Analyzers, in-situ sensors and samplers

Experts in Liquid Analysis

Endress+Hauser
People for Process Automation

Endress+Hauser – Your partner

Endress+Hauser is a global leader in measurement instrumentation, services and solutions for industrial process engineering.

Endress+Hauser supports customers around the globe with a wide range of instruments, services and automation solutions for industrial process engineering. Around half of the 15,000 „People for Process Automation“ work in sales. They help customers throughout the world to make their processes safe, economical and environmentally friendly. With sales centers in over 50 countries, Endress+Hauser is always near its customers. In places and locations where Endress+Hauser is not directly present, representatives complete this global network allowing Endress+Hauser to serve its customers quickly, flexibly and individually.

Concentrated expertise
The headquarters of our production centers focus on production, product management, research and development, as well as logistics. At sites in Germany and Switzerland, we produce core components for our worldwide production. Plants in Brazil, China, the Czech Republic, France, India, Italy, Japan, South Africa, the UK and the United States assemble, test and calibrate instruments and devices mainly for regional markets.

Sustained growth
For us, profit is not the goal but the result of good economic activities. The Group focuses on sustained growth on its own strength. The basis for this endeavor is a sound equity ratio of 75 percent. Profits are predominantly returned to the company – this also ensures the success and independence of the Group. Endress+Hauser was founded by Swiss native Georg H. Endress and German native Ludwig Hauser in 1953. Over the years, the company thrived and is now a global enterprise - wholly owned by the Endress family since 1975.

Expertise in liquid analysis

Within the globally active Endress+Hauser Group, Endress+Hauser Liquid Analysis counts among the leading international manufacturers of sensors, transmitters, assemblies, analyzers, samplers and complete solutions for liquid analysis. As a center of excellence, we have worked hard over the last 45 years to achieve a top-ranking position on the international market.
Endress+Hauser Liquid Analysis has five production plants: in Gerlingen (Germany), Waldheim (Germany), Groß-Umstadt (Germany), Anaheim (USA) and Suzhou (China).


Gerlingen, Germany


Waldheim, Germany


Groß-Umstadt, Germany


Anaheim, USA


Suzhou, China

Precise Liquid Analysis

Environmental protection, consistent product quality, process optimization and safety – these are just a few reasons why liquid analysis is becoming increasingly essential.

Liquids such as water, beverages, dairy products, chemicals and pharmaceuticals have to be analyzed day in and day out. We support you in fulfilling all these measuring tasks with application know-how and cutting-edge technologies. Our comprehensive portfolio always offers the product best suited to your process needs.

- From standard sensors to complete measuring stations – we provide cutting-edge technology for every liquid analysis parameter.
- Our high-precision instruments help you to increase product yield, improve product quality and ensure process safety.
- State-of-the-art communication interfaces and protocols enable you to seamlessly integrate our devices into your production and business processes and your plant asset management.
- Whether process lab, process or utilities – use our know-how and expertise to optimize your application.
- As leading supplier of analytical measuring technology, we support you during the entire product life cycle - everywhere in the world.

Content

Measuring principles

Nowadays, if for example you need to measure nitrate or ammonium online, you will often have a tough time deciding what analysis principle the device should use. It's an important decision because an unsuitable measuring principle can lead to seriously incorrect measurements. On the other hand, no general recommendation can be made for a measuring principle that is ideally suited to every application.

The question is more what the measurement results are to be used for:

- If the focus is on control and regulation strategies, you need fast measured values that reflect the current conditions in the process. These rapid measured values are mostly returned by sensor systems that are used directly in the process. They work based on optical or potentiometric measuring principles.
- If monitoring and documentation tasks are to be performed, high-precision, self-cleaning analyzers that are automatically calibrated are the solution. Such types of measuring systems are based on colorimetric, wet-chemical, biological or potentiometric measuring principles.

Endress+Hauser's unique complete product range always offers you the right device with the right measuring principle for your application.

Photometric methods

Photometry is one of the oldest and most time-tested analysis procedures there is. It is based on the fact that different substances contained in an aqueous sample absorb, or filter out, different amounts of light introduced into the sample. Detectors on the receiver side of the measuring system analyze this difference between the light introduced and the light received, and use the calibration curve saved in the system to determine the concentration of the specific substance in the sample.

The majority of all the measuring systems available today works on the basis of photometric measuring principles:

- Colorimetry: using special reagents, the initially invisible particles are "dyed" and the dyed substances are then measured photometrically.
- UV absorption: The substances to be measured display direct self-absorption in the ultraviolet range of the light. People often refer to optical measuring systems here that usually analyze a measuring wavelength and a reference wavelength.
- UV-VIS spectrometry: The spectrometer measures in the wavelength range from 200 nm up to 800 nm and determines the substance-specific absorption of this radiation.The measured absorption at specific wavelenghts is used to calculate the concentration of various parameters.

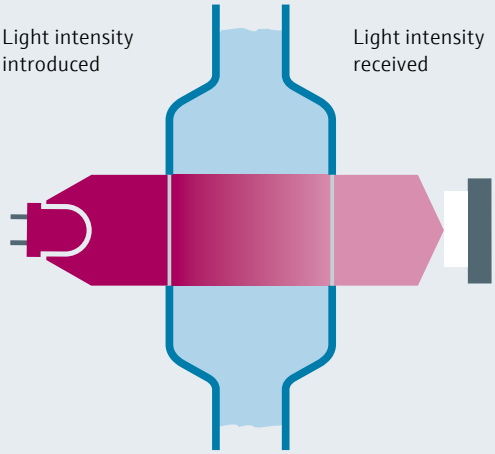
Colorimetry measuring principle
One or more reagents are added to the water sample to "dye" the sample to be analyzed. Afterwards, the aqueous sample is measured by photometric means. The intensity of the specific absorption signal is proportional to the concentration of the dyed substance in the sample. A reference measurement (sample without chemicals) is taken before every measurement to be able to compensate for any interference caused by inherent color, turbidity or contamination. The actual concentration of the substance is ascertained using this information.

Video on the colorimetric measuring principle

Most standardized procedures for water and wastewater inspection are based on photometry and colorimetry. By specifically selecting the dye reagents, many different parameters can be measured very accurately, ranging from aluminum and silicate to phosphate.

Endress+Hauser's Liquiline System CA80 online analyzers use these tried-and-tested laboratory procedures so you can be sure you can rely on the measurement result.

Measuring principle: colorimetric absorption measurement



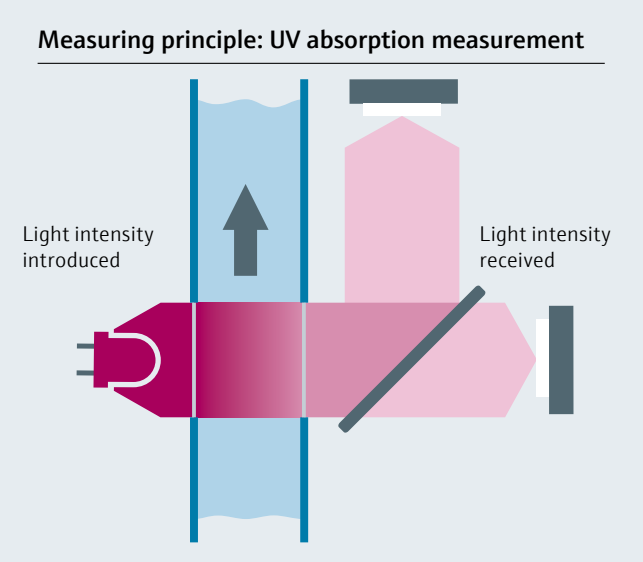
Absorption = measurement of the attenuation of light relative to the introduced light intensity

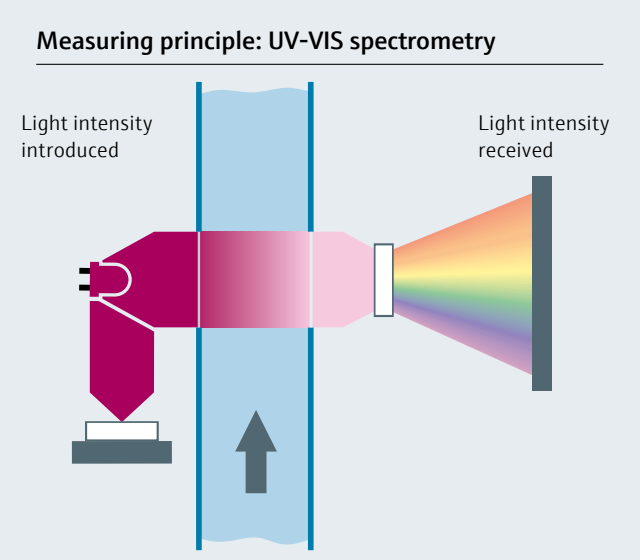
Measuring principle: UV absorption
UV sensors use the self-absorption of the substance that is to be measured in the ultraviolet range of the light.

For this purpose, the ultraviolet light of a pulsed, highly stable flash lamp is shone through the measurement section. The substances in the sample which are to be measured absorb this light in proportion to their concentration. The intensity of the attenuated beam of light is measured at two fixed wavelengths (measuring wavelength and reference wavelength) using photodiodes. Interference from turbidity, contamination or other organic hydrocarbons is eliminated mathematically. The substance concentration is determined with the aid of a calibration curve saved in the system.

The Viomax CAS51D in-situ sensors for measuring nitrate or SAC work on the principle of UV absorption. The sensors measure directly in the process. Nitrate and SAC (sum parameter for the organic load of the water) absorb directly in the UV range without reagents being added.

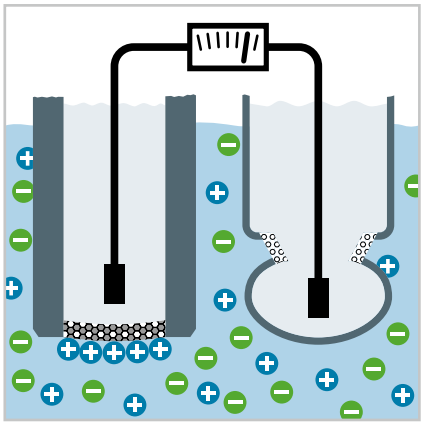
Measuring principle: UV-VIS spectrometry
Spectrometry uses the interaction of light with substances. Electrons or molecules are excited by specific wave lengths and absorb them so that the detector measures a lower intensity of these wave lengths. In case of spectrometry, absorption is measured at several wave lengths and correlated to the concentration of several substances such as COD, SAC, nitrogen, TOC, turbidity, color APHA/HAZEN etc. using data models.





Potentiometric method with ion-selective electrodes (ISE)

Potentiometric measurement using ion-selective electrodes is similar to pH measurement. The heart of the ion-selective electrode (ISE) is a membrane that is selective for the specific ion to be measured. Ionophores are accommodated in this membrane. These ionophores facilitate the selective “migration” of the ions to the inside of the electrode and this change in charge causes an electrochemical potential. This potential is measured against a separate reference electrode with a constant potential. It is proportional to the ion concentration in the medium. With this measuring principle, the measurement result is not affected by the color and turbidity of the medium. Since the ISE sensor is immersed directly into the medium and responds rapidly, the measuring system reacts very quickly to changes in concentration. The measuring signal and concentration of the measured ions are directly related over a very broad range in such a way that these systems can cover a very wide measuring range.



Measuring parameter overview

	Description	Applications
Nutrients	**Description** In addition to reducing carbon, modern wastewater treatment plants also reduce nitrogen and phosphate. For this purpose, online measurement of the following parameters is required: ▪ Ammonium ▪ Nitrate ▪ Nitrite ▪ Phosphate Online analysis helps in meeting the more stringent discharge limit values and in reducing operating costs, for example wastewater discharge costs.	Applications  ▪ WWTP aeration: Ensuring nitrification with minimum oxygen consumption and sufficient denitrification, controlling recirculation, optimizing precipitant dosage ▪ WWTP outlet: Monitoring and documentation of limit values ▪ Water treatment: Monitoring and documentation of limit values
Sum parameters	**Description** Sum parameters are mainly used to measure and assess the organic load of water and wastewater: ▪ Spectral absorption coefficient (SAC) ▪ Biological oxygen demand (BOD) ▪ Chemical oxygen demand (COD) ▪ Total organic carbon (TOC) ▪ Total phosphorus (TP) ▪ Total nitrogen (TN)	Applications  ▪ WWTP inlet: Process control and monitoring by measuring the total organic carbon and the amount that can be broken down biologically ▪ WWTP outlet: Monitoring and documentation of mandatory limit values, product loss monitoring, load accounting ▪ Industrial wastewater ▪ River monitoring ▪ Drinking water treatment: Monitoring of raw water quality
Metals and others	**Description** The requirements for water quality differ depending on the industry. Drinking water and most of the process water is, however, chlorinated, softened and/or chemically conditioned for setting the pH value, corrosion control and for preventing sludge buildup. Practically all manufacturing processes require corrosion-free water, which shows neither turbidity and color nor contains iron and manganese. Microbiological growth is also to be avoided. The following parameters are measured: ▪ Aluminum (Al) ▪ Chromate (Cr) ▪ Iron (Fe) ▪ Hardness (Ha) ▪ Silica (Si) ▪ Sodium (Na)	Applications  ▪ Drinking water: Ensuring unspoilt, odorless quality ▪ Ultrapure water for water and steam generation ▪ Softening of industrial wash and rinse water ▪ WWTP outlet: Monitoring and documentation of mandatory limit values ▪ Color and iron measurement in paper processes
Sampling, condtioning	**Sample conditioning** Correct sample conditioning is part and parcel of every analysis. Good sample conditioning should: ▪ Not alter the sample ▪ Retain all the particles etc. that cause interference ▪ Require minimum maintenance This is particularly important in the wastewater industry.	Applications Page 18  ▪ WWTP: From the inlet through various stages of treatment to the outlet ▪ Raw wastewater in the chemical, food and paper industry ▪ Drainage water

Measuring principles

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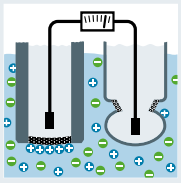
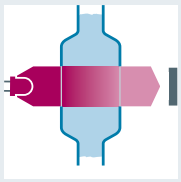
Potentiometric measuring principle.....Page 5



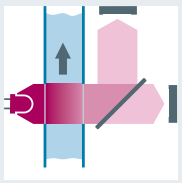
Based on an ion-selective membrane on which ammonium and nitrate ions accumulate thereby causing an electrical potential to build up.

Colorimetric measuring principle .....Page 4



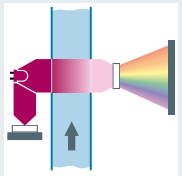
Reagents are added to the water sample to "dye" it. Afterwards the sample is measured by photometric means.

Measuring principle UV absorption.....Page 5



Based on an absorbance measurement at two fixed wavelengths in UV.

Measuring principle UV-VIS spectrometry.....Page 4



Based on an absorbance measurement at various wave lengths. The absorbance measured is correlated to the concentration of various substances using data models.

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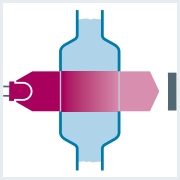
Colorimetric measuring principle .....Page 4



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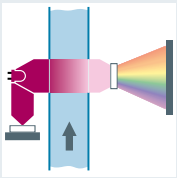
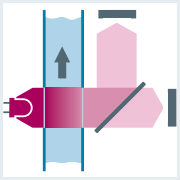
Measuring principle UV-VIS spectrometry.....Page 4



Based on an absorbance measurement at various wave lengths. The absorbance measured is correlated to the concentration of various substances using data models.

Measuring principle UV/infrared absorption.....page 5



Based on absorbance measurement at defined wave lengths.

- UV: UV light is shone through the measurement section and the absorption is measured at two fixed wavelengths (SAC).
- IR: The sample is combusted and the combustion gas is cooled down. Afterwards the CO_2 content is determined by IR absorption and used to calculate the TOC value.

