Long live your power plant! Modular SWAS panels for a safe water/steam cycle

The smart solution for monitoring water/steam cycle

Optimum instrumentation:

Specialized analytical devices minimize maintenance costs and plant downtime and help extend your power plant's service life.

Flexible engineering:

Each panel is adapted to your power plant, presenting a turnkey solution.

Reliable documentation:

Sophisticated documentation tools simplify quality and plant asset management.

Seamless system integration:

Easily integrated into your process control system thanks to certified communication standards.

Strong partner:

Measuring technology, consulting and global support from a single source make the SWAS solution easy and future-proof.





How do you monitor your water/steam cycle?

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 quality of the demineralized water used in power plants depends on a number of parameters. Sodium and silicate (SiO_4^{4-}) indicate the condition of the ion exchange resin in the feedwater treatment system. The conductivity value is an indicator of the ion concentration in the water. If it's too high, this can lead to the build-up of deposits in the systems. If the pH value of the water is too low or the oxygen value too high, there is a risk of corrosion. By measuring the dissolved oxygen, it is also possible to determine whether the negative pressure is causing air leaks in the condenser, to check whether degassing is sufficient and to monitor the integrity of the feedwater circuit. The presence of metals such as iron and copper in the steam/water cycle are an indicator of heat exchanger corrosion.

The readings for the individual parameters therefore provide information on the purity of the water and help you make the right decisions, such as whether to add ammonia to increase the pH value, or use bisulfite or hydrazine to bond the oxygen dissolved in the water.

Monitoring the water/steam cycle

- Prevents damage to your plant and keeps it running effectively.
- Minimizes plant downtime and maintenance costs.
- Documented readings provide proof that water quality has always been within the required range. This way you are always on the safe side in the event of warranty issues with your turbine supplier.

Steam/Water Analysis System (SWAS)

The high temperatures and pressures in the water/steam cycle and the low measuring ranges demand smart solutions. SWAS panels (SWAS = Steam/Water Analysis System) have proven to be especially suitable. All the measuring technology that is needed to monitor a water/ steam cycle is installed on these panels. 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.



Conductivity - the key parameter

The conductivity provides information about the corrosive quality, contamination and condition of the water. In the power industry, a distinction is made between different types of conductivity:

Total (also direct or specific) conductivity

This is a measure of the purity of the water. A sudden increase in the total conductivity is often an indicator of leaks (air entering) or cracks or flaws in the heat exchanger or the ion exchange resin. It also reflects the level of additives and alkalis that have been added.

Cation conductivity (also acid conductivity)

In the cation exchanger, any impurities are transformed into acid, causing a significantly higher conductivity reading – the cation conductivity. This means that even minute amounts of impurities are quickly visible and suitable measures can be taken.

Differential conductivity

The differential conductivity is an indicator of the concentration of alkalis in the ultrapure water. It is also used to calculate - and therefore regulate - the pH value. For example, if the pH value is falling, alkalization agents such as ammonia can be added to quickly return the pH value to the optimum level. This protects the plant from corrosion.

Degassed cation conductivity

When the turbines are started, air and therefore also carbon dioxide are drawn into the condensate, thereby driving up the cation conductivity reading. The degassed cation conductivity value indicates whether this higher reading is caused by impurities or by the less problematic carbon dioxide. If impurities can be ruled out as the cause, the start-up phase is shortened considerably: electricity generation can start earlier, saving you time and money.



Cation, differential and total conductivity



The **total conductivity** is measured upstream from the cation exchanger. In the exchanger, all the cations are replaced by H⁺ ions. If the water does not contain impurities (example on the top left), the result is pure water with a lower conductivity downstream from the cation exchanger.

Any impurities in the water, such as salts, are transformed to their acid form in the cation exchanger (example on the top right: sodium chloride/NaCl \rightarrow hydrochloric acid/HCl). The resulting higher **cation conductivity** is measured at the outlet of the cation exchanger.

Differential conductivity is derived from the two measurements upstream and downstream from the cation exchanger.

Degassed cation conductivity



 CO_2 dissolved in the form of HCO₃⁻ (carbonic acid) occurs when the turbine is started and can affect the cation conductivity value. To be able to factor out this effect, the **degassed cation conductivity** is determined. For this, the sample is heated in a degassing system to drive out the CO_2 . The sample is then measured a second time. In the above example, the sample contains CO_2 and NaCl (becomes HCl in the cation exchanger). With the degassed cation conductivity, it is possible to reliably identify the NaCl despite the presence of CO_2 .

