EnviroFALK

Pure and ultra-pure water systems

Not just clean, but absolutely pure

Pure and ultra-pure water treatment systems

For more than 30 years, EnviroFALK GmbH has been designing, manufacturing and selling pure and ultra-pure water systems for a wide range of industries worldwide. Fundamentally, water as it comes out of the tap does not present a challenge for process sensors. Ultra-pure water, however, is a whole different story. The sensors used in these treatment processes have to be much more efficient and robust.

> *"With IO-Link, I have full transparency right down to each individual sensor via the HMI and the controller.*

Everyone who has tried to clean a surface with tap water is familiar with the effect: You might find that unsightly stains appear. On window panes or drinking glasses, this effect may only disturb our aesthetical perception, but in industrial processes, it can seriously compromise the quality of products. For example, where treated water is used to rinse processed metal parts to remove oils and coolants, in order to prepare them for subsequent coating or electroplating. Or in the optics industry and in medical technology, where rinsing water must not leave any residue after drying. The solution: pure water. This water contains no dissolved minerals, salts, or bacteria. Depending on the quality grade, the term pure or ultra-pure water is used.

Ultra-pure water systems

The company EnviroFALK based in Westerburg, Germany, has established itself as a specialist in this field. Founded in 1989, the company is now one of the market leaders for ultra-pure water systems.

Peter Leyendecker, co-founder and Managing Director, explains: *"We develop concepts from the different water treatment technologies available on the market: reverse osmosis systems, ultrafiltration, nanofiltration, or ion exchange systems. Often, our systems use a combination of various technologies. We offer our customers complete concepts for water reduction, recirculation, and in particular for pure water treatment."*

Maximilian Meurer, Measurement and Control Engineer at EnviroFALK, explains how it works: *"In this process water treatment system, we inject normal water as it comes out of the tap. In the first step, it is softened. With this soft water, all solids are filtered out by means of reverse osmosis. In the next purification step, the water passes through an ion exchange cartridge. It is filled with a special granulate, or mixed bed resin, which removes all minerals from the water. To check the quality of this fully desalinated water, we use conductivity sensors from ifm. Based on the process value it provides, we can immediately recognise an increase in conductivity once the cartridge is exhausted and needs to be replaced. The pure water is pumped into a tank for intermediate storage and also partially heated to allow for flexible use in various applications. The desalinated water is additionally subjected to UV radiation to combat germs and maintain a high degree of purity."*

Sensors and requirements

Various sensors of the automation specialist ifm are used to monitor the complex treatment process and ensure a permanently high quality of the ultra-pure water. Even the smallest contamination or remineralisation could reduce the quality and must be avoided at all costs. This is why EnviroFALK uses flush mount sensors in their pipes and tanks. The advantage: There are no dead spaces causing static water, which could lead to unwanted enrichment.

Insulated downstream tanks for heating and storing pure water.

Another challenge is that demineralised water will constantly try to compensate for the unnatural desalinated state by dissolving minerals from the surrounding materials, e.g. from conventional stainless steel walls, which will lead to pitting over time. This is why the pipes in this system are made from plastic or stainless steel of a particularly high quality. The same applies to the sensors that come into contact with the media.
ifm provides special sensors for ultra-pure water applications. The contacting parts of the sensing face consist of high-grade stainless steel or other materials from which ultra-pure water cannot extract any molecules.

Key measurement: the conductivity value

The LDL101 conductivity sensor is the right choice where the purity of water is crucial for product quality or process reliability. The conductivity value is the reciprocal of the electrical resistivity value of water. The purer the water, the higher its resistance and the lower the conductivity.

Maximilian Meurer, Measurement and Control Engineer at EnviroFALK, adds: *"We use the IO-Link sensor for conductivity measurement, which is key to assuring the quality of highly purified water. The conductivity indicates the concentration of ions in the water. The smaller the number of free ions, the lower the conductivity. The LDL101 conductivity sensor impressed us with its very large measuring span from 0.04 to 1,000 microsiemens per centimetre. This is ideal because it allows us to cover all system stages with one type of sensor, from normal 'municipal' water at the inlet to ultra-pure water at the outlet. Using only one sensor type reduces our storage costs. And less sensor variety also means less complexity for our service technicians in the field. We have equally been*

impressed by the compact design of the sensor. We can connect it with standard M12 connection technology and do not need expensive data cables or an external evaluation unit in the cabinet, which saves time, space and costs."
The high resolution and the loss-free digital transmission of the measured values via IO-Link enable a permanently precise analysis of the water quality, ensuring flawless processes. For example, if the conductivity value rises during ultra-pure water production, this indicates that parts require maintenance.

