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Contact Us:

Irl Ph: 01 4523432

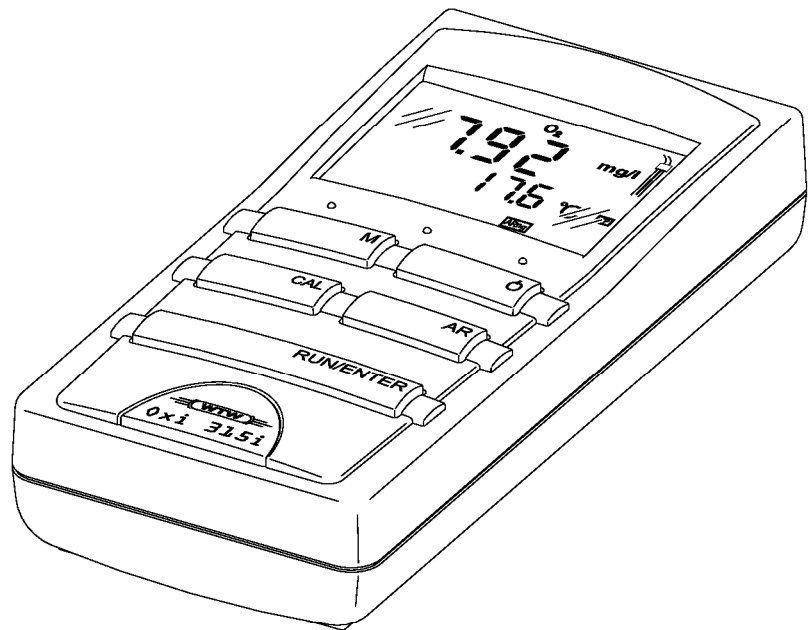
UK Ph: 08452 30 40 30

Web: www.carlstuart.com

Email: info@carlstuart.com

Operating manual

ba52304e **Handheld meter
Oxi 315i**



Oxygen measuring instrument

**Accuracy when
going to press**

The use of advanced technology and the high quality standard of our instruments are the result of continuous development. This may result in differences between this operating manual and your instrument. Also, we cannot guarantee that there are absolutely no errors in this manual. Therefore, we are sure you will understand that we cannot accept any legal claims resulting from the data, figures or descriptions.

Warranty

We guarantee the instrument described for 3 years from the date of purchase.

The instrument warranty covers manufacturing faults that are discovered within the warranty period. The warranty does not cover components that are replaced during maintenance work, e.g. batteries.

The warranty claim extends to restoring the instrument to readiness for use but not, however, to any further claim for damages. Improper handling or unauthorized opening of the instrument invalidates any warranty claim.

To ascertain the warranty liability, return the instrument and proof of purchase together with the date of purchase freight paid or prepaid.

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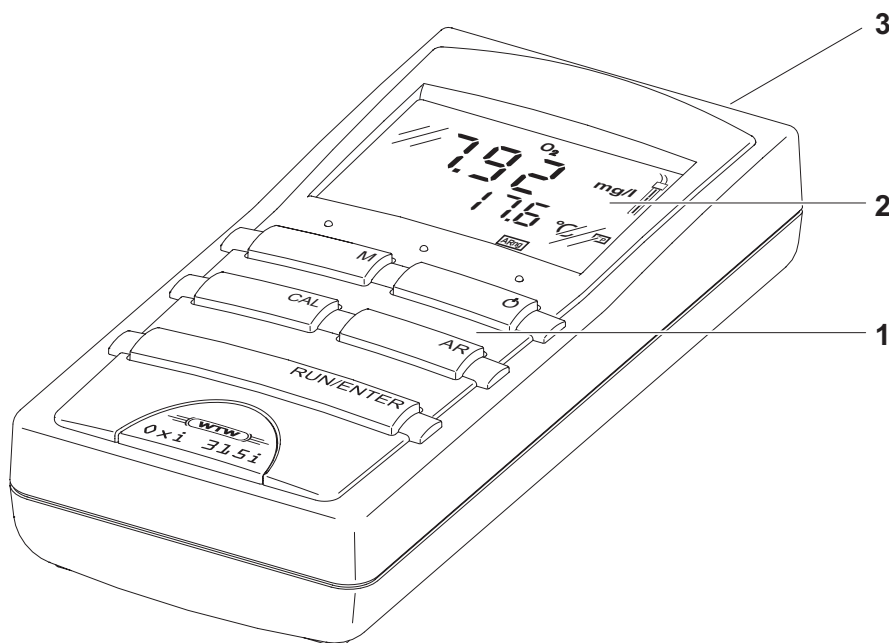
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1 Overview

The compact precision Oxi 315i handheld meter enables you to carry out oxygen measurements rapidly and reliably.

