seriously contaminated waste water with solid matter content

Quantity	Name	see page	Order no.
2	pH sensor PHEX 112 SE	→ 1-11	305096

with clear waste water

Quantity	Name	see page	Order no.
2	pH sensor PHEP 112 SE	→ 1-10	150041

Benefits

- Excellent process safety thanks to simultaneous control and independent control measurement
- Reliable and precise pH control of neutralisation by the simultaneous metering of alkali and acid and PID control characteristics
- Operating menu in national language
- Precisely coordinated components
- Data logger saves measured values and messages

2.13 Application Examples

2.13.6

Treatment of Swimming Pool Water

Private swimming pools with measurement of pH and ORP

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 hypochlorite is used as a disinfectant. The disinfectant is to be regulated on the basis of the ORP value (there should be regular comparison using a DPD 1 measuring unit).

Components of the measuring/control station

Quantity	Name	see page	Order no.
1	DSRa 2-Channel control for pH and ORP	→ 2-29	DSRAW20PR5020N010E1
2	Cable combination coax 2.0 m - S	→ 1-64	1005672
1	pH sensor PHEP 112 SE	→ 1-10	150041
1	ORP sensor RHES-Pt-SE	→ 1-19	150703
1	Bypass fitting DGMa with sample water scale	→ 1-71	DGMa120T000

Benefits

- Simple operation, controller with plain text operator guidance in 6 languages
- Automatically correct pH value and correct concentration of disinfectant
- All products are pre-selected to coordinate 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 hypochlorite is used as a disinfectant. The disinfectant is to be regulated on the basis of the concentration of chlorine (calibration should be performed at regular intervals with a DPD 1 measuring unit).

Components of the measuring/control station

Quantity	Name	see page	Order no.
1	diaLog DACa multi-channel controller	→ 2-25	DACa 0061340001001 DE
2 m	Signal cable, sold by the metre 2 x 0.25 mm ² Ø 4 mm	→ 1-66	725122
1	Chlorine sensor CLE 3-mA-2 ppm	→ 1-28	792920
1	pH sensor PHEP 112 SE	→ 1-10	150041
1	Bypass fitting DGMa with sample water limit contact	→ 1-71	DGMa311T000
1	Cable combination coax 2 m- SN6 - pre-assembled*	→ 2-63	1024106

Benefits

- Simple operation, controller with plain text operator guidance
- Automatically correct pH value and direct measurement and control of chlorine concentration
- All products are pre-selected to coordinate with each other
- Data logger saves measured values and messages

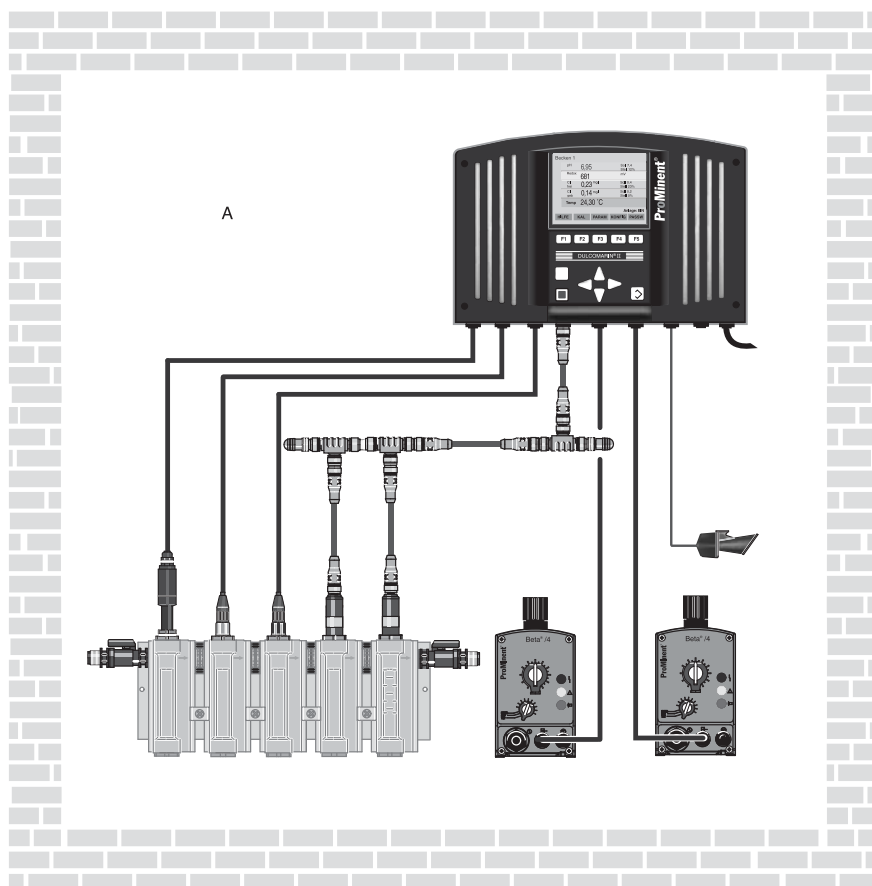
2.13 Application Examples

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 hypochlorite is used as a disinfectant. The disinfectant is to be regulated on the basis of the concentration of chlorine. The filters and pool are older, therefore, for safety, the percentage of bound chlorine should be continuously measured (regular calibration with a DPD 1+4 measuring unit is necessary). All measured values should be documented with a writer.

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	→ 2-42	DXCaW001MA PSEN01
1	Chlorine sensor CLE 3.1-CAN-10 ppm	→ 1-31	1023426
1	Chlorine sensor CTE 1-CAN-10 ppm	→ 1-36	1023427
2	Cable combination coax 2 m- SN6 - pre-assembled*	→ 2-63	1024106
1	pH sensor PHEP 112 SE	→ 1-10	150041
1	ORP sensor RHES-Pt-SE	→ 1-19	150703
2 m	Signal cable, sold by the metre 2 x 0.25 mm ² Ø 4 mm	→ 1-66	725122
1	Bypass fitting DGMa with sample water limit contact	→ 1-71	DGMa322T000

All cables, T-pieces and termination resistors needed to connect the sensors are supplied.



2.13 Application Examples

Benefits

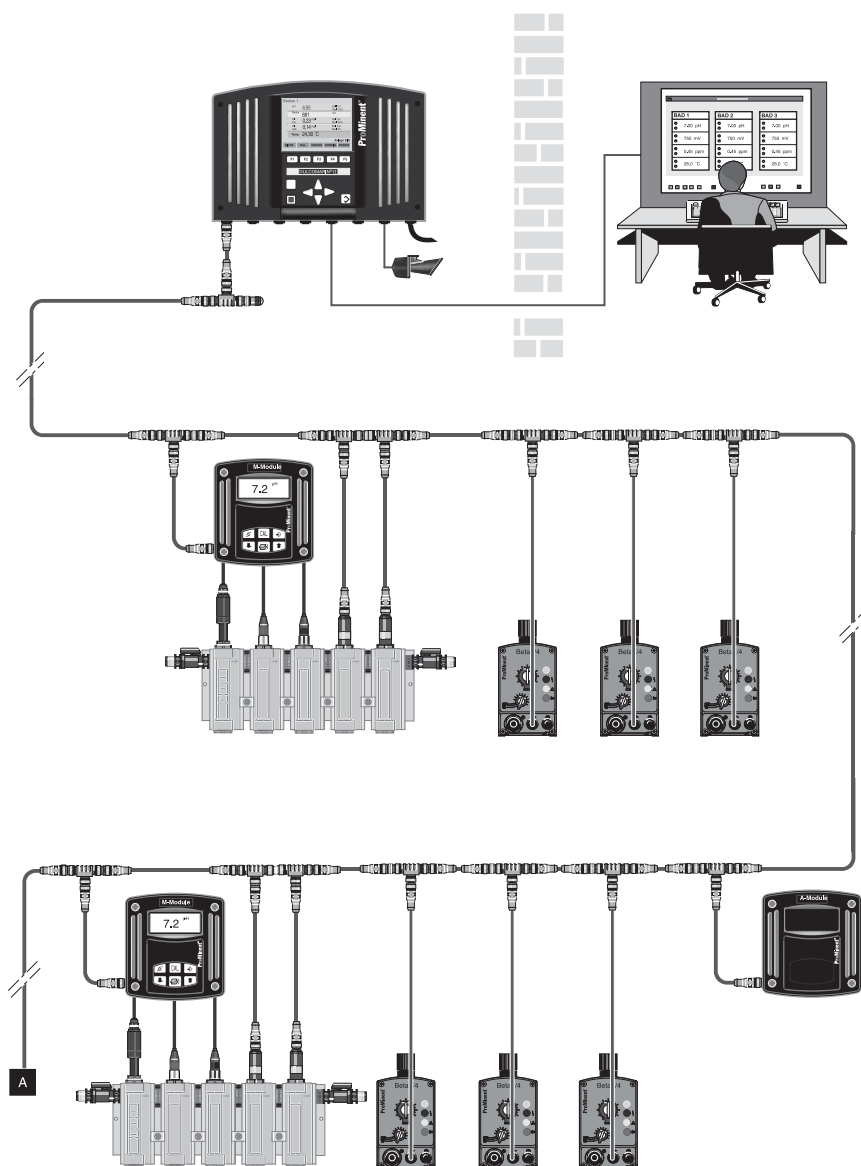
- The integral data logger and screen writer document the hygiene parameters required by law
- Continuous measurement of the bound chlorine provides information about the water quality
- The measuring and control system can be subsequently extended, for instance if a whirlpool is planned

Public swimming pool with several pools

Tasks and applications

The pool water of 5 filtration circuits in a frequently-used adventure pool is to be treated. Sulphuric acid is used to correct the pH and sodium hypochlorite is used as a 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, for safety's sake the percentage of bound chlorine should be continuously measured (regular calibration with a DPD 1+4 measuring unit is necessary). All measured values should be documented with a writer and the measured values should be transmitted via OPC to 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.

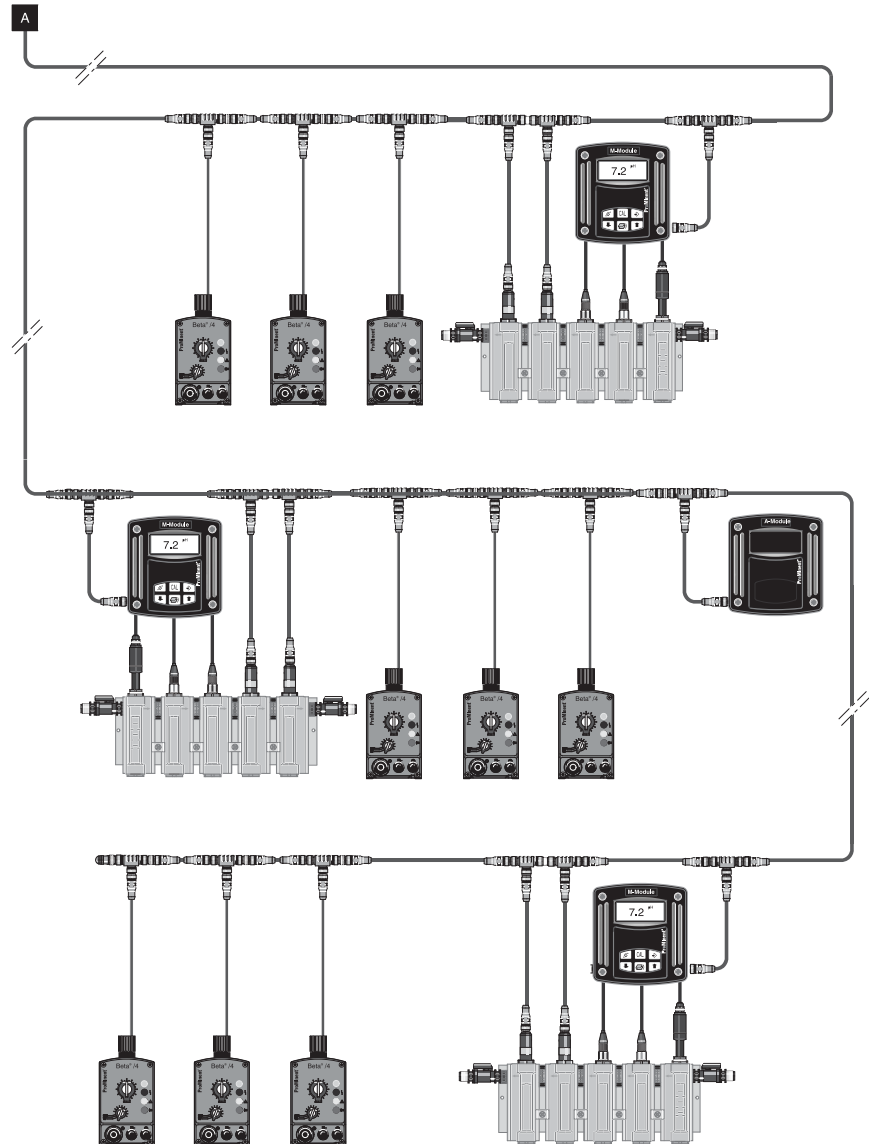
- A Whirlpool 1
B Whirlpool 2



pk_5_050

2.13 Application Examples

- A Dip pool
- B Paddle pool
- C (Terminating resistor)
- D Swimming pool



pk_5_051



2.13 Application Examples

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	→ 2-42	DXCaW06100PSE N01
5	Measuring module DXMa, measurement and control of pH, ORP, free and bound chlorine and temperature	→ 2-49	DXMAMW0SEN01
5	Chlorine sensor CLE 3.1-CAN-10 ppm	→ 1-31	1023426
5	Chlorine sensor CTE 1-CAN-10 ppm	→ 1-36	1023427
10	Cable combination coax 2 m- SN6 - pre-assembled*	→ 2-63	1024106
5	pH sensor PHEP 112 SE	→ 1-10	150041
5	ORP sensor RHES-Pt-SE	→ 1-19	150703
10 m	Signal cable, sold by the metre 2 x 0.25 mm ² Ø 4 mm	→ 1-66	725122
5	Bypass fitting DGMa with sample water limit contact	→ 1-71	DGMa322T000
2	Power supply modules DXMaN	→ 2-49	DXMANW300001
300 m	Connecting cable - CAN (by the metre)	→ 2-63	1022160
5	CAN (by the metre) – connection kit	→ 2-63	1026589

All cables, T-pieces and termination resistors needed to connect the sensors are supplied.

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





3.0 Overview of Panel-Mounted Measuring/Control Stations

3.0.1 Selection Guide

Measuring, control, monitoring tasks in water treatment

DULCOTROL® drinking water/F&B	DULCOTROL® cooling water	DULCOTROL® waste water
Treatment of potable water, water of quality similar to drinking water as well as of flushing water, industrial water and process water treatment by <ul style="list-style-type: none"> ■ Disinfection ■ CIP ■ pH value adjustment ■ Monitoring 	Treatment of cooling water in open cooling circuits and closed cooling circuits by <ul style="list-style-type: none"> ■ Desalination ■ Disinfection ■ pH value adjustment ■ Metering of corrosion inhibitors 	Treatment of industrial and municipal wastewater by <ul style="list-style-type: none"> ■ pH neutralisation ■ Disinfection ■ Decontamination ■ Desalination of process waters ■ Controlling of dissolved oxygen ■ Monitoring

DULCOTROL® Free Chlorine - pH-independent

All applications with clear, uncontaminated water where there are unstable pH values or pH values of > 8.0 .

3.0.2 DULCOTROL® Ordering System

DULCOTROL® measuring/control stations are available in three series assigned to the drinking water/F&B, cooling water and waste water applications. The measuring/control stations can be configured using the relevant Identcode order system. The DULCOTROL® order system is based on user-related selection criteria so that the right measuring/control station can be selected without the need for any technical knowledge. In all series, up to a maximum of 3 measured variables can be configured. The Identcode features of the Identcode are explained in detail in the following section. The features apply to all DULCOTROL® measuring/control stations. If required, the content described in the features is explained in the individual DULCOTROL® series. The scope of delivery of the technical components for a certain selection is also specified there.

Feature: "Measured variable"

This determines the parameter to be measured or controlled (e.g. pH or chlorine). Up to three measuring parameters can be simultaneously selected depending on the given options. This determines the sensor class (e.g. pH electrode or chlorine sensor) and the controller suitable for the measured variable as well as the corresponding measuring cable.

