DULCOTEST®
Sensor Technology

There are four methods of measurement for reliable water treatment:

- **Potentiometric method: For pH and redox potential (ORP) measurement**
- **Amperometric method: For the measurement of chlorine, chlorine dioxide and ozone residual**
- **Conductometric method: For the measurement of electrolytic conductivity**
- **Potentiostatic method: For the measurement of hydrogen peroxide, peracetic acid and dissolved oxygen**

Potentiometry–Measurement of the potential of an electrode against an electrolyte solution.

The measuring element always consists of a **measuring electrode** that reacts specifically to changes in electrical charges, and a **reference electrode** which generates a potential that is as constant as possible and independent of the measuring electrode changes. ProMinent provides both in a combination electrode.

An example for this kind of measuring element is the pH sensor.

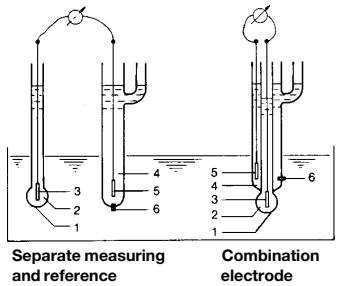


Fig. 1

pH - that's the negative logarithm of the hydrogen ion activity

Since hydrogen ions in aqueous solutions range in concentrations from less than 10^{-14} g/L to more than 10 g/L (= mol/L) and the exponential notation is rather unwieldy, the pH scale is defined as

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

When the concentration is not too high, activity and concentration can be considered as equivalent. Thus, a hydrogen ion concentration of 10^{-14} mol/L means a pH of 14, one of 10^{0} = 1 mol/L a pH of 0.

The pH value of 7 is called the neutral point. This means that the effective concentrations of H^+ ions and OH^- ions produced by the dissociation of water ($H_2O \Rightarrow H^+ + OH^-$) are equal.

If the hydrogen ions predominate because an acid (e.g. HCl) has been added, the pH value is lower than 7. If caustic has been added (e.g. NaOH), the solution becomes alkaline and the pH value is higher than 7.

pH is a logarithmic scale, such that each change of the pH by 1 corresponds to a change in concentration by the factor 10.

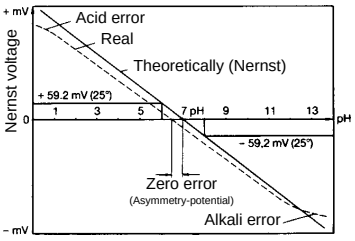


Fig. 2
Zero error and slope of a pH combination sensor

Fig. 2 shows the theoretical voltage curve of a pH glass electrode. In reality, the voltage curves of glass electrodes depart more or less from the theoretical values.

Electrode systems usually show a zero error (asymmetry potential) which, however, as a rule is less than ±0.5 pH. The slope (mV/pH) too can deviate from the theoretical value [59.2 mV/pH at 77°F (25°C)] which is true particularly for glass electrodes that have been used for some time.

An acid error which manifests itself at very low pH values; while an alkali error (or sodium error) will occur at high pH values.

pH transmitters must be calibrated so as to compensate zero and slope errors of the electrode used...

Zero calibration is made by means of a standardizing solution having a pH of 7. Slope calibration is made by means of a buffer solution, normally pH 4 or pH 10.

With pH measurements, except at pH 7, varying temperatures of the sample liquid might necessitate a correction for temperature variations. **The following questions need to be answered:**

1. At which pH will the measurement take place?
2. How great are the temperature changes?
3. How accurate a measurement is required?

The following is an example for the influence of temperature without correction:

At pH 10 an increase of the temperature by 18°F (10°C) results in an error of about +0.1 pH. The error increases with increasing distance from pH 7.

Measurement of the redox potential is a potentiometric measurement too!

The term "redox" stands for the simultaneously occuring reduction and oxidation processes in aqueous solutions. In an oxidation process electrons are transferred from the substance to be oxidized to the oxidant. Simultaneously, in oxidizing the substance, the oxidant is reduced. Oxidants are electron acceptors and reducing agents electron donors.

The redox potential is measured by means of noble metal electrodes, usually platinum electrodes. In a solution containing an oxidant (e.g. chlorine) the redox voltage will be positive, in a solution containing a reducing agent (e.g. sodium sulfite) it will be negative.

The magnitude of the redox potential is an indicator of the oxidizing or reducing properties of a solution. In water treatment the redox potential is a yardstick for the disinfecting properties of, for example, chlorine or ozone.

Thus, in water treatment the redox potential can be considered as an indicator of the disinfection potential.

It should be noted that there is a relationship between redox potential and pH so that redox measurements can be compared with each other only when the measurements were made at the same pH.

Typical applications of redox measurements:

1. Cyanide control by oxidation at high pH values, redox potential measurement by means of gold electrodes.
2. Chromate control by reduction at low pH values, redox potential measurement by means of platinum electrodes.
3. In disinfecting processes, measurement of chlorine residual or ozone concentration by means of platinum electrodes.

Amperometry– a method of measuring concentrations of certain dissolved substances in aqueous solutions.

In this method electric currents in the order of nA (10^{-9} A) or µA (10^{-6} A) are measured. The sensors used in this method are bare or membrane-covered 2-electrode cells.

Our DULCOTEST® chlorine, ozone and chlorine dioxide sensors are designed as membrane-covered 2-electrode cells of the highest quality.

By separating the electrodes from the sample liquid by means of a special microporous membrane, clearly defined measuring conditions are achieved and interferences eliminated.

The ProMinent DULCOTEST® sensor uses a platinum or gold cathode and a silver/silver chloride anode. In an appropriate electrolyte the latter assumes a well defined potential that may be used as a reference potential.

Unlike bare-electrode cells, which are extremely prone to interferences, membrane-covered cells do not require a constant flow rate of the sample liquid as long as there is a minimum flow rate of about 8 GPH (30 L/h). This does away with expensive equipment to keep the flow rate constant.

The influence of pH on the measurement of chlorine

It is important to know in what form chlorine exists in an aqueous solution. Only at a very low pH chlorine is present as a dissolved gas (Cl_2), while above pH 3 it exists in form of hypochlorous acid (HOCl) which at still higher pH dissociates into hypochlorite ion (OCl^-) (Fig. 3).

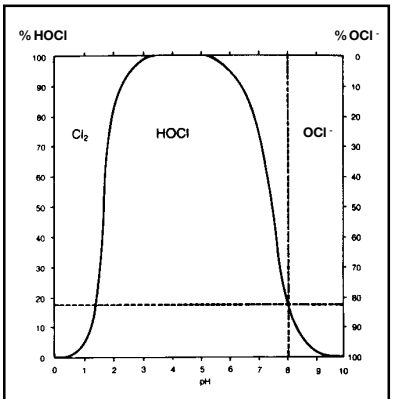


Fig. 3
Relationship between elemental chlorine, hypochlorous acid and hypochlorite ion, and pH

Compared to hypochlorous acid, the bactericidal action of hypochlorite ion is lower by the factor 100. Therefore, it makes little sense to measure hypochlorite. However, both hypochlorous acid and hypochlorite are interpreted as "free chlorine" and returned as such when determined by the DPD 1 method which is most commonly used for standardizing the chlorine analyzer.

The following example will make this clear:

At pH 8 only about 20% of the chlorine exist in form of highly effective HOCl, while about 80% are present as ineffective OCl^- (Fig. 3). If the chlorine analyzer is to read the same value as is obtained by a comparative determination by the DPD 1 method, the slope must be adjusted accordingly. ProMinent's D1C controller offers optional pH correction for free chlorine according to the dissociation curve (Fig. 3). The WS series with CLE sensor measures only the hypochlorous acid component of free chlorine.

The influence of temperature on the chlorine reading must be considered. That is why the reading of the DULCOTEST® chlorine sensor is automatically corrected for variations in temperature.

While the amperometric method of ascertaining chlorine does not pose any problems when inorganic chlorine is used (chlorine gas Cl_2, sodium hypochlorite NaOCl or calcium hypochlorite $Ca(OCl)_2$), provided the pH is constant, some complications might be introduced when chlorinated organic compounds as sources of chlorine are used, but under certain conditions such problems can be eliminated.

When chlorinated organic compounds are added to the water they do not only react to form hypochlorous acid, which is registered by the chlorine sensor, but they also form combined chlorine which is bound to ammonia or isocyanuric acid, and as such is less effective and not registered by the CLE chlorine sensor.

However, the DPD 4 method measures total chlorine, which is measurable using the amperometric method with the CTE sensor.

The determination of chlorine is interfered with in the presence of bromine, iodine, ozone or chlorine dioxide, but not in the presence of dissolved oxygen. Surface-active substances (fats, tensides) block the membrane and prohibit the use of the chlorine sensor.

For determining chlorine dioxide or ozone residual, a sensor similar to the chlorine sensor is used. The reading is independent of the pH. The influence of temperature is negligible. Dissolved oxygen and chlorite do not interfere.

The benefits of the DULCOTEST® chlorine, chlorine dioxide and ozone sensors at a glance

Easy handling.
- Quick installation and calibration.
- No buffers or reagents.

Reliable reading
- The DULCOTEST® method of ascertaining chlorine is not affected by dissolved solids and therefore may be used for sea water.
- The reading is not affected by the flow rate of the sample liquid above a minimum of 0.5 L/min.

Low maintenance
- Maintenance work is limited to changing membrane cap and electrolyte filling approx. once every 6 or 12 months.
- Low long-term operating costs.
- No continual changing of buffer solutions or reagants.

Conductometry– measurement of the electrolytic conductivity

Unlike the conductivity of metals which is brought about by the migration of electrons, electrolytic conductivity is caused by the migration of ions, that is, of positively or negatively charged atoms or groups of atoms existing in aqueous solutions owing to dissociation. Conductivity measuring cells are distinguished by the following criteria:

The cell constant

A system in which the conductivity of an electrolyte would be measured in a pipe of a length L = 1 cm and a cross sectional area of A = 1 cm^2 has a cell constant k = 1 cm^{-1}. If the length were L = 10 cm (or the area were A= 0.1 cm^2) the cell constant would be k = 10 cm^{-1}. If the area were increased to A = 10 cm^2 (or the length decreased to L = 0.1 cm) then the cell constant would be k = 0.1 cm^{-1}. A measuring cell having a small cell constant is used for determining low conductivities and one having a large cell constant for determining high conductivities. The reason behind it is obviously to increase the sensivity for low conductivities (e.g. k = 0.1 cm^{-1}) and to decrease it for high conductivities (e.g. k = 10 cm^{-1}).

Conductivity varies with temperature

As a rule different dissolved substances possess different temperature coefficients α (alpha) so that the temperature behavior is very complex and varies as the concentration and the temperature change.

Since the objective of conductivity measurement usually is to determine the concentration of a substance, readings must be corrected for temperature changes if accurate measurement is required, especially when conductivity is to be corrected to the internationally used reference temperature of 77° F (25°C). The temperature is sensed by an NTC resistor or a Pt 100 (platinum resistance thermometer), the Pt 100 being superior as far as linearity, and hence accuracy.

Potentiostatic Measurement– combining potentiometry and amperometry

The measurement of hydrogen peroxide, peracetic acid and dissolved oxygen use the potentiostatic measurement principle. This combines a three-electrode technique (working electrode, counter electrode and reference electrode) with a two-electrode amperometric measurement (working and counter electrodes), plus temperature compensation. The complexity of the system requires a special microprocessor capable of recognizing the unique signatures of low concentrations for accurate measure-ment and control without cross-sensitivity to other oxidants.

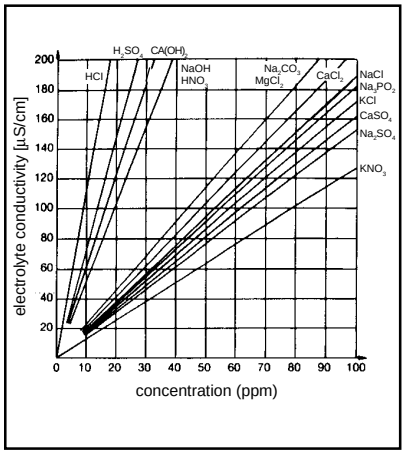


Figure 4. Electrolytic conductivity – concentration relationship for dilute acids, bases and salt solutions.

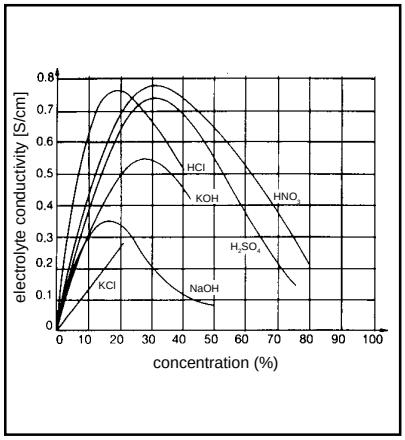


Figure 5. Specific conductivity – concentration relationship for dilute acids, bases and salt solutions (% w/w).

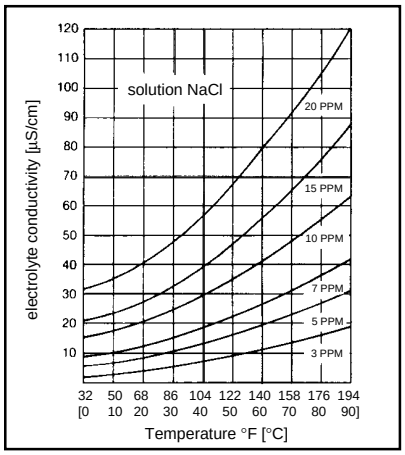


Figure 6. Conductivity of aqueous solutions of table salt vs. temperature at different concentrations.

DULCOTEST®
pH sensors

All sensors are combination sensors that have been proven in both industrial and laboratory applications.

Before being shipped all sensors are tested twice; the first time immediately after manufacture, the second time about 2 weeks afterwards, in order to eliminate glass-specific manufacturing risks.