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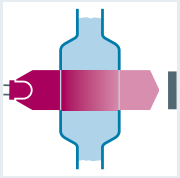
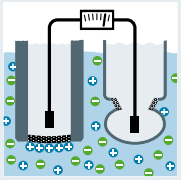
Colorimetric measuring principle .....Page 4



Reagents are added to the water sample to "dye" it. Afterwards the sample is measured by photometric means.

Potentiometric measuring principle.....Page 5



Based on an ion-selective membrane on which sodium ions accumulate thereby causing an electrical potential to build up.

Samplers
Samplers provide automatic sampling, defined distribution and preservation of liquid samples. They guarantee that these samples remain undistorted until they are analyzed in the laboratory.
The Liquistation CSF48 and Liquiport CSP44 samplers can easily be equipped with sensors for online measurement of various parameters. They can also be seamlessly integrated into process control systems.

Applications.....Page 19

- Municipal and industrial wastewater treatment plants
- Laboratories and water authorities
- Monitoring of liquid media in industrial processes

Nutrient parameters

	Ammonium	Nitrate	Nitrite	Phosphate
ISEmax CAS40D	■	■		
Viomax CAS51D		■		
Memosens Wave CAS80E		■		
Liquiline System CA80	■		■	■

Nutrient measurement enables process optimization and outlet control in wastewater treatment plants. It also helps to monitor the water quality during water treatment.

In-Situ measuring systems

These systems enable continuous measurement of nutrients directly in the medium. Using a suitable assembly, they are directly mounted in the process and deliver fast measured values. That‘s why they are especially suited to process control.

Your benefits
- Continuous, real-time measurement directly in the process
- Digital Memosens technology for reliable, interference-free communication
- No sample conditioning required
- No reagents required
- Compact systems, easy to install

Ammonium and nitrate measurement with the ion-selective measuring system ISEmax CAS40D/Liquiline CM44

ISEmax is used for the continuous measurement of ammonium and/or nitrate in the aeration basin of municipal wastewater treatment plants. The sensor consists of ion-selective electrodes that measure ammonium, nitrate and, where applicable, other measured variables simultaneously and a reference electrode. The sensor is installed in an immersion assembly with automatic compressed-air cleaning and a pre-amplifier. Using a suitable holder, the sensor is mounted directly on the basin rim.

View of CAS40D sensor head ISE electrode Membrane cap

Your benefits
- Ammonium and nitrate in a single sensor: you always have nitrification and denitrification under control
- Low maintenance thanks to easy exchange of membrane caps
- Robust membranes and the integrated cleaning system ensure that the sensor is always operational.

Typical applications
- Measurement of the concentration of ammonium and nitrate directly in the sludge activation process
- Rapid change of measured values for control and regulation
- Determining the ammonium load (pH-compensated) in the inlet to the sludge activation process
- Load-dependent aeration control

Diverse measuring ranges
- Ammonium-nitrogen: 0.1 to 1000 mg/l NH_4-N
- Nitrate-nitrogen: 0.1 to 1000 mg/l NO_3-N

Liquiline CM44 transmitter

Nitrate measurement with the UV measuring system Viomax CAS51D/Liquiline CM44

With this sensor it is possible to measure nitrate directly in the medium. Thanks to its outstanding dynamic measuring range, the sensor has a very broad field of application. It is low maintenance thanks to its optical measuring principle and does not require any wipers, moving parts or axial seals in the wastewater.

Your benefits
- Fast and simple commissioning thanks to factory calibration and factory configuration
- Maximum availability and minimum maintenance thanks to automatic air cleaning
- Perfect adaptation to open basins and pipes using the Flexdip CYH112 or various flow assemblies

Typical applications
The all-rounder with an 8-mm gap
- Monitoring of nitrate content in the outlet of wastewater treatment plants
- Monitoring and optimization of denitrification

Drinking water sensor with a 2-mm gap
- Monitoring and control of drinking water treatment plants
- Nitrate measurement in natural bodies of water

Diverse measuring ranges
- 0.01 to 50 mg/l NO_3-N (Wastewater)
- 0.01 to 20 mg/l NO_3-N (Drinking water)

Viomax CAS51D in-situ sensor with Liquiline CM44

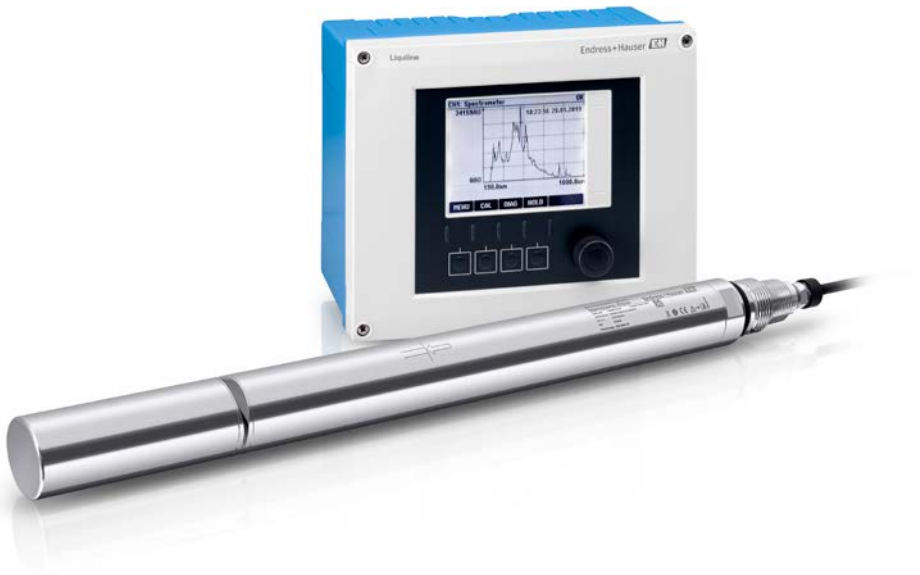
Nitrate measurement and measurement of diverse parameters with Memosens Wave CAS80E spectrometer

The Memosens Wave CAS80E UV-VIS spectrometer offers highly precise real-time measurement of nitrate and additional relevant parameters in one single device. It thus increases efficiency and mimizes measuring point costs.

Your benefits
- Continuous analysis of many standard parameters in water and wastewater monitoring without the need for consumables or chemicals
- Fast adaptation to specific requirements through pre-installed analysis models
- Optimum adaptation to process conditions by offering suitable materials such as optional titanium housing or sapphire windows
- Compact, light-weight spectrometer: very easy to install and maintain

Typical applications
Memosens Wave CAS80E spectrometer measures a variety of analysis parameters in:
- Drinking water
- Surface water
- Municipal wastewater
- Industrial wastewater
- Utilities

Diverse measuring ranges
- NO3-N: 0 to 500 mg/l
- TU: 0 to 800 FAU
- TSS: 0 to 10 000 mg/l
- APHA/Hazen: 0 to 500 Hazen



Colorimetric analyzers Liquiline System CA80 for nutrient measurement

Liquiline System CA80 with cooling module

Liquiline System CA80 analyzers provide highly precise measurements for monitoring and documentation tasks. Thanks to their integration in the Liquiline Memosens platform, they offer the same intuitive operating concept as Liquiline transmitters and can be commissioned fast and easily together with their sample preparation systems.

Your benefits

- Standardized measuring methods according to ISO and DIN regulations for reliable, regulation compliant measurements
- Low operating costs thanks to automatic calibration and low reagent consumption
- Easy maintenance with minimal tools
- Advanced diagnostics with remote access for higher process safety
- Easy upgrade to a complete measuring station by connecting Memosens sensors
- Seamless integration into process control systems via Modbus, PROFIBUS, EtherNet/IP or webserver communication
- Proper sample preparation by selecting one of three filter systems, based on the specific application conditions

Nitrite measurement with Liquiline System CA80NO

Nitrite is an important chemical indicator of the water quality. It is toxic and promotes the formation of carcinogenic nitrosamines. That's why authorities stipulate strict nitrite limits for drinking water, mineral water and raw water for food production, especially for baby food. With Liquiline System CA80NO, waterworks and producers of mineral water or food can rely on high-precision online monitoring of the denitrification process.

The analyzer allows:

- Online measurement according to the standardized colorimetric naphthylamine method following ISO 6777 and DIN EN 26777 that guarantees direct compatibility with lab results.
- Fast reaction and troubleshooting of possible process disturbances
- Higher safety of the denitrification process.

Typical applications

Monitoring of the strict nitrite limits in

- Drinking water
- Mineral water
- Raw water for food production

Measuring range

Nitrite nitrogen
10 µg/l to 3 mg/l NO_2-N

Ammonium and ortho-phosphate measurement with Liquiline System CA80AM and CA80PH

Liquiline System CA80AM

The primary focus in wastewater treatment plants is to protect downstream waters. This is why the limit values for ammonium and orthophosphate are becoming stricter every year. Phosphate load is particularly important as phosphorus is the decisive factor for excessive algae and plant growth in water bodies.

Liquiline System CA80AM and CA80PH analyzers use standardized colorimetric measuring principles to ensure direct comparability to lab results:

- Indophenol blue method following ISO 7150-1, DIN 38406-5, GB 7181-87 for ammonium
- Molybdenum blue method following DIN EN 1189 for low orthophosphate concentrations
- Molybdate vanadate method (yellow method) for higher orthophosphate concentrations

Typical applications

The analyzers provide highly precise ammonium and phosphate analyses at all critical control points:

Outlet The analyzers support compliance with limit values and appropriate documentation.

Inlet The analyzers continuously monitor the incoming freight and allow prompt handling of peak loads.

Aeration basin The analyzers save energy and costs.

- The ammonium analyzer combined with an oxygen sensor allows accurate measurement of ammonium and oxygen concentrations and thus a precise, load-dependent control of the blowers.
- The reliable orthophosphate measurement helps to optimize precipitant dosing.

Water treatment In cooling cycles, the analyzers help to optimize phosphate dosing which is used to stabilize water hardness and for corrosion protection.

Measuring ranges

- Ammonium nitrogen
  0 to 100 mg/l NH_4-N
- Orthophosphate phosphorus
  0 to 10 mg/l PO4-P (blue method)
  0.5 to 50 mg/l PO4-P
  (yellow method)

Sum parameters

	SAC	COD	COD_{eq}	TOC	TOC_{eq}	TP	TN
Viomax CAS51D	■		■		■		
Memosens Wave CAS80E	■		■		■		
Liquiline System CA80		■				■	■
TOCII CA72TOC			■	■			
CA78 / CA79				■			

Sum parameters help to assess the organic load of water such as drinking water, wastewater or ultrapure water.

In-Situ measuring systems

These systems enable continuous measurement of nutrients directly in the medium. Using a suitable assembly, they are directly mounted in the process and deliver fast measured values. That's why they are especially suited to process control.

Your benefits
- Continuous, real-time measurement directly in the process
- Digital Memosens technology for reliable, interference-free communication
- No sample conditioning required
- No reagents required
- Compact systems, easy to install

SAC measurement with UV measuring system Viomax CAS51D/Liquiline CM44

This sensor makes it possible to measure SAC directly in the medium. Its robust design does not require any wipers, moving parts or axial seals in the wastewater. Thanks to its outstanding dynamic measuring range, the sensor has a very broad field of application. In addition, sensor and transmitter enable the determination of COD_{eq}, TOC_{eq} or related variables.

Viomax CAS51D in-situ SAC sensor with Liquiline CM44

Your benefits
- Fast and simple commissioning thanks to factory calibration and factory configuration
- Maximum availability and minimum maintenance thanks to automatic air cleaning
- Perfect adaptation to open basins and pipes using the Flexdip CYH112 or various flow assemblies

Typical applications
- Determination of the spectral absorption coefficient
- Continuous monitoring of wastewater for organic pollution
- River monitoring
- Special measuring tasks in UV range

Diverse measuring ranges
- 0 to 1000 m^{-1} SAC
- 0 to 1500 mg/l COD_{eq}/BOD_{eq}
- 0 to 600 mg/l TOC_{eq}/DOC_{eq}

COD, BOD, TOC, SAC measurement with Memosens Wave CAS80E spectrometer

Memosens Wave CAS80E UV-VIS spectrometer offers reliable real-time measurement of chemical and biological oxygen demand (COD, BOD), spectral absorption coefficient (SAC) and more relevant parameters in one single device. It thus increases efficiency and minimizes measuring point costs.

Your benefits
- Analysis of many standard parameters in water and wastewater monitoring
- Fast adaptation to specific requirements through pre-installed analysis models
- Compact, light-weight spectrometer: easy to install and maintain

Typical applications
Memosens Wave CAS80E spectrometer measures a variety of analysis parameters in:
- Drinking water
- Surface water
- Wastewater
- Industrial wastewater
- Utilities

Diverse measuring ranges
- TOC_{eq}: 0 to 400 mg/l
- COD_{eq}: 0 to 20 000 mg/l
- BOD_{eq}: 0 to 5000 mg/l
- SAC_{254}: 0 to 1000 /m

Online analyzers

COD measurement with Liquiline System CA80COD colorimetric analyzer

The chemical oxygen demand is the most commonly used parameter to determine the organic load of wastewater.

True COD values for precise environmental monitoring
Liquiline System CA80COD is the right choice for all users that require “true” COD values to comply with their national or regional regulations:
- Established dichromate COD method ensures consistent comparability with laboratory measurements.
- Peristaltic pumps support representative determination of the chemical oxygen demand since they are able to cope with particles in the sample.
- The optional dilution module enables regulation-compliant, precise measurement also in water with higher organic load.
- The optical dosing module improves reproducibility of the measurement results.
- Detailed logbooks provide continuous documentation of the COD values.

Highest safety level
The pressure reactor of the analyzer offers highest operational and occupational safety during chemical and therma digestion.
- The reactor‘s precise temperature control ensures complete sample digestion.
- The software-controlled safety cover prevent opening of the digestion reactor when it is too hot or under pressure.
- Optical dosing unit with redundant light barrier for highest safety.

Typical applications
- Municipal wastewater treatment plants: COD is measured in inlet and outlet to redirect heavily loaded water into buffer basins and to evaluate the cleaning capacity of the wastewater treatment plant.
- Industrial wastewater treatment plants: COD ist measured in the outlet to enable load-based billing of the discharge fees.
- Process water

Measuring ranges
- 0 to 5,000 mg/l O_2
- 0 to 5,000 mg/l O_2 (dilution module 1:4)

Your benefits
- Low maintenance thanks to automatic cleaning and calibration
- Advanced diagnostics via remote access for more process safety
- Fast upgrade to a complete measuring system simply by connecting Memosens sensors
- Seamless integration into process control systems via Modbus, PROFIBUS, EtherNet/IP or webserver communication

Continuous TOC measurement with the high-temperature TOCII CA72TOC analyzer

TOCII CA72TOC monitors industrial wastewater using high-temperature measurement in a way that is safe and easy to maintain. The system is optimized for industrial applications, even those with varying pH values and high salt loads.