Feature: "Water to be measured"

This facilitates the classification of the sample water (e.g. "clear water" or "turbid water") in addition to the main application (e.g. potable water, cooling water, waste water). Together with the main application, the exact sensor type and the measuring range (e.g. CLE 3-mA-2ppm) and sensor fitting (e.g. DGMA) are specified. The price assigned to this feature also includes the piping. In some cases, the selection of the water to be measured (e.g. flushing water / service water / process water, $T > 45^\circ\text{C}$ and $< 55^\circ\text{C}$) also necessitates a selection of the accessories stated in the Identcode as separate feature (e.g. heat exchanger). These cases are correspondingly referenced in the order system.

Feature: "Category of use"

The "Category of use" feature determines whether the measuring unit assigned to a measured variable

- Is only to measure
- Or is to have additional control functionality. In this respect, "two-way control" means that the controller can both increase and decrease the measured variable. In this case, the D1Ca controller is assigned with full control functionality.

In the event of several measured variables, the following type of application is also available:

- One-way controlling: this means that the controller may either increase or decrease the measured variable. The D2C controller is assigned for cases such as this. For this reason, only the measured variable combinations can be selected for which a D2C controller exists. These are specified in the order system. Note the limited functionality of the D2C controller compared to the D1C controller described in Chapter 7.

In the ordering system, various configurations of measurement and control functions are offered to suit the combination of several measured variables.

3.0 Overview of Panel-Mounted Measuring/Control Stations

Feature: “Electrical connection“

This feature determines the voltage supply of the measuring/control station. The electrical power supply is connected by the user via the “terminal” on the measuring/control station. Measuring/control panels for several measured variables include a terminal box.

Feature: “Sensor equipment“

This feature determines whether the measuring/control panel is supplied with or without sensors. The option “without sensors“ should be chosen if the standard sensor types cannot be used (e.g.: non-applicable measuring range) or if measuring panels are intended to be put in storage.

Feature: “Design“

This feature determines whether and which label is affixed to the panel. With DULCOTROL® drinking water/F&B, the components can also be installed in a stainless steel cabinet.

Feature: “Sample water treatment“

This feature determines whether a filter ready for connection is included. It is installed by the customer upstream of the measuring/control station. Likewise, a peristaltic pump can also be selected for metering pH buffer solution into the sample water bypass.

Feature: “Accessories“

This feature defines the accessories, such as pressure reducer or sample water pump. These components are delivered together with the measuring and control panel but will be installed by the customer externally to the panel.

Feature: “Language“

This feature determines the operating language of the measuring/control station.

Feature : “Approval“

This feature states the existing approvals, certificates.



3.1 DULCOTROL® Drinking Water/F&B

3.1.1

DULCOTROL® Drinking Water/F&B Ordering System

DULCOTROL® drinking water/F&B measuring and control stations are specifically designed for the drinking water industry as well as the food and beverages industry. Furthermore, special requirements are met that exist with drinking water / product water treatment and flushing water, service water and process water treatment.

In the following Identcode, the “water to be measured” feature is thus differentiated into:

- “Drinking/product water treatment”: this means the final treatment (e.g. disinfection) of water similar to drinking water as performed in the production of drinking water or in the production of beverages or food
- Flushing/service/process water: this includes e.g. all flushing processes in the food and beverage industry aimed at the cleaning and disinfection of pipes, vessels and machines or process or industrial water with a higher level of contamination.



3.1 DULCOTROL® Drinking Water/F&B

3.1.2 Identcode Ordering System

DULCOTROL® Drinking Water/F&B - One Measured Variable

PWCA	Measured variable
C000	Free chlorine (at pH-value < 8.0)
G000	Total chlorine (free+combined chlorine)
P000	pH
R000	ORP
D000	Chlorine dioxide
I000	Chlorite
L000	Conductivity (only "water to be measured" 1)
Z000	Ozone
F000	Fluoride (pH min.= 5.5, pH max. = 8.5)
H000	Hydrogen peroxide
A000	Peracetic acid
X000	Dissolved oxygen
T000	Temperature
Water to be measured	
1	Drinking water / product water, T< 45 °C
2	Flushing water / service water / process water, T< 45 °C
3	Drinking water / product water T> 45 °C and < 55 °C (only measured variable D000, H000, A000, others only with heat exchanger accessory)
4	Flushing water / service water / process water T> 45 °C and <55 °C (only measured variable D000, H000, A000, others only with heat exchanger accessory)
5	Drinking water / product water T> 55 °C and <80 °C (only with accessory: heat exchanger)
6	Flushing water / Industrial water / process water T> 55 °C and <80 °C (only with heat exchanger accessory)
Category of use	
0	All measured variables only measurable
9	All measured variables two-way controllable
Power supply	
A	230 V, 50/60 Hz
C	115 V, 50/60 Hz
Sensor equipment	
0	With sensors
1	Without sensors
Version	
0	With ProMinent Logo
2	Stainless steel cabinet
Sample water treatments	
0	None
1	With filter
Accessories	
0	None
1	With pressure reducer
2	With heat exchanger
3	With sample water pump
4	With pressure reducer and heat exchanger
6	With heat exchanger and sample water pump
Language	
DE	German
EN	English
FR	French
IT	Italian
NL	Dutch
ES	Spanish, not for H000 / A000
PL	Polish, not for H000 / A000
SV	Swedish, not for H000 / A000
HU	Hungarian, not for H000 / A000
PT	Portuguese, not for H000 / A000
CS	Czech, not for H000 / A000
Approvals	
1	CE

3.1 DULCOTROL® Drinking Water/F&B

Examples

Example 1: PWCA_D000_1_0_A_0_0_0_0_EN_1:

Measuring of chlorine dioxide in drinking water / product water.

Controller:

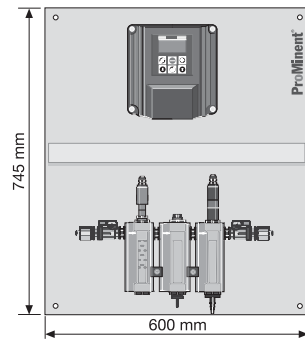
- D1CA_W_0_D_1_0_0_1_4_G_0_0_0_EN

Sensor fitting:

- DGM_A_3_1_1_T_0_0_0:
 - 1 Measuring module: Chlorine dioxide sensor, 1 empty measuring module for retrofitting of temperature,
 - 1 Flow monitoring module

Sensors:

- CDE-2-mA 0.5 ppm



P_DCT_0024_SW_NEU

Example 2: PWCA_D000_6_9_A_0_0_1_2_EN_1:

Chlorine dioxide control in turbid and hot flashing water (> 55 °C) in a bottle flushing plant. A filter and a heat exchanger installed outside of the panel are included in the scope of delivery.

Controller:

- D1CA_W_0_D_1_2_1_1_4_M_2_2_0_EN

Sensor fitting:

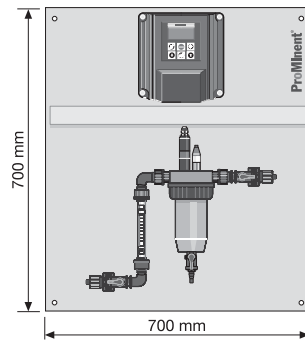
- DLG III for chlorine dioxide and temperature + flow monitoring

Sensors:

- CDP 1-mA-2 ppm
- PT 100

External to the panel (not shown), accessories:

- Filter
- Heat exchanger



P_DCT_0029_SW_1



3.1 DULCOTROL® Drinking Water/F&B

DULCOTROL® Drinking Water/F&B - Two Measured Variables

PWCA	Measured variable
CP00	1. Free chlorine / 2. pH (at pH-value < 8.0)
CR00	1. Free chlorine / 2. ORP (at pH-value < 8.0)
GP00	1. Total chlorine / 2. pH (free+combined chlorine)
RP00	1. ORP / 2. pH
HP00	1. Hydrogen peroxide / 2. pH
FP00	1. Fluoride / 2. pH (pH min.= 5.5, pH max. = 8.5)
AP00	1. Peracetic acid / 2. pH
LP00	1. Conductivity / 2. pH
AL00	1. Peracetic acid / 2. conductivity
DP00	1. Chlorine dioxide / 2. pH
DR00	1. Chlorine dioxide / 2. ORP
DI000	1. Chlorine dioxide / 2. chlorite (only "water to be measured" 1, 3, 5)
ZR00	1. Ozone / 2. ORP
Water to be measured	
1	Drinking water / product water, T< 45 °C
2	Flushing water / service water / process water, T< 45 °C
3	Drinking water / product water, T> 45 °C and < 55 °C (only measured variable RP00, HP00, AP00, LP00, AL00, DP00, DR00, others only with heat exchanger accessory)
4	Flushing water / service water / process water, T> 45 °C and < 55 °C (only measured variable RP00, HP00, AP00, LP00, AL00, DP00, DR00, others only with heat exchanger accessory)
5	Drinking water / product water, T> 55 °C and < 80 °C (only with heat exchanger accessory)
6	Flushing water / industrial water / process water, T> 55 °C and < 80 °C (only with heat exchanger accessory)
Category of use	
0	All measured variables only measurable
1	1st measured variable two-way controllable, 2nd measured variable only measurable
2	2nd measured variable two-way controllable, 1st measured variable only measurable
3	Both measured variables one-way controllable with two-channel controller D2C (only for CP00, GP00, RP00, DP00)
9	All measured variables two-way controllable
Power supply	
A	230 V, 50/60 Hz
C	115 V, 50/60 Hz
Sensor equipment	
0	With sensors
1	Without sensors
Version	
0	With ProMinent logo
2	Stainless steel cabinet
Sample water treatments	
0	None
1	With filter
Accessories	
0	None
1	With pressure reducer
2	With heat exchanger
3	With sample water pump
4	With pressure reducer and heat exchanger
6	With heat exchanger and sample water pump
Language	
DE	German
EN	English
FR	French
IT	Italian
NL	Dutch
ES	Spanish, not for H and A in HP00 / AP00/ AL00
PL	Polish, not for H and A in HP00 / AP00/ AL00
SV	Swedish, not for H and A in HP00 / AP00/ AL00
HU	Hungarian, not for H and A in HP00 / AP00/ AL00
PT	Portuguese, not for H and A in HP00 / AP00/ AL00
CS	Czech, not for H and A in HP00 / AP00/ AL00
Approvals	
1	CE

3.1 DULCOTROL® Drinking Water/F&B

Examples

Example 1: PWCA_DI00_1_1_A_0_0_0_1_EN_1:

Measuring of chlorine dioxide and chlorite in drinking water / product water. The scope of delivery includes a pressure reducer installed externally to the panel.

Controller:

- D1CA_W_0_1_1_0_0_1_4_G_0_0_0_EN
- D1CA_W_0_D_1_0_0_1_4_G_0_0_0_EN
- + terminal box on the panel

Sensor fitting:

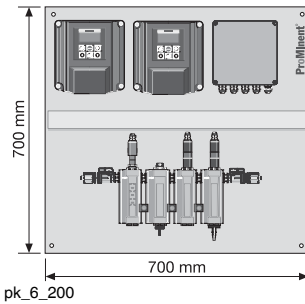
- DGM_A_3_1_2_T_0_0_2:
- 2 measuring modules for chlorine dioxide and chlorite sensors, 1 empty measuring module for retrofitting temperature, 1 flow monitoring module

Sensors:

- CDE-2-mA 0.5ppm
- CLT 1-mA-0.5ppm

External to the panel (not shown), accessories:

- Pressure reducer



Example 2: PWCA_CP00_6_3_A_0_0_1_6_EN_1

One-way control of pH and chlorine in hot flushing water (> 55 °C). A filter, heat exchanger and sample water pump installed outside of the panel are included in the scope of delivery.

Controller:

- D2CA_W_0_PC_5_2_0_4_M_2_0_EN

Sensor fitting:

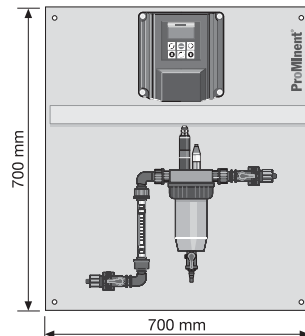
- DLG III for pH and chlorine+ flow monitoring

Sensors:

- CLE-3-mA 2ppm
- PHER 112-SE

External to the panel (not shown), accessories:

- Filter
- Sample water pump
- Heat exchanger



3.1 DULCOTROL® Drinking Water/F&B

DULCOTROL® Drinking Water/F&B - Three Measured Variables

PWCA	Measured variable
CPL0	1. Free chlorine / 2. pH / 3. conductivity (at pH-value < 8.0)
CRP0	1. Free chlorine / 2. ORP / 3. pH (at pH-value < 8.0)
GPL0	1. Total chlorine / 2. pH / 3. conductivity (free+combined chlorine)
GRP0	1. Total chlorine / 2. ORP / 3. pH (free+combined chlorine)
RPL0	1. ORP / 2. pH / 3. conductivity
DPR0	1. Chlorine dioxide / 2. pH / 3. ORP (with "water to be measured": 2,4,6 only with manual temperature compensation)
DPI0	1. Chlorine dioxide / 2. pH / 3. chlorite (only "water to be measured": 1,3,5)
DRI0	1. Chlorine dioxide / 2. ORP / 3. chlorite (only "water to be measured": 1,3,5)
ZPR0	1. Ozone / 2. pH / 3. ORP
ALP0	1. Peracetic acid / 2. conductivity / 3. pH
Water to be measured	
1	Drinking water / product water, T < 45 °C
2	Flushing water / industrial water / process water, T < 45 °C
3	Drinking water / product water, T > 45 °C and < 55 °C (only measured variable RPL0, DPR0, ALP0)
4	Flushing water / industrial water / process water, T > 45 °C and < 55 °C (only measured variable RPL0, DPR0, ALP0)
5	Drinking water / product water, T > 55 °C and < 80 °C (only with heat exchanger accessory)
6	Flushing water / industrial water / process water, T > 55 °C and < 80 °C (only with heat exchanger accessory)
Category of use	
0	All measured variables only measurable
4	1st measured variable two-way controllable, 2nd + 3rd measured variable only measurable
5	2nd measured variable two-way controllable, 1st + 3rd measured variable only measurable
6	1st + 2nd measured variable one-way controllable with two-channel controller D2C and 3rd measured variable only measurement (only for CPL0, GPL0, RPL0, DPR0, DPI0)
7	1st measured variable two-way controllable, 2nd + 3rd measured variable one-way controllable with two-channel controller D2C (only for CRP0, GRP0, DPR0, ZPR0)
9	All measured variables two-way controllable
Power supply	
A	230 V, 50/60 Hz
C	115 V, 50/60 Hz
Sensor equipment	
0	With sensors
1	Without sensors
Version	
0	With ProMinent logo
2	Stainless steel cabinet
Sample water treatments	
0	None
1	With filter
Accessories	
0	None
1	With pressure reducer
2	With heat exchanger
3	With sample water pump
4	With pressure reducer and heat exchanger
6	With heat exchanger and sample water pump
Language	
DE	German
EN	English
FR	French
IT	Italian
NL	Dutch
ES	Spanish, not for A in ALP0
PL	Polish, not for A in ALP0
SV	Swedish, not for A in ALP0
HU	Hungarian, not for A in ALP0
PT	Portuguese, not for A in ALP0
CS	Czech, not for A in ALP0
Approvals	
1	CE

3.1 DULCOTROL® Drinking Water/F&B

Examples

Example 1: PWCA_DRI0_5_4_A_0_0_0_2_EN_1

Two-way controll of chlorine dioxide and measurment of chlorite and pH in hot potable water / product water (> 55 °C). The scope of delivery includes a heat exchanger installed externally to the panel.