Generally, the shelf life of pH and redox sensors is limited. It is recommended that the stocks be limited to a three-month supply.

All pH sensors have their voltage zero at pH 7 ±0.5.

The reference electrode systems of ProMinent pH and redox combination sensors is of the Ag/AgCl type which is not only less harmful to the environment than the calomel type (mercurous chloride) but has a wider temperature range of application.

The shaft diameter of all sensors is 0.47" ± 0.01" (12 mm ±3 mm). All dimensions are approximate since pH and redox sensors are handmade.

All sensors must be mounted using either the DLG III B sensor holder, immersion type sensor holder, or the DGM modular sensor holder. Note that the PHEP/RHEP sensors have a 14 mm ø sleeve at the top that prevents its use with the immersion-type holders.

pH-Combination Sensors With Plug Connector for Coax Plug

Type description

PHEX T 112 SE 3D

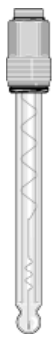
- **pH-**combination sensor
- **X**: with solid electrolyte and circular gap diaphragm
- **K**: with strong plastic shaft
- **N**: refillable KCl electrode
- **E**: insertion electrode
- **R**: with PTFE ring diaphragm
- **P**: pressure tight up to 87 psi (6 bar)
- **D**: 2 ceramic diaphragms (double junction)
- unspecified: standard gel electrode
- with integrated temperature sensor

- **3D**: 3 ceramic diaphragms
- **E**: mounting thread PG 13.5
- **L**: KCl refillable laboratory electrode
- **S**: Plug connector for SN6 coax plug
- **V**: Vario Pin socket

- pH measurement range: 1…12

Description	Part No.

pH combination sensors and Pt 100 with push-and-twist connector for type SN 6 coax connector



Type PHE 112 SE

Gel-filled non-refillable pH sensor with glass shaft and ceramic diaphragm; installed length 4.72" (120 mm); with push-and-twist connector for SN6 coax connector, and mounting thread PG 13.5; measuring range pH 1-12; temperature range 32-140°F (0-60°C); maximum working pressure 7 psig (0.5 bar), preferably for operation under atmospheric pressure. **Without cable and holder.** 305054

4a Typical applications: Potable water and slightly polluted wastewater, swimming pool water.

DULCOTEST®
pH sensors

ProMinent®

Description	Part No.

Type PHEX 112 SE

4b

pH sensor with closed glass shaft, pressure resistant silver chloride-free solid electrolyte and foul resistant annular gap diaphragm.

Installed length 4.72" (120 mm); with push-and-twist connector for SN6 coax connector and mounting thread PG 13.5; measuring range pH 1-12; temperature range 32-212°F (0-100°C); maximum working pressure: 232 psig (16 bar) at 77°F (25°C), max. 87 psig (6 bar) at 212°F (100°C). **Without cable and holder.** 305096

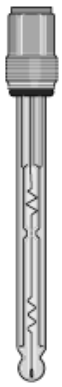
Typical applications: Wastewater, chemical processes, metal plating baths, paper industry.

For measurements in:
- Heavily polluted media
- Emulsions, suspensions
- Media with high sulphide contents
- Protein containing media
- At high pressures and heavy pressure variations

Not recommended for:
- Hot steam sterilization
- Measurements under conditions of heavy continuous temperature variations and in low-conductivity media
- Applications with chlorine concentration >3 ppm
- Water containing >1 ppm fluoride

PHEX with fixed 30 ft. cable and SN6 connector (PHEX 112-FE-310S) 150023

Type PHED 112 SE



pH sensor with closed glass shaft, pressure resistant gel electrolyte and double junction (2) ceramic diaphragms.

Installed length 4.72" (120 mm); with SN6 coax connector and mounting thread PG 13.5; measuring range pH 1-12; temperature range 32-176°F (0-80°C); maximum working pressure: 116 psig (8 bar); minimum conductivity 150 µs/cm. **Without cable and holder.** 741036

Typical applications: Industrial wastewater, potable water, cooling water, air scrubbers, and media with high fluoride (max. 1 ppm at pH 7.5) and chlorine (max. 5 ppm). Recommended for pH compensation of free chlorine with D1C.

Not suitable for:
- Hot steam sterilization
- Measurements under conditions of heavy continuous temperature variations and in low-conductivity media

Type PHER 112 SE

pH sensor with closed glass shaft, pressure resistant gel electrolyte and PTFE ring diaphragm.
Installed length 4.72" (120 mm); with push-and twist connector for SN6 coax connector and mounting thread PG 13.5; measuring range pH 1-12; temperature range 32-176°F (0-80°C); maximum working pressure: 87 psig (6 bar); minimum conductivity 50 µs/cm. **Without cable and holder.** 1001586

Typical applications: Wastewater, potable water, process water.

Not suitable for:
- Hot steam sterilization
- Low conductivity water
- Wide temperature variations

ProMinent®

DULCOTEST®
pH sensors

Description	Part No.

Type PHEP 112 SE

pH sensor with closed glass shaft, pressure resistant gel electrolyte and ceramic diaphragm.

Installed length 4.72" (120 mm); with push-and twist connector for SN6 coax connector and mounting thread PG 13.5; measuring range pH 1-12; temperature range 32-176°F (0-80°C); maximum working pressure: 87 psig (6 bar); minimum conductivity 150 µs/cm. **Without cable and holder.** 150041

DGM housing requires 15 mm mounting set for use in DLG III or DGM sensor holder only. 791219

Typical applications: Slightly polluted wastewater, potable water, process water, swimming pool water, high temperature and pressure applications

Not suitable for:
- Hot steam sterilization
- Measurements under conditions of heavy continuous temperature variations and in low-conductivity media

Type PHEPT 112 VE

pk_5_082

pH sensor with closed glass shaft, pressure resistant gel electrolyte and ceramic diaphragm with integrated Pt 100 enclosed in glass shaft and Vario Pin plug with gold plated contacts.

Installed length 4.72" (120 mm); with Vario pin plug and mounting thread PG 13.5; measuring range pH 1-12; temperature range 32-176°F (0-80°C); maximum working pressure: 87 psig (6 bar); minimum conductivity 150 µs/cm. **Without cable and holder.** 1004571

DGM housing requires 15 mm mounting set for use in DLG III or DGM sensor holder. 791219

Typical applications: Slightly polluted wastewater, potable water, process water, swimming pool water, high temperature and pressure applications

Not suitable for:
- Hot steam sterilization
- Measurements under conditions of heavy continuous temperature variations and in low-conductivity media

Signal Cables for Sensors with Vario Pin Plug

pk_5_083

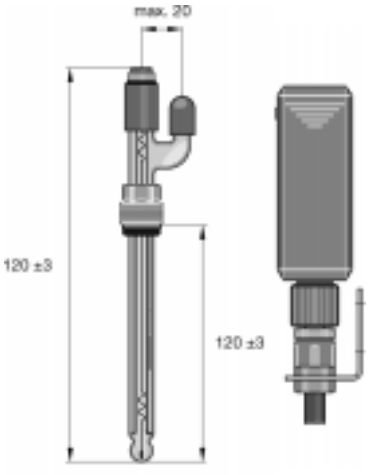
Pre-assembled 6-core cable with Vario Pin plug for connection to PHEPT 112 VE sensor.

Vario Pin signal cable VP 6-ST/ 6 ft. (2m) 1004694

Vario Pin signal cable VP 6-ST/ 15 ft. (5m) 1004695

Vario Pin signal cable VP 6-ST/ 30 ft. (10m) 1004696

DULCOTEST®
pH sensors



pk_5_029

Description	Part No.

Type PHEN 112 SE

pH sensor with glass shaft, pressure resistant, continuously refillable KCl electrolyte and ceramic diaphragm.

Installed length 4.72" (120 mm); with push-and twist connector for SN6 coax connector and mounting thread PG 13.5; measuring range pH 1-12; temperature range 32-176°F (0-80°C); maximum working pressure: atmospheric pressure; minimum conductivity 150 µs/cm. **Without cable and holder.** 305090

Typical applications: Slightly polluted waste water, clean water

Not suitable for:
- Pressure applications
- Hot steam sterilization
- Measurements under conditions of heavy continuous temperature variations and in low-conductivity media

PHEN 112 SE ex works HD

Accessories:

PE storage container with connectors and tubing		305058
We recommend installation approximately 1 1/2 to 3 ft. (0.5 to 1 m) above sample fluid level		
KCl solution 3 molar	250 mL	791440
KCl solution 3 molar	1000 mL	791441

Delivery approximately 4-6 weeks

Type PHEN 112 SE 3D

pH sensor with glass shaft, pressure resistant refillable KCl electrolyte and 3 ceramic diaphragms.

Installed length 4.72" (120 mm); with push-and twist connector for SN6 coax connector and mounting thread PG 13.5; measuring range pH 1-12; temperature range 32-176°F (0-80°C); maximum working pressure: atmospheric pressure; minimum conductivity >50 µs/cm. **Without cable and holder.** 150078

Typical applications: Waste water, lower conductivity.

Not suitable for:
- Hot steam sterilization
- Measurements under conditions of heavy continuous temperature variations
- Pressure applications

Accessories:

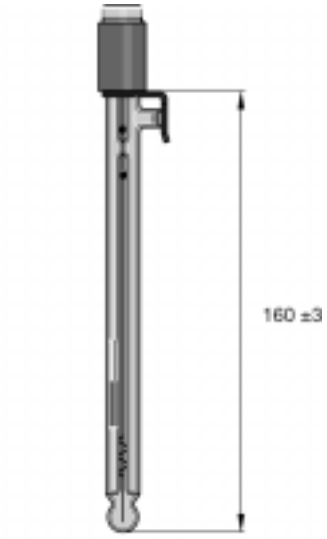
We recommend installation approximately 1 1/2 to 3 ft. (0.5 to 1 m) above sample fluid level		
KCl solution 3 molar	250 mL	791440
KCl solution 3 molar	1000 mL	791441

Delivery approximately 4-6 weeks

DULCOTEST®
pH sensors

Description	Part No.

Type PHEN 012 SL



pH sensor with glass shaft, pressure resistant refillable KCl electrolyte and ceramic diaphragm with integrated Pt 100 enclosed in glass shaft.

With push-and twist connector for SN6 coax connector; measuring range pH 0-12; temperature range 32-176°F (0-80°C); maximum working pressure: atmospheric pressure; minimum conductivity >150 µs/cm. **Without cable and holder.** 305078

Typical applications: In the laboratory.

Not suitable for:
– Hot steam sterilization
– Measurements under conditions of heavy continuous temperature variations and in low-conductivity media

Accessories:
We recommend installation approximately 1 1/2 to 3 ft. (0.5 to 1 m) above sample fluid level

KCl solution 3 molar	250 mL	791440
KCl solution 3 molar	1000 mL	791441

Delivery approximately 4-6 weeks

Type PHEN 012 SL 3D

pH sensor with glass shaft, pressure resistant refillable KCl electrolyte and 3 ceramic diaphragms.

With push-and twist connector for SN6 coax connector; measuring range pH 0-12; temperature range 32-176°F (0-80°C); maximum working pressure: atmospheric pressure; minimum conductivity >50 µs/cm. **Without cable and holder.** 791508

pk_5_028

Typical applications: Laboratory, lower conductivity.

Not suitable for:
– Hot steam sterilization
– Measurements under conditions of heavy continuous temperature variations and in low-conductivity media

Accessories:
We recommend installation approximately 1 1/2 to 3 ft. (0.5 to 1 m) above sample fluid level

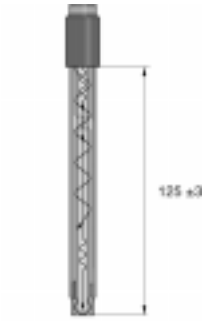
KCl solution 3 molar	250 mL	791440
KCl solution 3 molar	1000 mL	791441

Delivery approximately 4-6 weeks

DULCOTEST®
pH sensors

ProMinent®

Description	Part No.



pk_5_031

Type PHEK 112 S

pH sensor with plastic shaft, pressure resistant gel electrolyte and fiberglass diaphragm.

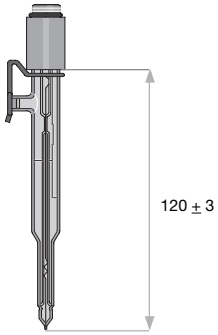
With push-and twist connector for SN6 coax connector; measuring range pH 1-12; temperature range 32-140°F (0-60°C); maximum working pressure: atmospheric pressure; minimum conductivity >150 µs/cm.
Without cable. 305051

Typical applications: Hand-held measurement in swimming pool, portable water etc.

Not suitable for:
– Hot steam sterilization
– Measurements under conditions of heavy continuous temperature variations and in low-conductivity media

Delivery approximately 4-6 weeks

Type PHEE 112 S



pk_5_033

pH sensor with glass shaft, pressure resistant refillable gel electrolyte and 3 ceramic diaphragms.

Length 4.72" (120 mm); with push-and twist connector for SN6 coax connector; measuring range pH 1-12; temperature range 32-140°F (0-60°C); maximum working pressure: atmospheric pressure; minimum conductivity >150 µs/cm.
Without cable. 791094

Typical applications: pH measurement in foodstuffs, e.g. meat, cheese non sterilizable

Not suitable for:
– Hot steam sterilization
– Measurements under conditions of heavy continuous temperature variations and in low-conductivity media

Cleaning fluid: Pepsin / HCl 250mL 791443

Delivery approximately 4-6 weeks

ProMinent®

DULCOTEST®
pH sensors

pH-Combination Sensor With Fixed Cable

Type description

PHEK 112 FE 301 S

- **pH-**combination sensor
- **K**: with strong plastic shaft
- **N**: refillable KCl electrode
- **D**: with double diaphragm
- pH measurement range: 1…12
- **F**: fixed cable electrode
- **E**: internal mounting thread
- **L**: refillable laboratory electrode
- plug type
  - **S** = SN6
  - **B** = BNC
  - **O** = no plug
  - **M** = SN6 male
- cable length in meters
- cable diameter 3 or 5 mm

The technical data corresponds to the pH measuring cells with SN6 plug.

pk_5_032

Type PHE 112 F

pH combination sensors, gel filled, with fixed coax cable and device plug, no internal thread.

