HAMILTON®

Process Analytics in Breweries

Improving Consistency of the Brewing Process

Yeast propagation and pitching are the most important steps during beer production. These processes require a defined yeast management procedure, but are often operated based on experience or offline analysis of the viable yeast.

During propagation, the harvest time should be optimized to ensure reproducibility and high amounts of viable yeast. This is not possible without a real-time measurement of this parameter. Pitching is routinely performed with a defined yeast volume, without regard for the viable cell density of the yeast. This results in high variability between brewing processes and product quality.

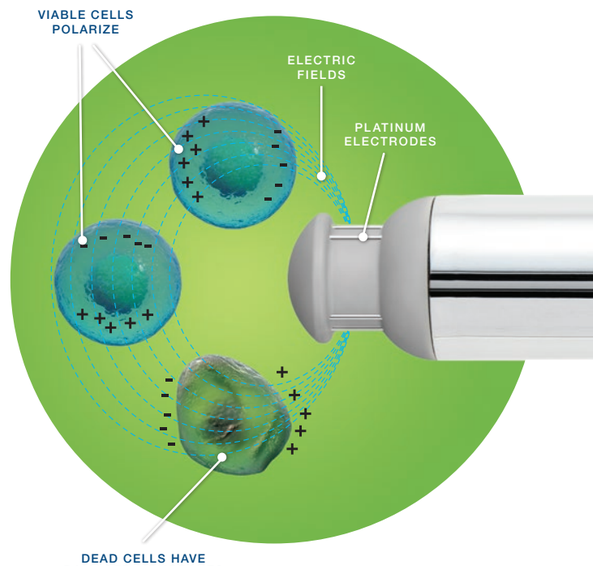
Viable yeast variance may result in:

- Huge variations in fermentation times
- Inability to fully utilize valuable assets
- Filtration difficulties
- Flavor variation
- Inconsistent foam behavior
- Changes of color and turbidity

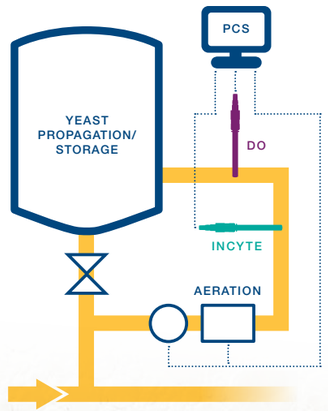
Overcoming Uncertainties with Real-Time Measurement

Online monitoring of viable yeast leads to actionable data in real time without manual intervention. The data can be leveraged for process optimization, allowing for planned pitching and propagation times. This allows increased product consistency and reduced loss of time and money.

How real-time measurement of viable yeast works:
The Incyte sensor enables online measurement based on permittivity. In an alternating electrical field viable yeast behaves like many small capacitors. The stored charge from these capacitors is measured by the sensor and reported as permittivity (capacitance per area). Increasing permittivity directly correlates to increasing yeast density.



Measuring Points

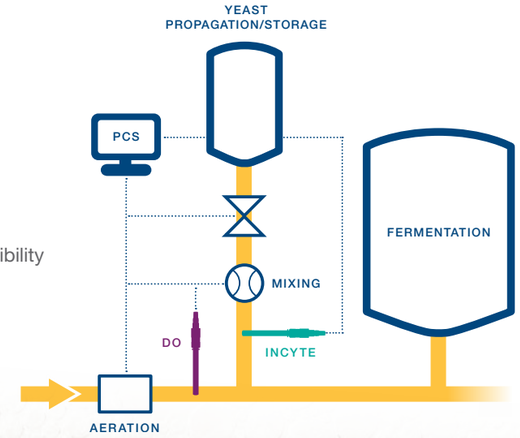


< Yeast Propagation

- Accurate determination of viable yeast
- Detect deviations early

Yeast Pitching >

Increase fermentation reproducibility and pitch the optimal defined amount of viable yeast

