



**KROHNE**

▶ measure the facts

# Process analysis

Product overview



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## KROHNE trademarks:

KROHNE  
CalSys  
CARGOMASTER  
EcoMATE  
EGM  
KROHNE Care  
OPTIBATCH  
OPTIBRIDGE  
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OPTIMASS  
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OPTISOUND  
OPTISWIRL  
OPTISWITCH  
OPTISYS  
OPTIWAVE  
PipePatrol  
WATERFLUX  
SENSOFIT  
SMARTBASE  
SMARTMAC

## Trademarks of other owners:

Amphenol  
FDT Group  
FOUNDATION™ fieldbus  
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# measure the facts

technology driven by KROHNE

## Letter from the Corporate Management

Dear Customers,

Communication techniques are becoming ever more complex, from the field through to the control level. At the same time the demands for recording physical measured variables such as flow rates, fill levels, temperature, pressure and analysis parameters are constantly growing. The principal requirement in this respect is absolute reliability of the measured values. This means the measuring equipment, even when subjected to disruptive influences such as changing flow profiles or inclusion of gas bubbles, must always deliver reliable values, and above all must guarantee virtually 100 % security against failure.

**“Measure the facts”** means not only reliable measurement of standard process variables – even under the most difficult process conditions – but also clear and precise process diagnostics right through to the material composition of the medium. Both of these contribute to improved process control and allow remarkable increases in process efficiency and production.

In order to guarantee this for you, more than 400 engineers in the worldwide KROHNE Group are continuously engaged in research into promising technologies for the future, in pursuit of improved measurement and further developments. We are a family-owned enterprise and we take our responsibilities seriously. We have permanent representation in more than 130 countries and employ more than 3,500 people in order to bring you highly innovative products from a single source, and tailor-made technical solutions to your measurement requirements, now and in the future.



Michael Rademacher-Dubbick



Stephan Neuburger

## Product selection list: SMARTPAT sensors

This table will help you in selecting the right sensor for your application

	SMARTPAT PH 8570 pH sensor	SMARTPAT PH 8150 pH sensor	SMARTPAT PH 8530 pH sensor	SMARTPAT PH 8320 pH sensor	SMARTPAT PH 8510 pH sensor	SMARTPAT ORP 8150 ORP sensor
	Page12/19/38	Page12/19/38	Page12/19/38	Page12/19/38	Page12/19/39	Page12/19/39
Measuring principle	Potentiometric	Potentiometric	Potentiometric	Potentiometric	Potentiometric	Potentiometric
Chemical	–	x	–	x	–	x
Petrochemical	–	x	–	x	–	x
Pharma	x	–	o	–	–	–
Semiconductor	–	–	x	–	–	–
Food and beverage (process monitoring and control)	x	–	–	–	–	–
Food and beverage (steam generation)	–	–	x	–	–	–
Power (cooling water and boiler feed water)	–	–	x	–	–	x
Desalination	–	o	x	–	o	x
Potable water	x	–	x	–	x	–
Process water	–	x	–	x	o	x
Wastewater	–	x	–	x	–	x

SMARTPAT ORP 8510 ORP sensor	SMARTPAT PH 1590 pH sensor	SMARTPAT PH 2390 pH sensor	SMARTPAT ORP 1590 ORP sensor	SMARTPAT COND 1200 Conductivity sensor	SMARTPAT COND 3200 Conductivity sensor	SMARTPAT COND 5200 Conductivity sensor	SMARTPAT COND 7200 Conductivity sensor
Page12/19/39	Page12/19/39	Page12/19/39	Page12/19/39	Page12/21/40	Page12/21/40	Page12/21/40	Page12/21/40
Potentiometric	Potentiometric	Potentiometric	Potentiometric	Conductive conductivity	Conductive conductivity	Conductive conductivity	Conductive conductivity
–	–	x	–	–	–	x	–
–	–	x	–	–	–	x	–
–	–	–	–	–	o	–	x
–	–	–	–	–	x	–	–
–	–	–	–	–	–	–	x
–	–	–	–	–	o	–	x
x	o	–	–	–	x	–	o
x	o	x	x	–	x	x	o
x	x	o	x	x	x	o	o
x	o	x	x	x	–	x	–
x	o	x	x	o	–	x	–

x = suitable, o = suitable under certain conditions, – = not suitable

## Product selection list: solutions for water analysis

This table will help you in selecting the right solution for your application

	OPTISENS PH 8XX0/9X00, ORP 8XX0 Sensor family	OPTISENS CL 1100 (Cl <sub>2</sub> ,ClO <sub>2</sub> ,O <sub>3</sub> ) Sensor family	OPTISYS CL 1100 (Cl <sub>2</sub> ,ClO <sub>2</sub> ,O <sub>3</sub> ) Measuring systems
	Page 14/46/47	Page 15/45	Page 14/44
Measuring principle	Potentiometric	Potentiostatic	Potentiostatic
Potable water			
Water quality/ limit values monitoring	x	x	x
Water quality monitoring in distribution network	–	–	x
Process control water treatment	x	x	x
Filter monitoring	–	–	–
Disinfection control	–	x	x
Power plant			
Quality control	x	x	x
Process control water treatment	x	x	x
Filter monitoring	–	–	–
Regeneration ion exchanger	–	–	–
Dosing of biocides	–	x	x
Protection of reverse osmosis (RO) membranes	–	x	x
Food and beverage			
Process control water treatment	x	x	x
Filter monitoring	–	–	–
Regeneration ion exchanger	–	–	–
Dosing of biocides	–	x	x
Protection of reverse osmosis (RO) membranes	–	x	x

	OPTISENS COND 1200 Sensor family	OPTISENS IND 1000 Sensor family	OPTISYS TUR 1050 Turbidity measuring system
	Page 15/20/45	Page 15/45	Page 14/33/44
Measuring principle	Conductive conductivity	Inductive conductivity	90° scattered light ISO 7027 or US-EPA 180.1
Potable water			
Water quality/ limit values monitoring	x	–	x
Water quality monitoring in distribution network	–	–	x
Process control water treatment	x	x	x
Filter monitoring	x	–	x
Disinfection control	–	–	–
Power plant			
Quality control	x	–	x
Process control water treatment	x	–	x
Filter monitoring	x	–	x
Regeneration ion exchanger	–	x	–
Dosing of biocides	–	–	–
Protection of reverse osmosis (RO) membranes	–	–	–
Food and beverage			
Process control water treatment	x	–	x
Filter monitoring	x	–	x
Regeneration ion exchanger	–	x	–
Dosing of biocides	–	–	–
Protection of reverse osmosis (RO) membranes	–	–	–

x = suitable, o = suitable under certain conditions, - = not suitable

## Product selection list: solutions for wastewater analysis

This table will help you in selecting the right solution for your application

	OPTISENS PH 83X0 Sensor family	OPTISENS IND 1000 Sensor family	OPTISENS TUR 2000 Turbidity sensor	OPTISENS ADO 2000 Dissolved oxygen sensor	OPTISENS ODO 2000 Dissolved oxygen sensor	OPTISYS SLM 2100 Sludge level meter
	Page 14/15/19/46	Page 15/45	Page 16/33/49	Page 16/29/49	Page 16/31/49	Page 16/34/37/48
Measuring principle	Potentiometric	Inductive conductivity	90° scattered light	Amperometric	Optical	Optical
Wastewater treatment						
Inlet						
Monitoring of influent values	x	x	x	-	-	-
Primary clarifier						
Automatic extraction of primary sludge	-	-	-	-	-	x
Biological treatment						
Aeration control	-	-	-	x	x	-
Control of sludge retention time/ sludge age	-	-	o	-	-	-
Secondary clarifier						
Automated extraction of sludge	-	-	-	-	-	x
Prevention of sludge washout	-	-	-	-	-	x
Return and waste sludge pump line	-	-	-	-	-	-
Post-precipitant dosage	-	-	-	-	-	-
Outlet						
Monitoring of effluent values	x	-	x	x	-	-

x = suitable, o = suitable under certain conditions, - = not suitable



## Product selection list: solutions for hygienic applications

This table will help you in selecting the right solution for your application

	OPTISYS IND 8100 Inductive conductivity measuring system	OPTISENS COND 7200 Conductive conductivity sensor	OPTISENS IND 7000 Inductive conductivity sensor	OPTISYS IND 7100 Inductive conductivity measuring system
	Page 17/50	Page 17/51	Page 17/27/51	Page 17/50
Measuring principle	Inductive conductivity	Conductive conductivity	Inductive conductivity	Inductive conductivity
Dairies				
Quality control milk reception	x	x	o	o
Process control separation process (milk/water)	x	–	x	o
Process control CIP/SIP cleaning	x	–	x	x
Breweries				
Quality control brew water	–	x	–	–
Quality control keg and bottle filling	x	–	x	x
Process control bottle cleaning	x	o	x	x
Process control CIP/SIP cleaning	x	–	x	x
Mineral water				
Quality control water extraction	–	x	–	–
Process and quality control softening	x	x	x	x
Process control CIP/SIP cleaning	x	–	x	x
Pharmaceutical				
PW/WFI monitoring	–	x	–	–
Distillation	–	x	–	–
Process control CIP/SIP cleaning	x	x	–	–

x = suitable, o = suitable under certain conditions, – = not suitable

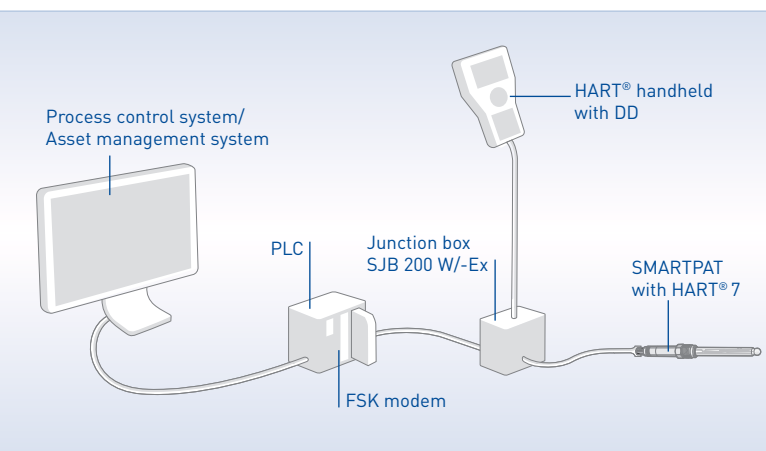
## SMARTPAT – The first family of analytical sensors that no longer require transmitters

Introduced in 2013, SMARTPAT sensors revolutionised the handling of analytical measurements: KROHNE miniaturised the entire transmitter technology and fitted it into the sensor head. Thanks to its unique circuit technology and special encapsulation, the SMARTPAT series offer process reliability at a level previously unknown.

SMARTPAT sensors function as 2-wire loop powered systems. They can be used both in point-to-point operation and for multi-drop installations. Up to 32 sensors can be connected in a loop of more than 1000 m in length.

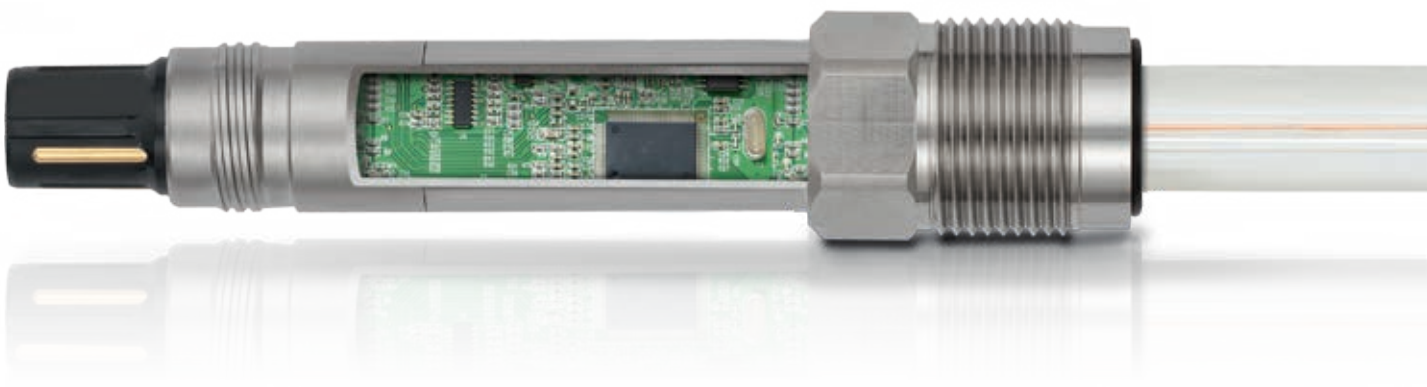
Each SMARTPAT sensor is specifically designed for its field of application: approvals and certifications range from installation in explosive (zone 0) to hygienic areas. Thanks to its standardised connector design, SMARTPAT sensors are compatible with most of the existing mounting assemblies. A large portfolio of accessories, ensures that SMARTPAT will fit into your application:

- OPTIBRIDGE, USB interface cable for offline calibration and configuration mit PACTware™ FDT/DTMs for each parameter
- SD 200 W/R, loop powered indicators for wall or rack mount
- SJB 200 W/-Ex, junction boxes with connection for HART® handheld
- SMARTBASE, with PACTware™ operating philosophy for easy handling of sensor data during offline calibration and configuration. Storage function of configuration and calibration data of SMARTPAT sensors, incl. statistic module
- SMARTMAC 200 W, operating unit with calibration and configuration function



### Direct connection to the process control system

KROHNE is the only supplier that uses a real open standard – and a direct connection from sensor to the process control system via the standardised fieldbus. The SMARTPAT sensors store all data and transfer it bidirectionally and digitally with the 4...20 mA current signal via the HART® protocol to process control and





asset management systems, handhelds, PCs and other peripheral devices. Sensor configuration is possible using a HART® handheld device and freely available HART® DD or also via freely available PACTware™ FDT/DTM on all conventional asset management and process control systems.