Type	Cable Length	Device Plug	Part No.
PHE 112 F 301 S	3 Ft. (1 m)	SN6	304976
PHE 112 F 301 B	3 Ft. (1 m)	BNC	304980
PHE 112 F 303 B	10 Ft. (3 m)	BNC	304981
PHE 112 F 503 S	10 Ft. (3 m)	SN6	150039

Further types on request.

Delivery approximately 4-6 weeks

pk_5_035

Type PHEK 112 F

pH combination sensor with plastic shaft, glass stem, fixed coax cable and connector, no internal thread.

Type	Cable Length	Device Plug	Part No.
PHEK 112 F 301 S	3 Ft. (1 m)	SN6	304994
PHEK 112 F 301 B	3 Ft. (1 m)	BNC	304996

Further types on request.

Delivery approximately 4-6 weeks

DULCOTEST®
pH and temperature sensors

ProMinent®

pk_5_036

Description **Part No.**

Type PHE 112 FE

Gel-filled non-refillable pH combination sensor with glass shaft, ceramic diaphragm, fixed coax cable and internal mounting thread.

Type	Cable Length	Device Plug	
PHE 112 FE 303 S	10 Ft. (3 m)	SN6	304984
PHE 112 FE 310 S	30 Ft. (10 m)	SN6	304985
PHE 112 FE 303 B	10 Ft. (3 m)	BNC	304988
PHE 112 FE 310 O	30 Ft. (10 m)	without	304990

Further types on request.

Delivery approximately 4-6 weeks

pk_5_037 pk_5_037

Type PHED 112 FE

pH combination sensor with closed glass shaft, pressure resistant gel electrolyte, fixed coax cable, internal mounting thread and double junction (2) ceramic diaphragms.

Type	Cable Length	Device Plug	
PHED 112 FE 303 B	10 Ft. (3 m)	BNC	741038

Further types on request.

Delivery approximately 4-6 weeks

Temperature

1765/4

Resistance thermometer

Platinum resistance thermometer, glass-jacketed, installed length 4.72" (120 mm); with push-and-twist connector for SN6 coax connector, and mounting thread PG 13.5; temperature range 32-212°F (0-100°C); maximum working pressure: 145 psig (10 bar). **Without cable and holder.**

Pt 100 SE	305063
Pt 1000 SE	1002856

Typical applications: Temperature measurement and temperature correction of pH, conductivity, chlorine dioxide (CDP sensor) hydrgen peroxide and peracetic acid measurements.

ProMinent®

DULCOTEST®
Redox sensors

Redox-Combination Sensors With SN6 Connector

Type description

RHEX Pt SE

Redox-combination sensor

X: with solid electrolyte and circular gap diaphragm

K: with strong plastic shaft

P: pressure tight to 87 psi (6 bar)

R: with PTFE ring diaphragm

N: refillable KCl electrode

unspecified: standard gel-filled electrode

E: internal mounting thread PG 13.5

S: connector for SN6 coax plug

Pt: Platinum electrode (pin)

Au: Gold electrode (pin)

Description	Part No.

Redox combination sensors with push-and-twist connector for type SN 6 coax connector

2141/4

Type RHE-Pt-SE

Gel-filled non-refillable redox sensor with platinum pin, glass shaft and ceramic diaphragm; installed length 4.72" (120 mm); with push-and-twist connector for SN6 coax connector, and mounting thread PG 13.5. Temperature range 32-140°F (0-60°C); Maximum working pressure 7 psig (0.5 bar); preferably for operation under atmospheric pressure; minimum conductivity > 150 µs/cm. **Without cable and holder.** 305001

Typical applications: Potable water and slightly polluted wastewater, swimming pool water.

1782/4

Type RHEX-Pt-SE

Redox sensor with encapsulated glass shaft, pressure-resistant silver-chloride-free solid electrolyte, and foul resistant annular gap diaphragm. Platinum pin electrode. Installed length 4.72" (120 mm); with push-and-twist connector for SN6 coax connector, and mounting thread PG 13.5. Temperature range 32-212°F (0-100°C); Maximum working pressure 232 psig (16 bar) at 77°F (25°C), 87 psig (6 bar) at 212°F (100°C); minimun conductivity > 500 µs/cm; **Without cable and holder.** 305097

Typical applications: Wastewater, chemical processes, metal plating baths, paper industry.

For measurements in:
- Heavily polluted media
- Emulsions media with high sulphide content
- At high pressures and heavy pressure variations

Not suitable for:
- Hot steam sterilization
- Measurements under conditions of heavy continuous temperature variations and in low-conductivity media

RHEX with fixed 30 ft. cable and SN6 connector (RHEX PT-FE-310S) 7305097

DULCOTEST®
Redox sensors (cont.)

Description	Part No.

Type RHEP-PT-SE

Redox sensor with closed glass shaft, pressure resistant gel electrolyte and ceramic diaphragm.

Installed length 4.72" (120 mm); with push-and twist connector for SN6 coax connector and mounting thread PG 13.5; temperature range 32-176°F (0-80°C); maximum working pressure: 87 psig (6 bar); minimum conductivity 150 µs/cm.
Without cable and holder. 150094

DGM housing requires 15 mm mounting set for use in DLG III or DGM sensor holder only. 791219

Typical applications: Slightly polluted wastewater, potable water, process water, swimming pool water.

Not suitable for:
– Hot steam sterilization
– Measurements under conditions of heavy continuous temperature variations and in low-conductivity media

Type RHEP-AU-SE

Redox sensor with closed glass shaft, pressure resistant gel electrolyte, gold pin electrode and ceramic diaphragm.

Installed length 4.72" (120 mm); with push-and twist connector for SN6 coax connector and mounting thread PG 13.5; temperature range 32-176°F (0-80°C); maximum working pressure: 87 psig (6 bar); minimum conductivity 150 µs/cm.
Without cable and holder. 1003875

DGM housing requires 15 mm mounting set for use in DLG III or DGM sensor holder only. 791219

Typical applications: Cyanide detoxification, ozone monitoring.

Not suitable for:
– Hot steam sterilization
– Measurements under conditions of heavy continuous temperature variations and in low-conductivity media

Delivery approximately 4-6 weeks

Type RHER-PT-SE

Redox sensor with closed glass shaft, pressure resistant gel electrolyte and PTFE ring diaphragm.

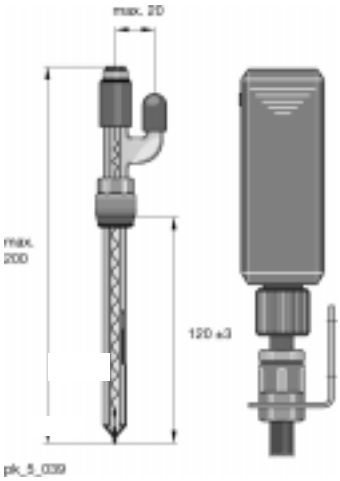
Installed length 4.72" (120 mm); with push-and twist connector for SN6 coax connector and mounting thread PG 13.5; temperature range 32-176°F (0-80°C); maximum working pressure: 87 psig (6 bar); minimum conductivity 50 µs/cm.
Without cable and holder. 1002534

Typical applications: Wastewater, potable water, process water.

Not suitable for:
– Hot steam sterilization
– Low conductivity water
– Wide temperature variations

DULCOTEST®
Redox sensors (cont.)

Description	Part No.



Type RHEN-PT-SE

Redox sensor with closed glass shaft, pressure resistant refillable KCl electrolyte and ceramic diaphragm.

Installed length 4.72" (120 mm); with push-and twist connector for SN6 coax connector and mounting thread PG 13.5; temperature range 32-176°F (0-80°C); maximum working pressure: atmospheric pressure; minimum conductivity >150 µs/cm.
Without cable and holder. 305091

Typical applications: Waste water

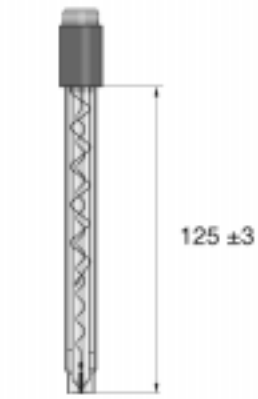
Not suitable for:
– Hot steam sterilization
– Measurements under conditions of heavy continuous temperature variations and in low-conductivity media

RHEN-Pt SE ex works HD

Accessories:

PE storage container with connectors and tubing		305058
We recommend installation approximately 0.5-1 m above sample fluid level.		
KCl solution 3 molar	250 ml	791440
KCl solution 3 molar	1000 ml	791441

Delivery approximately 4-6 weeks



Type RHEK-PT-S

Redox sensor with closed glass shaft, pressure resistant refillable gel electrolyte and fiberglass diaphragm.

Installed length 4.92" (125 mm); with push-and twist connector for SN6 coax connector and no internal thread; temperature range 32-140°F (0-60°C); maximum working pressure: atmospheric pressure; minimum conductivity >150 µs/cm.
Without cable and holder. 305052

Typical applications: Manual measurement of swimming pool, potable water etc.

Not suitable for:
– Hot steam sterilization
– Measurements under conditions of heavy continuous temperature variations and in low-conductivity media

Delivery approximately 4-6 weeks

DULCOTEST®
Redox sensors (cont.)

ProMinent®

Redox Combination Sensors With Fixed Cable

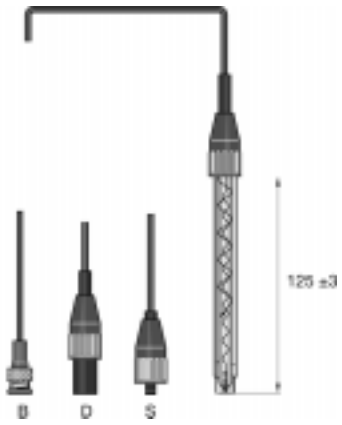
Type description

RHEK - Pt - FE 501 S

- Redox combination sensor
- **K**: with strong plastic shaft
- **Pt:** Platinum electrode
- **F:** Fixed cable electrode
- **E**: internal thread PG 13.5
- cable diameter 3 or 5 mm
- cable length in meters
- plug type
  - **S** = SN6
  - **B** = BNC

Technical data for redox measuring cells with SN6 connector.

Description	Part No.



pk_5_044

Type RHE-PT-FE

Redox combination sensor, gel-filled, with glass shaft, internal mounting thread PG 13.5, with fixed coax cable and connector.

Type	Cable Length	Device Plug	
RHE-PT-FE 310 B	10 m	BNC	304993

Delivery approximately 4-6 weeks

Type RHE-PT-F

Redox combination sensor, gel-filled, with glass shaft, without internal mounting thread PG 13.5, with fixed coax cable and connector.

Type	Cable Length	Device Plug	
RHE-PT-F 303 B	3 m	BNC	304983

Delivery approximately 4-6 weeks

Type RHEK-PT-F

Redox combination sensor with plastic shaft, Pt electrode with cover. Fixed coax cable and connector, no internal mounting thread.

Type	Cable Length	Device Plug	
RHEK-PT-F 301 S	1 m	SN6	304997

Further types on request.

Delivery approximately 4-6 weeks

DULCOTEST®
Chlorine sensors

Description **Part No.**

For the measurement of chlorine, chlorine dioxide or ozone in aqueous solutions, the amperometric measurement principle is used. Our membrane covered 2-electrode sensors are described as Clark-type sensors in literature (types CLE, CTE, CDE, CDP and OZE).

All our amperometric sensors are the result of in-house development and are subjected to long-term practical trials. They have a very compact construction with an encapsulated pre-amplifier already integrated in the sensor shaft. **The 25 mm smooth shaft must be installed in a flow-through sample cell such as the DGMa or DLG and be ordered with an adapter set.**

Amperometric sensors are not electrically isolated. When connecting to external devices other than DIC/D2C/DMT etc, it may be necessary to isolate the supply voltage and the analog input signal.

DULCOTEST® free chlorine sensor (CLE)

Membrane-covered amperometric sensor for determining free chlorine (HOCl) in water. The sensor has an integrated preamplifier including automatic temperature correction. The zero stability is very high so that a zero calibration is not necessary.

CLE 3 - mA

The CLE 3-mA sensor is equipped with a passive 4-20 mA interface for two-wire connection on controllers with a supply voltage of 16-24 VDC (for D1C controllers). The sensor is also equipped with a terminal strip and a cable gland for cable connection. **Without cable and holder.**

The CLE 2.2-4P sensor has a 4-pole plug-in connector and is used with the CLWS series controller and CLD pump. **Without cable and holder.**

pH range:	pH 5.5-8.0
Temperature:	41-113°F (5-45°C)
Max. pressure:	14.5 psig (1 bar)
Flow rate:	8-16 GPH (30-60 L/h) minimum recommended in "in-line" sensor housing type DLG lll or DGM

Note: Not for use in ultrapure or very low conductivity water or water containing isocyanuric acid/stablizers.

The 4-20 mA output corresponds to approx. chlorine value (not calibrated), it roughly corresponds to the sensor signal at pH 7.2 in new condition. The slope calibration (DPD 1) then takes place on the D1C controller.