The Oxi 315i handheld meter provides the maximum degree of operating comfort, reliability and measuring certainty for all applications.

The proven OxiCal[®] calibration procedure and the special AutoRead function support you in your work with the Oxihandheld meter.



1	Keypad
2	Display
3	Jack field



Note

If you need further information or application notes, you can obtain the following material from WTW:

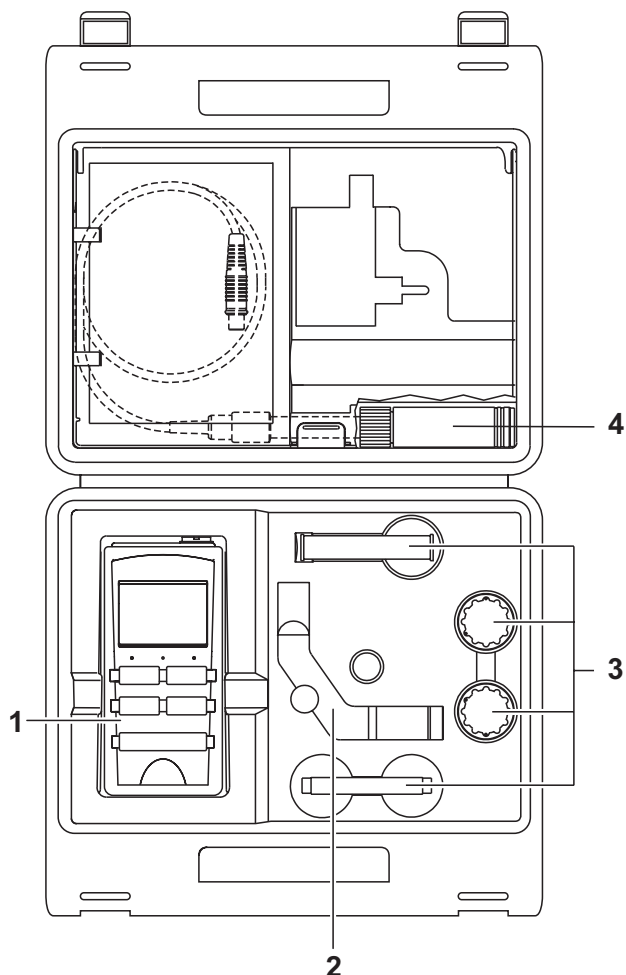
- Application reports
- Primers
- Safety datasheets.

You will find information on available literature in the WTW catalog or via the Internet.

1.1 SETs of equipment

The measuring instrument is also available as part of individual SETs of equipment.

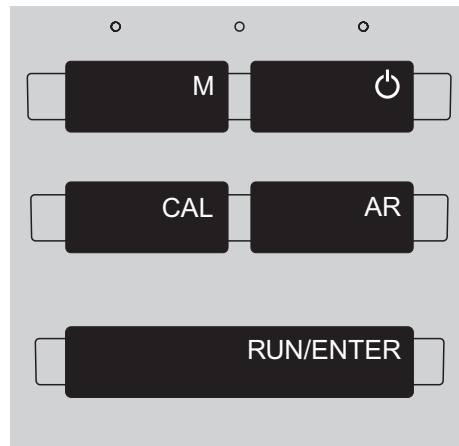
You will find additional information on this and other accessories in the WTW catalog or via the Internet.