#### **Offline calibration**

SMARTPAT sensors are the only ones that can be connected directly to a PC via OPTIBRIDGE (USB interface cable) for offline calibration and configuration with PACTware™ FDT/DTM. During the offline calibration the sensors can be cleaned and regenerated at the same time. Depending on the application purpose and site, their service life is up to four times longer under these circumstances.

The sensor handling in the laboratory shows a huge advantage instead of sensor handling at the application site under continually changing conditions. Due to the controlled, clean conditions in the laboratory, a much more exact calibration can be performed too. This enables more precise measuring results and higher product quality.

Additionally SMARTPAT sensors can still be calibrated and configured online in accordance with HART® handheld and free of charge HART® DD software.

#### **Saves a lot of money, time and effort**

The elimination of the external transmitter reduces the price and maintenance costs of the complete measuring point considerably in comparison with any other competing measuring system. Additionally the offline calibration reduces time and effort significantly. At the same time, it increases productivity and efficiency of the measuring point.



Visit [www.goodbye-transmitters.com](http://www.goodbye-transmitters.com)  
for more information.

## pH/ORP sensors



SMARTPAT PH 8570\*  
Hygienic pH sensor for food,  
beverage and pharmaceutical  
industry



SMARTPAT PH 8150\*  
High performance pH sensor  
for chemical industry



SMARTPAT PH 8530  
pH sensor for pure  
water applications



SMARTPAT PH 8320\* Durable  
pH sensor for water and  
wastewater applications



SMARTPAT PH 8510  
General purpose pH sensor  
for water applications



SMARTPAT ORP 8150\*  
High performance ORP sensor  
for harsh applications



SMARTPAT ORP 8510  
General purpose  
ORP sensor for  
water applications



SMARTPAT PH 1590  
Rugged pH sensor with 3/4" NPT  
process connection for water  
and wastewater applications



SMARTPAT PH 2390  
Rugged pH sensor with 3/4" NPT  
process connection for wastewater  
applications



SMARTPAT ORP 1590  
Rugged ORP sensor with 3/4" NPT  
process connection for water and  
wastewater applications

## Conductivity sensors



SMARTPAT COND 1200  
Conductivity sensor for  
general purpose water  
applications



SMARTPAT COND 3200  
Conductivity sensor for  
pure water applications



SMARTPAT COND 5200\*  
Conductivity sensor for  
harsh applications



SMARTPAT COND 7200  
Conductivity sensor for  
hygienic applications

\*also available with Ex approval



## Accessories



**OPTIBRIDGE\***  
USB interface cable for  
offline calibration and  
configuration with  
PACTware™ FDT/DTM



**SJB 200 W/-Ex**  
Junction boxes for connecting  
the sensor with the process  
control system



**SD 200 W/R\***  
Loop powered indicators  
for wall or rack mount



**SMARTMAC 200 W\***  
Loop powered operating  
unit for configuration and  
calibration of SMARTPAT  
sensors

### Also available:

- DTM's for PACTware™
- SMARTBASE – Database for sensor data management and statistics
- FSK USBex interface cable for offline calibration of Ex approved sensors
- Sensor cables and various calibration solutions

## Mounting assemblies



**SENSOFIT RET 5000**  
Manual retractable assembly  
with ball valve for easy sensor  
exchange without interruptions



**SENSOFIT RAM 5810/5830**  
Automatic retractable  
assemblies (pneumatic) for  
demanding process conditions  
in chemical industry



**SENSOFIT RET 5810/5830**  
Manual retractable assemblies  
for easy sensor exchange without  
process interruptions



**SENSOFIT INS 1310**  
Static insertion assembly  
for reliable connection to  
tanks and pipes in general  
purpose applications



**SENSOFIT INS 7311/7312**  
Static insertion assemblies for  
reliable connection to tanks and  
pipes in hygienic applications



**SENSOFIT IMM 2920**  
Immersion assembly for  
installation in tanks and  
open basins



**SENSOFIT FLOW 1710**  
Flow-through assembly in  
stainless steel for all applications

SMARTPAT sensors for process industries





MAC 100  
Signal converter



OPTISENS PH 8100  
pH sensor with Pt100 for  
low-conductivity media and  
high temperatures



OPTISENS ORP 8500  
ORP sensor with large platinum ring  
for reliable and precise measurement  
in all water applications



OPTISENS PH 8390, 8590  
pH sensors with different diaphragm  
material for water and wastewater  
applications



OPTISENS ORP 8590  
ORP sensor with large platinum ring  
for water and wastewater applications

## Measuring systems



OPTISYS CL 1100  
Measuring system for free chlorine, chlorine  
dioxide and ozone with automatic sensor cleaning  
system for safe use and extended lifetime



OPTISYS TUR 1050  
Turbidity measuring system with cost  
efficient cuvette calibration and  
automatic ultrasonic cleaning system



**OPTISENS PH 8300**  
pH sensor with dirt-repellent PTFE diaphragm  
for wastewater, surface and process water



**OPTISENS PH 8500**  
pH sensor with ceramic diaphragm  
for general water applications



**OPTISENS PH 9100, 9500**  
pH sensors with liquid filling  
for special applications



**OPTISENS CL1100**  
Low-maintenance, membrane-free  
gold electrode sensor for free  
chlorine, chlorine dioxide and ozone  
measurements in potable water



**OPTISENS COND 1200**  
2-electrode stainless steel sensor  
for conductivity measurements in  
all general applications



**OPTISENS IND 1000**  
Reliable dirt-resistant sensor for  
inductive conductivity measurements  
suitable also for wastewater

## Mounting assemblies



**SENSOFIT FLOW 1000**  
Flow assembly with optimised flow  
profile and easy installation



**SENSOFIT INS 1310**  
Static insertion assembly for  
reliable connection to tanks  
and pipes in general purpose  
applications



**SENSOFIT IMM 1000**  
Immersion assembly in polymeric  
material with excellent price-  
performance ratio

Solutions for water and wastewater analysis



MAC 100  
Signal converter



OPTISENS ADO 2000  
Amperometric sensor for dissolved oxygen measurements with easy exchangeable electrode cartridge



OPTISENS ODO 2000  
Low maintenance optical sensor for dissolved oxygen measurements, with automatic cleaning, no recalibration required



SENSOFIT IMM 2000  
Telescopic rod in fiber glass for OPTISENS ODO/ADO/TUR sensors as well as 3/4" NPT process connection



OPTISENS TUR 2000  
90° scattered light sensor for turbidity measurements with NIR-LED for long-term stability and automatic cleaning

## Measuring systems



OPTISYS SLM 2100  
Optical measuring system for sedimentation profile measurement and continuous tracking of sludge blanket

Solutions for wastewater analysis





MAC 100  
Signal converter



OPTISENS COND 7200  
Conductive conductivity sensor with  
hygienic connection



OPTISENS IND 7000  
Hygienic sensor for inductive conductivity  
measurements



OPTISYS IND 7100  
Inductive measuring system for various  
industries and applications



OPTISYS IND 8100  
Hygienic inductive conductivity  
measuring system in stainless steel  
for the food and beverage industry

Solutions for hygienic applications

## Highlights:

- Digital and analog sensors available
- 2-wire loop powered sensors with integrated transmitter technology
- True open standard in fieldbus systems – HART®
- Ex approvals (zone 0) e.g. IECEx
- Increased safety due to direct connection to the process control system
- Extended lifetime of sensors due to the offline calibration and regeneration
- Offline statistic over complete life cycle
- Ingress protection IP68
- Different diaphragm materials for all applications
- Integrated temperature sensor
- Fits into most of all mounting assemblies
- No special cable needed

## pH/ORP measurement

### The measuring principle

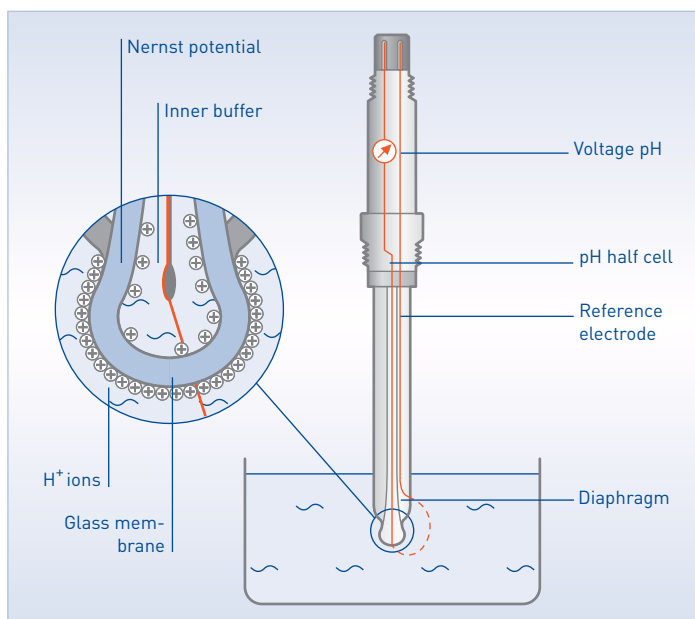
Arnold Orville Beckmann built the first pH-meters in 1935 to measure the citric acid in lemons. These pH-meters determined pH using the potentiometric principle according to the electric Nernst potential, measured across a pH glass membrane.

The glass membrane of a pH sensor is able to reversibly incorporate the  $H^+$  ions from the surface of the liquid to be measured. This results in a electrical potential, which is proportional to the  $H^+$  concentration. An internal electrolyte (inner buffer) common to the pH value to be measured is found on the inside of the electrode. So, the voltage across the glass membrane is set differently between the outer and inner electrolyte with regard to the pH value. A complete pH measuring chain consists of a pH half cell described above and a reference electrode. The voltage generated by the reference electrode is independent of the pH value and provides a stable potential, the so-called reference potential.

Via the diaphragm, the reference electrode is in electrical contact with the measuring solution. Through this the electric circuit is closed and the voltage generated by the measuring loop can be measured at the signal converter. The pH half cell and reference electrode are usually integrated in a combination electrode.

### The ORP reaction

A Oxidation Reduction Potential (ORP) reaction is a chemical reaction where one reaction partner's electrodes are transferred to the other. This generates an ORP voltage which provides information about the individual reaction partner as to which material oxidises or reduces. The ORP sensor is build similar to a pH combination electrode. However the measuring electrode is made out of metal (gold or platinum) instead of glass. In order to determine the ORP value, the galvanic voltage between the metal tip and the liquid media is measured.





SMARTPAT PH 8150 with SENSOFIT RET 5810 in a chemical plant

## Made to fit

SMARTPAT and OPTISENS range of pH and ORP sensors are available in a wide choice of body styles with different membrane glasses and diaphragm materials. Additionally there are versions with Ex approvals (zone 0) and hygienic certificates available.

Our pH and ORP sensors are suitable for a large range of applications such as pure water control, process monitoring in hygienic areas over to harsh environments like industrial wastewater treatment to process control and monitoring in chemical plants. As the first sensor line in the market, the SMARTPAT PH/ORP sensors have an integrated transmitter with built in fieldbus communication and current output, which makes them easy to integrate in any process loop.

So, our SMARTPAT/OPTISENS sensors are made to fit just about every application in liquid analytics.

### Typical applications

#### Chemical

- All types of neutralization processes
- Reverse osmosis
- Plastics production
- Fertilizer production

#### Pharmaceutical/food/beverage

- Process control of pharmaceutical processes
- Process control in the production of cheese, milk, beer, fruit juices, yogurt

#### Power plants/semiconductor manufacturing

- Control of reverse osmosis
- Cooling water control
- Boiler feed water control

#### Wastewater

- Monitoring for surface water and wastewater
- Control of biology
- Neutralizations in industrial/municipal wastewater
- Process control
- Dosage of flocculation agents
- Oily and greasy media

#### Water

- Process control and monitoring of limit values in potable water



SMARTPAT  
PH 8570



SMARTPAT  
PH 8150



SMARTPAT  
PH 8530



SMARTPAT  
PH 8320



OPTISENS  
PH 8300



OPTISENS  
PH 8500



OPTISENS  
ORP 8500



OPTISENS  
PH/ORP 8X90

## Conductive conductivity measurement

### The measuring principle

The principle of conductivity measurement is defined as the capacity of a solution to conduct an electrical current between two electrodes. In a solution, the current flows by ion transport. The higher the ion concentration, the more current can flow. Using Ohm's law:  $\text{Ohm} = \text{Voltage} / \text{Current}$ , the resistance of a liquid can be determined by measuring the current while keeping voltage constant. Specific conductivity is defined by  $1 / \text{resistance}$ . The unit of measurement is Siemens and is normally expressed in  $\mu\text{S}/\text{cm}$ .

