



Amperometric
Sensors

pH - and ORP
Sensors

Electrolytical
Conductivity
Sensors



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Amperometric Sensors



ProMinent®

Free Chlorine Sensor Type CLE 3

Features & Benefits

- Measured variable: free chlorine, no cross sensitivity towards combined chlorine (chloramines)
- Membrane covered sensor (encapsulated) prevents interference by
 - Flow
 - Water composition (conductivity, water soluble species)
- Hydrophobic membrane ensures high selectivity towards HOCl

General purpose - free chlorine sensor for clear water

Applications

- Potable water
- Pool water
- In general: clear not polluted water (no tensides)



Measured variable/ Calibration Method	free chlorine/DPD1	X
	total available chlorine/DPD1	
	total chlorine/DPD4	
	combined chlorine/DPD4	
Selectivity free chlorine	yes	X
	no	
Disinfectant	chlorine gas hypochlorite electrolysis with diaphragm	X
	electrolysis without diaphragm, electrodes in process	
	organic chlorine disinfectants, e.g. cyanuric acid derivated	damage of membrane
Applications	public pools	X
	private pools	X
	drinking water	X
	cooling water	
	waste water	

Specifications	measuring range [ppm] (different versions)	0.01-100
	pH range	5.5 - 8.0
	operating temperature range [°C]	5 - 45
	maximum pressure [bar]	1.0
Installation	bypass/open outlet of measured water	X
	inline/direct pipe insertion	
Compatibility Measuring Device	D1C, D2C, DAC	X
	DULCOMARIN® II	X
	DMT	X
Technology	direct amperometric measurement/ 2 electrodes membrane covered	

Free Chlorine Sensor Type CLO 1

Features & Benefits

- Measured variable: free chlorine,
no cross sensitivity towards combined chlorine (chloramines)
- Open sensor (no membrane) prevents interference by byproducts in
direct electrolysis systems (without diaphragm)
- Missing membrane enables measurement of OCl^-
 - Free chlorine measurement up to pH9 possible
 - High pressure application up to 8 bar

Free chlorine sensor for clear water with “direct electrolysis” and / or
“high pressure” and / or $\text{pH} > 8.0$

Applications

- Potable water
- Pool water
- In general: clear not polluted water



Measured variable/ Calibration Method	free chlorine/DPD1	X
	total available chlorine/DPD1	
	total chlorine/DPD4	
	combined chlorine/DPD4	
Selectivity free chlorine	yes	X
	no	
Disinfectant	chlorine gas hypochlorite electrolysis with diaphragm	X
	electrolysis without diaphragm, electrodes in process	X
	organic chlorine disinfectants, e.g. cyanuric acid derivated	
Applications	public pools	X
	private pools	X
	drinking water	(X)
	cooling water	
	waste water	

Specifications	measuring range [ppm] (different versions)	0.02-10.0
	pH range	5.0 - 9.0
	oper. temperature range [°C]	5 - 45
	maximum pressure [bar]	8.0
Installation	bypass/open outlet of measured water	X
	inline/direct pipe insertion	X
Compatibility Measuring Device	D1C, D2C, DAC	X
	DULCOMARIN® II	via I-module
	DMT	
Technology	direct amperometric measurement/ 3 electrodes/no membrane (open)	

Features & Benefits

- Measured variable: free chlorine,
no cross sensitivity towards combined chlorine (chloramines)
- Basic segment (low cost)
 - Connection to Compact Controller via primary signal: [μ A]
 - Life time of “one way sensor”: 1-2 years
 - Simple low cost maintenance without handling of membrane caps
- Open Sensor (no membrane) prevents interference by byproducts in direct electrolysis systems (without diaphragm)
- Missing membrane enables measurement of OCl^-
 - Free chlorine measurement up to pH9 possible
 - High pressure application up to 8 bar

**Low cost/one way-free chlorine sensor for clear water,
“direct electrolysis” and/or “high pressure” and/or pH > 8.0**

Applications

- Potable water
- Pool water
- In general: clear not polluted water

Measured variable/ Calibration Method	free chlorine/DPD1	X
	total available chlorine/DPD1	
	total chlorine/DPD4	
	combined chlorine/DPD4	
Selectivity free chlorine	yes	X
	no	
Disinfectant	chlorine gas hypochlorite electrolysis with diaphragm	X
	electrolysis without diaphragm, electrodes in process	X
	organic chlorine disinfectants, e.g. cyanuric acid derived	
Applications	public pools	X
	private pools	X
	drinking water	(X)
	cooling water	
	waste water	

Specifications	measuring range [ppm] (different versions)	0.05 - 10
	pH range	5.0 - 9.0
	oper. temperature range [°C]	5 - 45
	maximum pressure [bar]	8.0
Installation	bypass/open outlet of measured water	X
	inline/direct pipe insertion	X
Compatibility Measuring Device	D1C, D2C, DAC	
	DULCOMARIN® II	
	DMT	
	Compact Controller	X
Technology	direct amperometric measurement/ 3 electrodes/no membrane (open)	

Features & Benefits

- Measured variables: free chlorine, free and combined bromine (Disinfectant BCDMH cannot be measured see type BCR 1)
- Resistance against pollutants is reached by:
 - Electrolyte with antimicrobial effect
Reduced clogging by biofilms
 - Big pore membrane
Reduced clogging by solid particles/dirt
- Application at elevated pH up to 9.5 and much less dependency than sensor types CLE is reached by
 - Electrolyte features

**Unique free chlorine / bromine sensor in polluted water
and/or elevated pH values up to 9.5**

Applications

- Cooling water
- Polluted service water: all industries
- Less polluted waste water: e.g. outlet of secondary clarifier
- In general: water with elevated pH up to 9.5 (but stable)



**Feature Pattern:
Bromine-Sensor Type CBR 1**

Measured variable/ Calibration Method	free chlorine/DPD1	X
	total available chlorine/DPD1	
	total chlorine/DPD4	
	combined chlorine/DPD4	
	free/combined bromine/DPD4	X
Selectivity free chlorine	yes	X
	no	
Disinfectant	chlorine gas hypochlorite electrolysis with diaphragm	X
	electrolysis without diaphragm, electrodes in process	
	organic chlorine disinfectants, e.g. cyanuric acid derivated	
Applications	public pools	
	private pools	
	drinking water	
	cooling water	X
	waste water	X