Set (sample configuration):

1	Measuring instrument, Oxi 315i
2	Stand
3	<ul style="list-style-type: none"> - 50 ml ELY/G electrolyte solution for D.O. sensors - 50 ml RL/G cleaning solution for D.O. sensors - 3 WP 90/3 exchange membrane heads - SF300 abrasive film for D.O. sensors
4	Cellox 325 D.O. sensor with calibration vessel

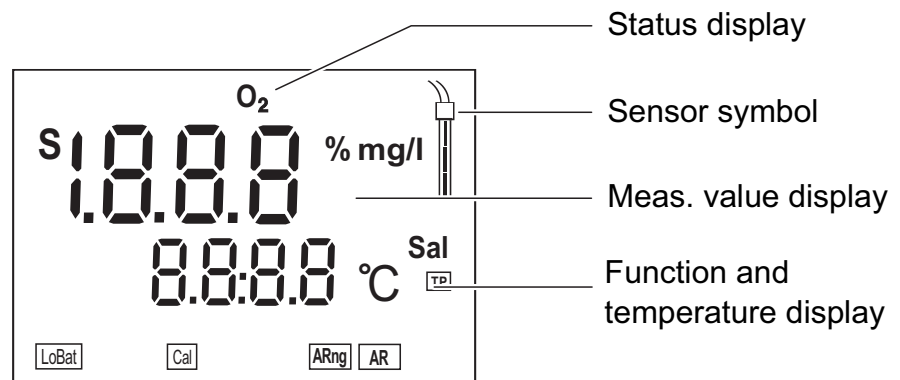
1.2 Keypad



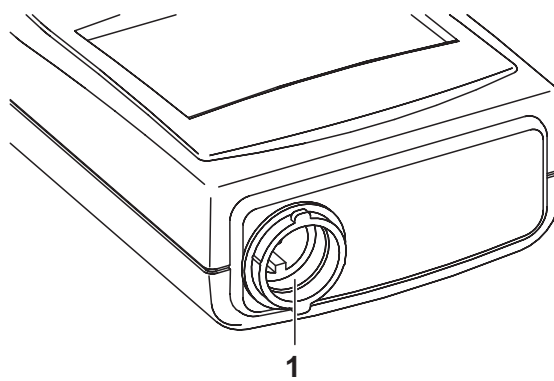
Key functions

	Select the measuring mode <M> : <ul style="list-style-type: none"> – D. O. concentration – Oxygen saturation – Oxygen partial pressure
	Switch measuring instrument on/off <ON/OFF>
	Calibrate, select the calibration procedure <CAL>
	Activate/deactivate the AutoRead function <AR>
	Confirm entries, start AutoRead <RUN/ENTER>

1.3 Display



1.4 Jack field



1 | Oxygen sensor

2 Safety

This operating manual contains basic instructions that you must follow during the commissioning, operation and maintenance of the measuring instrument. Consequently, all responsible personnel must read this operating manual carefully before working with the measuring system. The operating manual must always be available within the vicinity of the measuring system.

Target group

The measuring instrument was developed for work in the field and in the laboratory. We assume that, as a result of their professional training and experience, the operators will know the necessary safety precautions to take when handling chemicals.

Symbols used



Warning

indicates instructions that must be followed to prevent damage to your instrument.



Note

indicates notes that draw your attention to special features.



Note

indicates cross-references to other documents, e.g. application reports, operating manuals of probes, etc.

2.1 Authorized use

The authorized use of the measuring instrument consists exclusively of the measurement of the oxygen content in the field and laboratory. The technical specifications as given in chapter 7 TECHNICAL DATA must be observed. Only the operation and running of the measuring instrument according to the instructions given in this operating manual is authorized.

Any other use is considered to be **unauthorized**.

2.2 General safety instructions

This instrument is built and inspected according to the relevant guidelines and norms for electronic measuring instruments (see chapter 7 TECHNICAL DATA).

It left the factory in a safe and secure technical condition.

Function and operating safety

The smooth functioning and operational safety of the measuring instrument can only be guaranteed if the generally applicable safety measures and the specific safety instructions in this operating manual are followed during operation.

The smooth functioning and operational safety of the measuring instrument can only be guaranteed under the environmental conditions that are in specified in chapter 7 TECHNICAL DATA.

If the instrument was transported from a cold environment to a warm environment, the formation of condensate can lead to the faulty functioning of the instrument. In this event, wait until the temperature of the instrument reaches room temperature before putting the instrument back into operation.

