On-line pH/ORP Measurement

Measuring · Monitoring · Controlling

pH is one of the most important analysis parameters 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. 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.

On-line pH/ORP

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

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

- Sensor check function for glass breakage detection
- Robust mechanical design
- Simple change of pH electrode
- Pre-calibration of sensor possible (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 reliability and operating safety of the systems employed.

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.

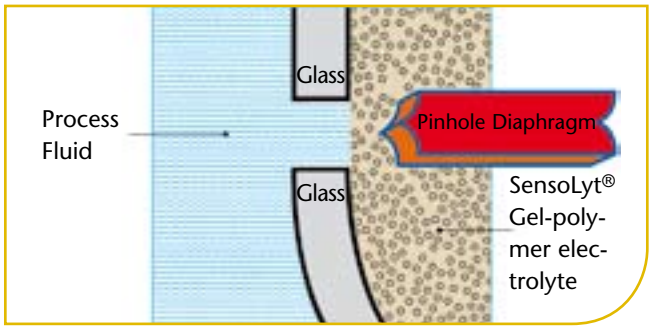
The digital technology of the IQ sensors, which can store calibration values directly in the sensor, offer particular advantages. This feature allows the user to calibrate the sensor in the laboratory and then return it to its location of use. This provides a certain independency, especially in winter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

SensoLyt® 700 *SensoLyt® 700 IQ*

IQ Sensor connection

SensoLyt® Combination Electrodes

- Reliable
- Stable against interference
- Easy to maintain



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.

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.

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.

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*

Especially 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

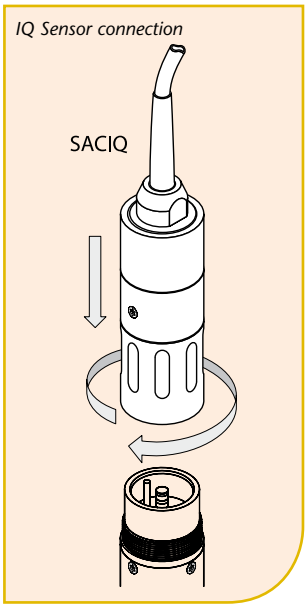
SensoLyt® PtA / Pt*

This ORP electrode is also fitted with a pin-hole diaphragm, and is primarily recommended for applications in heavily contaminated wastewater.

Measuring range: ± 2000 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

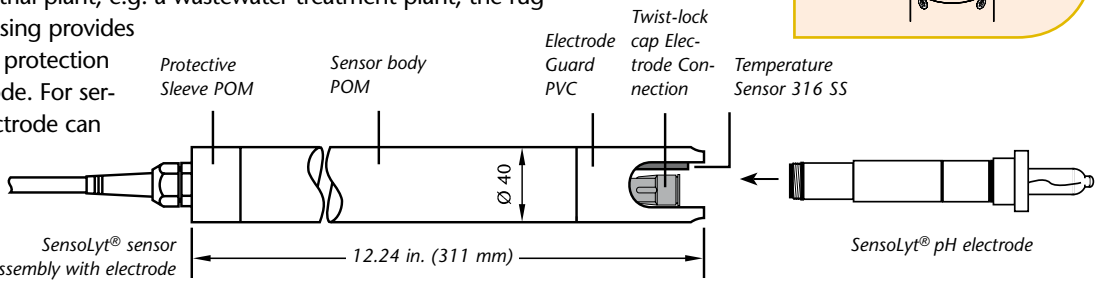


SensoLyt® sensor assemblies perform multiple functions:

- **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 preamplifer 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.

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.



Analog

SensoLyt® 700
The SensoLyt® 700 standard assembly incorporates an integrated preamplifier and a built-in stainless steel NTC temperature 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 or Stratos 2211 X pH 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

Type	Analog			Digital
	SensoLyt® 700 (SW*)	**SensoLyt® 690**	**SensoLyt® 650**	**SensoLyt® 700 IQ (SW*)**
Integrated Preamplifier	Yes	Yes	No	Yes
Signal output	Low impedance, analog	Low impedance, analog	High impedance	Digital
Sensor check funktion	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 connection 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 Intended for indispensable operation
Certifications	CUL, UL			CE, cETLus
Mechanical	Sensor body: POM Protective cap: PVC Protection rating: IP 68			Sensor body: 316 Ti stainess steel Protection cap: PVC Sensor holder: POM Protection rating: IP 68
Dimensions (L x D)	12.24 x 1.57 in. (311 x 40 mm); SW: 15.52 x 2.34 in. (318 x 59.5 mm)			20 x 1.57 in. (508 x 40 mm); SW: 20.78 x 2.34 in. (515 x 59.5 mm)
Weight (without cable)	Approx. 0.71 lb (320 g); SW: approx. 1.94 lb (880 g)			2.14 lb (970 g) SW: approx. 3.97 lb (1.800 g)
Guaranty	2 years for defects of quality			2 years for defects of quality