Specifications	measuring range [ppm] (different versions)	0.01-10.0
	pH range	5.0-9.5
	oper. temperature range [°C]	5 - 45
	maximum pressure [bar]	1.0
Installation	bypass/open outlet of measured water	X
	inline/direct pipe insertion	
Compatibility Measuring Device	D1C, D2C, DAC	X
	DULCOMARIN® II	via I-Modul
	DMT	
Technology	direct amperometric measurement/ 2 electrodes/membrane covered	

Free Chlorine Sensor, Type CGE 2

Features & Benefits

- Measured variable: Total available chlorine, such as organic chlorine-disinfectant like chlorine (iso-) cyanuric acid derivatives.
- Membrane covered sensor (encapsulated) prevents interference by
 - Flow
 - Water conditions
- Hydrophilic membrane ensures
 - Penetration of chlorine-(iso) cyanuric acid derivatives to electrodes
- Special reaction system of electrolyte enables
 - Detection of total available chlorine
 - Application at elevated pH up to 9.5

Sensor for total available chlorine e.g. chlorine-(iso) cyanuric acid derivatives in swimming pool applications

Applications

- Private pools
- Public pools



Measured variable/ Calibration Method	free chlorine/DPD1	
	total available chlorine/DPD1	X
	total chlorine/DPD4	
	combined chlorine/DPD4	
Selectivity free chlorine	very high	
	high	
	no	X
Disinfectant	chlorine gas	
	hypochlorite	
	electrolysis with diaphragm	
	electrolysis without diaphragm, electrodes in process	
	organic chlorine disinfectants, e.g. cyanuric acid derivated	X
Applications	public pools	X
	private pools	X
	drinking water	
	cooling water	
	waste water	

Specifications	measuring range [ppm] (different versions)	0.02-10.0
	pH range	5.5 - 9.5
	oper. temperature range [°C]	5 - 45
	maximum pressure [bar]	3.0
Installation	bypass/open outlet of measured water	X
	inline/direct pipe insertion	
Compatibility Measuring Device	D1C, D2C, DAC	X
	DULCOMARIN® II	X
	DMT	
Technology	indirect amperometric measurement/ 2 electrodes/membrane covered	

Free Chlorine Sensor, Type CTE 1

Features & Benefits

- Measured variable: total chlorine, offered in any chlorine containing compound in which Cl acts as oxidizing species e.g. free chlorine (HOCl , also OCl^-), chloramines etc.
- Membrane covered sensor (encapsulated) prevents interference by
 - Flow
 - Water conditions
- Hydrophilic membrane ensures
 - Penetration of any water soluble oxidant to electrodes
- Special reaction system of electrolyte enables
 - Detection of any compound containing oxidizing Cl
 - Application at elevated pH up to 9.5

Sensor for total chlorine including e.g. free chlorine, chloramines etc. also at elevated pH-valued in different water

Applications

- Cooling water
- Waste water
- Potable water



Measured variable/ Calibration Method	free chlorine/DPD1	X
	total available chlorine/DPD1	
	total chlorine/DPD4	X
	combined chlorine/DPD4	X
Selectivity free chlorine	very high	
	high	
	no	X
Disinfectant	chlorine gas	X
	hypochlorite	
	electrolysis with diaphragm	
	electrolysis without diaphragm, electrodes in process	
	organic chlorine disinfectants, e.g. cyanuric acid derivatives	

Applications	public pools (as combined chlorine= total chlorine-free chlorine)	X
	private pools (as combined chlorine= total chlorine-free chlorine)	X
	drinking water	X
	cooling water	X
	waste water	X
Specifications	measuring range [ppm] (different versions)	0.01-10.0
	pH range	5.5 - 9.5
	oper. temperature range [°C]	5 - 45
	maximum pressure [bar]	3.0
Installation	bypass/open outlet of measured water	X
	inline/direct pipe insertion	
Compatibility Measuring Device	D1C, D2C, DAC	X
	DULCOMARIN® II	X
	DMT	X
Technology	indirect amperometric measurement/ 2 electrodes/membrane covered	

Chlorine Dioxide Sensor, Type CDR 1

Features & Benefits

- Measured variable: chlorine dioxide
- Resistance against pollutants is reached by:
 - Silicone membrane without any pores
 - Reduced clogging by solid particles/biofilms
 - Reduced interference by chemicals which are dissolved in water
- Operating temperature up to 60°C (short term) is reached by
 - Suitable sensor materials

Chlorine dioxide sensor for any water including hot and polluted water

Applications

- Raw water of waterworks
- Cooling water
- Rinsing water of bottle washing machines
- Irrigation water for growing of plants
- Warm water system of buildings (legionella problem)



Measured variable	chlorine dioxide	
Selectivity against	chlorite	
	chlorate	
	free chlorine	
	combined chlorine	
	hydrogen peroxide	
Interference by	ozone	
Resistance against	tensides	X
	water soluble pollutants	X
	solid matter/dirt	X
	biofilm	X
Applications	untreated raw water	X
	drinking water	X
	cooling water	X
	waste water	X
	irrigation water	X

Specifications	measuring range [ppm] (different versions)	0.01-10.0
	pH range	1.0 - 10.0
	oper. temperature range [°C] (short term)	1-55 (60)
	maximum pressure [bar]	3.0
	response time t90 [s]	180
Installation	bypass/open outlet of measured water	X
	inline/direct pipe insertion	
Compatibility Measuring Device	D1C, D2C, DAC	X
	DULCOMARIN® II	X
	DMT	
Technology	direct amperometric measurement/ 2 electrodes/membrane covered/ internal T-compensation	

Features & Benefits

- Measured variable: BCDMH (bromo-3-chloro-5.5 dimethylhydantoin)
- Resistance against pollutants is reached by:
 - Electrolyte with antimicrobial effect
Reduced clogging by biofilms
 - „Big pore membrane“
Reduced clogging by solid particles/ dirt
- Application at elevated pH and much less pH-dependency than sensor types CLE is reached by
 - Electrolyte features