Your benefits

- Accurate and fast measurement with “double-batch” operation
- One and two-channel measurement available
- Fast and easy maintenance thanks to good accessibility of all components
- Heatable salt trap significantly increases the service life
- Exchangeable furnace concept significantly decreases service time thanks to prepared furnace
- pH-controlled acid dosage for TIC stripping minimizes acid consumption
- Externally triggered self testing with TOC standard

Typical applications

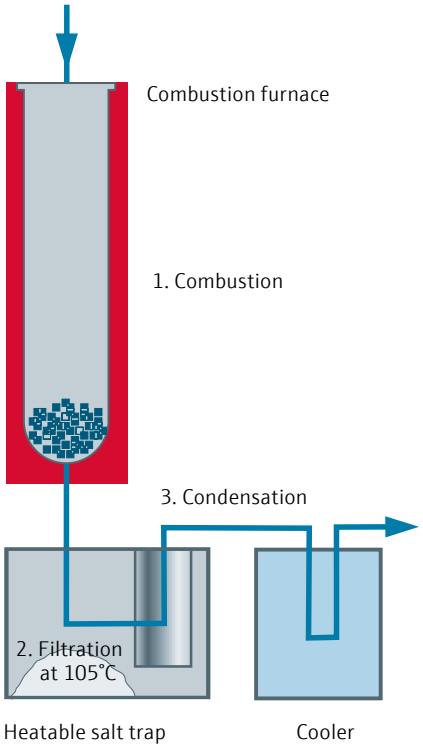
- Industrial wastewater monitoring (for example in inlet and outlet)
- Control of process wastewater
- Monitoring of industrial surface water
- Municipal wastewater monitoring

Properties

- Thermal catalytic combustion according to EPA Method 415.1, DIN EN 1484, ISO 8245
- Measuring time in double-batch: New measured value every seven minutes
- Optional extension of measuring range thanks to predilution by a factor of 20
- Programmable dosage of sample into the furnace guarantees extremely high accuracy

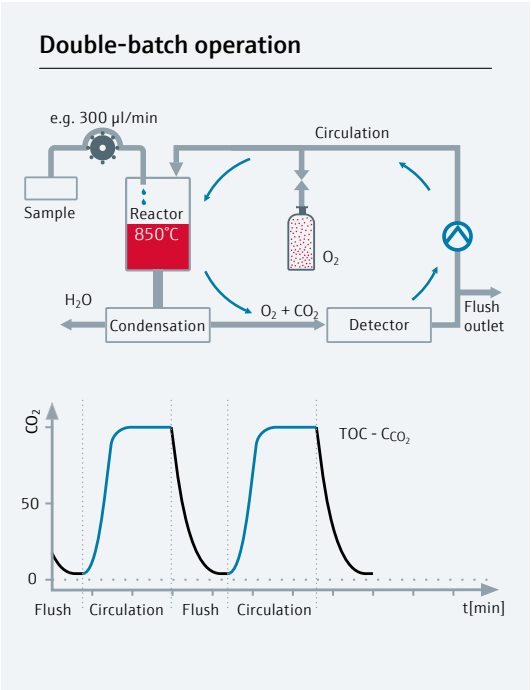
Diverse measuring ranges

- 0.25 to 12,000 mg/l



Double-batch operation

The patented double-batch operation links the water and the gas circuits. The aqueous sample is continuously prepared in the analyzer and fed batch-wise into the furnace. During measurement, the gas containing CO_2 is circulated and accumulated in the gas circuit. This makes it possible to record large sample volumes (1200 µl) which leads to high sensitivity. After measurement, the gas circuit is flushed with CO_2-free carrier gas and the basic line for the next measurement is determined.



Heatable salt trap

- With the heatable salt trap, the majority of volatile salts precipitate in the salt trap and not in the furnace.
- The furnace does not have to cool down before maintenance is performed on the salt trap. This increases the availability of the measuring point dramatically.
- It only takes 5 minutes to clean or replace the salt trap.

Total phosphorus measurement with Liquiline System CA80TP

New quality standards require a reduction in the amount of phosphorus released from wastewater treatment plants into rivers and lakes because phosphorus is the decisive factor for excessive algae and plant growth in water bodies. Liquiline System CA80TP helps managers of wastewater treatment plants to achieve these reductions without increasing the costs for precipitants.

Precise online measurement of total phosphorus

- The standard molybdenum blue method following ISO 6878 ensures consistent comparability to lab measurements.
- Peristaltic pumps are able to cope with representative samples containing particles.
- The optional dilution module enables compliant measurements even in water with higher phosphorus load.
- The optical dosing unit ensures optimized reproducibility of the measuring results.
- Detailed logbooks enable consistent documentation of the TP values.

Highest level of safety

The analyzer features a pressure reactor that ensures highest operational and occupational safety during thermal and chemical digestion.

- A precisely adjusted reactor temperature guarantees complete digestion of the sample.
- The software-controlled safety cover prevents opening of the digestion reactor if it is too hot or under pressure. The safety cover can only be removed for maintenance when the reactor is in a safe state.
- The optical dosing unit is equipped with a redundant safety light barrier which ensures the best level of reliability.

Typical applications

- Inlets and outlets of wastewater treatment plants for documentation purposes and calculation of the cleaning capacity.
- Discharges of industrial wastewater treatments plants to determine discharge fees and to support the polluter-pays-principle
- Process water

Measuring ranges

- 0 to 10 mg/l P_{tot}
- 0.5 to 50 mg/l P_{tot} (with dilution module)

Total nitrogen measurement with Liquiline System CA80TN

Nitrogen is a lead parameter to determine surface water quality and wastewater effluent values. Both, organic and inorganic substances contribute to the total nitrogen load. Increased nitrogen contents indicate influences from wastewater, landfill leachate or agriculture. Liquiline System CA80TN analyzer omonitors organic (e.g. proteins, urea) and inorganic (e.g. nitrate, nitrite, ammonium) nitrogen compounds.

Precise online measurement of total nitrogen

- Standardized alkaline persulfate digestion and UV measurement according to HJ636 offer direct comparability to most cuvette tests.
- Robust: Titanium reactor with sapphire windows ensures a long lifetime.
- Flexible: Integrated dilution module covers a wide measuring range.
- Fast and easy process integration: Direct installation of self-priming version or y-strainer for bypass installations.
- Easy upgrade to a complete measuring station by adding modules and connecting Memosens sensors.

Typical applications

- Inlets and outlets of wastewater treatment plants for documentation purposes and calculation of the cleaning capacity
- Discharges of industrial wastewater treatment plants to determine discharge fees and to support the polluter-pays principle
- Monitoring of surface water quality

Measuring ranges

- 0 to 10 mg/l N
- 0 to 50 mg/l N
- 0 to 200 mg/l N

Low-range TOC measurement with the CA78 and CA79 analyzers

Total organic carbon (TOC) content strongly influences the quality of ultrapure water. A high TOC concentration can cause damage of water purification systems, compromise the required water quality or even lead to contamination of pharmaceutical charges. The CA78 and CA79 online TOC analyzers provide continuous, accurate TOC monitoring of ultrapure water or water for injection (WFI). Pharmaceutical product batches can be produced safely and in compliance with regulations and you gain full control of production processes and product quality.

Your benefits

- Fast response time (t_{90}) of 50 seconds enable immediate reaction to potential water contamination and efficient protection of your product.
- Proven UV oxidation and differential conductivity measurement for reliable TOC trace analysis in ultrapure water.
- Optional 3 channel configuration for reduced investment costs
- Compliance: CA79 meets the requirements of the European and US Pharmacopeias and allows working according to FDA 21 CFR Part 11. The analyzer provides clear documentation of relevant events, regular quality reports and system suitability tests (SSTs).
- Complete support for the measuring point, including the installation qualification (IQ) and regular operational qualifications (OQ)

Typical applications

CA79:
TOC monitoring of ultrapure water in life sciences applications:

- Conductivity < 2 µS/cm
- pH range: neutral

CA78:
TOC monitoring of ultrapure and de-ionized water in the following industries:

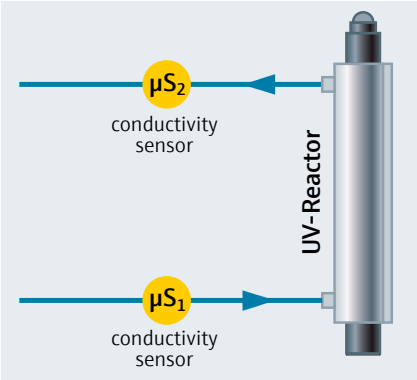
- Power & Energy
- Semiconductor production

Process conditions:

- Conductivity: 2 µS/cm (standard), 10 µS/cm (order option)
- pH range: neutral

Measuring range

0.5 to 1,000 µg/l (ppb)



UV oxidation and measurement of differential conductivity

While the medium flows through the UV reactor, the organic substances are oxidized to CO_2 by short-wave UV radiation. The dissolved CO_2 causes an increase in conductivity via the carbonic acid balance due to the formation of hydrogen carbonate. This increase is measured by electrode pairs upstream and downstream of the UV radiation and is converted to TOC.

Metals and other parameters of water treatment

	Aluminum	Chromate	Iron	Hardness	Silica	Sodium
Liquiline System CA80	■	■	■	■	■	
CA76NA						■

Metal content and other parameters are mainly measured in process, drinking and ultra-pure water treatment to ensure a good water quality. For users of process water and operators of water, wastewater and steam generation plants, it is very important to know which substances are dissolved or suspended in the water.

Aluminum, iron and hardness measurement with Liquiline System CA80

Liquiline System CA80FE

Continuous monitoring as key to safe water

Iron, aluminum and hardness are important chemical indicators of the water quality:

- Aluminum is naturally present in low levels in groundwater. If it, however, occurs in higher concentrations, it is harmful to human health.
- Iron only rarely occurs in concentrations that are harmful to human health but even very low concentrations of iron suffice to impair the water taste and color.
- Water hardness has an impact on the product quality, for example in the beverage or paper industry.

Liquiline System analyzers ensure compliance with the with the strict limits for drinking water, bottled water and process water. Thanks to their standardized measuring methods, they deliver measured values that are consistently comparable to lab measurements.

- Iron: standardized ferrozine method
- Aluminum: colorimetric pyrocatechol violet method according to DIN ISO 10566
- Hardness: phthalein violet method

The analyzers feature detailed logbooks to provide continuous documentation of the measured values to the authorities

Typical applications

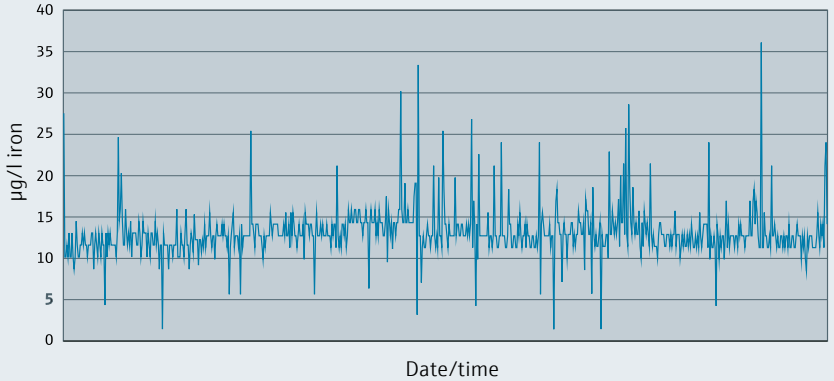
- Liquiline System CA80FE supports optimization of iron removal since it enables optimum control of the air blowers.
- Liquiline System CA80AL optimizes aluminum dosing: as much as necessary to safely remove suspended particles but avoid high aluminum concentrations.
- Liquiline System CA80HA supports improvement of softening processes in waterworks and informs about the hardness of drinking water.

Measuring ranges

- Aluminum: 15 to 1000 µg/l (ppb) Al
- Iron: 0.05 to 2.5 mg/l (ppm) Fe
  0.1 to 5 mg/l (ppm) Fe
- Hardness: 0 to 80 mg/l (ppm) $CaCO_3$

Application example

Mineral water monitoring, limit value 30 µg/l iron



Sodium and silica measurement with CA76NA and Liquiline System CA80SI

Silica and sodium are two core parameters for the water quality in power plants. The maximum silica content permitted in boiler feedwater is often contractually agreed on between turbine and boiler suppliers and power plant operators. Increased silica and sodium concentrations can lead to deposits on turbines, boiler walls and heat exchangers that have an adverse effect on a power plant's efficiency and can even cause damages of the expensive plant equipment. In addition, accurate silica and sodium measurement provides an early indication of condenser leakages or exhaustion of the ion exchanger bed.

Liquiline System CA80SI

- Helps ensuring the required water quality. Detailed logbooks facilitate documentation of the measured values.
- Delivers measurement results that are directly comparable to laboratory measurements thanks to its standardized heteropoly blue method.
- Can be fitted with up to 6 sampling channels allowing for online measurement at all important control points and easy adaptation to any kind of application.
- Is easily upgraded to a complete measuring station by connection of up to 4 Memosens sensors.

CA76NA sodium analyzer

- Uses the potentiometric measuring principle with a separate reference pH electrode for precise temperature compensation and optimum pH value adjustment.
- Offers up to 6 sampling channels for perfect process adaptation.

Typical applications

- In the boiler
- At the ion exchanger outlet
- In the feedwater make-up line after the condenser

Measuring ranges

- Silica
  0 to 500 µg/l (ppb) SiO_2
  50 to 5,000 µg/l (ppb) SiO_2
- Sodium
  0.1 to 9,999 µg/l (ppb) Na

Liquiline System CA80SI

CA76NA

Chromate measurement with Liquiline System CA80CR

For industrial wastewater, regulations stipulate close monitoring of specific parameters. In case of chromate, electroplating companies and tanneries operate their own wastewater treatment to reduce the contaminants to levels that allow the discharge into municipal wastewater treatment plants. Here, the standardized diphenyl-carbazide method of Liquiline System CA80CR ensures compliance with discharge regulations and the analyzer's detailed logbooks provide continuous documentation of the chromate values.

Typical applications

- Optimizing cleaning capacity of industrial wastewater treatment plants
- Outlets of electroplating companies and tanneries
- Monitoring of membrane filtration

Measuring ranges

- 0.03 to 2.5 mg/l Cr(VI)
- 0.2 to 5.0 mg/l Cr(VI)

Sample conditioning for analyzers

Correct sample conditioning is part and parcel of every analysis. Complementing the sample conditioning system, the sample collector conveys treated sample to the analyzer and ensures that sufficient sample is always available for analysis.

Liquiline System CAT810
- Filtration system with sieve filter for installation in by-passes or pressurized pipes
- Fully automated backflushing with pressurized air
- Controlled by Liquiline System CA80 or independent, timer-controlled version

Liquiline System CAT860
- In-situ micro-filtration system for heavily loaded wastewater, e.g. in the inlets of wastewater treatment plants
- Complete system with integrated pump and additional chemical cleaning of the filter element
- Controlled by Liquiline System CA80 with advanced diagnostic possibilities

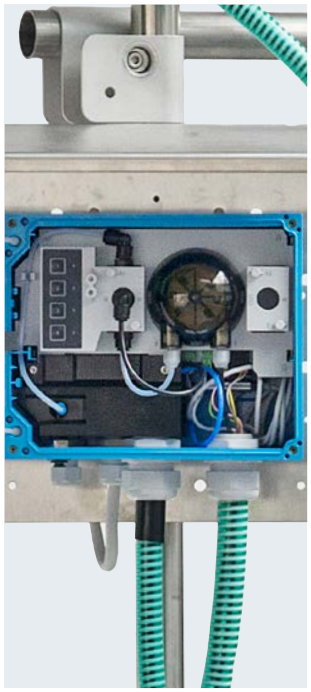
Liquiline System CAT820
- In-situ micro-filtration system for biological stages and channels
- Complete system with integrated pump
- Longer maintenance intervals thanks to optional automated backflushing
- Controlled by Liquiline System CA80 with advanced diagnostic possibilities or independent version

CAT810

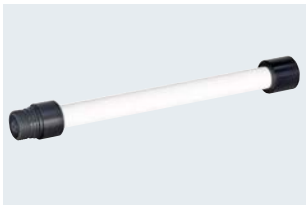
Y-Strainer

CAT860 open

CAT820 open



PA-2 at device



Filter candle

Y-strainer
- Direct sampling from bypass pipes.
- Easy installation by standard adhesive fitting (40 mm).
- Representative samples thanks to the sample hose floating in the middle of the sample stream.
- Fluidic movement removes particles and avoids blocking.

PA-2/PA-3/PA-8 sample conditioning for CA72TOC
- Low-maintenance thanks to tangential filter principle and fully automated backflushing
- Volume flow from 0.1 to 8 m^3/h
- Very long operating life, no mechanical wear
- Stainless steel version also available for high pressures and temperatures
- For all wastewater applications, including heavy-duty applications




Automatic samplers

The samplers provide automatic sampling, defined distribution and preservation of liquid samples. They guarantee that these samples remain undistorted until they are analyzed in the laboratory. Our sampler portfolio offers the suitable device for any kind of application.

