

**AQUA**<sup>®</sup>  
**LYTIC**

# AL200xi

Dissolved Oxygen Meter  
Operating instructions



GB



## Declaration of CE-Conformity

The manufacturer:

**Tintometer GmbH**

Schleefstraße 8 a

44287 Dortmund

Deutschland

declares that this product

Product name:

**AL20Oxi**

with all optional items conforms to the following regulations:

**EMC**

EN 55 022 : 6 / 1993 class B  
EN50082-1(EN61000-4-6,  
EN 61000-4-4, EN 61000-4-3,  
EN 61000-4-2)

**The product conforms to the regulations of the EMC Directive  
89/336/EEC and 73/23/EEC.**

Dortmund, March 12, 2003

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Cay-Peter Voss,  
Managing Director

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# 1. Scope of Delivery

## Standard:

- AQUALYTIC® AL200xi
- Measuring cell
- Batteries, 4\*AA 1,5 V Cells
- Operating instructions

## Set:

- AQUALYTIC® AL200xi
- Batteries, 4\*AA 1,5 V Cells
- Measuring probe
- Carrying case
- Operating instructions

# 2. System description

The AQUALYTIC® SensoDirect Oxi200 is a sturdy, water-tight handheld meter designed for daily measurements in the area of field or laboratory analysis.

It is used to measure oxygen concentration in surface waters and groundwater as well as for waste water and service water analysis.

The system complies with the requirements in EN 60529 relating to protection class IP67 and water-proof/dustproof properties.

The permanent protective plating on the unit serves not just as impact protection but also as a storage compartment for the sensor and as an anti-slip device when the meter is used in an upright position.

Microprocessor technology and 4\*AA 1,5 V batteries allow unit operation without battery change for 12,000 hours or more.

A „Low Bat“ indicator in the display shows the user when it is time to change the batteries.

The required temperature compensation for the system is performed automatically following connection of the temperature sensor (NTC, 10 kOhm) that is integrated as standard in the AQUALYTIC oxygen sensor.

The AUTO HOLD feature enables the user to identify stable results and call them up on the display.

The standard MEAS measuring function is for continuous measurement of oxygen concentrations, partial pressures or saturations.

The absolute atmospheric pressure is measured in the unit and is automatically used, for among other things, calculation of the oxygen partial pressure or calibration of the system.

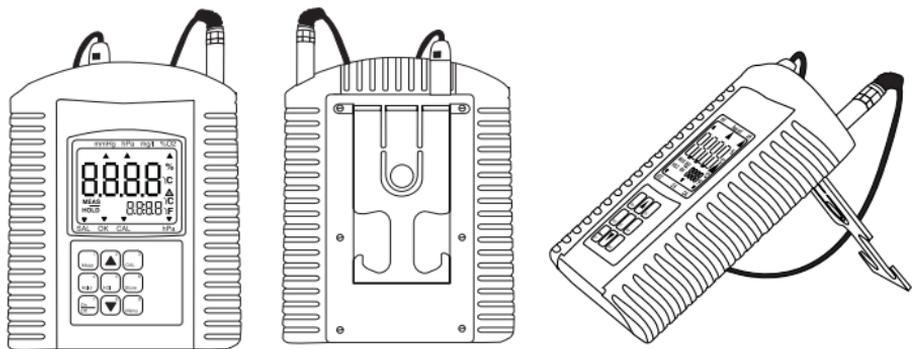
The integrated automatic salinity correction feature is based on the „International Oceanographic Tables“ and is user-selectable in the range from 0% to 70% via the configuration function of the unit.

The system is calibrated using the oxygen in the air.

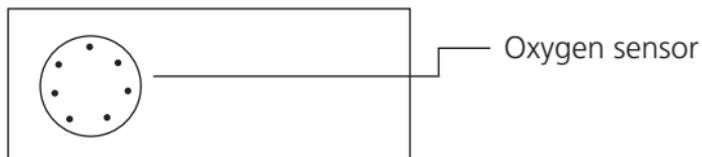
A sensor evaluation is automatically shown in the display (or can be called up via the menu) after each calibration.