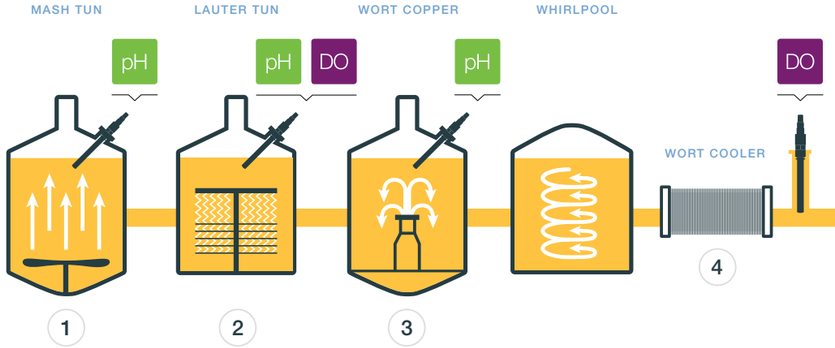


BREWERY PROCESS ANALYTICS

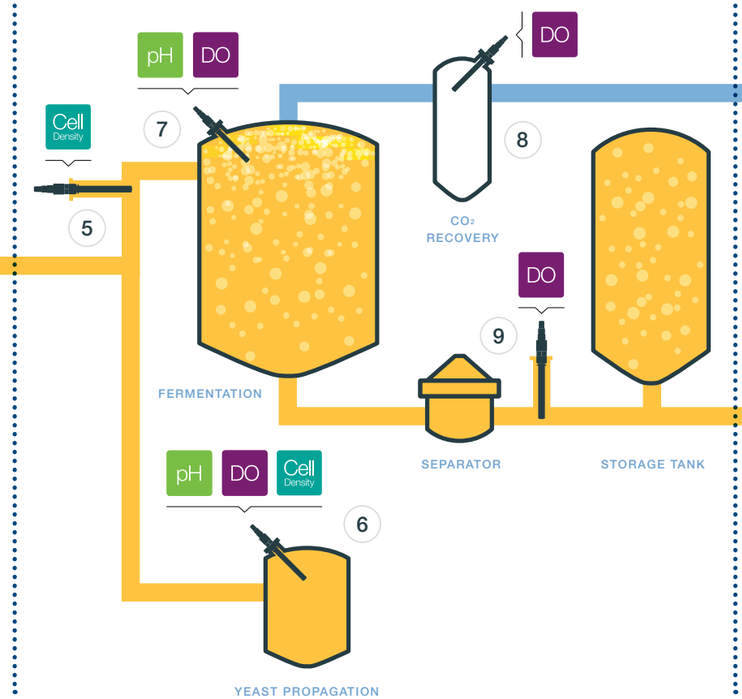
Your Process – Our Solutions

The basic raw materials for beer are water, barley, hops and yeast. Making beer is a multi-step process, and each step has to be monitored and controlled in order to produce high quality and tasty beer consistently. In-line measurement and control of analytical parameters such as pH, conductivity, dissolved oxygen, and viable cell density are essential to the brewing process.

