

5 Critical Measurements to Optimize Brewing

1 On-Line Dissolved Oxygen
Productivity on the Filling Line



2 Dissolved CO₂
Provide Consistent Mouthfeel



3 Conductivity
Reduce Beer Loss

4 Portable Dissolved Oxygen
Quality Control Spot Checks



5 Optical Color Monitoring
Alternative to Sight Glasses

Higher Productivity at the Filling Line with Intelligent Optical DO Sensors

Fast response, excellent signal stability, and almost no maintenance – METTLER TOLEDO's intelligent sensors are giving one of Italy's major beer brands the highest dissolved oxygen sensor performance.

Globally recognized brand

Peroni Brewery, part of Asahi Europe Ltd., has been operating in Italy since 1846. Its annual production exceeds five million hectoliters and its beers, such as Nastro Azzurro, are recognized across the globe.

Dissolved oxygen measurement challenges

The brewery is focused on maintaining the best taste characteristics and maximizing the shelf life of their products. This approach starts with constant attention to dissolved oxygen (DO) levels at the filling lines.

However, the amperometric dissolved oxygen sensors they were using were

a constant cause of concern. Slow response, long sampling time, unscheduled downtime, and high cost of maintenance and spare parts were an ongoing burden that Peroni Brewery wanted to eliminate.

Mr. Giovanni Morlino, Chief Brewer at Peroni, had heard of METTLER TOLEDO's optical dissolved oxygen sensors, and in the hope that this new technology would solve his issues, he asked for a demonstration.

Optical technology transforms DO measurement

Whereas amperometric sensors require many hours of polarization after maintenance before they can be used,

METTLER TOLEDO's optical sensors do not need polarized, so are instantly available. They also have no membrane, inner body or electrolyte that needs replaced. The only maintenance they require is exchange of the oxygen-sensing OptoCap™. A task that takes only a minute and is required approximately once a year.

Very low drift is another feature of optical sensor technology, so measurement stability remains high over a long period.

The combination of long-life OptoCap and low maintenance would eliminate the excessive maintenance problems Peroni was having with their amperometric sensors.

Diagnostics prevent unscheduled downtime

In addition, Intelligent Sensor Management (ISM®) technology in METTLER TOLEDO sensors provides an array of features that simplify sensor operations and improve process reliability. These include the Dynamic Lifetime Indicator (DLI) diagnostic tool, which monitors the condition of the OptoCap and displays on the connected transmitter the remaining number of days until it should be replaced.

The DLI would therefore allow Peroni to plan maintenance in advance,





Optical trace level DO sensor InPro 6970i

Detection down to 2 ppb in beer and water

Fast response time minimizes beer losses

Sensing element is immune to pressure shocks and extreme CIP cycle conditions

Plug and Measure simplifies handling and ensures fast flawless start up

Predictive diagnostics for proactive maintenance

No polarization time or electrolyte required

preventing the unscheduled downtimes that were impacting Peroni's production.

Worry-free oxygen control

The InPro® 6970i optical DO sensor was designed specifically for filling line applications. With its highly accurate measurement of ppb O₂ levels and very fast response time (98 % of final value in less than 20 seconds) it is the

most efficient and reliable oxygen sensor on the market.

Mr. Morlino was delighted with the demonstration of the InPro 6970i and could see immediately how it could eliminate his concerns with DO measurement.

Four InPro 6970i sensors were installed in the bottle, can and barrel

filling lines, and are now providing Peroni Brewery with a performance level that they previously never experienced. Mr. Morlino said, "With the optical DO sensors from METTLER TOLEDO, oxygen control in beer is no longer an issue to worry about."

► www.mt.com/InPro6970i

Unequaled Reliability in CO₂ Monitoring with Accurate, Low Maintenance Sensor

Giving beer the mouthfeel that consumers like relies on maintaining the desired carbon dioxide concentrations in brewery processes. Dissolved CO₂ sensors based on thermal conductivity provide accurate measurements, but sensor membrane integrity or a drop in purge gas supply can cause problems. The METTLER TOLEDO CO₂ system has the answers.