Controller:

- D1CA_W_0_D_1_2_1_1_4_M_2_2_0_EN
- D1CA_W_0_L_1_0_0_1_4_G_0_0_0_EN
- D1CA_W_0_P_5_2_0_1_4_G_0_0_0_EN
- + terminal box on the panel

Sensor fitting:

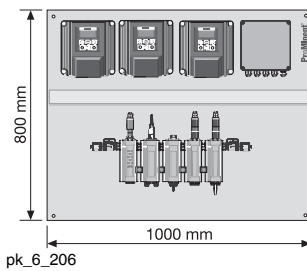
- DGM_A_3_2_2_T_0_0_2:
- 2 measuring module chlorine dioxide and chlorite sensors and 1 measuring module pH sensor, 1 empty measuring module for retrofitting temperature, 1 flow monitoring module

Sensors:

- CDE2-mA-0.5ppm
- CLT 1-mA-0.5ppm
- PHEP 112 SE

External to the panel, accessory:

- Heat exchanger



Example 2: PWCA_CPL0_2_6_A_0_0_1_0_EN_1

One-way controll of pH and chlorine and measurement of conductivity in turbid flushing water. The scope of delivery includes a heat exchanger installed externally to the panel.

Controller:

- D2CA_W_0_PC_5_2_0_4_M_2_0_EN
- D1CA_W_0_L_6_2_0_1_4_G_0_0_0_EN
- + terminal box on the panel

Sensor fitting:

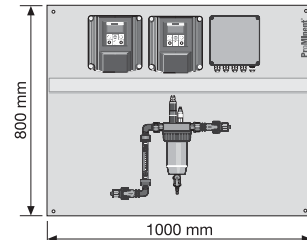
- DLG III for pH and chlorine + flow monitoring

Sensors:

- CLE-3-mA 2ppm
- PHEP 112-SE
- ICT2 + milk tube fitting mounted externally to the panel

Accessories, outside the panel (not illustrated):

- Filter



P_DCT_0028_SW



3.1 DULCOTROL® Drinking Water/F&B

3.1.3

Technical Description of the Scope of Delivery of the DULCOTROL® Drinking Water/F&B

Controller

(for detailed information see chap. Measuring and Control Technology)

The Identcode “Measured variable” and “Category of use” features define the equipment of the measuring/control device.

The Identcode feature “**measurable**” defines the following version of the **D1CA measuring unit**:

- Connection of a correction variable
- Two limit value relays
- “Pause” control input
- Two freely programmable standard signal outputs

The Identcode “**two-way controllable**” feature defines the following version of the **D1CA controller** in addition to the properties listed in “**measurable**”:

- Feedforward control
- Alarm and 2 solenoid valve relays
- Control of two pumps
- PID Controller

The Identcode “**one-way controllable**” feature defines the **D2CA controller** as follows:

- two freely programmable standard signal outputs
- alarm and 2 solenoid valve relays
- Control of two pumps
- PID Controller

The specific Identcodes are as follows:

Measured variable	two-way controllable	measurable	one-way controllable
Chlorine	D1CA_W_x_C_1_1_2_1_4_M_2_2_0_x	D1CA_W_x_C_1_1_0_1_4_G_0_0_0_x	
Chlorine dioxide (with CDE sensor)	D1CA_W_x_D_1_0_1_1_4_M_2_2_0_x	D1CA_W_x_D_1_0_0_1_4_G_0_0_0_x	
Chlorine dioxide (with CDP sensor)	D1CA_W_x_D_1_2_1_1_4_M_2_2_0_x	D1CA_W_x_D_1_2_0_1_4_G_0_0_0_x	
Chlorite	D1CA_W_x_I_1_0_1_1_4_M_2_2_0_x	D1CA_W_x_I_1_0_0_1_4_G_0_0_0_x	
Fluoride	D1CA_W_x_F_1_2_1_1_4_M_2_2_0_x	D1CA_W_x_F_1_2_0_1_4_G_0_0_0_x	
Dissolved oxygen	D1CA_W_x_X_1_0_1_1_4_M_2_2_0_x	D1CA_W_x_X_1_0_0_1_4_G_0_0_0_x	
Conductivity, inductive	D1CA_W_x_L_6_2_4_1_4_M_2_2_0_x	D1CA_W_x_L_6_2_0_1_4_G_0_0_0_x	
Conductivity, conductive	D1CA_W_x_L_3_2_1_1_4_M_2_2_0_x	D1CA_W_x_L_3_2_0_1_4_G_0_0_0_x	
Ozone	D1CA_W_x_Z_1_0_1_1_4_M_2_2_0_x	D1CA_W_x_Z_1_0_0_1_4_G_0_0_0_x	
Peracetic acid	D1CA_W_x_A_7_0_1_1_4_M_2_2_0_x	D1CA_W_x_A_7_0_0_1_4_G_0_0_0_x	
ORP	D1CA_W_x_R_5_0_1_1_4_M_2_2_0_x	D1CA_W_x_R_5_0_0_1_4_G_0_0_0_x	
Temperature	D1CA_W_x_T_4_0_1_1_4_M_2_2_0_x	D1CA_W_x_T_4_0_0_1_4_G_0_0_0_x	
Hydrogen peroxide	D1CA_W_x_H_7_0_1_1_4_M_2_2_0_x	D1CA_W_x_H_7_0_0_1_4_G_0_0_0_x	
pH	D1CA_W_x_P_5_2_1_1_4_M_2_2_0_x	D1CA_W_x_P_5_2_0_1_4_G_0_0_0_x	
pH/chlorine			D2CA_W_x_PC_5_2_0_4_M_2_0_x
pH/chlorine dioxide			D2CA_W_x_PD_5_2_0_4_M_2_0_x
pH/ORP			D2CA_W_x_PR_5_2_0_4_M_2_0_x + transducer RHV1
pH/pH			D2CA_W_x_PP_5_2_0_4_M_2_0_x + transducer PHV1



3.1 DULCOTROL® Drinking Water/F&B

Sensors

(for detailed information see chap. entitled “DULCOTEST® Sensor Technology”)

The Identcode “measured variable” and “water to be measured” features define the sensor type used, as shown below. An accessory, such as a heat exchanger for instance, may be necessary (see Identcode):

- If a different sensor type is required, the measuring/control panel may also be supplied without sensors (see Identcode feature: “Sensor equipment”).
- The ICT2 sensor is not mounted on the panel but adapted to the process by a 10-metre long cable. It is adapted to the process by a milk pipe connection.

Measured variable	Sample water	Sensor type	Order no.
Free chlorine	1/5	CLE 3-mA-0.5 ppm	792927
Free chlorine	2/6	CLE 3-mA-2 ppm	792920
Total chlorine	1/5	CTE 1-mA-0.5 ppm	740686
Total chlorine	2/6	CTE 1-mA-2 ppm	740685
pH	1/3/5	PHEP 112 SE	150041
pH	2/4/6	PHER 112 SE	1001586
ORP	1/3/5	RHEP-Pt-SE	150094
ORP	2/4/6	RHER-Pt-SE	1002534
Chlorine dioxide	1/5	CDE 2-mA-0.5 ppm	792930
Chlorine dioxide (temp.corr.)	2/4/6	CDP 1-mA-2 ppm	1002149
Chlorite	1/2/5/6	CLT 1-mA-0.5 ppm	1021596
Conductivity, conductive	1/3/5	LFT 1 DE	1001376
Conductivity, inductive	2/4/6	ICT 2	1023352
Ozone	1/2/5/6	OZE 3-mA-2 ppm	792957
Fluoride (temp.corr.)	1/2/5/6	FLEP 010-SE / FLEP 0100-SE +Reference electrode, REFP-SE (Order no.1018458) +Pt 100 SE (Order no.305063)	1028279
Hydrogen peroxide	1/3/5	PER 1-mA-200 ppm	1022509
Hydrogen peroxide	2/4/6	PER 1-mA-2000 ppm	1022510
Peracetic acid	1/3/5	PAA 1-mA-200 ppm	1022506
Peracetic acid	2/4/6	PAA 1-mA-2000 ppm	1022507
Dissolved oxygen	1/2/5/6	DO 1-mA-20 ppm	1020532
Temperature	1/2/3/4/5/6	Pt 100 SE	305063

3.1 DULCOTROL® Drinking Water/F&B

Sensor fittings

(for detailed information see chap. entitled "DULCOTEST® Sensor Technology")

The bypass sensor fitting used, depends in particular on the sample water, sometimes also on the measured variable or combination of measured variables. DGMA with flow monitoring, DLG III also with upstream flow monitoring is used for contaminated water. The DGMA bypass sensor fitting always includes a measuring module for retrofitting the correction variable measurement in addition to the measuring modules required.

Particularities:

- The DLG IV is used for fluoride.
- A milk pipe connection for direct adaptation to the process is used for conductivity with ICT2.
- A T-adapter is used for dissolved oxygen.

Measured variable	Sample water	Sensor type
Chlorine dioxide (CDE 2)	1	DGMA
Chlorine dioxide (CDE 3)	3	DGMA
Chlorine dioxide (CDP)	2/4/6	DLGIII
Chlorite	2/6	DLGIII
Chlorite	1/5	DGMA
Fluoride (temp.corr.)	1/2/5/6	DLGIV
Free chlorine	2/6	DLGIII
Dissolved oxygen (DO1)	1/2/5/6	Adapter d75 pipe
Total chlorine	1/5	DGMA
Total chlorine	2/6	DLGIII
Total chlorine	1/5	DGMA
Conductivity, inductive (ICT 2)	2/4/6	milk pipe connection
Conductivity	1/3/5	DGMA
Ozone	2/6	DLGIII
Ozone	1/5	DGMA
Peracetic acid	1/3/5	DGMA
Peracetic acid	2/4/6	DLGIII
ORP	2/4/6	DLGIII
ORP	1/3/5	DGMA
Temperature	2/4/6	DLGIII
Temperature	1/3/5	DGMA
Hydrogen peroxide	1/3/5	DGMA
Hydrogen peroxide	2/4/6	DLGIII
pH	2/4/6	DLGIII
pH	1/3/5	DGMA

Hydraulic connection

The sample water is hydraulically connected by means of a 8x5 mm hose connection. Shut-off ball valves are installed upstream and downstream of the bypass sensor fitting. Upstream of the bypass sensor fitting, a sample water filter will be positioned on ordering. The bypass sensor fitting includes a sampling tap. A metal pin is integrated in the bypass sensor fitting for an equipotential bonding line.



3.2 DULCOTROL® Cooling Water

3.2.1 DULCOTROL® Cooling Water

DULCOTROL® cooling water measuring/control stations are used in all sectors of industry in which cooling water is treated. The following applications are possible:

- In closed cooling circuits, the conditioning of cooling water by pH value adjustment, metering of corrosion inhibitors and the disinfection of cooling water with non-oxidative biocides and oxidative disinfectants.
- In open cooling circuits (cooling towers), automatic desalination (blow down) of cooling water on the basis of conductivity measurement in addition to the above mentioned functions.



3.2 DULCOTROL® Cooling Water

3.2.2 Identcode Ordering System

DULCOTROL® Cooling Water - One Measured Variable

CWCA	Measured variable
L000	Conductivity
C000	Free chlorine (at pH-value < 8.0)
G000	Total chlorine (free+combined chlorine)
B000	Organic bromine (e.g. BCDMH, Stabrex)
B001	Free bromine (HOBr)
P000	pH
R000	ORP
D000	Chlorine dioxide (with temperature as correction variable)
Z000	Ozone
H000	Hydrogen peroxide
Water to be measured	
1	Cooling water
Category of use	
0	All measured variables measurable (L000: desalinate)
9	All measured variables two-way controllable
Power supply	
A	230 V, 50/60 Hz
C	115 V, 50/60 Hz
Sensor equipment	
0	With sensors
1	Without sensors
Version	
0	With ProMinent logo
Sample water treatments	
0	None
1	With filter
Accessories	
0	None
1	With pressure reducer
2	With heat exchanger
3	With sample water pump
4	With pressure reducer and heat exchanger
6	With heat exchanger and sample water pump
Language	
DE	German
EN	English
FR	French
IT	Italian
NL	Dutch
ES	Spanish, not for H000
PL	Polish, not for H000
SV	Swedish, not for H000
HU	Hungarian, not for H000
PT	Portuguese, not for H000
CS	Czech, not for H000
Approvals	
1	CE

3.2 DULCOTROL® Cooling Water

Examples

Example 1: CWCA_L000_1_0_A_0_0_0_0_EN_1

Measuring of conductivity and desalination (blow down) as well as time-controlled metering of biocides and corrosion inhibitors.

Controller:

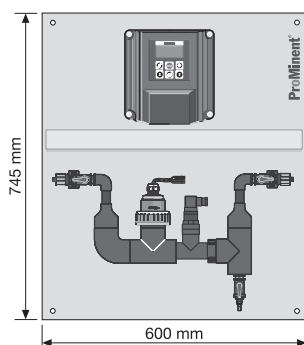
- D1CA_W_0_K_6_2_2_1_1_G_2_0_0_EN

Sensor fitting:

- T-piece for ICT 1

Sensors:

- ICT 1



P_DCT_0027_SW

Example 2: CWCA_B000_1_9_A_0_0_0_6_EN_1

Control of organic bromine in turbid and hot ($> 45^{\circ}\text{C}$) cooling water. The scope of delivery includes a heat exchanger and a sample water pump installed externally to the panel.

Controller:

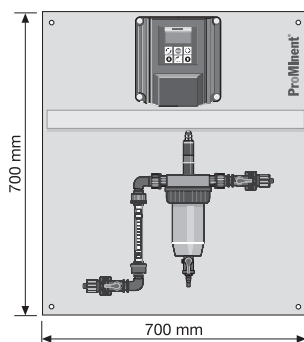
- D1CA_W_0_B_1_0_1_1_4_M_2_2_0_EN

Sensor fitting:

- DLG III for bromine + flow monitoring

Sensors:

- BRE-1-mA 2 ppm



P_DCT_0030_SW_NEU

External to the panel (not shown), accessories:

- Sample water pump
- Heat exchanger



3.2 DULCOTROL® Cooling Water

DULCOTROL® Cooling Water - Two Measured Variables

CWCA	Measured variable
LC00	1. Conductivity / 2. free chlorine (at pH-value < 8.0)
LG00	1. Conductivity / 2. total chlorine (free+combined chlorine)
LB00	1. Conductivity / 2. organic bromine (e.g. BCDMH, Stabrex)
LB01	1. Conductivity / 2. free bromine (HOBr)
LD00	1. Conductivity / 2. chlorine dioxide (with temperature as correction variable)
LZ00	1. Conductivity / 2. ozone
LR00	1. Conductivity / 2. ORP
LP00	1. Conductivity / 2. pH
CP00	1. Free chlorine / 2. pH (at pH-value < 8.0)
GP00	1. Total chlorine / 2. pH (free+combined chlorine)
BP00	1. Organic bromine / 2. pH
BP01	1. Free bromine (HOBr) / 2. pH
DP00	1. Chlorine dioxide / 2. pH (with temperature as correction variable)
HP00	1. Hydrogen peroxide / 2. pH
RP00	1. ORP / 2. pH
Water to be measured	
1	Cooling water
Category of use	
0	All measured variables measurable (Lx0x: desalinate)
1	1st measured variable = conductivity: desalinate (blow down), others two-way controllable, 2nd measured variable only measurable
2	2nd measured variable two-way controllable, 1st measured variable = conductivity: desalinate (blow down), others only measurable
3	Both measured variable one-way controllable with two-channel controller D2C (CP00, GP00, RP00, DP00)
9	All measured variables two-way controllable
Power supply	
A	230 V, 50/60 Hz
C	115 V, 50/60 Hz
Sensor equipment	
0	with sensors
1	without sensors
Version	
0	With ProMinent logo
1	Without ProMinent logo
Sample water treatments	
0	None
1	With filter
Accessories	
0	None
1	With pressure reducer
2	With heat exchanger
3	With sample water pump
4	With pressure reducer and heat exchanger
6	With heat exchanger and sample water pump
Language	
DE	German
EN	English
FR	French
IT	Italian
NL	Dutch
ES	Spanish, not for H in HP00
PL	Polish, not for H in HP00
SV	Swedish, not for H in HP00
HU	Hungarian, not for H in HP00
PT	Portuguese, not for H in HP00
CS	Czech, not for H in HP00
Approvals	
1	CE

3.2 DULCOTROL® Cooling Water

Examples

Example 1: CWCA_LB00_1_2_A_0_0_0_0_EN_1

Control of organic bromine (BCDMH) and measurement of conductivity for desalination as well as time-controlled metering of biocides and corrosion inhibitors.