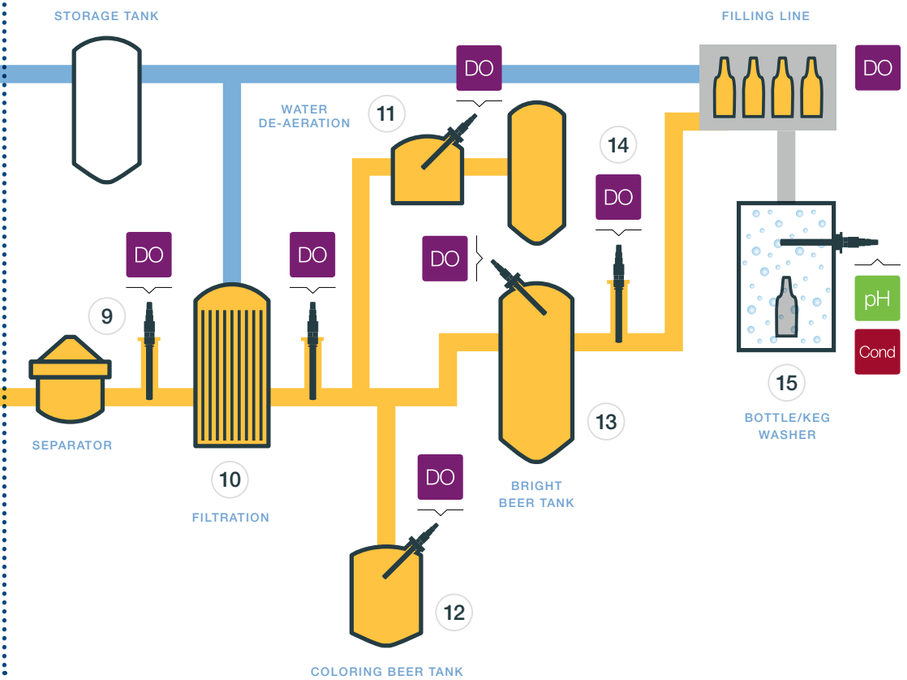
Brewhouse

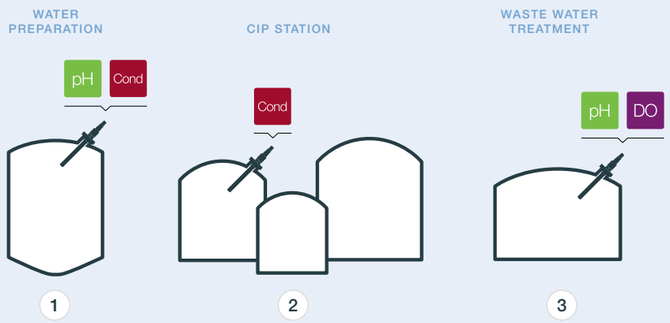


Fermentation and Storage Cellar



Filtration and Filling



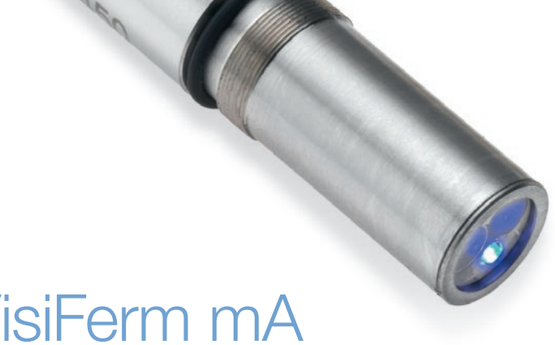


1 **pH:** Polilyte Plus | **Cond:** Conducell 4USF
2 **Cond:** Conducell 4USF
3 **pH:** Polilyte Plus | **DO:** VisiFerm

All Hamilton sensors are user friendly and easy to integrate into existing process control systems. Sensors, housings and buffers are compliant with the existing regulations.

1 **pH:** EasyFerm Bio
2 **pH:** EasyFerm Bio | **DO:** VisiFerm
3 **pH:** EasyFerm Bio
4 **DO:** VisiFerm
5 **Cell Density:** Incyte
6 **pH:** EasyFerm Bio | **DO:** VisiFerm | **Cell Density:** Incyte
7 **pH:** EasyFerm Bio | **DO:** VisiTrace
8 **DO:** VisiTrace / VisiFerm
9 **DO:** VisiTrace
10 **DO:** VisiTrace
11 **DO:** VisiTrace
12 **DO:** VisiTrace
13 **DO:** VisiTrace
14 **DO:** VisiTrace
15 **pH:** Polilyte Plus | **Cond:** Conducell 4USF

Our Sensors – Your Benefits



EasyFerm Bio

The EasyFerm Bio family of pH electrodes is ideal for food & beverage applications like fermentations, where cleaning in place (CIP), steam sterilization (SIP) and autoclavation procedures occur frequently. Precise measurement and long sensor durability can be achieved due to the high performance coatramic diaphragm and the CIP-resistant HB pH glass. The certified reference electrolyte “Foodlyte” has passed biocompatibility tests successfully.