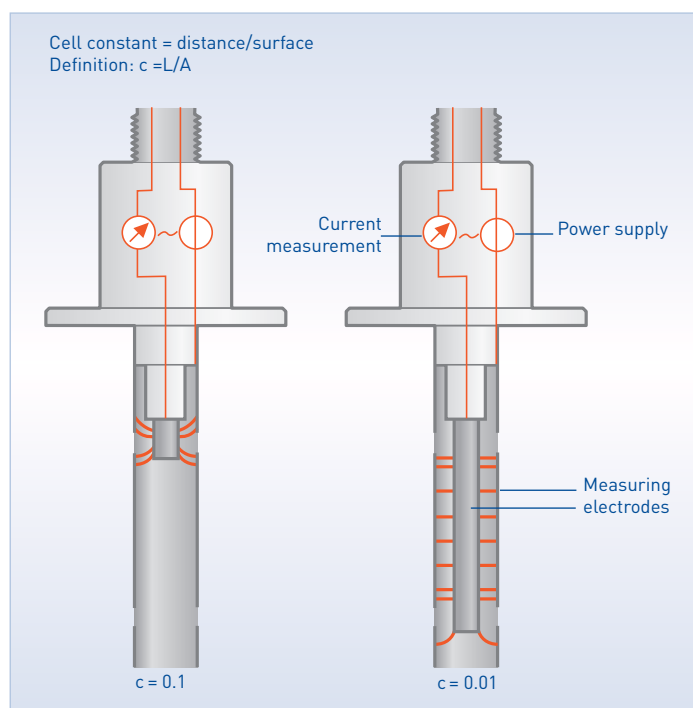
An important criterion for the measuring range of conductivity cells is the geometry of the electrodes. There are two rules which are characteristic for conductivity measurement:

1. The larger the distance between the two electrodes, the higher the resistance.
2. The larger the electrode surface, the lower the resistance.

The surface area (A) and the distance (L) must be correctly matched to the desired measuring range. This is called the "cell constant" defined as  $c = L/A$ .

### Highlights:

- Digital and analog sensors available
- 2-wire loop powered sensors with integrated transmitter technology
- True open standard in fieldbus systems – HART®
- Ex approvals (zone 0) e.g. IECEx
- Increased safety due to direct connection to the process control system
- Integrated temperature sensor
- Different cell constants for a wide range of applications
- Stainless steel, titanium or graphite electrode materials
- Wide range of process connections for seamless integration
- Hygienic versions available





## Easy to integrate

The measurement of conductive conductivity is used in many applications and is after pH the second most important parameter in analytic measurements.

This is particularly true of SMARTPAT COND and OPTISENS COND sensors. The large selection of cell constants and different electrode materials mean they can be successfully applied to anything like aggressive media or from ultrapure water to potable water.

Additionally due to the innovative SMARTPAT technology the SMARTPAT COND sensors can be directly connected to any common process control system using industry standard communication like 4...20 mA/HART®. They are hence easy to integrate into any plant infrastructure.



OPTISENS  
COND 1200



SMARTPAT  
COND 3200



SMARTPAT  
COND 5200



SMARTPAT  
COND 7200

### Typical applications

#### Power

- Quality measurement in condensate, cooling water, boiler feed water
- Reverse osmosis
- Monitoring of ion exchanger

#### Water

- Process monitoring in water treatment plants (industrial and potable water)

#### Semiconductor

- Monitoring of ultrapure water in semiconductor production

#### Food and beverage, pharmaceutical

- Pure water and ultrapure water monitoring
- Separation processes (milk/water)
- Distillation
- Electro deionization
- Monitoring of ion exchanger/ reverse osmosis

#### Chemical

- Separation processes (caustic/water)
- Process monitoring water treatment
- Process monitoring wastewater treatment



## From flow to analysis – Applying our proven operating and service concept

Because we know high-end technology only makes sense if it is simple and convenient for you to access, user-friendliness has always been a top priority at KROHNE, whether during installation, commissioning, operation or in communication. This is why, at KROHNE, user-friendliness begins with the electronics. Over the years, our development and application engineers have developed a comprehensive design we call the General Device Concept (GDC). Customers of KROHNE flow and level meters have benefited from this overarching concept for many years. Now KROHNE is the first and only manufacturer to extend the GDC to analytical parameters.

The MAC 100 signal converter adheres to the same General Device Concept as our flow and level converter which means rapid commissioning, reduced training times and standardisation of your measuring instruments. Simplifying the operating process helps to reduce costs even further.

For you, this means:

### Same Human Machine Interface (HMI)

The MAC 100 has the same state-of-the-art graphic display as KROHNE products you are already familiar with.

A multifunction display with four measuring screens provides you with comprehensive information about measurement values, device status and trends. The user-friendly interface has just four simple and convenient buttons.



MAC 100

### Same service concept

Because the hardware and software platform is the same as other KROHNE products, spare parts supply and field services are unified. This means the cost of spare parts is reduced. Training times for operators and service technicians are also minimised, especially for those already familiar with KROHNE flow or level meters who can therefore easily make the move to analysis devices.

### Same communication concept

Like all KROHNE devices, the MAC 100 communicates with most standard Fieldbuses, analogue and digital interfaces.

### Same modular structure for tailored solutions

As with our flow and level converter, the MAC 100 can be adapted to suit your specific requirements. You specify the number and type of signal inputs and outputs as well as define the complexity of the measuring point and the number of parameters.

## A well organised system

The modular design offers great flexibility in configurations from cost-efficient single-channel converters to complex measuring systems.

Analogue sensors of the OPTISENS series can be connected. This means that a wide variety of applications in liquid analysis can be handled by one single converter.

Thanks to its robust aluminium housing with protection category IP66, the MAC 100 is perfectly suited for external installation even in the harshest ambient conditions.



## Free chlorine/ chlorine dioxide/ozone measurement

### Highlights:

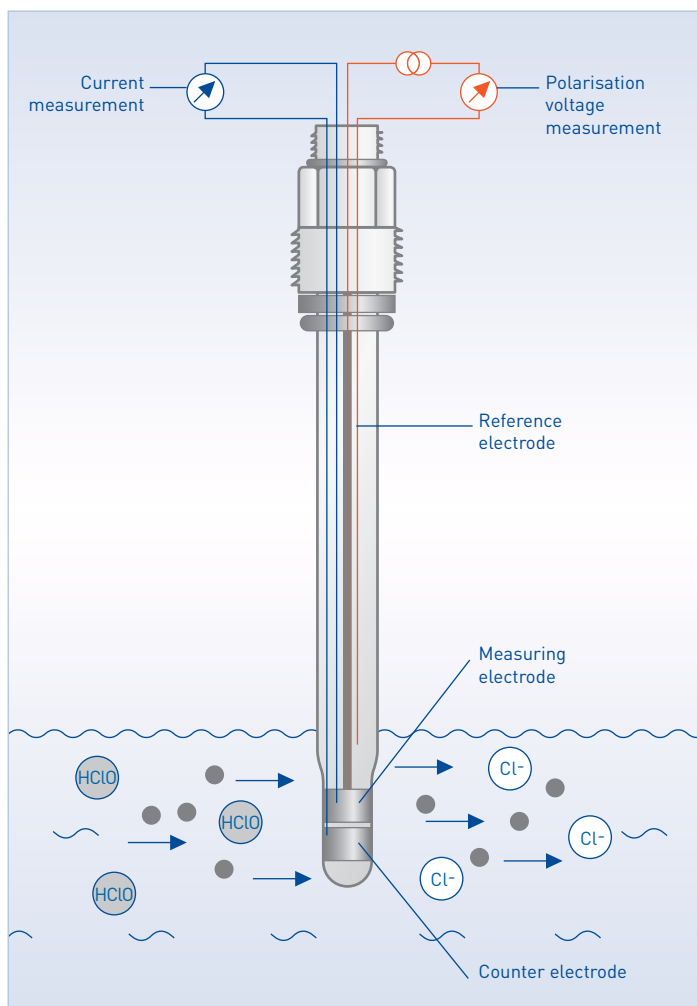
- Membrane-free sensor for long-term stability and easy maintenance
- Gel-filled 12 mm sensor for a wide range of applications
- Potentiostatic measurement with fast response time
- Automatic sensor cleaning for extended maintenance intervals
- Measuring system with integrated pH compensation

### The measuring principle

The potentiostatic sensor has three electrodes: a measuring electrode (gold), a counter electrode (gold) and a reference electrode (Ag/AgCl).

A precise potential is built up between the measuring and the counter electrode. The measuring electrode starts polarising and negative charges collect close to the measuring electrode. After polarisation, the electrical current decreases to 0 mA as long as the polarising layer is not changed. Free chlorine molecules that hit the surface of the measuring electrode take a defined portion of the charge with them, changing the status of the measuring potential.

The converter constantly measures the potential between the measuring and reference electrode and immediately readjusts the potential as soon as it begins to change. The current needed to maintain a constant potential is directly correlated to the free chlorine concentration in the measuring medium. The measurement of chlorine dioxide or ozone follows the same principle.





## Self-cleaning sensor with extended lifetime

For easy handling, KROHNE offers you OPTISYS CL 1100 – a complete pre-wired and tested chlorine measuring system including all the necessary components for measurement and compensation as well as a quick and cost effective installation.

The unique combination of the membrane-free OPTISENS CL 1100 sensor and the automatic cleaning system of the OPTISYS CL 1100 means extremely low maintenance.

Even the most persistent coating is no problem, which adds up to an extended product life.

The chlorine signal will be compensated by the integrated temperature measurement under all process conditions. The chlorine measuring system can also manage pH compensation and will handle the complete chlorine measuring range, even at higher pH values.

Combine the OPTISYS CL 1100 with our OPTISYS TUR 1050 turbidity measuring system and you have the best solution for pumping stations.



OPTISYS CL 1100  
for monitoring water quality

### Typical applications

#### Water

- Monitoring potable water quality
- Disinfection control
- Process water treatment
- Emergency chlorination for potable water

#### Wastewater

- Monitoring limit values in industrial effluent



OPTISYS CL 1100 and OPTISYS TUR 1050  
for monitoring water quality in pump stations

### Highlights:

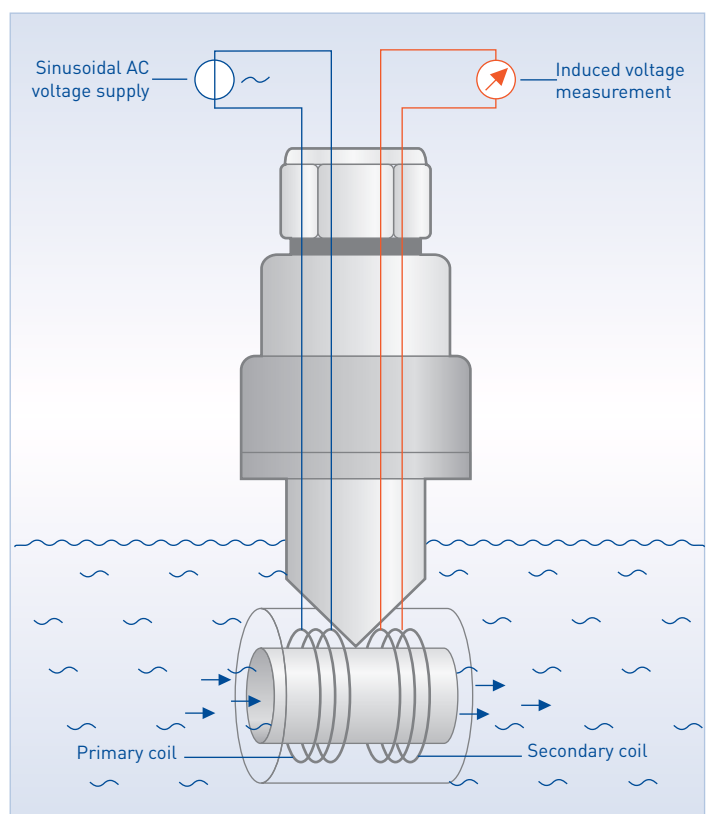
- Electrodes not in contact with the media
- Different materials for all applications e.g. PVDF, PP, PEEK
- Insensitive to contamination
- Integrated automatic temperature compensation with fast response time
- Excellent long-term stability in all liquids
- Perfect linearity at high conductivity values
- No polarisation effects at high conductivity values
- Different process connections including hygienic connections
- Immersion version for installation in open channels
- Hygienic design

## Inductive conductivity measurement

### The measuring principle

The well-known Faraday Law of magnetic induction is used here to determine conductivity in solutions at higher values, where direct contact measurement is not well suited.

When a magnetic field is generated by an electrical coil and a second electrical coil is placed next to it, a certain amount of electric energy will be transferred to it. With an inductive conductivity sensor, the process media flows directly through the middle of both coils. The amount of energy transferred from the primary to the secondary coil is directly proportional to the electrical resistance of the solution.





Conductivity monitoring for product control at soft drink manufacturer

## Resistant to dirt

The OPTISENS IND sensors can safely be used for conductivity measurements in aggressive and corrosive media like industrial wastewater, sea water and acidic solutions.

Why? Because the measuring electrodes of the OPTISENS IND sensors are completely sealed and have no direct contact with media. We also use tough chemical and dirt-resistant materials, such as PVDF, PP or PEEK.

So, thanks to the OPTISENS IND rugged design and special materials, the sensors have long life span and are practically maintenance free.

