On-Line pH/ORP Measurement

Measuring · Monitoring · Controlling

- Wastewater Treatment Facilities
- Water Treatment Utilities
- Neutralization Plants
- Surface Waters and Groundwater
- Food Industry
- Chemical Production
- Industrial Processes

pH is one of the most important analysis parameter measured throughout the water, wastewater and many process industries. In the biological treatment of wastewaters, for example, the acidic or alkaline condition of the mixed liquor has an essential influence on the activity of the microorganisms; i.e., continuous on-line pH control is required. Precise and reliable systems for pH monitoring and control are also necessary in drinking water plants and in a variety of industrial process technologies.

Over the last 50 years, WTW have been designing and manufacturing precision systems for pH measurement. Ongoing research and development coupled with innovative ideas have resulted in novel methodologies and sophisticated products that have set technological milestones time and time again. WTW`s technical expertise and long experience in this field are the reason that our on-line pH instruments are now recognized for their excellent performance, reliability and product quality.

Neutralization/Precipitation/Detoxification

Both in water and wastewater treatment and also in industrial processes pH is of great practical importance. The acidity or alkalinity of a process medium plays a key role in many chemical or biological reactions as well as in mechanical/ physical actions. A number of reactions – in precipitation and detoxification, for example – may only take place if the pH condition is properly controlled. A "misadjusted" pH can cause a variety of serious effects, of which corrosion is the most common. Therefore, at a low or high pH **neutralization** treatment often is required.

In the area of **municipal and industrial wastewater** treatment extreme pH conditions may result in the following harmful effects:

- Microorganisms in biological purification processes are sensitive to acidic and alkaline conditions. Therefore, the pH of the sewage is supposed to be in the neutral range of pH 7. At pH levels of less than 5 or larger than 10 the activity of the bacteria practically ceases.
- pH values of 6.5 and lower result in gradual destruction of metallic materials and mechanical components, and even in damage of the sewer network.
- The solubility of many substances varies with the pH level and temperature. Undesirable and obstructive precipitation of solids may be the result.

Today's legislative regulations and environmetal directives in many countries already require that trade effluents may only be discharged into municipal sewer systems if the pH is between 6.5 and 8.5. For this reason, industrial dischargers, for instance, breweries and dairies, often have to pretreat its effluent in a **neutralization** plant.

pH Control System

Neutralization, precipitation and detoxification not only require continuous pH measurement but also an efficient **pH control system**. In less demanding applications, such as stable processes with slowly changing conditions, a simplified 2-point logic control may be adequate. In many cases, however, a proportional control loop is considerably more efficient and also economical with regard to dosing of flocculants or neutralization chemicals.

pH measuring technology by WTW

WTW`s complete line of pH/ORP instrumentation comprises sensor assemblies, monitors and system components for a wide range of applications.

In addition to the well proven SensoLyt® sensor assemblies, which are widely used in wastewater facilities, the product line includes ruggedized sensor assemblies for in-line measurements in industrial processes.

The proven monitors of the 170 and 296 series have a PIF control algorithm. A special measuring transducer as well as sensors and accessories are available for use in explosion-proof areas (see brochure "Product Details").

The IQ Sensor Net and the IQ sensors open up a whole new realm of technology with features such as an immense degree of flexibility and "sensors which can be pre-calibrated in the laboratory".

Sensolyt®
pH/ORP Sensor Systems

SensoLyt® 700 *SensoLyt® 700 IQ*

SensoLyt® System Design

For continuous pH/ORP measurement, especially under the difficult conditions very often found in sewage treatment facilities, very high demands are made concerning the reliabilty and operating safety of the systems employed. For more than three decades, WTW`s field-proven pH/ORP measuring systems can satisfy these requirements to the fullest.

Designed specifically for these harsh applications, the SensoLyt® sensors are precision engineered assemblies, which consist of a submersible housing with a built-in preamplifier and the appropriate combination pH or ORP electrode. In combination with our high-performance monitors, the sensors constitute an integrated, extremely reliable pH/ORP measuring system which represents the highest standard, state-of-the-art technology with regard to accuracy, EMC noise immunity and economy.

The digital technology of the IQ sensors, which can store calibration values directly in the sensor, offer particular advantages. This feature allows the user to calibrate the sensor in the laboratory and then return it to its location of use. Its sensor's quick coupler permits direct reintegration into the system.