Controller:

- D1CA_W_0_K_6_2_2_1_1_G_2_0_0_EN
- D1CA_W_0_B_1_0_1_1_4_M_2_2_0_EN
- + terminal box on the panel

Fitting:

- DLG III (flushable) for bromine + flow monitoring
- T-piece for ICT 1

Sensors:

- ICT 1
- BRE 1-mA 2 ppm

Example 2: CWCA_RP00_1_3_A_0_0_1_3_EN_1

One-way control of organic bromine in turbid cooling water. The scope of delivery includes a sample water pump installed externally to the panel.

Controller:

- D2CA_W_0_PR_5_2_0_4_M_2_0_EN + transducer RHV1

Sensor fitting:

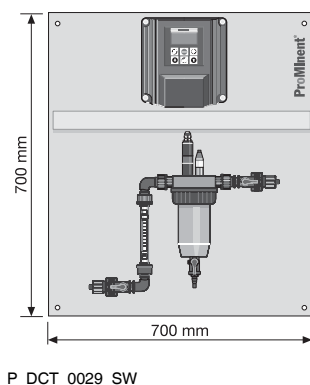
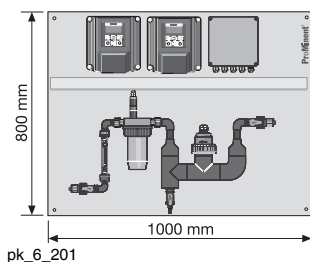
- DLG III for pH and ORP + flow monitoring

Sensors:

- RHER-Pt SE
- PHER 112 SE

External to the panel (not shown), accessories:

- Filter
- Sample water pump



3.2 DULCOTROL® Cooling Water

DULCOTROL® Cooling Water - Three Measured Variables

CWCA		Measured variable
	LCP0	1. Conductivity / 2. free chlorine / 3. pH (at pH-value < 8.0)
	LGP0	1. Conductivity / 2. total chlorine (free+combined chlorine) / 3. pH
	LBP0	1. Conductivity / 2. organic bromine (e.g. BCDMH, Stabrex) / 3. pH
	LBP1	1. Conductivity / 2. free bromine (HOBr) / 3. pH
	LDP0	1. Conductivity / 2. chlorine dioxide (with temperature as correction variable) / 3. pH
	LZP0	1. Conductivity / 2. ozone / 3. pH
	LHP0	1. Conductivity / 2. hydrogen peroxide / 3. pH
		Water to be measured
	1	Cooling water
		Category of use
	0	All measured variables measurable (Lxxx: desalinate)
	4	1st measured variable = conductivity: desalinate, 2nd +3rd measured variable only measurable
	5	2nd measured variable two-way controllable, 1st measured variable = conductivity: desalinate, 3rd measured variable only measurable
	6	1st measured variable = conductivity: desalinate (blow down), 2nd + 3rd measured variable one-way controllable with two-channel controller D2C (only LCP0/LGP0/LDP0)
	7	1st measured variable = conductivity: desalinate (blow down), 2nd + 3rd measured variable two-way controllable
	9	All measured variables two-way controllable
		Power supply
	A	230 V, 50/60 Hz
	C	115 V, 50/60 Hz
		Sensor equipment
	0	With sensors
	1	Without sensors
		Version
	0	With ProMinent logo
		Sample water treatments
	0	None
	1	With filter
		Accessories
	0	None
	1	With pressure reducer
	2	With heat exchanger
	3	With sample water pump
	4	With pressure reducer and heat exchanger
	6	With heat exchanger and sample water pump
		Language
	DE	German
	EN	English
	FR	French
	IT	Italian
	NL	Dutch
	ES	Spanish, not for H in LHP0
	PL	Polish, not for H in LHP0
	SV	Swedish, not for H in LHP0
	HU	Hungarian, not for H in LHP0
	PT	Portuguese, not for H in LHP0
	CS	Czech, not for H in LHP0
		Approvals
	1	CE

3.2 DULCOTROL® Cooling Water

Examples

Example 1: CWCA_LCP0_1_6_A_0_0_0_1_EN_1

One-way control of chlorine and pH and measurement of conductivity for desalination as well as time-controlled metering of biocides and corrosion inhibitors. The scope of delivery includes a pressure reducer installed externally to the panel.

Controller:

- D1CA_W_0_K_6_2_2_1_1_G_2_0_0_EN
- D2CA_W_0_PC_5_2_0_4_M_2_0_0_EN
- + terminal box on the panel

Fitting:

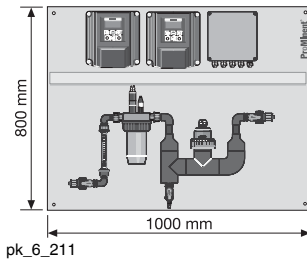
- DLG III (flushable) for pH and chlorine + flow monitoring
- T-piece for ICT 1

Sensors:

- ICT 1
- CLE 3-mA 0.5 ppm
- PHER-112-SE

External to the panel (not shown), accessories:

- Pressure reducer



Example 2: CWCA_LBP0_1_7_A_0_0_0_3_EN_1

Two-way control of organic bromine and pH and measurement of conductivity for desalination as well as time-controlled metering of biocides and corrosion inhibitors. The scope of delivery includes a sample water pump installed externally to the panel.

Controller:

- D1CA_W_0_K_6_2_2_1_1_G_2_0_0_EN
- D1CA_W_0_B_1_0_1_1_4_M_2_2_0_EN
- D1CA_W_0_P_5_2_1_1_4_M_2_2_0_EN
- + terminal box on the panel

Fitting:

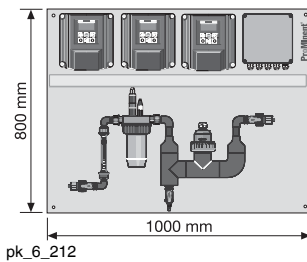
- DLG III for pH and bromine + flow monitoring
- T-piece for ICT 1

Sensors:

- ICT 1
- BRE 1-mA 2 ppm
- PHER-112-SE

External to the panel (not shown), accessories

- Sample water pump



3.2 DULCOTROL® Cooling Water

3.2.3

Technical Description of the Scope of Delivery of the DULCOTROL® Cooling Water

Controller

(for detailed information see chapter on Measuring and Control Technology)

The Identcode features “Measured variable” and “Category of use” define the equipment on the measuring/control device. The D1Ca control unit in the Cool-Control version with the Identcode **D1CA_W_x_K_6_2_0_1_1_G_2_0_0_x** is used for measuring the conductivity for desalination (blow down) as well as for metering biocides and corrosion inhibitors.

The Identcode specification “**measurable**” defines the following version of the **D1CA measuring unit** for the other measured variables:

- Connection of a correction variable
- Two limit value relays
- “Pause” control input
- Two freely programmable standard signal outputs

The Identcode feature “**two-way controllable**” defines the following version of the **D1CA controller** in addition to the properties listed in “**measurable**”:

- Feedforward control
- Alarm and 2 solenoid valve relays
- Control of two pumps
- PID Controller

The Identcode feature “**one-way controllable**” defines the **D2CA controller** as follows

- Two freely programmable standard signal outputs
- Alarm and 2 solenoid valve relays
- Control of two pumps
- PID controller

The specific Identcodes are as follows:

Measured variable	two-way controllable	measurable	one-way controllable
Bromine	D1CA_W_x_B_1_0_1_1_4_M_2_2_0_x	D1CA_W_x_B_1_0_0_1_4_G_0_0_0_x	
Chlorine	D1CA_W_x_C_1_1_2_1_4_M_2_2_0_x	D1CA_W_x_C_1_1_0_1_4_G_0_0_0_x	
Chlorine dioxide (with CDP sensor)	D1CA_W_x_D_1_2_1_1_4_M_2_2_0_x	D1CA_W_x_D_1_2_0_1_4_G_0_0_0_x	
Conductivity, inductive	D1CA_W_x_L_6_2_4_1_4_M_2_2_0_x	D1CA_W_x_K_6_2_0_1_1_G_2_0_0_x	
Ozone	D1CA_W_x_Z_1_0_1_1_4_M_2_2_0_x	D1CA_W_x_Z_1_0_0_1_4_G_0_0_0_x	
ORP	D1CA_W_x_R_5_0_1_1_4_M_2_2_0_x	D1CA_W_x_R_5_0_0_1_4_G_0_0_0_x	
Hydrogen peroxide	D1CA_W_x_H_7_0_1_1_4_M_2_2_0_x	D1CA_W_x_H_7_0_0_1_4_G_0_0_0_x	
pH	D1CA_W_x_P_5_2_1_1_4_M_2_2_0_x	D1CA_W_x_P_5_2_0_1_4_G_0_0_0_x	
pH/chlorine			D2CA_W_x_PC_5_2_0_4_M_2_0_x
pH/chlorine dioxide			D2CA_W_x_PD_5_2_0_4_M_2_0_x
pH/ORP			D2CA_W_x_PR_5_2_0_4_M_2_0_x + transducer RHV1



3.2 DULCOTROL® Cooling Water

Sensors

(for detailed information see chap. on DULCOTEST® Sensor Technology)

The Identcode feature “measured variable” defines the sensor type used, as listed below. An accessory, such as a filter, may be necessary:

- If a different sensor type is required, the measuring/control panel may also be supplied without sensors (see Identcode feature: “Sensor equipment”).

Measured variable	Sensor type	Order no.
Conductivity, inductive	ICT 1	1023244
Total chlorine	CTE 1-mA-0.5 ppm	740686
Organic bromine	BRE 1-mA-2 ppm	1006894
Free bromine	BRE 2-mA-10 ppm	1020529
Free chlorine	CLE 3-mA-0.5 ppm	792927
ORP	RHER-Pt-SE	1002534
pH	PHER 112 SE	1001586
Chlorine dioxide	CDR 1-mA-0.5 ppm	1033762
Ozone	OZE 3-mA-2 ppm	792957
Hydrogen peroxide	PER 1-mA-50 ppm	1030511

* CBR 1-mA-2ppm (1038015), measuring range relative to bromine: 0.04-4 ppm

** CBR 1-mA-10ppm (1038014)



3.2 DULCOTROL® Cooling Water

Sensor fittings

The Identcode feature “measured variable” defines the sensor fittings used, as listed below:

Measured variable	Sample water	Sensor type
Bromine	1	DLGIII
Chlorine dioxide (temp.corr.)	1	DLGIII
Free chlorine	1	DLGIII
Total chlorine	1	DLGIII
Conductivity	1	Adapter DN40 pipe
Ozone	1	DLGIII
ORP	1	DLGIII
pH	1	DLGIII

Hydraulic connection

The sample water is hydraulically connected by means of a 8x5 mm hose connection. Shut-off ball valves are installed upstream and downstream of the bypass sensor fitting. A sample water filter will be positioned upstream of the bypass sensor fitting, if ordered. The sensor fitting includes a sampling tap. A metal pin is integrated in the bypass sensor fitting for an equipotential bonding line.





3.3 DULCOTROL® Waste Water

3.3.1 DULCOTROL® Waste Water

The DULCOTROL® waste water measuring and control stations are used in all segments of industry where waste water is treated. The following applications are possible:

- pH neutralisation and pH value adjustment
- Disinfection of clarified water
- Decontamination of waste water by eliminating reductives and oxidants
- Monitoring of flushing water
- Desalination of process water
- Control of the dissolved oxygen in the biologic clarification stage

The selection of components can be further optimised by differentiating between the “water to be measured” feature in the Identcode order system:

- “Clear water”: all waste water that has almost no or no visible solid fractions.
- “Water with solid fraction, turbid”: all waste water that contains a small solid fraction which, however, is clearly seen as cloudy turbidity.
- “Water with solid fraction, muddy”: all waste water that has a high volume of solids. In a sample, solids either clearly precipitate or the sample is no longer translucent.
- “Water with fluoride and pH < 7”: a higher content of free hydrofluoric acid (HF) should be assumed in this kind of water, which could damage certain materials (e.g. glass).

3.3 DULCOTROL® Waste Water

3.3.2 Identcode Ordering System

DULCOTROL® Waste Water - One Measured Variable

WWCA	Measured variable
G000	Total chlorine (free+combined chlorine or chlorine measurement for pH value > 8.0) for "water to be measured" 1, 2
P000	pH
R000	ORP for "water to be measured" 1, 2, 3
L000	Conductivity
D000	Chlorine dioxide (with temperature as correction variable) for "water to be measured": 1,2
Z000	Ozone for "water to be measured": 1,2
H000	Hydrogen peroxide for "water to be measured": 1,2
F000	Fluoride for "water to be measured" 1, 2, 4 (pH min. = 5.5, pH max. = 8.5)
T000	Temperature for "water to be measured": 1, 2, 3
Water to be measured	
1	Clear water
2	Water with solid fraction, turbid
3	Water with solid fraction, muddy (sensor directly within pipe, without filter)
4	Water with fluoride and pH < 7
Category of use	
0	All measured variables only measurable
9	All measured variables two-way controllable
Power supply	
A	230 V, 50/60 Hz
C	115 V, 50/60 Hz
Sensor equipment	
0	With sensors
1	Without sensors
Version	
0	With ProMinent logo
Sample water treatments	
0	None
1	With filter
Accessories	
0	None
2	With heat exchanger
3	With sample water pump
6	With heat exchanger and sample water pump
Language	
DE	German
EN	English
FR	French
IT	Italian
NL	Dutch
ES	Spanish, not for H000
PL	Polish, not for H000
SV	Swedish, not for H000
HU	Hungarian, not for H000
PT	Portuguese, not for H000
CS	Czech, not for H000
Approvals	
1	CE



3.3 DULCOTROL® Waste Water

Examples

Example 1: WWCA_P000_3_9_A_0_0_0_0_EN_1

Two-way controll of pH in muddy waste water.

Controller:

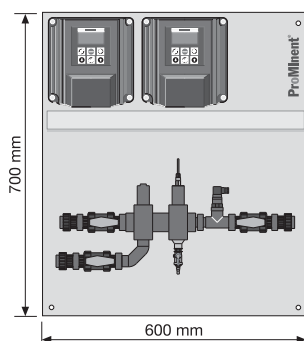
- D1CA_W_0_P_5_2_1_1_4_M_2_2_0_EN

Sensor fitting:

- T-piece for pH electrodes

Sensors:

- PHEX-112-SE



P_DCT_0026_SW1

Example 2: WWCA_H000_2_9_A_0_0_0_0_EN_1

Two-way controll of hydrogen peroxide in turbid waste water.

Controller:

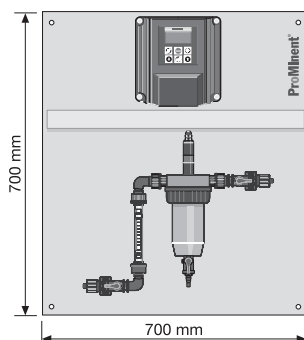
- D1CA_W_0_H_7_0_1_1_4_M_2_2_0_EN

Fitting:

- DLG III for hydrogen peroxide
+ flow monitoring

Sensors:

- PER1-200 ppm



P_DCT_0030_SW_NEU

3.3 DULCOTROL® Waste Water

DULCOTROL® Waste Water - Two Measured Variables

WWCA	Measured variable
GP00	1. Total chlorine / 2. pH (free+combined chlorine or chlorine measurement for pH value > 8.0), for "water to be measured" 1, 2
GR00	1. Total chlorine / 2. ORP (free+combined chlorine or chlorine measurement for pH value > 8.0), for "water to be measured" 1, 2
PP00	1. pH / 2. pH
PR00	1. pH / 2. ORP for "water to be measured" 1, 2, 3
PL00	1. pH / 2. conductivity
RL00	1. ORP / 2. conductivity for "water to be measured" 1, 2, 3
DP00	1. Chlorine dioxide (with temperature as correction variable) / 2. pH for "water to be measured" 1, 2
DR00	1. Chlorine dioxide (with temperature as correction variable) / 2. ORP for "water to be measured" 1, 2
ZP00	1. Ozone / 2. pH for "water to be measured" 1, 2
ZR00	1. Ozone / 2. ORP for "water to be measured" 1, 2
HP00	1. Hydrogen peroxide / 2. pH for "water to be measured" 1, 2
XP00	1. Dissolved oxygen / 2. pH for "water to be measured" 1, 2, 3
PF00	1. pH / 2. fluoride for "water to be measured" 1, 2, 4 (pH min. = 5.5, pH max. = 8.5)
Water to be measured	
1	Clear water
2	Water with solid fraction, turbid
3	Water with solid fraction, muddy
4	Water with fluoride and pH < 7
Category of use	
0	All measured variables only measurable
1	1st measured variable two-way controllable, 2nd measured variable only measurable
2	2nd measured variable two-way controllable, 1st measured variable only measurable
3	Both measured variables one-way controllable with two-channel controller D2C (only for GP00/ PR00 / DP00/ PP00)
9	All measured variables two-way controllable
Power supply	
A	230 V, 50/60 Hz
C	115 V, 50/60 Hz
Sensor equipment	
0	With sensors
1	Without sensors
Version	
0	With ProMinent Logo
Sample water treatments	
0	None
1	With filter
Accessories	
0	None
2	With heat exchanger
3	With sample water pump
6	With heat exchanger and sample water pump
Language	
DE	German
EN	English
FR	French
IT	Italian
NL	Dutch
ES	Spanish, not for H in HP00
PL	Polish, not for H in HP00
SV	Swedish, not for H in HP00
HU	Hungarian, not for H in HP00
PT	Portuguese, not for H in HP00
CS	Czech, not for H in HP00
Approvals	
1	CE



3.3 DULCOTROL® Waste Water

Examples

Example 1: WWCA_DR00_2_1_A_0_0_1_3_EN_1

Two-way control of chlorine dioxide and redundant check measurement of ORP in turbid waste water.