The OPTISENS IND 7000 series additionally provides hygienic connections and approvals for applications in food, beverages and pharmaceutical process. The hygienic sensors are also available as compact measuring system OPTISYS IND 7100 or OPTISYS IND 8100.

### Typical applications

#### Water

- Regeneration of ion exchangers
- Control of sea water desalination processes

#### Wastewater

- Monitoring of limit values in industrial influent at the inlet of wastewater treatment plants

#### Food and beverage

- Product control (dairies, breweries, beverages)
- CIP/SIP processes
- Regeneration of ion exchangers (steam generation)



OPTISENS IND 7000



OPTISYS IND 8100

## Amperometric measurement of dissolved oxygen

### The measuring principle

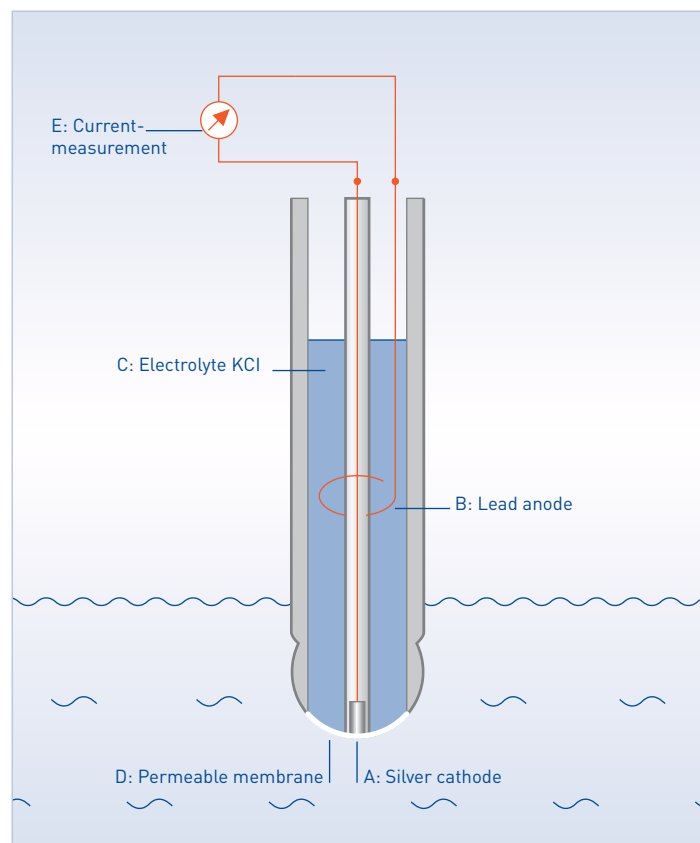
The principle of amperometric measurement of dissolved oxygen (DO) was developed by the American Biochemist Leland C. Clark in 1954, who designed the first commercial DO sensor. This sensor is nowadays widely used for instance for wastewater treatment in aeration basins or for fish farming.

The electrode consists of a silver cathode (A) and a lead anode (B), which are connected via an electrolyte (C). Those electrodes are separated from the water by a permeable membrane (D) e.g. Teflon® (PTFE). If the sensor is immersed in the medium being measured, such as the biological treatment stage of a sewage plant, oxygen enters the electrode cartridge via the membrane. The oxygen entered is reduced at the cathode.

The cathode releases electrons to the oxygen molecules, which are attracted to the anode due to its charge state. Electrons are released on the anode via an oxidation process. The current (E) that is produced by this electron transfer is directly proportional to the partial pressure of the oxygen.

### Highlights:

- Self polarising amperometric cell
- Fast response time in all applications
- Integrated temperature compensation for reliable measuring results
- Stainless steel housing for harsh applications
- Longer maintenance intervals due to large electrolyte reservoir
- Easy maintenance via sensor cartridge replacement
- Suitable for connection to the MAC 100 signal converter or as 2-wire loop powered sensor for direct connection to the process control system





Measurement of dissolved oxygen for aeration control at a wastewater treatment plant

## Stable measurements with low maintenance and high accuracy

Amperometric dissolved oxygen sensors are widely used in wastewater treatment plants to control and monitor the biological treatment of wastewater.

In these applications, where ragging to the sensors can be caused by hair and fibres and contamination by biofilm often makes precise measurement difficult, OPTISENS ADO 2000 sensors perform outstandingly. Their robust stainless steel housing has a large diameter, which minimises ragging and reduces the need for manual cleaning.

In addition, the large Teflon membrane – abrasion resistant even under severe conditions – as well as the large electrolyte reservoir prolongs service intervals and reduces the drifting of measured values. Through the cartridge system, the whole electrode can be changed easily, enabling fast and easy maintenance.



OPTISENS ADO 2000



Electrode cartridge

### Typical applications

#### Water

- Fish farming (fresh water)
- Drinking water monitoring

#### Wastewater

- Controlling biological treatment in wastewater aeration basins
- Prevention of water pollution



## Optical measurement of dissolved oxygen

### The measuring principle

An alternative to the amperometric measurement is the optical measurement of dissolved oxygen.

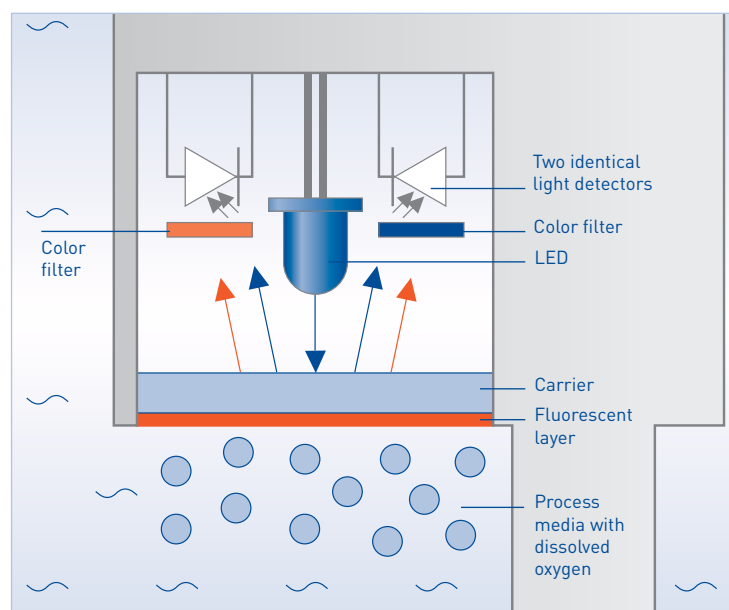
The application of optical oxygen measurement has been studied extensively since the mid 1980s. The optical oxygen sensor OPTISENS ODO 2000 contains an oxygen sensitive dye (fluorophore) that is immobilised in an oxygen permeable polymer matrix layer and in direct contact with the process media.

The fluorophore is excited by the energy-rich blue light emitted by the LED inside the sensor into an excited state. This energy can be emitted from the excited fluorophore after a short period (micro seconds) by emission of low-energy red light. In case an oxygen molecule is getting in contact with the excited fluorophore, the energy can also be transferred from the excited fluorophore in a non-radiative reaction to the oxygen. In that case the intensity of the emitted red light from the polymer matrix layer is decreased (fluorescence quenching).

Consequently, the intensity of the emitted red light is decreased with increasing oxygen content. The intensity of the emitted red light is measured with a light detector. The change in intensity is used to measure the oxygen concentration in the process media. To compensate the intensity drift of the light emitting blue LED its intensity is directly measured with a second light detector.

### Highlights:

- No recalibration necessary
- Reliable measurement via fluorescence measurement
- Fast response time in all applications
- No media flow required
- Low cost of ownership



## Precise measurements without recalibration

Optical dissolved oxygen sensors are widely used to control and monitor oxygen concentration during the biological treatment of sewage water.

OPTISENS ODO 2000 from KROHNE is especially designed for small and medium-sized wastewater treatment plants, where regular calibration and cleaning of the sensors is difficult due to limited maintenance resources.

OPTISENS ODO 2000's use of the optical principal interacting with a fluorescent membrane means there's no need for recalibration. Precision and reliability remain constant.

OPTISENS ODO 2000 measures dissolved oxygen concentration in an aeration basin at a wastewater treatment plant, Stuttgart, Germany



OPTISENS ODO 2000



Luminophore disc with mounting equipment



### Typical applications

#### Water

- Fish farming (fresh water)

#### Wastewater

- Controlling biological treatment in wastewater aeration basins
- Prevention of water pollution

## Turbidity measurement

### The measuring principle

Turbidity is the cloudiness of a fluid caused by the presence of suspended and colloidal matter. In waterworks, a turbidity measurement is used to indicate the clarity of water.

Technically, turbidity is an optical property of water based on the amount of light reflected by colloidal and suspended particles. The measuring unit for the turbidity is Nephelometric Turbidity Unit (NTU).

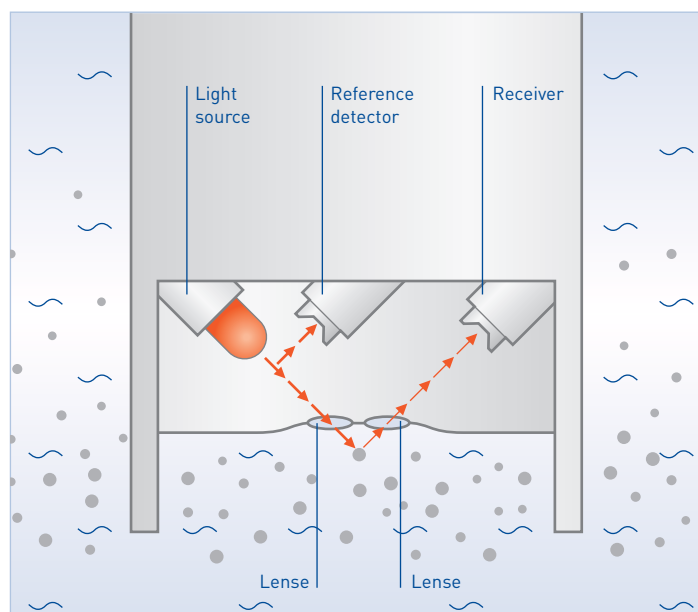
According to ISO 7027, turbidity values below 40 NTU have to be measured with the 90° scattered light method.

The light source and receiver are positioned in a 90° angle to each other. The light transmitted from the source is directed in equal strength to the reference receiver and into the medium. Light is now reflected from the particles and fractions of the scattered light are received by the detector, positioned at a 90° angle.

The meter now compares the light from the reference receiver and scattered light receiver and calculates the turbidity value.

### Highlights:

- Precise turbidity measurement < 40 FNU/NTU through the 90° scattered light method
- Measurement according to ISO 7027/US EPA 180.1
- Fastest calibration on market (<15 minutes)
- Reusable calibration cuvettes for calibration without dangerous formazine contact
- High accuracy over the complete range due to unique three-point calibration
- Fast response time due to small sample volume
- Automated ultrasonic cleaning system
- Best price/performance ratio in terms of maintenance and calibration costs







Turbidity measurement for filter monitoring

## Calculating turbidity the easy way

Turbidity measurement is widely used in potable water and wastewater applications. To address a wide range of applications, KROHNE offers different measuring solutions, from open channel measurement with the OPTISENS TUR 2000 to low-range measurement systems such as OPTISYS TUR 1050.

OPTISYS TUR 1050 is the best performing turbidity measurement system when it comes to fulfilling all the necessary regulations and requirements. Because of its optimised cuvette measuring system, it has the fastest measuring response time and lowest maintenance requirements on the market.

### Typical applications

#### Water

- Monitoring of potable water quality in pump stations
- Filter monitoring
- Process water treatment
- Controlling of limit values
- Cooling water
- Demineralisation

#### Wastewater

- Water quality control in the outlet



OPTISENS TUR 2000



OPTISYS TUR 1050



## OPTISYS SLM 2100 – Better knowledge about your sedimentation process



The sludge level measuring system OPTISYS SLM 2100 features an accurate and reliable profile measurement of your sedimentation tank using an optical sensor which travels through all layers of the tank reading suspended solids concentration at the different heights. This gives you more information than you can ever obtain with any comparable ultra sonic device, which hence generates better knowledge about your sedimentation process.