Type CLE 3 - mA
Complete with electrolyte (100 mL) and membrane cap

4-20 mA (D1C)	Measuring Range	
Type CLE 3 - mA - 20 ppm	0.2 - 20 mg/L	1002964
Type CLE 3 - mA - 10 ppm	0.1 - 10 mg/L	792919
Type CLE 3 - mA - 2 ppm	0.02 - 2 mg/L	792920
Type CLE 3 - mA - 0.5 ppm	0.01 - 0.5 mg/L	792927
Type CLE 3 - mA - 50 ppm	0.5 - 50 mg/L	on request

CLE 2.2 - 4P

Type CLE 2.2 - 4P
Complete with electrolyte (100 mL) and membrane cap

4-pole (WS)		
Type CLE 2.2 - 4P	0.1 - 20 mg/L	914958

For installation in the DGMa or DLG housing, a threaded adapter set is required (see sensor housing section).

Consumable material:

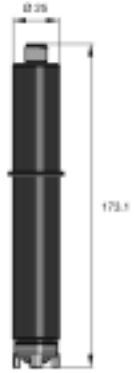
Electrolyte for chlorine sensor type CLE (all models) 100 mL	506270
Spare membrane cap for chlorine sensors CLE (The tips of the membrane cap are colored red.)	790488

DULCOTEST®
Chlorine sensors (cont.)

ProMinent®

Description	Part No.

DULCOTEST® free chlorine sensor (CLE)



pk_5_045

Type CLE 3 - DMT

Sensor for use with the DMT "chlorine" measurement transmitter.

Measured variable:	Free chlorine (hypochlorous acid HOCl)
Analysis:	DPD1
Measurement range:	0.01...5.0 mg/L 0.05...50 mg/L
Supply:	From the DMT measurement transmitter
Output signal:	Uncalibrated, not temperature compensated
Temperature measurement:	Via integrated Pt 1000: compensation carried out in DMT
Sensor output:	5 pin plug (requires cable, see Dulcotest-40)

Other data as for CLE 3 - mA.

	Order No.
CLE 3-DMT-5 ppm set with 100 mL electrolyte	1005511
CLE 3-DMT-50 ppm set with 100 mL electrolyte	1005512

Note: An assembly set (part number 791818 for DGM or 815079 for DLG III) is required for the initial installation of the chlorine sensors.

DULCOTEST®
Chlorine sensors

Description	Part No.

DULCOTEST® total chlorine sensor (CTE)

CTE 1 - mA

Membrane-covered amperometric sensor for determining free chlorine plus combined chlorine in water. Total chlorine equals free chlorine plus combined chlorine. The sensor has an integrated preamplifier including automatic temperature correction. The zero stability is very high so that a zero calibration is not necessary.

The CTE 1-mA sensor is equipped with a passive 4-20 mA interface for two-wire connection on controllers with a supply voltage of 16-24 VDC (e.g. D1C). The sensor is also equipped with a terminal strip and cable gland for cable connection. **Without cable and holder.**

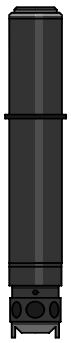
The CGE 2-4P sensor has a 4-pole plug-in connector and is used with the CLWS series controller and CLD pump. **Without cable and holder.**

pH range:	pH 5.5-9.5
Temperature:	41-115°F (5-45°C)
Max. pressure:	40 psig (3 bar), 14.5 psig (1 bar) recommended
Flow rate:	8-16 GPH (30-60 L/h) minimum recommended in "in-line" sensor housing type DLG lll or DGM

The 4-20 mA output corresponds to approx. chlorine value (not calibrated), it roughly corresponds to the sensor signal at pH 7.2 in new condition. The slope calibration (DPD 4) then takes place on the controller.

Type CTE 1 - mA
Complete with electrolyte (50 mL) and membrane cap

4-20 mA (DIC)	Measuring Range	
Type CTE 1 - mA - 10 ppm	0.1 - 10 mg/L	740684
Type CTE 1 - mA - 5 ppm	0.05 - 5 mg/L	1003203
Type CTE 1 - mA - 2 ppm	0.02 - 2 mg/L	740685
Type CTE 1 - mA - 0.5 ppm	0.01 - 0.5 mg/L	740686



CGE 2-4P

Type CGE 2 - 4P
Complete with electrolyte (50 mL) and membrane cap

4-pole (WS)		
Type CGE 2 - 4P	0.1 - 10 mg/L	792838

For installation in the DGMa or DLG housing, a threaded adapter set is required (see sensor housing section).

Consumable material:

For 2 ppm, 5 ppm and 10 ppm sensors:	
Spare parts kit (2 membrane caps and 50 mL electrolyte)	740048
Membrane Cap (color: orange)	792862
Electrolyte (50 mL)	792892
For 0.5 ppm sensor:	
Spare parts kit (2 membrane caps and 50 mL electrolyte)	741277
Membrane Cap (color: blue)	741274
Electrolyte (50 mL)	792892

NOTE: The CTE total chlorine sensors are interchangeable with the ProMinent European CGE 2 "organic chlorine" sensors.

DULCOTEST®
Chlorine sensors (cont.)

Description	Part No.

DULCOTEST® total chlorine sensor (CTE)

pk_5_022

Type CTE 1 - DMT

Sensor for use with the DMT "chlorine" measurement transmitter.

Measured variable:	Total chlorine
Analysis:	DPD4
Measurement range:	0.01...10.00 mg/L
Supply:	From the DMT measurement transmitter
Output signal:	Uncalibrated, not temperature compensated
Temperature measurement:	Via integrated Pt 1000: compensation carried out in DMT
Sensor output:	5 pin plug (requires cable, see Dulcotest-40)

Other data as for CTE 1 - mA.

	Order No.
CTE 1-DMT-10 ppm set with 50 mL electrolyte	1007540

Note: An assembly set (part number 791818 for DGM or 815079 for DLG III) is required for the initial installation of the chlorine sensors.

DULCOTEST®
Chlorine Dioxide sensors

Description	Part No.

DULCOTEST® chlorine dioxide sensor (CDE)

Chlorine Dioxide sensor 4-20 mA

Membrane-covered amperometric sensor for determining chlorine dioxide in water. The sensor has an integrated preamplifier including automatic temperature correction. The zero stability is very high so that a zero calibration is not necessary.

The CDE 2-mA sensor is equipped with a passive 4-20 mA interface for two-wire connection on controllers with a supply voltage of 16-24 VDC (e.g. D1C). The sensor is also equipped with a terminal strip and cable gland for cable connection. **Without cable and holder.**

pH range:	stable range of chlorine dioxide
Temperature:	41-115°F (5-45°C)
Max. pressure:	14.5 psig (1 bar)
Flow rate:	8-16 GPH (30-60 L/h) minimum recommended in "in-line" sensor housing type DLG lll or DGM
Selectivity:	If chlorine is present in addition to chlorine dioxide, the return of chlorine is only about 2%; thus the contribution of chlorine is virtually suppressed.

The 4-20 mA output corresponds to approx. chlorine dioxide value (not calibrated), it roughly corresponds to the sensor signal at pH 7.2 in new condition. The slope calibration (DPD1) then takes place on the D1C controller.

Type CDE 2 - mA

Complete with electrolyte (100 mL)	Measuring Range	
Type CDE 2 - mA - 10 ppm	0.1 - 10.0 mg/L	792928
Type CDE 2 - mA - 2 ppm	0.02 - 2.0 mg/L	792929
Type CDE 2 - mA -0.5 ppm	0.01 - 0.5 mg/L	792930

For installation in the DGMa or DLG housing, a threaded adapter set is required (see sensor housing section).

Consumable material:

Electrolyte for chlorine sensor type CDE (all models) 100 mL	506272
Spare membrane cap for chlorine sensor CDE (The tips of this membrane cap are colored red.)	790488

NOTE: If using the DPD1 method for calibration, it is necessary to make sure that there is no chlorine present in the water as this will give errors. If chlorine is present, some glycine has to be added to the sample. Then the DPD1 test can be done. For chlorine dioxide, multiply the DPD1 value by 1.9 for chlorine dioxide residual value. If using the ProMinent DT1 Photometer, the chlorine dioxide value can be measured directly.

DULCOTEST®
Chlorine Dioxide sensors

ProMinent®

Description	Part No.

DULCOTEST® chlorine dioxide sensor (CDP)

Chlorine Dioxide sensor 4-20 mA

Membrane-covered amperometric sensor for determining chlorine dioxide in process water, specifically for use in bottle washing machines. The sensor has an integrated preamplifier, temperature correction is done externally. The zero stability is very high so that a zero calibration is not necessary.

The CDP 1-mA sensor is equipped with a passive 4-20 mA interface for two-wire connection on controllers with a supply voltage of 16-24 VDC (e.g. D1C). The sensor is also equipped with a terminal strip and cable gland for cable connection. **Without cable and holder.**

pH range:	5.5 -10.5 pH
Temperature:	50 -115°F (10 - 45°C) [short term periods 131°F (55°C)] with external temperature correction via PT 100 (no internal temperature correction)
Max. pressure:	43.5 psig (3 bar)
Flow rate:	8 - 16 GPH (30 - 60 L/h) minimum recommended in "in-line" sensor housing type DLG lll or DGM
Interference:	Ozone, chlorine

The 4-20 mA output corresponds to approx. chlorine dioxide value (not calibrated), it roughly corresponds to the sensor signal at pH 7.2 in new condition. The slope calibration (DPD1) then takes place on the D1C controller.

Type CDP 1 - mA

Complete with electrolyte (100 mL)	Measuring Range	
Type CDP 1 - mA - 2 ppm	0.02 - 2.0 mg/L	1002149
A PT 100 sensor is required for temperature correction.		305063

For installation in the DGMa or DLG housing, a threaded adapter set is required (see sensor housing section).

Consumable material
for CDP mA, 2 ppm

Spare Parts Kit (2 membrane caps and 100 mL electrolyte)	1002744
Membrane Cap (Color: black)	1002710
Electrolyte (100 mL)	1002712

Note: If using the DPD1 method for calibration, it is necessary to make sure that there is no chlorine present in the water as this will give errors. If chlorine is present, some glycine has to be added to the sample. Then the DPD1 test can be done. For chlorine dioxide, multiply the DPD1 value by 1.9 for chlorine dioxide residual value. If using the ProMinent DT1 Photometer the chlorine dioxide value can be measured directly.

DULCOTEST®
Ozone sensor

Description	Part No.

DULCOTEST® ozone sensor (OZE)

Membrane-covered amperometric sensor for determining dissolved ozone (O_3) in water. The sensor has an integrated preamplifier including automatic temperature correction. The zero stability is very high so that a zero calibration is not necessary.

The OZE 3-mA sensor is equipped with a passive 4-20 mA interface for two-wire connection on controllers with a supply voltage of 16-24 VDC (e.g. D1C). The sensor is also equipped with a terminal strip and cable gland for cable connection. **Without cable and holder.**

Thr OZE 2-4P sensor has a 4-pole plug-in connector and is used with the OZWS series controllers. **Without cable and holder.**

pH range:	pH 4-11
Temperature:	41-104°F (5-40°C)
Max. pressure:	14.5 psig (1 bar)
Flow rate:	8-16 GPH (30-60 L/h) minimum recommended in "in-line" sensor housing type DLG lll or DGM

The 4-20 mA output corresponds to approx. ozone value (not calibrated), it roughly corresponds to the sensor signal in new condition. The slope calibration (DPD4) then takes place on the D1C controller.

Type OZE 3 - mA
Complete with electrolyte (100 mL)

4-20 mA (DIC)

Type OZE 3 - mA - 2 ppm	measuring range: 0.02 - 2 mg/L	792957

Type OZE 2 - 4P
Complete with electrolyte (100 mL) and membrane cap

4-pole (WS)

Type OZE 2 - 4P	measuring range: 0.1 - 3 mg/L	914923

For installation in the DGMa or DLG housing, a threaded adapter set is required (see sensor housing section).

Consumable material:

Electrolyte for sensor type OZE (all models) 100 mL	506273
Spare membrane cap for sensor OZE	790488

NOTE: When using DPD4 for calibration, the value should be multiplied by 0.68 for ozone residual. If using the ProMinent DT1 Photometer the chlorine dioxide value can be measured directly.

DULCOTEST®
Conductivity sensors

ProMinent®

Description	Part No.

Conductivity sensors

For optimum performance of conductivity sensors, please note the following guidelines:

- The sensors should be installed with the electrode totally immersed in the sample fluid
- The cables should be kept as short as possible (<65 ft (20 m))
- Temperature compensation is necessary when subject to fluctuating temperatures
- Clean (conductive conductivity sensors) regularly
- Cell constant and measurement range must correspond

Summary of features:

- Simple to install
- Reliable measurement
- Simple to maintain

Flow

Conductive Conductivity Sensors

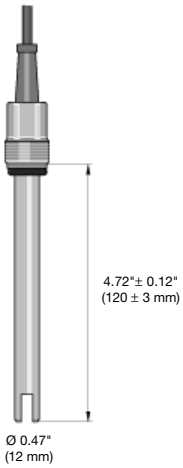
CKR Pt 10

305611

Measurement range:	0.01 - 200 mS/cm
Cell constant k:	10 cm^{-1}
Fluid Temperature:	32 - 194°F (0 - 90°C) with integrated Pt 100 for temperature compensation
Max. pressure:	232 psig (16 bar)
Electrodes:	graphite
Sensor shaft:	PP
Internal thread:	1" Parallel thread
Length:	4.80" (122 mm)
Electrical connection:	10' (3 m) fixed cable
Typical applications:	CIP plant, bottle cleaning machines

Note: Flow must be directed as shown. Do not remove the protective tubing over the electrode; it is a part of the sensor.

DULCOTEST®
Conductivity sensors



Description	Part No.

Conductive Conductivity Sensors

LF 1 FE

741152

Measurement range:	0.01 - 20 (100) mS/cm
Cell constant k:	1.0 cm^{-1} ± 5%
Fluid Temperature:	32 - 176°F (0 - 80°C)
Max. pressure:	232 psig at 68°F (16 bar at 20°C)
Electrodes:	graphite
Sensor shaft:	fiberglass reinforced PP
Internal thread:	PG 13.5
Installed Length:	4.72" ± 0.12" (120 mm ± 3)
Electrical connection:	16' (5 m) fixed cable (2 x 0.5 mm^2)

Typical applications: Potable water, cooling water, industrial water, process water, water phase separations, tank and pipe cleaning systems.