Liquistation CSF28 stationary sampler
- Ideally suited to basic wastewater monitoring
- 2 versions: peristaltic pump or vaccum pump
- 3 sampling methods: time-paced, volume-paced, flow-paced
- Unique wizards for simple commissioning and programming.

Liquistation CSF48 stationary sampler
- Versatile applications in municipal and industrial water and wastewater
- 3 versions: peristaltic pump, vacuum pump or CSA420 assembly for pressurized pipes and tanks
- 4 sampling methods: time paced, volume paced, flow paced, event controlled
- Plastic or stainless steel housing
- Easy upgrade to a complete measuring system with true plug & play for Memosens sensors
- Heartbeat Technology for status-oriented maintenance

Liquiport CSP44 portable sampler
- Flexible monitoring of municipal and industrial wastewater
- 4 sampling methods: time paced, volume paced, flow paced, event controlled
- Easy upgrade to a complete measuring system with true plug & play for Memosens sensors

Safety for your samples
- Sampling with the automatic samplers complies with international standards and legislation such as ISO5667.
- No corrupt samples due to temperature variations: The fail-safe, sustainable cooling system guarantees stable temperatures in the sample compartment.
- No more samples lost by vandalism: No screws outside to open the locked device.

The harmonized sampler portfolio is tailored to your needs.

Automatic samplers

Three sampling technologies for any kind of use

- If your application demands high accuracy, repeatability and speed, select the vacuum pump.
- For short suction heights, variable sample volumes and toxic applications, choose the peristaltic pump.
- If you need to sample directly from pressurized pipes, the Samplefit CSA420 assembly is the best choice.

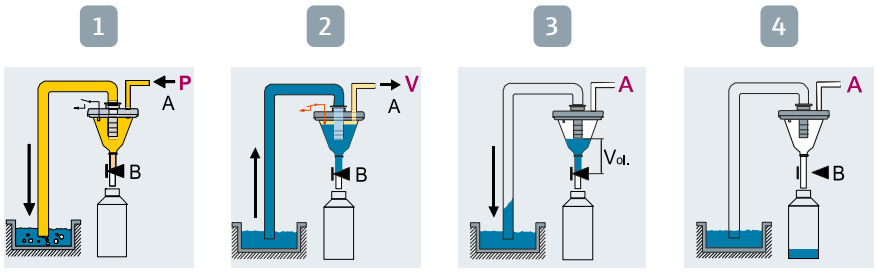
Simple to maintain

- Cleaning the sampling system is very easy. Wetted components can be removed and cleaned without tools.
- The compact cooling system with 24 VDC eliminates all problems with different supply voltages and can be maintained and replaced without special knowledge.
- Replacing electronic modules is also a swift matter. The sampler detects them automatically which reduces the maintenance time to a minimum.

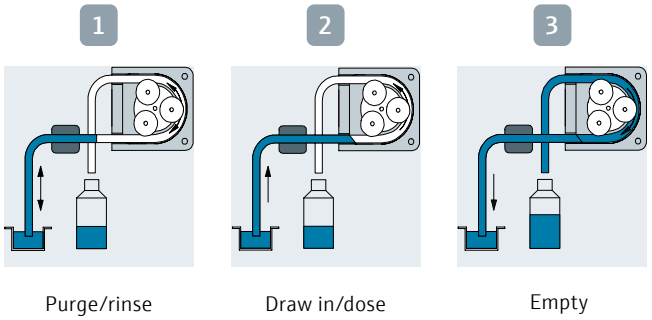
Future-proof

- When equipped with sensors with Memosens technology, Liquistation CSF48 and Liquiport CSP44 turn into a complete system solution for modern environmental monitoring.
- Currently, they can measure twelve different parameters with a tendency steeply upward: pH, ORP, conductivity, oxygen, turbidity, chlorine, nitrate, SAC, ammonium, chloride, potassium and sludge level. Four of those parameters can be measured at the same time.

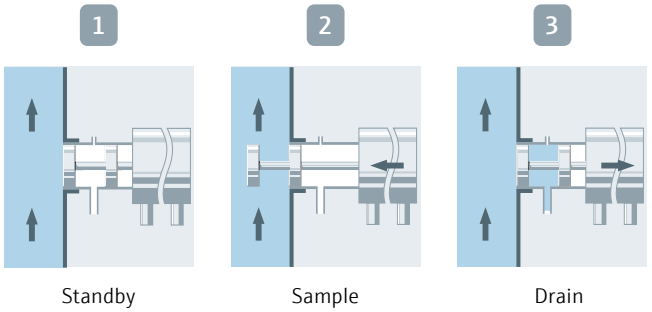
Principle of the vacuum pump



Principle of the peristaltic pump



Principle of sampling with Samplefit CSA420



- What will your process look like in two years? Keep all doors open: Make your sampler ready for four measuring channels in no time.
- Integration into FieldCare (configuration software) and Netilion (IIoT ecosystem) enables effective asset management. These tools offer allround support throughout the plant lifecycle and provide up-to-date and complete information. Netilion allows access to your data independent of time and place for efficient operation of your plant.

Premium service for analyzers and samplers

The right maintenance guarantees smooth operation for long-term, optimum instrument performance

Endress+Hauser offers a wide range of services focused on industrial measurement and process automation. These range from application advice to commissioning and calibration and even complete maintenance packages. Our service support offering gives you everything you need for the entire life cycle of your facility.

Application advice and commissioning
The demands on your employees are increasing continuously. They must maintain the existing facilities while simultaneously planning and commissioning new ones with state-of-the-art technology. Endress+Hauser can help you with these tasks. Our contacts provide comprehensive application advice, draft concepts and you need individually, we offer professional support both for Endress+Hauser devices and other makes.

Support services
Do you need immediate advice in emergencies or support in maintenance planning? Our Sales and Service Support Centers not only offer services on site but also remote expert services supporting you in:
- Commissioning of devices, configuration and replacement
- Remote diagnostics and troubleshooting
- Execution of services
- Improvement of plant performance

work with you to develop the ideal solution. We commission the measuring points along with you, provide support for the integration into the facility-wide process control and asset management system and run a series of tests to ensure that your measuring point works correctly.

Maintenance concepts
Our maintenance concepts provide the right safeguards for quality and safety-related measuring points. We work closely with our customers and, in consultation with you, determine the amount of maintenance required for your devices.
From Service Level 1, in which we carry out all required maintenance tasks and generate documented reports about compliance with quality procedures, to Service Level 4, where you can select the service components

Thanks to innovative remote connectivity solutions and unique expertise, support services aim to reduced unexpected plant downtime, effort for on site maintenance and costs of field service call-outs for maintenance or device replacement.

Analytical solutions

Turnkey solutions for liquid analysis

Depending on the measuring task in question, we develop customer-specific analytical solutions such as monitoring panels, cabinets or stations as well as automation systems. We support you from the concept development stage to implementation and commissioning. What's more, with our global support network, you can rely on Endress+Hauser as your partner throughout the entire life cycle of your solution.

Monitoring
Our monitoring stations are supplied in turnkey condition and contain all of the components required from sample preparation right through to the transfer of data to higher-level systems. This guarantees easy installation, operation and calibration. The monitoring solutions are individually adapted to the customer's specific ambient conditions as well as communication and service requirements.

Automation
Our automation solutions support you in optimizing your processes, be this aeration control or phosphate dosing in a wastewater treatment plant or the automatic cleaning and calibration of pH measuring stations in the chemical, food & beverage or power & energy industries.

Your benefits
- Single source supplier
- Ready to use thanks to excellent project consultation right from the planning stage
- Efficient process integration as our containers and cabinets are designed in cooperation with you
- Fast commissioning due to function-tested analytical measuring technology
- Reliable operation in the field with easy measured value management provided by optional remote access and telealarm
- Worldwide support

Experts in pH, conductivity, oxygen, turbidity and disinfection

Endress+Hauser pH measuring systems can be found in any application that requires reliable measured values, a high degree of availability and long operating times. With our extensive experience in the production and development of process sensors, we occupy a leading position in the world market.

For further information:

Know-how in sensor technology
In no other component of a measuring point is so much development expertise and time invested than in sensors. The vertical range of manufacture, modular assemblies and a high degree of automation guarantee the utmost in product quality, safety and reliability no matter what liquid analysis parameter you want to measure.

User-friendly transmitters
Endress+Hauser transmitters are renowned for their standardized, easy-to-use interfaces. With its navigator function, the Liquiline product family, in particular, offers users added convenience. Furthermore, its modular design means that it can be easily extended as required.

The product portfolio ranges from the low-cost single-channel unit to the multichannel and multiparameter controller Liquiline CM44, so you always have the right transmitter to suit every application.

Wide range of assemblies
Virtually any measurement in the process requires an assembly that has to be optimally designed for the sensor and application. Our line of assemblies ranges from extremely flexible immersion holders to the automatic heavy-duty retractable assembly which enables on-the-fly sensor removal and delivers reliable measured values even at elevated pressures and temperatures. Combined with a wide range of process connections, you are sure to find a solution for every installation position.

Parameters		Advantages and benefits
pH The monitoring of the pH value is a guarantee for optimized product yields in all sectors of industry. In addition, the pH value is an important controlled variable that has a bearing on the efficiency of a plant.		▪ Universal glass electrodes (0 - 14 pH) Large product portfolio for all applications. Available with gel or liquid reference and various junctions. Suitable for temperatures up to 140 °C ▪ Non-glass ISFET sensors For hygienic applications and processes with a high particle content. Shatter-proof sensors that react quickly and are suitable for low temperatures ▪ Shatter-proof electrode with pH-sensitive enamel For hygienic applications and direct installation in the process, stable measurements over many years, extremely corrosion-resistant
Conductivity Monitoring the electrolytic conductivity level is important for monitoring wastewater treatment and controlling treatment processes. In the chemical industry, the conductivity is used to determine the concentration of acids and bases.		▪ Contacting conductivity sensors Wide range for all applications: for high temperatures, in pure and ultrapure water, in hygienic applications and in wastewater and drinking water; the sensors have a simple design and are very sensitive ▪ 4-electrode contacting conductivity sensors For applications with widely varying conductivity values such as phase separation ▪ Inductive conductivity sensors Robust Indumax CLS50D sensor with excellent chemical resistance properties, for measuring the concentration of acids, bases and salts; hygienic sensor CLS54D for the food and pharmaceutical industry, suitable for high conductivity values, not sensitive to fouling
Oxygen The level of dissolved oxygen is an important indicator of the quality of water when monitoring surface water or during water treatment. It is also a key parameter for optimum conditions in the aeration basin and in fish farming.		▪ Amperometric oxygen sensors Always the right sensor for a wide range of tasks, ranging from hygienic applications and water treatment to wastewater; time-tested technology with accurate results, Memosens COS51E with 3-electrode system for maximum long-term stability ▪ Optical oxygen sensors COS61D for water, wastewater and fish farming, COS81E for hygienic applications in the life sciences and food industries; purely optical measurement method based on the principle of fluorescence quenching; characterized by short response times, high availability and low maintenance
Turbidity Turbidity measurement is an important quality parameter in drinking water. In wastewater, turbidity is measured to control the wastewater treatment processes in the primary sludge, in sludge dewatering and in the aeration basin through to the outlet.		▪ Turbidity sensors Online turbidimeters and sensors for drinking water and treated process water and wastewater sensors; use the common scattered light method at 90°, 135°, the alternating light method and the absorption method; reliable sensors offering long-term stability ▪ Sludge level measurement For water, wastewater, mining and the chemical industry, ultrasonic system for parallel measurement, minimum installation effort, easy configuration
Disinfection Free chlorine, chlorine dioxide, total chlorine, bromine and ozone must be measured in all areas of disinfection to ensure safe and efficient water treatment.		▪ Amperometric disinfection sensors Suitable for drinking water, recreational water, industrial water and wastewater, sensors for free available chlorine, chlorine dioxide, total chlorine, bromine and ozone, membrane-covered, low maintenance and virtually unaffected by flow conditions ▪ Measuring panels for disinfection Complete measuring points including all components carrying medium and couplings, ready for connection, easily accessed from the front and easy to calibrate and maintain
Transmitters and systems Transmitters complete the measuring point. They process the measured value and display it or make it available for further processing. Automatic cleaning and calibration systems prove their worth in applications with strict requirements.		▪ Transmitters For all possible applications. Product portfolio ranges from the cost-effective 4-wire device Liquiline CM14 over the powerful, 2-wire device Liquiline M CM42 to Liquiline CM44 - the multiparameter and multichannel controller for all digital sensors with Memosens technology. The portfolio is supplemented by Liquiline Compact CM72/CM82, the smallest transmitter for Memosens sensors with plug-in head. ▪ For analog systems, the Liquisys systems are available. ▪ Fully automated cleaning and calibration systems for pH measurement For demanding applications, or for aggressive process conditions in the chemical, food and pharmaceutical industries
Assemblies Assemblies are the interface to the process. They place the sensors in the boiler, pipe, fermenter or basin in the preferred position in the medium.		▪ Retractable assemblies For constant sensor availability e.g. full tank or process pressure ▪ Installation assemblies Low-cost assemblies if the application does not require sensor replacement or cleaning under process pressure ▪ Holder and assemblies for immersion operation Flexible systems for open basins and channels, or installation in tanks from above ▪ Flow assemblies For bypass measurement in water works, food and chemical industry, power stations

Water is our life

Increase your efficiency and ensure compliance with an experienced and trusted partner

Today more than ever the water & wastewater industry must balance the opposing pressures of improving water safety and shrinking budgets. Whether treating for consumption or discharge, process complexity is rising. Endress+Hauser combines a wide portfolio of smart measuring instruments with industry-experienced consulting and expert services to flexibly and efficiently ensure water safety with verifiable regulatory compliance.

Endress+Hauser helps you to improve your processes:

- With a comprehensive portfolio of measuring instruments and tailor-made services
- With reliable industry application expertise
- With optimized maintenance routines through instruments with self-diagnostic functionalities

Product highlights

Liquiline CM44
Fexible multichannel and multiparameter transmitter for 12 different parameters and up to eight sensors. Fast commissioning thanks to plug and play. Easy operation due to intuitive menu guidance. Seamless integration into process control systems via digital fieldbuses. Comfortable remote access via any web browser.

Oxymax COS61D
Optical oxygen sensor with Memosens technology for fast, drift-free measurements in the biological stage of wastewater treatment plants or reliable monitoring of surface water and drinking water quality. Low maintenance thanks to optical technology and stable fluorescence layer.

Turbimax CUS52D/CUS51D
Turbidity sensors with Memosens technology. CUS52D for safe measurements in the low turbidity range and in drinking water. Reduces installation effort and avoids product losses. CUS51D for reliable measurements in a wide application range thanks to integrated application models. Very low maintenance due to self-cleaning design.

Memosens CCS51D
Digital sensor with Memosens technology for measurement of free chlorine in drinking water, pool water or process water. Reliable values even with fluctuating flow rates and conductivities. Long maintenance and calibration intervals thanks to membrane-covered sensor head.

Liquistation CSF48/CSF28
Stationary sampler for water and wastewater treatment. Safe samples thanks to insulated, cooled sample compartment. Fast cleaning and maintenance due to easy removal of medium-transporting parts. Flexible adaptation to application needs via a variety of sampling methods and sampling programs.

Liquiline System CA80
Analyzers for precise online measurement of e.g. ammonium in all critical control points of wastewater treatment plants: inlet, aeration basin, outlet. Low maintenance thanks to automatic calibration and cleaning. Low reagent consumption. Connection of up to four Memosens sensors. Advanced diagnostics for higher process safety and improved process documentation.