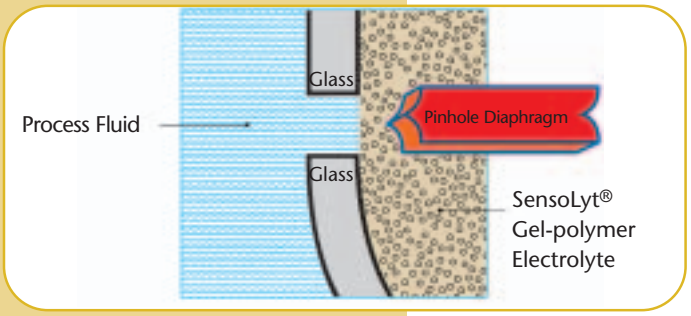
- **Low interference**
- **Sensor check function for glass breakage detection**
- **Robust mechanical design**
- **Simple change of pH electrode**
- **Pre-calibration of sensor possible (SensoLyt® 700 IQ)**
- **Combination electrodes for diverse applications**

IQ Sensor connection

SensoLyt® Combination Electrodes

The reliability of pH and ORP measurements are determined to a large extent by the quality of the pH/ORP electrode which commonly is exposed to extreme conditions; particularly in many industrial applications. With its special design, WTW Sensolyt® combination electrodes are superior to conventional electrodes in terms of failures and durability.

The design of the applied reference system used is crucial to the overall performance of an electrode. In Sensolyt® combination electrodes the reference is a conventional Ag/AgCl/Cl electrode system, completely embedded in a pressure resistant solid gel-polymer electrolyte. As concentration changes in gel-type electrolyte occur very slowly, i.e. the electrochemical characteristic of the cell is unchanged, a stable and constant reference potential will be achieved.



With this electrode design, the polymer matrix/process fluid interphase consists of a pinhole diaphragm; i.e. an electrical flux is established through two fine holes in the cell of the reference system. Such a diaphragm especially reduces the risk of failures.

In addition, Sensolyt® combination electrodes require very little maintenance as there is no electrolyte replacement.

NEW

SensoLyt® SEA-HP

SensoLyt® SEA / SE*

This pressure and temperature resistant combination pH electrode incorporates a double pin-hole diaphragm and a gel polymer solid electrolyte, which is AgCl free and therefore resistant to sulfides. This pH electrode is specially designed for use in moderately to highly polluted municipal and industrial wastewater.

Measuring range: pH 2 ... 12
- Highly contaminated sewage
- Emulsions and suspensions
- Media containing proteins and sulfides

SensoLyt® SEA-HP

Analog SensoLyt® SEA version, with optimized armoring for use under high pressure / temperature conditions.

Measuring range: pH 4 ... 12
- Inline measurement in pipes

SensoLyt® DWA / DW*

The DWA pH electrode is specially suitable for drinking water measurements. Its long service life and precise measurement make it stand out from the crowd, in particular for measurements of drinking water with low conductivity.

Measuring range: pH 0 ... 14
- Drinking water

SensoLyt® ECA / EC*

This combination pH electrode has a single pin-hole diaphragm and a gel electrolyte. With its long-term stability it provides an economical solution, particularly in most wastewater facilities.

Measuring range: pH 2 ... 12
- normally polluted wastewater

SensoLyt® PtA / Pt*

Similar to the Sensolyt® SEA regarding its design features and electrochemical characteristics, the Sensolyt® PtA is a combination ORP electrode. It is also fitted with a pinhole diaphragm, and is primarily recommended for applications in heavily contaminated wastewater.

Measuring range: ± 1000 mV
- Municipal and industrial sewage
- Emulsions and suspensions
- Media containing proteins and sulfides

** electrode without armor for direct use in flow-thru vessels*

SensoLyt® Sensor Assemblies

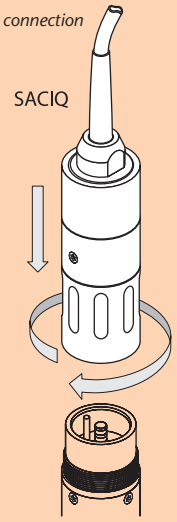
SensoLyt® sensor assemblies perform multiple functions:
- **preamplification** of the electrode signal
- holder for an integrated NTC sensor for **temperature measurement**
- reliable **protection** of the installed pH-electrodes against mechanical damage
- Digital signal processing with calibration value storage (IQ sensors)