Not suitabale for: Cleaning solutions containing surfactants or liquids containing solvents.

LFT1 FE

1001374

Technical data as above but incorporates integrated Pt 100 for automatic temperature compensation.

LF1 DE

1001375

Technical data as LF1 FE but with DIN four pin plug.

LFT1 DE

1001376

Technical data as LF1 FE but with DIN four pin plug and integrated Pt 100 for automatic temperature compensation.

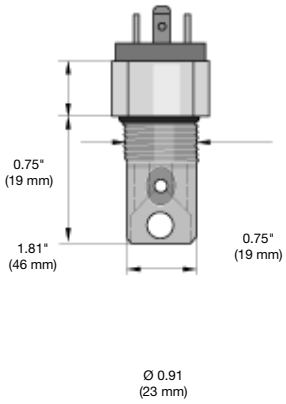
DULCOTEST®
Conductivity sensors

ProMinent®

Description	Part No.

Conductive Conductivity Sensors

LM 1



740433

Measurement range:	0.1 - 20 mS/cm
Cell constant k:	1.0 cm^{-1} ± 5%
Fluid Temperature:	32 - 176°F (0 - 80°C)
Max. pressure:	232 psig up to 140°F (16 bar up to 60°C)
Electrodes:	graphite
Sensor shaft:	PP
Internal thread:	3/4" Parallel thread ISO 228/1
Installed Length:	1.81" (46 mm)
Electrical connection:	DIN 4 pin plug
Typical applications:	Potable water, cooling water, industrial water, process water, separation of media.

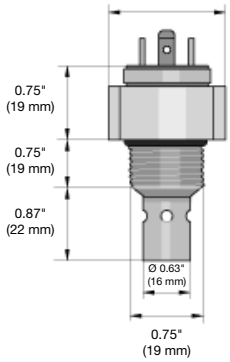
Requires Transducer Dulcotest - 26

LMN 1

740434

Technical data as LM1 but with NTC for automatic temperature conpensation.
Requires Transducer Dulcotest - 26

LM 01

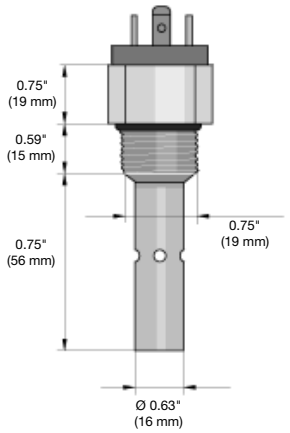


740435

Measurement range:	0.1 - 2000 mS/cm
Cell constant k:	0.1 cm^{-1} ± 5%
Fluid Temperature:	32 - 176°F (0 - 80°C)
Max. pressure:	232 psig up to 140°F (16 bar up to 60°C)
Electrodes:	stainless steel 1.4571
Sensor shaft:	PP
Internal thread:	3/4" Parallel thread ISO 228/1
Installed Length:	1.61" (41 mm)
Electrical connection:	DIN 4 pin plug
Typical applications:	Monitoring ion exchanges and reverse osmosis systems, desalination plant.

Requires Transducer Dulcotest - 26

LM 001



740436

Measurement range:	0.01 - 200 µS/cm
Cell constant k:	0.01 cm^{-1} ± 5%
Fluid Temperature:	32 - 176°F (0 - 80°C)
Max. pressure:	232 psig up to 140°F (16 bar up to 60°C)
Electrodes:	stainless steel 1.4571
Sensor shaft:	PP
Internal thread:	3/4" Parallel thread ISO 228/1
Installed Length:	2.80" (71 mm)
Electrical connection:	DIN 4 pin plug
Typical applications:	Clean water applications, monitoring ion exchanges and reverse osmosis systems.

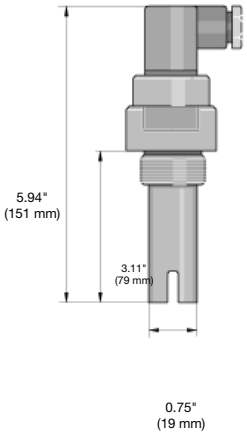
Requires Transducer Dulcotest - 26

DULCOTEST®
Conductivity sensors

ProMinent®

Description	Part No.

Conductive Conductivity Sensors



CK 1

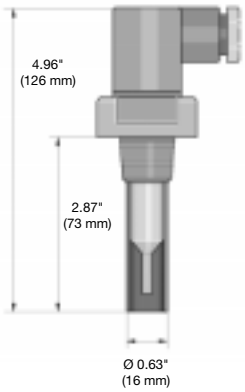
305605

Measurement range:	0.1 - 20 mS/cm
Cell constant k:	1.0 cm^{-1} ± 5%
Fluid Temperature:	32 - 302°F (0 - 150°C)
Max. pressure:	232 psig up to 140°F (16 bar up to 60°C)
Electrodes:	graphite
Sensor shaft:	PES
Internal thread:	1" parallel thread
Length:	3.11" (79 mm)
Electrical connection:	DIN 4 pin plug
Typical applications:	Cooling water, industrial water, process water, tank and pipe cleaning systems in breweries and dairies, separation of media.

CKPt 1

305606

Technical data as CK 1 but with Pt 100 for automatic temperature correction.



XG 01

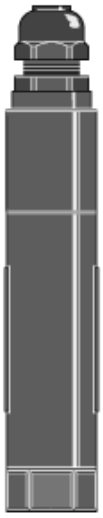
305601

Measurement range:	0.1 - 100 µS/cm
Cell constant k:	0.1 cm^{-1} ± 5%
Fluid Temperature:	32 - 140°F (0 - 60°C)
Max. pressure:	87 psig up to 140°F (6 bar up to 60°C)
Electrodes:	316 stainless steel
Sensor shaft:	Polycarbonate
Internal thread:	R 1" NPT (with PVC socket for DN 25 T-piece, max. 140°F (60°C))
Length:	2.87" (73 mm)
Electrical connection:	DIN 4 pin plug
Typical applications:	Total desalination plant

DULCOTEST®
Signal converters 4-20 mA

Description	Part No.

Signal converters 4-20 mA



Some controllers (depending on the ident code) have 4-20 mA inputs for measurement of pH, redox, temperature and chlorine. While the chlorine sensors have integral 4-20 mA output, here the point-of use signal converters which are described must be attached onto pH, redox or Pt 100 electrodes and whose signal is converted into 4-20 mA. These are typically used for extremely long cable runs between the sensor and controller.

Signal converter 4 - 20 mA

They are used for pH and redox combination sensors as well as Pt 100 sensors with SN 6 female push and twist connectors. The signal converters have a terminal strip and a cable gland for 2-wire connection. The signal converter does not have any calibration facilities. The pH zero and slope calibration is carried out on the controller.

Technical data for all versions:

Length/diameter:	5.55"/0.98" (141/25 mm)
Weight:	approx. 3.53 oz. (100 g)
Enclosure rating:	NEMA 4
Material:	PPE
Permissible ambient temp.:	23-122°F (–5 to 50°C) non-condensing
Supply voltage:	18-24 VDC

pH signal converter 4 - 20 mA pH V1 809126

Signal output:	4-20 mA ≈ –500 to 500 mV ≈15.45...-1.45 pH, not calibrated, not electrically isolated
Measurement range:	0-14 pH
Accuracy:	better than 0.1 pH (typical ±0.07 pH)
Input resistance:	10^{12} Ω

Redox signal converter 4 - 20 mA RH V1 809127

Measurement range:	0-1000 mV
Signal output:	4-20 mA ≈ 0-1000 mV, not electrically isolated
Accuracy:	better than ±0.5 mV (typical ±3 mV)
Input resistance:	> 5 x 10^{11} Ω

Temperature signal converter 4 - 20 mA Pt 100 V1 809128

Measurement range:	32-212°F (0-100°C)
Signal output:	4-20 mA ≈ 32-212°F (0-100°C)
Accuracy:	better than 0.9°F (0.5°C), typical 0.5°F (0.3°C)
Input resistance:	~ 0 Ω

Two-wire cable for connection between point-of-use signal converters 4-20 mA and controller - priced per foot (specify length). 7740215

Impedance converter

Owing to their high impedance, pH and redox sensor systems are prone to be disturbed by electrical noise, particularly if the sensor cables are longer than usual. The impedance converter changes the impedance of the sensor signal to about 1 kOhm and makes it less susceptible to electrical noise. The unit can be screwed down directly onto the pH or redox sensor with SN6 connections. The converter has a SN6 connection for the sensor cable.

Powered by a built-in battery, sufficient for 5 years of operation. Enclosure rating NEMA 4.

Type 2 AMZ 20 305350

DULCOMETER® Perox Measurement and Control Technology for Hydrogen Peroxide and Peracetic Acid

ProMinent®

Measuring principle

The Perox measuring systems are based on amperometric/potentiostatic measuring principles incorporating several special features compared to conventional measuring technologies. The platinum [hydrogen peroxide (H_2O_2) measurement] or gold (peracetic acid measurement) working electrode with a small surface area is covered by a microporous membrane cap to achieve a degree of selectivity and independence from flow influences. The entire stainless steel shaft of the Perox sensor serves as the counter-electrode. This represents the complete sensor section for H_2O_2 measurement; a reference electrode is also required for peracetic acid measurement.

A special, continuous electrode activation function which is the result of extensive research, ensures long-term stability of the measurement without the need for frequent recalibration.

Since all amperometric measurement methods are relatively dependent on temperature, we recommend additional temperature compensation with the Pt 100 sensor if temperature fluctuations occur during applications. With the Pt 100, H_2O_2 measurement is a 2-electrode system while peracetic acid measurement is based on a 3-electrode system.

This sensor/controller system differs from our other systems in that it is not a wide range measuring and control device. It is designed to function as a process control instrument instead. This means that, once calibrated at or close to the desired process control point, it will maintain the H_2O_2 or PAA level accurately around that setpoint. It will provide good linearity and control within a +/- 15% control band above and below the setpoint. However, wide variations in concentration may not be accurately measured by the system.

Applications

The environmentally-friendly substance hydrogen peroxide is used to an increasing extent in process control applications as an oxidizing or reduction agent. Examples of applications where continuous Perox H_2O_2 measurement control is used either alone or in advanced oxidation systems (with ozone, UV or Fenton's reagent) are:

- Odor control scrubbers
- Ground water purification
- Drinking water oxidation
- Utility water/cooling water disinfection
- Dechlorination, e.g. in chemical processes
- Landfill leachate treatment
- Biotechnology
- Vat dying/textile industry
- Swimming pool water disinfection

Peracetic acid as a disinfectant is used in the following industries:

- Food and beverage
- Cosmetics
- Pharmaceuticals
- Medicine

Continuous measurement and control is necessary wherever more demanding requirements are made with regard to disinfection and quality assurance.

Increasing the peracetic acid concentration in CIP processes as well as concentration control in bottle cleaning machines are typical applications of Perox peracetic acid measurement.

Operating conditions

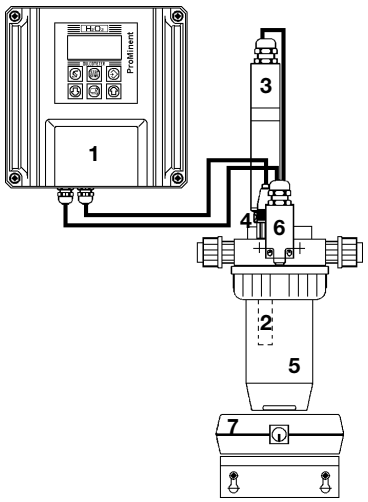
Measuring ranges and applications	**H2O2**	**Peracetic acid**
Measuring range (selectable) mg/l	1 - 20 / 10 - 200 / 100 - 2000	10 - 200 / 100 - 2000
pH range	pH 2.5 - 10	pH 1 - 8
Temperature range	32 - 104°F (0 - 40°C)	41 - 95°F (5 - 35°C)
Permissible changes in temperature	less than 0.9°F (0.5°C) per minute	
Sensor response rate T_{90} approx.	20 seconds	2 minutes
Reproducible measuring accuracy	better than 2% referred to end value of measuring range	
Min. conductivity of measurement solution at:		
measuring range 20 mg/L	50 µS/cm	-
measuring range 200 mg/L	200 µS/cm	500 µS/cm
up to 1000 mg/L	500 µS/cm	2000 µS/cm
up to 2000 mg/L	1000 µS/cm	4000 µS/cm
Measurement water flow rate	recommended 16 gph (60 L/h)	
Max. operating pressure	29 psig (2 bar)	

Depending on the application, other parameters or water constituents may be of significance. For instance, higher concentrations of surface-active substances, such as fats or tensides, or suspended solids can have a detrimental effect on the measurement.

DULCOMETER® Measurement and Control Technology: Hydrogen Peroxide (H_2O_2)

Description	Part No.

Hydrogen Peroxide Measurement and Control Systems



Recommended Hydrogen Peroxide System (descriptions follow)

1	D1C H_2O_2 Controller *(1)*	see DULOMETER®-7
1	Hydrogen Peroxide Sensor: H 2.10 P, complete with membrane cap *(2)*	792976
1	Perox signal converter: Perox-micro-H 1.20-mA *(3)*	741129
1	Connection between Perox signal converter and limit sensor Three-wire cable, priced per foot (specify length)	791948
1	Temperature Sensor: Pt 100 SE *(4)*	305063
1	Connection between the temperature sensor and the controller: (Based on distance between the controller and temperature sensor)	
	Up to 30 ft SN6 open end cable	
	15 ft. (5 m) long	1003208
	30 ft. (10 m) long	1003209
	Over 30 ft. Signal converter 4-20 mA Pt 100 V1	809128
	Two-wire cable - priced per foot (specify length)	7740215
1	DLG-PER In-line sensor housing *(5)* (includes limit sensor with 2 n/o contacts) *(6)*	1000165
1	Connection between the limit switch on the DLG-PER and the controller: Two-wire cable - priced per foot (specify length)	7740215
1	Magnetic stirrer 115 VAC *(7)*	7790915
1	Stirrer Magnet	7790916
1	Compact stand (PE, UV protected, black)	7740000
1	Power Cord, 6 ft.	741203

Accessories:

Replacement membrane cap: M 2.0 P for H_2O_2 sensor	792978
Polishing paste for sensor, 3 oz. (90 g) tube	559810

Note: We can also provide measuring and control instruments mounted and wired, e.g. on PVC board or in a control cabinet. See PCM Systems in *Feed & Control Packages* section.

