

# Brewery

Perspectives in Liquid Process Analytics



# 12 News

**INGOLD**

Leading Process Analytics

## Intelligent Oxygen Measurement in Filtration and Filling

**METTLER TOLEDO's new digital InPro 6900 i oxygen sensor measured up to all performance criteria and provided accurate and verifiable results throughout the entire testing phase. The new digital measurement technology ensures accurate and reliable results even in harsh environment.**

### Oxygen concentration

In the brewery process, oxygen concentration is a decision-making parameter in addition to turbidity, conductivity, and pH. From yeast propagation through utilization in the fermentation and storage cellar to filtration and filling, the concentration of dissolved and gaseous oxygen is monitored. Here, one large brewery in the southern German region places considerable weight on intelligent digital monitoring of dissolved oxygen in filtration and filling lines.

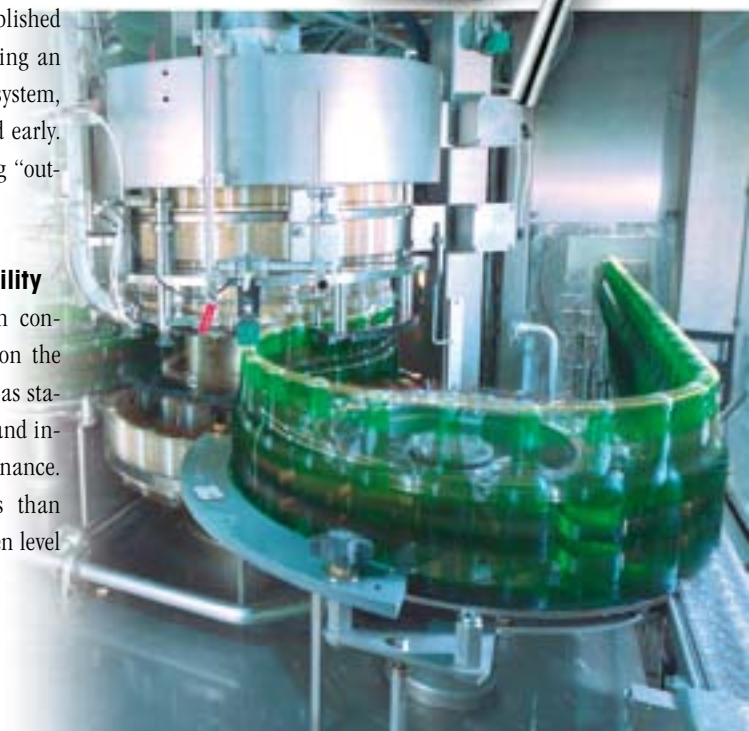
### Oxygen-free filtration

Oxygen-measurement in the filtration plant is a decisive measurement point because oxygen could enter via a faulty pump or valve. The filtered beer should be almost free of oxygen before storage in the

bright beer tanks so that the established quality criteria can be met. By using an intelligent oxygen measurement system, possible oxygen ingress is detected early. Consequently the risk of producing "out-of-specs" beer is minimized.

### Process reliability and flexibility

Continuous monitoring of oxygen concentration places high demands on the in-line measurement system such as stable measurement, easy operation and installation, and minimum maintenance. An oxygen concentration of less than 25 µg/L (ppb) is the current oxygen level from filtration to filling.



**METTLER TOLEDO**

### The InPro 6900 i oxygen sensor

With a detection limit of 3 µg/L in liquids containing CO<sub>2</sub>, the InPro 6900 i digital oxygen sensor is an optimum choice for use in the brewery. Our customer's years of experience with the proven and tested InPro 6800 have paved the way for the use of digital and intelligent measurement technology.

### Advantages of digital ISM® sensors

Intelligent Sensor Management (ISM) probes are automatically detected by the transmitter using the "plug-and-measure" principle and the measurement system parameters are set automatically. This considerably simplifies the installation and configuration of the measuring point. The groundbreaking design makes it possible to calibrate sensors under controlled conditions in the laboratory. Also, because the calibration data can be stored in the sensor, on-site replacement can be done by untrained personnel.

ISM supported digital sensors reduce the maintenance overhead of a measuring point to a minimum and give them manageable dimensions. Unnecessary maintenance and downtime costs are eliminated because sensor calibration and maintenance is done on an as-needed basis.

The use of digital communications between the modular M700 transmitter and the InPro 6900 i sensor ensures interference free data transmission even under difficult conditions. Even in a humid environment the digital measuring system is an undisputed winner because the operational readiness and accessibility of the measuring point is markedly improved. In addition, control and monitoring of two measuring points can be done at the same time. This system solution is augmented by the InTrac 777 retractable housing.