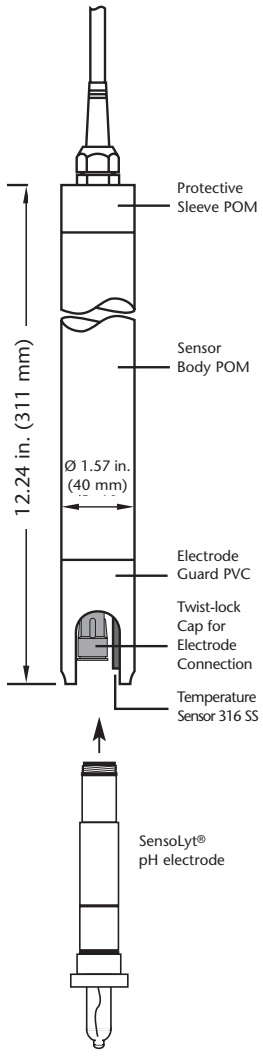
The very low voltage signal delivered by the pH/ORP electrode is very susceptible to noise and ground-loop interferences. For this reason WTW has integrated a pre-amplifer in the sensor assemblies. Its amplification and impedance conversion assure low-impendance and thus reliable signal transmission over long distances; e.g. required for operation with remotely installed monitors. In addition, electrical isolation of the preamplifier prevents influences from external field potentials.

SensoLyt® sensor assemblies feature a built-in NTC thermistor for temperature measurement and automatic temperature compensation. This enables both pH or ORP and temperature to be measured simultaneously with a single probe.

Under the rigorous operating conditions of an industrial plant, e.g. a wastewater treatment plant, the rugged design of the housing provides important mechanical protection of the glass pH electrode. For service purposes, the electrode can be replaced in the field without tools.

IQ Sensor connection





Analog

SensoLyt® 700

The SensoLyt® 700 standard assembly incorporates an integrated preamplifier and a built-in stainless steel NTC sensor. When using a WTW monitor, a special circuitry allows the pH electrode to be monitored for glass breakage. In addition, the SensoLyt® 700 offers as a standard feature an efficient lightning protection system. The SensoLyt® 700 sensor assembly can be fitted with any combination electrode of the SensoLyt® series. It is compatible with all WTW monitors of the EcoLine and QuadroLine® Series.

SensoLyt® 690

Same as SensoLyt® 700, but without the SensCheck function.

SensoLyt® 650

The SensoLyt® 650 unit is a passive assembly without preamplifier; i.e., it is designed for "high-impedance operation" with the electrode connected directly to the monitor input. The assembly is directly compatible with the high-impedance input of following WTW monitors: pH 170 and pH 296 models.

Digital

SensoLyt® 700 IQ

Digital pH/ORP armature with integrated preamplifier and lightning protection as well as digital signal processing and integrated temperature probe for connection to an IQ SENSOR NET. A special circuiting permits glass breakage detection monitoring. Due to the integrated calibration value memory, a "pre-calibrated pH measurement", the value of which is stored in the sensor, can be set in the laboratory. The sensor's quick release coupling allows the user to remove it from the location of use and return it after successful calibration in the laboratory. With an IQ connection in the laboratory, inconvenient field calibration under adverse conditions can be completely eliminated.

Technical Data SensoLyt® Sensor Assemblies

SensoLyt®	700	690	650	700 IQ
Integrated Preamplifier	Yes	Yes	No	Yes
Signal output	Low impedance, analog	Low impedance, analog	High impedance, analog	Digital
Sensor check function	Yes	No	No	Yes
Sensor memory for calibration values	–			Yes
Power consumption	–			0.2 Watt
Temperature measurement	Integrated NTC, 32 … 140 °F (0 … +60 °C)			Integrated NTC , 23 … 140 °F (-5 … +60 °C)
Ambient conditions	Operating temperature: 32 … 140 °F (0 … +60 °C)			Operating temperature: 32 … 140 °F (0 … +60 °C)
Electrical connections	integrated PU connecting cable with fitted 7-pole screw connector (IP 65)		Integral PU connecting cable with bare cable ends	2-wire shielded cable with quick fastener to sensor
Transient voltage protection	Yes			Yes
EMI/RFI Conformance	EN 61326 class B, FCC Class A			EN 61326 class B, FCC Class A
Certifications	CE, CUL, UL			CE, UL, CAN/CSA
Mechanical	Sensor body: POM Protective cap: PVC Protection rating: IP 68			Sensor body: 316 Ti stainless steel Protective cap: PVC Sensor holder: POM Protection rating: IP 68
Dimensions (L x D)	12.24 x 1.57 in. (311 x 40 mm)			20 x 1.57 in. (508 x 40 mm)
Weight	Approx. 2.2 lb (1 kg)			1.46 lb (660 g, without cable)