Sensors: Hydrogen Peroxide Measurement

The H_2O_2 sensor shaft is made of stainless steel (counter and reference electrode) with a platinum working electrode. Installation length 4.7" (120 mm), 0.5" (12 mm) Ø, PG 13.5 internal thread and SN6 plug connection.

H 2.10 P, complete with membrane cap	792976

Temperature sensor Pt 100 for temperature compensation of H_2O_2 measurement; necessary when temperature fluctuations can occur in the measurement medium.

Pt 100 SE	305063

A coaxial measuring line with an SN6 connector is required for direct connection of a temperature sensor:

SN6 open end	15 ft. (5 m) long	1003208
SN6 open end	30 ft. (10 m) long	1003209

When distances between the measuring unit and sensor exceed 30 ft. (10 m), it is recommended to use a temperature signal converter which transmits the temperature signal via a 2-wire connection at 4-20 mA. Temperature compensation input should be taken into consideration when selecting the D1C-Perox controller from the identity code.

Signal converter 4-20 mA Pt 100 V1	809128
Two-wire cable for connection between point-of-use signal converter 4-20 mA and controller - priced per foot (specify length).	7740215

DULCOMETER® Measurement and Control Technology: Hydrogen Peroxide (H_2O_2)

ProMinent®

Description	Part No.

Perox Signal Converter

The signal converter controls and activates the hydrogen peroxide sensor and evaluates the sensor signal. It is screw-mounted directly on the head of the sensor.

The signal converter has a length of approx. 8.1" (205 mm) and a 1.25" (32 mm) Ø.

Signal converter for H_2O_2 measurement

A changeover switch for the three measuring ranges 1 - 20, 10 - 200 and 100 - 2000 mg/L H_2O_2 is located on the inside.

Perox-micro-H 1.20-mA	741129

In-line Sensor Housing

The DLG-PER in-line sensor housing must be used for hydrogen peroxide measurement where all (max. 3) individual sensors are installed in a measuring cup. A limit sensor must also be used which switches off the power supply for the signal converter when the measuring cup is removed. The DLG-PER in-line sensor housing features a body made of rigid PVC with a transparent polyamide cup and measurement water connection with 1/2" MNPT fittings.

DLG-PER In-line sensor housing (includes limit sensor with 2 n/o contacts)	1000165
Two-wire cable for connection between the limit switch on the DLG-PER and the controller - priced per foot (specify length)	7740215

For calibration of the DLG-PER in-line sensor housing, we recommend a magnetic stirrer to facilitate flow independent calibration.

Magnetic stirrer 115 VAC	7790915
Stirrer magnet	7790916
Mounting bracket for magnetic stirrer PVC (includes screws with wall anchor)	1000166

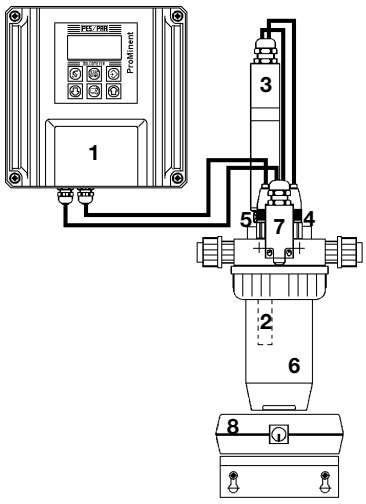
Accessories/Spare Parts

Replacement membrane cap: M 2.0 P for H_2O_2	792978
Polishing paste for Perox sensor, 3 oz. (90 g) tube	559810

DULCOMETER® Measurement and Control Technology: Peracetic Acid (PAA)

Description	Part No.

Peracetic Acid Measurement and Control Systems



Recommended Peracetic Acid System (descriptions follow)

1	D1C PAA Controller *(1)*	see DULCOMETER®-7
1	Peracetic Acid Sensor: P2.10 B, complete with membrane cap *(2)*	809150
1	Perox signal converter: Perox-micro-P 1.30-mA *(3)*	741128
1	Connection between Perox signal converter and limit sensor Three-wire cable, priced per foot (specify length)	791948
1	pH Sensor: REFP - SE *(4)*	1000505
1	Temperature Sensor: Pt 100 SE *(5)*	305063
1	Connection between the temperature sensor and the controller: (Based on distance between the controller and temperature sensor)	
	Up to 30 ft SN6 open end cable 15 ft. (5 m) long 30 ft. (10 m) long	 1003208 1003209
	Over 30 ft. Signal converter 4-20 mA Pt 100 V1	809128
	Two-wire cable - priced per foot (specify length)	7740215
1	DLG-PER In-line sensor housing *(6)* (includes limit sensor with 2 n/o contacts) *(7)*	1000165
1	Connection between the limit switch on the DLG-PER and the controller: Two-wire cable - priced per foot (specify length)	7740215
1	Magnetic stirrer 115 VAC *(8)*	7790915
1	Stirrer Magnet	7790916
1	Compact stand (PE, UV protected, black)	7740000
1	Power Cord, 6 ft.	741203

Accessories:

Replacement membrane cap: M 2.0 B for peracetic acid sensor	809154
Polishing paste for sensor, 3 oz. (90 g) tube	559810

Note: We can also provide measuring and control instruments mounted and wired, e.g. on PVC board or in a control cabinet. See PCM Systems in *Feed & Control Packages* section.

Sensors: Peracetic Acid Measurement

The peracetic acid sensor shaft is made of stainless steel (counter electrode) with a gold working electrode. Installation length 4.7" (120 mm), 0.5" (12 mm) Ø.

P 2.10 B, complete with membrane cap 809150

A pH sensor is also required as a reference electrode for peracetic acid measurement

REFP - SE 1000505

Temperature sensor Pt 100 for temperature compensation of peracetic acid measurement; necessary when temperature fluctuations can occur in the measurement medium.

Pt 100 SE 305063

A coaxial measuring line with an SN6 connector is required for direct connection of a temperature sensor:

SN6 open end	15 ft. (5 m) long	1003208
SN6 open end	30 ft. (10 m) long	1003209

When distances between the measuring unit and sensor exceed 30 ft. (10 m), it is recommended to use a temperature signal converter which transmits the temperature signal via a 2-wire connection at 4-20 mA. Temperature compensation input should be taken into consideration when selecting the D1C-Perox controller from the identity code.

Signal converter 4-20 mA Pt 100 V1 809128

Two-wire cable for connection between point-of-use signal converter 4-20 mA and controller - priced per foot (specify length). 7740215

DULCOMETER® Measurement and Control Technology: Peracetic Acid (PAA)

ProMinent®

Description	Part No.

Perox Signal Converter

The signal converter controls and activates the pracetic acid sensor and evaluates the sensor signal. It is screw-mounted directly on the head of the sensor.

The signal converter has a length of approx. 8.1" (205 mm) and a 1.25" (32 mm) Ø.

Signal converter for peracetic acid measurement

A changeover switch for the two measuring ranges 10 - 200 and 100 - 2000 mg/L peracetic acid is located on the inside; the standard scope of delivery includes a measuring line with SN6 plug connector to facilitate connection to the reference electrode.

Perox-micro-P 1.30-mA	741128

In-line Sensor Housing

The DLG-PER in-line sensor housing must be used for peracetic acid measurement where all (max. 3) individual sensors are installed in a measuring cup. A limit sensor must also be used which switches off the power supply for the signal converter when the measuring cup is removed. The DLG-PER in-line sensor housing features a body made of rigid PVC with a transparent polyamide cup and measurement water connection with 1/2" MNPT fittings.

DLG-PER In-line sensor housing (includes limit sensor with 2 n/o contacts)	1000165
Two-wire cable for connection between the limit switch on the DLG-PER and the controller - priced per foot (specify length)	7740215

For calibration of the DLG-PER in-line sensor housing, we recommend a magnetic stirrer to facilitate flow independent calibration.

Magnetic stirrer 115 VAC	7790915
Stirrer magnet	7790916
Mounting bracket for magnetic stirrer PVC (includes screws with wall anchor)	1000166

Accessories/Spare Parts

Replacement membrane cap:	
M 2.0 B for peracetic acid	809154
Polishing paste for Perox sensor, 3 oz. (90 g) tube	559810

DULCOTEST® accessories
pH, redox and chlorine sensor housings

Description	Part No.

DGM modular in-line sensor housings

These sensor housings may be ordered individually for single sensors, or connected together for multiple sensor applications. An optional flow meter (rotameter) is used for setting sample flow, and the optional flow sensor attachment to the flow meter has an adjustable switch that signals loss of flow. A flow control valve is standard with every housing, whether one module or multiple module. Other options include a sampling tap, calibration cup, bubble dispenser and reference potential plug.

The housings are ordered by identity code, page 35. Add mounting adapters as needed for PHEP sensors (15 mm) or CLE, CTE, CGE, CDE, CDP or OZE sensors (25 mm).

Specifications:

Weight: 0.55 lb. (249 g) (13.5 mm module)
1.05 lb. (475 g) (25 mm module)

Material: PVC/Viton®

Max. Temperature: 140°F (60°C)

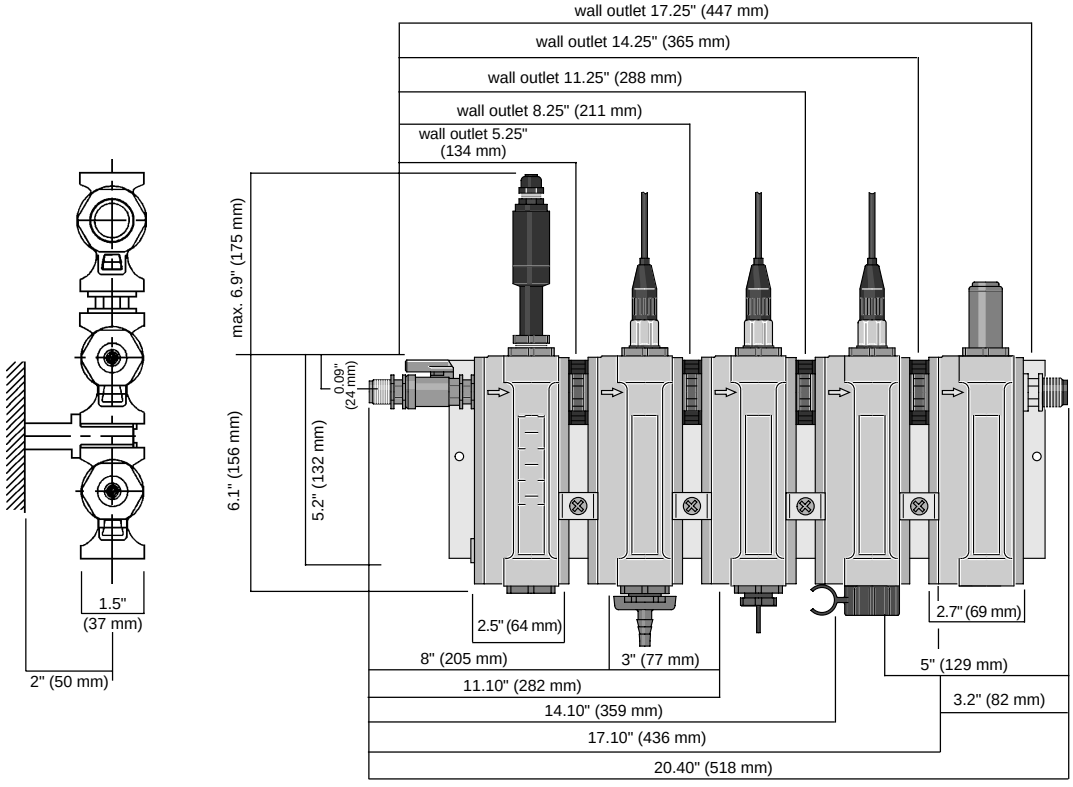
Max. Pressure: 87 psig (6 bar) at 86°F (30°C)
14.5 psig (1 bar) at 140°F (60°C)
29 psig (2 bar) with flow monitor

Recommended Sample Flow: 10.5 gph (40 l/h)

Flow Sensor Switch: Reed switch (max. making and breaking capacity 3W
max. switching voltage 175 V
max. switching current 0.25 A
max. permanent current 1.2 A
max. contact resistance 150 mOhm) n/o or n/c

In processes for water with a lot of air or pressure changes an accumulator should be used on the inlet of the DGMa probe holder.

Accumulator (10 cu. in.)	7253216



pk_5_080

Identity code ordering system for ProMinent® DGM in-line sensor housings

Series:
DGM In-line sensor housing

A **Series version:**
Standard

Module for flow measurement (Rotameter):
0 None
1 With scale L/h
2 With scale gph
3 With flow sensor, scale L/h
4 With flow sensor, scale gph

Number of modules with PG 13.5 thread (pH, ORP, PT 100, conductivity sensors, or PHEP sensor with optional mounting set):
0 None
1 One module, PG 13.5
2 Two modules, PG 13.5
3 Three modules, PG 13.5
4 Four modules, PG 13.5
Note: Add 15 mm mounting set for PHEP/RHEP sensor, if used.