The use of the retractable housing simplifies access and consequently maintenance of the sensor, even in running operation. This increases flexibility, because the necessary maintenance procedures can be done easily and quickly, without outages and shutdowns.

### Convincing arguments

- Process stability
- Flexibility
- Cost savings
- Time savings
- Easier operation
- Low maintenance overheads
- Intelligent measuring point
- Predictability of sensor wear

▶ [www.mt.com/ISM](http://www.mt.com/ISM)

▶ [www.mt.com/DO](http://www.mt.com/DO)

# ISM



Retractable housing  
InTrac 777.



Oxygen sensor  
InPro 6900 i.



Multi-parameter transmitter  
M700S.

#### Publisher/Production

Mettler-Toledo AG  
Process Analytics  
Im Hackacker 15  
CH-8902 Urdorf  
Switzerland

#### Illustrations

Mettler-Toledo AG  
Brinkhoff Brewery, Germany  
Carlsberg Brewery, Italy  
Labatt Breweries, Canada

Subject to technical changes.  
© Mettler-Toledo AG 07/08  
Printed in Switzerland.

## The Importance of Turbidity Control in Brewing Processes



**Turbidity is a key measurement during the production. Back, forward and sideward scattered light sensors from METTLER TOLEDO offer you the right solution for any type of application.**

### Parameters which influence turbidity

Beer and wort turbidity measurement results may differ due to the different optical systems used. The characteristics of optical systems are based on

- the wavelength,
- the measuring angle and
- the geometry of the optical system.

Consequently only readings from turbidimeters – process and laboratory types – should be compared if they have the same optical characteristics. For example, the use of a red light source (wavelength 650 nm) has become a standard in many breweries in the last decade. Results from red light systems cannot be compared with systems using a broadband white light source (wavelength 400–1100 nm) or a near infrared source (wavelength bigger than 800 nm).

### The importance of the scatter angle

The scattering angle employed in the measurement of turbidity is of significant importance. The brew master takes advantage of a combined measurement of 25° forward and 90° sideward scattered light in case beer brightness is controlled. The 25° scattered light is very sensitive to bigger particles like yeast cells and Kieselguhr powder. An early detection of these particles avoids expensive re-filtration of contaminated beer. The 90° scattered light controls the turbidity caused by smaller particles such as proteins and

glucanes. If the concentration of these particles is too high, the beer suffers from a shorter shelf life as well as from unwanted cloudiness.

### Turbidity in the filter cellar

The steps involved in beer filtration include removal of yeast and colloidal particles for longer shelf life and best beer brightness as consumer quality criteria. Filter breakthrough control and beer quality monitoring is only possible with a 2-angle turbidity system (25° and 90°).

### Turbidity at the lauter tun

A number of process steps are involved in the separation of spent grains from extract. These include pumping of trub wort, first wort flow-off, spargings, and last running. Turbidity measurements help to keep recirculation time optimal and wort quality uniform. This measurement task is solved with a forward scattered light sensor (25°).

### Turbidity at the whirlpool

At the whirlpool separation of wort and solids which precipitate during wort cook-

ing takes place. Turbidity is measured to ensure a low solid concentration in the hot wort throughout the whole separation process. Also here a forward scattered light sensor (25°) provides the best measurement performance.

### Phase separation yeast/beer

In the outlet of cylindroconical tanks backscattering (180°) sensors are installed to detect the interphase between yeast and beer. This sensor type is always the best choice for high turbidity applications (> 100 EBC) because of their extremely wide measurement range.

### METTLER TOLEDO solutions

Innovative Mettler-Toledo Ingold turbidity systems represent a further step forward in providing efficient equipment for in-line process control. The InPro 8600 sensor series convinces in beer filtration and brew house applications whereas the InPro 8200 sensors are used in phase separation applications.

► [www.mt.com/turbidity](http://www.mt.com/turbidity)



Turbidity sensor InPro 8200.



Turbidity sensor InPro 8600.

## Stringent Measuring of Oxygen Keeps Quality of Beer up

**Reliability of implemented measuring systems allowed precise control of oxygen in beer and therefore raised quality and reduced need for calibration and for maintenance improving uptime.**

### **Carlsberg Italia SpA and its market**

Although Italy is not known as a beer drinking nation beer consumption has been steadily increasing over recent decades. Both Carlsberg and Tuborg hold significant positions in the premium segment. Carlsberg gained 100% ownership of Tuborg in 2002. Carlsberg Italia operates today two breweries – the historic brewery in Varese in Northern Italy and a second in Ceccano, in the province of Frosinone south of Rome. In Italy Carlsberg is distributing 9 different brands.