Safe operation

If safe operation is no longer possible, the instrument must be taken out of service and secured against inadvertent operation!

Safe operation is no longer possible if the measuring instrument:

- has been damaged in transport
- has been stored under adverse conditions for a lengthy period of time
- is visibly damaged
- no longer operates as described in this manual.

If you are in any doubt, please contact the supplier of the instrument.

Obligations of the purchaser

The purchaser of the measuring instrument must ensure that the following laws and guidelines are observed when using dangerous substances:

- EEC directives for protective labor legislation
- National protective labor legislation
- Safety regulations
- Safety datasheets of the chemical manufacturers.

3 Commissioning

Scope of delivery

- Handheld meter, Oxi 315i
- Operating manual and short operating manual
- 4 batteries, 1.5 V Mignon type AA (in the instrument)

For details of scope of delivery of SETs, see chapter 1.1 SETs OF EQUIPMENT and WTW catalog.

4 Operation

4.1 Switching on the measuring instrument

1	Connect the D. O. probe to the measuring instrument.
2	Press the <ON/OFF> key. The display test appears briefly on the display. The relative slope for the sensor type that was just connected subsequently appears for approx. one second. The measuring instrument then automatically switches to the measuring mode that was last selected. The display shows the relevant measured value.



Note

The Oxi 315i handheld oxygen meter automatically recognizes the type of D.O. sensor that is connected (CellOx 325 or DurOx 325).



Warning

Only connect sensors to the measuring instrument that cannot return any voltages or currents that are not allowed (> SELV and > current circuit with current limiting). Almost all sensors - in particular WTW sensors - fulfill these conditions.

4.2 Measuring

You can measure the following parameters:

- D. O. concentration
- Oxygen saturation
- Oxygen partial pressure

The Oxi meter is supplied with the following functions:

- AutoRange (automatic switchover of the measurement range),
- The AutoRead function (drift control) for checking the stability of the measurement signal. This ensures the reproducibility of the measuring signal. For details of how to switch the AutoRead function on/off, see page 18.

Preparatory activities

Perform the following preparatory activities when you want to measure:

1	Connect the D. O. probe to the measuring instrument.
2	Calibrate or check the measuring instrument with the sensor. How to calibrate is described in section 4.3 from page 19.
3	Immerse the D. O. probe in the test sample.
4	Select the measuring mode with <M> .



Note

Incorrect calibration of D. O. probes will result in incorrect measured values. Calibrate at regular intervals.

Temperature sensor

The D. O. probe has an integrated temperature sensor that always measures the current temperature of the test sample.

4.2.1 Measuring the D. O. concentration

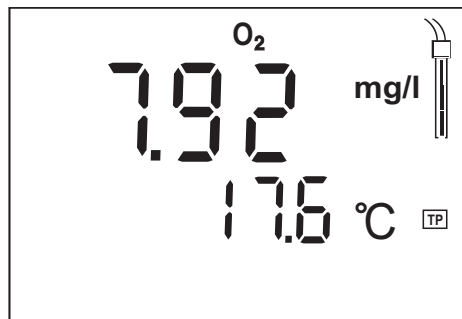


Note

A fixed salt content correction value of 30.0 is provided. How to switch it on or off is described below.

You can measure the oxygen content without a salt content correction as follows:

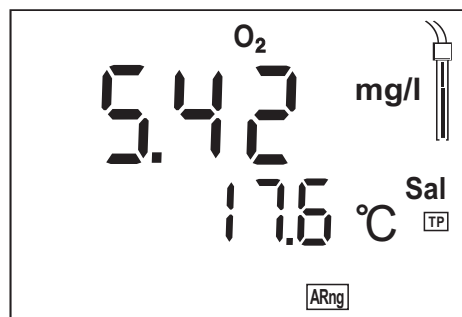
1	Perform the preparatory activities according to section 4.2.
2	Press the <M> key repeatedly until the D. O. concentration in <i>mg/l</i> appears on the display.



Switching on/off salt content correction

Proceed as follows to switch on the salt content correction:

1	Perform the preparatory activities according to section 4.2
2	Switch on the salt content correction with <M> while pressing the <RUN/ENTER> key. The SAL display indicator appears on the display. The fixed value of 30.0 is taken into account in the measurement.