Clean pressure measurement

The pressure in the pipes must be monitored at several points in the system. In the future, the PL15 pressure sensor will be used in a complex water system to fulfil a combination of several tasks.
"Firstly, we use the PL15 for pump control. Thanks to IO-Link, the sensor possesses excellent resolution across the entire pressure range of 0 to 10 bar. IO-Link allows direct reading of the measured values in a digital format, i.e. without conversion losses, which gives us even more precision. In addition, we no longer need to make any settings on the sensor itself, which facilitates handling."

Another area of application where the pressure sensor can really unleash its strengths is the tank.

"The PL15 is also suited for level monitoring. Its flush design prevents dead spaces causing static water, and thus, unwanted enrichment. Another benefit of the pressure sensor is that it provides the medium temperature as an additional process value, which further enhances process transparency and control," says **Maximilian Meurer**.

The LDL101 sensor from ifm performs conductivity measurements to monitor water purity, and signals in time when ion exchanger cartridges need to be replaced.

”The main advantages of IO-Link for us are the reduced sensor variety and storage costs.

The specially compact and flush pressure sensors of the PL15 series, which can be freely configured via IO-Link, offer maximum flexibility.

Precise flow rate measurement of ultra-pure water

Also relevant to the customer is the quantity of pure water available at the end of the treatment process. During reverse osmosis, the feed stream is separated into a pure water stream, referred to as permeate, and a concentrate stream, which contains the particles. For example, by comparing both quantities, the plant operator can see that filters require maintenance or that the feed stream is heavily contaminated with foreign substances. To obtain an exact result, the flow rate must be precisely measured at several points in the system.

For this purpose, sensor specialist ifm has developed the SU-type ultrasonic flow meter for ultra-pure water applications, which can detect flow rates of up to 1,000 l/min with high precision. Thanks to ultrasound technology, this also applies to ultra-pure water with low conductivity as it is produced in the plants at EnviroFALK. In combination with the conductivity sensors of the LDL family, reliable control of the quality and quantity can be established in the filtration process.

The measuring pipe of the flow meter is made of higher-grade stainless steel and is free of measuring elements, seals and moving parts. This means that faults caused by deposits, damage, leaks or blockages, which

can occur in mechanical systems such as impellers or turbines, or design-related pressure drops as they occur with other measuring principles, are excluded from the outset. The measuring pipe made entirely of stainless steel eliminates the need for material compatibility tests of electrodes or seals and allows easy, complete and residue-free cleaning. The LED, which can symbolise the signal strength, serves as an additional visual indicator of a stable process. A dropping value can be an indicator of particles, air bubbles or deposits on the inner wall of the pipe.

Non-contact radar measurement in tanks

The IO-Link-capable LW2120 radar level sensor is ideally suited for non-contact level monitoring in tanks. It can detect levels up to a height of 10 metres without blind zones and at a millimetre resolution. The 80 GHz frequency used ensures stable and precise measurement results even in confined spaces. With the antenna extension, available as an accessory, the sensor can also be used outside closed metal tanks, for example on open tubs or plastic tanks.

"For certain applications, we use the radar sensor instead of hydrostatic level measurement. For example, end customers request this in the ultra-pure field, where every screw connection and every measuring point represents a potential source of contamination. In such applications, level measurement using a radar sensor is advantageous, as the sensor is installed outside the tank lid and does not come into contact with the medium," explains **Maximilian Meurer**.

The measuring pipe of ifm's ultrasonic flow meter is free of measuring elements or moving parts and thus ideal for use in ultra-pure water applications.

