

PRACTICE REPORT
PROCESS ANALYSIS
OXYGEN MEASUREMENT BREWING
ORBISPHERE M1100



ORBISPHERE M1100: CUSTOMER SUCCESS STORY - CARLSBERG

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The ORBISPHERE M1100 luminescent dissolved oxygen (LDO) sensor was launched by HACH and HACH LANGE in January, 2009. This product launch followed significant development and commercialization efforts along with numerous operational trials and has since resulted in a number of customer successes.

This short document will focus on one of these key successes to provide insights, technical details, and customer quotes relating to one of the earliest installations of the ORBISPHERE M1100.

"I appreciated the M1100's ease of handling, ease of calibration and the long interval between calibrations." Florian Galler, Quality and Lab Manager at Cardinal Breweries, Fribourg (Switzerland)

ORBISPHERE M1100: Application Background

The ORBISPHERE M1100 is designed for use in breweries for oxygen measurement in bright beer in addition to measurement of oxygen levels in de-aerated water in soft drink and bottled water plants.

Controlling oxygen levels in these applications is important for brewing and beverage manufacturers to maximize product shelf-life.

ORBISPHERE M1100: Installation with Carlsberg

The ORBISPHERE M1100 was first installed at the Cardinal brewery in Fribourg, Switzerland, in September, 2007. Cardinal is owned by the Carlsberg Group, the 4th largest brewer in the world. Since this first installation, the ORBISPHERE M1100 has been evaluated in process for over 18 months with measurements taken under continuous use every two seconds with a daily CIP procedure.

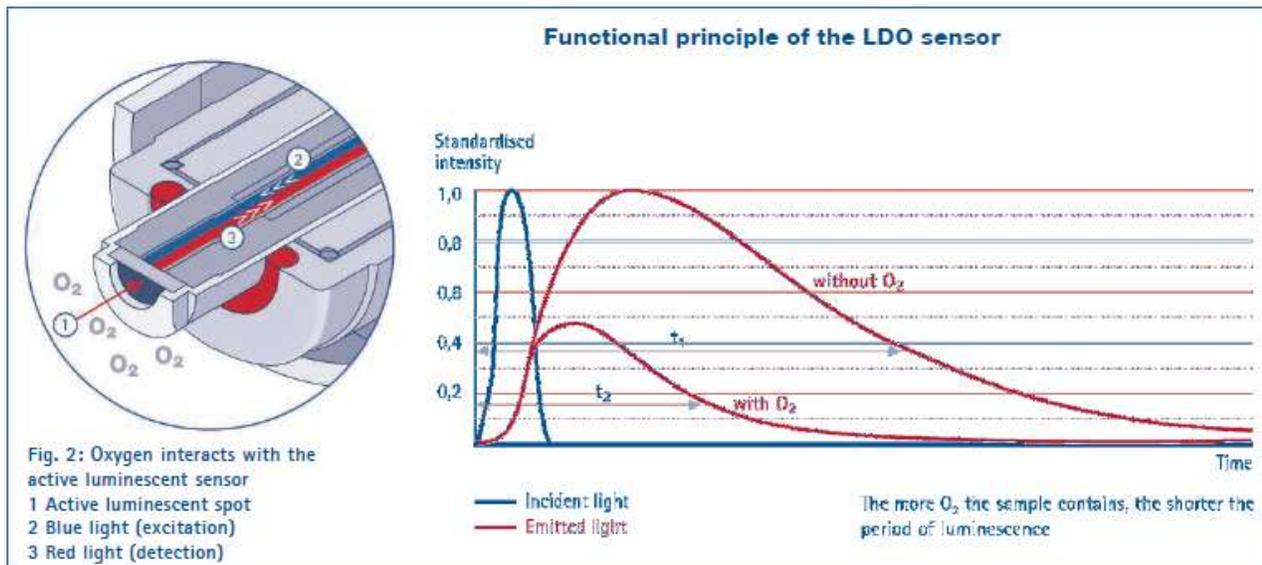
To give an indication of the process setup, the ORBISPHERE M1100 was installed on a production line with a throughput of 100 hl/h (approximately 30,000 33 cl bottles per hour) and a room/sensor temperature of 20-35 °C. Beers produced included lager at 8 °C, with a typical O₂ level of < 20 ppb, and a mix (beer, syrup) at 7 °C, with a typical O₂ level of 100 ppb to 200 ppb.

