

# CIP Conductivity Meter Saves \$500,000 for Busy Food and Beverage Processing Plants

The food processing industry faces increasingly stringent quality standards, cost pressures, and hygienic regulations, all of which help explain the broad adoption of clean-in-place (CIP) solutions that do not require disassembly of processing equipment between production runs.

A well-designed CIP program minimizes downtime, improves safety and product quality, and imposes the lowest impact possible on the environment by minimizing waste. An effective CIP solution also tracks and monitors phase changes in the fluid stream more quickly and accurately, resulting in improved water savings, lower costs, and reduced total cost of ownership.

Water conductivity meters are critical to a CIP system's ability to achieve these results and key to optimizing the performance and efficiency of a CIP solution. Incorporated within the CIP piping, these meters detect real-time changes in the electric conductivity of a sample stream. Conductivity changes due to differing electrical responses from chemicals and detergents passing through the pipe and can indicate when the flushing process has begun and ended. When the meter indicates that conductivity has fallen within a certain threshold, users can be confident that the process stream is primarily clean water and the system is ready for the next run.

Like any component within a system, water conductivity meters vary widely in performance and design, which makes it important to specify options with the demands of CIP systems or a particular food and beverage application in mind. Baumer's high-

sensitivity Combilyz conductivity sensor is designed specifically for CIP systems used in food and beverage processing. Properly configured, it can help save \$500,000 and more than 1 million liters of water annually for high-volume processing facilities.

## Precision Metrics Project Savings

To guarantee food safety and quality, process and filling facilities must be cleaned regularly, completely, and preferably with a cost-effective CIP system that avoids time-consuming disassembly and reassembly of processing equipment between production runs. Specifying components and configuring a CIP system to meet these standards is not always a straightforward task, namely because there are as many CIP requirements as there are cleaning programs.

Some systems are cleaned with water only, while chemical cleaning agents such as acidic or caustic solutions are used in others. Some systems recover water from the last rinsing cycle and use it for the first rinsing cycle of the next CIP sequence to keep overall running costs low.



The efficient *Combilyz* conductivity meter proves its worth through a high level of functionality and hygienic design that meets the highest standards in the food and pharmaceutical industries.



To control concentrate dosing of acid or caustic substances, the conductivity transmitter measures the specified concentration. Precise measurement ensures food safety with minimal cleaning agent usage. The meter's robust hygienic-designed tip survives over a long life cycle.

Regardless of the CIP program selected, the key component underlying its ability to minimize costs, waste, and water usage is the conductivity meter. Two functions of this critical component are important to consider when specifying for CIP applications. First is the meter's ability to help control concentrate dosing of acid or caustic substances. As concentrations of an acid or alkali increase, the conductivity within the CIP's fluid stream changes in predictable measures. Thus, conductivity meters become a fundamental part of a control scheme that ensures highly precise volumes of cleaning chemicals are used to guarantee optimal cleaning with minimal waste. Precise, robust, real-time measurement of conductivity not only improves performance and lowers costs for the CIP system but enables a process that saves resources and protects the environment.

The second function defining high-performance conductivity meters is the ability to accurately monitor phase separation of detergents and water in a CIP system's return flow, which is critical to quickly recognizing different cleaning agents even when temperatures and pressures within the fluid stream fluctuate enormously. It also helps reduce the loss of stored cleaning agents. After one cleaning cycle, highly sensitive conductivity meters can accurately measure the residual concentration of chemicals in the rinsing water to inform the programmable logic controller when the water is absolutely clean, reducing the risk of food contamination. The exact concentration of cleaning agents — along with flow rate, pressure, temperature, and time — defines a reproducible process that allows accurate projections of the water and cost savings enabled by such meters (see sidebar on p. 4).

### Designed for CIP Systems

Conductivity sensors designed for CIP and sterilization processes must perform under very harsh conditions without compromising either sensitivity or accuracy. Baumer's robust Combilyz meter can measure water conductivity within a range of 50  $\mu\text{S}/\text{cm}$  to 1000  $\text{mS}/\text{cm}$  and delivers 1 percent accuracy and temperature compensation of 15 seconds. Its compact design offers a 75 percent improvement in flow volume over competitive systems, regardless of flow speed and inside pipe diameter, thanks to its low profile within the pipe cross-section.

Housing conductivity sensors for CIP processes in a chemical- and heat-resistant material can improve both reliability and performance. Baumer housed the sensing element of its Combilyz meter within a high-performance polyetheretherketone (PEEK) polymer able to withstand the caustic solutions and rigorous temperatures within a CIP system. The housing additionally enables Combilyz to endure frequent thermal cycling and shocks, ensuring a long service life by reducing unnecessary downtime and increasing system availability.

### Third-Party Validation

Well-designed CIP systems proactively comply with cleaning guidelines established by third-party industry groups. According to the European Hygienic Engineering and Design Group (EHEDG) — a consortium of equipment manufacturers, research institutes, and public health authorities formed to promote hygiene during the processing and packaging of food products — an estimated 75 percent of cleanings performed daily in the food industry are not properly validated and are poorly documented. The objective

of CIP validation is to guarantee that the processing equipment is consistently cleaned of food product, microbes, chemicals, allergens, and soils.