Safe water
The cost-effective supply of clean water is one of the main challenges - today and in future. Comprehensive monitoring of water quality requires a portfolio that covers all relevant parameters. Liquiline CM44 enables you to measure up to eight of the water quality parameters simultaneously - simply by connecting the corresponding sensors via plug and play. You achieve:

- Reliable, accurate measured values
- High plant availability thanks to low-maintenance operation and calibration in the laboratory
- Easy installation, commissioning and operation for cost-optimized plant operation
- Seamless integration into your process control system via diverse digital fieldbuses
- Documentation of sensor life cycles and process traceability using sensor and measuring point management tools such as Memobase Plus

Comply with limit values - reduce fees
The primary focus in wastewater treatment plants is to protect downstream waters. This is why the limit values are becoming stricter every year. To keep discharge fees at reasonable levels and to avoid penalties, managers of wastewater treatment plants need nutrient monitoring they can rely on. Liquiline System CA80 analyzers use standardized measuring methods for full consistency with laboratory results. In addition, the analyzers feature the logbooks to provide continuous documentation of the measured values to the water authorities.

Analyzers and samplers in wastewater treatment

Preliminary sedimentation
During primary treatment, the wastewater is separated into „generally liquid substances“ - the water part - and „generally solid substances“ - the sludge part. The water part contains organic carbon as well as nitrate and ammonium. These are known as nutrient parameters.

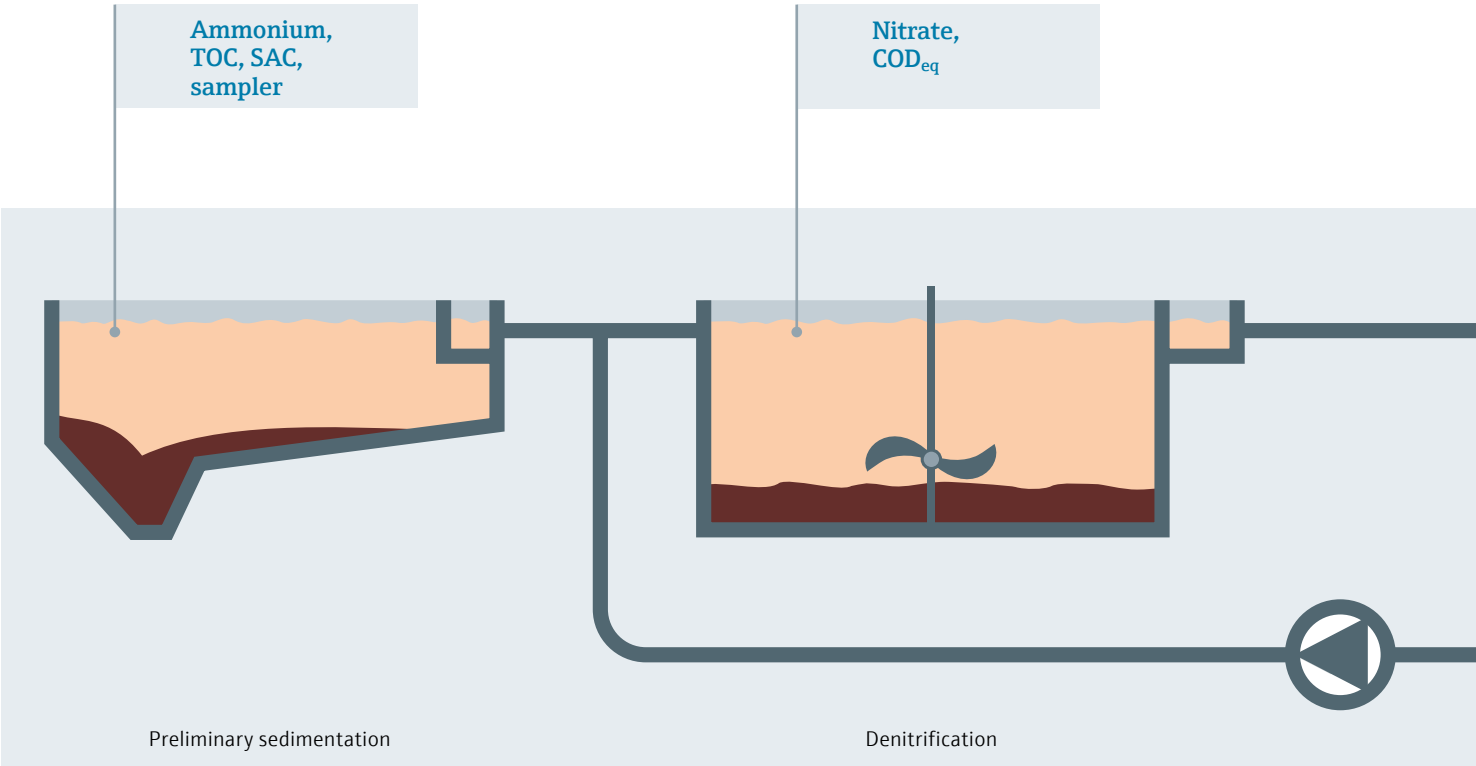
What is measured?
- TOC and SAC measurements provide information on the carbon load entering the plant > CAS51D, CAS80E, CA72TOC
- Ammonium measurement provides information on the amount of nitrogen in the wastewater. This nitrogen also has to be digested in the biological treatment phase > CAS40D, CA80AM with CAT860, CA80TN
- Sampling enables a detailed analysis of the introduced water.

These measurements taken prior to sludge activation make it possible to detect load spikes and to redirect these into buffer basins. Their subsequent return to the wastewater treatment process allows for safe and smoother system operation. The discharge values can be maintained at any time.

Denitrification and recirculation
Wastewater and activated sludge are merged during this process. If oxygen is not present, nitrate is reduced to basic nitrogen. This is the first step in the biological treatment process. Carbon serves as a source of nutrition for the bacteria and is also reduced.

What is measured?
- The measured COD value provides information on the amount of carbon in the biological treatment process > CA80COD, CAS51D, CAS80E
- Nitrate measurement indicates the nitrate nitrogen which is reduced during this stage of the process > CAS51D, CAS80E

The next stage of the treatment process can commence as soon as the nitrate is processed. A low concentration of nitrate in the denitrification stage is essential to achieving low concentrations in the outlet and thus reducing wastewater charges. By determining values for the sludge parameters it is possible to optimally control the sludge process.



Nitrification
During the nitrification stage, oxygen is used to reduce the remaining ammonium to nitrate. Some of the wastewater is returned to the denitrification stage for further nitrate reduction and to „inoculate“ the fresh wastewater.

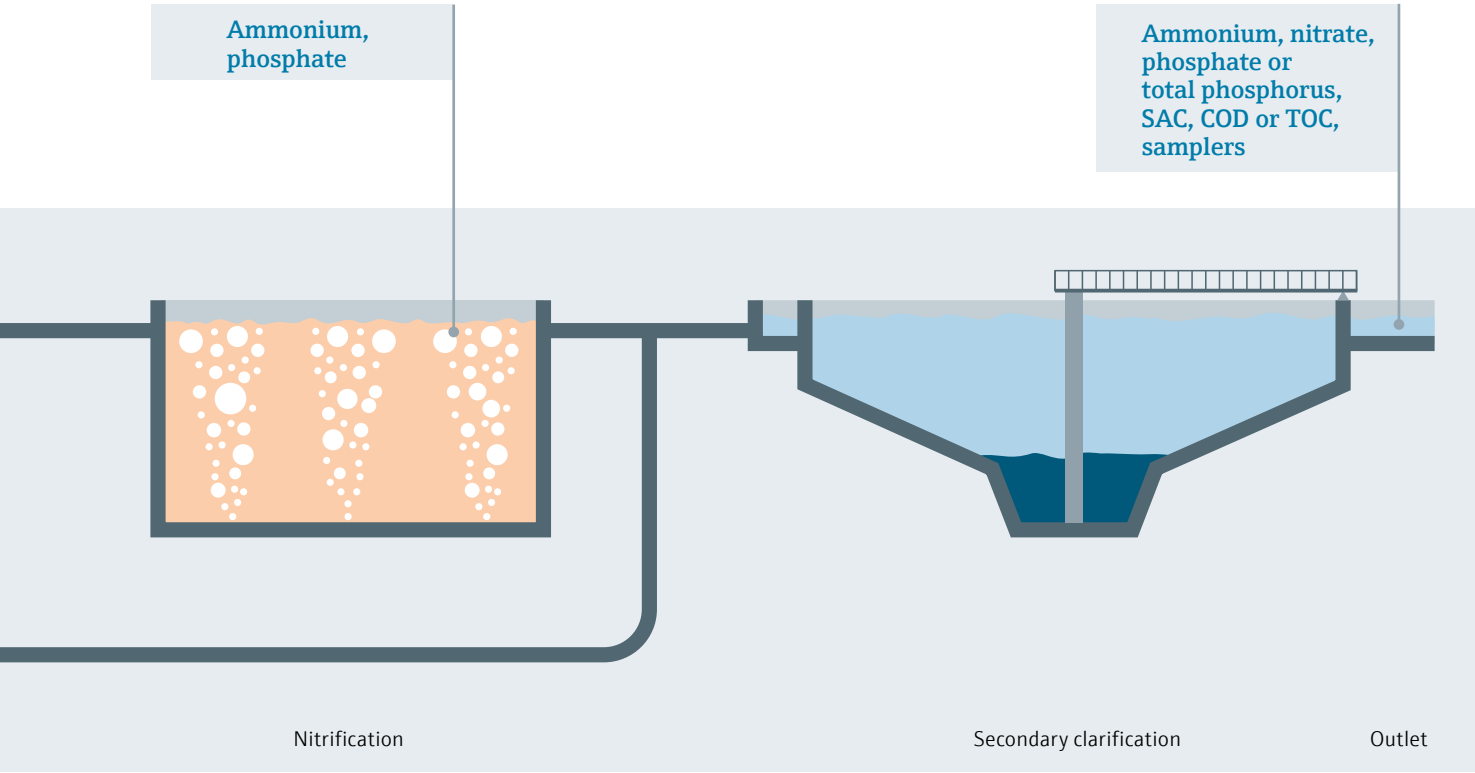
What is measured?
- The ammonium measurement indicates how much ammonium has been reduced > CAS40D, CA80AM with CAT820
- Oxygen is measured to help regulate and control the efficiency of the reduction process. Too little oxygen slows down the process while too much drives up operating costs > COS61D
- Orthophosphate measurement is used to regulate and control the dosing of precipitants > CA80PH with CAT820

Aeration accounts for up to 70% of the power used in biological wastewater treatment plants. Sensors for ammonium, nitrate and oxygen can reduce aeration and thus lower the energy consumption of the plant.

Outlet
After biological treatment, the wastewater settles in the secondary clarifier. The sludge settles on the floor and can be reused as activated sludge or surplus sludge. The clear water is drawn off and directed as clean water into public bodies of water via the drainage canal.

What is measured?
In clear water:
- Ammonium and nitrate measurements are indicators of the ability of the wastewater treatment plant to reduce the nitrogen load > CA80AM, CAS51D
- SAC, COD and TOC measurements document the degradation efficiency of the wastewater treatment plant with regard to the carbon load >CAS51D, CA80COD, CA72TOC
- The measurement of phosphate in the form of PO_4^{3-} or P_{tot} provides information on the rate of phosphate removal > CA80PH, CA80TP
- Sampling in combination with comprehensive quality monitoring proves compliance with legal discharge limits

Continuous monitoring of the discharge values ensures safety. Complete documentation can be used as proof of wastewater treatment performance to the authorities, and also for internal monitoring purposes. As the sludge profile is monitored, changes caused by a heavy downpour, for instance, can be detected quickly and countermeasures can be taken.



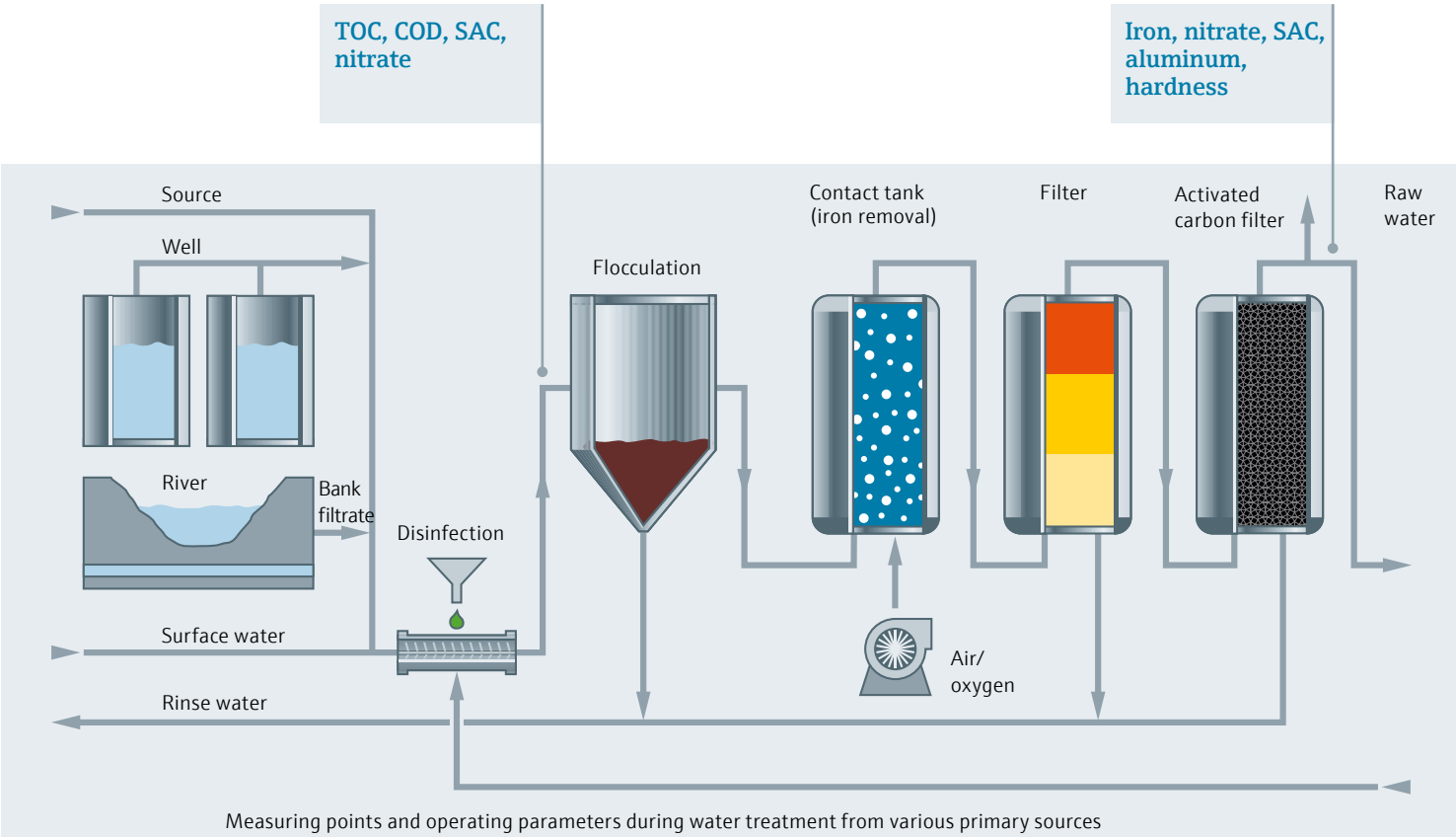
Analyzers and samplers in water treatment

Untreated water
Water from different sources carries with it different loads. For example, water from springs and wells contains particles; surface water contains additional biologically active elements; and process water from industrial processes contains chemicals. The aim here is to ascertain the quality of the untreated (raw) water:

What is measured?
- Physical variables such as the pH value, turbidity and conductivity, and the organic load SAC, TOC and derived variables provide information on the usability of the untreated water > CM44, CAS51D, CAS80E, CA72TOC
- Nitrate - when converted to nitrite - can cause toxicity and thus has to be measured > CAS51D, CAS80E, CA80NO
- Sampling after bank filtration allows for monitoring of the sample quality in the laboratory > CSF28, CSF48, CSP44

Industrial water treatment
The water passes through various stages in the treatment process: substances causing turbidity are removed by flocculation and gravel filters; oxygen is added to oxidize iron; and the pH balance is regulated. The resulting water is now the basis for drinking water. It is also used as process water in industry.