### **What counts are the qualitative and organoleptic characteristics**

Oxygen has an enormous impact on the quality of the product. If beer contains dissolved oxygen, it ages rapidly. Once the beer is delivered to the market, it retains its fresh character for many months if its

oxygen content is sufficiently low. Oxygen content makes the difference between a beer which retains its qualitative and organoleptic characteristics (taste) for many months and a beer which degrades rapidly and becomes “oxidized”.

### **Type of application**

To hold beer quality high Carlsberg Italia keeps an eye on the oxygen content at two important positions in the production. One is the filtration and one is the bottling phase. Due to the quality of taste oxygen in beer cannot be accepted. In other words, any value above trace limits will alert the technicians. Carlsberg knows that air ingress may occur through defective tubing. The latest chance to check the beer quality is during the bottling phase. In case something goes wrong somewhere between filtration and the bottling phase the process can be stopped to eliminate

the beer with too high oxygen content. It goes without saying that this scenario has to be prevented otherwise the production costs will rise dramatically.

### **Customer's expectations**

Therefore the control of dissolved oxygen in the beer is very important for all Carlsberg breweries. It is required to keep the beer quality on a high level, to be able to produce without unnecessary breakdowns and to maintain a strong process stability paired with as little maintenance work as possible. As a result, only the best and most stable instrumentation to monitor and control the critical parameter dissolved oxygen can be accepted.







### Unsatisfying instrumentation caused a lot of troubles

Carlsberg has been carrying out these measurements for about 20 years. However, the instrumentation they used had frequent problems with reliability. The previously used instruments had acceptable precision, but they presented problems because they often suffered malfunctions (breakdowns, taking them out of service). This gave rise to periods in which the process was not being monitored, with the risk of problems connected with final product quality.

### Chosen METTLER TOLEDO solution

After evaluation of the unsatisfactory situation METTLER TOLEDO suggested its concept. Carlsberg arranged a test phase to see if the promised performance could be achieved. As this phase showed promising and successful results in total six measuring systems were installed built out of following instruments:

- Oxygen sensor InPro 6900
- Multi-parameter transmitter M700 S
- Stationary housing InFit 761 for the sensor

- 3 loops were installed at the filling station,
- 2 loops before and after the filtration and
- 1 loop at the yeast propagation (aerobic fermentation)

In addition one portable oxygen system InTap 4000e was ordered for off-line measuring.

### Switch to METTLER TOLEDO was beneficial

According to Fabio Mazotti, supervisor for Brewing and Processing, reliability was the “problem number one” for Carlsberg. The INGOLD measuring systems of METTLER TOLEDO were definitely more reliable, with less frequent needs for maintenance or recalibration; furthermore, INGOLD instruments can be more rapidly returned to service than the previously used systems; thus, the systems are now more rarely out of service, and spend less time out of service during each interruption.

### Outlook to further projects

Asking Fabio Mazotti if further projects have been realized with METTLER TOLEDO or if anything has been planned he answered: “There were some other projects where we installed a new filtration line. There we added also a new METTLER TOLEDO measuring system which was supplied directly by the construction company. But we also need to modify partially the wort production process. A decision regarding this project is still pending. In any case, most probably we will install a new METTLER TOLEDO measuring system. In this process the oxygen levels which need to be monitored are very low. We are also considering to test the INGOLD sensors in a new application for yeast propagation. Even more, we do have at least two or three new applications to be established which we would like to discuss with the Italian representatives of METTLER TOLEDO”.

### Benefits of InPro 6900

- Service in seconds
- For low levels of oxygen
- Long lasting membranes
- FDA positive listed materials
- Hygienically polished surface
- EHEDG certified and 3A compliant
- Suitable for CIP

### Benefits of M700 S

- Measures two parameters with temperature
- Module for measuring ppb available



Multi-parameter transmitter M700S.



Stationary housing InFit 761.



Oxygen sensor InPro 6900.

► [www.mt.com/DO](http://www.mt.com/DO)

## Self-Sufficient CO<sub>2</sub> Production in Brewing Process

**Fermentation CO<sub>2</sub> can be stored and used in carbonation for self-sufficiency. The required quality was obtained through in-line control with the O<sub>2</sub> sensor InPro 6950. As a result a considerable cost saving was achieved.**

### To buy or to produce requested CO<sub>2</sub>

Breweries, soft drink producers and other segments of the Food and Beverage industry use carbon dioxide (CO<sub>2</sub>) in their production process. But in the brewing industry CO<sub>2</sub> is a byproduct of the brewing fermentation process that is used to protect and ensure the quality and uniformity of beer. CO<sub>2</sub> is used to displace air from tanks, cans, bottles, and kegs before they are filled with beer.