Controller:

- D1CA_W_0_D_1_2_1_1_4_M_2_2_0_EN
- D1CA_W_0_R_5_2_0_1_4_G_0_0_0_EN
- + terminal box on the panel

Sensor fitting:

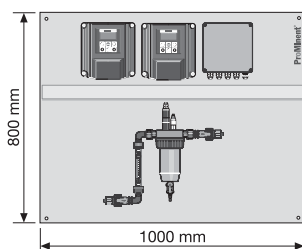
- DLG III for ORP, temperature, and chlorine dioxide
- + flow monitoring

Sensors:

- CDR-1-mA 2ppm
- RHER Pt-SE
- Pt 100

External to the panel (not shown), accessories:

- Filter
- Sample water pump



P_DCT_0028_SW

Example 2: WWCA_PL00_2_1_A_0_0_0_0_EN_1

Two-way control of pH and measurement of conductivity in turbid waste water.

Controller:

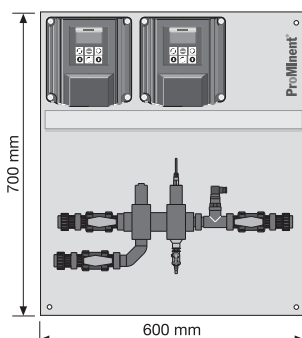
- D1CA_W_0_P_5_2_1_1_4_M_2_2_0_EN
- D1CA_W_0_L_6_2_0_1_4_G_0_0_0_EN
- + terminal box on the panel

Sensor fitting:

- T-piece for pH-electrode
- T-piece for ICT 1

Sensors:

- ICT 1
- PHEX 112-SE



P_DCT_0026_SW1

3.3 DULCOTROL® Waste Water

DULCOTROL® Waste Water - Three Measured Variables

WWCA Measured variable	
RPL0	1. ORP / 2. pH / 3. conductivity for "water to be measured" 1, 2, 3
GRP0	1. Total chlorine / 2. ORP / 3. pH for "measured water" 1, 2
DPR0	1. Chlorine dioxide / 2. pH / 3. ORP for "measured water" 1, 2 (only manual temp. compensation)
ZPR0	1. Ozone / 2. pH / 3. ORP for "measured water" 1, 2
GPL0	1. Total chlorine / 2. pH / 3. conductivity for "measured water" 1, 2
PDL0	1. pH / 2. chlorine dioxide (with temp.) / 3. conductivity for "measured water" 1, 2
PZL0	1. pH / 2. ozone / 3. conductivity for "measured water" 1, 2
PLX0	1. pH / 3. conductivity / 2. dissolved oxygen for "measured water" 1, 2, 3
PHL0	1. pH / 2. hydrogen peroxide / 3. conductivity for "measured water" 1, 2
Water to be measured	
1	Clear water
2	Water with solid fraction, turbid
3	Water with solid fraction, muddy
4	Water with fluoride and pH < 7
Category of use	
0	All measured variables only measurable
4	1st measured variable two-way controllable, 2nd + 3rd measured variable only measurable
5	2nd measured variable two-way controllable, 1st + 3rd measured variable only measurable
6	1st + 2nd measured variable one-way controllable with two-channel controller D2C (only for GPL0, RPL0, DPR0, PDL0) and 3rd measured variable only measurable
7	1st measured variable two-way controllable, 2nd + 3rd measured variable one-way controllable with two-channel controller D2C (only for GRP0, DPR0, ZPR0)
9	All measured variables two-way controllable
Power supply	
A	230 V, 50/60 Hz
C	115 V, 50/60 Hz
Sensor equipment	
0	With sensors
1	Without sensors
Version	
0	With ProMinent logo
Sample water treatments	
0	None
1	With filter
Accessories	
0	None
2	With heat exchanger
3	With sample water pump
6	With heat exchanger and sample water pump
Language	
DE	German
EN	English
FR	French
IT	Italian
NL	Dutch
ES	Spanish, not for H in PHL0
PL	Polish, not for H in PHL0
SV	Swedish, not for H in PHL0
HU	Hungarian, not for H in PHL0
PT	Portuguese, not for H in PHL0
CS	Czech, not for H in PHL0
Approvals	
1	CE

3.3 DULCOTROL® Waste Water

Examples

Example 1: WWCA_DPRO_2_6_A_0_0_1_0_EN_1

One-way control of pH and chlorine dioxide and redundant check measurement of ORP in turbid waste water.

Controller:

- D2CA_W_0_DP_5_2_0_4_M_2_0_EN
- D1CA_W_0_R_5_0_0_1_4_G_0_0_0_EN
- + terminal box on the panel

Sensor fitting:

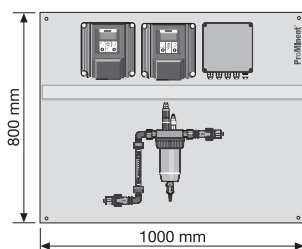
- DLG III for ORP, pH, and chlorine dioxide
- + flow monitoring

Sensors:

- CDP-1-mA 2ppm (manual temp. comp.)
- RHER Pt-SE
- PHER 112-SE

Accessories, outside the panel (not illustrated):

- Filter



P_DCT_0028_SW

Example 2: WWCA_PLX0_3_9_A_0_0_0_0_EN_1

Two-way control of pH, conductivity and dissolved oxygen in muddy waste water.

Controller:

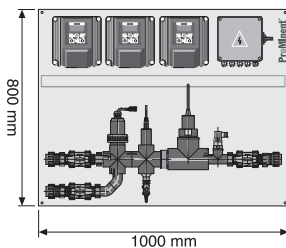
- D1CA_W_0_P_5_2_1_1_4_M_2_2_0_EN
- D1CA_W_0_X_1_0_1_1_4_M_2_2_0_EN
- D1CA_W_0_L_6_2_4_1_4_M_2_2_0_EN
- + terminal box on the panel

Sensor fitting:

- T-piece for pH-electrode
- T-piece for ICT 1
- T-adaptor for DO1

Sensors:

- ICT 1
- PHEX 112-SE
- DO1-mA-20 ppm



P_DCT_0022_SW



3.3 DULCOTROL® Waste Water

3.3.3

Technical Description of the Scope of Delivery of the DULCOTROL® Waste Water

Controller

(for detailed information see chap. Measuring And Control Technology)

The Identcode “Measured variable” and “Category of use” features define the equipment on the measuring/control device.

The Identcode specification “**measurable**” defines the following version of the **D1CA measuring unit**:

- Connection of a correction variable
- Two limit value relays
- “Pause” control input
- Two freely programmable standard signal outputs

The Identcode feature “**two-way controllable**” defines the following version of the **D1CA controller** in addition to the properties listed in “**measurable**”:

- Feedforward control
- Alarm and 2 solenoid valve relays
- Control of two pumps
- PID controller

The Identcode feature “**one-way controllable**” defines the **D2CA controller** as follows:

- Two freely programmable standard signal outputs
- Alarm and 2 solenoid valve relays
- Control of two pumps
- PID controller

The specific Identcodes are as follows:

Measured variable	two-way controllable	measurable	one-way controllable
Chlorine	D1CA_W_x_C_1_1_2_1_4_M_2_2_0_x	D1CA_W_x_C_1_1_0_1_4_G_0_0_0_x	
Chlorine dioxide (with CDP sensor)	D1CA_W_x_D_1_2_1_1_4_M_2_2_0_x	D1CA_W_x_D_1_2_0_1_4_G_0_0_0_x	
Fluoride		D1CA_W_0_F_1_2_1_1_4_M_2_2_0_D	
Dissolved oxygen	D1CA_W_x_X_1_0_1_1_4_M_2_2_0_x	D1CA_W_x_X_1_0_0_1_4_G_0_0_0_x	
Conductivity, inductive	D1CA_W_x_L_6_2_4_1_4_M_2_2_0_x	D1CA_W_x_L_6_2_0_1_4_G_0_0_0_x	
Ozone	D1CA_W_x_Z_1_0_1_1_4_M_2_2_0_x	D1CA_W_x_Z_1_0_0_1_4_G_0_0_0_x	
ORP	D1CA_W_x_R_5_0_1_1_4_M_2_2_0_x	D1CA_W_x_R_5_0_0_1_4_G_0_0_0_x	
Temperature	D1CA_W_x_T_4_0_1_1_4_M_2_2_0_x	D1CA_W_x_T_4_0_0_1_4_G_0_0_0_x	
Hydrogen peroxide	D1CA_W_x_H_7_0_1_1_4_M_2_2_0_x	D1CA_W_x_H_7_0_0_1_4_G_0_0_0_x	
pH	D1CA_W_x_P_5_2_1_1_4_M_2_2_0_x	D1CA_W_x_P_5_2_0_1_4_G_0_0_0_x	
pH/chlorine			D2CA_W_x_PC_5_2_0_4_M_2_0_x
pH/chlorine dioxide			D2CA_W_x_PD_5_2_0_4_M_2_0_x
pH/ORP			D2CA_W_x_PR_5_2_0_4_M_2_0_x + transducer RHV1
pH/pH			D2CA_W_x_PP_5_2_0_4_M_2_0_x + transducer PHV1





3.3 DULCOTROL® Waste Water

Sensors

(for detailed information see chap. on DULCOTEST® Sensor Technology)

The Identcode features "Measured variable" and Wwater to be measured" define the type of sensor used, as specified below.

- If a different sensor type is required, the measuring/control panel can also be supplied without sensors (see Identcode feature: "Sensor equipment")

Measured variable	Sample water	Sensor type	Order no.
pH	1	PHEP 112 SE	150041
pH	2	PHER 112 SE	1001586
pH	3	PHEX 112 SE	305096
pH	4	PHEF 012 SE	1010511
ORP	1	RHEP-Pt-SE	150094
ORP	2	RHER-Pt-SE	1002534
ORP	3	RHEX-Pt-SE	305097
Fluoride (temp.corr.)	1/2/4	FLEP 010-SE / FLEP 0100-SE +Reference electrode, REFP-SE (Order no.1018458) +Pt 100 SE (Order no.305063)	1028279
Conductivity, inductive	1/2/3	ICT 1	1023244
Conductivity, inductive	4	ICT 2	1023352
Total chlorine	1/2	CTE 1-mA-10 ppm	740684
Hydrogen peroxide	1/2	PER 1-mA-50 ppm	1030511
Dissolved oxygen	1/2/3	DO 1-mA-20 ppm	1020532
Ozone	1/2	OZE 3-mA-2 ppm	792957
Chlorine dioxide	1/2	CDR 1-mA-2 ppm	1033393
Temperature	1/2/3	Pt 100 SE	305063

Sensor fittings

(for detailed information see chap. on DULCOTEST® Sensor Technology)

The type of bypass fitting used depends specifically on the "water to be measured" and sometimes on the measured variable or the combination of measured variables. The sensor fitting DLG III is used with all clear water or water with a low solid fraction. With muddy water, the sensors are, if possible, directly installed in a pipe using a T-piece. Exception:

- for fluoride, the DLG IV is used.

Measured variable	Sample water	Sensor type
pH	1/2/4	DLGIII
pH	3	T-piece
ORP	1/2	DLGIII
ORP	3	T-piece
Total chlorine	1/2	DLGIII
Hydrogen peroxide	1/2	DLGIII
Ozone	1/2	DLGIII
Chlorine dioxide (CDP)	1/2	DLGIII
Temperature	1/2	DLGIII
Temperature	3	T-piece
Fluoride	1/4	DLGIV+magnetic stirrer
Dissolved oxygen (DO1)	1/2/3	Adapter for PVC pipe d75
Conductivity, inductive (ICT1)	1/2	Adapter for PVC pipe DN 40
Conductivity, inductive (ICT1)	3	ICT 1 in T-piece

3.3 DULCOTROL® Waste Water

Hydraulic connection, piping

The "water to be measured" 1, 2, 4 is connected by means of a 8x5 mm hose connection and the "water to be measured" 3 with a DN 25 connector. The sample water is hydraulically connected by means of a 8x5 mm hose connection. Shut-off ball valves are installed upstream and downstream of the bypass sensor fitting. A sample water filter is positioned upstream of the bypass sensor fitting, if ordered. The bypass sensor fitting includes a sampling tap. A metal pin is integrated in the bypass sample fitting for an equipotential bonding line. With muddy waste water (water to be measured 3), the sensors are, if possible, directly installed in a pipe.



3.4 DULCOTROL® Free Chlorine – pH-independent

3.4.1

DULCOTROL® Free Chlorine – pH-independent

The DULCOTROL® free chlorine - pH independent measuring and control stations are used, independently of the application, wherever free chlorine needs to be measured and in applications where pH values are either unstable or higher than 8.0. The pH value can be lowered and stabilised during measuring by metering a pH buffer solution.

Function and design

The water to be measured flows through the DGMA modular bypass fitting.

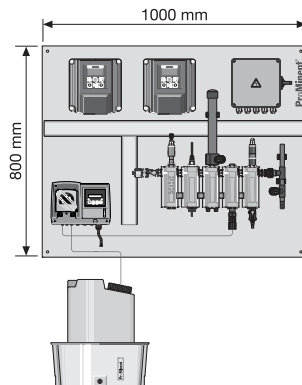
- A flow monitor measures the flow and triggers an alarm that can also be transmitted to a superordinated control desk via the D1Ca controller should it fall below 20 l/h.
- A module with an overflow tube limits the flow to a level ideal for the subsequent metering of the buffer solution.
- A peristaltic pump meters a pH buffer solution into a mixer module so that the pH level in the downstream measuring chamber is maintained at < pH 6.5. This enables pH-independent amperometric measurement of the free chlorine.
- The in-line sensor features an amperometric diaphragm-covered sensor for free chlorine connected to the D1Ca controller.
- Depending on the identcode selection, the D1Ca controller can be configured to measure or control free chlorine and either pH or ORP can optionally be selected as a second measurement. In terms of control, feedforward control can be activated via frequency input if the flow rates of the main flow are variable.