An internal memory for 20 results is integrated in the unit as standard. The memory stores location, result and temperature.

The memory is called up via the display.



### 3. Connections



## 4. Display

Main Display: Result or user prompt

[mmHg] Oxygen partial pressure in mmHg

[hPa] Oxygen partial pressure in hPa

[mg/l] Oxygen concentration

[%O<sub>2</sub>] Oxygen saturation

Secondary display: Result - temperature or user prompt

[%] Percent (sensor evaluation)

[°C/°F] Temperature unit

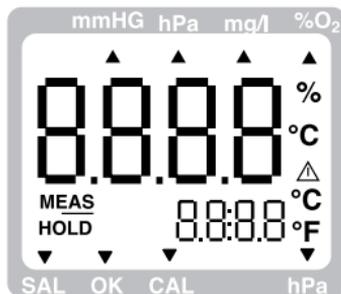
[Δ] Warning index - battery

[SAL] Salinity correction on/off

[OK] Measuring signal stable

[CAL] Auto. oxygen calibration

[hPa] Absolute air pressure



## 5. Keypad

[Meas] Continuous measurement - standard

[Hold] Auto-Hold: Automatic retaining of stable result

[On/Off] On / Off

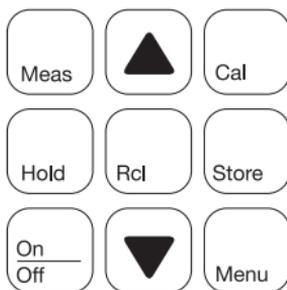
[▲] [▼] Display change: partial pressure, concentration or saturation. Leaf through menu or display

[Rcl] Display of stored results

[Cal] Calibration mode

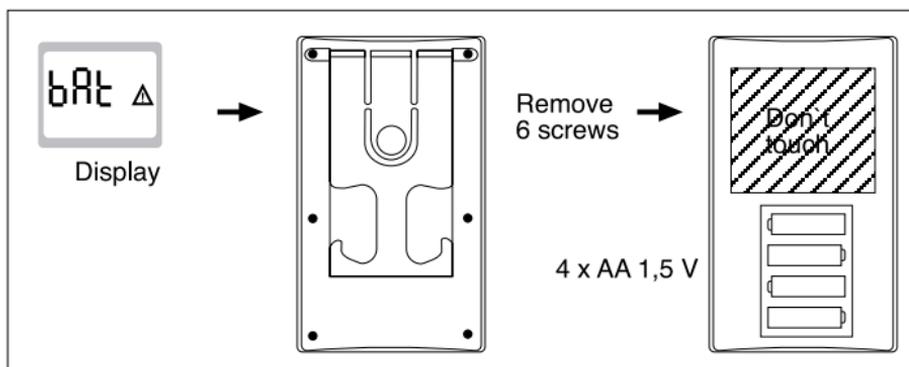
[Store] Storage of current result or acceptance of unit configuration

[Menu] Unit configuration



## 6. Startup

The unit is supplied with integrated batteries as standard and is therefore ready for immediate use. You have to unscrew the unit to insert or change the batteries.



When inserting the batteries, ensure correct polarity!  
Screw the unit back together carefully without exerting too much pressure on the gasket seal.

If the [▲] symbol appears together with „bAt“ in the lower section of the display, this means that the batteries are nearly empty and need replacing.

However, the unit will continue to function for a certain period of time.



If „bAt“ appears in the upper section of the display, this means that the batteries are completely empty.

Only use the matching AQUALYTIC oxygen sensors!  
Other sensors may cause serious damage to the meter and the sensor.

The sensor or temperature sensor must be plugged in before the unit is switched on.

Switch the unit on via the [On/Off] key.

The system must be calibrated when the system is first used.



Following measurement, please switch the unit off using the [On/Off] key.

See the enclosed Operating Instructions for more detailed information on storage and care of the sensors.

