

# Optical Oxygen Systems

## With ISM ... a Powerful Combination

### Open the way for enhanced process control in biotech applications

To enable optimal growth conditions for high yield and quality in biotech processes, control of the oxygen level is essential. Maintenance or replacement of a failing sensor during the batch involves the risk of contamination with microorganisms and is therefore not practicable in most cases. The key requirements to reach optimum batch to batch consistency are the measurement reproducibility and safety of the oxygen measurement. METTLER TOLEDO's optical oxygen sensors with built-in Intelligent Sensor Management technology sets new benchmarks for ease of use, process safety, simplified documentation and maintenance efficiency.

For 60 years Ingold has successfully developed process analytical instruments for biotech applications and serves the industry with the most innovative and reliable measurement solutions available.

The optical measurement principle offers significant advantages compared to non-optical systems. Enhanced process control resulting from combined measurement safety, reliability and handling were key prerequisites for the development of the sensors. The unique combination of optical technology with METTLER TOLEDO's Intelligent Sensor Management (ISM) results in a highly efficient and reliable oxygen measurement system.



### **Plug and Measure significantly reduces installation and start up time**

The InPro 6860 i / 6870 i sensors are tailored for the biopharmaceutical industry, where safety of process control is the main focus of interest. During preparation and maintenance of an oxygen sensor for the coming batch, all procedures must be carefully performed and well documented. This prevents possible handling errors with potentially disastrous consequences once the sensor is installed and the fermentation is started.

Because these handling errors can never be completely excluded, METTLER TOLEDO has equipped its optical sensors with the most advanced technology available for advanced process control. With ISM technology, all sensor data, including calibration and diagnostics, are stored in the sensor itself. Maintenance and a first calibration can be performed in the lab under controlled and clean conditions. Afterwards, installation in the process can be done in minutes. After connecting the sensor to the transmitter all relevant data are automatically transferred to the transmitter and an oxygen reading is available in less than a minute. System status and the quality of the sensing element, the OptoCap, is monitored in real-time and if maintenance is required the user will be informed via the transmitter. Before starting the batch the user has the latest information available about remaining OptoCap lifetime.

When using a conventional amperometric oxygen measurement system, special care must be given to the quality of the analog communication between sensor and transmitter. A damaged cable or connector can lead to measurement errors. With digital RS485-based communication between sensor and transmitter such installation issues can be largely avoided. Pre-calibrated sensors can be held on stock and swiftly exchanged at the measurement point.

### **Reduced maintenance and higher process reliability**

Especially in biopharmaceutical applications, all maintenance and handling steps of production instruments are defined in standard operating procedures (SOPs) and have to be documented according to validation requirements. Optical oxygen measurement with METTLER TOLEDO sensors is characterized by easy maintenance and, together with ISM features, facilitates handling, maintenance planning and documentation.

Instead of membrane body, inner body and electrolyte found in amperometric sensors, only one component, the OptoCap has to be replaced from time to time as a consumable. Long lifetime and simple replacement of the OptoCap reduces maintenance costs.

### **Hygienic design for higher process safety**

Next to complying with the stringent industry requirements for quality and reliability, measurement systems for the biotech and pharmaceutical industry must be designed to the highest hygienic standards.

The exchangeable OptoCap fulfills the high requirements for FDA compliance. Material and position of the O-Ring (USP Class VI) are optimized for minimized risk of cross-contamination. The InPro 6860 i does not even have an O-ring exposed to the medium and the OptoCap is covered by a PTFE layer to reduce biofouling and increase long term stability.



### Enhanced diagnostics for predictive maintenance



During batch processes high reliability of the instrumentation is required because only very limited corrective actions are possible, as too much interference could jeopardize the necessary sterile conditions for optimal growth. Because of the potentially disastrous consequences of a failed batch in term of loss of manufacturing time and higher costs, biotech companies have tried to minimize the possibility of instant failure by introducing highly developed manual control of quality and performance. With the use of optical DO measurement systems in combination with the highly innovative ISM technology for predictive maintenance, significant improvements in measurement reliability are achieved without excessive maintenance operations. With ISM, additional reactive sensor information is generated in the sensor itself and calculated into a value called the Dynamic Lifetime Indicator (DLI) in the transmitter. The DLI uses information about the quality of the OptoCap after each calibration and together with the current process conditions (temperature and oxygen level), translates this information into an estimated remaining lifetime of the system. The highest stress for an optical oxygen sensor is during cleaning (CIP), sterilization (SIP) and autoclaving of the fermenter. Normally the user has to record all actions manually in the logbook for each sensor. Thanks to ISM technology the InPro 6860 i / 6870 i detect CIP and SIP automatically and the number of cycles is stored in the sensor memory. The user has the option to predefine a maximum number of CIP, SIP and

#### Features overview

- Plug and Measure with pre-calibrated systems without polarization
  - Easy maintenance
  - Higher performance
  - Enhanced diagnosis
  - Predictive maintenance
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- Hygienic design
  - Class VI USP O-rings
  - Surface roughness and FDA compliant materials

autoclaving cycles for each measurement point. The sensor automatically recognizes if this maximum is reached, and generates an alarm to replace the OptoCap. As a result, unwanted use of a potentially failing sensor is avoided. The data is always available when the sensor is connected to a transmitter. There is no need for manual documentation of the SIP/CIP and autoclavings.

### Reliable accuracy for efficient process control



Increasing requirements on process control are met by METTLER TOLEDO's optical sensors, with their outstanding measuring performance. Excellent signal stability, low drift and low signal to noise ratio reduce the need of recalibration. Especially fermentation over several months can be performed with a very high and predictable accuracy. During the process, the user has access to reliable up to date information about the quality of the measurement at any time.

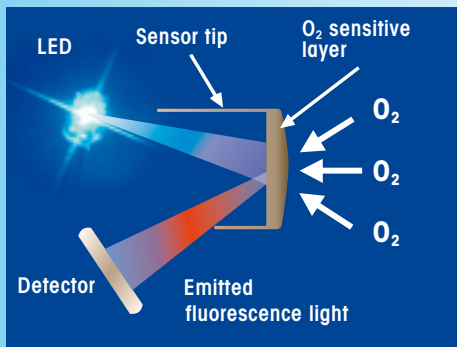


**At a glance**

**The optical measurement principle**

The heart of the optical sensor is an oxygen sensitive layer containing immobilized marker molecules. They absorb light from a LED and are able to release this energy as light at a different wavelength (fluorescence).

The fluorescence depends on the amount of oxygen that is present in the environment of the marker molecules. This effect allows determination of the oxygen concentration in the sample media.



An oxygen-sensitive layer containing immobilized marker molecules is the "heart" of the optical sensor.



InPro 6860i

InPro 6870i



Transmitters M400 and M800 for high versatility and advanced process control

For more information:

- ▶ [www.mt.com/InPro6870 i](http://www.mt.com/InPro6870i)
- ▶ [www.mt.com/InPro6860 i](http://www.mt.com/InPro6860i)
- ▶ [www.mt.com/M400](http://www.mt.com/M400)