Technical Data SensoLyt® Combination Electrodes

	SEA / SE*	SEA-HP	DWA / DW*	ECA / EC*	PtA / Pt*
Electrode type	Gel-polymer solid electrolyte double pinhole diaphragm		Modified gel electrolyte ceramic diaphragm	Gel electrolyte single pinhole diaphragm	Gel-polymer solid electrolyte double pinhole diaphragm
Operating conditions (Overpressure/temperature)	10 bar/68 °F (20 °C) 1 bar/140 °F (60°C) 32...140 °F (0...60 °C)	10 bar/140 °F (60°C) 32...140 °F (0...60 °C)	6 bar / 68 °F (20 °C) 1 bar / 140 °F (60°C) 32 … 140 °F (0 … 60 °C)	6 bar / 68 °F (20 °C) 1 bar / 140 °F (60°C) 32 … 140 °F (0 … 60 °C)	10 bar / 68 °F (20 °C) 1 bar / 140 °F (60°C) 32 … 140 °F (0 … 60 °C)
Measuring range	2 … 12 pH	4 … 12 pH	0 … 14 pH	2 … 12 pH	±1000 mV
Mechanical	Cylindrical glass membrane, armored version with PVC armouring (SEA-HP: POM), 2 Viton O-ring seals for mounting into SensoLyt® sensor assemblies				
Dimensions	Length 4.72 in./120 mm (without plug head)				
Electrical connections	Watertight plug head connector				
	*** Electrode without armor, e.g. for direct use in flow-thru vessels**				

Ordering Information pH/ORP Sensors

	Analog sensors	Order No.
SensoLyt® 700-7	pH/ORP sensor with integrated preamplifier; cable length 7.66 yds (7.0 m)	109 191
SensoLyt® 690-7	Same as model 700-7, but without SensCheck function	109 180
SensoLyt® 650-7	pH/ORP sensor for high impedance operation; cable length 7.66 yds (7.0 m)	109 195
	Digital sensors	
SensoLyt® 700 IQ	pH/ORP sensor for combination electrodes SensoLyt® SEA, DWA, ECA, PtA	109 170
SACIQ-7,0	Sensor connection cable for all IQ sensors, cable length 7.66 yds (7.0 m)	480 042
	Combined electrodes	
SensoLyt® SEA	pH combination electrode, measuring range 2 … 12 pH, for mounting into SensoLyt® sensor assemblies	109 115
SensoLyt® SEA-HP	pH combination electrode, measuring range 4 … 12 pH, for mounting into SensoLyt® sensor assemblies	109 118
SensoLyt® DWA	pH combination electrode, measuring range 0 … 14 pH, for mounting into SensoLyt® sensor assemblies	109 119
SensoLyt® ECA	pH combination electrode, measuring range 2 … 12 pH, for mounting into SensoLyt® sensor assemblies	109 117
SensoLyt® PtA	ORP combination electrode, measuring range ± 1000 mV, for mounting into SensoLyt® sensor assemblies	109 125
SensoLyt® SE	Same as model SEA, but without armor; e.g. for direct use in flow-thru vessels	109 100
SensoLyt® DW	Same as model DWA, but without armor; e.g. for direct use in flow-thru vessels	109 103
SensoLyt® EC	Same as model ECA, but without armor; e.g. for direct use in flow-thru vessels	109 102
SensoLyt® Pt	Same as model PtA, but without armor; e.g. for direct use in flow-thru vessels	105 412
	Further cable lengths and buffer solutions see brochure "Product Details"	

InTrac® 777-SLM

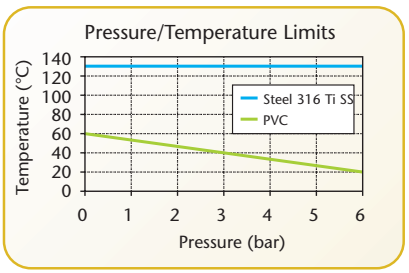
Valve Assembly for Sensor Insertion/Retraction