In many cases, CO<sub>2</sub> is also incorporated directly into the product. In these applications either recovered or purchased commercial CO<sub>2</sub> is used.

### Self-sufficient CO<sub>2</sub> production

In many breweries there is a desire to become or remain self-sufficient in their CO<sub>2</sub> production for use in their processes. To be self-sufficient a brewery must be able to produce enough CO<sub>2</sub> and have the storage capabilities to meet the demands throughout the entire production process. They must also balance the cost of purchasing CO<sub>2</sub> with the cost of the collection system and the operating costs associated with purifying, storing, and distributing recovered CO<sub>2</sub>.

### Standards of purity in the beverage industry

In the case of both purchased or recovered CO<sub>2</sub> the quality of the products needs to be monitored for impurities. CO<sub>2</sub> used in this application has a purity of 99.98% and higher. The International Society of Beverage Technologists (ISBT) has suggested standards upon which impurities in CO<sub>2</sub> must be analyzed for public safety. Trace detection of ppm levels of O<sub>2</sub>, THC, H<sub>2</sub>O<sub>2</sub> and total sulfides in CO<sub>2</sub> used in the production processes need to be monitored. Incidents of benzene impurities in Perrier water as well as H<sub>2</sub>S concern for Coke in Europe have heightened awareness and need for this quality control measurement.

#### Benefits which can be achieved

- Cost saving
- No commercial CO<sub>2</sub> derived from ammonia synthesis or hydrogen generation or from wells
- Direct sensor installation without gas sampling and conditioning systems



Multi-parameter transmitter M700S.



### Purity requirements in brewing industry

In breweries the monitoring of the ppm level of O<sub>2</sub> in the CO<sub>2</sub> is a typical application. O<sub>2</sub> present in the CO<sub>2</sub> will dissolve into the process in the liquid phase and cause oxidation of the beer effecting flavor, color and shelf life. Purity standards for CO<sub>2</sub> are typically less than 30 ppm for O<sub>2</sub>. O<sub>2</sub>-gas measurement systems are used throughout the collection and recovery system to monitor the different O<sub>2</sub> levels. Using an O<sub>2</sub>-gas measurement system at the collector head of the fermentation tanks to trigger whether to vent or collect can result in longer collection times and less wasted vented CO<sub>2</sub>, which is also an environmental concern. Monitoring CO<sub>2</sub>

after the vaporizers of the recovery plant ensures the CO<sub>2</sub> being sent to the brewing or packaging meets the purity requirements.

### METTLER TOLEDO solution

METTLER TOLEDO's newest sub ppm sensor InPro 6950 for O<sub>2</sub> detection together with the M700S multi-parameter transmitter and its advanced diagnostics is specifically designed for this application. The lower detection limits of the sensor will accurately measure the levels of oxygen in the CO<sub>2</sub> without the extensive process conditioning required of other monitoring systems available. The rugged design of the sensor will also withstand the pressure fluctuations seen on the collection system reducing downtime and maintenance. Utilizing the M700 dual channel capabilities the cost per measurement is also reduced to provide an overall savings on installation operational cost.

### InPro 6950 – the best choice for O<sub>2</sub> control in gas phase applications.

INGOLD's extensive experience in offering high quality gas measuring solutions for brewery applications has been implemented in the InPro 6950 sensor.



Oxygen sensor InPro 6950.

### Features and benefits

- Easy-to-replace membrane body reduces service time
- Durable and rugged sensor design for increased resistance to harsh environments
- FDA compliant materials of construction and easy-to-clean high-polished surface finish (Ra ≤ 4 μm / 16 μin) to satisfy stringent regulatory requirements
- Suitable for hygienic applications: EHEDG certified

► [www.mt.com/ISM](http://www.mt.com/ISM)

► [www.mt.com/DO](http://www.mt.com/DO)

# Process Analytics Product Catalog

## New Edition 08/09 Available

**Get an overview of the latest INGOLD and THORNTON products available for your process application with the new product catalog 08/09.**

The catalog offers comprehensive overview on product features and specifications, benefits and recommended application areas, order details and much more for process analytics measurement solutions.

The product catalog covers complete measuring solutions for the parameters:

- pH
- Dissolved oxygen and O<sub>2</sub> in gases
- Ozone
- Dissolved CO<sub>2</sub>
- Conductivity
- Turbidity
- TOC
- Flow

The featured product range includes:

- Electrodes / sensors
- Housings
- Process connections
- Transmitters / analyzers
- Cleaning and Calibration systems
- Cables
- Accessories

Order your copy of this useful desk tool today!