## 7. Measurement

### Measuring mode MEAS



After the unit is switched on, it is automatically in the standard measuring mode (MEAS).

You can switch to the standard MEAS measuring mode by pressing the [Meas] key.

The display shows the current, possibly still fluctuating result and [Meas].

If the result is stable, the [ok] arrow appears in the display.

### Measuring mode HOLD



Pressing the [Hold] key takes you into the AUTO HOLD measuring mode.

In this mode, the recorded result is checked by the system in line with the predefined stability criteria until these criteria are met.

The display shows Auto/HOLD in alternating mode together with the result.

Once a stable reproducible value is present, the result is shown permanently in the display („frozen“).

The display also shows HOLD and the temperature.

If you press the [Hold] key again, the measuring cycle starts again and runs until the stability criteria are met.

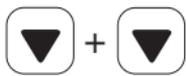


## 8. Configuration of the unit

To configure the unit, press the [Menu] key.

The first menu item appears.

If you press the [Menu] key again, the display jumps to the next menu item.



You can set the various parameters using the [▲] [▼] keys.

Press the [Store] key to store and conclude configuration.

The unit then switches back to measuring mode.



You can terminate the configuration process by pressing the [Meas] or [Hold] key.

Settings made up to this point are not stored.

The unit retains the previous settings.



### 8.1 Resolution: resolution of display for oxygen measurement

**Hi:** high resolution, restricted measuring ranges

**Lo:** low resolution, maximum measuring ranges

**Auto:** automatic, maximum measuring ranges



### 8.3 Salinity: salinity correction

**0...70,0 %:** Selection of salinity correction

**off:** Salinity correction inactive



### 8.4 Display of sensor status

Indication of the sensor status that is computed internally during every calibration depending on the sensor used.

- |                 |   |
|-----------------|---|
| <b>100%</b>     | The electrode is in excellent condition.    |
| <b>30...90%</b> | The condition of the electrode is adequate. |
| <b>&lt;30%</b>  | The electrode is old from use or soiled.    |

If there is no improvement after you have cleaned and recalibrated the sensor (see operating instructions for electrode), you need to replace the sensor.



## 8.5 Pressure Absolute, display of absolute pressure

Display of the absolute atmospheric pressure in hPa.



## 8.6 Selection of temperature unit °C /°F

°C All temperature values in degrees Celsius

°F All temperature values in degrees Fahrenheit

(°C = 0.556\*°F-17.8 or °F = 1.8\*°C+32)



## 8.7 Selection of unit for oxygen partial pressure

**hPa:** Oxygen partial pressure in hPascal

**mmHg:** Oxygen partial pressure in mm mercury column



## 8.8 "Power off": automatic unit switch-off

If no key is pressed during the switch-off delay period, the unit switches off automatically after the selected time has run down.

The desired delay time is entered in minutes.

If P.off = off, automatic unit switch-off is inactive.

## 9. Oxygen measurement

Please note the following when measuring dissolved oxygen:

The sensor should be calibrated after the unit is switched on.

The sensor and the liquid to be measured must have the same temperature (leave until the temperatures match if necessary)

Measurements are only sufficiently accurate if performed with a minimum flow rate of approx. 30 cm/sec; in other words, the liquid must be constantly stirred or a suitable stirring mechanisms must be used.

Remove the protective cap prior to measurement.

The oxygen partial pressure, the oxygen concentration [mg/l] and the oxygen saturation [%] are calculated on the basis of the sensor signal and the temperature.

The measurement is based on steam-saturated air in accordance with DIN38408-C22.

### 9.1 Absolute pressure

The absolute atmospheric pressure is measured in the unit.

The measured air pressure primarily affects saturation measurement [%] but also plays a major role during automatic oxygen calibration.

During depth measurements, there are different pressure conditions at the sensor and it is necessary to correct the oxygen saturation [%].

The results for oxygen concentration [mg/l] and oxygen partial pressure are not affected by this.