Typical applications

- Drinking water disinfection in water supply utilities with pH > 8.0
- Drinking water disinfection on cruise liners

Customer benefits

- Short response time and precise chlorine measurement thanks to continuous real-time measurements
- Reliable measurement/control without interference
 - Metering of the buffer solution prevents disturbance of the chlorine measurement due to pH fluctuations
 - The feedforward control prevents disturbance of chlorine control caused by fluctuations in the flow rate of the main process flow
 - The amperometric measurement prevents disturbances caused by the influence of colour and turbidity
- Fully automatic operation
 - Automatic monitoring of the sample water flow
 - Automatic monitoring of the buffer reagent consumption
 - Fault alarms



P_DCT_0023_SW



3.4 DULCOTROL® Free Chlorine – pH-independent

3.4.2 Identcode Ordering System

DULCOTROL® free chlorine pH-independent

FCCA	Measured variable
C001	1. Measured variable free chlorine
CP01	1. Measured variable free chlorine / 2. Measured variable pH
CR01	1. Measured variable free chlorine / 2. Measured variable ORP
	Water to be measured
0	Drinking water or similar water
	Category of use
0	All measured variables only measurable
1	1 st measured variable two way controllable, 2 nd measured variable only measurable (not C001)
3	Both measured variables one way controllable with two-channel controller D2C (only CP01)
9	All measured variables two-way controllable (not CR01)
	Power supply
A	230 V, 50/60 Hz
B	115 V, 50/60 Hz
	Sensor equipment
0	with sensors
1	without sensors
	Version
0	Panel-mounted with ProMinent logo
1	Panel-mounted without ProMinent logo
	Sample water treatments
0	without filter
1	with filter
	Accessories
A	with 10 litre tank and level monitoring
B	with 35 litre tank and level monitoring
C	with 35 litre tank and level monitoring + stirrer
	Language
DE	German
EN	English
FR	French
IT	Italian
NL	Dutch
ES	Spanish
PL	Polish
SV	Swedish
HU	Hungarian
PT	Portuguese
CS	Czech
	Certification
1	CE



3.4 DULCOTROL® Free Chlorine – pH-independent

3.4.3

Technical Description of the Scope of Delivery of the DULCOTROL® Free Chlorine, pH-independent

Controller

The identcode specification "measurable" defines the following version of D1CA measuring unit:

- Connection of a correction variable (with pH measured variable)
- Two limit value relays
- "Pause" control input
- Two freely programmable standard signal outputs

The identcode specification "two-way controllable" defines the following version of D1CA controller in addition to the properties listed under "measurable":

- Feedforward control via mA input
- Alarm and two solenoid valve relays
- Activation of two pumps
- PID control

The identcode specification "one-way controllable" defines the D2CA controller as follows:

- Two freely programmable standard signal outputs
- Alarm and two solenoid valve relays
- Control of two pumps
- PID control

The precise identcodes are as follows:

Measured variable	two-way controllable	measurable	one-way controllable
Chlorine	D1CA_W_x_C_1_0_1_1_4_M_2_2_0_x	D1CA_W_x_C_1_0_1_1_4_G_0_0_0_x	
Chlorine/pH			D2CA_W_0_1_PC_5_2_0_4_M_2_0_x
ORP		D1CA_W_x_R_5_0_1_1_4_G_0_0_0_x	
pH	D1CA_W_x_P_5_2_1_1_4_M_2_2_0_x	D1CA_W_x_P_5_2_1_1_4_G_0_0_0_x	

Sensors

- Measured variable **Free chlorine**: CLE 3-mA-5 ppm (part no. 1033392)
- Measured variable **pH**: PHEP112-SE (part no. 150041)
- Measured variable **ORP**: RHEP PT-SE (part no. 150094)

Fittings

Bypass fitting

- DGMA with flow limitation and mixer chamber for metering of buffer solution, assembly FCCA compl. (part no. 1036144)

Peristaltic pump

DF4A FW004004P0U10000122001

Reagent tank and level monitoring

	Order no.
10 litre canister, labelled	1036354
Suction fitting with filling level monitor	1002513
35 litre metering container, labelled	1036355
Suction fitting with filling level monitor	790365
Manual mixer	741118

Buffer reagent

	Order no.
4.2 kg of citric acid in a 5 litre bucket for the production of 10 litres of ready-to-use solution	1036014

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, referred 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 ₂ SO ₄ + 5 % K ₂ Cr ₂ O ₇ /Na ₂ Cr ₂ O ₇
Chromic acid	≥ 10 % CrO ₃
Hydrochloric acid	≥ 25 % HCl
Hydrogen peroxide	≥ 5 % H ₂ O ₂
Hydrofluoric acid	≥ 0 % HF

Explanation of abbreviations used as column headings:

Acrylic:	Acrylic resistance
PVC:	PVC, rigid, (PVC-U) resistance
PP:	Polypropylene resistance
PVDF:	PVDF resistance
1.4404:	Stainless steel 1.4404 & 1.4571 resistance
FPM:	Fluorine Rubber (e.g. Viton® A & B) resistance
EPDM:	Ethylene-Propylene-Dien-rubber resistance
Tygon:	Tygon® R-3603 resistance
Pharmed:	Pharmed® resistance
PE:	Polyethylene resistance
2.4819:	Hastelloy C-276 resistance
WGK:	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	Acryl	PVC	PP	PVDF	1.4404	FPM	EPDM	Tygon	PharMed	PE	HastelloyC	WPC
Acetaldehyde	CH ₃ CHO	100%	-	-	o	-	+	-	+/-	-	-	+	+	2
Acetamide	CH ₃ CONH ₂	s	+	+	+	+	+	o	+	-	+/-	+	+	1
Acetic Acid	CH ₃ COOH	100%	-	50%	+	+	+	-	o	60%	60%	70%	+	1
Acetic Anhydride	(CH ₃ CO) ₂ O	100%	-	-	o	-	+	-	+/-	-	+	o	+	1
Acetic Ether => Ethyl Acetate														
Acetone	CH ₃ COCH ₃	100%	-	-	+	-	+	-	+	-	-	+	+	1
Acetophenone	C ₆ H ₅ COCH ₃	100%	-	n	+	-	+	-	+	n	n	+	+	
Acetyl Chloride	CH ₃ COCl	100%	-	+	n	-	o	+	-	-	o	n	+	1
Acetylacetone	CH ₃ COCH ₂ COCH ₃	100%	-	-	+	-	+	-	+	n	n	+	+	1
Acetylene Dichloride => Dichloro Ethylene														
Acetylene Tetrachloride => Tetrachloro Ethane														
Acrylonitril	CH ₂ =CH-CN	100%	-	-	+	+	+	-	-	-	-	+	+	3
Adipic Acid	HOOC(CH ₂) ₄ COOH	s	+	+	+	+	+	+	+	-	+/-	+	+	1
Allyl Alcohol	CH ₂ CHCH ₂ OH	96%	-	o	+	+	+	-	+	-	o	+	+/-	2
Aluminium Acetate	Al(CH ₃ COO) ₃	s	+	+	+	+	+	+	+	+	+	+	+/-	1
Aluminium Bromide	AlBr ₃	s	+	+	+	+	n	+	+	+	+	+	+	2
Aluminium Chloride	AlCl ₃	s	+	+	+	+	-	+	+	+	+	+	+	1
Aluminium Fluoride	AlF ₃	10%	+	+	+	+	-	+	+	+	+	+	+/-	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 ₃ COONH ₄	s	+	+/-	+	+	+	+	+	+	+	+	+	1
Ammonium Bicarbonate	NH ₄ HCO ₃	s	+	+	+	+	+	+	+	+	+	+	+	1
Ammonium Carbonate	(NH ₄) ₂ CO ₃	40%	+	+	+	+	+	+	+	+	+	+	+	1
Ammonium Chloride	NH ₄ Cl	s	+	+	+	+	-	+	+	+	+	+	+/-	1
Ammonium Fluoride	NH ₄ F	s	+	o	+	+	o	+	+	+	+	+	+	1
Ammonium Hydroxide	"NH ₄ OH"	30%	+	+	+	+	+	-	+	+	+	+	+	2
(25 °C)														
Ammonium Nitrate	NH ₄ NO ₃	s	+	+	+	+	+	+	+	+	+	+	+	1
Ammonium Oxalate	(COONH ₄) ₂ * H ₂ O	s	+	+	+	+	+	+	+	+	+	+	+	1
Ammonium Perchlorate	NH ₄ ClO ₄	10%	+	+	+	+	+	+	+	+	+	+	+	1
Ammonium Peroxodisulphate	(NH ₄) ₂ S ₂ O ₈	s	+	+	+	+	5%	+	+	+	+	+	5%	2
Ammonium Phosphate	(NH ₄) ₃ PO ₄	s	+	+	+	+	10%	+	+	+	+	+	10%	1
Ammonium Sulphate	(NH ₄) ₂ SO ₄	s	+	+	+	+	10%	+	+	+	+	+	10%	1
Ammonium Sulphide	(NH ₄) ₂ S	s	+	+	+	+	n	+	+	n	n	+	n	2
Ammoniumaluminium Sulphate	NH ₄ Al(SO ₄) ₂	s	+	+	+	+	+	+	+	+	+	+	+	1
Amyl Alcohol	C ₅ H ₁₁ OH	100%	+	+	+	+	+	-	+	-	-	+	+	1
Aniline	C ₆ H ₅ NH ₂	100%	-	-	+	+	+	-	+/-	-	o	+	+	2
Aniline Hydrochloride	C ₆ H ₅ NH ₂ * HCl	s	n	+	+	+	-	+/-	+/-	-	o	+	+	2
Antimony Trichloride	SbCl ₃	s	+	+	+	+	-	+	+	+	+	+	n	2
Aqua Regia	3 HCl + HNO ₃	100%	-	+	-	+	-	-	o	-	-	-	-	2
Arsenic Acid	H ₃ AsO ₄	s	+	+	+	+	+	+	+	20%	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 ₆ H ₅ CHO	100%	-	-	+	-	+	+	+	-	-	o	+	1
Benzene	C ₆ H ₆	100%	-	-	o	+	+	o	-	-	-	o	+	3
Benzene Sulphonic Acid	C ₆ H ₅ SO ₃ H	10%	n	n	+	+	+	+	-	-	-	n	+	2
Benzoic Acid	C ₆ H ₅ COOH	s	+	+	+	+	+	+	+	-	+/-	+	+	1
Benzoyl Chloride	C ₆ H ₅ COCl	100%	-	n	o	n	o	+	+	n	n	o	+	2
Benzyl Alcohol	C ₆ H ₅ CH ₂ OH	100%	-	-	+	+	+	+	-	-	+	+	+	1
Benzyl Benzoate	C ₆ H ₅ COOC ₇ H ₇	100%	-	-	+	o	+	+	-	-	-	+	+	2



ProMinent® Chemical Resistance List

Chemical	Formula	Conc	Acryl	PVC	PP	PVDF	1.4404	FPM	EPDM	Tygon	PharMed	PE	HastelloyC	WPC
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	-	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	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	n	3
Butyl Oleate	$C_{22}H_{42}O_2$	100%	n	n	n	+	+	+	+/o	n	n	n	+	1
Butyl Stearate	$C_{22}H_{44}O_2$	100%	o	n	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	-	o	+	
Chlorine Water	$Cl_2 + H_2O$	s	+	+	o	+	-	+	+	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	o	+	10%	3
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



ProMinent® Chemical Resistance List

Chemical	Formula	Conc	Acryl	PVC	PP	PVDF	1.4404	FPM	EPDM	Tygon	PharMed	PE	HastelloyC	WPC
Copper-II-Acetate	$\text{Cu}(\text{CH}_3\text{COO})_2$	s	+	+	+	+	+	+	+	+	+	+	+	3
Copper-II-Arsenite	$\text{Cu}_3(\text{AsO}_3)_2$	s	+	+	+	+	+	+	+	+	+	+	+	3
Copper-II-Carbonate	CuCO_3	s	+	+	+	+	+	+	+	+	+	+	+	2
Copper-II-Chloride	CuCl_2	s	+	+	+	+	1%	+	+	+	+	+	+	2
Copper-II-Cyanide	$\text{Cu}(\text{CN})_2$	s	+	+	+	+	+	+	+	+	+	+	+	(3)
Copper-II-Fluoride	CuF_2	s	+	+	+	+	+	+	+	+	+	+	+	(2)
Copper-II-Nitrate	$\text{Cu}(\text{NO}_3)_2$	s	+	+	+	+	+	+	+	+	+	+	+/o	2
Copper-II-Sulphate	CuSO_4	s	+	+	+	+	+	+	+	+	+	+	+	2
Cresols	$\text{C}_6\text{H}_4\text{CH}_3\text{OH}$	100%	o	o	+	+	+	+	-	-	-	+	+	2
Crotonaldehyde	$\text{CH}_3\text{C}_2\text{H}_2\text{CHO}$	100%	n	-	+	+	+	-	+	-	-	+	+	3
Cubic Nitre => Sodium Nitrate														
Cumene => Isopropyl Benzene														
Cyclo Hexane	C_6H_{12}	100%	+	-	+	+	+	+	-	-	-	+	o	1
Cyclohexanole	$\text{C}_6\text{H}_{11}\text{OH}$	100%	o	+/o	+	+	+	+	-	-	-	+	+	1
Cyclohexanone	$\text{C}_6\text{H}_{10}\text{O}$	100%	-	-	+	-	+	-	+/o	-	-	+	+	1
Cyclohexyl Alcohol => Cyclohexanol														
Cyclohexylamine	$\text{C}_6\text{H}_{11}\text{NH}_2$	100%	n	n	n	n	+	-	n	n	n	n	+	2
Decahydronaphthaline	$\text{C}_{10}\text{H}_{18}$	100%	-	+/o	o	+	n	o	-	-	-	o	+	2
Decaline => Decahydronaphthalene														
Dextrose => Glucose														
Diacetonolalcohol	$\text{C}_6\text{H}_{12}\text{O}_2$	100%	-	-	+	o	+	-	+	-	-	+	+	1
Dibromoethane	$\text{C}_2\text{H}_4\text{Br}_2$	100%	-	-	n	+	+	+	-	-	-	-	+	3
Dibutyl Ether	$\text{C}_4\text{H}_9\text{OC}_4\text{H}_9$	100%	-	-	+	+	+	-	o	-	-	+	+	2
Dibutyl Phthalate	$\text{C}_{16}\text{H}_{22}\text{O}_4$	100%	-	-	+	+	+	-	+/o	o	+	o	+	2
Dibutylamine	$(\text{C}_4\text{H}_9)_2\text{NH}$	100%	n	n	+	+	+	-	-	n	n	+	+	1
Dichloro Acetic Acid	Cl_2CHCOOH	100%	-	+	+	+	+	-	+	-	o	+	+	1
Dichloro Benzene	$\text{C}_6\text{H}_4\text{Cl}_2$	100%	-	-	o	+	+	+	-	-	-	o	+	2
Dichloro Butan	$\text{C}_4\text{H}_8\text{Cl}_2$	100%	-	-	o	+	+	+	-	-	-	o	+	3
Dichloro Butene	$\text{C}_4\text{H}_6\text{Cl}_2$	100%	-	-	o	+	+	o	-	-	-	o	+	3
Dichloro Ethane	$\text{C}_2\text{H}_4\text{Cl}_2$	100%	-	-	o	+	+	+	-	-	o	-	+	3
Dichloro Ethylene	$\text{C}_2\text{H}_2\text{Cl}_2$	100%	-	-	o	+	+	o	-	-	o	-	+	2
Dichloro Methane	CH_2Cl_2	100%	-	-	o	o	o	+	-	-	o	-	+	2
Dichloroisopropyl Ether	$(\text{C}_3\text{H}_6\text{Cl})_2\text{O}$	100%	-	-	o	n	+	o	o	-	-	o	+	(2)
Dicyclohexylamine	$(\text{C}_6\text{H}_{12})_2\text{NH}$	100%	-	-	o	n	+	-	-	-	-	o	+	2
Diethyleneglycol	$\text{C}_4\text{H}_{10}\text{O}_3$	s	+	+	+	+	+	+	+	+	+	+	+	1
Diethyleneglycolethyl Ether	$\text{C}_8\text{H}_{18}\text{O}_3$	100%	n	n	+	+	+	n	+/o	-	o	+	+	1
Diethylether	$\text{C}_2\text{H}_5\text{OC}_2\text{H}_5$	100%	-	-	o	+	+	-	-	-	o	o	+	1
Diglycolic Acid	$\text{C}_4\text{H}_6\text{O}_5$	30%	+	+	+	+	+	+	n	+	+/o	+	+	3
Dihexyl Phthalate	$\text{C}_{20}\text{H}_{26}\text{O}_4$	100%	-	-	+	+	+	-	n	o	+	+	+	(1)
Diisobutylketone	$\text{C}_8\text{H}_{18}\text{O}$	100%	-	-	+	+	+	-	+	-	-	+	+	1
Di-iso-nonyl Phthalate	$\text{C}_{26}\text{H}_{42}\text{O}_4$	100%	-	-	+	+	+	n	n	o	+	+	+	1
Diisopropylketone	$\text{C}_7\text{H}_{14}\text{O}$	100%	-	-	+	+	+	-	+	-	-	+	+	1
Dimethyl Carbonate	$(\text{CH}_3\text{O})_2\text{CO}$	100%	n	n	+	+	+	+	-	n	n	+	+	1
Dimethyl Ketone => Acetone														
Dimethyl Phthalate	$\text{C}_{10}\text{H}_{10}\text{O}_4$	100%	-	-	+	+	+	-	+/o	o	+	+	+	1
Dimethylformamide	$\text{HCON}(\text{CH}_3)_2$	100%	-	-	+	-	+	-	+	-	+/o	+	+	1
Dimethylhydrazine	$\text{H}_2\text{NN}(\text{CH}_3)_2$	100%	n	n	+	n	+	-	+	n	n	+	+	3
Dioctyl Phthalate	$\text{C}_{24}\text{H}_{44}(\text{COOC}_8\text{H}_{17})_2$	100%	-	-	+	+	+	-	+/o	o	+	+	+	1
Dioxane	$\text{C}_4\text{H}_8\text{O}_2$	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	$\text{C}_2\text{H}_5\text{OH}$	100%	-	+	+	+	+	-	+	-	+	+	+	1
Ethanol Amine	$\text{HOC}_2\text{H}_4\text{NH}_2$	100%	o	n	+	-	+	-	+/o	-	o	+	+	1
Ethyl Acetate	$\text{CH}_3\text{COOC}_2\text{H}_5$	100%	-	-	35%	+	+	-	+/o	-	+/o	+	+	1
Ethyl Acrylate	$\text{C}_2\text{H}_3\text{COOC}_2\text{H}_5$	100%	-	-	+	o	+	-	+/o	-	-	+	+	2
Ethyl Benzene	$\text{C}_6\text{H}_5\text{-C}_2\text{H}_5$	100%	-	-	o	+	+	o	-	-	-	o	+	1
Ethyl Benzoate	$\text{C}_6\text{H}_5\text{COOC}_2\text{H}_5$	100%	n	-	+	o	+	+	-	-	-	+	+	1
Ethyl Bromide	$\text{C}_2\text{H}_5\text{Br}$	100%	-	n	+	+	n	+	-	-	o	+	+	2
Ethyl Chloroacetate	$\text{ClCH}_2\text{COOC}_2\text{H}_5$	100%	-	o	+	+	+	+	-	-	-	+	+	2
Ethyl Chlorocarbonate	$\text{ClCO}_2\text{C}_2\text{H}_5$	100%	n	n	n	n	n	+	-	n	n	n	n	(2)
Ethyl Cyclopentane	$\text{C}_5\text{H}_4\text{C}_2\text{H}_5$	100%	+	+	+	+	+	+	-	-	-	+	+	(1)