CO₂ control for better product quality

Good beer is not just about taste. For consumers, the mouthfeel and foam are also very important. Monitoring and controlling dissolved CO₂ concentrations helps ensure consumers experience the sight and effervescence of your products the way you want them to. Consequently, typical applications for in-line CO₂ measurement systems in breweries include carbonation control, and measurements in filling lines.

p/T and TC measurement principles

The market for in-line CO₂ measuring systems is dominated by sensors based on two measurement principles: pressure/temperature (p/T), and thermal conductivity (TC). These principles are well established in the brewery industry and are recommended by international committees for standardized beverage analysis.

p/T-based sensors provide accurate measurements, but they contain moving parts for sample withdrawal/return and chamber expansion that require regular servicing.

Why thermal conductivity measurement is better

A major advantage of TC-based sensors is the complete avoidance of moving parts (see 'How it works'). As good as TC-based CO₂ instruments are, their performance relies on two main aspects: the reliability of the required air purge supply, and the integrity of the sensor's CO₂-permeable membrane.

A drop in the supply of purge gas or deterioration of the membrane results in inaccurate CO₂ measurements. Operators will often not be able to distinguish between an actual change in the dissolved CO₂ concentration in the beer and a problem with the CO₂

measurement system, and may erroneously adjust CO₂ dosing.

This compromises plant efficiency and can impact the quality of the beer. In addition, if the membrane fails and liquid comes into contact with the TC chip, costly servicing will be required. The InPro 5500i sensor from METTLER TOLEDO solves these problems.

Smart sensor protects itself from damage

The InPro 5500i dissolved CO₂ sensor incorporates METTLER TOLEDO Intelligent Sensor Management (ISM®) technology. The ISM concept simplifies sensor handling, enhances reliability, and reduces sensor lifecycle costs. ISM's features include diagnostic tools that constantly monitor a sensor's condition. On the InPro 5500i, these tools provide an immediate alarm should the purge gas supply decrease or membrane integrity drop.

This means corrective action can be taken before the situation deteriorates further. If the fault is not rectified quickly, the TC sensing element will even shut down to protect itself from damage.

Hygienic design and quick maintenance

Accurate measurement and ISM are not the only valuable features of the





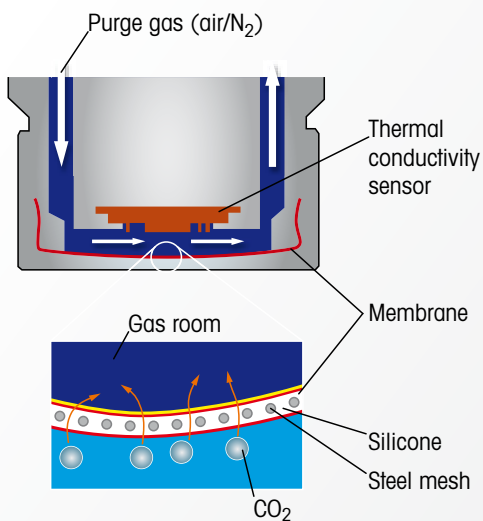
InPro 5500i: The single-piece membrane cap has been designed for fast, simple replacement and high cleanability-in-place to prevent contamination. The sensor is available with Tuchenhagen Varinline, TriClamp, and 28mm M42 process connections.

Easy operation and more process uptime

With the InPro 5500i sensor, the unique combination of an industry-accepted measurement principle and the ISM concept leads to substantial benefits regarding simple operation and process uptime.

www.mt.com/InPro5500i

How it works



The partial CO₂ pressure level is acquired using a measurement chip that determines the thermal conductivity of the CO₂ present in a chamber within the sensor. The chip is separated from the liquid stream by a CO₂-permeable membrane. When in operation, air is first blown through the measuring chamber to remove CO₂ that has passed through the membrane. Next, air purging stops and the TC chip measures the increase in thermal conductivity as CO₂ begins to permeate through from the beer. By repeating this purging/measuring cycle the sensor provides accurate dissolved CO₂ measurements.