**Unique BCDMH- sensor in polluted waters and/or
elevated pH values up to 9.5**

Applications

- Cooling water
- Polluted service water: all industries
- Less polluted waste water: e.g. outlet of secondary clarifier
- Generally: water with elevated pH up to 9.5 (but stable)

**Feature Pattern:
Sensor Type BCR 1**

Measured variable/ Calibration Method	free chlorine/ DPD1	
	total available chlorine/ DPD1	
	total chlorine/ DPD4	X
	combined chlorine/ DPD4	X
	BCDMH/ DPD4	X
Selectivity free chlorine	yes	
	no	X
Disinfectant	chlorine gas hypochlorite electrolysis with diaphragm	
	electrolysis without diaphragm, electrodes in process	
	BCDMH (bromo-3-chloro- 5.5 dimethy /hydantoin)	X
Application	public pool	
	private pool	
	drinking water	
	cooling water	X
	waste water	X

Specifications	measuring range [ppm] (different versions)	0.01-10.0
	pH range	5.0 - 9.5
	oper. temperature range [°C]	5 - 45
	maximum pressure [bar]	1.0
Installation	bypass/ open outlet of measured water	X
	inline/ direct pipe insertion	
Compatibility Measuring Device	D1C, D2C, DAC	X
	DULCOMARIN® II	via I-Module
	DMT	
Technology	indirect amperometric measurement/ 2 electrodes/ membrane covered	

Chlorite Sensor Type CLT 1

Features & Benefits

- Measured variable: chlorite
- No interference by chlorine dioxide / chlorine / chlorate
- Enables online control of disinfection byproduct chlorite
- Exceeds requirement of drinking water regulations (only lab analysis necessary)
 - Increases process safety
 - Saves laboratory costs

Interference-free online sensor for chlorite for control of disinfection byproduct according to drinking water regulations

Applications

General control of disinfection byproduct

- Raw water of waterworks treated by chlorine dioxide (preoxidation)
- Finished water of waterworks treated by chlorine dioxide (disinfection)
- Legionella decontamination by chlorine dioxide in domestic water installations (hospitals, hotels etc.)



Measured variable	chlorite (ClO_2^-)	
Selectivity against	chlorine dioxide	
	chlorate	
	free chlorine	
	combined chlorine	
Interference by	ozone	
Resistance against	tensides	X
	water soluble pollutants	
	solid matter/dirt	
Applications	raw water waterworks	X
	drinking water	X
	cooling water	
	waste water	
	irrigation water	

Specifications	measuring range [ppm] (different versions)	0.02-2.00
	pH range	6.5 - 9.5
	oper. temperature range [°C]	1 - 40
	maximum pressure [bar]	1.0
Installation	bypass/open outlet of measured water	X
	inline/direct pipe insertion	
Compatibility Measuring Device	D1C, DAC	X
	DULCOMARIN® II	X
	DMT	
Technology	direct amperometric measurement/ 2 electrodes membrane covered/ internal T-compensation	

Ozone Sensor Type OZE 3

Features & Benefits

- Measured variable: ozone
- No cross sensitivity towards: chlorine, hydrogen peroxide
- Membrane covered sensor (encapsulated) prevents interference by
 - Flow
 - Water composition (conductivity, water soluble species)
- Hydrophobic membrane ensures
 - High selectivity towards ozone

General purpose ozone sensor for clear waters



Applications

- Drinking water
- Water for food & beverage
- Pool water
- Water in zoos, aquariums
- In general: clear not polluted water (no tensides)



Measured variable	ozone	
Selectivity against	free chlorine	
	combined chlorine	
	hydrogen peroxide	
Interference by	chlorine dioxide	
Resistance against	tensides	X
	water soluble pollutants	
	solid matter/dirt	
Applications	pool water	X
	drinking water	X
	food & beverage	X
	cooling water	X if clear
	zoo, aquarium	X

Specifications	measuring range [ppm]	0.02-2.00
	pH range	4.0 - 11.0
	oper. temperature range [°C]	5- 40
	maximum pressure [bar]	1.0
	response time t 90 [s]	180
Installation	bypass/open outlet of measured water	X
	inline/direct pipe insertion	
Compatibility Measuring Device	D1C, DAC	X
	DULCOMARIN® II	via I-Modul
	DMT	
Technology	direct amperometric measurement/ 2 electrodes membrane covered/ internal T-compensation	

Features & Benefits

- Measured variable: hydrogen peroxide
- Resistance against pollutants is reached by:
 - Silicone membrane without any pores
 - Reduced clogging by solid particles/biofilms
 - Reduced interference by chemicals which are dissolved in water
- Operating temperature up to 50°C is reached by
 - Suitable sensor materials

Resistant hydrogen peroxide sensor for chemically polluted water and water with solid contents

Applications

- Waste water (e.g. semiconductor industry, NOx-air scrubber)
- Cooling water
- Service water
- Private pool water
- Aqua culture (e.g. public fountains)
- Process water (CIP in food & beverage, textile, galvanics)



Measured variable	hydrogen peroxide	
Selectivity against	sulfite	
Interference by	ozone, chlorine dioxide, peracetic acid, chlorine, bromine	
Resistance against	tensides	X
	water soluble pollutants	X
	solid matter/dirt	X
Applications	waste water	X
	cooling water	X
	service water	X
	process water	X
	private pools	X
	aqua culture	X

Specifications	measuring range [ppm] (different versions, special versions up 10%)	0.5- 2,000
	pH range	2.5 - 11.0
	oper. temperature range [°C]	0- 50
	maximum pressure [bar]	1.0
	response time t90 [s]	480
Installation	bypass/open outlet of measured water	X
	inline/direct pipe insertion	
Compatibility Measuring Device	D1C, DAC	X
	DULCOMARIN® II	via I-Modul
	DMT	
Technology	indirect amperometric measurement/ 2 electrodes membrane covered/ internal T-compensation	