### Some key benefits:

- Reliable measurement of the sedimentation profile as well as sludge blanket and fluff levels
- Continuous level measurement of sludge blanket (zone tracking)
- Direct measurement by immersion of optical sensor
- No interference with fluff or floating sludge due to the direct measurement
- Common operating and service concept with KROHNE flow and level devices
- Low maintenance due to automatic flushing of sensor and cable after each measuring cycle

## Measurement of sedimentation profile

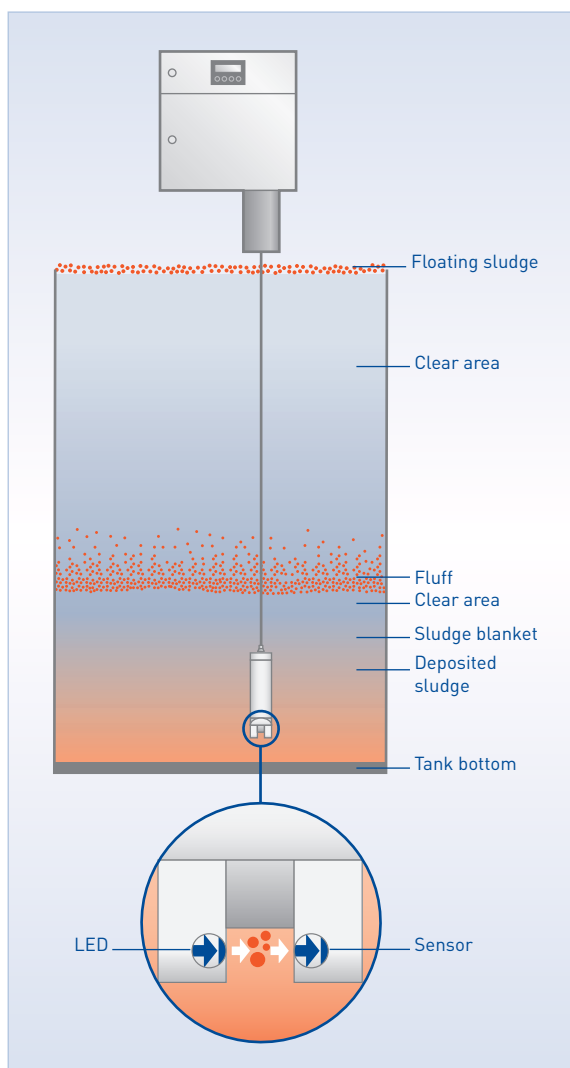
### The measuring principle

Unlike the commonly used ultrasound level measurement, the KROHNE sedimentation profile and sludge blanket meter is using an optical sensor which travels through the media. Thus it can directly measure the suspended solids concentration at different heights.

The measurement of the suspended solids content is based on the method of the transmission of light, which provides precise measurement results independent of the sludge colour. The direct measuring principle excludes incorrect measurements due to echo returns from walls or separating zones as well as signal damping by fluff or floating sludge.

#### Highlights:

- Direct measurement by immersion of optical sensor
- No interference with fluff or floating sludge due to direct measurement
- Reliable measurement of the sedimentation profile as well as sludge blanket and fluff levels
- Continuous level measurement of sludge blanket (zone tracking)
- Common operating and service concept with flow and level devices
- Low maintenance due to (optional) automatic flushing of sensor and cable after each measuring cycle
- Rake guard switch protects the sensor from being caught by the rake
- IP54 enclosure and build in heater for outdoor installations
- Durable stainless steel sensor and instrument enclosure
- Reliable signal transmission from sensor, due to digital communication via optocoupler





Sludge blanket measurement in secondary clarifier of wastewater treatment plant, Krefeld, Germany

## A clear view right to the ground

OPTISYS SLM 2100 goes right down to the bottom of a tank and detects all sludge phases, supplying precise concentration and level measurements.

Via the zone tracking function you can follow one specific concentration (i.e. the sludge blanket) and hence continuously monitor one specific "zone", for instance for controlling the pumps during de-pumping of the sludge.

You even have the option of recording a sludge profile, enabling you to detect sedimentation problems early and prevent sludge being washed out to the next stage.

### Typical applications






#### Water

- Monitoring of sedimentation processes and automated de-pumping in sedimentation basins

#### Wastewater

- Prevention of sludge washout in primary and secondary clarifiers
- Control of sludge settlement and automated extraction of sludge in clarifiers and sludge thickeners

## 2-wire digital pH/ORP sensors

	Hygienic pH sensor for food, beverage and pharmaceutical industry	High performance pH sensor for chemical industry	pH sensor for pure water applications	Durable pH sensor for water and wastewater applications	General purpose pH sensor for water applications
	SMARTPAT PH 8570*	SMARTPAT PH 8150*	SMARTPAT PH 8530	SMARTPAT PH 8320*	SMARTPAT PH 8510
					
Parameter	pH	pH	pH	pH	pH
Dimension	Ø12; 120/225 mm length Ø0.5"; 4.7"/8.9" length	Ø12; 120/225 mm length Ø0.5"; 4.7"/8.9" length	Ø12; 120/225 mm length Ø0.5"; 4.7"/8.9" length	Ø12; 120/225 mm length Ø0.5"; 4.7"/8.9" length	Ø12; 120 mm length Ø0.5"; 4.7" length
Process connection	PG 13.5	PG 13.5	PG 13.5	PG 13.5	PG 13.5
Measuring range	0...14 pH	0...14 pH	0...14 pH	0...14 pH	0...14 pH
Measuring accuracy	0.5%	0.5%	0.5%	0.5%	0.5 %
Diaphragm	Ceramic	Open	Ceramic	PTFE	Ceramic
Reference	RheoLid gel	Duralid gel	KCl gel	Ag/AgCl/TepoxGel	Ag/AgCl/TepoxGel
Glass type/ measuring electrode	S glass	H glass	A glass	AH glass	AH glass
Body material	Glass	Glass	Glass	Glass	Glass
Temperature range	0...+140°C; +32...+284°F (CIP, SIP, autoclavable)	0...+130°C; +32...+266°F	0...+80°C; +32...+176°F	0...+70°C; +32...+158°F	0...+70°C; +32...+158°F
Pressure range	Max. 12 bar; 174 psi	Max. 12 bar; 174 psi	Max. 12 bar; 174 psi	Max. 16 bar; 232 psi	Max. 2 bar; 30 psi
Min. conductivity	>100 µS/cm	>150 µS/cm	>2 µS/cm	>150 µS/cm	>150 µS/cm
Communication	1 x 4...20 mA (passive), HART® 7	1 x 4...20 mA (passive), HART® 7	1 x 4...20 mA (passive), HART® 7	1 x 4...20 mA (passive), HART® 7	1 x 4...20 mA (passive), HART® 7
Power supply	15...30 V (loop powered)	15...30 V (loop powered)	15...30 V (loop powered)	15...30 V (loop powered)	15...30 V (loop powered)
Temperature sensor	Pt1000	Pt1000	Pt1000	Pt1000	Pt1000
Connector	VP (VarioPin)	VP (VarioPin)	VP (VarioPin)	VP (VarioPin)	VP (VarioPin)
Approvals	IECEX, ATEX, NEPSI, FM [zone 0]	IECEX, ATEX, NEPSI, FM [zone 0]	-	IECEX, ATEX, NEPSI, FM [zone 0]	-
Certificates	Calibration certificate, FDA; CE	Calibration certificate; CE	Calibration certificate; CE	Calibration certificate; CE	Calibration certificate; CE
Accessories	<ul style="list-style-type: none"> <li>- OPTIBRIDGE USB interface cable</li> <li>- SMARTBASE database</li> <li>- HART® DD</li> <li>- PACTware™ FDT/DTM</li> <li>- SJB 200 W/-Ex junction boxes</li> <li>- SD 200 W/R indicators</li> <li>- SMARTMAC 200 W operating unit</li> <li>- VP2 cables in various lengths</li> <li>- Various calibration solutions</li> </ul>				







High performance ORP sensor for harsh applications	General purpose ORP sensor for water applications	Rugged pH sensor with 3/4" NPT process connection for water and wastewater applications	Rugged pH sensor with 3/4" NPT process connection for wastewater applicatons	Rugged ORP sensor with 3/4" NPT process connection for water and waste- water applications
SMARTPAT ORP 8150*	SMARTPAT ORP 8510	SMARTPAT PH 1590	SMARTPAT PH 2390	SMARTPAT ORP 1590
				
ORP	ORP	pH	pH	ORP
Ø12; 120/225 mm length Ø0.5"; 4.7"/8.9" length	Ø12; 120 mm length Ø0.5"; 4.7" length	Ø20; 23 mm length Ø0.7"; 0.9" length	Ø20; 23 mm length Ø0.7"; 0.9" length	Ø20; 23 mm length Ø0.7"; 0.9" length
PG 13.5	PG 13.5	3/4" NPT (male)	3/4" NPT (male)	3/4" NPT (male)
-1,500...1,500 mV	-1,500...1,500 mV	0...14 pH	0...14 pH	-1,500...1,500 mV
0.5%	0.5%	0.5%	0.5%	0.5%
Open	Ceramic	Ceramic	PTFE	Ceramic
Duralid gel	Ag/AgCl/TepoxGel	KCl gel	KCl gel	KCl gel
Platinum	Platinum	Multi purpose glass	Multi purpose glass	Platinum
Glass	Glass	CPVC	Ryton	CPVC
0...+130°C; +32...+266°F	0...+70°C; +32...+158°F	0...+80°C; +32...+176°F	0...+80°C; +32...+176°F	0...+80°C; +32...+176°F
Max. 12 bar; 174 psi	Max. 2 bar; 30 psi	Max. 5.9 bar; 85 psi	Max. 5.9 bar; 85 psi	Max. 5.9 bar; 85 psi
>150 µS/cm	>150 µS/cm	>150 µS/cm	>150 µS/cm	>150 µS/cm
1 x 4...20 mA (passive), HART® 7	1 x 4...20 mA (passive), HART® 7	1 x 4...20 mA (passive), HART® 7	1 x 4...20 mA (passive), HART® 7	1 x 4...20 mA (passive), HART® 7
15...30 V (loop powered)	15...30 V (loop powered)	15...30 V (loop powered)	15...30 V (loop powered)	15...30 V (loop powered)
Pt1000	Pt1000	Pt1000	Pt1000	Pt1000
VP (VarioPin)	VP (VarioPin)	VP (VarioPin)	VP (VarioPin)	VP (VarioPin)
IECEX, ATEX, NEPSI, FM (zone 0)	-	-	-	-
Calibration certificate; CE	Calibration certificate; CE	Calibration certificate; CE	Calibration certificate; CE	Calibration certificate; CE
<ul style="list-style-type: none"> <li>- OPTIBRIDGE USB interface cable</li> <li>- SMARTBASE database</li> <li>- HART® DD</li> <li>- PACTware™ FDT/DTM</li> <li>- SJB 200 W/-Ex junction boxes</li> <li>- SD 200 W/R indicators</li> <li>- SMARTMAC 200 W operating unit</li> <li>- VP2 cables in various lengths</li> <li>- Various calibration solutions</li> </ul>				

\*also available with Ex approval







## 2-wire conductivity sensors

	Conductivity sensor for general purpose water applications	Conductivity sensor for pure water applications	Conductivity sensor for harsh applications	Conductivity sensor for hygienic applications
	SMARTPAT COND 1200	SMARTPAT COND 3200	SMARTPAT COND 5200*	SMARTPAT COND 7200
				
Parameter	Conductive conductivity	Conductive conductivity	Conductive conductivity	Conductive conductivity
Type	Two-electrode measuring cell with integrated temp. sensor	Two-electrode measuring cell with integrated temp. sensor	Two-electrode measuring cell with integrated temp. sensor	Two-electrode measuring cell with integrated temp. sensor
Dimension: insertion length	100 mm / 3.94"	60 mm / 2.36"	60 mm / 2.36"	40 mm / 1.57" 70 mm / 2.76"
Process connections	G3/4A thread (male)	G3/4A thread (male), 3/4"NPT (male)	G3/4A thread (male), 3/4"NPT (male)	Varivent DN40-125 Clamp DN25/32/40 Clamp DN50
Measuring ranges	$c = 1 \text{ cm}^{-1}$ : 100 $\mu\text{S/cm}$ ...20 $\text{mS/cm}$ at +25°C; +77°F	$c = 0.01 \text{ cm}^{-1}$ : 0.05...10 $\mu\text{S/cm}$ $c = 0.1 \text{ cm}^{-1}$ : 1...1000 $\mu\text{S/cm}$ at +25°C; +77°F	$c = 1 \text{ cm}^{-1}$ : 10 $\mu\text{S/cm}$ ...15 $\text{mS/cm}$ at +25°C; +77°F	$c = 0.01 \text{ cm}^{-1}$ : 0.05...10 $\mu\text{S/cm}$ $c = 0.1 \text{ cm}^{-1}$ : 1...1000 $\mu\text{S/cm}$ at +25°C; +77°F
Measuring accuracy	<3% of the measured value	<3% of the measured value	<3% of the measured value	<3% of the measured value
Materials	Electrodes: Stainless steel (1.4571/316Ti); Process connection: PVDF Isolator: PVDF	Electrodes: Stainless steel (1.4571/316Ti) Process connection: PVDF Isolator: PVDF	Electrodes: Graphite Process connection: PVDF	Electrodes/process connection: Stainless steel (1.4435 /316L) Isolator: PEEK
Temperature range	0...+135°C; +32...+275°F	0...+135°C; +32...+275°F	0...+130°C; +32...+266°F	0...+135°C; +32...+275°F
Pressure range	Max. 16 bar; 232 psi	Max. 16 bar; 232 psi	Max. 16 bar; 232 psi	Max. 16 bar; 232 psi
Communication	1 x 4...20 mA (passive); HART® 7	1 x 4...20 mA (passive); HART® 7	1 x 4...20 mA (passive); HART® 7	1 x 4...20 mA (passive); HART® 7
Power supply	15...30 V (loop powered)	15...30 V (loop powered)	15...30 V (loop powered)	15...30 V (loop powered)
Temperature sensor	Pt1000	Pt1000	Pt1000	Pt1000
Connector	VP (VarioPin)	VP (VarioPin)	VP (VarioPin)	VP (VarioPin)
Approvals	-	-	IECEX, ATEX, NEPSI, QPS (zone 0)	-
Certificates	Calibration certificate; CE	Calibration certificate; CE	Calibration certificate; CE	3.1, FDA, calibration certificate; CE
Accessories	- OPTIBRIDGE USB interface cable - HART® DD - PACTware™ FDT/DTM - SJB 200 W-Ex junction box - SD 200 W/R indicators - SMARTMAC 200 W operating unit - VP2 cables in various lengths - Various calibration solutions			