Benefits

- Fast recovery and stable measurement signals after several CIP, SIP and autoclavation procedures
- Pre-pressurized for accurate measurement and reduced maintenance
- Enhanced hygienic barrier due to coatramic diaphragm
- Biocompatibility tested according to EN ISO 10993-5

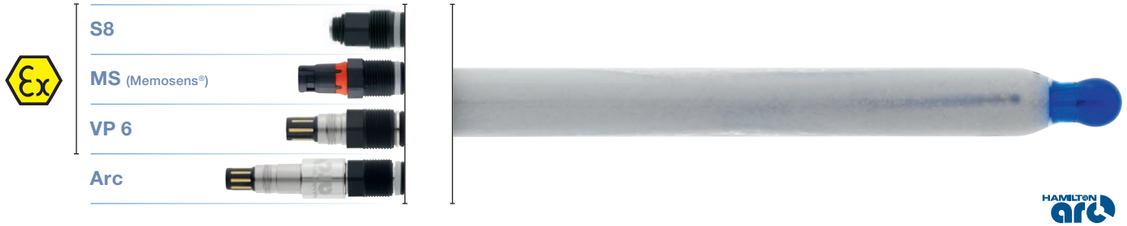
USP Class VI

Polilyte Plus

The Polilyte Plus family of pH and ORP electrodes is designed for harsh chemical environments like in the bottle / keg washer, for process water preparation and wastewater treatment. The great performance in these applications can be achieved due to the Single Pore technology and the Polisolve Plus electrolyte.

Benefits

- Highly reproducible and stable measurements in bottle & keg washers thanks to the Polisolve Plus electrolyte
- No clogging in wastewater due to the Single Pore technology ensures long lifetime
- Polisolve Plus reference electrolyte covers a wide temperature range and withstands reference poisoning
- Available as ORP sensor



VisiFerm mA

The VisiFerm is designed to measure in high dissolved oxygen ranges in the brewing process, like during the wort aeration. It has all the advantages of Hamilton’s optical DO sensors: fast response time and easy maintenance. It’s designed for frequent CIP, and SIP procedures. This is powerful during measurements in breweries, which may not allow for calibration after every CIP. The strengthened luminophore matrix helps to better withstand chemical attacks caused by chlorine and chlorine dioxide without compromising the response time. Analog (4-20 mA) as well as digital (HART) output signals are possible. Bluetooth communication with the help of the ArcAir app is possible.

Benefits

- Broad measuring range up to 25 ppm
- Easy and very little maintenance, no electrolyte to replace & refill
- Insensitive to CO_2, pressure hammers, and independent from flow – ideal for wort aeration, yeast propagation, and CO_2 recovery
- Suitable for CIP, and SIP due to rugged sensor construction
- Stable against chlorine, and chlorine dioxide
- 2-wire 4-20 mA-, and HART-interface integrated

HART COMMUNICATION PROTOCOL

USP Class VI

VisiTrace mA

The VisiTrace is designed to measure dissolved oxygen in low ppb ranges in brewing applications, notably after filtration, in filling lines, and in water de-aeration. It has all the advantages of Hamilton’s optical DO sensors: fast response time and easy maintenance. VisiTrace is designed for frequent CIP, and SIP procedures. This is powerful during measurements in breweries, which may not allow for calibration after every CIP. The strengthened luminophore matrix helps to better withstand chemical attacks caused by chlorine and chlorine dioxide without compromising the response time. Analog (4-20 mA) as well as digital (HART) output signals are possible. Bluetooth communication with the help of the ArcAir app is possible.

Benefits

- Trace level measurement from 0 - 2000 ppb
- Easy and very little maintenance, no electrolyte to replace & refill
- Insensitive to CO_2, pressure hammers, and independent from flow – ideal after filtration, in filling lines, and water de-aeration
- Suitable for CIP, and SIP due to rugged sensor construction
- Stable against chlorine, and chlorine dioxide
- 2-wire 4-20 mA-, and HART-interface integrated

HART COMMUNICATION PROTOCOL

USP Class VI

Conducell 4USF

The Conducell 4USF family of 4-pole conductivity sensors is suitable to measure a broad range of conductivities with excellent linearity. A typical application is the water preparation and monitoring of the CIP station. Available with the innovative Arc technology. Various process connections are available: PG 13.5, Tuchenhagen Varivent®, BioConnect® and Triclamp. The right pole material for every environment: stainless steel DIN 1.4435, DIN 2.4602, titanium, and platinum.