Peracetic Acid Sensor, Type PAA 1

Features & Benefits

- Measured variable: peracetic acid
- Resistance against pollutants is reached by:
 - "Silicone membrane without any pores"

Reduced clogging by solid particles/biofilms

Reduced interference by chemicals which are dissolved in water

**Resistant peracetic acid sensor for chemically polluted water
and water with solid contents**

Applications

- Food & beverage (e.g. CIP, aseptic filling, bottle rinsing)
- Medical care, pharmaceuticals for cold disinfection/sterilization
- Pulp & paper degradation of biofilms on paper machines
- Waste water treatment for disinfection



Measured variable	peracetic acid	
Selectivity against	hydrogen peroxide	
Interference by	ozone, chlorine dioxide, chlorine, bromine	
Resistance against	tensides	X
	water soluble pollutants	X
	solid matter/dirt	X
Applications	food & beverage	X
	medical care, pharmaceutics	X
	pulp & paper	X
	waste water	X

Specifications	measuring range [ppm] (different versions, special versions up 1%)	1-2,000
	pH range	1.0 -9.0
	oper. temperature range [°C]	0-45
	maximum pressure [bar]	3.0
	response time t 90 [s]	180
Installation	bypass/open outlet of measured water	X
	inline/direct pipe insertion	
Compatibility Measuring Device	D1C, DAC	X
	DULCOMARIN® II	via I-Modul
	DMT	
Technology	indirect amperometric measurement/ 2 electrodes membrane covered/ internal T-compensation	

Fluoride Sensor Type FLEP

Features & Benefits

- Measured variable : Fluoride by ion selective electrode
- Unique pH range up to 9.5
- Diaphragm and reference system optimized for selective measurement of fluoride
 - LaF3-cristal-diaphragm for highly selective fluoride measurement
 - Optimized electrolyte for accurate measurement at elevated pH
- Two measuring ranges available
 - 0.05 -10 ppm for drinking water
 - 0.5 -100 ppm for waste water

Selective, real online fluoride sensor, optimized for fluoridation of potable water, monitoring of less polluted waste water elevated pH

Applications

- Fluoridation of potable water
- Monitoring of fluoride in less polluted waste water in semiconductor industry, solar industry: neutralized water from air scrubber



Measured variable	fluoride	
Applications	swimming pool/whirlpool	
	drinking water	X
	cooling water	
	waste water	X
	pure water	
	air scrubber	X
	chemical polluted water	
	chemical processes	
	electroplating	
	aquaristics	
Resistance against	disinfectants	X
	low contents of solid matter	X
	sludges, emulsions	
	hydrofluoric acid (HF)	

Specifications	measuring range [ppm]	0.05-10 0.5-100
	pH range	5.5-9.5
	oper. temperature range [°C]	1-35
	maximum pressure [bar]	7.0
	min. conductivity [µS/cm]	100
Hydraulic Installation	bypass/open outlet of measured water	X
	inline/direct pipe insertion	X
	retractable pipe insertion	X
	immersion tube	X
Electrical Connection	SN6 plug/other types on request	
Compatibility Measuring Device	D1C, DAC	X
	DULCOMARIN® II	via I-Modul
	DMT	
Technology	direct potentiometric measurement/ 2 electrodes/gel-type electrolyte/ 1 ceramic diaphragm(s)/external temperature compensation/epoxi shaft	

pH- and ORP (*) Sensors



ProMinent®

(*) key features/specifications also valid for (ORP) sensors

pH-Sensor Type PHES (RHES)

Features & Benefits

- Measured variable: pH, (ORP) by electrochemical combination electrode
- Diaphragm and reference system optimized for swimming pool applications
 - Ceramic diaphragm with special material and optimized size/pore-diameter
 - Long lifetime: by reduced diffusion ("bleeding") of electrolyte
 - Long lifetime: by inert material against attack from disinfectants
- "Stable reference system"
- Lead free glass for progressive "green production/usage/disposal" available 2012

**pH sensor optimized for swimming pool/whirlpool applications
up to 60 °C/3 bar**

Applications

- Swimming pool/whirlpool water
- In general: for clear water within specified pH, temperature, pressure



Feature Pattern: Sensor Type PHES (RHES)

Measured variable	pH, (ORP)	
Applications	swimming pool/whirlpool	X
	drinking water	X
	cooling water	
	waste water	
	pure water	
	air scrubber	
	chemical polluted water	
	chemical processes	
	electroplating	
	aquaristics	
Resistance against	disinfectants	X
	low contents of solid matter	
	sludges, emulsions	
	hydrofluoric acid (HF)	

Specifications	measuring range [pH]	1-12
	oper. temperature range [°C]	0-60
	maximum pressure [bar]	3.0
	min. conductivity [$\mu\text{S}/\text{cm}$]	150
Hydraulic Installation	bypass/open outlet of measured water	X
	inline/direct pipe insertion	X
	retractable pipe insertion	X
	immersion tube	X
Electrical Connection	SN6 plug/fixed cable: SN6, DIN, BNC, 2wire	
Compatibility Measuring Device	Compact, D1C, D2C, DAC	X
	DULCOMARIN® II	X
	DMT	X
Technology	direct potentiometric measurement/ 2 electrodes/gel electrolyte ceramic diaphragm/external temperature compensation/glass shaft	

pH-Sensor Type PHEP (RHEP)

Features & Benefits

- Measured variable: pH, (ORP) by electrochemical combination electrode
- Diaphragm and reference system optimized for increased process requirements
 - Ceramic diaphragm with special material and optimized size/pore-diameter
 - Long lifetime: by reduced diffusion ("bleeding") of electrolyte
 - Long lifetime: by inert material against attack from chemicals
- Stable reference system for increased pressure/temperature requirements
- Lead free glass for progressive "green production/usage/disposal" available 2012

**pH sensor optimized for clear process water and
conditions up to 80 °C/6 bar**

Applications

- Industrial process water
- Galvanics
- In general: for clear water within specified pH, temperature, pressure



Feature Pattern: Sensor Type PHEP (RHEP)