ProMinent® Chemical Resistance List

Chemical	Formula	Conc	Acryl	PVC	PP	PVDF	1.4404	FPM	EPDM	Tygon	PharMed	PE	HastelloyC	WPC
Ethylacetacetate	$C_6H_{10}O_3$	100%	n	-	+	+	+	-	+/-	-	+/-	+	+	1
Ethylacrylic Acid	C_4H_7COOH	100%	n	n	+	+	+	n	+/-	n	n	+	+	(1)
Ethylene Diamine	$(CH_2NH_2)_2$	100%	o	o	+	-	o	-	+	n	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	+	+	1
Ethylhexanol	$C_8H_{16}O$	100%	n	+/-	+	+	+	+	+	-	-	+	+	2
Fatty Acids	R-COOH	100%	+	+	+	+	+	+	o	-	o	+	+	1
Ferric Chloride	$FeCl_3$	s	+	+	+	+	-	+	+	+	+	+	+/-	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	+	+	+	+	-	+	+	+	+	+	+/-	1
Ferrous Sulphate	$FeSO_4$	s	+	+	+	+	+	+	+	+	+	+	+	1
Fixing Salt => Sodium Thiosulphate														
Fluoro Benzene	C_6H_5F	100%	-	-	+	+	+	o	-	-	-	o	+	2
Fluoroboric Acid	$HB F_4$	35%	+	+	+	+	o	+	+	+	-	+	+	1
Fluorosilicic Acid	H_2SiF_6	100%	+	30%	30%	+	o	+	+	25%	o	40%	+/-	2
Formaldehyde	CH_2O	40%	+	+	+	+	+	-	+/-	-	-	+	+	2
Formalin => Formaldehyde														
Formamide	$HCONH_2$	100%	+	-	+	+	+	+	+	n	n	+	+	1
Formic Acid	$HCOOH$	s	-	+/-	+	+	+	-	-	+/-	+/-	+	+	1
Furane	C_4H_4O	100%	-	-	+	-	+	-	n	-	-	+	+	3
Furane Aldehyde	$C_5H_5O_2$	100%	n	n	n	o	+	-	+/-	-	-	n	n	2
Furfuryl Alcohol	$OC_4H_3CH_2OH$	100%	-	-	+	o	+	n	+/-	-	-	+	+	1
Gallic Acid	$C_6H_2(OH)_3COOH$	5%	+	+	+	+	+	+	+/-	+	+	+	+	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	n	+	+	1
Glycine	NH_2CH_2COOH	10%	+	+	+	+	+	+	+	+	+	+	+	1
Glycol	$C_2H_4(OH)_2$	100%	+	+	+	+	+	+	+	+	+	+	+	1
Glycolic Acid	$CH_2OHCOOH$	70%	+	37%	+	+	+	+	+	+	+/-	+	+	1
Gypsum => Calcium Sulphate														
Heptane	C_7H_{16}	100%	+	+	+	+	+	+	-	-	-	+	+	1
Hexachloroplatinic Acid	H_2PtCl_6	s	n	+	+	+	-	n	+	n	n	+	-	1
Hexanal	$C_6H_{11}CHO$	100%	n	n	+	+	+	-	+/-	-	-	+	+	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	n	+	+	1
Hexene	C_6H_{12}	100%	n	+	+	+	+	+	-	-	-	+	+	1
Hydrazine Hydrate	$N_2H_4 \cdot H_2O$	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%	-	40%	+/-	1
Hydrogen Cyanide	HCN	s	+	+	+	+	+	+	+	+	+	+	+	3
Hydrogen Peroxide	H_2O_2	90%	40%	40%*	30%	+	+	30%	30%	30%	+	+	+	1
Hydroiodic Acid	HI	s	+	+	+	+	-	-	n	+	-	+	n	1
Hydroquinone	$C_6H_4(OH)_2$	s	o	+	+	+	+	+	-	+	+/-	+	+	2
Hydroxylamine Sulphate	$(NH_2OH)_2 \cdot H_2SO_4$	10%	+	+	+	+	+	+	+	+	+	+	+	2
Hypochlorous Acid	HOCl	s	+	+	o	+	-	+	+/-	+	+	o	+	(1)
Iodine	I_2	s	o	-	+	+	-	+	+/-	+	+	o	+/-	1
Iron Vitriol => Ferrous Sulphate														
Isobutanol => Isobutyl Alcohol														
Isobutyl Alcohol	$C_2H_5CH(OH)CH_3$	100%	-	+	+	+	+	+	+	-	o	+	+	1
Isopropanol => Isopropyl Alcohol														
Isopropyl Acetate	$CH_3COOCH(CH_3)_2$	100%	-	-	+	+	+	-	+/-	-	+/-	+	+	1
Isopropyl Alcohol	$(CH_3)_2CHOH$	100%	-	+/-	+	+	+	+	+	-	o	+	+	1
Isopropyl Benzene	$C_6H_5CH(CH_3)_2$	100%	-	-	o	+	+	+	-	-	-	o	+	1
Isopropyl Chloride	$CH_3CHClCH_3$	80%	-	-	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%	-	+	+	+	+/-	+	10%	-	+/-	+	+	1



ProMinent® Chemical Resistance List

Chemical	Formula	Conc	Acryl	PVC	PP	PVDF	1.4404	FPM	EPDM	Tygon	PharMed	PE	HastelloyC	WPC
Lead Acetate	$\text{Pb}(\text{CH}_3\text{COO})_2$	s	+	+	+	+	+	+	+	+	+	+	+	2
Lead Nitrate	$\text{Pb}(\text{NO}_3)_2$	50%	+	+	+	+	+	+	+	+	+	+	+	2
Lead Sugar => Lead Acetate														
Lead Sulphate	PbSO_4	s	+	+	+	+	+	+	+	+	+	+	+	(2)
Lead Tetraethyl	$\text{Pb}(\text{C}_2\text{H}_5)_4$	100%	+	+	+	+	+	+	-	n	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	$\text{Mg}(\text{OH})_2$	s	+	+	+	+	+	+	+	+	+	+	+	1
Magnesium Nitrate	$\text{Mg}(\text{NO}_3)_2$	s	+	+	+	+	+	+	+	+	+	+	+	1
Magnesium Sulphate	MgSO_4	s	+	+	+	+	+	+	+	+	+	+	+/o	1
Maleic Acid	$\text{C}_4\text{H}_4\text{O}_4$	s	+	+	+	+	+	+	+	-	o	+	+	1
Malic Acid	$\text{C}_4\text{H}_6\text{O}_5$	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	$\text{Hg}(\text{CN})_2$	s	+	+	+	+	+	+	+	+	+	+	+	3
Mercury-II-Nitrate	$\text{Hg}(\text{NO}_3)_2$	s	+	+	+	+	+	+	+	+	+	+	+	3
Mesityl Oxide	$\text{C}_6\text{H}_{10}\text{O}$	100%	-	-	n	n	+	-	+/o	-	-	n	+	1
Methacrylic Acid	$\text{C}_5\text{H}_8\text{COOH}$	100%	n	n	+	+	+	o	+/o	-	+/o	+	+	1
Methanol	CH_3OH	100%	-	-	+	+	+	o	+	-	+/o	+	+	1
Methoxybutanol	$\text{CH}_3\text{O}(\text{CH}_2)_4\text{OH}$	100%	-	-	+	+	+	+	o	-	o	+	+	(1)
Methyl Acetate	$\text{CH}_3\text{COOCH}_3$	60%	-	-	+	+	+	-	+/o	-	+/o	+	+	2
Methyl Acrylate	$\text{C}_5\text{H}_8\text{COOCH}_3$	100%	-	-	+	+	+	-	+/o	-	o	+	+	2
Methyl Benzoate	$\text{C}_6\text{H}_5\text{COOCH}_3$	100%	-	-	+	o	+	+	-	-	-	+	+	2
Methyl Catechol	$\text{C}_6\text{H}_3(\text{OH})_2\text{CH}_3$	s	+	+	+	+	+	+	-	+	+o	+	+	(1)
Methyl Cellulose		s	+	+	+	+	+	+	+	+	+	+	+	1
Methyl Chloroacetate	$\text{ClCH}_2\text{COOCH}_3$	100%	-	o	+	+	+	o	-	-	-	+	+	2
Methyl Cyclopentane	$\text{C}_5\text{H}_9\text{CH}_3$	100%	+	+	+	+	+	+	-	-	-	+	+	(1)
Methyl Dichloroacetate	$\text{Cl}_2\text{CHCOOCH}_3$	100%	-	-	+	n	+	-	n	-	-	+	+	2
Methyl Ethyl Ketone	$\text{CH}_3\text{COC}_2\text{H}_5$	100%	-	-	+	-	+	-	+	-	-	+	+	1
Methyl Glycol	$\text{C}_3\text{H}_8\text{O}_2$	100%	+	+	+	+	+	-	+/o	+	+	+	+	1
Methyl Isobutyl Ketone	$\text{CH}_3\text{COC}_4\text{H}_9$	100%	-	-	+	-	+	-	o	-	-	+	+	1
Methyl Isopropyl Ketone	$\text{CH}_3\text{COC}_3\text{H}_7$	100%	-	-	+	-	+	-	+/o	-	-	+	+	1
Methyl Methacrylate	$\text{C}_5\text{H}_8\text{COOCH}_3$	100%	-	-	+	+	+	-	-	-	-	+	+	1
Methyl Oleate	$\text{C}_{17}\text{H}_{33}\text{COOCH}_3$	100%	n	n	+	+	+	+	+/o	n	n	+	+	1
Methyl Salicylate	$\text{HOC}_6\text{H}_4\text{COOCH}_3$	100%	-	-	+	+	+	n	+/o	-	-	+	+	1
Methylacetyl Acetate	$\text{C}_8\text{H}_8\text{O}_3$	100%	-	-	+	+	+	-	+/o	-	o	+	+	2
Methylamine	CH_3NH_2	32%	+	o	+	o	+	-	+	+	+	+	+	2
Methylene Chloride => Dichloro Methane														
Mirabilite => Sodium Sulphate														
Morpholine	$\text{C}_4\text{H}_9\text{ON}$	100%	-	-	+	-	+	n	n	-	-	+	+	2
Muriatic Acid => Hydrochloric Acid														
Natron => Sodium Bicarbonate														
Nickel-II-Acetate	$(\text{CH}_3\text{COO})_2\text{Ni}$	s	+	+	+	+	+	-	+	+	+	+	+	(2)
Nickel-II-Chloride	NiCl_2	s	+	+	+	+	-	+	+	+	+	+	+	2
Nickel-II-Nitrate	$\text{Ni}(\text{NO}_3)_2$	s	+	+	+	+	+	+	+	+	+	+	+/o	2
Nickel-II-Sulphate	NiSO_4	s	+	+	+	+	+	+	+	+	+	+	+/o	2
Nitrate of Lime => Calcium Nitrate														
Nitric Acid	HNO_3	99%	10%	10%*	50%	65%	50%	65%	10%	35%	35%	50%	65%	1
Nitro Methane	CH_3NO_2	100%	-	-	+	o	+	-	+/o	-	-	+	+	2
Nitro Propane	$(\text{CH}_3)_2\text{CHNO}_2$	100%	-	-	+	n	+	-	+/o	-	-	+	+	2
Nitro Toluene	$\text{C}_6\text{H}_4\text{NO}_2\text{CH}_3$	100%	-	-	+	+	+	o	-	-	-	+	+	2
Octane	C_8H_{18}	100%	o	+	+	+	+	+	-	-	-	+	+	1
Octanol	$\text{C}_8\text{H}_{17}\text{OH}$	100%	-	-	+	+	+	+	+	-	-	+	+	1
Octyl Cresol	$\text{C}_{15}\text{H}_{24}\text{O}$	100%	-	-	+	+	+	o	n	-	-	+	+	(1)
Oil => Engine Oils														
Oleum	$\text{H}_2\text{SO}_4 + \text{SO}_3$	s	n	-	-	-	+	+	-	+	+	-	+	2
Orthophosphoric Acid => Phosphoric Acid														