Number of modules with 25 mm thread (CLE, CTE, CGE, CDE, CDP or OZE sensors)
0 None
1 One module, 25 mm *
2 Two modules, 25 mm *
* 25 mm mounting set necessary

Material:
T PVC-transparent
Note: Other materials by request

Sealing material:
0 Viton®
Viton® is a registered trademark of DuPont Dow Elastomers

Connection type:
0 1/2" x 3/8" tubing adapters
1 PVC half-union connections with 1/4" MNPT adapters

Version:
0 Standard

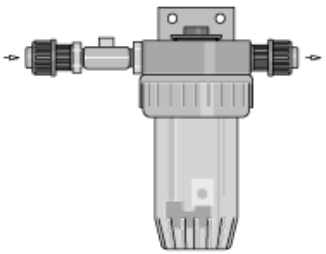
Recommended accessories:	**Part No.**
Mounting set for sensor 15 mm (PHEP/RHEP):	791219
Mounting set for sensor 25 mm (CLE, CTE, CGE, CDE, CDP, OZE):	791818
If liquid reference potential is necessary	
Reference potential plug w/SS pin	791663
Flow Sensor (spare)	791635
Calibration Cup (spare)	791229
Bubble disperser for Cl sensor	740207
Bubble disperser for pH, Redox sensors	791703
PG 13.5 Sampling Tap	1004737
25 mm Sampling Tap	1004739

DGM A 1 1 0 T 0 0 0

DULCOTEST® accessories
pH, redox and chlorine sensor housings

Description	Part No.

In-line sensor housing type DLG III for pH and redox sensors, chlorine, chlorine dioxide and ozone sensors, conductivity cells and resistance thermometers



1113/4

In-line sensor housing accepting two sensors with PG 13.5 mounting thread (pH, redox, conductivity and Pt 100 types marked ...SE) and one 1" British thread for chlorine, chlorine dioxide or ozone sensor (CLE, CTE, CGE, CDE, CDP, OZE series). The CLE, CTE, CGE, CDE and OZE sensors are smooth shaft sensors requiring an adapter set which provides a compression fitting for 1" British thread.

The DLG III is fitted with a plastic ball valve on the input side for stopping and adjusting the sample water flow. The housing is provided with a built-in stainless steel pin representing the liquid reference potential for use with pH monitors in systems with electrical noise.

To be used with systems operating under atmospheric pressure and, considering the maximum working pressures of the respective sensors, with slightly pressurized systems. Operation under atmospheric pressure is strongly recommended. An inflow regulating valve is provided.

Materials: Body of rigid PVC, perspex cup of polyamide, regulating valve of rigid PVC.

T_{max} = 131°F (55°C);
P_{max} = 14.5 psig (1 bar)

Type DLG III B

With 1/2" MNPT connections.	914956
Adapter set for CLE, CTE, CGE, CDE and OZE sensors (compression fitting x 1" British thread)	815079

pk_5_084

DLG Type IV In-line Sensor Housing

Same as DLG Type III but accepts 4 sensors: (conductivity, Pt 100, pH, redox) with PG 13.5 threaded connector, with integrated stainless steel pin as liquid reference potential. Bracket for wall mounting.

Note: Sensors with 25 mm threads cannot be used with this housing.

Materials: Body of rigid PVC, or PP perspex cup of polyamide.

T_{max} = 131°F (55°C) PVC; 176°F (80°C) PP
P_{max} = 14.5 psig (1 bar)

Type DLG IV

With 1/2" MNPT connections	PVC:	1005332
	PP:	1005331

DULCOTEST® accessories
pH, redox and chlorine sensor housings

ProMinent®

Description	Part No.

pk_5_085

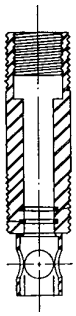
Sampling tap for DGM

for PG 13.5 and 25 mm modules

PG 13.5 sampling tap:	1004737
PG 25 mm sampling tap:	1004739

Sensor holders

Designed for mounting sensors into standard 3/4" pipe tees for continuous pH, redox, temperature or conductivity flow-thru monitoring. Holders are threaded female PG 13.5 internally on top for insertion of sensors; threaded 3/4" MNPT on top for connection to conduit for in-tank mounting, and threaded 3/4" MNPT on bottom for insertion of holder into 3/4" standard pipe tee. Holders include Viton® O-rings for sealing sensor and extended guard tip for sensor protection. Holders are available in several chemically compatible materials.



CPVC holder

CPVC universal in-line sensor holder with 3/4" MNPT, 5" (127 mm) long body. 7305020

Kynar holder

Kynar universal in-line sensor holder with 3/4" MNPT, 5" (127 mm) long body. 7305021

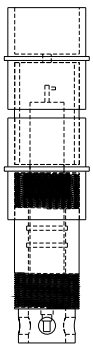
Stainless steel holder

Stainless steel universal in-line sensor holder with 3/4" MNPT, 5" (127 mm) long body. 7305022

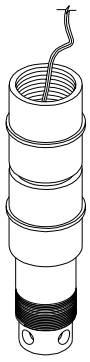
Submersible CPVC holder

CPVC universal in-line sensor holder with 1-1/2" MNPT, 5" (127 mm) long body. 7500005

25 mm Submersible sensor holder



Front View



Assembly View

Used for holding one sensor (free or total chlorine, chlorine dioxide, ozone) below the water surface to help guard against surface contaminants. The holder is waterproof and includes a 30 ft. (9 m) fixed cable for connection to the sensor. Sensor not included.

Not suited for applications with heavy suspended solids, which can clog the sensor membrane.

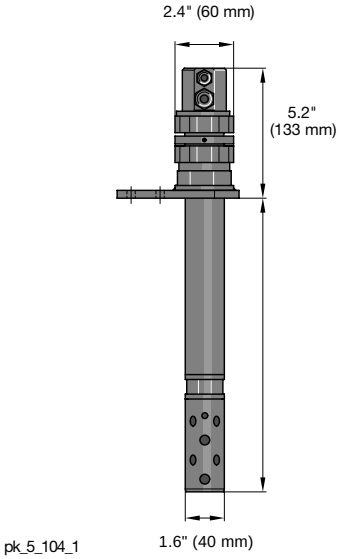
The flow must meet recommended sensor requirements:

Recommended flowrate:	8 gph (30 L/h)
Usable flowrate:	5 - 26 gph (20 - 100 L/h)
Max. recommended velocity over sensor membrane:	2.37 ft./ second
Sensor holder material:	CPVC
Maximum temperature:	Sensor dependent
Maximum pressure:	Sensor dependent
Seal material:	FPM (or Viton®)
Connection:	1-1/2" NPT

Submersible sensor holder, 25 mm 7744008

DULCOTEST® accessories
submersible sensor holder

Description	Part No.



pk_5_104_1

PP submersible sensor holder Type PP IPHa 1 - PP

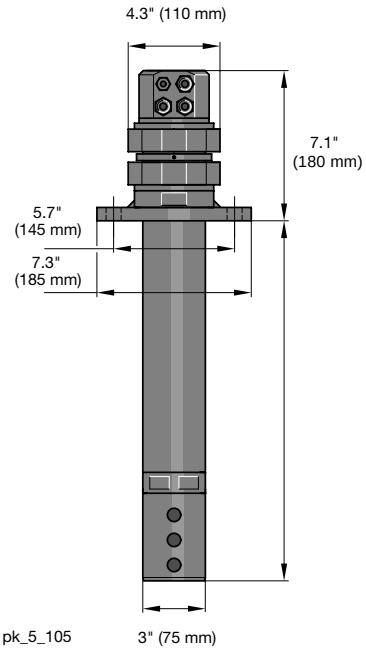
To hold one sensor (e.g. pH, redox) with PG 13.5 internal thread, standard length 4.7" (120 mm). The inside diameter is designed to accept pH or redox transmitter. Also incorporates a stainless steel pin for fluid reference potential. The outside diameter is 1.6" (40 mm). Immersion depths 3 or 6 ft. (1 or 2 m) available but the customer can shorten the immersion lance/cut to length on site. The sensor holder head contains two threaded cable connectors. 0.1-0.3" (3-7 mm) cables can be connected to the sensor holder. Cables are not included in the delivery.

Sensor housing material:	PP
Seal material:	Viton®
Maximum temperature:	176°F (80°C)
Pressure:	Atmospheric pressure installation
Immersion depth:	Maximum 3 and/or 6 ft. (1 and/or 2 m), adjustable
Immersion lance diameter:	1.6" (40 mm)

Type IPHa 1-PP, installed length 3 ft. (1 m)	1008600
Type IPHa 1-PP, installed length 6 ft. (2 m)	1008601

Other materials available upon request.

Viton® is a registered trademark of DuPont Dow Elastomers.



pk_5_105

PP submersible sensor holder Type IPHa 3 - PP

To accept a maximum of three sensors (e.g. pH, redox, temperature) with PG 13.5 internal thread, standard length 4.7" (120 mm). The inside diameter is designed to accept up to three pH, temperature and redox transmitters at the same time. Also incorporates a stainless steel pin for fluid reference potential. The outside diameter is 3" (75 mm). Immersion depths 3 or 6 ft. (1 or 2 m) available but the customer can shorten the immersion lance on site. The sensor holder head contains four threaded cable connectors. 0.1-0.3" (3-7 mm) cables can be connected to the sensor holder. Cables are not included in the delivery. Technical specification as for IPHa 1 but immersion lance diameter is 3" (75 mm).

Type IPHa 3-PP, installed length 3 ft. (1 m)	1008602
Type IPHa 3-PP, installed length 6 ft. (2 m)	1008603

Other materials available upon request.

Accessories for sensor housing Type IPHa

Immersion lance mounting for IPHa 1-PP	1008624
Immersion lance 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 welded connection for IPHa 1-PP	1008628
Clamped threaded connector for welded connection for IPHa 3-PP	1008629
Protective (weatherproofing) cover for sensor holder for IPHa 1-PP	1008630
for IPHa 3-PP	1008631
Waterproof clips for IPHa 1-PP	1008632
Waterproof clips for IPHa 3-PP	1008633

DULCOTEST® accessories
Connector and cable combinations

ProMinent®

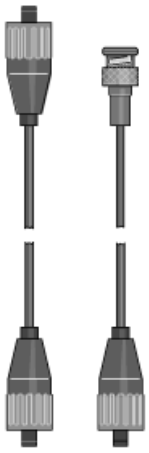
Description	Part No.

pH/redox connector and cable combinations

For the transmission of pH and redox measurement signals only coax cable of a suitable design should be used since the high internal probe impedances and the low voltages in the mV range may pose some problems.

The signal cables should be as short as possible. They should not be run parallel to or in the same conduit as power cables. If necessary they should be run in grounded conduits. A maximum cable length cannot be specified since this depends on many parameters. The DULCOMETER® monitors/controllers are provided with an active noise suppression and a high-quality differential input amplifier with a high common mode rejection so that interferences are eliminated as far as possible even when long cables are used.

DULCOTEST® complete signal cables



2358/4

Generally, we recommend the use of complete, ready-made cable combinations which do away with self-made cables and offer the advantage of being tested. 0.12" (3 mm) dia. coax cable is used for signal cables with SN 6 connectors both ends. Signal cables with BNC connectors 0.12" (3 mm) dia. coax cable are available. For pH/ORP measurement.

Connectors	Designation		
2 x SN 6	Coax	3 ft. (0.8 m)	305077
		6 ft. (2 m)	304955
		15 ft. (5 m)	304956
		30 ft. (10 m)	304957
SN6 open end	Coax	6 ft. (2 m)	305030
		15 ft. (5 m)	305039
		30 ft. (10 m)	305040
SN 6 - BNC	Coax	30 ft. (10 m)	305099

A coaxial measuring line with an SN6 connector is required for direct connection of a temperature sensor:

SN6 open end	Coax	15 ft. (5 m)	1003208
SN6 open end		30 ft. (10 m)	1003209

Note: If a custom length of cable is required, price the cable by the foot and add the price of the 2 x SN6 connectors.

SN 6 to BNC

SN 6 male to BNC male universal sensor connection adapter.	7305024
SN 6 female to BNC female universal sensor connection adapter.	7305065

SN 6 to SN 6

SN 6 male to SN 6 male universal sensor connection adapter.	7305024
SN 6 female to BNC female universal sensor connection adapter.	7305025

ProMinent®

DULCOTEST® accessories
Adapters, Signal cables

Description	Part No.

Signal Cables for DMT type chlorine sensors

pk_1_085

The signal cable is required for connection of DMT type sensors to the DMT transmitter.

Universal cable, 5 pin round plug; 5 core	6 ft. (2m)	1001300
Universal cable, 5 pin round plug; 5 core	15 ft. (5m)	1001301
Universal cable, 5 pin round plug; 5 core	30 ft. (10m)	1001302

SN 6 coax connector

2359/4

Fitting on top of pH, redox sensors and Pt 100 thermometers, and also into SN 6 sockets of transmitters, etc. For 0.12" (3 mm) dia. coax cable. The cable can be easily fitted to the connector without any special tools (soldering iron only). After having been plugged on top of the electrode connector only the front part needs twisting, not the entire connector. Moisture-protected according to NEMA 4.

SN 6 coax connector - 0.12" (3 mm) dia. cable	7304975
SN 6 coax connector - 0.19" (5 mm) dia. cable	304974

Signal cables

1789/4

Coax signal cable for pH, redox and temperature measurement.

0.12" (3 mm) dia. coax cable	723718
0.19" (5 mm) dia. coax cable	723717

1789/4 - 2

4 core, sheathed signal cable for conductivity sensors.

0.24" (6.2 mm) dia. 4 core, sheathed cable	723712

Note: Prices per foot. Please state desired length when ordering.

Signal cables for chlorine, chlorine dioxide and ozone sensors

DULCOTEST® signal cable

2366/4

With 4-pole connector and moisture-protected fastening thread both ends, for sensor models CLE-4P, CGE-4P and OZE-4P (WS series controllers).