Measured variable	pH, (ORP)	
Applications	swimming pool/whirlpool	
	drinking water	
	cooling water	
	waste water	
	pure water	
	air scrubber	
	chemical polluted water	X
	process water	X
	galvanics, electroplating	X
	aquaristics	
Resistance against	disinfectants	X
	low contents of solid matter	
	sludges, emulsions	
	hydrofluoric acid (HF)	

Specifications	measuring range [pH]	1-12
	oper. temperature range [°C]	0-80
	maximum pressure [bar]	6.0
	min. conductivity [$\mu\text{S}/\text{cm}$]	150
Hydraulic Installation	bypass/open outlet of measured water	X
	inline/direct pipe insertion	X
	retractable pipe insertion	X
	immersion tube	X
Electrical Connection	SN6 plug/fixed cable: SN6, DIN, BNC, 2wire	
Compatibility Measuring Device	Compact, D1C, D2C, DAC	X
	DULCOMARIN® II	X
	DMT	X
Technology	direct potentiometric measurement/ 2 electrodes/ceramic diaphragm/ gel electrolyte/external temperature compensation/glass shaft	

pH-Sensor Type PHEP-H (RHEP-H)

Features & Benefits

- Measured variable: pH, (ORP) by electrochemical combination electrode
- Diaphragm and reference system optimized for increased process requirements
 - Optimized pH-sensitive glass
 - Long lifetime/accurate: measurement for high pH up to 14
 - Long lifetime: for high temperature up to 100 °C
- Stable reference system for increased pressure/temperature requirements
- Lead free glass for progressive “green production/usage /disposal” available 2012

**pH sensor optimized for clear process water especially for
alkaline process solutions at elevated temperatures up to 100 °C**

Applications

- Industrial process water
- Chemical industry
- In general: for clear water within specified pH, temperature, pressure



Feature Pattern: Sensor Type PHEP-H (RHEP-H)

Measured variable	pH, (ORP)	
Applications	swimming pool/whirlpool	
	drinking water	
	cooling water	
	waste water	
	pure water	
	air scrubber	X (no HF)
	chemical polluted water	X
	process water	X
	galvanics, electroplating	X
	aquaristics	
Resistance against	disinfectants	X
	high alkaline	X
	sludges, emulsions	
	hydrofluoric acid (HF)	

Specifications	measuring range [pH]	3-14
	oper. temperature range [°C]	0- 100
	maximum pressure [bar]	6.0 (25 °C)
	min. conductivity [µS/cm]	150
Hydraulic Installation	bypass/open outlet of measured water	X
	inline/direct pipe insertion	X
	retractable pipe insertion	X
	immersion tube	X
Electrical Connection	SN6 plug/other versions on request	
Compatibility Measuring Device	Compact, D1C, D2C, DAC	X
	DULCOMARIN® II	X
	DMT	X
Technology	direct potentiometric measurement/ 2 electrodes/high alkaline-, temp. glass ceramic diaphragm/gel electrolyte/ external temperature compensation/ glass shaft	

pH-Sensor Type PHEP-T

Features & Benefits

- Measured variable: pH by electrochemical combination electrode
- Diaphragm and reference system optimized for increased process requirements
 - Ceramic diaphragm with special material and optimized size/pore diameter
 - Long lifetime: by reduced diffusion (“bleeding”) of electrolyte
 - Long lifetime: by inert material against attack from chemicals
 - Stable reference system for increased pressure/temperature requirements
 - Integrated Pt 100 temperature sensor for internal temperature compensation makes additional sensor housing dispensable
 - Vario Pin plug head with IP 67 specification
- Lead free glass for progressive “green production/usage/disposal” available 2012

**pH sensor with internal temperature compensation optimized
for clear process water and up to 80 °C/6 bar/IP67**

Applications

- Industrial process water with fluctuating temperature
- Galvanics
- In general: for clear water and temperature fluctuation within specified pH, temperature, pressure



Feature Pattern: Sensor Type PHEP-T

Measured variable	pH	
Applications	swimming pool/whirlpool	
	drinking water	
	cooling water	
	waste water	
	pure water	
	air scrubber	
	chemical polluted water	X
	process water	X
	galvanics, electroplating	X
	aquaristics	
Resistance against	disinfectants	X
	low contents of solid matter	
	sludges, emulsions	
	hydrofluoric acid (HF)	

Specifications	measuring range [pH]	1-12
	oper. temperature range [°C]	0- 80
	maximum pressure [bar]	6.0
	min. conductivity [$\mu\text{S}/\text{cm}$]	150
Hydraulic Installation	bypass/open outlet of measured water	X
	inline/direct pipe insertion	X
	retractable pipe insertion	X
	immersion tube	X
Electrical Connection	vario pin plug	
Compatibility Measuring Device	Compact, D1C, D2C, DAC	X
	DULCOMARIN® II	X
	DMT	X
Technology	direct potentiometric measurement/ 2 electrodes/ceramic diaphragm/ gel electrolyte/internal temperature compensation/glass shaft	

pH-Sensor Type PHEX (RHEX)

Features & Benefits

- Measured variable: pH, (ORP) by electrochemical combination electrode
- Diaphragm and reference system optimized for extreme high solid contents
 - Solid electrolyte makes diaphragm dispensable and so avoids blockage of reference system
 - Long lifetime: in presence of sludges by missing diaphragm
 - Long lifetime: solid electrolyte avoids “electrolyte bleeding”
- Stable reference system against attack of solid contents
- Lead free glass for progressive “green production/usage/disposal” available 2012

pH sensor optimized for polluted water with high solid contents
6 bar/100 °C or 16 bar/25 °C

Applications

- Sludges/emulsions from waste water of industrial process
- Waste water treatment plants
- In general: for water with high solid contents within specified pH, temperature, pressure



**Feature Pattern:
Sensor Type PHEX (RHEX)**

Measured variable	pH, (ORP)	
Applications	swimming pool/whirlpool	
	drinking water	
	cooling water	
	waste water	X
	pure water	
	air scrubber	
	chemical polluted water	
	process water	X
	galvanics, electroplating	X
	aquaristics	
Resistance against	disinfectants	
	low contents of solid matter	(X)
	sludges, emulsions	X
	hydrofluoric acid (HF)	