## 9.2 Salinity correction

The higher the salinity, the lower the solubility of oxygen in water; in other words, fewer mg of oxygen are dissolved per litre of water at the same oxygen partial pressure.

It is therefore necessary to first enter the salinity of the medium in order to determine the oxygen concentration.

The salinity correction feature is adjusted for aqueous media whose chemical composition corresponds to that of seawater.

Correction is based on the „International Oceanographic Tables“ (IOT).

## 10. Calibration of oxygen measurement

The sensor data of oxygen sensors are affected by ageing and manufacturing tolerances that result in fluctuations. You should therefore calibrate the unit with the sensor on a regular basis.

The sensor is automatically adjusted to the oxygen content of the air (20.95%; 1-point calibration).

We recommend calibration prior to each series of measurement.

### 10.1 Performing calibration

Remove the protective cap from the sensor prior to calibration.

Pat the diaphragm dry using a soft cloth.

Starting calibration: -Press [Cal] key.



'CAL' appears in the display.

As soon as the results for oxygen, temperature and air pressure are constant, calibration is terminated automatically.

The sensor status ('ELEC', valuation in 10% steps) is then briefly displayed.

Depending on the temperature, a correctly calibrated sensor shows a result of 102..114% (oxygen saturation).

If error messages occur during calibration, please see the troubleshooting tips.

If calibration is not completed after you have waited a lengthy period of time, at least one of the three measuring signals (oxygen partial pressure, temperature or air pressure) is not stable.

In this event, you should check the measuring setup.

## 11. Oxygen sensor

### 11.1 Technical data:

#### Measuring range of the unit:

Oxygen partial pressure:	0 ... 1200 hPa O <sub>2</sub>
Temperature:	-5.0 ... 50.0 °C
Sensor:	Galvanic, active diaphragm-covered sensor, with integrated NTC resistor

Response time:	95% in 10 sec., temperature-dependent
Operating pressure:	max. 3 bar.
Installation diameter:	Ø 12.0 ±0.2 mm (fits a 1/2 „ screw connection, for example)
Overall length:	approx. 220 mm (incl. anti-kink protection)
Installation length:	approx. 110 mm
Weight:	approx. 180 g
Operating temperature:	0 to +40°C
Storage temperature:	0 to +60°C

The galvanic self-polarising sensor with silver cathode and lead anode with potassium hydroxide as an electrolyte, is an active system.

The lead anode, the silver cathode and the electrolyte are used up during operation.

The sensor is affected by ageing over time.

Continuous maintenance of the sensor is therefore necessary.

## 11.2 Operating notes

a.) The oxygen sensor must always be kept moist to prevent the membrane from drying out. To this end, you should place the sensor in deionised water in the supplied storage cap.

If the diaphragm has dried out, the sensor needs to be

watered for approx. 2 hours prior to measurement. It then needs to be recalibrated.

b.) The sensors may only be used with the corresponding units. The use of the sensors in combination with unsuitable units can destroy the unit and the sensors!

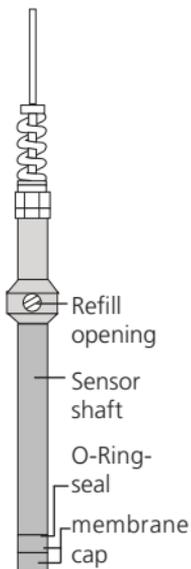
c.) Unit and sensor must be handled with care and used in accordance with the technical data outlined above. Always protect the connector and connection socket against soiling and dirt.

d.) Do not insert the connector at an angle. If the connector is inserted properly, you should be able to press it in without using force.

When disconnecting the sensor, do not pull it by the cable but always by the connector sleeve.

e.) Remove the sensor storage cap before performing measurements.

## 11.3 Design of the sensor



The housing of the sensor probe is made of PVC. With the exception of the sensor shaft, all parts must be serviced regularly and replaced if necessary.

**Storage cap:** The storage cap is used to moisten the membrane. This increases the service life of the sensor. The storage cap contains deionised water.