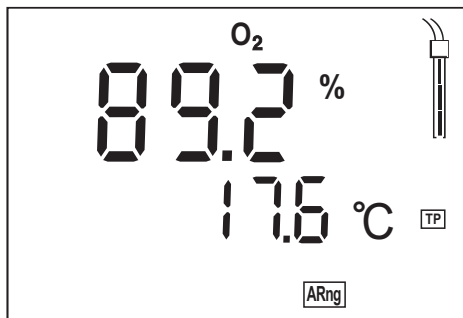


3	Switch off the salt content correction with <M> while pressing the <RUN/ENTER> key. The SAL display indicator is no longer displayed.
---	---

4.2.2 Measuring the D. O. saturation

You can measure the D. O. saturation as follows:

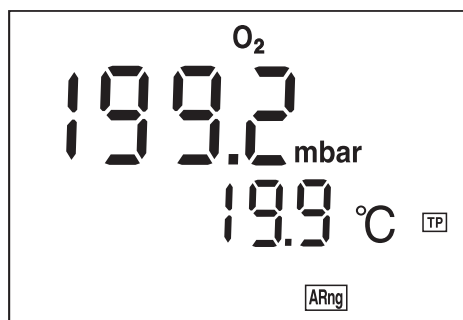
- | | |
|---|--|
| 1 | Perform the preparatory activities according to section 4.2 |
| 2 | Press the <M> key repeatedly until the saturation in % appears on the display. |



4.2.3 Measuring the D. O. partial pressure

You can measure the D. O. partial pressure as follows:

- | | |
|---|--|
| 1 | Perform the preparatory activities according to section 4.2 |
| 2 | Press the <M> key repeatedly until the partial pressure in <i>mbar</i> appears on the display. |



4.2.4 Selecting the measuring range, AutoRange

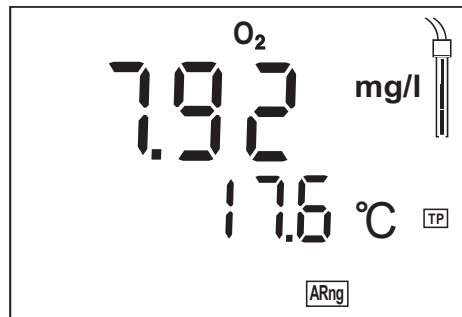
Sensors

You can use the DurOx or CelloX325 sensors. If the automatic recognition function recognizes the DurOx sensor, the measurement is carried out at a lower resolution. The CelloX325 sensor measures with a resolution that is a factor of 10 higher.

AutoRange

Each of the measuring parameters has 2 measuring ranges available. *AutoRange* causes the Oxi meter to change to measuring range II if measuring range I is exceeded, and also vice versa.

AutoRange is always switched on and is indicated on the display by *ARng*:



**Measuring ranges/
resolutions with
CelloX 325 oxygen
sensor**

	mg/l	%	mbar
Measuring range I	0 ... 19.99	0 ... 199.9	0 ... 199.9
Resolution	0.01	0.1	0.1
Measuring range II	0 ... 90.0	0 ... 600	0 ... 1250
Resolution	0.1	1	1

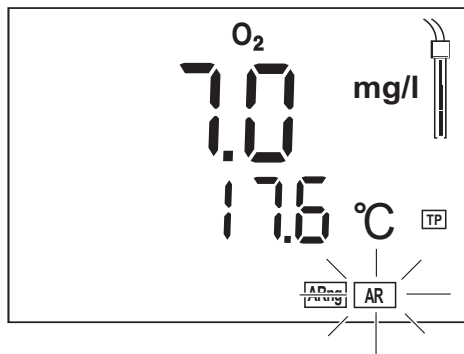
**Measuring ranges/
resolutions with
DurOx 325 oxygen
sensor**

	mg/l	%	mbar
Measuring range I	0 ... 19.9	0 ... 199	0 ... 199
Resolution	0.1	1	1
Measuring range II	0 ... 90	0 ... 600	0 ... 1250
Resolution	1	1	1

4.2.5 AutoRead AR (Drift control)

The AutoRead (drift control) function checks the stability of the measurement signal. The stability has a considerable effect on the reproducibility of the measured value.