Specifications	measuring range [pH]	1-12
	oper. temperature range [°C]	0- 100
	maximum pressure [bar]	16 (25°C)
	min. conductivity [µS/cm]	500
Hydraulic Installation	bypass/open outlet of measured water	X
	inline/ direct pipe insertion	X
	retractable pipe insertion	X
	immersion tube	X
Electrical Connection	SN6 plug/further on request	
Compatibility Measuring Device	Compact, D1C, D2C, DAC	X
	DULCOMARIN® II	X
	DMT	X
Technology	direct potentiometric measurement/ 2 electrodes no diaphragm/polymer electrolyte/external temperature compensation/glass shaft	

pH-Sensor Type PHED

Features & Benefits

- Measured variable: pH by electrochemical combination electrode
- Diaphragm and reference system optimized for chemical polluted but clear water
 - Double junction: two ceramic diaphragm in series protect reference system
- Long lifetime: in presence of chemical pollutants
- Special construction allows max. pressure of 8 bar
- Lead free glass for progressive “green production/usage/disposal” available 2012

pH sensor optimized for chemically polluted but clear water up to 80 °C/8 bar

Applications

- Chemically polluted water, e.g. in galvanics
- Cooling water
- Clear waste water
- Air scrubber



Feature Pattern: Sensor Type PHED

Measured variable	pH, (ORP)	
Applications	swimming pool/whirlpool	
	drinking water	
	cooling water	X
	waste water	X
	pure water	
	air scrubber	X
	chemical polluted water	X
	process water	X
	galvanics, electroplating	X
	aquaristics	
Resistance against	disinfectants	X
	low contents of solid matter	
	sludges, emulsions	
	hydrofluoric acid (HF)	

Specifications	measuring range [pH]	1-12
	oper. temperature range [°C]	0- 80
	maximum pressure [bar]	8.0
	min. conductivity [$\mu\text{S}/\text{cm}$]	150
Hydraulic Installation	bypass/open outlet of measured water	X
	inline/direct pipe insertion	X
	retractable pipe insertion	X
	immersion tube	X
Electrical Connection	SN6 plug/fixed cable: BNC, further on request	
Compatibility Measuring Device	Compact, D1C, D2C, DAC	X
	DULCOMARIN® II	X
	DMT	X
Technology	direct potentiometric measurement/ 2 electrodes double junction/ gel electrolyte/external temperature compensation/glass shaft	

pH-Sensor Type PHEF (RHEF)

Features & Benefits

- Measured variable: pH, (ORP) by electrochemical combination electrode
- Type of pH sensitive glass optimized for usage in presence of glass corroding hydrofluoric acid (HF)
 - HF is formed significantly in presence of fluoride (F^-) at $pH < 4$
 - Glass corrosion is supported by increasing fluoride concentration, decreasing pH and increasing temperature
 - Glass composition and structure of PHEF type avoid SiF_4 releasing
- Prolonged lifetime in presence of fluoride (F^-) at $pH < 7$
- Flat shape of glass membrane and large ring diaphragm enables application in polluted water also containing abrasive solid material

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

Applications

- Fluoride containing, acid water from industrial processes
- Air scrubber
- Waste water from solar industry
- In general: pH adjustment of (solid containing) water with fluoride within specified pH, temperature, pressure



Feature Pattern: Sensor Type PHEF (RHEF)

Measured variable	pH, (ORP)	
Applications	swimming pool/whirlpool	
	drinking water	
	cooling water	
	waste water	X
	pure water	
	air scrubber	X
	chemical polluted water	X
	process water	X
	galvanics, electroplating	X
	aquaristics	
Resistance against	disinfectants	X
	low contents of solid matter	X
	sludges, emulsions	
	hydrofluoric acid (HF)	X

Specifications	measuring range [pH]	0-12
	oper. temperature range [°C]	0-50
	maximum pressure [bar]	7.0
	min. conductivity [$\mu\text{S}/\text{cm}$]	150
Hydraulic Installation	bypass/open outlet of measured water	X
	inline/direct pipe insertion	X
	retractable pipe insertion	X
	immersion tube	X
Electrical Connection	SN6 plug/further on request	
Compatibility Measuring Device	Compact, D1C, D2C, DAC	X
	DULCOMARIN® II	X
	DMT	X
Technology	direct potentiometric measurement/ 2 electrodes PE ring diaphragm/HF-compatible flat glass membrane/gel electrolyte/external temperature compensation/epoxide shaft	

ORP-Sensor Type RHEK-L (PHEK-L)

Features & Benefits

- Measured variable: ORP, (pH) by electrochemical combination electrode
- Plastic -shaft for increased mechanical stability for saver use by unskilled operators (chemical stability not necessary for target applications)
- Horizontal (level) - installation possible (90 angle degree) (normally restricted to 0 - 75 angle degree)
- Diaphragm and reference system optimized for swimming pool applications
 - Ceramic diaphragm with special material and optimized size/pore-diameter
 - Long lifetime: by reduced diffusion ("bleeding") of electrolyte
 - Long lifetime: by inert material against attack from disinfectants
- Stable reference system

Plastic ORP sensor optimized for swimming pool/whirlpool with saver handling, horizontal installation, application up to 60 °C / 3 bar

Applications

- Swimming pool/whirlpool
- In general: for clear water within specified pH, temperature, pressure



Feature Pattern: Sensor Type RHEK-L (PHEK-L)

Measured variable	ORP, (pH)	
Applications	swimming pool/whirlpool	X
	drinking water	X
	cooling water	
	waste water	
	pure water	
	air scrubber	
	chemical polluted water	
	chemical processes	
	electroplating	
	aquaristics	
Resistance against	disinfectants	X
	low contents of solid matter	
	sludges, emulsions	
	hydrofluoric acid (HF)	

