How to use a liquid monitoring and sampling station to increase process efficiency

Sampling stations have improved over the years and now can be used for much more than just satisfying regulations

By Tracy Doane-Weideman, Endress+Hauser, USA

Water sampling has been required since the 1980s. Every water and wastewater utility or business holding a permit employs some kind of technique or equipment to acquire water samples, and a method to analyze the samples according to guidelines. While some plants still take manual samples, in many cases, automatic water samplers are used.

The vast majority of existing stationary automatic water samplers are used mainly to meet local permit requirements. These samplers are designed to minimize effects on the chemical and physical integrity of the sample, and to ensure adequate storage conditions until they can be analyzed in the laboratory.

Most of the stationary units available on the market today use peristaltic pumps as the sample transport method. These units periodically take samples and combine them into a single bottle that's stored in the sampler at 4° C. Lab technicians remove the sample bottles, and take them to the laboratory for analysis and subsequent reporting.

In recent years, automatic samplers have improved to the point where they can be used for much more than just meeting regulations. Today, several robust automatic sampling transfer methods and systems are available to meet a wide variety of matrix and sample compositions. Advanced features provide data which can be used for increasing the process efficiency of water and wastewater plants.

Sampling the samplers

Automatic sampling systems offer various means of obtaining water samples from basins, closed tanks and pipes. Typically, this involves the installation of a line from the basin, pipe or vessel made from Teflon® or C-Flex® pump tubing from the pipe to the sampling pump. Three types of sample transfer configurations are available:

Peristaltic pumps These pumps meet the recommended line velocity of at least 2 feet/sec at head heights up to 26 feet. Peristaltic pumps are the most common method used for sampling, and are good for toxic applications.

Vacuum pumps These pumps also meet requirements, and have no internal tubing that must be cleaned and maintained. Vacuum pumps can transport samples faster, reducing the time particles have to settle. The lack of compression from tubing avoids particle shearing. This is especially important when determining the dewatering of sludge, the permeation rate of water through membranes, or the head loss in granular media filters. These pumps work well in industrial applications where particle size and shape are important quality parameters.

Closed pipe systems These are used on high-pressure pipes or vessels, and no sample pump is required. A pneumatic probe protrudes through the wall of the pipe or vessel, and extends a plunger into the stream to collect a sample. The sampler can be used on pipes or vessels at pressures up to 87 psi. Some closed-pipe samplers are available with automatic cleaning systems to reduce maintenance of the sample probe.

Monitoring water quality

While the-required analysis of the samples is done in a lab, modern sampling systems can have their own sensors to provide event-driven, online monitoring. These online and real-time measurements can be fed to automation systems to improve process control.

For example, the Endress+Hauser Liquistation sampler (Figure 1) can accept inputs from up to four industrial grade sensors including pH/ORP, conductivity, total suspended solids/turbidity, dissolved oxygen, SAC and nitrate, ammonium/nitrate and free chlorine—in addition to analog inputs from flow or level devices. With the ability to combine sequential sample collection with composite sampling in one system, it's possible to provide the obligatory sample, and collect samples based on events.

Data from the sensors can be stored internally in logbooks or on an industrial SD card, displayed locally on an LCD, and transmitted in real-time via standard industrial networks including EtherNet/IP™, HART®, Profibus® DP, Modbus RS485 and Modbus TCP.

Data collected typically includes measured values with date/time stamps, and information regarding calibration, configuration and diagnostics. Some systems come with built-in web server capability, allowing access to the data from any web browser. With such access, an operator or engineer can check sampler status, read measurement values or change sampling programs remotely from a smartphone, a tablet or a PC.

While most automatic sampling systems are used to meet regulations, and are therefore installed on the output side of a water and wastewater plant, samplers can be installed anywhere in the process as required to control, monitor and improve operation.

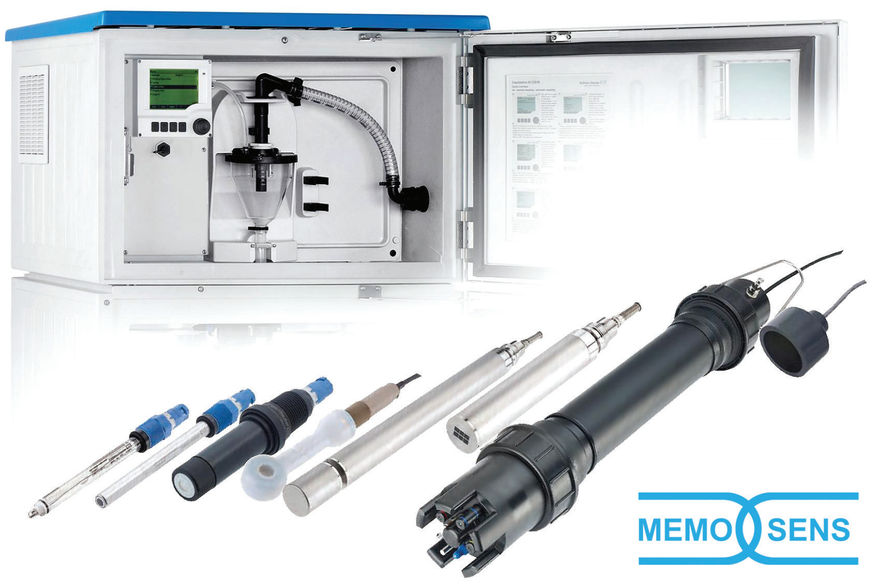

Figure 1: A modern sampling station, such as this Endress+Hauser Liquistation, can accommodate up to four additional process sensors, such as pH, conductivity, total suspended solids/turbidity and dissolved oxygen, to provide information that the W&WW plant can use to control processes.

Controlling processes

When sent to the plant's automation system in real-time, water quality data from the sampling system can be used to monitor and control various treatment processes such as chemical dosing, aeration, sludge activation, carbon load entering the plant, nitrogen in wastewater, load spikes, denitrification, recirculation, carbon in the biological treatment, and dosing of precipitants.

Water from different sources carries with it different loads. For example, water from springs and wells contains particles; surface water contains biologically active elements; and water from industrial processes contains chemicals. Using an automated sampler with analyzers helps determine the quality of untreated raw water, which allows the automation system to adjust processes accordingly.

Event monitoring at the inlet of a treatment plant identifies excursions of effluent entering the plant, such as a large influx of TOC, or a large shift in pH or turbidity, each of which can occur due to accidental discharges by industrial entities upstream of the plant.

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

Automated samplers, therefore, can do more than just satisfy local reporting requirements. When combined with on-board analyzers, modern industrial networks, and supporting software—automated samplers provide vital data for controlling and optimizing water and wastewater processes.

References:

1. Handbook for Sampling and Sample Preservation of Water and Wastewater; United States Environmental Protection Agency; EPA-600/4-82-029; Sept. 1982.
2. 40 CFR Part 136, part 136.3 (e)
3. EPA Handbook for Analytical Quality Control in Water and Wastewater Laboratories

www.ca.endress.com

Endress+Hauser
Canada Ltd
1075 Sutton Drive
Burlington, ON L7L 5Z8

Tel: 905 681 9292
1 800 668 3199
Fax: 905 681 9444

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