**Membrane cap:** the diaphragm head is covered with a Teflon membrane.

The diaphragm cap is filled with KOH electrolyte and screwed onto the sensor shaft in such a way that there are no air bubbles.

Damaged membrane or air bubbles in the membrane cap cause incorrect results.

The membrane cap is listed in the spare parts list.

Refill opening: if the sensor is used at excessive temperatures or stored outside the storage bottle for lengthy periods of time, this will result in electrolyte evaporation losses.

If necessary, you should therefore unscrew the diaphragm head, remove the sealing screw, and fill up the electrolyte using a syringe.

Then screw the sealing screw back in place.

## **11.4 Care and maintenance**

If the sensor is not needed, it should be stored either in the storage cap (filled with water) or directly in a container full of deionised water.

If a bacterial, fungal or algae coating has formed on the membrane, you should wipe off the coating using a soft paper cloth prior to measurement.

If it is no longer possible to calibrate the sensor or if the membrane is damaged, the sensor needs servicing.

Air bubbles in the membrane cap can affect measurements. Please remove carefully.

! Exercise caution during maintenance work – the electrolyte is caustic !

Wear disposable gloves when servicing the sensor and wash your hands thoroughly with water afterwards.

## Servicing the sensor:

Unscrew the membrane head and wipe off the electrolyte solution carefully using a paper cloth.

Do not allow the electrolyte to come into contact with your hands. If it does come into contact with your skin, rinse the affected area thoroughly in water.

To clean the silver cathode, sand lightly using sandpaper (240 grit). Do not sand the silver cathode to a smooth finish. It needs to be rough so that the electrolyte is distributed evenly. Carefully remove the sanding dust after sanding.

Unscrew the refill screw and fill up carefully with electrolyte until it just overflows (disposable syringe). Screw the refill screw back in place.

Fill new membrane cap with electrolyte, avoiding air bubbles.

Screw the sensor vertically into the cap from above. When you insert the sensor, the electrolyte is displaced from the membrane head and overflows.

Remove excess electrolyte using a paper cloth.

Turn the sensor upside down and check for air bubbles. If there are no air bubbles, servicing is complete.

If air bubbles are still present, please remove carefully.

If the O-ring seal is damaged it needs replacing.

Important note: leave the sensor to settle for at least 1 hour before performing recalibration.

If it is still not possible to calibrate the sensor despite servicing, the sensor needs to be checked at the factory and replaced if necessary.

## 12. Result memory

A maximum 20 results with the corresponding temperatures can be stored.

### 12.1 Storing results



You can store the current result in the result memory by pressing the [Store] key.

[Stor] and the number of the memory location appear briefly in the display.

### 12.2 Displaying stored results



You can call the stored results up in the display by pressing the [Rcl] (=Recall) key.

The first time you press the [Rcl] key, the number of the memory location and the corresponding oxygen-value are displayed.

The second time you press the key, the temperature for this result is displayed, the third time the air pressure is displayed.



You can use the [▲] [▼] keys to switch between the stored results.

As soon as you press the [Store], [Meas] or [Hold] key, the unit reverts to the corresponding measuring mode.

### 12.3 Deleting stored results



If you press the [Store] key for longer than 2 seconds, the unit switches to the delete menu [CLR].

You can use the [▲] [▼] keys to select the desired act

and press the [Store] key to execute it.

The unit then returns to the corresponding measuring mode.

[CLr-ALL]: delete all stored results.

[CLr-LASt]: delete the last-stored result.

[CLr-nonE]: do not delete any result.