Specifications	measuring range [ORP]	-1000 to +1000 mV
	pH range	1-12
	oper. temperature range [°C]	0-60
	maximum pressure [bar]	3.0
	min. conductivity [$\mu\text{S}/\text{cm}$]	150
Hydraulic Installation	bypass/open outlet of measured water	X
	inline/direct pipe insertion	X, up to horizontal
	retractable pipe insertion	X
	immersion tube	X
Electrical Connection	SN6 plug/fixed cable: SN6, DIN, BNC, 2wire	
Compatibility Measuring Device	Compact, D1C, D2C, DAC	X
	DULCOMARIN® II	X
	DMT	X
Technology	direct potentiometric measurement/ 2 electrodes/gel electrolyte/ceramic diaphragm/external temperature compensation/plastic shaft	

ORP-Sensor Type RHER (PHER)

Features & Benefits

- Measured variable: ORP, (pH) by electrochemical combination electrode
- Dirt repellent sensor, optimized for solid contents in polluted water
 - Dirt repellent large Teflon® diaphragm avoids blockage of reference system
 - Long lifetime: in presence of solid contents
- Sensor optimized for low conductivity applications
 - High viscous electrolyte in combination with salt reservoir avoids electrolyte bleeding
 - Long lifetime: without drifts in presence of clear water with low conductivity
- Lead free glass for progressive “green production/usage/disposal” available 2012

ORP sensor optimized for polluted water with solid contents and for low conductivity > 50 $\mu\text{S}/\text{cm}$ up to 80 °C/6 bar

Applications

- Cooling water, polluted raw water
- Turbid water in waste water treatment
- Clear water with low conductivity >50 $\mu\text{S}/\text{cm}$
- Generally for water with turbid appearance or low conductivity water within specified pH, temperature, pressure and conductivity



Feature Pattern: Sensor Type RHER (PHER)

Measured variable	ORP, (pH)	
Applications	swimming pool/whirlpool	
	drinking water	
	cooling water	X
	waste water	X
	pure water	X
	air scrubber	X
	chemical polluted water	
	process water	X
	galvanics, electroplating	X
	aquaristics	
Resistance against	disinfectants	X
	low contents of solid matter	X
	sludges, emulsions	
	hydrofluoric acid (HF)	

Specifications	measuring range [ORP]	-1,000 to +1,000 mV
	oper. temperature range [°C]	0- 80
	maximum pressure [bar]	6.0
	min. conductivity [μ S/cm]	50
Hydraulic Installation	bypass/open outlet of measured water	X
	inline/direct pipe insertion	X
	retractable pipe insertion	X
	immersion tube	X
Electrical Connection	SN6 plug/further on request	
Compatibility Measuring Device	Compact, D1C, D2C, DAC	X
	DULCOMARIN® II	X
	DMT	X
Technology	direct potentiometric measurement/ 2 electrodes/teflon ring diaphragm/ polymer electrolyte/external temperature compensation/glass shaft	

ORP-Sensor Type RHEN (PHEN)

Features & Benefits

- Measured variable: ORP, (pH) by electrochemical combination electrode
- Renewable liquid electrolyte by continuous refill via electrolyte bottle, installed above electrode
- 1/3 ceramic diaphragm(s) with special material and optimized size / pore-diameter
 - Long lifetime: in presence of dissolved chemicals, which could poison the reference system (1 diaphragm)
 - Long lifetime: in presence of low conductivity water $> 50 \mu\text{S}/\text{cm}$ and in presence of solid contents (3 diaphragm) only PHEN

ORP sensor optimized for chemically polluted water for solid contents/low conductivity $> 50 \mu\text{S}/\text{cm}$ (only PHEN-3D) up to 80°C /without over pressure

Applications

- Chemically polluted clear water from processes or waste water
- Waste water with solid contents (only PHEN-3D)
- Pure water with low conductivity $> 50 \mu\text{S}/\text{cm}$ (only PHEN-3D)



Feature Pattern: Sensor Type RHEN (PHEN)

Measured variable	ORP, (pH)	
Applications	swimming pool/whirlpool	
	drinking water	
	cooling water	X
	waste water	X
	pure water	X (PHEN-3D)
	air scrubber	
	chemical polluted water	X
	chemical processes	X
	electroplating	X
	aquaristics	
Resistance against	disinfectants	X
	low contents of solid matter	X (PHEN-3D)
	sludges, emulsions	
	hydrofluoric acid (HF)	

Specifications	measuring range [ORP]	-1,000 to +1,000 mV
	pH range	1-12
	oper. temperature range [°C]	0-80
	maximum pressure [bar]	1.0
	min. conductivity [μ S/cm]	150/50 (PHEN-3D)
Hydraulic Installation	bypass/open outlet of measured water	X
	inline/direct pipe insertion	
	retractable pipe insertion	
	immersion tube	
Electrical Connection	SN6 plug/further on request	
Compatibility Measuring Device	Compact, D1C, D2C, DAC	X
	DULCOMARIN® II	X
	DMT	X
Technology	direct potentiometric measurement/ 2 electrodes/liquid electrolyte/ 1,3 ceramic diaphragm(s)/external temperature compensation/glass shaft	



Features & Benefits

- Measured variable: electrolytical conductivity
- Cost effective sensor, for all clear, not polluted water with contacting sensor: electrodes in contact with medium
- Special graphite electrodes optimized for high dynamic measuring range: 0.01-20 mS/cm
- Cost effective LF versions if medium temperature is constant
- LFT versions with integrated Pt 100 for temperature compensation
- LFTK versions with Pt 1000: for more accurate compensation in restricted T-range and for longer cable lengths
- Flexible process adaption by different versions:
 - Electrical connection via DIN plug: LF (TK)1 DE-and fixed cable: LF (TK) FE-versions
 - Hydraulic connection via PG 13.5 male thread: standard and 1/2" male thread: LF(TK)1 1/2" versions

Flexible to adapt, low cost-2-electrode contacting conductivity sensor, suitable for clear, non-polluted water and sea water

Applications

- Any kind of clear, non-polluted water
- Sea water



**Feature Pattern:
Sensor Type LF (TK) 1**

Measured variable	Electrolytical Conductivity	
Applications	swimming pool/whirlpool	X
	drinking water	X
	sea water	X
	cooling water	
	waste water	
	pure water	>10 μ S/cm
	air scrubber	
	chemical polluted water	
	chemical processes	
	electroplating	
	aquaristics	X
Resistance against	electrolytical conductivity > 20 mS/cm	
	tensides, solvents, other chemicals	
	deposit forming media	
	aggressive chemicals (acid, alkaline)	