The sensor itself was installed between the tank and filler in a 60 mm line with beer flowing past at about 1 m/s (tangential velocity). To illustrate the effectiveness of the ORBISPHERE M1100 sensor, it was installed face-to-face with an ORBISPHERE A1100 electrochemical sensor (regarded as the reference for oxygen measurement in the brewing sector over the past 10+ years) via a Tuchenhagen Varin-line installation—the ideal scenario for comparative data.

The brewing line and sensor followed a daily CIP (Cleaning In Place) with a hot caustic and hot acid cycle, followed by hot rinsing.



Fig. 1: M1100 sensor in use between tank and filler in a 60 mm line.



ORBISPHERE M1100: Performance at Carlsberg

The ORBISPHERE M1100 proved to be a great success with Cardinal both from a functional and operational perspective. The following provides some key highlights of the performance of the ORBISPHERE M1100 at Cardinal:

- ORBISPHERE M1100 sensor deviation (from the EC sensor) for 30 days was less than 1 ppb with daily CIP (30 day drift would be lower than 0.5 ppb if the CIP cycle was weekly). This equates to approximately 1.2 million M1100 measurements.
- ORBISPHERE M1100 sensor deviation (from the EC sensor) for 6 months was less than 6 ppb with daily CIP (6 month drift would be less than 3 ppb with a weekly CIP cycle over the same 6 month period).
- ORBISPHERE M1100 response time matched that of the reference, the ORBISPHERE EC sensor, and was not influenced by pressure shocks or an absence of flow, unlike traditional EC sensors—these two points are illustrated below in Fig. 3 and 4.

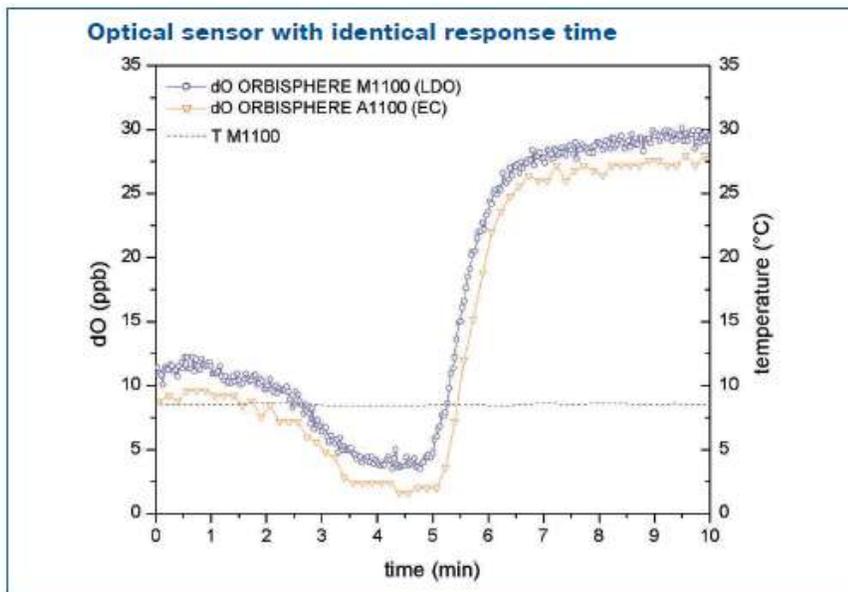


Fig. 3: The ORBISPHERE M1100 responds as quickly as the ORBISPHERE A1100 (amperometrical sensor).