### 13. Error messages and troubleshooting

Display	Cause	Remedy
	Weak battery voltage the unit will only continue to function for a short time	Insert new batteries
	Batteries empty	Insert new batteries
		
No display or strange symbols.  Unit does not react when keys are pressed	Batteries empty	Insert new batteries
	Batteries incorrectly inserted	Check batteries
	System error	Disconnect batteries, wait for a short time, reconnect the batteries
	Unit defective	Send in for repair

<b>Display</b>	<b>Cause</b>	<b>Remedy</b>
Err.1	Exceeds measuring range	Check: can value be exceed admissible measuring range? -> Result too high!
	Sensor defective	Replace sensor
Err.2	Below measuring range	Check: can value be below admissible measuring range? -> Result too low!
	Sensor defective	Replace sensor
Err.7	System error	Send in for repair
Err.9	Sensor not present	Connect sensor
	Sensor defective	Replace sensor
Err.11	Value could not be calculated	Temperature outside the admissible temperature measuring range

### **Oxygen calibration**

<b>Display</b>	<b>Cause</b>	<b>Remedy</b>
CAL.-Err.1	Wrong temperature	Temperature must be between 5 and 40°C
CAL.-Err.2	Wrong air pressure	Air pressure must be between 500 and 1100hPa

<b>Display</b>	<b>Cause</b>	<b>Remedy</b>
CAL.-Err.3	Sensor signal too low	Membrane dried out? -> Place sensor in water for 2 hours (waterxx) Repair or replace sensor Check calibration environment
CAL.-Err.4	Sensor signal too high	Air bubbles in the diaphragm head?
		Check calibration environment

## 14. Technical data

### Indicating ranges

	<b>High resolution</b>	<b>Low resolution, Auto Range</b>
Oxygen partial pressure	0.0...570.0 hPa	0...1200 hPa
	0.0...427.5 mmHg	0...900 mmHg
Oxygen concentration	0.00...25.00 mg/l	0.0...70.0 mg/l
Oxygen saturation	0.0...250.0 %	0...600 %
Temperature	-5,0 ... +50,0°C/ 23.0 ... 122.0°F	
Abs. pressure	500..1100 hPa	

**Accuracy:**

(at nominal temperature,  $\pm 1$  digit)

Oxygen measuring ranges	+/-1.5% +/-0.2mg/l (0...25 mg/l) or +/-2.5% +/-0.3mg/l (25...70 mg/l)
Temperature	$\pm 0,1^{\circ}\text{C}$
Abs. pressure	+/- 0,5% full scale

**Nominal**

**temperature:** 25°C

**Operating**

**temperature:** 0 to +50°C

**Storage**

**temperature:** -20 to +70°C

**Memory:**

20 result memory locations

**Power supply:**

4 x 1.5 V -batteries, Type AA  
operating life up to 2000h (depending on  
measuring mode and battery type)

**Power****consumption:**

max. 0.25 mA (depending on measuring  
mode – MEAS or AUTO-  
HOLD)

**Battery change**

**indicator:** , bAt ,

**Automatic „Off”****function:**

if no key is pressed and no data transfer is  
occurring, the unit switches off after the  
switch-off delay time. May be set between  
1 and 120 minutes or inactive.

<b>Housing:</b>	water-tight in accordance with IP67 Integral protective plating LCD Film keypad
<b>Sensor:</b>	self-polarising galvanic oxygen sensor with integrated NTC sensor
Connection:	7-pin DIN socket
Installation diameter:	12.0 +/- 0.2mm (also fits 1/2" screw connections)
Overall length:	approx. 220 mm (incl. anti-kink protection)
Operating temperature:	0...40°C

## 15. Accessories

4723200	AQUALYTIC® AL20Oxi Basic Instrument
4723220	AQUALYTIC® AL20Oxi Set
723201	AL20 Oxygen Sensor 1 m cable
723210	AL20 Oxygen Sensor 10 m cable
723230	AL20 Oxygen Sensor 30 m cable
723250	Service Set Oxygen Sensor
723260	Armature for Depth Measurement
725020	Case SensoDirect



## **AQUALYTIC®**

Schleefstraße 12

D-44287 Dortmund

Phone: (+49) (0)231 / 9 45 10 - 755

Fax: (+49) (0)231 / 9 45 10 - 750

[sales@aqualytic.de](mailto:sales@aqualytic.de)

[www.aqualytic.de](http://www.aqualytic.de)



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