Benefits

- High accuracy and linearity over a broad measuring range
- Hygienic design with FDA-compliant materials for excellent cleanability
- Suitable for CIP, steam sterilization and autoclavation

HAMILTON arc

USP Class VI

new

Incyte Arc

The Incyte Arc sensor enables continuous, real-time, online measurement of viable yeast in solution. It is capable to support yeast management during propagation and pitching, to ensure consistent brewing results. Analog (4-20 mA via Arc Wi 2G Adapter) and digital (Modbus) signal outputs are possible. Available with the innovative Arc technology.

Benefits

- Determination of viable yeast
- Improved yeast management due to real-time data
- Possibility to better define pitching and propagation times
- Increase product consistency

HAMILTON arc

USP Class VI

▶ Download the Arc brochure from www.hamiltoncompany.com

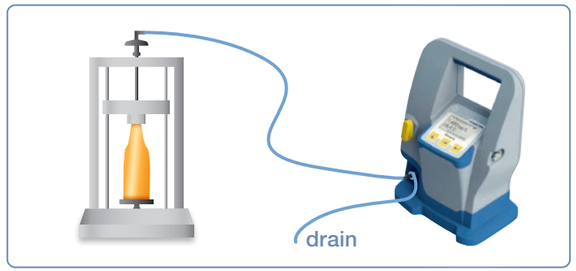
Beverly – Born to Brew

Beverly is designed for at-line and laboratory use to provide excellent reliability in a rugged design, and purpose built to handle the environmental extremes encountered in everyday brewing operations. Superior performance at an affordable price is achieved using Hamilton's best in class optical sensor VisiFerm with built-in intelligence, making Beverly the brewer's best friend.

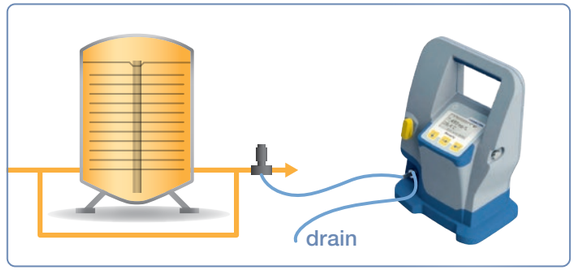
Benefits

- Efficiency and serviceability bred from Visiferm optical sensors
- Built to endure IP 67 watertight standards
- Stamina for 50 hours of continuous operation
- Fast response time down to ppb level
- Calibration without removing the sensor

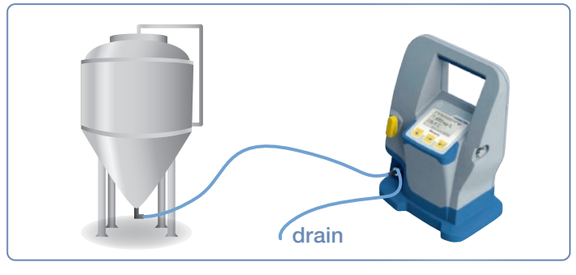
Measure DO in the bottle or can



Measure DO during or after filtration



Check DO of bright tank prior to bottling



Hygienic Housings

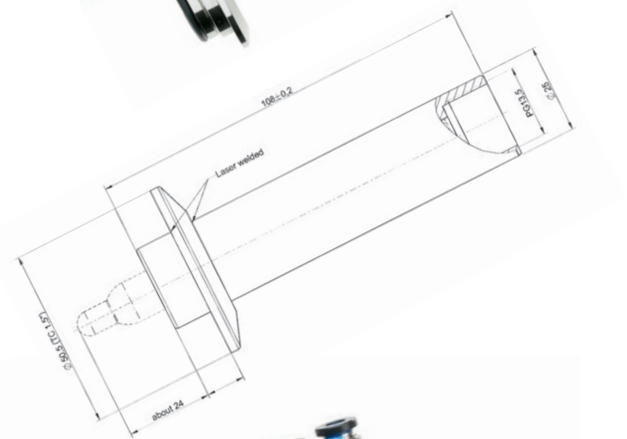
Hamilton has developed hygienic housings for Pharma, Biotech and the Food & Beverage industry. They are compliant with all relevant existing regulations including FDA. Hamilton's housings fulfill all cleanability and sterilization requirements. Various process connections are available, like Tuchenhagen Varivent®, 25 mm standard port and Triclamp.