- 1 Select the measuring mode with **<M>**.
- 2 Activate the AutoRead function with **<AR>**. The current measured value is frozen (hold function).
- 3 Start AutoRead with **<RUN/ENTER>**.
The AR display indicator flashes until a stable measured value is reached.



- 4 If necessary, start the next AutoRead measurement with **<RUN/ENTER>**.

Criteria With identical measurement conditions, the following applies:

Parameter	Reproducibility	Response time
D. O. concentration	Better than 0.05 mg/l	> 10 seconds
Oxygen saturation index	Better than 0.6 %	> 10 seconds
Oxygen partial pressure	Better than 0.6 mbar	> 10 seconds

4.3 Calibrating

Why calibrate?

D. O. probes age. This changes the slope of the D. O. probe. Calibration determines the current slope of the probe and stores this value in the instrument.
Thus, you should calibrate at regular intervals.

Separate calibration of CellOx 325 and DurOx 325

The Oxi 315i handheld meter enables the two sensor types, CellOx 325 and DurOx 325, to be calibrated separately from one another. The calibration of a specific sensor type does not affect the calibration of any other type of sensor. When connecting a sensor, the calibration data stored for the respective sensor type are automatically used.

Calibration procedure




The calibration is performed in water vapor-saturated air. Use the OxiCal[®]-SL air calibration vessel for calibration (accessory).

AutoRead

The calibration procedure automatically activates the AutoRead function. The AR display indicator flashes. The calibration process is finished when AR stops flashing.

Sensor evaluation

After the calibration, the measuring instrument evaluates the current status of the sensor against the relative slope. The evaluation appears on the display. The relative slope has no effect on the measuring accuracy. Low values indicate that the electrolyte will soon be depleted and the probe will have to be regenerated.

Display	Relative slope
	S = 0.8 ... 1.25
	S = 0.7 ... 0.8
	S = 0.6 ... 0.7
E3 Eliminate the error according to chapter 6 WHAT TO DO IF...	S < 0.6 or S > 1.25

4.3.1 Starting the calibration

Proceed as follows to calibrate the instrument:

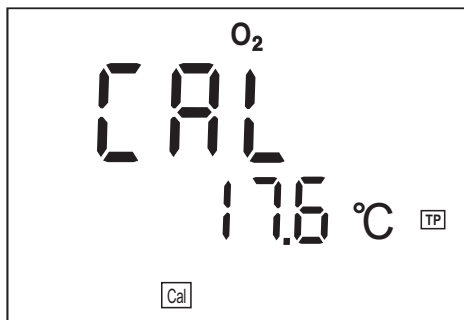
- 1 | Connect the D. O. probe to the measuring instrument.
- 2 | Keep the OxiCal[®]-SL air calibration vessel ready.



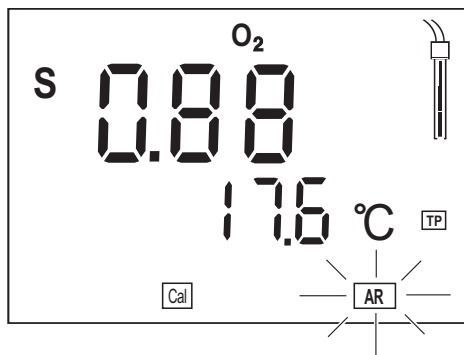
Note

The sponge in the air calibration vessel must be moist (not wet). Follow the instructions in the OxiCal[®]-SL operating manual.

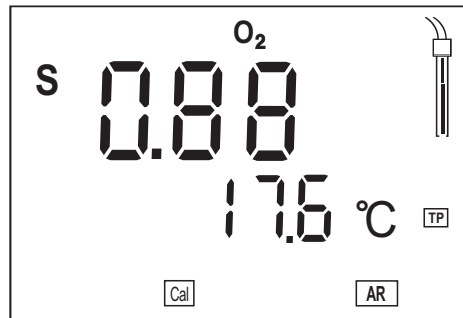
- 3 | Put the D. O. probe into the air calibration vessel.
- 4 | Press the <CAL> key. The calibration mode appears.



- 5 | Press the <RUN/ENTER> key. AutoRead is active, AR flashes.



