



# From water to beer: monitoring critical parameters in brewing

**ThermoFisher**  
SCIENTIFIC

# Improving pH, oxygen & conductivity measurements in beer production

The brewing water's pH value and salt content are major determinants of the taste and quality of beer. This is why depending on the substances it contains, raw or potable water must be subjected to various types of treatment ranging from reverse osmosis and chemical treatment to filtration. pH sensors or Memosens conductivity sensors are used to monitor the brewing water alkalinity and salt content required for each specific style of beer.

## **Mashing process: highly pH dependent starch-sugar conversion**

In subsequent processes, pH measurement also plays a major role. After the brewing water is mixed with milled malt in the mash tun, enzymes convert the starch it contains into maltose. This highly pH-dependent process takes place in the 5.4 to 5.6 pH range. In the next step, wort boiling, hops are added to control the future beer's taste and shelf life, its specific gravity is set and the pH value lowered. Because the SE 555 pH sensor can be sterilized with superheated steam and is biocompatible, it is ideal for monitoring these processes.

## **Oxygen measurement – essential for reliable process management**

Afterward, the trub – hops debris and precipitated protein – is separated in a whirlpool and metered yeast and oxygen are added to the wort in order to trigger the fermentation process. Rigorous rules apply for the yeast. To ensure optimal quality, the pH value and dissolved oxygen content are monitored during yeast breeding. Since the dissolved oxygen content determines yeast vitality during fermentation and taste development as well, oxygen measurement is essential for reliable process management. At this point, the SE 706 oxygen sensor in the hygienic stainless steel variant guarantees reliable inline measurement.

Next, the wort turns into green beer in storage tanks. At this stage, low oxygen content retains the beer's taste. And continuous oxygen measurement also allows leaks in the storage tanks to be detected in time. Before it is bottled, beer is filtered and stored in pressurized tanks. To safeguard taste and prevent oxidation, maximum limit values for the concentration of oxygen must be complied with. Some large breweries also set the precise alcohol content of the beer by diluting it with degassed water. The degassing process is monitored by measuring the dissolved oxygen. The same applies to bottling, in which the oxygen concentration must remain below 25 ppb to maintain shelf life and taste.

## **CIP: Dosing rinse media with inductive conductivity measurement**

In order to comply with the rigorous hygiene rules for food production, the systems involved in brewing beer must be cleaned by alternately flushing with a sodium hydroxide solution and acid (often nitric acid) at temperatures of around 65 °C (CIP process). The concentration of the CIP media (intrusion) is controlled based on inductive conductivity measurement with a SE 680 sensor. During the final rinse of the cleaned process lines, the complete removal of all rinse media is verified using the SE 605 H conductivity sensor.





### **Brewery wastewater treatment**

Last but not least, Memosens technology is also applied in the treatment of brewery wastewater, which requires sensors such as the SE 554 pH sensor, the highly chemical resistant SE 655 for measuring inductive conductivity in heavily polluted media and the long-term stable SE 715 oxygen sensor. Since brewery wastewater treatment assumes an unusually high load of debris, automated cleaning systems at the measuring points involved are recommended.

### **Built for Wet Environments**

Breweries are extremely wet and humid. Robust sensors are a must due to constant temperature swings and frequent equipment washdown. Sensors using conductive metal connection and coaxial cables are susceptible to corrosion causing drift and sensor failure.

The Memosens inductive connection head is completely immune to these conditions. The hermetically sealed submersible connection is made of molded plastic without any metal parts. This means that there is no possibility of corrosion or interference with the transmitted digital signal.