The TC measurement principle is immune to the presence of background gases, which results in high CO₂ selectivity. Also, it exhibits high comparability with established reference methods.

Reduce Beer Loss with Conductivity Measurements

In-line conductivity measurement before the filling line can quickly identify water/beer transition. Resulting in less product loss and greater process reliability.

Save more product

By using conductivity measurement systems, manual control of media separation by using a sight glass is avoided and the process can be automated resulting in minimal loss of product, reduced labor cost and increased process safety and reliability.

Conductivity accurately identifies media changes

The beer filling process is based on a CO₂ atmosphere with a pressure of up to 6 bars that pushes the product to the bottle. During the CIP process, cleaning solution and water is circulated in the machine and in the pipes that bring beer from the production area to the filling line. By the time that the final CIP rinse cycle ends, the pipes and filling machine are completely filled with water.

When production starts again, filling must wait until water has cleared the system and the first filled bottles are sent for lab analysis to determine which bottles will be separated and which have the correct concentration of beer (no water contamination) to go to the market. Setting the waiting time too short results in a loss of bottles/cans. If the time is set too long, good beer will be sent to the drain. Sometimes, an operator goes to the drain pipe to determine by color the

Convenient M300 transmitter

- **Flexible**

Available in single- or dual-channel conductivity, pH or DO versions for ISM or analog sensors.

- **Fast installation**

A user-friendly and sophisticated "Quick Setup" routine guides you through the first settings.

- **PID controller**

PID controller with pulse length, pulse frequency or analog control.

- **Password protection**

Multi-level password protection against accidental parameter changes.

▶ www.mt.com/M300





Durable InPro 7100i conductivity sensor

- **High versatility**

The InPro 7100i is compatible with a wide choice of static and retractable housings. WideRange™ technology keeps the sensor design small and easy to install. That allows installation in pipes with a diameter down to DN50.

- **Fast response time**

The InPro 7100i's rapid response time allows quick detection of process changes, leading to better process control. Benefits are:

- Increased yield
- Higher product quality
- Cost savings in the production process.

- **Easy process integration**

The compact design of the InPro 7100i makes it compatible with a wide choice of housings, opening an extensive range of integration options.

- **Robust**

The PEEK shaft material offers high resistivity against aggressive solutions and is particularly suitable in processes with frequent CIP cycles.

▶ www.mt.com/InPro7100

correct moment when the water ends and the beer starts. An operation that is subject to human error.

The use of a conductivity system to control the exact phase separation between water and beer, and to ensure the correct time to start filling, results in a fully automated process with minimized loss of bottles/cans and beer, and reduced labor cost.

METTLER TOLEDO solution

The recommended system for this application consists of an M300 transmitter with an InPro® 7100i conductivity sensor installed in the pipe that feeds the filling machine.

InPro 7100i conductivity sensor

Intelligent Sensor Management (ISM®) provides Plug and Measure installation for fast, error-free start up, and robust, digital communication between sensor and transmitter.

The 4-electrode InPro 7100i sensor detects the switch from water to beer very quickly and precisely due to a fast response time to both conductivity and temperature.

4-electrode conductivity systems have a response time in the range of seconds. The sensor has to be installed upstream of the valve.

With fast and precise phase detection, the loss of beer and water in the installation can be significantly reduced.

M300 transmitter

The M300 transmitter series combines robustness with ease of use. High reliability makes this instrument the ideal choice for basic process applications. The M300 is available as a single- or dual-channel unit with an attractive price/performance ratio.



No Manual Errors During Sensor Calibration Portable, Bluetooth DO Meter

With the ability to communicate with in-line dissolved oxygen sensors by Bluetooth, the InTap™ portable DO analyzer removes the manual steps of calibrating in-line dissolved oxygen sensors. This eliminates the possibility of human error that can affect product quality and yield.