The solution for a long power plant life: Endress+Hauser SWAS panels

We know the importance of water/steam cycle monitoring for your power plant. That's why our SWAS panels come equipped with cutting-edge measuring technology that delivers accurate and reliable measurements even in very low measuring ranges. They are so reliable and maintenance-free that you hardly need to think about them – the measurements are simply taken. And what if maintenance is due? Thanks to the fact that our instrumentation is based on Memosens digital technology (see page 6), you can plan ahead and perform the maintenance swiftly. In this way, you increase your efficiency and avoid expensive plant downtime.

Memosens can do even more: measuring signals are reliably transmitted without any interference. As a result, you always have an accurate and reliable overview of the quality of your water/steam cycle and the status of the individual measuring points that are installed on your panel. If measured values are abnormal, clear messages are displayed so you can take the appropriate action in the right place. This helps you protect your plant from damage and ensures plant longevity. In addition, all values and events are securely logged. Our SWAS has been tested in a host of applications but it remains a very individual solution. It is designed by our engineering experts to suit your particular conditions. You get a turnkey solution that is a perfect fit for your plant - from sample preparation right through to the flowmeter. All you need to do is connect the process connections! In the bidding phase, we provide 3D drawings so you can visualize how your solution will look later on. Furthermore, we also create mechanical and electrical diagrams according to power plant standards that enable swift integration into your process engineering system.

Needless to say, we are also at your service with factory acceptance testing (FAT) and site acceptance testing (SAT) as well as a host of other services provided worldwide, such as on-site consulting, installation, commissioning and product training. If required, maintenance agreements can guarantee the availability of the measured data and enable cost accounting over several years. And what if you have other analytical measuring points? Just talk to us, we are certain to have the right solutions to fit your needs.



Products and solutions for all analytical measuring points in a power plant

Feedwater, steam and condensate monitoring

Parameter	Instrument	Information
Sample preparation	As per customer specification	Pressure and temperature reduction
Total conductivity Cation conductivity Differential conductivity Degassed cation conductivity	CLS15D	For low measuring ranges $\geq 0.05 \ \mu S/cm$
Oxygen	COS22D-##3	For low measuring ranges < 5 ppb
pH / ORP	CPS11D-7AS CPS41D	Long operating life with salt ring Liquid-filled KCl reference
Turbidity	CUE21/22 CUS52D	For bypass installation For process and bypass installation
Silicate	CA71SI	For low measuring ranges < 10 ppb
Ammonium	Liquiline System CA80AM	Simple maintenance, economical consumption
Phosphate	Liquiline System CA80PH	Simple maintenance, economical consumption
Sodium	Sodium 9032	Measuring range: 0.1 - 1000 µg/kg
Hydrazine	CA71HY	Colorimetric measurement method
Iron	CA71FE	Colorimetric measurement method

Cooling water, wastewater and flue gas desulfurization

Parameter	Instrument	Information
Conductivity	CLS21D CLS50D	Conductive for medium measuring range Inductive for high measuring range
Chlorine	CA71CL CCS142D	Colorimetric DPD measurement method Amperometric sensor
Turbidity / solids	CUS51D	Low maintenance with automatic cleaning
pH (flue gas desulfurization)	Topcal CPC310	Automatic cleaning and calibration
Oxygen	COS51D COS61D	Amperometric sensor Optical sensor
Oil in water	FL200	0 - 10 mg/l phenol, oil, BTEX
Organic carbon	CA72TOC	High-temperature TOC analyzer
Nitrate	CAS51D	Optical UV sensor
Samplers	CSP44 / CSF48	Portable / stationary

All-in solutions and tools

Solution	Instrument	Information
SWAS panel	As per customer specification	See SWAS panel catalog
Measurement cabinet / container	As per customer specification	See solution industry catalog
Transmitter	Liquiline CM44	For up to 8 sensors for all parameters
Handheld	Liquiline To Go CYM290	Quick on-site measurement and calibration
Laboratory software	Memobase Plus CYZ71D	Measure, calibrate, document
Measured value simulator	Memocheck Sim CYP03D	For quick and easy commissioning
Reporting software	Field Data Manager MS20	Process data visualization and storage
Asset management software	W@M	Life cycle management

Simplify your life with Memosens and Liquiline

The transmitters in the Liquiline CM44 series make your life easy. For example, you can use pre-calibrated Memosens sensors and connect or replace them in just one simple step. The transmitter recognizes every sensor automatically and reads the data saved in the sensor head. That way your measurement is ready for operation again in seconds and process downtime due to sensor maintenance is reduced to a minimum.