- 6 | As soon as a stable value is reached, the AR display indicator stops flashing. This indicates that the calibration is complete; the relative slope that was determined and the sensor evaluation appear on the display (see page 19).



7 | Switch to the measuring mode with <M>.



Note

In chapter 6 WHAT TO DO IF..., you will find the measures to take for error elimination.

4.4 Reset

You can reset the measuring parameters (initialization).

Basic settings

The following settings are reset to the default values when a reset is performed (initialized):

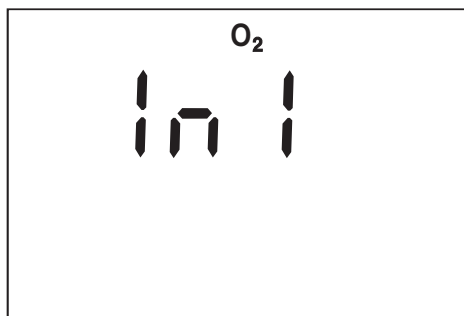
Measuring mode	D. O. concentration
Relative slope of CellOx 325	1.00
Relative slope of DurOx 325	1.00
Salinity correction (function)	Off



Note

During a reset, the relative slope for the sensor types CellOx 325 and DurOx 325 are reset together. They cannot be reset separately.

- 1 Press the **<RUN/ENTER>** key and hold it down.
- 2 Press the **<CAL>** key.



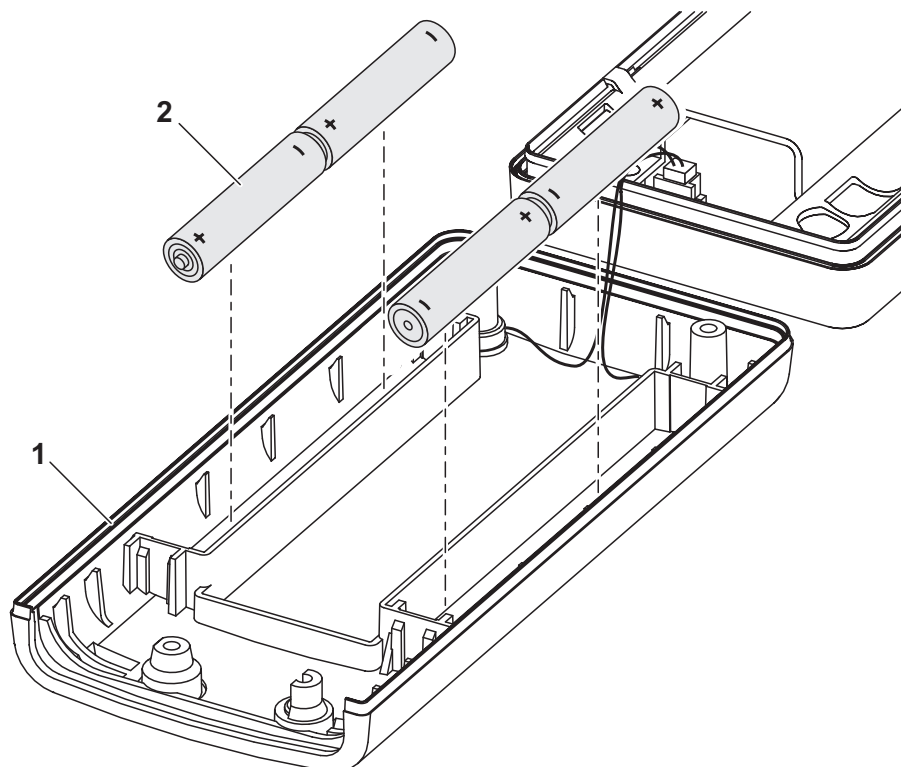
- 3 Confirm with **<RUN/ENTER>**. The functions are reset. The instrument switches to the measuring mode.
Retaining settings:
Use **<M>** to change to the measuring mode without a reset.

5 Maintenance, cleaning, disposal

5.1 Maintenance

The measuring instrument is almost maintenance-free. The only maintenance task is replacing the batteries. *LoBat* indicates that the batteries should be changed. The batteries are then largely depleted.