What is measured?
- The physical variables pH, turbidity and conductivity make it possible to regulate the pH balance and oxidation > CM44
- The iron content is measured after the filtration process to gauge the efficiency of the oxidation > CA80FE
- The nitrate concentration is measured to check the limit value for drinking water. Nitrite measurement provides information on the presence or absence of hazardous substances > CAS51D, CAS80E, CA80NO
- The residual aluminum is measured to determine the flocculant that remains after filtering > CA80AL
- Water hardness analysis helps optimize softening processes such as ion exchange or reverse osmosis > CA80HA



Measuring points and operating parameters during water treatment from various primary sources

Drinking water treatment

The treated water is pressurized or pumped into an elevated tank. Depending on the conditions, chlorine is injected into the pipe as a disinfectant and the water is then fed into the drinking water system. The water quality undergoes a thorough analysis at the waterworks outlet.

What is measured?

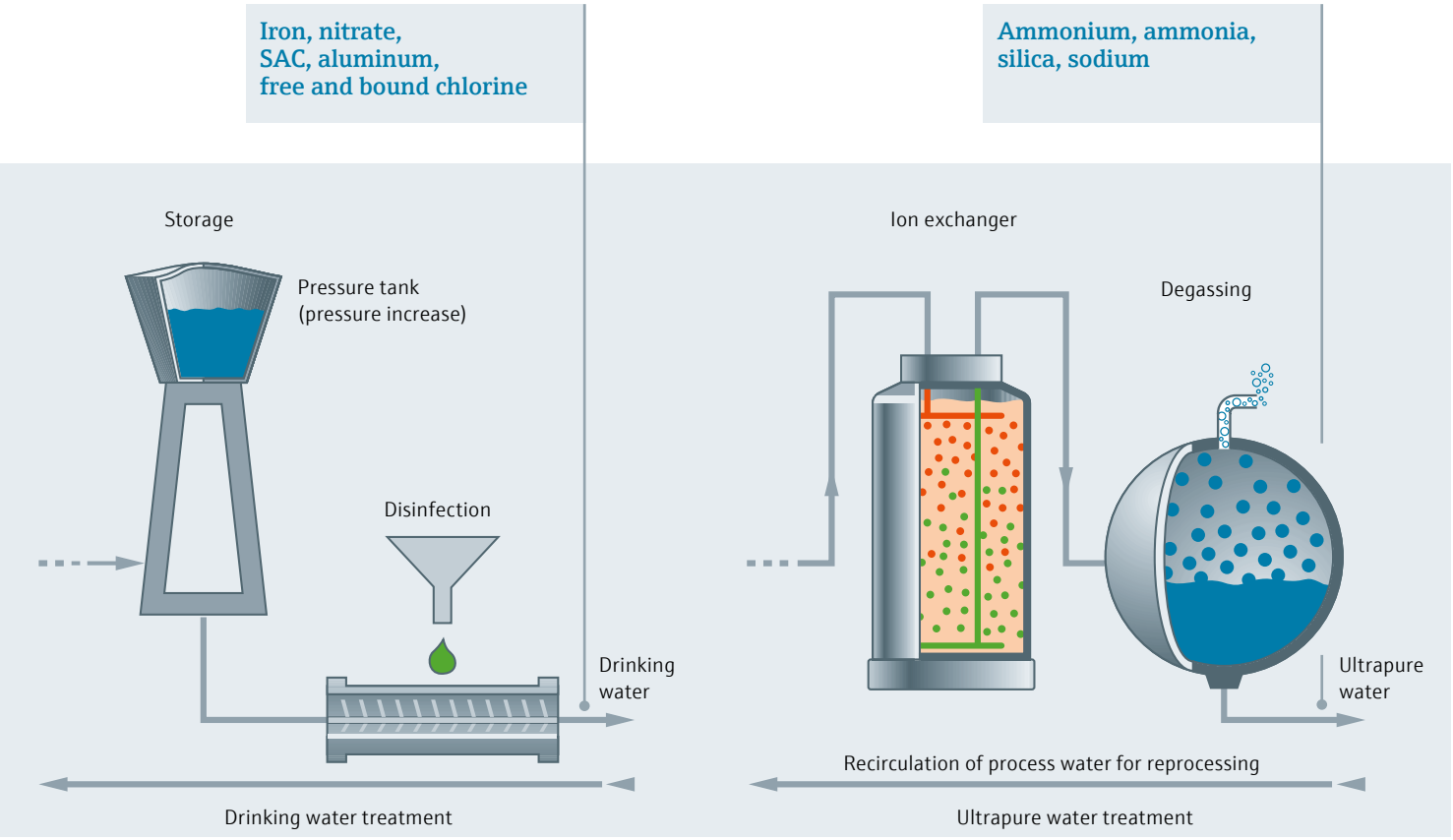
- The amount of free available chlorine reflects the disinfection quality of the water > CM44, CCS51D
- Physical variables such as pH and turbidity are measured to ensure that water quality complies with legal regulations > CM44
- The amount of iron and aluminum in the water also provides information on compliance with legal regulations > CA80FE, CA80AL
- Water hardness is measured to classify drinking water > CA80HA

Ultrapure water treatment

Ionic salts are removed from the treated water. The water is softened and gas is removed. This results in ultrapure water for industrial processes or boiler feedwater for power stations. As they have already been treated, the return water and condensate are directed back into the water system.

What is measured?

- At high pressures and temperatures, residual oxygen can cause excessive corrosion and thus has to be monitored > CM44
- The difference in conductivity provides information about the operation of the ion exchanger and the pH value > CM44
- Ammonia is used as a corrosion inhibitor. It is measured to ensure optimum dosing > CA80AM
- Silica can cause buildup on the turbine blades. For this reason, it is very important to monitor the amount of silicate in power plants > CA80SI
- Sodium content detects dissolved impurities and is an early indication of condenser leaks or malfunction of ion exchangers > CA76NA



Trust in quality

We help you to improve quality while reducing operational costs.

Constant demand for consistency in product quality and taste makes Food & Beverage a demanding industry. Complexity increases as ever more stringent hygiene regulations for food safety add cost pressures. Endress+Hauser's industry leading portfolio of reliable instrumentation, expert global consulting and accredited calibration services all combine to enable greater plant availability, resource conservation and high repeatability in processing with traceable compliance.

Endress+Hauser helps you to improve your processes:

- With a hygienic, robust product portfolio that meets international standards
- With access to traceable, reliable and real-time data
- With a network of industry application experts that help you ensure greater plant availability throughout the product life cycle

Product highlights

Smartec CLD18/CLD134
Compact, inductive conductivity systems for beverage plants. Hygienic design prevents product contamination. Fast detection of phase separation minimizes product losses and organic load of wastewater. Suitable for cleaning in place (CIP). CLD18 is suitable for small pipe diameters.

Liquiline CM44
Fexible multichannel and multiparameter transmitter for 12 different parameters and up to eight sensors. Fast commissioning thanks to plug and play. Easy operation due to intuitive menu guidance. Seamless integration into process control systems via digital fieldbuses. Comfortable remote access via any web browser.

Indumax CLS54D
Inductive conductivity sensor with Memosens technology for highest hygienic and sterile demands. Food-grade virgin PEEK body without joints or crevices. With all required hygienic certificates. Suitable for cleaning in place (CIP) and sterilization in place (SIP). Available with all common hygienic process connections.

Memosens CPS77E and Ceramax CPS341D
Glass-free pH sensors with Memosens technology for hygienic applications. Unbreakable for highest product safety. Low maintenance. CPS77E provides reliable measurements and fast response times even at low temperatures and features contanimation-resistant gel. Sterilizable and autoclavable. CPS341D is long-term stable over many years. Suitable for cleaning in place (CIP) and sterilization in place (SIP). High mechanical stability thanks to pH-sensitive enamel on a steel carrier.

OUSAF11
Glass-free NIR/VIS absorption sensor for phase detection and suspended solids. Unbreakable for highest product safety. Fast response time for minimized product losses. Suitable for cleaning in place (CIP) and sterilization in place (SIP). Flexible installation: insertion in pipes or immersion in basins. Low maintenance thanks to stable lamp and dirt-repellent FEP sensor head. FDA and 3-A certificates.

Cleaning in Place (CIP)
Cleaning in place is a key application in every food or beverage process. The concentration of the cleansing agents is a decisive factor to ensure the hygienic operation of a production facility. This concentration is controlled by conductivity measurement using the Smartec compact devices or Liquiline CM44 and Indumax CLS54D. These inline measurements deliver fast measured values for optimized control of the cleaning process and precise dosing of the cleansing agents.

Phase separation
Cost efficiency plays a decisive role in the food industry. Cost savings can be achieved by avoiding product losses and reducing the organic load of the wastewater. To achieve these aims, fast detection of the product/water phase separation is indispensible.
In processes where media with different conductivities are used, the Smartec compact devices or Indumax CLS54D with Liquiline CM44 guarantee a reliable detection of phase separation. In dairies, Liquiline CM44P and the glass-free OUSAF11 process photometer are the ideal solution.

No glass breakage in foodstuff
Food applications do not tolerate glass breakage – that's why glass-free sensors are used in these applications for maximum product safety.

Competitive and safe

We help you boost your plant's safety and performance

Maximizing productivity and profitability whilst meeting toughening safety and sustainability standards is the greatest challenge facing the chemical industry today. Technological innovation brings opportunity, but reliability is vital. Plant modernization is expedient, yet project delivery complex. Our innovatory instrumentation with safety built-in, allied to expert safety and project consulting, enables Endress+Hauser to deliver solutions to safely and reliably attain peak plant performance.

Endress+Hauser helps you to improve your processes:

- With our field instruments that are designed with safety in mind
- With our worldwide industry application know-how
- With technologies and services for performance optimization

Product highlights

Liquiline CM42
Robust transmitter for demanding applications and hazardous areas. Intuitive operating concept for easy commissioning, operation and maintenance. Seamless system integration via HART, PROFIBUS PA, FOUNDATION Fieldbus. International approvals for hazardous areas.

Memosens CPS71E
Digital pH sensor with Memosens technology for fast-changing media compositions. Resistant to poisoning thanks to pressurized reference system or ion trap. Fast response time due to ceramic junction. International approvals for hazardous areas.

Memosens CPS11E
Digital pH sensor with Memosens technology for long-term monitoring of stable processes. Long poison diffusion path and dirt-repellent PTFE junction. Process glass for highly alkaline media available. Pressure-stable up to 16 bar. International approvals for hazardous areas.

Indumax CLS50D
Inductive conductivity sensor with Memosens technology for concentration measurement of acids, bases, brine and chemical products. High chemical stability and temperature-stable up to 125°C thanks to PFA or PEEK coating. Large sensor opening avoids soiling. International approvals for hazardous areas.

OUSTF10
Scattered light turbidity sensor for undissolved solids, emulsions and immiscible media. Highly sensitive inline measurement for quality control of product purity, fast detection of filter blocking or filter ruptures and leakage detection in heat exchangers. Temperature-stable up to 90°C. Approved for hazardous area use (ATEX, FM).

Cleanfit CPA871/CPA472D
Retractable assemblies for sensor cleaning and calibration without process interruption. Intelligent safety functions prevent unintended moving of the sensor into or out of the process. Suitable wetted materials for corrosive processes. Manual versions are pressure-stable up to 8 bar (CPA871) or 4 bar (CPA472D), pneumatic versions up to 16 bar (CPA871) or 10 bar (CPA472D).

Safety for people and environment
Handling combustible, toxic substances is still a critical challenge for the chemical industry and a potential risk for the safety of people and environment. When developing our devices, we take all relevant factors for a safe plant operation into account. Our instruments comply with international safety standards/ recommendations and are approved for application in explosion-hazardous areas.

Process safety for sensors
Chemical processes often involve aggressive media, which makes regular sensor cleaning a must. Retractable assemblies such as Cleanfit CPA871 enable sensor cleaning and calibration without process interruption and are perfectly suited for the chemical industry.

- Robust thanks to wetted materials such as PEEK, PVDF, etc. for corrosive processes
- Mechanically stable thanks to metallic support housing
- Intelligent safety functions prevent unintended movement of the sensor into or out of the process.

Technologies for efficiency and quality
In the chemical industry, production efficiency, product quality and operating costs are key factors of production. They are, however, interdependent which makes optimization a rather complex task. It is not easy to find the right balance. To achieve top performance of production processes, a great number of reliable and precise data and key performance indicators are necessary. Innovative technologies and services for liquid analysis support the generation and analysis of these data. They enable:

- Reduced maintenance by providing accurate process data
- Precise key performance indicators of the measuring points for highest reliability
- Higher availability of the measuring points thanks to Memosens
- Lower operating costs and higher occupational safety thanks to calibration in the laboratory

The pulse of life sciences

Trust a reliable partner who helps you achieve operational excellence

Today's thriving biopharmaceutical industry demands high productivity and efficiency balanced with meticulous alignment to GMP standards. From our innovatory ASME-BPE compliant product portfolio enabling standardized production automation, reliable monitoring and predictive maintenance, to our expert consulting in process scale-up and operations optimization, Endress+Hauser offers the full solution. We speed time to market, sustain operational excellence, enhance productivity, and reduce risk.

Endress+Hauser helps you to improve your processes:

- With the largest range of innovative and compliant measuring instruments, integrated calibration solutions and the latest instrument diagnostics
- With standardized project engineering and project management as well as a service portfolio that focuses on higher productivity

Product highlights

Liquiline CM44P

Flexible multichannel and multiparameter transmitter. Combines up to four Memosens sensors and two process photometers for the monitoring of process quality in the life sciences industry. Fast commissioning and seamless integration into process control systems thanks to digital fieldbuses. Comfortable remote access via web browser.

Memosens CPS61E

Robust digital pH sensor for fermentation processes in bioreactors. Suitable for SIP, CIP and autoclaving. Certified biocompatibility with regard to biological reactivity acc. to USP Class VI, FDA compliant, no zytotoxicity, free from animal-based materials. Optional pharma certificate of compliance.

Memosens CLS16E and CLS82E

Digital contacting conductivity sensor for highly precise measurements and 4-electrode conductivity sensor for reliable measurements over a wide measuring range. Certified hygienic design according to FDA, EHEDG, USP Class VI (CLS16E) and 3-A (CLS82E). Sterilizable and autoclavable.

Memosens COS81E

Optical oxygen sednsor for precise and long-term stable measurements in hygienic applications. High safety thanks to compensation of LED aging. Certified hygienic design according to EHEDG, ASME BPE and compliance with USP Class VI and FDA. Sterilizable and autoclavable.

OUSAF44

UV absorption sensor for reliable monitoring of product concentrations. Excellent accuracy for maximum linearity and full consistency with laboratory results. Suitable for sterilization in place (SIP) and cleaning in place (CIP). Liquid-free online calibration traceable to NIST.

CA79

Low-range TOC analyzer for ultapure water or water for injection (WFI). Continuous measurement and fast response time ensure effective protection of pharmaceutical batches. Complies with requirements of the European and American pharmacopeias and enables operation according to FDA 21 CFR Part 11.

Memosens technology

Product quality, measuring accuracy and reproducibility are all critical in the highly regulated life sciences industry. Memosens digital technology enables you to achieve consistent measured values from the laboratory over pilot plants through to the process. With Memosens, you can perform calibration under optimum ambient conditions to improve measuring accuracy. Furthermore, it offers advanced diagnostic functions that provide an excellent database to decide whether a sensor is still ready for the next batch or needs to be cleaned and regenerated - a very important benefit for biotech processes.

Memobase multichannel and multiparameter tool for measurement, calibration and documentation enables full traceability

The Memobase software stores the complete lifetime history of all Memosens sensors used. It is beneficial for GLP, GMP, Audit Trail and enables you to operate in accordance with FDA 21CFR Part 11. With as-found/as-left documented values, changes in the sensor characteristics during the batch can be identified, printed and stored. Memobase Plus turns your computer into a space-saving, high-performance workstation with up to four channels. It minimizes the risk of discrepancies between laboratory results of grab samples and online values. The same type of sensors with identical signal communication can be used in the laboratory as in the process – essential for product quality improvement as well as production efficiency.