## Accessories





	USB interface cable for offline calibration and configuration with PACTware™ FDT/DTM	Junction boxes for connecting the sensor with the process control system	Loop powered indicator for wall or rack mount	Loop powered operating unit for configuration and calibration of SMARTPAT sensors
	OPTIBRIDGE*	SJB 200 W/-Ex	SD 200 W/R*	SMARTMAC 200 W*
				
Parameter	All	All	pH, ORP, conductivity	pH, ORP, conductivity
Type	-	Wall mounted	Wall or rack mounted	Wall and pipe mounted
Housing	Stainless steel	Plastic enclosure: IP65 AlSi 12 enclosure: IP66	Wall-mounted: IP65 Rack mounted: IP65/NEMA4	Die-cast aluminium field housing: IP66
Display	-	-	LCD	Graphic display, 128 x 64 pixels
Input	-	-	1 sensor input (4...20 mA)	1 sensor input
Ambient temperature	0...+55°C; +32...+131°F	Plastic enclosure: -20...+55°C; -4...+131°F AlSi 12 enclosure: -40...+65°C / -40...+149°F	-30°C...+80°C / -22°F...+176°F -30°C...+70°C / -22°F...+158°F (intrinsically safe)	-20...+55°C; -4...+131°F
Power supply	Via USB	-	15..30 VDC (loop powered), 2 V voltage drop	15..30 VDC (loop powered)
Communication	HART® 7	-	1 x 4...20 mA with signal calibration feature (passive); HART® 7	1 x 4...20 mA (passive); HART® 7
Approvals	IECEEx, ATEX, NEPSI, FM	-	IECEEx, ATEX, CSA (zone 1/T4)	IECEEx, ATEX, NEPSI, FM (zone 1/T4)
Certificate	CE	-	CE	CE
Other features	OPTIBRIDGE is used for all 2-wire loop powered HART® devices.	SJB 200 W-Ex suitable for installation in hazardous area	-	Operating unit with full configuration and calibration function for SMARTPAT sensors including error logbook, calibration logbook.

\*also available with Ex approval





## Mounting assemblies


	Manual retractable assembly with ball valve for easy sensor exchange without interruptions	Automatic retractable assemblies (pneumatic) for demanding process conditions in chemical industry	Manual retractable assemblies for sensor exchange without process interruptions
	SENSOFIT RET 5000	SENSOFIT RAM 5810/5830	SENSOFIT RET 5810/5830
			
<b>Sensor/assembly type</b>	Ø12; 120 mm length Ø0.5"; 4.7" length PG 13.5 sensor connection	Ø12; 225 mm length Ø0.5"; 8.9" length PG 13.5 sensor connection	Ø12; 225 mm length Ø0.5"; 8.9" length PG 13.5 sensor connection
<b>Materials</b>	Stainless steel (1.4404/316L)	Stainless steel (1.4404/316L)	Stainless steel (1.4404/316L)
<b>Sealing material</b>	PTFE, EPDM, FPM (Viton®) and/or FFKM (Kalrez®)	FPM (Viton®), EPDM (FDA/USP VI) or FFKM (Kalrez®)	FPM (Viton®), EPDM (FDA/USP VI) or FFKM (Kalrez®)
<b>Pressure range</b>	Up to 12 bar; 174 psi at +130°C; +266°F	Up to 16 bar; 232 psi at +140°C; +284°F	Up to 16 bar; 232 psi at +140°C; +284°F
<b>Process connections</b>	Flange DN50 PN16 w/o valve Flange DN50 PN16 w ball valve Flange ANSI 1 1/4" w/o valve Flange ANSI 1 1/4" w ball valve Thread G1 1/4" male w/o valve Thread 1 1/4"NPT male w/o valve	Flange DN32; PN16, DN40; PN16, DN50; PN16, ANSI 2"; 150 lbs or G1 1/4 (DN25)	Flange DN32; PN16, DN40; PN16, DN50; PN16, ANSI 2"; 150 lbs or G1 1/4 (DN25)
<b>Insertion length</b>	Up to 700 mm / 11.81"	Up to 107 mm; 4.21"	Up to 107 mm; 4.21"
<b>Cleaning connection</b>	G1/8", G1/4", 1/4"NPT	G1/8; 1/4"NPT	G1/8; 1/4" NPT
<b>Certificates</b>	Material certificate 3.1 EN 10204, certificate for elastomer EPDM (FDA/USP VI)	Material certificate 3.1 EN 10204, certificate for elastomer EPDM (FDA/USP VI)	Material certificate 3.1 EN 10204, certificate for elastomer EPDM (FDA/USP VI)
<b>Other features</b>	Ball valve, free positioning of sensor immersion depth, cleaning connection	With position switch, cleaning connection	With cleaning connection

Static insertion assembly for reliable connection to tanks and pipes in general purpose applications	Static insertion assemblies for reliable connection to tanks and pipes in hygienic applications	Immersion assembly for installation in tanks and open basins	Flow-through assembly in stainless steel for all applications
SENSOFIT INS 1310	SENSOFIT INS 7311/7312	SENSOFIT IMM 2920	SENSOFIT FLOW 1710
			
Ø12; 120 mm length Ø0.5"; 4.7" length PG 13.5 sensor connection	Ø12; 120 mm length Ø0.5"; 4.7" length PG 13.5 sensor connection	Ø12; 120 mm length Ø0.5"; 4.7" length PG 13.5 sensor connection 3/4" NPT (male) sensor connection	SENSOFIT RAM/RET 5810/5830; SENSOFIT INS X31X; G3/4 female thread and 3/4" NPT (female)
Stainless steel (1.4404/316L)	Stainless steel (1.4404/316L)	PP	Stainless steel (1.4571/316Ti)
FPM (Viton®) or EPDM (FDA/USP VI)	EPDM (FDA/USP VI)	FPM (Viton®) or EPDM	-
Up to 10 bar; 145 psi at +140°C; +284°F	Up to 10 bar; 145 psi at +140°C; +284°F	Up to 4 bar; 58 psi at +80°C; +176°F	Up to 16 bar; 232 psi at +140°C; +284°F
G1 1/4 (DN25)	Tri-Clamp 1-1.5" (OD 50.5 mm); Tri-Clamp 2" (OD 64 mm); VARIVENT DN40-125	Suspended holder; Flange DN50, PN16; Flange ANSI 2" 150 lbs	Flange DN25, DN50; ANSI 1 1/2"; Welding pipe DN25 / 1"; DN50 / 2"
70 mm; 2.75"	40 or 45 mm; 1.57" or 1.77"	1 or 2 m; 39.37" or 78.74"	-
-	-	Hose connection	-
Material certificate 3.1 EN 10204, certificate for elastomer EPDM (FDA/USP VI)	Material certificate 3.1 EN 10204, certificate for elastomer EPDM (FDA/USP VI)	-	Material certificate 3.1 EN 10204
Protection cage (optional)	-	Spray cleaning (optional)	Flow direction 90° or 180°

## Measuring systems

	Turbidity measuring system with cost efficient cuvette calibration and automated ultrasonic cleaning system	Measuring system for free chlorine, chlorine dioxide and ozone with automatic sensor cleaning system for safe use and extended lifetime
	OPTISYS TUR 1050	OPTISYS CL 1100
		
Parameter	Turbidity	Free chlorine (Cl <sub>2</sub> ), chlorine dioxide (ClO <sub>2</sub> ), ozone (O <sub>3</sub> )
Inputs	-	1 or 2 sensor
Measuring principle	90° scattered light (EN ISO 7027/US-EPA 180.1)	Potentiostatic (disinfection parameter) Potentiometric (pH/ORP)
Measuring range	0...100 NTU/FNU 0...1000 NTU/FNU	Cl <sub>2</sub> : 0.03...5 mg/l ClO <sub>2</sub> : 0.05...5 mg/l O <sub>3</sub> : 0.05...5 mg/pH: 0...14 ORP: -1500...+1500 mV;
Measuring accuracy	±2% of the measured value below 40 NTU; ±5% of the measured value above 40 NTU	2% full scale
Resolution	0.0001 NTU/FNU	0.1/0.01 mg/l
Min. flow rate	0.1 l/min	>30 l/h (constant)
Min. conductivity	-	>200 µS/cm
Ambient temperature	+1...+50°C; +34...+122°F	-15...+55°C; +5...+131°F
Process temperature	+1...+50°C; +34...+122°F	0...+50 °C; +32...+122 °F
Pressure range	Max. 14 bar; 200 psi, built-in pressure regulator	Max. 6 bar; 87 psi at 20°C; 68°F
Design	Compact device	Mounted on panel
Installation	Bypass	Bypass in flow-through installation
Outputs	1x 4...20 mA (aktiv) or RS485 Modbus RTU/ASCII	3 x current output (4...20 mA), galvanically isolated
Power supply	100...240 VAC, 47...63 Hz	100...230 VAC, 50/60 Hz; 24 VAC/DC
Relay	2 x relays 120...240 VAC, free programmable	3 x mechanical relays (NO and NC), free programmable
Automatic cleaning	Ultrasonic cleaning	ASR
Protection category	IP66; NEMA 4X	IP66
Other features	Reusable calibration cuvettes (with traceable liquid standard)	Calibration and status logbook, temperature and pH compensation
Certificate	CE (ETL listing acc. to UL 6101108-1-6), ETL certification (acc. to CSA 2.2)	CSA general purpose





## Converter

	Signal converter
	MAC 100
	
Type	Wall and pipe mounted
Housing	Die-cast aluminium field housing (IP66)
Display	Graphic display, 128 x 64 pixels
Parameter	pH, ORP, conductive and inductive conductivity, Cl <sub>2</sub> , ClO <sub>2</sub> , O <sub>3</sub> , dissolved oxygen, turbidity
Inputs	1 or 2 sensor inputs
Ambient temperature	-15...+55°C; +5...+131°F
Outputs	3 x current output (4...20 mA), galvanically isolated
Relay	3 x mechanical relays (NO and NC), free programmable
Power supply	100...230 VAC, 50/60 Hz; 24 VAC/DC
Protection category	IP66
Other features	Calibration and status logbook, temperature compensation, control input (e.g. hold function, flow alarm)
Approvals	CSA general purpose

## Analog chlorine and conductivity sensors

	Low-maintenance, membrane-free gold electrode sensor for free chlorine, chlorine dioxide and ozone measurements in potable water	2-electrode stainless steel sensor for conductivity measurements in all general applications	Reliable dirt-resistant sensor for inductive conductivity measurements suitable also for wastewater
	OPTISENS CL 1100	OPTISENS COND 1200	OPTISENS IND 1000
			
Parameter	Free chlorine (Cl <sub>2</sub> ), chlorine dioxide (ClO <sub>2</sub> ), ozone (O <sub>3</sub> )	Conductive conductivity	Inductive conductivity
Type	Ø12/120 mm length Ø0.5/4.7" length PG 13.5	2-electrode measuring cell with integrated temperature sensor	Inductive measuring cell with integrated temperature sensor
Measuring range	Cl <sub>2</sub> : 0.03...5 mg/l ClO <sub>2</sub> : 0.05...5 mg/l O <sub>3</sub> : 0.05...5 mg/l	c = 0.01 cm <sup>-1</sup> : 0.05...10 µS/cm c = 0.05 cm <sup>-1</sup> : 0.1...200 µS/cm c = 0.1 cm <sup>-1</sup> : 1...1000 µS/cm c = 0.2 cm <sup>-1</sup> : 1...2000 µS/cm c = 1 cm <sup>-1</sup> : 0.01 ...15 mS/cm c = 1 cm <sup>-1</sup> : 1...20 mS/cm	0...2000 mS/cm
Temperature range	-5...+70°C; +23...+158°F	-10...+135°C; +14...+275°F	-10...+80°C; +14...+176°F
Pressure range	Max. 6 bar; 87 psi at 20°C; 68°F	Max. 16 bar; 232 psi at +25°C; +77°F	Max.10 bar; 145 psi at +20°C; +68°F
Min. flow rate	>30 l/h (constant)	-	-
Min. conductivity	>150 µS/cm	-	-
Installation	Flow-through installation only	Pipe installations Immersion installations	Pipe installations Immersion installations
Materials	Glass shaft, gold electrodes, EPDM gasket	Electrode: Stainless steel (1.4571/316Ti) or titanium Process connection: PVDF or PP Isolator: PVDF	PP or PVDF
Diaphragm	Ceramic	-	-
Temperature sensor	-	Pt100	Pt1000
Connector	M12	4-pin right-angle plug (Hirschmann) or attached cable 10 m/32.8 ft	Attached cable 10 m/32.8 ft


## Analog pH/ORP sensors

	pH sensor with Pt100 for low-conductivity media and high temperatures	pH sensor with dirt-repellent PTFE diaphragm for wastewater, surface and process water	pH sensor with ceramic diaphragm for general water applications	pH sensors with liquid filling for special applications
	OPTISENS PH 8100	OPTISENS PH 8300	OPTISENS PH 8500	OPTISENS PH 9100, 9500
				