Similar guidelines are published by the 3-A Sanitary Standards Inc. (3-A SSI), a nonprofit corporation dedicated to advancing hygienic equipment design for the food and beverage and pharmaceutical industries.

The Combilyz conductivity meter conforms with the standards of both organizations. The hygienic, one-piece molded design of its housing helps support documented validation processes by ensuring deposits and impurities are quickly and efficiently transported out of a CIP system, as confirmed by the component's EHEDG certification and conformance under 3-A SSI guidelines.

#### Intuitive, Adaptable Design

While precision is the defining characteristic for any water conductivity meter, ease of use is also important. Desirable design features include a large illuminated display that can be rotated 360 degrees and read easily from all directions. It allows different view options — for example, the simultaneous display of conductivity and concentration values as well as fully customizable text related to metrics. Additionally, users can see alarms and configurations on the device, which can also be transmitted to the higher-level controller.

With its integrated relay, the Combilyz meter can carry out simple control tasks in environments such as microbreweries, which have a low degree of automation because valves don't have a process control system. The same applies when retrofitting systems undergoing upgrades from manually controlled to partly automated processes.

Available in lengths of 37 mm, 60 mm, and 83 mm, the Combilyz sensor comes in a compact version and a version with separate electronics. The latter comes with cable lengths of 2.5 m, 5 m, and 10 m. If required, the display and the sensing element can be installed separately, allowing maximum flexibility for optimum mounting positions. A wide range of adapters allows hygienic installation in most standard process connections.

Inductive conductivity meters offering high sensitivity, a compact design, short response time, and fast temperature compensation deliver precise cleaning process control to ensure safety, increase uptime, and save water in food and dairy processing plants. Combilyz facilitates efficient resource and material utilization, reducing CIP operation costs by hundreds of thousands of dollars and saving more than 1 million liters of liquid annually.

For more information on the Combilyz water meter, visit <http://www.baumer.com/US-CIP>.



To avoid chemical contamination of food and ensure food safety, the conductivity transmitter precisely measures the residual concentration of chemicals in the rinsing water in order to inform the PLC when the water is absolutely clean.

## Estimate Savings With CIP Calculator

To quantify their savings in flow volume, liquid usage, and total costs, users can enter their CIP parameters into Baumer's CIP calculator ([www.baumer.com/CIP](http://www.baumer.com/CIP)). The CIP calculator also allows companies to easily determine their cost savings when using the CombiLyz conductivity sensor.

For example, a company that has three cleanings per day and four separations per cleaning at 225 production days per year can expect a yearly total cost savings of \$511,163, or on average \$1,400 a day. The same facility will experience a total annual liquid savings of 1,221,451 liters (322,673 gallons), or 3,346 liters (884 gallons) daily.

But it isn't just high-volume food, dairy, and pharmaceutical production facilities that can benefit from CombiLyz. A plant that undergoes only one CIP cleaning per day and two separations per cleaning at 200 production days annually can expect a total cost savings of \$75,728 and total liquid savings of nearly 181,000 liters (47,518 gallons) per year.

Users can enter the following parameters into the calculator to determine their savings and see how the CombiLyz compares with competitive solutions:

Calculation of flow volume in liquid processing				
<b>Introduction</b>				
1.0% accuracy and a fast temperature compensation of less than 15s is why the CombiLyz® conductivity sensor is the most cost-efficient and reliable CIP process control on the market. EHEDG and 3-A certified, in a robust one-piece design with sensing part made of PEEK and housing of stainless steel. The innovative conductivity sensor CombiLyz® clearly stands out from any other product on the market. To find out your cost savings potential based on the short reaction time of the CombiLyz®, add in your current CIP parameters in the calculator below.				
Response time incl. Temperature compensation <b>Standard Sensor (Competitor)</b>	$t_s$	60.0	s	
Response time incl. Temperature compensation <b>Baumer CombiLyz (AFI)</b>	$t_b$	15.0	s	
Flow speed	$v$	2.0	m/s	
Inside Pipe Diameter	$d$	80.0	mm	
Flow Volume	$Q$	603.2	l/min	$=(\pi \cdot \text{Diameter}^2 / 4) \cdot \text{Flowspeed} / 1000$
<b>Standard Sensor (Competitor)</b>	$V_s$	603.2	l	$= Q / t_s$
<b>Baumer CombiLyz (AFI)</b>	$V_b$	150.8	l	$= Q / t_b$
<b>Savings per cycle</b>		452.4	l	$= V_s - V_b$
Number of CIP cleaning per day	#	3	times per day	
Number of phase separations per CIP cleaning	#	4	sequences	
Number of production days per year	#	200		
<b>Standard Sensor (Competitor)</b>		7,238.2	l/day	1,447,646 l/year
<b>Baumer CombiLyz (AFI)</b>		1,809.6	l/day	361,911 l/year
<b>Total liquid savings with Baumer CombiLyz (AFI)</b>		5,428.7	l/day	1,085,734 l/year