Power up your plant

Power plants play a vital role, we help maximize uptime while delivering safety and productivity

Today's Power & Energy industry must strike a complex balance: meeting spiraling demand for affordable and reliable energy while increasing cleaner and renewable sources in the energy mix. As cost and regulatory pressures grow, modernization is essential for efficient, safe resource use. As renewables advance, so does the need for energy storage. With best-fit instrumentation, deep power application expertise, services and solutions, Endress+Hauser brings efficient, reliable productivity.

Endress+Hauser helps you to improve your processes:

- With innovative installation concepts executed during operation to minimize downtime
- With experts to advise you from concept to commissioning
- With measurement technologies, accessories and mechanical pre-assembled components to minimize outages

Product highlights

Liquiline CM44
Flexible multichannel and multiparameter transmitter for 12 different parameters and up to eight sensors. Fast commissioning thanks to plug and play. Easy operation due to intuitive menu guidance. Seamless integration into process control systems via digital fieldbuses. Integrated VGB calculation models.

Memosens CLS15E
Digital contacting conductivity sensor with Memosens technology for pure and ultra-pure water. Reliable measurement of lowest conductivities and determination of differential conductivity for the calculation of pH values enable safe determination of corrosion, impurities and conditioning of the water. Low maintenance thanks to polished measuring surfaces.

Memosens CPS11E
Digital pH sensor with Memosens technology. Long poison diffusion path and dirt-repellent PTFE junction. Salt ring for accurate measurements at low conductivity in steam production. International approvals for hazardous areas.

Memosens COS22E
Digital amperometric oxygen sensor with Memosens technology for trace measurement. Optional gold cathode for compensation of cross-sensitivities. Reliable measured values for safe detection of possible pipe corrosion. Long-term stable with international approvals for hazardous areas.

Liquiline System CA80
Analyzers for precise online measurement. Accurate silica values for the monitoring of ion exchanger quality during feedwater preparation. Reliable iron values for safe detection of potential corrosion of heat exchangers. Low maintenance thanks to automatic calibration and cleaning. Low reagent consumption. Connection of up to four Memosens sensors to Liquiline System CA80.

SWAS panel
Panel containing the complete measuring technology for online monitoring of water and steam quality, including temperature and pressure reduction. Seamless integration into process control systems. Tamper-proof documentation of the measured values. Tailored to individual customer requirements.

Highest safety thanks to reliable trace measurement
In power plants, the quality of the water is a key factor in keeping the water/steam cycle free from contamination. Turbines, boilers and pipes can become corroded and encrusted if the water is not pure enough, leading to expensive repairs or even complete unit replacement. The high temperatures and pressures in the water/steam cycle and the low measuring ranges demand smart solutions.

- Conductivity, pH and oxygen sensors that have been designed for trace measurement ensure that even minute impurities in the demineralized feedwater are detected.
- SWAS panels (Steam/Water Analysis System) comprise all the measuring technology that is needed to monitor a water/steam cycle. The measurements are performed online, i.e. a sample of the feedwater comes directly from the cycle, passes through a temperature and pressure reduction system (sample preparation) and is then sent to the sensors and analyzers that are mounted on the panel. The sample is discarded after the measurement.

Extracting more from less

In a world of lower ore grades, skill gaps and excavation challenges, we can help you hit your targets.

Never more so than today has the mining, minerals & metals industry had to manage such tension between soaring demand, increased scarcity, lower ore grades, fluctuating prices, and toughening safety and sustainability criteria. Combining our innovative product portfolio with our deep application and industry knowledge enables Endress+Hauser customers to optimize processes, boost productivity, and ensure safety and environmental compliance.

Endress+Hauser helps you to improve your processes:

- With process experts who recommend the best-fit products, services and solutions according to industry requirements
- With solutions that mitigate risk and reduce your environmental impact
- With access to the right data at the right time

Product highlights

Liquiline CM44
Flexible multichannel and multiparameter transmitter for 12 different parameters and up to eight sensors. Fast commissioning thanks to plug and play. Easy operation due to intuitive menu guidance. Seamless integration into process control systems via digital fieldbuses. Comfortable remote access via any web browser. Chemoclean function for automated sensor cleaning.

Memosens CPF81E
Digital pH sensor with Memosens technology. Robust polymer housing protects against mechanical damage. Flat pH membrane for application in abrasive media. Second electrolyte bridge for better protection against electrode poisioning ions (S^{2-}, CN^{-}).

Turbimax CUS71D
Digital ultrasonic sensor for interface measurement in e.g. thickeners. Quick, continuous interface information ensures precise control of valves and separators. Fast commissioning thanks to predefined calculation models. Low maintenance due to wiper function.

Flexdip CYH112/CYA112
Modular holder for the installation of sensors and assemblies in open basins or tanks. Flexibly adaptable to any installation situation: ground, wall or rail mounting with chain retainer, fixed or pendulum holder.

Cleanfit CPA871/CPA472D
Retractable assembly for sensor cleaning and calibration without process interruption. Guarantees longer sensor lifetime even in harsh environments. Intelligent safety functions prevent unintended moving of the sensor into or out of the process. Suitable wetted materials for corrosive processes. Manual versions are pressure-stable up to 8 bar (CPA871) or 4 bar (CPA472D), pneumatic versions up to 16 bar (CPA871) or 10 bar (CPA472D).

Cleanfit Control CYC25
Cleaning unit for retractable assemblies. Combined with Liquiline CM44 and Chemoclean Plus, it provides automated, regular sensor cleaning. Enables interval measurement in aggressive and abrasive media. Extends sensor lifetime even in harsh environments.

Measuring reliably even under toughest conditions
Processes in the primaries and metals industries are extremely demanding for sensors because they often involve abrasive solids. The sensor design must be very robust or the sensors must to be cleaned regularly to withstand these conditions.

- Memosens CPF81E pH sensor features a flat membrane that offers little contact surface for abrasive media.
- Cleanfit CPA871 assembly offers an optional immersion chamber that provides additional protection for the sensors.
- Cleanfit Control CYC25 in combination with Liquiline CM44 provides automated regular cleaning of the sensors thus contributing to reliable measurements.

Memosens technology makes daily life easier for plant personnel
The primaries and metal industries are not only demanding for measuring technology but also for the people who work in these industries. Thanks to Memosens digital technology, they only have to spend little time in the plant to exchange the sensors. Cleaning, regeneration and calibration can be done in the safe and comfortable environment of the laboratory.

Fuel for thought

We reduce complexities to help you perform, comply and thrive in the Oil & Gas sector

Maximizing plant availability, safety and the efficiency of operations are the key challenges for today's oil and gas industry. Complexity increases in the face of volatile market forces, strict international regulations and your ever-tightening resources. Close, accurate monitoring of key process parameters is critical. Our broad, reliable portfolio of instrumentation, deep industry experience, and our services and solutions make Endress+Hauser the ideal partner for optimal plant performance.

Endress+Hauser helps you to improve your processes:

- With the largest portfolio of safety instruments that comply with international regulations
- With applied technologies and people who have extensive industry application know-how
- With access to accurate and traceable information

Product highlights

Liquiline CM42
Robust transmitter for demanding applications or hazardous areas. Intuitive operating concept for easy commissioning, operation and maintenance. Seamless system integration via HART, PROFIBUS PA, FOUNDATION Fieldbus. International approvals for hazardous areas.

Memosens CPS11E
Digital pH sensor with Memosens technology. Long poison diffusion path and dirt-repellent PTFE junction. Salt ring for accurate measurements at low conductivity in steam production. International approvals for hazardous areas.

Indumax CLS50D
Inductive conductivity sensor with Memosens technology for high-temperature applications and hazardous areas. High chemical stability thanks to robust materials (PFA, PEEK). Large sensor opening avoids soiling. International approvals for hazardous areas.

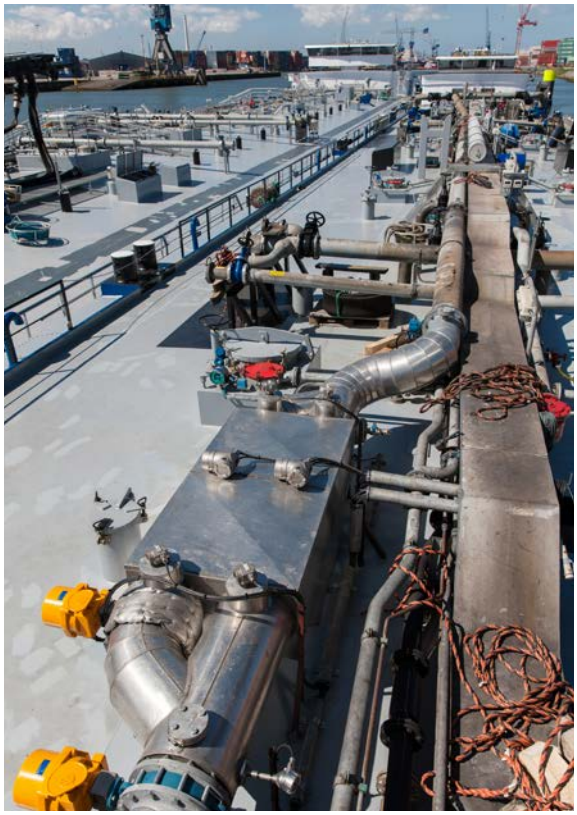
Cleanfit CPA871
Retractable assembly for sensor cleaning and calibration without process interruption. Guarantees longer sensor lifetime even in harsh environments. Intelligent safety functions prevent unintended moving of the sensor into or out of the process. Suitable wetted materials for corrosive processes. Manual versions are pressure-stable up to 8 bar (CPA871) or 4 bar (CPA472D), pneumatic versions up to 16 bar (CPA871) or 10 bar (CPA472D).

Memobase Plus CYZ71D
Multichannel and multiparameter tool for measurement, calibration and documentation. Higher process safety thanks to sensor traceability: full history of all applied Memosens sensors. Minimizes the risk of discrepancies between laboratory results and process values. More safety for plant personnel: they only spend minimal time in the plant to exchange the sensors. Cleaning, regeneration and calibration is done in the safe and comfortable environment of the laboratory.

Water preparation and treatment in oil production and refining

Production and refining of mineral oil requires large amounts of water and steam that need to be prepared for the refining process and treated after the process. Our portfolio provides complete monitoring of the water quality:

- Steam monitoring is performed by pH and conductivity sensors for accurate measured values in low measuring ranges. They help to avoid corrosion and deposits in the steam pipes and to prevent leakages.
- During process water preparation, digital pH sensors with salt ring provide precise monitoring of the boiler feedwater while turbidity sensors control the preparation process.
- Wastewater treatment and water reuse are becoming more and more important due to increasing water scarcity. Here, oxygen, turbidity, conductivity and ammonium measurements support the refineries in optimizing the wastewater treatment, increasing their water reuse and reducing discharge fees.



Steam and industrial water management

Rely on Endress+Hauser to boost your steam management and industrial water treatment

Utilities such as water, air, gas, energy and steam play a vital role in a multitude of auxiliary industrial processes, and yet despite the potential they offer they can be overlooked in the search for optimization opportunities. Whether for steam systems or industrial water treatment, the portfolio of applications and rich consultancy expertise offered by Endress+Hauser enable our partners to improve plant availability, safety, efficiency and compliance.

Endress+Hauser helps you to improve your processes:

- With customized solutions for your energy applications
- With competent planning, commissioning and maintenance
- With engineering, project management of simple solutions, for example, for boiler houses all the way to complete system solutions

Product highlights

Liquiline CM44
Flexible transmitter for 12 different parameters and up to eight sensors. Fast commissioning thanks to plug and play. Easy operation due to intuitive menu guidance. Seamless integration into process control systems via digital fieldbuses. Comfortable remote access via any web browser.

Memosens CLS15E
Digital contacting conductivity sensor with Memosens technology for pure and ultra-pure water. Reliable measurement of lowest conductivities for safe determination of corrosion, impurities and conditioning of the water. Low maintenance thanks to polished measuring surfaces.

Memosens CPS16E
Combined pH/ORP sensor with Memosens technology. Provides simultaneous pH and ORP measurement for better process control. Delivers information on the acid load and oxidizing effect of the water in filtration systems, for example.

Memosens COS22E
Digital amperometric oxygen sensor with Memosens technology for trace measurement. Optional gold cathode for compensation of cross-sensitivities. Reliable measured values for safe detection of possible pipe corrosion. Long-term stable with international approvals for hazardous areas.

Liquiline System CA80
Analyzers for precise online measurement. Accurate silica values for the monitoring ion exchanger quality during feed water preparation. Reliable iron values for safe detection of potential corrosion of the heat exchanger. Low maintenance thanks to automatic calibration and cleaning. Low reagent consumption. Connection of up to four Memosens sensors to Liquiline System CA80.

Memosens CCS51D
Digital sensor with Memosens technology for measurement of free chlorine in drinking water, pool water or process water. Reliable values even with fluctuating flow rates and conductitivities. Long maintenance and calibration intervals thanks to membrane-covered sensor head.

No contamination of feed water
High quality of boiler feedwater is a key factor to avoid corrosion or build-up of deposits in boilers or pipes. They might lead to expensive repairs or even complete unit replacement. Conductivity, pH and oxygen sensors, specially designed for trace measurement, ensure that even minute impurities in the demineralized feed water are detected. Plant operators can react fast and take necessary measures.

Safe cooling water cycles
Cooling water cycles must run stably and must not interfere with the product. Contaminated cooling medium can cause corrosion or build-up of deposits and thus leakage in the cooling water cycle that leads to mixing of product and cooling medium. Conductivity, pH, chlorine and SAC sensors ensure that contamination is detected before problems can occur.
Cooling water must be of such quality that no micro organisms can settle in the system. They form a biofilm on the pipes that impedes the heat transfer and thus limits the cooling performance. Reliable chlorine measurement enables precise chlorine dosing leading to bacteria-free water.

Seamless system integration

Greater transparency through added information: only digital field buses enable device and process data to be transmitted simultaneously. That is why our devices are available with all state-of-the-art fieldbus technologies.

Intelligent devices with digital communication offer users a vast number of benefits for plant operation. In addition to seamless integration into automation systems and the ability to monitor functional capability, digital communication also allows you access to what's happening in the process. This offers significant benefits:

- Comfortable device configuration and optimization of your processes.
- Optimum plant availability and reliability thanks to state-of-the-art diagnostics and predictive maintenance.
- High flexibility: main device variables and parameters are available.
- Full transparency due to access to all parameters and diagnostics of the devices and process environment.
- Cost-efficient, fast system integration without additional network components or gateways.

Endress+Hauser's fieldbus laboratory in Reinach (CH)

Fieldbus technology from Endress+Hauser

Endress+Hauser only uses internationally-recognized open standards for the digital communication of its field devices. This ensures seamless intergraton into plants and guaranteed investment protection. Various communication systems that Endress+Hauser also supports have become established in the area of process automation:

- HART
- PROFIBUS DP/PA
- FOUNDATION Fieldbus
- Modbus
- EtherNet/IP

Endress+Hauser is one of the pioneers of fieldbus technology. The company plays a leading role in the implementation of HART, PROFIBUS DP/PA and FOUNDATION Fieldbus technology. Endress+Hauser operates its own fieldbus laboratory in Reinach, Switzerland:

- Accredited PROFIBUS competence center
- Engineering of fieldbus networks
- System integration testing
- Training courses and seminars
- Customer-specific application development
- Troubleshooting

HART COMMUNICATION PROTOCOL · PROFIBUS · FOUNDATION · Modbus · EtherNet/IP

Tools for selection and operation

Endress+Hauser Applicator

Our Applicator software is a convenient selection and sizing tool for planning processes. Using the entered application parameters, e.g. from measuring point specifications, Applicator determines a selection of suitable products and solutions. Applicator Industry Applications uses graphics or tree structures to guide you to the right product selection. With additional sizing functions and the Applicator Project module for project management, it makes your day-to-day engineering tasks easier.

www.endress.com/applicator

Endress+Hauser Operations App

The app offers mobile access to up-to-date product information and device details such as order code, availability, documentation, spare parts, successor products for old devices and general product information - wherever you are, whenever you need it. Simply enter the serial number or scan the data matrix code on the device to download the information.