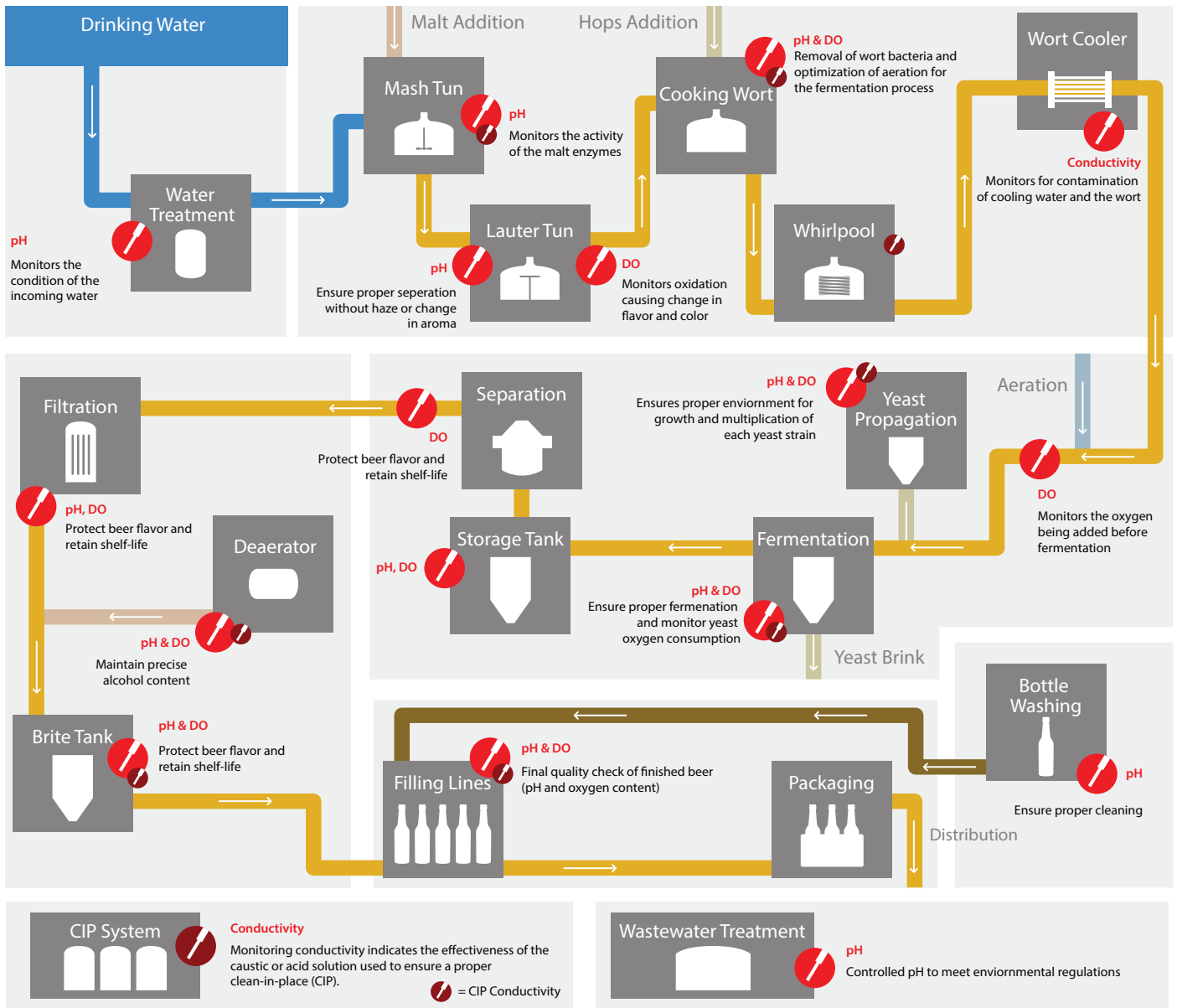
### **Consistent Measurements for Great Taste**

The primary purpose of inline analytical measurements throughout the brewing process is to ensure consistent beer production. pH, conductivity, and dissolved oxygen sensors are used to monitor production water quality, enzyme activity, yeast efficiency, and final product quality. Throughout the process these sensors help maintain the product alcohol content, color, smell, and taste.

M4 Knick sensors such as the SE 555, SE 605, & SE 707 ensure durability and provide fast response times. They are constructed of certified materials that have no effect on the taste profile of the beer.