- **Installation in pipes or pressure vessels**
- **Complete separation of the process fluid from the environment**
- **Sensor locking device as safeguard**
- **Pressure resistant electrode with polymer electrolyte**

For many years InTrac® valve assemblies have been successfully used for in-line pH measurement in industrial process applications. The devices are designed for installation in pipes or vessels, and permit manual insertion and retraction of the pH sensor without interrupting the process flow. InTrac® assemblies offer an enhanced reliability and safety for use under tough process conditions; e.g., measurement in pressure vessels.

The InTrac® 777-SLM is a series of high-performance valve assemblies which meet the increasingly stringent requirements of the industrial market place. In particular, the devices satisfy the high safety criteria currently set for process equipment by using a state of the art technology. In combination with WTW monitors the InTrac® 777 sensor valve assemblies provide versatile and integrated pH measurement systems for a variety of industrial applications.

The InTrac® 777-SLM is available in two different models: Depending on the application the wetted parts are made from PVC or stainless steel. The main difference between these two models is their stability to varying pressure/temperature conditions (see diagram below).



XEROLYT® Combination pH Electrode

HA 405-DXK-S8/225 *InPro 4250/225/Pt100*

The InTrac® 777-SLM valve assemblies are fitted with combination pH electrodes with a XEROLYT® reference system. Using a polymer electrolyte, this system is superior to conventional design with gel- or paste-type electrolytes with regard to operating reliability and working life. The twist-lock connector allows easy cable connection and simple electrode replacement.

- Electrode with double pinhole diaphragm
- Very low maintenance, because of polymer electrolyte: no electrolyte refilling required
- Especially suitable for polluted or solutions containing sulfide
- Electrode with built-in temperature sensor available

Electrodes for InTrac® 777-SLM

HA 405-DXK-S8/225
pH electrode without temperature sensor; with S8 plug head connection

InPro 4250/225/Pt100
pH electrode with built-in temperature sensor and VARIOPOL plug connection

System compatibility

The pH combination electrodes are connected directly to the high-impedance input of the model pH 170 and pH 296 monitors with the suitable connection cable. If there is a long distance between the measuring point and the monitor then the KI/pH 170 terminal box must be included. This ensures low-impedance interference-free signal transmission to the monitor (not in combination with InPro 4250). The terminal box also allows the connection of a temperature sensor if automatic temperature compensation is required.

Technical Data XEROLYT® pH Combined Electrodes

	HA 405-DXK-S8/225	InPro 4250/225/Pt100
Measuring range	pH 2 ... 14	pH 2 ... 14
Operating Temp.	32 ... 230 °F (0 ... 110 °C)	32 ... 230 °F (0 ... 110 °C)
Temperature sensor	–	Pt 100
Electrode type	Polymer electrolyte containing KCl, double pinhole diaphragm	Polymer electrolyte containing KCl, double pinhole diaphragm
Max. pressure range	16 bar / 77 °F (25 °C); 6 bar / 212 °F (100 °C)	16 bar / 77 °F (25 °C); 6 bar / 212 °F (100 °C)
Length	8.86 in. (225 mm)	8.86 in. (225 mm)
Connection	S8 plug head / IP67	VP plug / IP 67

Technical Data InTrac® 777- SLM

Construction	Positioner/Valve assembly for manually retracting/inserting XEROLYT® pH combination electrode; wetted materials PVC or stainless steel
Insertion depth	2.76 in. (70 mm)
Body material	POM
Wetted parts	Version SLM/PVC: PVC; Version SLM/1.4435: 316 L stainless steel
Solution chamber	Inlet/outlet: 2 x G 1/8"; 1 x G 1/4"; Pressure range: 2-6 bar

Ordering Information

	Sensor Valve Assemblies	Order No.
InTrac® 777-SLM/70/PVC	Manually operated valve assembly, wetted material PVC	109 223
InTrac® 777-SLM/70/1.4435	Manually operated valve assembly, wetted material 316 Ti stainless steel	109 224
	Sensors	**Order No.**
HA 405-DXK-S8/225	Combination pH electrode for InTrac® 777-SLM models	109 226
InPro 4250/225/Pt100	pH combination electrode for InTrac® 777-SLM models, with built in Pt100 temperature sensor	109 231