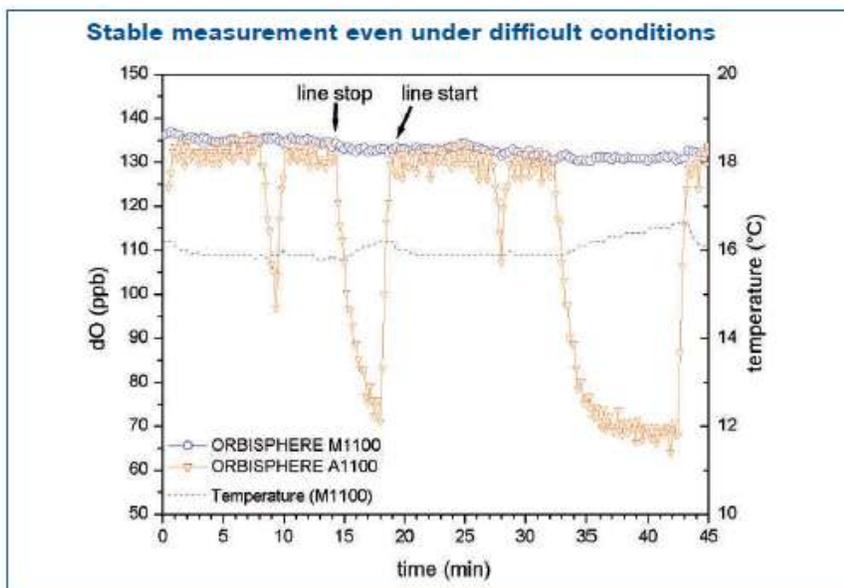


Fig. 4: The ORBISPHERE M1100 is not influenced by pressure shocks or absence of flow.

All brew masters agreed that a drift of under 10 ppb in a 6 month period was outstanding. The ORBISPHERE M1100 is the leading optical LDO system offering an accurate, calibration-free operation for over 6 months with measurements at 2-second intervals. In addition, it is the most accurate sensor available for breweries and is supported by the global sales and service network of Hach and Hach-Lange.

Key messages

The key benefits of the ORBISPHERE M1100 are shown below and can also be found in the data sheet:

- Lowest drift, fastest response, and annual calibration—the perfect combination
- Accuracy in ppb oxygen measurement for effective process control
- Optical technology eliminates membrane and electrolyte to minimize maintenance

ORBISPHERE M1100: The most important information and data

Standard offers ORBISPHERE M1100

	ORBISPHERE M1100: 28 mm sensor + 410 controller	ORBISPHERE M1100: 12 mm sensor + 410 controller
When?	New installations inline, ORBISPHERE customers	Customer has a Mettler, E&H, Hamilton or other 12 mm sensor/fitting installed
Why?	Ease of retrofit for ORBISPHERE customers	Reduced retrofit costs for non-ORBISPHERE customers
Standard offer includes	M1100-S00 (28 mm sensor) 410M/W1C00000 (410 wall mount) 32510.03 (3 m sensor cable) 3303x (3 m power cable; x = fitting) 33088 (Calibration device for M1100 sensors) 32003 (Insertion/retraction valve for use with Tuchenhagen)	M1100-S10 (12 mm sensor) 410M/W1C00000 (410 wall mount) 32510.03 (3 m sensor cable) 3303x (3 m power cable; x = fitting) 33088 (Calibration device for M1100 type sensors)

Technical data ORBISPHERE M1100 sensor

Range	0 to 2,000 µg/l (dissolved)	
Repeatability	±0.4 µg/l or 1 %, whichever is greater	
Reproducibility	±0.8 µg/l or 2 %, whichever is greater	
Accuracy	±0.8 µg/l or 2 %, whichever is greater	
Limit of detection (LOD)	Down to 0.6 µg/l	
Response time (90 %)	<10 s (gas phase), <30 s in a beer process	
Display resolution	0.1 ppb	
Calibration	Single point zero calibration	
Calibration sample	Standard 99.999 % Nitrogen (quality 50) or equivalent oxygen free gas	
Weights	M1100 12 mm (PG13.5)	0.6 kg
	M1100 28 mm	0.74 kg



Fig. 5: M1100 Sensors

Technical data ORBISPHERE 410 controller

Enclosures	Wall (pipe) mounting, stainless steel, IP 65 Panel mounting, aluminum, IP 65
Display	Monochrome STN 320x240 pixels with LED backlight
Analog outputs	3 Smart 0/4-20 mA (500 Ohms)
Relays	3 measurement alarm relays (2 A/30 V AC or 0.5 A/50 V DC) 1 system alarm relay (2 A/30 V AC or 0.5 A/50 V DC)
Digital communication	RS485, PROFIBUS DP (optional), Ethernet, USB-Client/-Host
Data storage	Rolling buffer or store once mode
User interface	Touch-screen panel
Ambient temperature	-5 to 50 °C (23 to 122 °F)
Humidity	0 to 95 % non-condensing relative humidity
Power supply	85-264 V AC @ 50/60 Hz, 25 VA, 10-36 V DC, 25 W
Weights	3.8 kg wall (pipe) mount 2.9 kg panel mount



Fig. 6: 410 Controller

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