6 ft. (2 m) length	818455
15 ft. (5 m) length	818456
30 ft. (10 m) length	818470

Two-wire, shielded cable for connection between mA sensors, point-of-use signal converters 4-20 mA and D1C/D2C controllers: priced per foot (specify length).	7740215
Two-wire, non shielded cable for connection between mA sensors inputs and pH, ORP, PT 100 and conductivity transmitters: priced per foot (specify length).	725122

DULCOTEST® standardizing solutions and electrolyte solutions for sensors

ProMinent®

Description		Part No.

High-quality standardizing solutions, pH

2371/4

Accuracy ±0.02 pH. The shelf life depends on the frequency of use and contamination due to use.

When left standing open for longer periods of time, alkaline standardizing solutions react with carbon dioxide and change their value. Therefore, close well after use.

After having been opened for the first time, standardizing solutions should be replaced not later than after 3 months.

pH 4.0	50 mL	506251
	1000 mL	506256
pH 7.0	50 mL	506253
	1000 mL	506258
pH 10.0	50 mL	506255
	1000 mL	506260

High-quality standardizing solutions, redox

2371/4

Accuracy ± 10 mV. The shelf life depends on the frequency of use and contamination due to use.

After having been opened for the first time, standardizing solutions should be replaced not later than after 3 months.

As a rule, two values are assigned to redox standardizing solutions. The higher value applies to platinum - silver/silver chloride (Ag/AgCI) systems, the lower one to platinum-calomel (mercurous chloride) systems. All DULCOTEST® redox sensors are of the Ag/AgCI type.

Caution: 465/430 mV standardizing solution is very corrosive.

Redox buffer 465/430 mV	50 mL	506240
	1000 mL (Ground shipment only)	506241

3-M KCl solution

2371/4

3-molar potassium chloride solution is used to preserve pH and redox sensors (e.g., by means of a storage cylinder).

3-M KCI solution	50 mL	505533
3-M KCI solution, AgCl-saturated	1000 mL	505534

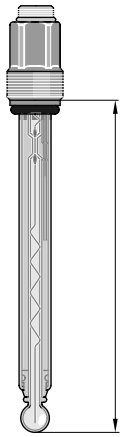
Conductivity calibration solution

For the accurate calibration of conductivity sensors we recommend using calibration solutions with known conductivity levels. One pack contains two 25 mL sacks holding 1413 µS/cm and 12.88 ms/cm.

4 pack conductivity value solution (4 x 25 mL)	1005212

Description	Part No.

pH/Redox sensors



pk_5_030

Type PHES 112 SE

Gel-filled non-refillable pH sensor with glass shaft and ceramic diaphragm.

Installed length 4.72” (120 mm); with push-and-twist connector for SN6 coax connector, and mounting thread PG 13.5; measuring range pH 1-12; temperature range 32-140°F (0-60°C); maximum working pressure 43.5 psig (3 bar), minimum conductivity >150 µs/cm. **Without cable and holder.**

PHES 112 SE 150702

Typical applications:

- Swimming pool water during pressurization, potable water and slightly polluted wastewater.

Delivery approximately 2-5 weeks.

Type PHEF 012 SE

pH sensor with epoxy shaft, a flat membrane glass and a flat double junction PE diaphragm.

Installed length 4.72” (120 mm); with push-and-twist connector for SN6 coax connector and mounting thread PG 13.5; measuring range pH 1-12; temperature range 32-122°F (0-50°C); maximum working pressure: 100 psig (7 bar); minimum conductivity >150 µs/cm. **Without cable and holder.**

PHEF 012 SE 1010511

Typical applications:

- Semiconductor manufacturing, electroplating and wastewater containing acidic fluorides.

Type RHES-Pt-SE

Gel-filled non-refillable redox sensor with platinum pin, glass shaft and ceramic diaphragm.

Installed length 4.72” (120 mm); with push-and-twist connector for SN6 coax connector, and mounting thread PG 13.5; temperature range 32-140°F (0-60°C); maximum working pressure: 43.5 psig (3 bar); minimum conductivity > 150 µs/cm. **Without cable and holder.**

RHES-Pt-SE 150703

Typical applications:

- Swimming pool water during pressurization, potable water and slightly polluted wastewater.

Delivery approximately 2-5 weeks

Description	Part No.

Free Chlorine Sensors (CLE)

For the measurement of chlorine, chlorine dioxide or ozone in aqueous solutions, the amperometric measurement principle is used. Our membrane covered 2-electrode sensors are described as Clark-type sensors in literature (types CLE, CTE, CDE, CDP and OZE).

All our amperometric sensors are the result of in-house development and are subjected to long-term practical trials. They have a very compact construction with an encapsulated pre-amplifier already integrated in the sensor shaft. **The 25 mm smooth shaft must be installed in a flow-through sample cell such as the DGMa or DLG and be ordered with an adapter set.**

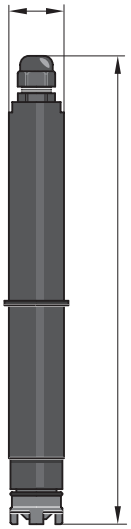
Amperometric sensors are not electrically isolated. When connecting to external devices other than DIC/D2C/DMT etc., it may be necessary to isolate the supply voltage and the analog input signal.

DULCOTEST® free chlorine sensor (CLE)

Membrane-covered amperometric sensor for determining free chlorine (HOCl) in water. The sensor has an integrated preamplifier including automatic temperature correction. The zero stability is very high so that a zero calibration is not necessary.

The CLE 3-mA sensor is equipped with a passive 4-20 mA interface for two-wire connection on controllers with a supply voltage of 16-24 VDC (for D1C/D2C controllers). The sensor is also equipped with a terminal strip and a cable gland for cable connection. The new CLE 3.1-mA sensor is used for measuring free chlorine where high amounts of combined chlorine are present. Typical applications include chlorination of surface water with high amounts of ammonium and/or organic nitrogen compounds or where high pH values (8-8.5) are present. **Without cable and holder.**

pH range:	pH 5.5-8.0
Temperature:	41-113°F (5-45°C)
Max. pressure:	14.5 psig (1 bar)
Flow rate:	8-16 GPH (30-60 L/h) minimum recommended in “in-line” sensor housing type DLG III or DGM



pk_5_046
CLE 3 - mA

Note: Not for use in ultrapure or very low conductivity water or water containing isocyanuric acid/chlorine stabilizers.

The 4-20 mA output corresponds to approximately chlorine value (not calibrated), it roughly corresponds to the sensor signal at pH 7.2 in new condition. The slope calibration (DPD 1) then takes place on the D1C/D2C controller.

Type CLE 3 - mA

Complete with electrolyte (100 mL) and membrane cap

4-20 mA (D1C/D2C)	Measuring Range	
Type CLE 3 - mA - 0.5 ppm	0.01 - 0.5 mg/L	792927
Type CLE 3 - mA - 2 ppm	0.02 - 2 mg/L	792920
Type CLE 3 - mA - 10 ppm	0.1 - 10 mg/L	792919
Type CLE 3 - mA - 20 ppm	0.2 - 20 mg/L	1002964
Type CLE 3 - mA - 50 ppm	0.5 - 50 mg/L	1020531

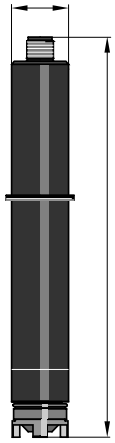
Description	Part No.

Free Chlorine Sensors (CLE) (cont.)

Type CLE 3.1 - mA

Complete with electrolyte (100 mL) and membrane cap

4-20 mA (D1C/D2C)	Measuring Range	
Type CLE 3.1 - mA - 2ppm	0.02 - 2 mg/L	1018369
Type CLE 3.1 - mA - 5 ppm	0.01 - 5 mg/L	1019398
Type CLE 3.1 - mA - 10 ppm	0.01 - 10 mg/L	1018368



pk_5_045

Type CLE 3 - DMT

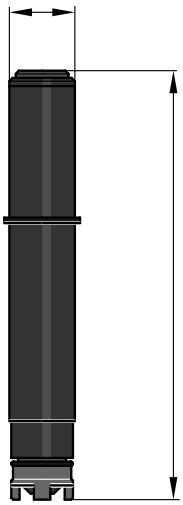
Sensor for use with the DMT “chlorine” measurement transmitter.

Measured variable:	Free chlorine (hypochlorous acid HOCl)
Analysis:	DPD1
Measurement range:	0.01...5.0 mg/L 0.05...50 mg/L
Supply:	From the DMT measurement transmitter (3.3 VDC)
Output signal:	Uncalibrated, not temperature compensated
Temperature measurement:	Via integrated Pt 1000: compensation carried out in DMT
Sensor output:	5 pin plug (requires cable, see Dulcotest section)

Other data as for CLE 3 - mA

CLE 3-DMT-5 ppm set with 100 mL electrolyte	1005511
CLE 3-DMT-50 ppm set with 100 mL electrolyte	1005512

Note: An assembly set (part number 791818 for DGM or 815079 for DLG III) is required for the initial installation of the chlorine sensors.



pk_5_049
CLE 2.2 - 4P

Type CLE 2.2 - 4P

The CLE 2.2-4P sensor has a 4-pole plug-in connector and is used with the CLWS series controller and CLD pump. **Without cable and holder**.

Complete with electrolyte (100 mL) and membrane cap

4-pole (WS)	Measuring Range	
Type CLE 2.2 - 4P	0.1 - 20 mg/L	914958

FOR ALL CLE SENSORS.

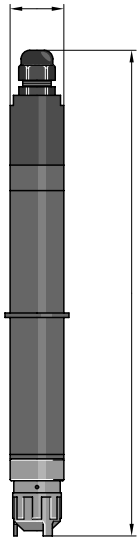
For installation in the DGMa or DLG housing, a threaded adapter set is required (see sensor housing section).

Consumable material:

Electrolyte for chlorine sensor type CLE (all models) 100 mL	506270
Spare membrane cap for chlorine sensors CLE (the tips of the membrane cap are colored red)	790488

Description	Part No.

Bromine sensor



pk_5_089

Inorganic bromine (HOBr/OBr-), for example, is produced from bromide plus sodium hypochlorite. The BRE sensor can detect both bromine types, whereas the slope of the sensors varies with the effect that for inorganic bromine the available measurement range is reduced to approx. 5 ppm and the pH dependency of the sensor signal is different.

Typical applications are in swimming pools and circulating cooling systems. In open circulating cooling systems in particular, the quality of the sample water should be noted and if necessary the compatibility with other chemicals used (e.g. corrosion inhibitors) should be checked. Dissolved copper (>0.1 mg/l) will falsify the measurement.

Photometric DPD measurement (e.g. with DT 1) calculated and displayed as bromine is recommended for calibrating the bromine sensor. If bromine is determined as “chlorine" via the DPD measurement, reduce the measurement range by a factor of 2.25.

Bromine measured variable

Measured variable:	bromine
Measurement range:	0.2-10.0 mg/L
pH range:	6.5-9.5
pH dependency:	a pH variation from pH 7 to pH 8 reduces the slope of the sensors by approx. 10%, in the case of HOBr
Temperature range:	41-113°F (5-45°C)
Max. pressure:	43.5 psi (3 bar)
Sample flow:	7.9-15.9 gph (30-60 L/h) (in DGM or DLG III)
Voltage:	16-24 V DC (two-wire technology)
Output signal:	4-20 mA ≈ measurement range (not calibrated)
Typical applications:	Swimming pools / whirlpools and cooling water; can also be used in seawater
Measurement and control device:	D1C-bromine
In-line probe housing:	DGM, DLG III

BRE 1-mA-10 ppm with 50 ml electrolyte 1006895

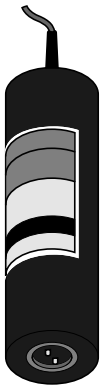
Note: An assembly set (PN 791818 for DGM or 815079 for DLG III) is required for the initial installation of the bromine sensor.

Description	Part No.

Dissolved Oxygen sensor

The measured variable “dissolved oxygen” gives the quantity of gaseous oxygen dissolved in a water sample in mg/l (ppm).

Dissolved oxygen is an important parameter for determining the quality of surface water and water for use in aquariums. Dissolved oxygen is also used to control processes in sewage plants and waterworks.



pk_5_060

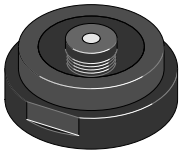
DO 1-mA

Measured variable:	Dissolved oxygen
Calibration:	Oxygen in air
Measurement range:	0-20 mg/l
Reproducibility of measurement:	± 0.5 % of full scale
Temp. range:	32-122 °F (0-50 °C)
Max. pressure:	145 psi (10 bar)
Velocity of sample water:	Minimum 0.05 m/s
Enclosure rating:	IP 68
Power supply:	12-30 VDC
Output signal:	4-20 mA. Measurement range calibrated, temperature corrected and electrically isolated
Process integration:	a) immersion, suspended on cable with or without mounting bracket for cable b) Immersion of immersion pipe 1. Immersion pipe with 2” (50 mm) outside diameter and 1-1/4” internal thread (provided by the customer). Connection via immersion pipe adapter 2. PVC immersion pipe with 2” (50 mm) outside diameter (provided by the customer). Connection via standard PVC adhesive union (provided by the customer).
Typical applications:	Fish and shrimp farming. Conditioning of water in large aquariums. Control of oxygen content in waterworks. Appraisal of the biological status of surface waters

Dissolved Oxygen Sensors

DO 1-mA-20 ppm	1020532

Spare Parts for Dissolved Oxygen sensors:



pk_5_076

Sensor insert for DO 1-mA-20 ppm Membrane thickness 125 µm, measurement range 0-20 mg/l	1020534
Bracket for the sensor insert for DO 1-mA-20 ppm (with membrane protection for fish farming)	1020540