Convenient companion to in-line measurement

InTap, with an internal optical DO sensor, allows users to measure dissolved oxygen values wherever and whenever required for optimum control of production processes and product quality.

The InTap is designed for at-line measurement of beer during or after filtration and prior to filling. It is also the perfect reference instrument for calibrating installed in-line optical DO sensors that measure at the lowest oxygen ranges.

For mid-size breweries, the InTap can support the transition from off-line DO

measurement to in-line measurement, with a portable, lower-cost system.

Accurate calibration reference or temporary replacement system

The accuracy of the InTap is comparable to standard in-line sensor/transmitter combinations, allowing the InTap to be used as a temporary replacement of an in-line sensor during maintenance, or as a direct reference to an in-line system during calibration.

Bluetooth communication technology in the system allows calibration information to be conveniently written directly from the InTap to in-line optical DO sensors equipped with the T100

Bluetooth tool. This can be done while a process is running, reducing time and potential for errors during manual data transfer.

Measurement point tracking in InTap allows operators to easily tie measurement data to different places in production, and maintain records point-by-point.

Simple, touchscreen operation

The system features a built-in transmitter with touchscreen interface. Operation is intuitive and the large screen allows data to be seen from a distance and for more information to be displayed, such as measurement charts.

The transmitter's 4GB of memory can be transferred to a USB, making record keeping more consistent with an in-line system than a standard portable system.

Robust design and easy maintenance
Piping connections are in-set on the side of the unit, reducing the risk of damage to these parts when transporting or storing the InTap.

The inside of the InTap is easily accessible from a panel, making the internal sensor as convenient to service as an in-line probe.



www.mt.com/InTap



Mobile oxygen measurement solution

InTap's Bluetooth communication technology allows calibration information to be conveniently written directly from the meter to in-line optical DO sensors. Cleanable flow-through design for at-line sampling.



Easy operation

Touchscreen interface provides intuitive operation and the large, high-resolution screen allows data on the screen to be seen from a distance.



Measurement point tracking

InTap allows operators to easily tie measurement data to different places in production, and maintain records point-by-point. Stores data for up to 99 measurement points.



Withstands everyday knocks

Piping connections are in-set on the side of the unit, reducing the risk of damage to these parts when using or transporting InTap. IP67 enclosure resists wet environments.



Optical Product Monitors

See the Way to Greater Productivity

Less beer loss, reduced waste costs, increased process safety: all are achievable with optical product monitors. The InPro® 8300 RAMS is an extremely cost-efficient tool for in-line turbidity and color monitoring.

Fast response and measurement accuracy are vital

Manual operation will always have an important role in beer production. But in many applications, in-line analytical equipment offers a level of accuracy and response speed that technicians cannot match.

One such application is yeast/beer separation after fermentation tanks. With the use of a sight glass, an operator must determine when to divert the flow prior to the filter press. If the

flow is diverted too early, the filter press will become blocked resulting in lost production time while the blockage is cleared. To prevent this, operators tend to throw the switch late; however, this leads to increased reprocessing plus additional beer losses.

A better alternative to sight glasses

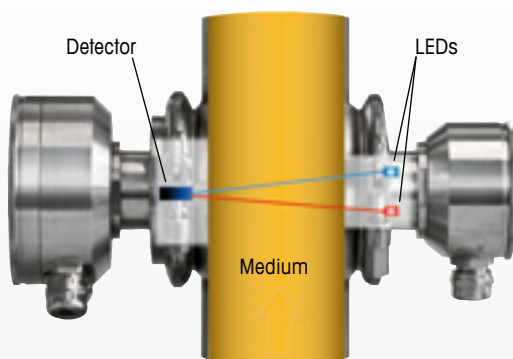
METTLER TOLEDO's InPro 8300 Reflection Absorption Multi-Switch (RAMS) was designed to solve exactly this type of problem. The RAMS series

of products use back-scattered or transmitted light to precisely determine liquid turbidity and/or color in real time, depending on the process concerned. The output of the unit (4–20 mA) can be set to trigger the appropriate valve when the turbidity measurement reaches a lower limit.