ProMinent® Chemical Resistance List

Chemical	Formula	Conc	Acryl	PVC	PP	PVDF	1.4404	FPM	EPDM	Tygon	PharMed	PE	HastelloyC	WPC
Oxalic Acid	(COOH) ₂	s	+	+	+	+	10%	+	+	+/o	+/o	+	+/o	1
Pentane	C ₅ H ₁₂	100%	+	+	+	+	+	+	-	-	-	+	+	1
Pentanol => Amyl Alcohol														
Perchloric Acid	HClO ₄	70%	n	10%	10%	+	-	+	+/o	o	+	+	n	1
Perchloroethylene => Tetrachloro Ethylene														
Perhydrol => Hydrogen Peroxide														
Petroleum Ether	C _n H _{2n+2}	100%	+	+/o	+	+	+	+	-	-	-	+	+	1
Phenole	C ₆ H ₅ OH	100%	-	-	+	+	+	+	-	10%	+	+	+	2
Phenyl Ethyl Ether	C ₆ H ₅ OC ₂ H ₅	100%	-	-	+	n	+	-	-	-	-	+	+	2
Phenyl Hydrazine	C ₆ H ₅ NHNH ₂	100%	-	-	o	+	+	o	-	-	-	o	+	2
Phosphoric Acid	H ₃ PO ₄	85%	50%	+	+	+	+	+	+	+	+	+	+	1
Phosphorous Oxychloride	POCl ₃	100%	-	-	+	+	n	+	+	n	n	+	+	1
Phosphorous Trichloride	PCl ₃	100%	-	-	+	+	+	o	+	+	+/o	+	+	1
Phthalic Acid	C ₆ H ₄ (COOH) ₂	s	+	+	+	+	+	+	+	-	+	+	+	1
Picric Acid	C ₆ H ₂ (NO ₃) ₃ OH	s	+	+	+	+	+	+	+	+	-	+	+	2
Piperidine	C ₅ H ₁₁ N	100%	-	-	n	n	+	-	-	-	-	n	+	2
Potash Alum => Potassium Aluminium Sulphate														
Potassium Acetate	CH ₃ COOK	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 ₄ H ₅ O 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 ₂ CO ₃	s	+	+	+	+	+	+	+	55%	55%	+	+	1
Potassium Chlorate	KClO ₃	s	+	+	+	+	+	+	+	+	+	+	+	2
Potassium Chloride	KCl	s	+	+	+	+	-	+	+	+	+	+	+/o	1
Potassium Chromate	K ₂ CrO 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 ₄ Fe(CN) ₆	s	+	+	+	+	+	+	+	+	+	+	+	1
Potassium Cyanoferrate III	K ₃ Fe(CN) ₆	s	+	+	+	+	+	+	+	+	+	+	+	1
Potassium Dichromate	K ₂ Cr ₂ O ₇	s	+	+	+	+	25%	+	+	+	+	+	10%	3
Potassium Fluoride	KF	s	+	+	+	+	+	+	+	+	+	+	+	1
Potassium Hydroxyde	KOH	50%	+	+	+	+	+	-	+	10%	10%	+	+	1
(25 °C)														
Potassium Iodide	KI	s	+	+	+	+	+	+	+	+	+	+	+	1
Potassium Nitrate	KNO ₃	s	+	+	+	+	+	+	+	+	+	+	+	1
Potassium Perchlorate	KClO ₄	s	+	+	+	+	n	+	+	+	+	+	+	1
Potassium Permanganate	KMnO ₄	s	+	+	+	+	+	+	+	6%	6%	+	+	2
Potassium Persulphate	K ₂ S ₂ O ₈	s	+	+	+	+	+	+	+	+	+	+	+	1
Potassium Phosphate	KH ₂ PO ₄	s	+	+	+	+	+	+	+	+	+	+	+	1
Potassium Pyrochromate => Potassium Dichromate														
Potassium Sulphate	K ₂ SO ₄	s	+	+	+	+	+	+	+	+	+	+	+	1
Potassium Sulphite	K ₂ SO ₃	s	+	+	+	+	+	+	+	+	+	+	+	1
Propionic Acid	C ₂ H ₅ COOH	100%	o	+	+	+	+	+	+	-	+/o	+	+	1
Propionitrile	CH ₃ CH ₂ CN	100%	n	n	+	+	+	+	-	-	-	+	+	2
Propyl Acetate	CH ₃ COOC ₃ H ₇	100%	-	-	+	+	+	-	+/o	-	-	+	+	1
Propylene Glycol	CH ₃ CHOHCH ₂ OH	100%	+	+	+	+	+	+	+	+	+	+	+	1
Prussic Acid => Hydrogen Cyanide														
Pyridine	C ₅ H ₅ N	100%	-	-	o	-	+	-	-	-	o	+	+	2
Pyrrole	C ₄ H ₄ NH	100%	n	n	+	n	+	-	-	-	-	+	+	2
Roman Vitriol => Copper Sulphate														
Salicylic Acid	HOC ₆ H ₄ COOH	s	+	+	+	+	+	+	+	+	+	+	+/o	1
Salmiac => Ammonium Chloride														
Saltpeter => Potassium Nitrate														
Silic Acid	SiO ₂ * x H ₂ O	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 ₃ COO	s	+	+	+	+	+	+	+	+	+	+	+	1



ProMinent® Chemical Resistance List

Chemical	Formula	Conc	Acryl	PVC	PP	PVDF	1.4404	FPM	EPDM	Tygon	PharMed	PE	HastelloyC	WPC
Sodium Benzoate	C ₆ H ₅ COONa	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 ₂ CO 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 ₂ CrO ₄	s	+	+	+	+	+	+	+	+	+	+	+	3
Sodium Cyanide	NaCN	s	+	+	+	+	+	+	+	+	+	+	+	3
Sodium Dichromate	Na ₂ Cr ₂ O ₇	s	+	+	+	+	+	+	+	+	+	+	+	3
Sodium Dithionite	Na ₂ S ₂ O ₄	s	+	10%	10%	+	+	n	n	+	+	10%	+/o	1
Sodium Fluoride	NaF	s	+	+	+	+	10%	+	+	+	+	+	+	1
Sodium Hydrogen Sulphate => Sodium Bisulphate														
Sodium Hydroxide	NaOH	50%	+	+	+	+	+	-	+	10%	30%	+	+	1
(60%/ 25 °C)														
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 ₂ C ₂ O ₄	s	+	+	+	+	+	+	+	+	+	+	+	1
Sodium Perborate	NaBO ₂ *H ₂ O ₂	s	+	+/o	+	+	+	+	+	+	+	+	+/o	1
Sodium Perchlorate	NaClO ₄	s	+	+	+	+	10%	+	+	+	+	+	10%	1
Sodium Peroxide	Na ₂ O ₂	s	+	+	+	+	+	+	+	n	n	-	+	1
Sodium Persulphate	Na ₂ S ₂ O ₈	s	n	+	+	+	+	+	+	+	+	+	+	1
Sodium Pyrosulphite	Na ₂ S ₂ O ₅	s	+	+	+	+	+	n	n	+	+	+	+	1
Sodium Salicylate	C ₆ H ₄ (OH)COONa	s	+	+/o	+	+	+	+	+	+	+	+	+	1
Sodium Silicate	Na ₂ SiO ₃	s	+	+	+	+	+	+	+	+	+	+	+	1
Sodium Sulphate	Na ₂ SO ₄	s	+	+	+	+	+	+	+	+	+	+	+	1
Sodium Sulphide	Na ₂ S	s	+	+	+	+	+	+	+	+	+	+	+	2
Sodium Sulphite	Na ₂ SO ₃	s	+	+	+	+	50%	+	+	+	+	+	50%	1
Sodium Tetraborate	Na ₂ B ₄ O ₇ * 10 H ₂ O	s	+	+	+	+	+	+	+	+	+	+	+	1
Sodium Thiosulphate	Na ₂ S ₂ O ₃	s	+	+	+	+	25%	+	+	+	+	+	25%	1
Sodium Tripolyphosphate	Na ₅ P ₃ O ₁₀	s	+	+	+	+	+	+/o	+	+	+	+	+	1
Starch	(C ₆ H ₁₀ O ₅) _n	s	+	+	+	+	+	+	n	+	+	+	+	1
Starch Gum		s	+	+	+	+	+	+	+	+	+	+	+	1
Styrene	C ₆ H ₅ CHCH ₂	100%	-	-	o	+	+	o	-	-	-	o	+	2
Sublimate => Mercury-II-Chloride														
Succinic Acid	C ₄ H ₆ O ₄	s	+	+	+	+	+	+	+	+	+	+	+	1
Sugar Syrup		s	+	+	+	+	+	+	+	+	+	+	+	1
Sulphur Chloride => Disulphur Dichloride														
Sulphuric Acid	H ₂ SO ₄	98%	30%	50%	85%	+	20%	+	+	30%	30%	80%	+	1
Sulphuric Acid, fuming --> Oleum														
Sulphurous Acid	H ₂ SO ₃	s	+	+	+	+	10%	+	+	+	+	+	+	(1)
Sulphuryl Chloride	SO ₂ Cl ₂	100%	-	-	-	o	n	+	o	-	-	-	n	1
Tannic Acid	C ₇₆ H ₅₂ O ₄₆	50%	+	+	+	+	+	+	+	+	+	+	+	1
Tartaric Acid	C ₄ H ₆ O ₆	s	50%	+	+	+	+	+	+/o	+	+	+	+	1
Tetrachloro Ethane	C ₂ H ₂ Cl ₄	100%	-	-	o	+	+	o	-	-	o	o	+	3
Tetrachloro Ethylene	C ₂ Cl ₄	100%	-	-	o	+	+	o	-	-	o	o	+	3
Tetrachloromethane => Carbon Tetrachloride														
Tetrahydro Furane	C ₄ H ₈ O	100%	-	-	o	-	+	-	-	-	-	o	+	1
Tetrahydro Naphthalene	C ₁₀ H ₁₂	100%	-	-	-	+	+	+	-	-	-	o	+	3
Tetralin => Tetrahydro Naphthalene														
THF => Tetrahydrofuran														
Thionyl Chloride	SOCl ₂	100%	-	-	-	+	n	+	+	+	+	-	n	1
Thiophene	C ₄ H ₄ S	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	n	1
Toluene	C ₆ H ₅ CH ₃	100%	-	-	o	+	+	o	-	-	-	o	+	2



ProMinent® Chemical Resistance List

Chemical	Formula	Conc	Acryl	PVC	PP	PVDF	1.4404	FPM	EPDM	Tygon	PharMed	PE	HastelloyC	WPC
Toluene Diisocyanate	$C_7H_3(NCO)_2$	100%	n	n	+	+	+	-	+/-	n	n	+	+	2
Tributyl Phosphate	$(C_4H_9)_3PO_4$	100%	n	-	+	+	+	-	+	o	+	+	+	1
Trichloro Ethane	CCl_3CH_3	100%	-	-	o	+	+	+	-	-	o	o	+	3
Trichloro Ethylene	C_2HCl_3	100%	-	-	o	+	+/-	o	-	-	o	o	+	3
Trichloro Methane => Chloroform														
Trichloroacetaldehyde Hydrate	$CCl_3CH(OH)_2$	s	-	-	o	-	+	o	o	n	n	+	+	2
Trichloroacetic Acid	CCl_3COOH	50%	-	+	+	+	-	-	o	+	+/-	+	+	1
Tricresyl Phosphate	$(C_7H_7)_3PO_4$	90%	-	-	+	n	+	o	+	o	+	+	+	2
Triethanol Amine	$N(C_2H_4OH)_3$	100%	+	o	+	n	+	-	+/-	-	o	+	+	1
Trilene => Trichloro Ethane														
Trioctyl Phosphate	$(C_8H_{17})_3PO_4$	100%	n	-	+	+	+	o	+	o	+	+	+	2
Trisodium Phosphate	Na_3PO_4	s	+	+	+	+	+	+	+	+	+	+	+	1
Urea	$CO(NH_2)_2$	s	+	+/-	+	+	+	+	+	20%	20%	+	+	1
Vinyl Acetate	$CH_2=CHOOCCH_3$	100%	-	-	+	+	+	n	n	-	+/-	+	+	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	+	+	+	+	+	+	+	+	+	+	+/-	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 %	Temperature in °C	Evaluation
Acetic acid	50	20	o
Acetic acid (wine vinegar)		20	o
Acetic acid (wine vinegar)		40	o
Acetic acid anhydride	100	20	-
Acetic acid, aqueous	6	20	+
Acetic acid, aqueous	6	40	o
Acetic acid, aqueous	6	60	o
Acetic ester	100	20	-
Acetone	all	20	-
Acetylene	100	20	o
Acetylene chlorohydrin solution		20	-
Acetylene tetrabromide	100	20	-
Aluminium salts, aqueous	all	40	+
Aluminium sulphate, aqueous	all	60	+
Alums of all kinds, aqueous	all	40	+
Ammonium salts	all	60	+
Ammonium, aqueous	15	40	+
Ammonium, aqueous	saturated	40	+
Aniline	100	20	-
Benzene	100	20	-
Benzine	100	20	o
Bisulphite, aqueous	all	40	+
Bisulphite, aqueous	all	60	o
Borax solution	all	40	+
Borax solution	all	60	o
Boric acid, aqueous	all	60	+
Bromine, vaporous and liquid		20	+
Buna latex		20	+
Butadiene	100	20	-
Butanol	100	20	-
Butyl acetate	100	20	-
Butyric acid, aqueous	20	20	o
Butyric acid, aqueous	conc.	20	-
Calcium chloride, aqueous	all	60	+
Carbon disulphide	100	20	-
Carbonic acid	all	40	+
Caustic potash	aqueous	20	+
Caustic potash	6	40	+
Caustic potash	6	60	o
Caustic potash	15	20	+
Caustic potash	30	20	o
Caustic potash	conc.	20	o
Caustic potash	conc.	40	-
Chlorinated hydrocarbons	all	20	-



ProMinent® Chemical Resistance List

Corrosive agent	Concentration in %	Temperature in °C	Evaluation
Chlorine, gaseous, moist	all	20	-
Chloromethyl	100	20	-
Chrome-alum, aqueous	all	40	+
Chromic acid, aqueous	0,5-10	20	+
Copper sulphate, aqueous	all	60	+
Creosote		20	-
Dextrin, aqueous	saturated	60	+
Diesel oils, compressed oils	100	40	o
Diesel oils, compressed oils	100	60	-
Diffuorodichloromethane	100	20	o
Ethanol	96	20	-
Ethyl acetate	100	20	-
Ethyl ether	100	20	-
Ethylene glycol	100	40	o
Ethylene glycol	100	60	-
Fats, animal and plant	100	20	-
Fats, aqueous suspension		20	o
Ferric chloride, aqueous	all		+
Fixing bands, phat.		40	+
Formaldehyde, aqueous	30	20	o
Glacial acetic acid	100		-
Glucose, aqueous	saturated	20	+
Glycerol	100	20	o
Glycol	100	20	o
Halogens	all	20	-
Hydrochloric acid, aqueous	10	20	+
Hydrogen bromide	all	40	+
Hydrogen peroxide	to 30	20	+
Hydrogen sulphide, gaseous	100	20	o
Hydrogen sulphide, gaseous	100	40	-
Ink		30	+
Lead acetate, aqueous		20	+
Lubricating oil, spindle oil and similar	100	40	o
Lubricating oil, spindle oil and similar	100	60	-
Magnesium salts, aqueous	all	60	+
Methyl alcohol	100	20	-
Methylene chloride	100	20	-
Monobromine-naphtaline	100	20	-
Nickel salts, aqueous	all	60	+
Nitric acid	aqueous	20	+
Nitric acid, aqueous	6.3	20	+
Nitric acid, aqueous	6.3	40	o
Nitric acid, aqueous	6.3	60	o
Nitric acid, aqueous	15	20	+
Nitric acid, aqueous	65	20	o
Nitric acid, aqueous	65	40	-
Nitrocellulose lacquer	solid	20	-
Nitroglycerol	100	20	-
Oils => fats, diesel oil, Lubricating oil and similar			
Oleum	10	20	-
Oxygen	all	60	+
Ozone		20	
Perchloric acid	all	20	o
Phenol, aqueous	all	20	o
Phosphoric acid, aqueous	100	20	-
PMMA (acrylic glass)	all	60	+
PMMA (acrylic glass)	Spec. additives		+
Potassium bichromate, aqueous	saturated	20	+
Potassium ferri- and ferrocyanide	all	60	+
Potassium persulphate, aqueous	saturated	40	+
Potassium salts, aqueous	all	60	+
Sea water		40	+



ProMinent® Chemical Resistance List

Corrosive agent	Concentration in %	Temperature in °C	Evaluation
Sea water		60	o
Silver nitrate	10	60	+
Soap solution	saturated	20	+
Soap solution	saturated	60	o
Sodium chloride, aqueous	all	60	+
Sodium hydroxide	aqueous	20	+
Sodium hydroxide, aqueous	4	40	+
Sodium hydroxide, aqueous	4	60	o
Sodium hydroxide, aqueous	50	40	o
Sodium hydroxide, aqueous	50	60	-
Sodium hypochlorite	15	20	o
Sodium salts => Sodium chloride (common salt)			
Stauffer grease	100	40	o
Sulphur dioxide, gaseous	all	40	o
Sulphuric acid	to 60	60	o
Sulphuric acid	98	20	-
Tetrachloromethane	100	20	-
Toluene	100	20	-
Transformer oil	100	40	o
Transformer oil	100	60	-
Trichloroethylene	100	20	-
Urea, aqueous	all	60	+
Urine		20	+
Water	100	20	+
Xylene	100	20	-
Zinc salts	all	60	+



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