Technical Data SensoLyt® Combination Electrodes

Type	**SEA/SE****	**SEA-HP**	**DWA/DW****	**ECA/EC****	**PtA/Pt****
Electrode type	Gel-polymer solid electrolyte double pinhole diaphragm		Modified gel electrolyte single pinhole diaphragm	Gel electrolyte single pinhole diaphragm	Gel-polymer solid electrolyte double pinhole diaphragm
Operation 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	±2000 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				
Guaranty	6 months for defects of quality				

Ordering Information pH/ORP Sensors

SensoLyt® Sensors		**Order No.**
SensoLyt® 700-7	pH/ORP sensor with integrated preamplifier; cable length 23 ft. (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 23 ft. (7.0 m) (for SensoLyt® SEA, DWA, ECA, PtA)	109 195
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 23 ft. (7.0 m)	480 042
SensoLyt® Combined electrodes		**Order No.**
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

IP 68 CE cETLus 2 *Year Warranty

*on armature

Further cable lengths, special design (e.g. for seawater) and buffer solutions see brochure "Product Details"

** SW: Sensor in sea water design (with plastic armouring (POM))*
*** Electrode without armor, e.g. for direct use in flow-thru vessels*
**** Depending on monitor*

InTrac® Valve Assemblies

For many years InTrac® valve assemblies have been successfully used for in-line pH and ORP 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.

InTrac® 777M

- Safe operation with overpressure
- Easy and fast handling
- Up to 16 bar and 140° C operatable

The InTrac® 777M is a high-performance valve assembly which meets the increasingly stringent requirements of the industrial practice. In particular, the device satisfies the high safety criteria currently set for process equipment by using a state of the art technology. In combination with WTW monitors the InTrac® sensor valve assembly provides versatile and integrated pH measurement systems for a variety of industrial applications.

InTrac® 777M is dedicated for

- Mounting in pipelines and pressure vessels
- Complete separation of measuring media to environment
- Compression-proof electrode with polymer electrode

The manually operated **InTrac® valve assembly** is available in a robust stainless steel construction, all wetted parts are made of stainless steel 1.4404/316 L. Thus, the valve assembly is operable at pressures of up to 16 bar and at temperatures of up to 291.2 °F (140 °C).

XEROLYT® Combination pH Electrode

The InTrac® 777M valve assembly is 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

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

System compatibility

The pH combination electrodes are connected directly to the high-impedance input of the model pH 170 and pH 296 as well as IQ Sensor Net 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 e.g. KI/pH-MIQ/S 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.

Electrodes for InTrac® 777M

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

Technical Data XEROLYT® pH Combination Electrodes		
Model	**HA 405-DXK-S8/225**	**InPro 4250/225/Pt100**
Measuring range	pH 2 ... 14	pH 0 ... 14
Operating Temp.	32 … 230 °F (0 ... 110 °C)	32 … 266 °F (0 ... 130 °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); 8 bar / 266 °F (130 °C)
Length	8.86 in. (225 mm)	8.86 in. (225 mm)
Connection	S8 plug head / IP67	VP plug / IP 67
Guaranty	6 months for defects of quality	6 months for defects of quality

Technical Data InTrac® 777M Sensor Valve Assembly	
Construction	Manually operated valve assembly, stainless steel (1.4404/316L); suitable for XEROLYTE® combination electrode
Insertion depth	2.76 in. (70 mm)
Body material	POM
Wetted parts	Stainless steel 1.4404/316L
Solution chamber	2 x G 1/8“; 1 x G 1/4“; 2-6 bar
Guaranty	2 years for defects of quality

Ordering Information		
InTrac® Sensor Valve Assembly		**Order No.**
InTrac® 777M/070/4404/D00/Vi/A00	Manually operated valve assembly, wetted material 316 K stainless steel	109 222
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

Connecting cables and accessories see brochure “Product Details”

Configuration Guide

			EcoLine pH 170 Field Monitor	QuadroLine® pH 296 Panel Mount	IQ Sensor Net Systems 182/2020 XT
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® 650 Sensor Assembly w/ integrated preamplifier, 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® 777M/070/ 4404/ D00/Vi/A00 Valve assembly with flushing for cleaning and calibration; Material: 316 L SS 16 bar / 284 °F (140 °C)	Compatible electrodes: InPro 4250/225/Pt100 0...14 pH 32…266 °F (0…130 °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 16 bar / 284 °F (140 °C) • Built-in temperature measurement with 4250/225/Pt100		KI/pH-MIQ/S 505 544
Digital	SensoLyt® 700 IQ with integrated pre-amplifier, integrated temperature measurement 32…140 °F (0…60 °C), SensorCheck and calibration value storage	Compatible electrodes: SEA: 2...12 pH SEA-HP: 4...12 pH DWA: 0…14 pH ECA: 2...12 pH PtA: ±2000 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