### **Durability in CIP Processes**

The clean-in-place (CIP) process in breweries enables automated cleaning of production vessels and piping. Due to elevated temperatures, high concentration of cleaning solutions, and the turbulent environment created, sensor survival can be compromised. While monitoring CIP solutions, the Memosens SE 680 conductivity and SE 555 pH sensors respond quickly to temperature changes and are built for surviving harsh conditions.



# Return on Investment

- In the moist environments of breweries and for system cleaning, the contactless inductive Memosens plug & play system guarantees unrivaled measurement reliability and quality.
- Reliably accurate measurements are essential for high product quality and safeguard the brand's key properties from the consumer's point of view.
- Reduced costs thanks to longer sensor service life: Memosens detects the number of CIP/SIP cycles and suggests maintenance intervals to extend sensor service life.

# Our recommended products for seamless brewing

## pH Sensors



### SE 515

Simple Water Sensor

0 ... 14 pH

-5 ... 80 °C

0 ... 145 psi (0 ... 10 bar)

Memosens

21 CFR p11 compliance module

### SE 555

All-Purpose Sensor

0 ... 14 pH

0 ... 140 °C

-14 ... 87 psi (-1 ... 6 bar)

Memosens, Analog

Optional software module

## Conductivity Sensors



### SE 605

Robust Coaxial Sensor for Ultrapure Water

0.001 ... 1,000  $\mu$ S/cm

-20 ... 135 °C

Ingold: Max. 362 psi (25 bar)

Triclamp: Max. 145 psi (10 bar)

Memosens

### SE 680

Hygienic Toroidal Sensor with FDA-Approved PEEK

0.002 ... 2000 mS/cm

-10 ... 125 °C

Max. 145 psi (10 bar)

Memosens, Analog

## Oxygen Sensors



### SE 707

High Resolution Trace Oxygen Sensor with

0 ... 45 mg/l 1 ppb

0 ... 80 °C

-3 ... 87 psi (0.2 ... 6 bar)

CIP, SIP, Autoclavable

Memosens & Analog

## Portable Meter



### Portavo 907 Multi

Multi-parameter

Automatic Calibration

Data Management with Paraly SW112

Sensor Network Diagram for Quick Troubleshooting

Display: Multi-Colored

Memosens

## Transmitters



### Stratos Evo

Multi-parameter (Digital & Analog)

2-Channel

4 Relays

4 ...20 mA, HART

Display: Multi-Colored Backlighting

Memosens & Analog

### Stratos MS

Multi-parameter (Digital)

Single Channel

2 Relays

4 ...20 mA

Display: White and Red Alarm

Memosens

### MemoRail

Multi-parameter (Digital)

Single Channel

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4 ...20 mA or Modbus RTU

No display: Compact, DIN rail mount

Memosens

## Static Holder



### CSS 120/225

Stainless Steel

Tri-clamp

-10 ... 140°C

0...145 psi (0...10 bar)

(at 0 ... 40°C)

Seals: EPDM, Viton™, or Kalrez

## Retractable Holder



### Sensogate 131 MH

Manual retractable fitting for sanitary applications

316 stainless steel, electropolished

-10 ... 70°C

232 psi (16 bar)

SIP and CIP compatible in process

## Flow-Through Fitting



### ARF 202

Stainless Steel or Hastelloy C4

Adapter for fittings with G1 1/4" Ingold socket

-20 ... 160°C

Max. 362 psi (25 bar)

Direction of flow 90°

Memosens & Analog

# Did you know?

We have a range of spectrophotometers to help analyse your beer quality that is simple, quick and affordable option to assure consistency from bottle to bottle, batch to batch with Thermo Scientific™ GENESYS™ Spectrophotometers equipped with BeerCraft Software.

- Get answers in real-time and make critical production decisions fast
- Ensure your quality by adding qualitative data to compliment your sensory testing program
- Run numerous photometric based assays such as color, bitterness and VDKs with ease

As your brewery grows, so too will your analytical testing needs. When you are ready to expand your quality testing, BeerCraft Software with the GENESYS 50 or GENESYS 150 UV-Vis Spectrophotometer will be a valuable addition to your testing process.



**M4Knick** >

Find out more at [thermofisher.com/knickbreweries](https://thermofisher.com/knickbreweries)

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