- Ability to connect up to 8 sensors for different parameters
- Automatic sensor recognition speeds up commissioning and saves time during sensor replacement
- Standardized, easily extensible components for lower storage costs and the long-term availability of spare parts
- Integrated, recognized calculation models of the power plant industry (VGB)
- Process data is saved, e.g. in case of warranty issues
- Controller functions, e.g. pH regulation, disinfection, precipitant dosage
- Seamless integration into every process control system (PCS) via 0/4...20 mA, HART, PROFIBUS DP, Modbus TCP, Modbus RS485, EtherNet/IP and web server

Incidentally, CM44 transmitters can also save your process data if required. Using an SD card or wireless communication, you can transfer this data to a PC where it can be visualized with the Field Data Manager MS20 software and securely saved. If your turbine becomes damaged, you have reliable proof of the quality of your water/steam cycle that you can present to the turbine manufacturer.



Liquiline CM44 as a field version (at back) and as DIN rail version with optional display.

Memosens: 1 The cutting-edge sensor technology

Memosens digitizes the measured value within the sensor and provides non-contact interference-free transfer to the transmitter. Since its introduction in 2004, it has become the worldwide leading standard in liquid analysis. Since then, a large portfolio of Memosens products enhances the safety, efficiency, transparency and quality of processes in all industries.

- Safe digital data transmission: inductive, corrosionfree, 100% reliable
- Easy-to-handle sensor connection
- Sensor head stores measurement data and sensor information for predictive maintenance
- Fast plug & play with pre-calibrated sensors
- International standard



Handy helpers for your day-to-day work

Convenient measuring point verification

Memocheck Sim is the perfect tool for checking all the measuring parameters on your SWAS panel. It simulates error messages, user-definable measured values and even dynamic measuring ranges, and assists you during commissioning, maintenance and quality assurance. In this way you can rest assured that measured value transmission is working smoothly, without any issues.

- All parameters in one handheld
- Comprehensive verification from cable coupling to process control system
- Can be deployed with all Liquiline transmitters
- Ex and non-Ex versions available
- Measuring point qualification possible with quality certificate

Measure, calibrate and document in just one tool

The Memobase Plus software turns your PC, laptop or tablet into a high-performance laboratory measuring station for Memosens sensors. With it, you can check, calibrate and regenerate your sensors under optimum conditions. This prolongs the service life and reliability of your sensors and saves you valuable time during sensor maintenance. Calibration cycles and maintenance intervals can be perfectly scheduled and you are constantly alerted to the state of your sensors. Added to this, not only can you pre-calibrate your pH sensors, you can also prepare them for deployment in the process by preconditioning them in high-purity water. This considerably increases measured value availability and accuracy.



Memocheck Sim CYP03D

The sensor and calibration data are saved in both the sensor and the database on your computer. The database contains a full history of all the Memosens sensors deployed in your plant, including buffer management and user administration. All data is easily accessible from a computer connected to the network. If needed, sensor and calibration reports as well as safety-related activity sequences can be printed out at any time for audit trails. With Memobase Plus you always have a convenient overview of your sensors and thus reliably ensure the quality of your water/steam cycle.



The W@M portal is the powerful solution for all administration tasks concerning your installed base with regard to documentation and spare parts management. Memobase Plus is the interface between W@M and your sensors, enabling easy access to certificates and documentation.





"The water/steam cycle in our combined heat and power plant is monitored by a SWAS panel from Endress+Hauser. We are amazed how reliable and low maintenance the solution is and can fully recommend it to other power plant operators."

Lutz Loos, Project leader, Heizkraftwerk Zwickau Süd GmbH



More information about our SWAS solutions is available at www.endress.com/SWAS

www.addresses.endress.com