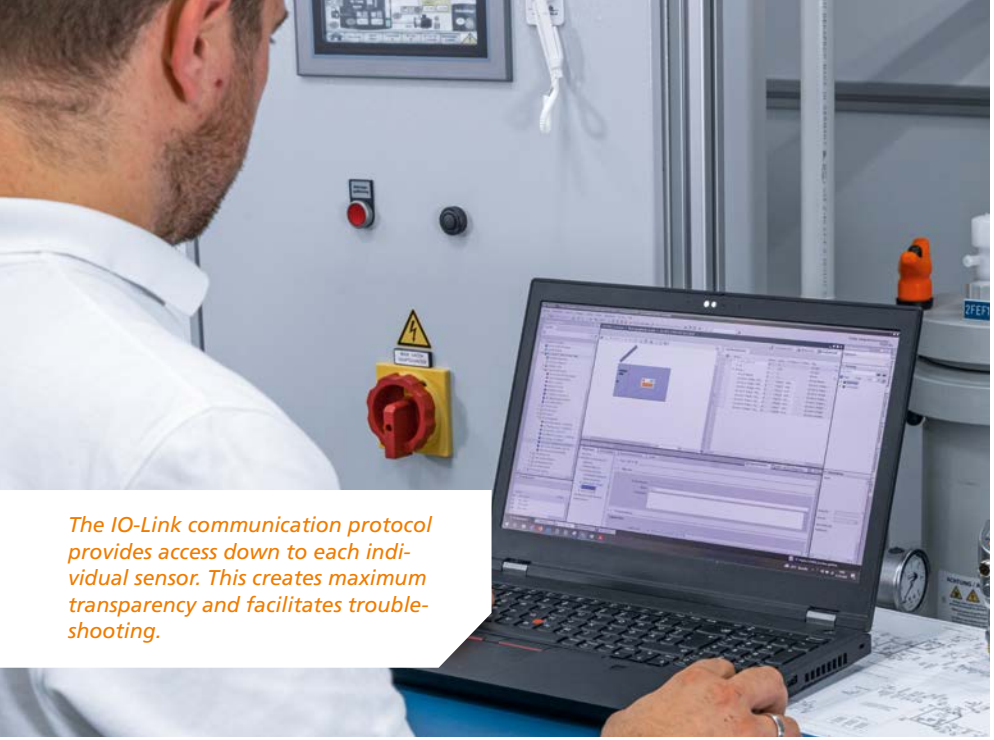
The non-contacting LW2120 radar level sensor is installed outside the lid of the pure water tank.

Standard M12 connection technology ensures error-free installation within minutes, while IO-Link adds the convenience of remote parameter setting and reading. The intelligent algorithm in the unit makes parameter setting via IO-Link seem like child's play: After setting the reference height once, the sensor immediately provides the exact level via IO-Link.

Added value with IO-Link

Speaking of IO-Link: Inspired by the technology, EnviroFALK has chosen to rely on sensors using this digital communication protocol.

Maximilian Meurer explains the benefits: *"With IO-Link, I have full transparency right down to each individual sensor via the HMI and the controller. If abnormal conditions arise, the diagnostic data of each sensor helps me to quickly identify and eliminate the problem. Passing the sensor data into the controller is also very simple. Thanks to cyclic data queries, the measured values are directly provided as numerical values. Previously, with analogue measured values, this was not possible. IO-Link also allows me to query and digitise other data, such*



The IO-Link communication protocol provides access down to each individual sensor. This creates maximum transparency and facilitates trouble-shooting.

as serial numbers or calibration data. I can even specify the output unit of the measured values, e.g. for flow sensors litres per minute or cubic metres per hour. Moreover, IO-Link lets me transmit several measured values of a sensor. An example of this would be the conductivity sensor, but also the pressure sensors we use on the tanks and the pump: We measure the pressure to determine the level in the tank, while at the same time reading the temperature value the sensor provides in order to know the medium temperature in the tank. This saves us the effort of installing additional temperature sensors and adding the corresponding screw connections in the tank. The SU-type flow meter also transmits several measured values through one data line: In addition to the flow rate and the sensor status, the total flow rate and the temperature are also available via IO-Link. And thanks to the data storage function, we, and the end customer notice immediately if a wrong sensor is used or if there are wiring errors. With this function and the simple connection of prewired M12 cables on both the master and the unit, you no longer necessarily need a qualified electrician to just quickly replace a sensor."

IO-Link supports comprehensive parameter setting. Output functions, measuring ranges, switch points and other parameters can be freely selected within the characteristic values of the sensor. Where many different sensors were required before, one IO-Link unit is often all that is needed today.

Maximilian Meurer: *"The main advantages of IO-Link for us are the reduced sensor variety and storage costs. Our service technicians no longer need so many different sensors when replacing devices. This saves time and money."*

Conclusion

In pure and ultra-pure water systems, ifm sensors allow streamlined yet precise process monitoring. IO-Link reduces the storage costs and mounting complexity, which results in significant costs savings, while also creating complete transparency of all processes as companies move into the digital age.
In a nutshell: a clean solution!

Decentralised IO-Link masters save space in the control cabinet and offer the possibility to connect sensors and actuators. Connection to the plant controller is made via Profinet.

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