Configuration Guide

			pH 170 Field Monitor	pH 296 Panel Mount	IQ Sensor Net
Analog	**SensoLyt® 650 Sensor Assembly** w/o preamplifier, high-impedance output, integrated temp. measurement, 32...122 °F (0...50 °C)	Compatible electrodes: SEA: 2...12 pH SEA-HP: 4...12 pH DWA: 0...14 pH ECA: 2...12 pH PtA: ±1000 mV 32...140 °F (0...60 °C)	• Low-cost configuration • High impedance signal transmission • pH measurement in highly polluted wastewater (municipal/industrial) Type SEA • pH measurement in normally polluted wastewater (municipal/industrial) Type ECA • pH measurement in drinking water (DWA) • ORP measurement in highly polluted wastewater (municipal/industrial) Type PtA • Inline installation (SEA or SEA-HP)		—
	SensoLyt® 690 Sensor Assembly w/ integrated pre-amplifier, low-impedance, output, integrated temp., measurement 32...122 °F (0...50 °C)	Compatible electrodes: SEA: 2..12 pH SEA-HP: 4...12 pH DWA: 0...14 pH ECA: 2...12 pH PtA: ±1000 mV 32...140 °F (0...60 °C)	• Low-cost configuration • Low impedance signal transmission • pH measurement in highly polluted wastewater (municipal/industrial) Type SEA • pH measurement in normally polluted wastewater (municipal/industrial) Type ECA • pH measurement in drinking water (DWA) • ORP measurement in highly polluted wastewater (municipal/industrial) Type PtA • Inline installation (SEA or SEA-HP)		—
	SensoLyt® 700 Sensor Assembly w/ integrated pre-amplifier, low-impedance output, integrated temp. measurement 32...122 °F (0...50 °C) and SensorCheck	Compatible electrodes: SEA: 2...12 pH SEA-HP: 4...12 pH DWA: 0...14 pH ECA: 2...12 pH PtA: ±1000 mV 32...140 °F (0...60 °C)	• Low impedance signal transmission • SensCheck • pH measurement in highly polluted wastewater (municipal/industrial) Type SEA • pH measurement in normally polluted wastewater (municipal/industrial) Type ECA • pH measurement in drinking water (DWA) • ORP measurement in highly polluted wastewater (municipal/industrial) Type PtA • Inline installation (SEA or SEA-HP)		—
	InTrac® 777-SLM/70/PVC Valve assembly with flushing for cleaning and calibration **Material: PVC** 6 bar / 68 °F (20 °C) 0 bar / 140 °F (60 °C)	Compatible electrodes: InPro 4250/225/Pt100 2...14 pH 32...122 °F (0...110 °C) HA 405-DXK-S8 2...14 pH 32...230 °F (0...110 °C)	• High impedance signal transmission • In-line pH measurement in process lines or pressure vessels • Reduced pressure/temperature requirements 6 bar / 68 °F (20 °C) 0 bar / 140 °F (60 °C) • Built-in temperature measurement with 4250/225/Pt100		—
	InTrac® 777-SLM/70/1.4435 Valve assembly with flushing for cleaning and calibration **Material:** 316 Ti SS 10 bar / 266 °F (130 °C)	Compatible electrodes: InPro 4250/225/Pt100 2...14 pH 32...230 °F (0...110 °C) HA 405-DXK-S8 2...14 pH 32...230 °F (0...110 °C)	• High impedance signal transmission • In-line pH measurement in process lines or pressure vessels • Increased pressure/temperature requirements 10 bar / 266 °F (130 °C) • Built-in temperature measurement with 4250/225/Pt100		—
Digital	**SensoLyt® 700 IQ**	Compatible electrodes: SEA: 2...12 pH SEA-HP: 4...12 pH DWA: 0...14 pH ECA: 2...12 pH PtA: ±1000 mV 32...140 °F (0...60 °C)	—		• Digital signal transmission • SensCheck • pH measurement in highly polluted wastewater (municipal/industrial) Type SEA • pH measurement in normally polluted wastewater (municipal/industrial) Type ECA • pH measurement in drinking water (DWA) • ORP measurement in highly polluted wastewater (municipal/industrial) Type PtA • Inline installation (SEA or SEA-HP)

– Configuration not possible