Specifications	measuring range [conductivity]	0.01 to 20 mS/cm
	cell constant	1cm ⁻¹ ±5%
	oper. temperature range [°C]	0-80
	maximum pressure [bar]	16.0
	Shaft material	epoxy
Hydraulic Installation via PG13.5 or 1/2"	bypass/open outlet of measured water	X
	inline/direct pipe insertion	X
	retractable pipe insertion	X
	immersion tube	X
Electrical Connection	DIN plug/ fixed cable	
Compatibility Measuring Device	Compact, D1Ca, DAC	X
	DULCOMARIN® II via DMT	X
	DMT	X
Technology	contacting sensor, 2 electrodes out of special graphite, epoxy shaft-glued	

Features & Benefits

- Measured variable: electrolytical conductivity
- Middle segment sensor line, for all clear, also chemical polluted aqueous mediums. Not for deposit forming media because electrodes in contact with medium
- Sensor body out of PP (PVDF), packing is realized by Viton® O-rings- no glue necessary
 - Materials ensure resistance/sealing for a variety of dissolved chemicals
 - LMP-HT-versions up to 120°C (PVDF)
 - Cost effective LM versions if medium temperature is constant
 - LMT versions with integrated Pt-100 for temperature compensation
- Process adaption by different versions completes the LF(TK) range:
 - Electrical connection via DIN plug: LM (P) versions: standard
 - Hydraulic connection via ¾ male thread or completely mounted immersion tube assembly: LM(P)x-TA-versions with 5 m fixed cable

**Middle segment,-2-electrode contacting conductivity sensor
line suitable for clear, also chemically polluted water (low conc.)**

Applications

- Clear, also sea and chemically polluted water (e.g. galvanic processes)



**Feature Pattern:
Sensor Type LM (P)**

Measured variable	Electrolytical Conductivity	
Applications	swimming pool/whirlpool	X
	drinking water	X
	sea water	X
	cooling water	
	waste water	
	pure water	X
	air scrubber	X
	chemical polluted water	X
	chemical processes	X
	electroplating	X
	aquaristics	
Resistance against	electrolytical conductivity > 20 mS/cm	
	tensides, solvents, other chemicals	X
	deposit forming media	
	aggressive chemicals (acid, alkaline)	

Specifications	measuring range [conductivity] by different types LM(P) 001/01/1	0.01 µS/cm - 20 mS/cm
	cell constant of different types LM(P) 001/01/1	0.01/0.1/1 cm ⁻¹ ± 5%
	oper. temperature range [°C]	0-70 (LM(P)) 0-120 (LM(P))-HT
	maximum pressure [bar]	16 bar
	shaft material LM (P)/LM (P)-HT	PP/PVDF
Hydraulic Installation	bypass/open outlet of measured water	on request
	inline/direct pipe insertion	X
	retractable pipe insertion	
	immersion tube, -TA-versions	X
Electrical Connection	DIN plug/fixed cable (-TA-versions)	
Compatibility Measuring Device	Compact, D1Ca, DAC	X
	DULCOMARIN® II via DMT	X
	DMT	X
Technology	contacting sensor, 2 electrodes, graphite, PP (PVDF) shaft, sealed by Viton® O-rings	

Features & Benefits

- Measured variable: electrolytical conductivity
- Measuring principle: inductive conductivity with integrated temperature compensation. Suitable for all media with minimum maintenance efforts, because electrodes are not in contact with medium
 - High conductivity > 20 mS/cm without disturbing "polarisation effect"
 - Chemical aggressive mediums e.g. acids, alkalines
 - Deposit forming media, e.g. corrosion inhibitors, biofilm
- Sensor totally moulded with inert material ensure resistance/sealing for a variety of chemicals, no glue necessary, no O-rings necessary
 - ICT 1: out of PP for most aqueous media up to 70 °C
 - ICT 2: out of PFA (similar Teflon) for aggressive media up to 125 °C
- Extreme high dynamics of measuring ranges available:
 - ICT 1: 0.2 to 1000 mS/cm ICT 2: 0.02-2000 mS/cm
- Flexible process adaption: pipe insertion and immersion assembly (ICTx-IMA)

Cost effective (ICT 1), high performance (ICT 2) inductive conductivity sensors, suitable for high conductivities or any medium with concentrated chemicals or deposit forming pollutants

Applications

- High conductivities e.g., CIP, salty process water, sea water
- High concentrated chemicals or pollutants e.g. waste-, cooling water, chemical processes



Feature Pattern: Sensor Type ICT

Measured variable	Electrolytical Conductivity	
Applications	swimming pool/whirlpool	X
	drinking water	X
	sea water	X
	cooling water	X
	waste water	X
	pure water	>20 mS/cm (FCT 2)
	air scrubber	X
	chemical polluted water	X
	chemical processes	X
	electroplating	X
	aquaristics	
Resistance against	electrolytical conductivity > 20 mS/cm	X
	tensides, solvents, other chemicals	X
	deposit forming media	X
	aggressive chemicals (acid, alkaline)	X ICT 2

Specifications	measuring range [conductivity] ICT 1 (ICT 2)	0.2 (0,01) 1000 (2000) mS/cm
	cell constant ICT 1 (ICT 2)	8.5 (1.98) cm ⁻¹ ±5%
	oper. temp. range [°C] ICT 1 (ICT 2)	0-70 (125)
	maximum pressure [bar]	16 bar
	Shaft material ICT 1 (ICT 2)	PP (PFA)
Hydraulic Installation	bypass/open outlet of measured water	
	inline/direct pipe insertion	X
	retractable pipe insertion	
	immersion tube, -TA-versions	X
Electrical Connection	fixed cable	
Compatibility Measuring Device	Compact, D1Ca	X
	DULCOMARIN® II via Compact	X
Technology	inductive conductivity sensor, temperature compensated (Pt 100), 2 coils, moulded, material PP (PFA)	