Endress+Hauser SmartBlue App

- Time-saving, mobile access to the device and its diagnostic and process information – even in hazardous areas
- Secure data transmisstion for fast and reliable configuration and maintenance. Checked by Fraunhofer Institute.

All apps are available for apple and android devices:

Available on the App Store

ANDROID APP ON Google play

Netilion – the multi-brand ecosystem

Netilion is a cloud-based IIoT ecosystem, designed for industrial processes. It connects the physical and digital worlds to send valuable information from the field straight to your phone, tablet or other devices. Netilion empowers you to improve efficiency and drive innovation.

Multi-brand ecosystem

You have equipment from various vendors in your installation. An IIoT solution should provide data from as many assets as possible, and Netilion can do that. This multi-brand ecosystem brings transparency into a plant regardless of device type or manufacturer.

Security and privacy

Your facility's information is valuable and needs protection. Netilion allows users to access data digitally because it meets internationally recognized standards of cloud-platform security. It's a safe harbor for your data.

Decentralized processes monitored efficiently

- Reduction of routine checkup tours through comprehensive visualization of essential process variables, e.g. flow quantities, limit values, levels, temperature, pressure or physicochemical quality parameters
- Low operating costs through fast reaction in case of failure

Legal compliance thanks to automation

- Continuous measurement of quantitative and qualitative parameters
- Generation of legally compliant documentation thanks to integrated reporting systems

Data access around the clock

- Complete data access independent of time and place
- Numerous options to analyze and visualize ratios, amounts, thresholds, time series and trends, as well as balances
- Everything at a glance thanks to the web-based visualization of networks with optimized depiction for highly diverse terminal devices

More about Netilion:
www.netilion.endress.com

5. Data fusion and analysis

Algorithms for leakage detection, verification, forecasts, etc.

4. Data management and visualization

Monitoring of networks and decentralized infrastructures

3. Data collection and transmission

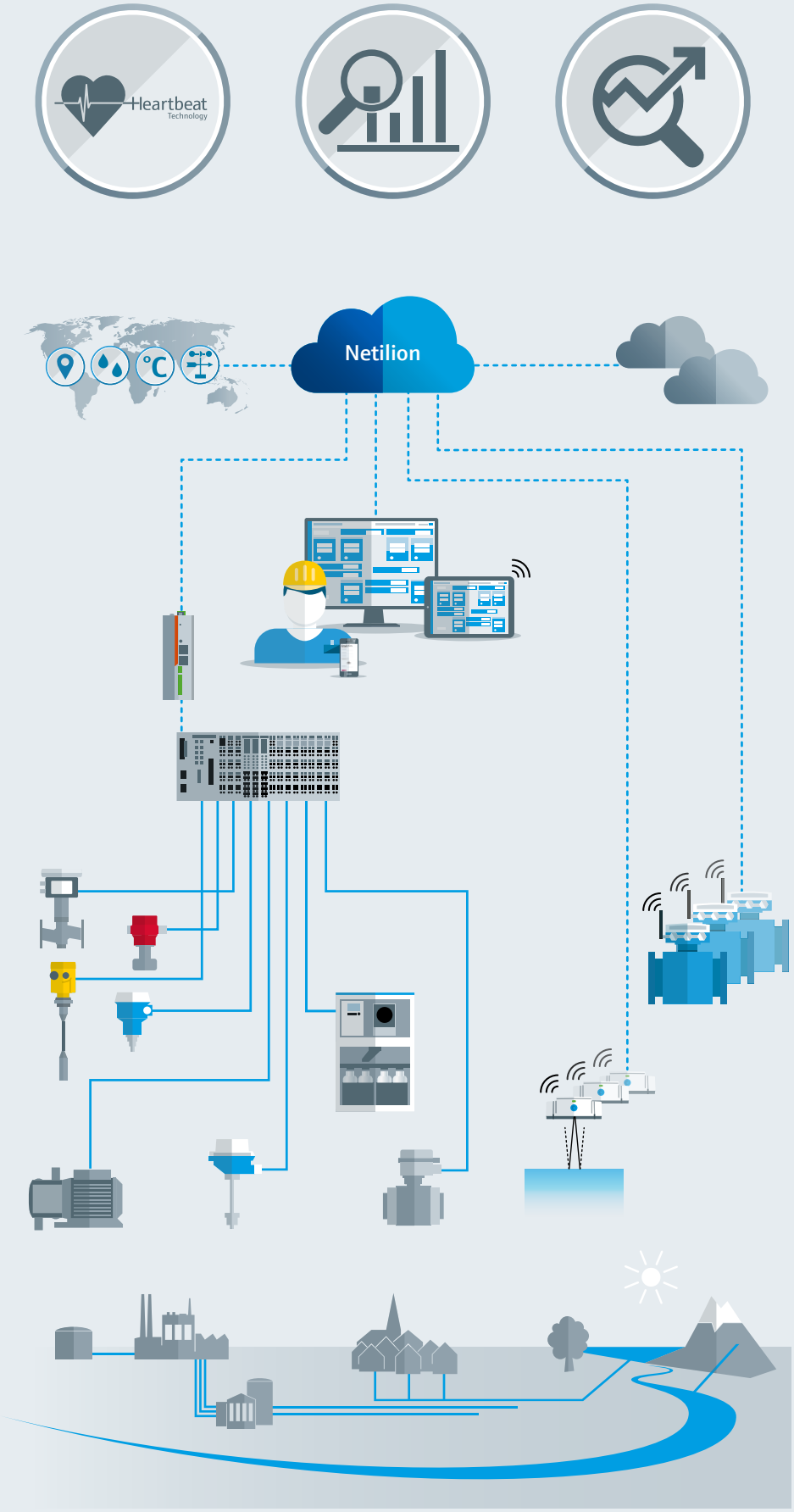
Flexible edge connectivity solutions

2. Data collection and control

Smart field devices and sensors (flow, analysis, pressure, level, temperature, etc.)

1. Physical world

Infrastructure (pipes, pumps, valves, etc.)



Guide to analyzers, sensors and samplers

Parameter	Typical applications	Device	Ranges	
Aluminum	▪ Water treatment	Liquiline System CA80AL	10 - 1,000 µg/l	Al
Ammonium	▪ Water treatment ▪ Wastewater ▪ Boiler feedwater	Liquiline System CA80AM	0 - 20 mg/l 0.5 - 50 mg/l 1 - 100 mg/l	NH_4-N NH_4-N NH_4-N
	▪ Wastewater: optimization of nitrification/denitrification	ISEmax CAS40D/CM44	0.1 - 1,000 mg/l	NH_4-N
APHA Hazen	▪ Outlets of wastewater treatment plants ▪ Drinking water	Memosens Wave CAS80E/ CM44	2 mm OPL 10 mm OPL 50 mm OPL	0 - 12,500 Hazen 0 - 2,500 Hazen 0 - 500 Hazen
BOD (biological oxygen demand)	▪ Drinking water ▪ Surface water ▪ Outlets of wastewater treatment plants ▪ Inlets of wastewater treatment plants	Viomax CAS51D (SAC)/ CM44	0 - 75 mg/l 0 - 375 mg/l 0 - 1,500 mg/l	BOD_{eq} Equiv. KHP BOD_{eq} Equiv. KHP BOD_{eq} Equiv. KHP
	▪ Inlets of wastewater treatment plants	Memosens Wave CAS80E	2 mm OPL 10 mm OPL 50 mm OPL	0 - 5,000 BOD_{eq} 0 - 1,000 BOD_{eq} 0 - 200 BOD_{eq}
	▪ Outlets of wastewater treatment plants		2 mm OPL 10 mm OPL 50 mm OPL	0 - 450 BOD_{eq} 0 - 90 BOD_{eq} 0 - 18 BOD_{eq}
	▪ Surface water		2 mm OPL 10 mm OPL 50 mm OPL	0 - 750 BOD_{eq} 0 - 150 BOD_{eq} 0 - 30 BOD_{eq}
Chromate	▪ Industrial wastewater ▪ Process water	Liquiline System CA80CR	0.03 - 2.5 mg/l 0.2 - 5 mg/l	Cr (VI) Cr (VI)
COD (chemical oxygen demand)	▪ Raw wastewater, inflow and outflow monitoring ▪ Raw wastewater, load control ▪ Industrial discharger monitoring ▪ Monitoring of cooling water	Liquiline System CA80COD	0 - 5,000 mg/l 0 - 5,000 mg/l	COD COD + dilution module (1:4)
		Viomax CAS51D (SAC)/ CM44	0.15 - 75 mg/l 0.75 - 370 mg/l 2.5 - 1,000 mg/l	COD_{eq} Equiv. KHP COD_{eq} Equiv. KHP COD_{eq} Equiv. KHP
	▪ Outlets of wastewater treatment plants	Memosens Wave CAS80E/ CM44	2 mm OPL 10 mm OPL 50 mm OPL	0 - 3000 COD_{eq} 0 - 600 COD_{eq} 0 - 120 COD_{eq}
	▪ Inlets of wastewater treatment plants		2 mm OPL 10 mm OPL 50 mm OPL	0 - 20,000 COD_{eq} 0 - 4000 COD_{eq} 0 - 800 COD_{eq}
Hardness	▪ Monitoring of softening processes in water and drinking water treatment	Liquiline System CA80HA	0 - 80 mg/l	$CaCO_3$
Iron	▪ Drinking water ▪ Wastewater ▪ Mineral well	Liquiline System CA80FE	0.05 - 2.5 mg/l 0.1 - 5 mg/l	Fe Fe
Nitrate	▪ Drinking water ▪ Outlet monitoring of wastewater treatment plants ▪ Monitoring and optimization of denitrification	Viomax CAS51D/CM44	2 mm OPL 8 mm OPL	0.1 - 50 mg/l NO_3-N 0.4 - 200 mg/l NO_3 0.01 - 20 mg/l NO_3-N 0.04 - 80 mg/l NO_3
		Memosens Wave CAS80E/ CM44	2 mm OPL 10 mm OPL 50 mm OPL	0 - 2500 mg/l NO_3-N 0 - 500 mg/l NO_3-N 0 - 100 mg/l NO_3-N
	▪ Wastewater: optimization nitrification/denitrification	ISEmax CAS40D/CM44	0.1 - 1,000 mg/l	NO_3-N

Parameter	Typical applications	Device	Ranges	
Nitrite	▪ Water treatment ▪ Wastewater	Liquiline System CA80NO	10 - 500 µg/l 0.1 - 1 mg/l 0.2 - 3 mg/l	NO_2-N NO_2-N NO_2-N
Phosphate	▪ Wastewater ▪ Drinking water ▪ Boiler water ▪ Cooling tower water	Liquiline System CA80PH	0 - 2.5 mg/l 0.05 - 10 mg/l 0.5 - 20 mg/l 0.5 - 50 mg/l	PO_4-P (blue method) PO_4-P (blue method) PO_4-P (yellow method) PO_4-P (yellow method)
SAC_{254} (spectral absorption coefficient)	▪ Continuous monitoring of wastewater for organic pollution ▪ Special measuring tasks in UV range ▪ Surface water ▪ Drinking water	Viomax CAS51D/CM44	0.1 - 50 m^{-1} 0.5 - 250 m^{-1} 1.5 - 700 m^{-1}	SAC SAC SAC
		Memosens Wave CAS80E/ CM44	2 mm OPL 10 mm OPL 50 mm OPL	0 - 1000 1/m SAC 0 - 200 1/m SAC 0 - 40 01/m SAC
Silica	▪ Power plants: Boiler feedwater, feedwater return from condensers, ion exchanger outlet	Liquiline System CA80SI	0 - 500 µg/l (ppb) 50 - 5,000 µg/l (ppb)	Si Si
Sodium	▪ Power plants: Boiler feedwater, feedwater returning from condensers, ion exchanger outlets, feedwater from desalination plants	CA76NA	0.1 - 9,999 µg/l (ppb)	Na
Total nitrogen	▪ Wastewater ▪ Surface water	Liquiline System CA80TN	0 - 10 mg/l 0 - 50 mg/l 0 - 200 mg/l	N_{tot} N_{tot} N_{tot}
TOC (total organic carbon)	▪ Deionized water in power plants ▪ Deionized water in disinfectant production ▪ Ultrapure water in semiconductor production	CA78	0.5 - 1000 µg/l	TOC
	▪ Ultrapure water in the pharmaceutical industry ▪ Water for injection	CA79	0.5 - 1000 µg/l	TOC
	▪ Municipal water containing solids ▪ Very polluted industrial wastewater ▪ Chemical industry	TOCII CA72TOC	0.25 - 600 mg/l 1 - 2,400 mg/l 2.5 - 6,000 mg/l 5 - 12,000 mg/l	TOC TOC TOC TOC
	▪ Continuous monitoring of wastewater for organic loads ▪ Surface water ▪ Drinking water	Viomax CAS51D (SAC)/ CM44	0.06 - 30 mg/l 0.3 - 150 mg/l 0.9 - 410 mg/l	TOC_{eq} Equiv. KHP TOC_{eq} Equiv. KHP TOC_{eq} Equiv. KHP
	▪ Continuous monitoring of the outlets of wastewater treatment plants for organic loads	Memosens Wave CAS80E/ CM44	2 mm OPL 10 mm OPL 50 mm OPL	0 - 1200 TOC_{eq} 0 - 240 TOC_{eq} 0 - 48 TOC_{eq}
	▪ Drinking water		2 mm OPL 10 mm OPL 50 mm OPL	0 - 8000 TOC_{eq} 0 - 400 TOC_{eq} 0 - 80 TOC_{eq}
Total phosphorus	▪ Wastewater ▪ Boiler feedwater ▪ Cooling tower water	Liquiline System CA80TP	0 - 10 mg/l P_{tot} 0.5 - 50 mg/l P_{tot}	(blue method) (blue method)
Sampling	▪ Inlets of wastewater treatment plants ▪ Outlets of wastewater treatment plants	Liquistation CSF28 Liquistation CSF48 Liquiport 2010 CSP44		

Additional documentation

TI01111C	Liquiline System CA80AM	Ammonium analyzer
TI01258C	Liquiline System CA80NO	Nitrite analyzer
TI01219C	Liquiline System CA80PH	Orthophosphate analyzer
TI01265C	Liquiline System CA80CR	Chromate analyzer
TI01291C	Liquiline System CA80FE	Iron analyzer
TI01185C	Liquiline System CA80COD	COD analyzer
TI00448C	TOCII CA72TOC	TOC analyzer
TI01623C	CA79	Low-range TOC analyzer
TI01622C	CA78	Low-range TOC analyzer
TI01264C	Liquiline System CA80TP	Total phosphorus analyzer
TI01492C	Liquiline System CA80TN	Total nitrogen analyzer
TI01290C	Liquiline System CA80AL	Aluminum analyzer
TI01352C	Liquiline System CA80HA	Hardness analyzer
TI01315C	Liquiline System CA80SI	Silica analyzer
TI01339C	CA76NA	Sodium analyzer
TI00459C	Viomax CAS51D	In-situ sensor
TI01522C	Memosens Wave CAS80E	In-situ spectrometer
TI00444C	Liquiline CM44	Transmitter
TI00427C	ISEmax CAS40D	In-situ sensor
TI01138C	Liquiline System CAT810	Sampling system
TI01131C	Liquline System CAT820	Sampling system
TI01137C	Liquiline System CAT860	Sampling system
TI00443C	Liquistation CSF48	Stationary sampler
TI01690C	Liquistation CSF28	Stationary sampler
TI00465C	Liquiport 2010 CSP44	Portable sampler

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