FlexiFit

The FlexiFit, a non-retractable housing can be used in many applications in the brewery, beverage and the pharmaceutical industry. It is suitable for cleanings in place (CIP) and in-line steam sterilizations (SIP). All kinds of Hamilton sensors can be inserted.

Retractex

If sensors have to be replaced, rinsed or recalibrated while in operation retractable housings are the method of choice. Hamilton offers manual and pneumatic housings for this purpose. The pneumatic Retractex HyCIP version can easily be integrated in process control systems. Different process connections ensure their compatibility to existing pipings and vessels. The hygienic design of the rinsing chamber makes the Retractex HyCIP an outstanding and unique product.



HAMILTON CUSTOMIZED PRODUCT

Need a custom housing or sensor? The Hamilton Customized Product team is happy to help design products for your specific application. Give us a call to learn more.

Traceable Buffers & Standards

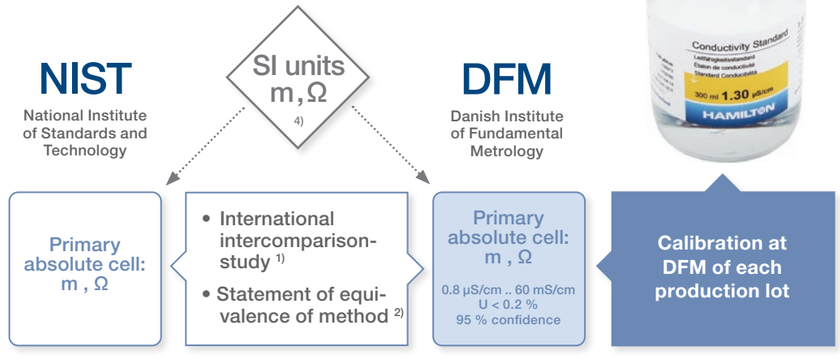
Hamilton offers a wide range of calibration buffers for pH and ORP as well as conductivity standards, suitable for the use under GMP, GLP, ISO 9001 and EN 45000 regulations. Traceability is ensured through an unbroken chain of comparison to reference material of the highest metrological quality from NIST (National Institute of Standards and Technology, USA) and PTB (Physikalisch Technische Bundesanstalt, Germany).

pH Buffers

A complete range of buffer solutions from pH 1.09 to 12.0 provides never before achieved pH stability. Hamilton guarantees that Duracal pH buffers will be stable for 5 years after the date of manufacturing. The plastic bottles with their built-in compartment allow very convenient calibrations. Primary and secondary standards are used for the calibration of the devices and the manufacturing of the buffers. All buffer solutions are certified by the accredited external laboratory DAkkS (Deutsche Akkreditierungsstelle) and traceable to NIST.

Conductivity Standards

Hamilton is the first manufacturer to offer conductivity standards in 1.3 and 5 µS/cm with a certified accuracy of ± 1 %, and a lifetime of 1 and 3 years respectively. The entire range from 1.3 to 12880 µS/cm is certified by the Danish Institute of Fundamental Metrology (DFM) and traceable to NIST.



1) International intercomparison of electrolytic conductivity between NIST, DFM and OMH (Hungarian Office of Metrology); published in Metrologia, vol. 38, no. 6, 549-554 (2001)
2) The accuracy level of the DFM measurement is secured through a cooperation with NIST with whom there has been made an agreement on mutual recognition of calibration results.
3) DFM is accredited by DANAK (Danish accreditation authority) under reg. no. 255.
DANAK is one of the signatories to the EA Multilateral Agreement for the mutual recognition of calibration certificates.
4) International System of Units: 7 base units are m, kg, s, A, K, mol, cd

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HAMILTON®

Web: www.hamiltoncompany.com
USA: 800-648-5950
Europe: +41-58-610-10-10

Hamilton Americas & Pacific Rim
Hamilton Company Inc.
4970 Energy Way
Reno, Nevada 89502 USA
Tel: +1-775-858-3000
Fax: +1-775-856-7259
sales@hamiltoncompany.com

Hamilton Europe, Asia & Africa
Via Crusch 8
CH-7402 Bonaduz, Switzerland
Tel: +41-58-610-10-10
Fax: +41-58-610-00-10
contact.pa.ch@hamilton.ch

To find a representative in your area, please visit hamiltoncompany.com/contacts