The InPro 8300 RAMS monitors require almost no maintenance and can be left to control valve switching without any operator involvement, thereby freeing technicians to work on other tasks.

How it works

InPro 8300 RAMS



The InPro 8300 RAMS measures light absorption and reflection from LEDs to determine color and/or turbidity. This technique is sensitive to even slight changes in the color or optical density of a liquid and responds almost instantaneously. A choice of optical parameters provides the option to monitor product transitions based on turbidity or color measurement, similar to an in-line photometer.

For turbidity measurement a near infrared (NIR) LED light source is used to measure forward scattering through the liquid. By using NIR light the turbidity measurement is mostly independent of color influence. For product transitions based on color measurement, a blue LED is used.

All members of the InPro 8300 RAMS product family are easily installed on Tuchenhagen VARINLINE housings. Process integration is achieved by implementing the 4–20 mA signal transmitting the turbidity or color measurement to a suitable PLC – no transmitter is required. The measurement signal is repeated more than five times per second providing a response time of less than 200 ms.



Instant product identification in filling lines

Reliable and reproducible product identification in filling lines helps to increase process safety and can be implemented in charge traceability documentation for quality assurance

purposes. Here also, InPro 8300 RAMS monitors are a cost-effective solution.

In addition, the monitors can detect the phase transition between rinse water and colored product for optimized

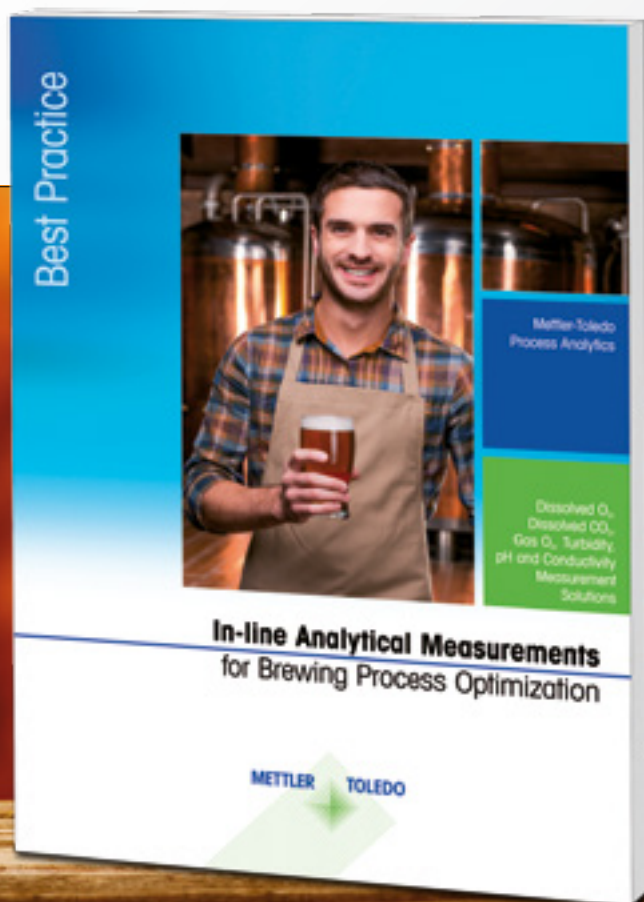
phase separation control of water to beverage.

If you want to reduce beer loss at your brewery, go to:

► www.mt.com/InPro8300

Resources to Support Quality Beer Production

METTLER TOLEDO is a market leader in process analytics for the brewery industry. To help you maximize beer quality and shelf life and learn more about the role of analytics, we have created a number of useful guides, white papers, etc.



Best Practice Guide to Brewing Process Optimization

This guide contains a collection of useful white papers and case studies related to brewing process monitoring and control.



Find this guide and more in our Expertise Library

www.mt.com/pro-library-beer

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