Parameter	pH	pH	pH	pH
Type	Ø12/120 mm length 0.5/4.7" length PG 13.5	Ø12/120 mm length 0.5/4.7" length PG 13.5	Ø12/120 mm length 0.5/4.7" length PG 13.5	Ø12/160 mm length 0.5/6.3" length refillable liquid KCL filling
Measuring range	0...14 pH	0...14 pH	0...14 pH	0...14 pH
Temperature range	0...+130°C; +32...+266°F	-5...+70°C; +23...+158°F	-5...+70°C; +23...+158°F	-5...+100°C; +23...+212°F
Pressure range	Max. 6 bar; 87 psi	Max. 10/145 bar	Max. 2 bar; 30 psi	Pressure less
Min. conductivity	>2 µS/cm	>150 µS/cm	>150 µS/cm	>20 µS/cm
Installation conditions	Pipe installations, Immersion installations	Pipe installations, Immersion installations	Pipe installations, Immersion installations	Various (pressure less)
Temperature sensor	Pt100 (optional)	Pt100 (optional)	Pt100 (optional)	-
Materials	H-glass, EPDM gasket	AH-glass, EPDM gasket	AH-glass, EPDM gasket	AH-glass
Diaphragm	Open	PTFE	Ceramic	OPTISENS PH 9100: open; OPTISENS PH 9500: ceramic
Connector	VarioPin (VP)	DIN-Coax or VarioPin (VP)	DIN-Coax or VarioPin (VP)	DIN-Coax
Cables	Cables in various length available			




ORP sensor with large platinum ring for reliable and precise measurement in all water applications	pH sensor with PTFE diaphragm for water and wastewater applications	pH sensor with ceramic diaphragm for water and wastewater applications	ORP sensor with large platinum ring for water and wastewater applications
<b>OPTISENS ORP 8500</b>	<b>OPTISENS PH 8390</b>	<b>OPTISENS PH 8590</b>	<b>OPTISENS ORP 8590</b>
			
ORP	pH	pH	ORP
Ø12/120 mm length 0.5/4.7" length PG 13.5	20/23 or 44 mm insertion length 0.6/0.9 or 1.7" insertion length 3/4" NPT (male) sensor connection	20/23 or 44 mm insertion length 0.6/0.9 or 1.7" insertion length 3/4" NPT (male) sensor connection	20/23 or 44 mm insertion length 0.6/0.9 or 1.7" insertion length; 3/4" NPT (male) sensor connection
-1500...+1500 mV	0...14 pH	0...14 pH	-2000...+2000 mV
-5...+70°C; +23...+158°F	-5...+80°C; +23...+176°F	-5...+80°C; +23...+176°F	-5...+80°C; +23...+176°F
Max. 2 bar; 30 psi	Max. 5.9 bar; 85 psi	Max. 5.9 bar; 85 psi	Max. 5.9 bar; 85 psi
>150 µS/cm	>150 µS/cm	>150 µS/cm	>150 µS/cm
Pipe installations, Immersion installations	Pipe installations, Immersion installations	Pipe installations, Immersion installations	Pipe installations, Immersion installations
-	Pt100	Pt100	Pt100
Glass, platinum electrodes, EPDM gasket	CPVC, glass	CPVC, glass	CPVC, platinum electrode
Ceramic	PTFE Double junction	Ceramic Double junction	Ceramic Double junction
DIN-Coax	4-pin connector or attached cable	4-pin connector or attached cable	4-pin connector or attached cable
Cables in various length available			




## Measuring system

	Optical measuring system for sedimentation profile measurement and continuous tracking of sludge blanket
	<b>OPTISYS SLM 2100</b>
	
<b>Parameter</b>	Sludge blanket and fluff level
<b>Measuring principle</b>	Optical - transmitted light
<b>Design</b>	Compact measuring system with KROHNE HMI and immersion sensor
<b>Measuring range</b>	0...10m; 0...33 ft (0.1...30 g/l)
<b>Measuring modes</b>	1. Profile measurement (height and concentration) 2. Sludge blanket and fluff level 3. Zone tracking (continuous measurement)
<b>Ambient temperature</b>	-20...+50°C; -4...+122°F
<b>Process temperature</b>	0...+60°C; +32...+140°F
<b>Enclosure rating</b>	IP54 (enclosure), IP68 (sensor)
<b>Communication</b>	2 x 4...20 mA current output (active)
<b>Power supply</b>	230 VAC (-15%/+10%) at 50 Hz (±10%)
<b>Other features</b>	Possibility for connection of a maintenance switch, 2 x rake guard switches and 2 x programmable relays; Build-in heater, ventilation; switchable height and depth measurement; flush cleaning unit for sensor and cable (optional)



## Converter

	Signal converter
	<b>MAC 100</b>
	
<b>Type</b>	Wall and pipe mounted
<b>Housing</b>	Die-cast aluminium field housing (IP66)
<b>Display</b>	Graphic display, 128 x 64 pixels
<b>Inputs</b>	1 or 2 sensor inputs
<b>Signal transmission</b>	-
<b>Parameter</b>	pH, ORP, conductive and inductive conductivity, Cl <sub>2</sub> , ClO <sub>2</sub> , O <sub>3</sub> , dissolved oxygen, turbidity
<b>Ambient temperature</b>	-15...+55°C; +5...+131°F
<b>Outputs</b>	3 x 4...20 mA, galvanically isolated
<b>Relay</b>	3 x mechanical relays (NO and NC), fully programmable
<b>Power supply</b>	100...230 VAC, 50/60 Hz; 24 VAC/DC
<b>Other features</b>	Calibration and status logbook temperature compensation, control input (e.g. hold function, flow alarm)
<b>Approvals</b>	CSA general purpose



## Wastewater sensors

	Amperometric sensor for dissolved oxygen measurements with easy exchangeable electrode cartridge	Low maintenance optical sensor for dissolved oxygen measurements, with automatic cleaning, no recalibration required	90° scattered light sensor for turbidity measurements with NIR-LED for long-term stability and automatic cleaning
	OPTISENS ADO 2000	OPTISENS ODO 2000	OPTISENS TUR 2000
			
Parameter	Dissolved oxygen	Dissolved oxygen	Turbidity
Measuring principle	Amperometric, Clark type	Optical, luminophore disc	90° scattered light, Near Infrared (NIR) - LED
Type	Digital sensor with 4...20 mA current output or for connection to MAC 100	Digital sensor with 4...20 mA current output or for connection to MAC 100	Digital sensor with 4...20 mA current output or for connection to MAC 100
Measuring range	0...20 mg/l	0...20 mg/l	0.001...4 NTU/FNU, 0.01...40 NTU/FNU, 0.1...400 NTU/FNU; measuring range is preconfigured at KROHNE (400 NTU is standard)
Measuring accuracy	±1% of reading	±0.1 ppm at <1 ppm; ±0.2 ppm at >1 ppm	<1% or 0.001 NTU/FNU
Temperature range	0...+50°C; +32...+122°F	-5...+50°C; +23...+122°F	0...+50°C; +32...+122°F
Pressure range	Max. 6 bar; 87 psi	Max. 1 bar; 14.5 psi	Max. 1 bar; 14.5 psi
Min. conductivity	-	-	-
Installation conditions	Immersion installation	Immersion installation	Immersion installation
Materials	Body: stainless steel	PVC	PVC
Enclosure rating	IP68	IP68	IP68
Cables	Attached cable 10 m/32.8 ft, 15 m/49 ft	Attached cable 10 m/32.8 ft, 20 m/65.6 ft or 30 m/98.4 ft	Attached cable 10 m/32.8 ft, 20 m/65.6 ft or 30 m/98.4 ft
Other features	Integrated temperature compensation; one-point air calibration, plugable electrode cartridge	Integrated temperature compensation; membrane life >1 year (not exposed to sunlight); cleaning hose connection	Cleaning hose connection

## Measuring systems

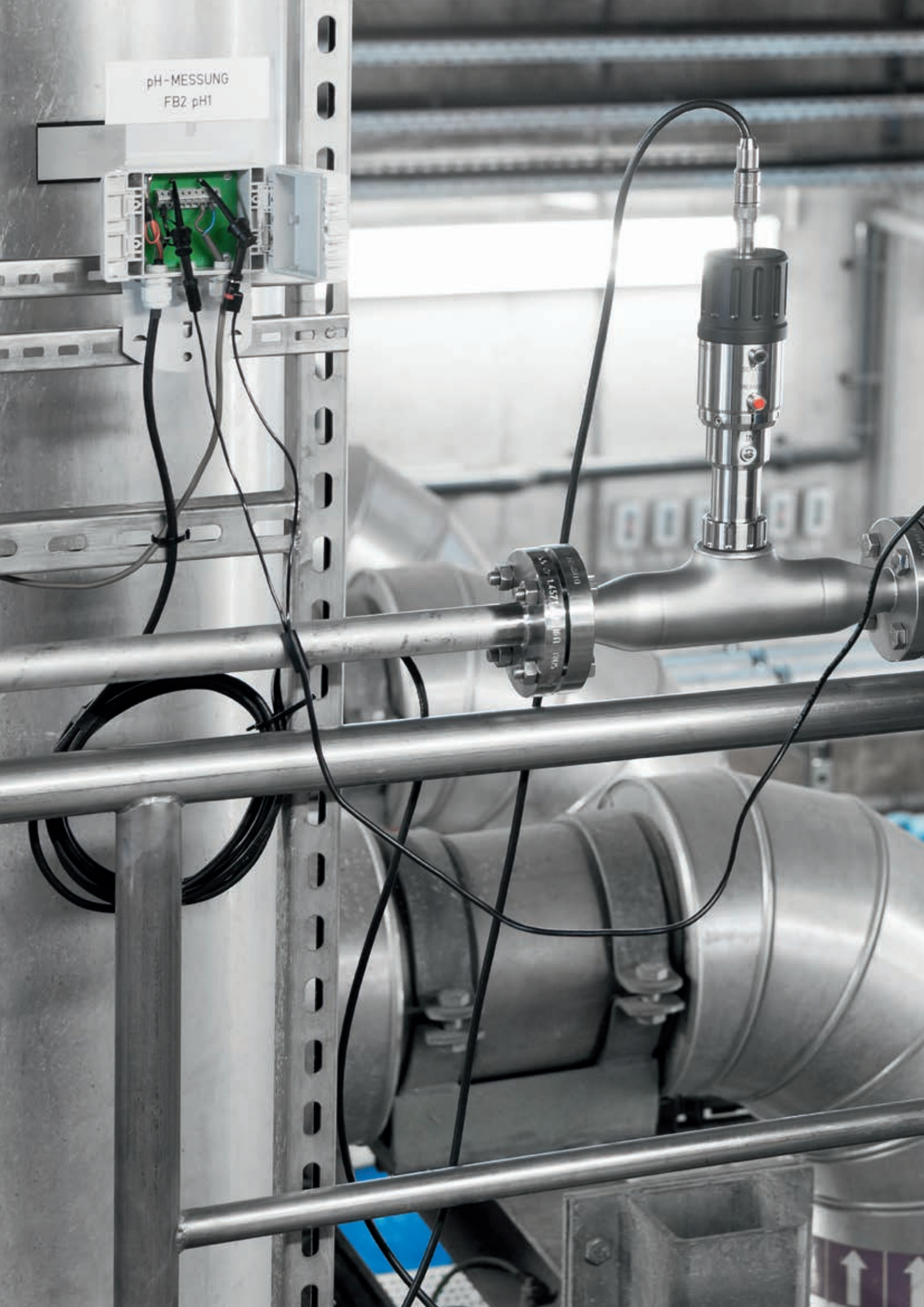
	Inductive measuring system for various industries and applications	Hygienic inductive conductivity measuring system in stainless steel for the food and beverage industry
	OPTISYS IND 7100	OPITSYS IND 8100
		
Parameter	Inductive conductivity	Inductive conductivity
Type	Compact measuring system incl. converter	Compact measuring system incl. converter
Enclosure rating	IP67	IP67 / IP69 K
Measuring range	0.5...2000 mS/cm Concentration of caustic soda and nitric acid or customer defined	0.05...1000 mS/cm Concentration of caustic soda and nitric acid or customer defined
Temperature range	-10...+120°C/+14...+248°F (briefly 140°C/+284°F)	-20...+140°C / -4...+285°F (150°C/302°F < 1 hour)
Pressure range	Max. 10 bar; 145 psi	Max. 25 bar; 362 psi
Process connection	MK DN50 DIN 11851 screwed pipe fitting	G1B hygienic, rotating Multiple mounting adapters
Materials	Converter: PA Sensor: PEEK	Converter: stainless steel (1.4301/304) Display: Polycarbonate Sensor: PEEK Mounting adapters: stainless steel (1.4404/316L)
Installation conditions	Pipe-installations	Pipe-installations
Outputs	2 x 4...20 mA (active)	3 x 4...20 mA
Power supply	19...31 VDC (24 VDC nominal)	15...35 VDC, 150 mA
Relays	2 x electronic relays (optical isolated)	2 x solid state relays in the display
Certificates	-	EHEDG, 3A

## Hygienic sensors

	Conductive conductivity sensor with hygienic connection	Hygienic sensor for inductive conductivity measurements
	OPTISENS COND 7200	OPTISENS IND 7000
		
Parameter	Conductive conductivity	Inductive conductivity
Type	Two-electrode measuring cell with integrated temp. sensor	Inductive measuring cell with integrated temp. sensor
Measuring range	c = 0.01 cm <sup>-1</sup> : 0.05...10 µS/cm c = 0.1 cm <sup>-1</sup> : 1...1000 µS/cm	0.5...2000 mS/cm
Temperature range	-10...+135°C; +14...+275°F	-10...+125°C (briefly +140°C); +14...+257°F (briefly +284°F)
Pressure range	16 bar; 232 psi at +25°C; +77°F	Max. 10 bar; 145 psi at +80°C; +176°F
Process connections	Tri-Clamp DN25	MK DN50 milk cone MK DN65 milk cone Varivent DN40-125 G 1 1/2A G 2A
Installation conditions	Pipe-installations	Pipe-installations
Temperature sensor	Pt100	Pt1000
Materials	Stainless steel	PEEK
Connector /Cable	M 12 connector or 4-pin right-angle plug (Hirschmann)	Attached cable 10 m/32.8 ft
Certificates	3.1 EN 10204, FDA, calibration certificate	FDA, calibration certificate



pH-MESSUNG  
FB2 pH1







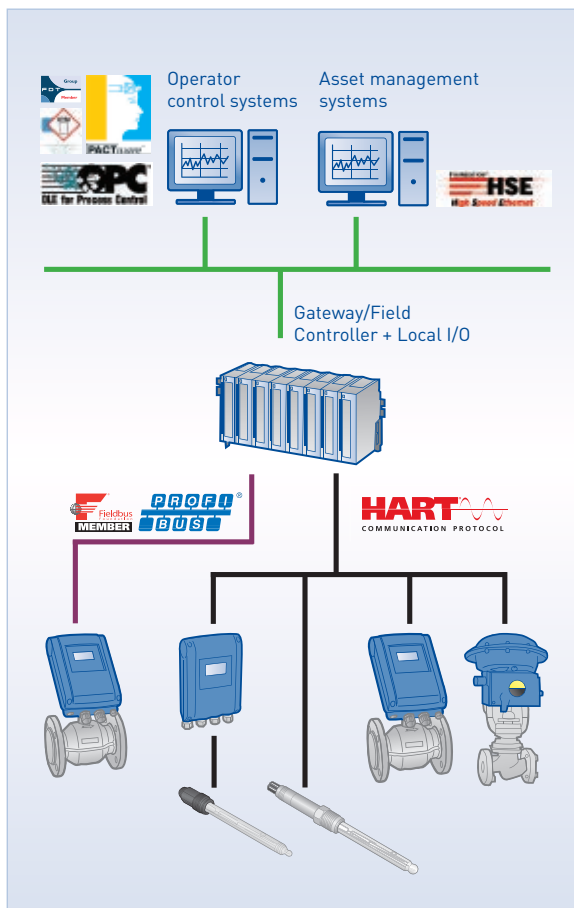
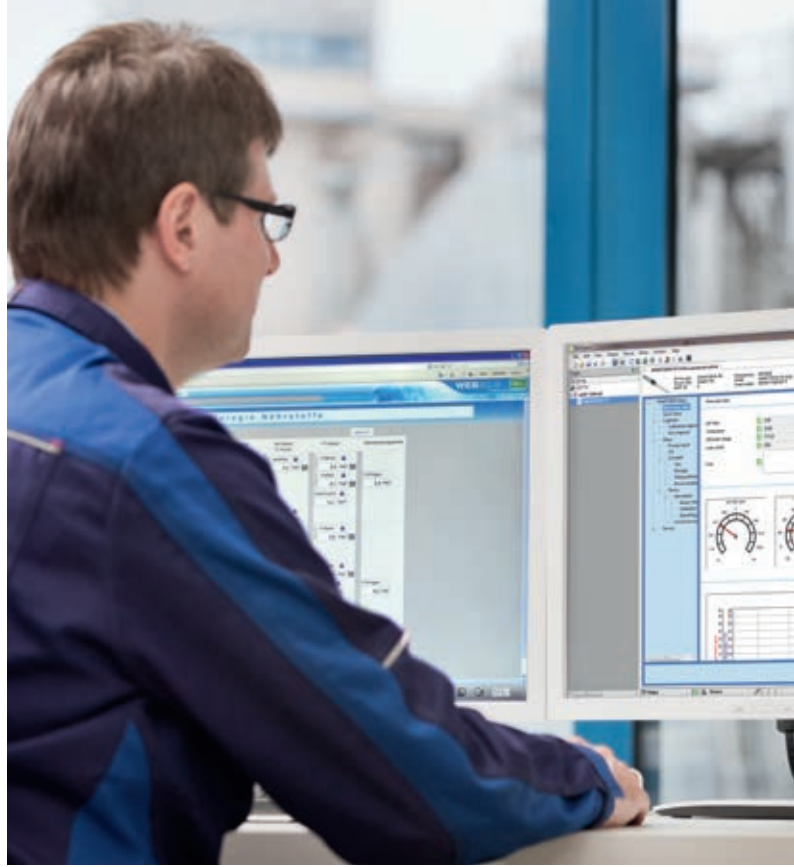
Beyond the highest requirements

## Communication at KROHNE: Open for the future

Industrial automation in the process industry has been undergoing rapid change for the past twenty years. This has also affected industrial measurement technology.

Where centralised and largely self-contained structures once dominated, today the pace is set by intelligent, decentralised architectures. So, system concepts in which the products of a variety of manufacturers work harmoniously together are a reality via open, standard interfaces such as HART®, PROFIBUS® and FOUNDATION™ fieldbus.

KROHNE has been actively following this development for years, whether we are talking about flow measurement, level measurement, temperature measurement or analytical measuring technology. All KROHNE field devices are open for the future. They communicate reliably with asset management systems, control systems and PCs and can also be used for a variety of control and regulating tasks.



## Integration is a top priority at KROHNE

KROHNE field devices meet all of the prerequisites for integration into modern plant asset management systems, based on integration technologies such as DD/EDD and FDT/DTM.

What's so special about FDT/DTM? For the first time, it makes open, bus-independent integration of field technology into a plant asset management system a reality.

This is without a doubt a milestone for industrial communication and KROHNE, a long-standing member of PACTware and the FDT group, has played and continues to play a significant role. So it is no wonder that we have made DTMs available for our field units with HART® and/or PROFIBUS® interfaces since the beginning of 2003.



Overview buffer and reference solutions	
Parameter	Solution
pH	pH 4 red pH 7 green pH 10 blue
Conductivity	0.015 mS/cm 0.147 mS/cm 1.413 mS/cm 25 mS/cm
ORP	468 mV 220 mV
Dissolved oxygen	Sodium sulfite
Sensor cleaning	Pepsin Thiocarbamide
Solution for storage and regeneration of pH and ORP sensors	3 M KCl solution

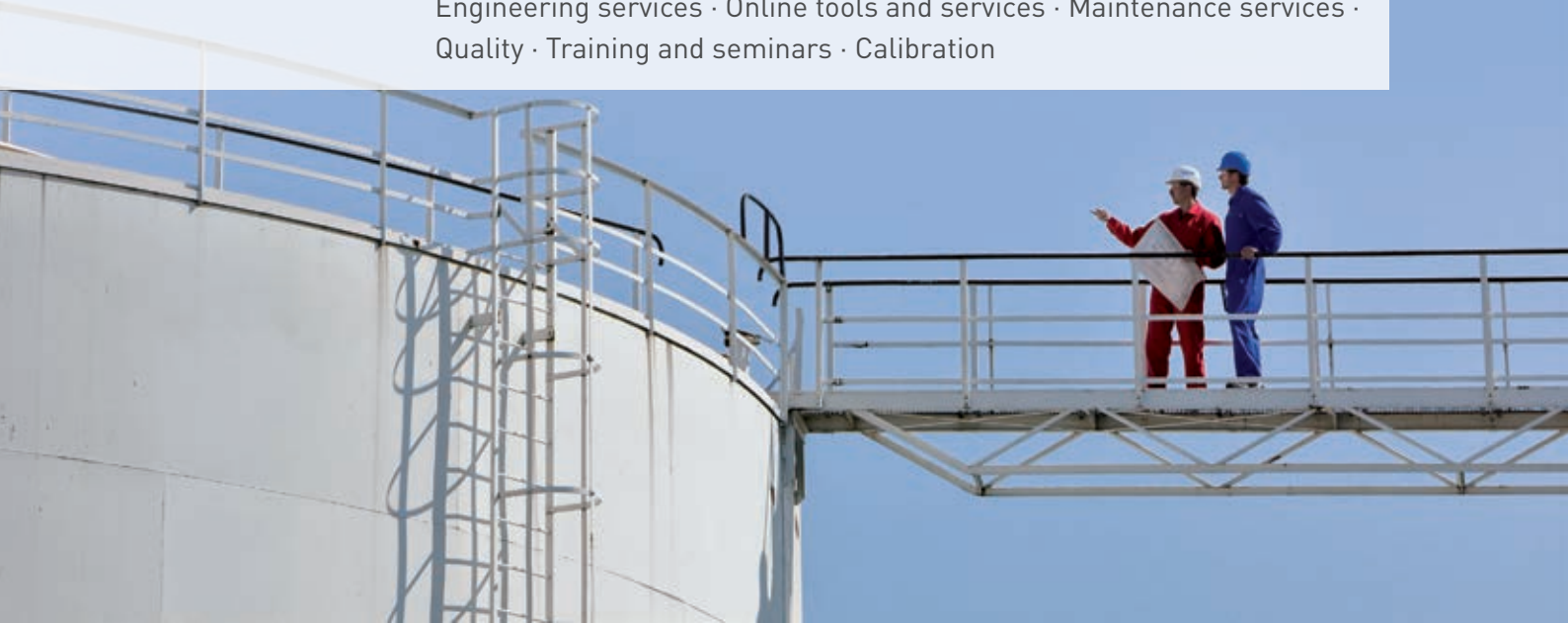
### Supply of spare parts and consumables

- Various calibration solutions
- Cables in various lengths
- Spare parts and consumables for OPTISYS measuring systems
- Etc.



## KROHNE services

Engineering services · Online tools and services · Maintenance services ·  
Quality · Training and seminars · Calibration



## Beyond the highest requirements

For us, service starts at our first contact with you and lasts as long as the life of our systems installed at your plant.

Quality and reliability are key to maintaining the highest service standards. All KROHNE feeder factories are ISO 9001 certified. In fact, long before ISO 9000 existed, KROHNE was already manufacturing to the highest industrial standards. Now certification exists in every factory to demonstrate that we not only fulfil ISO requirements but have passed the ISO certification procedure every three years since the standard was introduced.

But it's not simply a one-way process. We actively encourage companies like yours to participate in our research and development activities. Many of our products that are today considered the pinnacle of excellence were developed in cooperation with our customers.

### Engineering services through all project stages

- Project management
- Control and asset management systems in project concept phase
- Basic engineering based on the specification required by the user
- Detail engineering phase
- Commissioning services
- On-site start-up and commissioning
- Product training (on-site)
- Calibration services

### Proven quality

Before shipping, every meter is thoroughly inspected. This rigorous programme of specific measurements, tests and factory inspections is called KROHNE proved.

So, if you install and operate any KROHNE product by following our operating instructions correctly, problems shouldn't occur. If they do, we will provide you with all the technical support and service you need.

Choose from maintenance and service contracts tailored to suit all business sizes and needs:

- Spare parts and consumables
- Field service and on-site repair
- Returns
- Workshop repair
- Helpdesk

### KROHNE Academy and KROHNE Academy online

The KROHNE Academy is a series of seminars organised in collaboration with leading automation companies aimed at plant engineers, operators and contractors across the process industries. It brings industry experts together to provide an insight into the various technologies, industrial standards and procedures that plant operators can find themselves faced with.

Taking place in various countries, KROHNE Academy seminars address key operating issues, from plant safety to ways of increasing plant efficiency and controlling costs, and show possible solutions. They also provide an ideal opportunity for you to speak to the experts and benefit from their vast application knowledge.

Learn more about KROHNE Academy at [www.krohne.com](http://www.krohne.com)

KROHNE Academy online is a free eLearning platform that contains audio-enhanced, interactive Web Based Trainings. As with its on-site seminars, the online KROHNE academy learning material is vendor-agnostic and not specific to individual products and/or industries. The main focus of each course is on a measurement technology such as Variable Area, Vortex, Ultrasonic or Mass flow or to a more general topic such as the basics of gas measurement or pipeline leak detection.

Register now for free and start your training at <http://academy-online.krohne.com>

Please check [www.krohne.com](http://www.krohne.com) for your local service contact.

### Additional online services:

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- **Configure It**  
Configure It is a highly advanced online configuration tool for standard devices offering free 2D/3D CAD data of KROHNE flow devices for planning engineers. It enables you to configure any KROHNE product to handle your application in a few simple steps.
- **KROVASYS 4**  
Selection and calculation tool for variable area flowmeters.
- **Planning tool for water & wastewater industry**  
The planning tool for wastewater treatment plants as well as water and wastewater applications for generating tender documents covering flow, level, analysis, pressure and temperature.
- **PiCK**  
Get any information related to your KROHNE product from our dedicated online resource PiCK. Just enter your serial number, and key material like manuals, Quick Starts and calibration documents is at your fingertips.

## KROHNE – Process instrumentation and Measurement solutions

- Flow
- Level
- Temperature
- Pressure
- Process analysis
- Services



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