Replacing the batteries



1	Open the housing after the instrument has been switched off: – Undo the four screws on the underside of the instrument – Pull down the lower cover (1).
2	If necessary, take the four depleted batteries (2) out of the battery compartment.
3	Place four new batteries (type Mignon AA) in the battery compartment.
4	Close the lower cover (1).



Warning

Make sure that the poles of the batteries are the right way round. The \pm signs on the batteries must correspond to the \pm signs in the battery compartment.
Only use leakproof alkaline manganese batteries.



Note

For the maintenance of the sensors, follow the corresponding operating manual.

5.2 Cleaning

Occasionally wipe the outside of the measuring instrument with a damp, lint-free cloth. Disinfect the housing with isopropanol as required.



Warning

The housing is made of a synthetic material (ABS). Thus, avoid contact with acetone and similar detergents that contain solvents. Remove any splashes immediately.

5.3 Disposal

Packing

This measuring instrument is sent out in a protective transport packing. We recommend: Keep the packing material. The original packing protects the instrument against damage during transport.

Batteries

This note refers to the battery regulation that applies in the Federal Republic of Germany. We would ask end-consumers in other countries to follow their local statutory provisions.



Note

This instrument contains batteries. Batteries that have been removed must only be disposed of at the recycling facility set up for this purpose or via the retail outlet.

It is illegal to dispose of them in household refuse.

Measuring instrument

Dispose of the measuring instrument as electronic waste at an appropriate collection point. It is illegal to dispose of the instrument in household refuse.

6 What to do if...

Display LoBat	Cause	Remedy
	– Batteries almost empty	– Replace batteries (see section 5.1 MAINTENANCE)
Error message OFL	Cause	Remedy
	Display range exceeded	
	Oxygen sensor	
	– Not connected	– Connect the probe
	– Cable broken	– Replace probe
	– Electrolyte solution depleted	– Regenerate probe
– Short-circuit between gold and lead electrode	– Clean probe and replace it if necessary	
Error message E3	Cause	Remedy
	Invalid calibration	
	Oxygen sensor	
	– Electrolyte solution depleted	– Regenerate probe
	– Membrane contaminated	– Clean membrane
	– Electrode system poisoned	– Regenerate probe
	– Worn out	– Replace probe
– broken	– Replace probe	
AR flashes continuously	Cause	Remedy
	No stable measured value	
– Membrane contaminated	– Clean membrane	

Measured value too low	Cause	Remedy
	<ul style="list-style-type: none"> - Insufficient flow 	<ul style="list-style-type: none"> - Provide flow to the probe
Measured value too high	Cause	Remedy
	<ul style="list-style-type: none"> - High amount of dissolved substances 	<ul style="list-style-type: none"> - Correct solubility function using the salinity equivalent
	<ul style="list-style-type: none"> - Air bubbles bump on the membrane with high velocity 	<ul style="list-style-type: none"> - Avoid direct flow to the membrane
	<ul style="list-style-type: none"> - The carbon dioxide pressure is too high (> 1 bar) 	<ul style="list-style-type: none"> - Measuring not possible
Instrument does not react to keystroke	Cause	Remedy
	<ul style="list-style-type: none"> - Operating condition undefined or EMC load unallowed 	<ul style="list-style-type: none"> - Press the <CAL> and <ON/OFF> keys at the same time and release them again. The software version is displayed briefly.

7 Technical data

Ambient temperature	Storage	- 25 °C ... + 65 °C
	Operation	-10 °C ... + 55 °C
	Allowable relative humidity	Yearly mean: < 75 % 30 days/year: 95 % Other days: 85 %

	mg/l	%	mbar
Measuring ranges/resolutions with CelloX 325 oxygen sensor			
Measuring range I	0 ... 19.99	0 ... 199.9	0 ... 199.9
Resolution	0.01	0.1	0.1
Measuring range II	0 ... 90.0	0 ... 600	0 ... 1250
Resolution	0.1	1	1

	mg/l	%	mbar
Measuring ranges/resolutions with DurOx 325 oxygen sensor			
Measuring range I	0 ... 19.9	0 ... 199	0 ... 199
Resolution	0.1	1	1
Measuring range II	0 ... 90	0 ... 600	0 ... 1250
Resolution	1	1	1

Measuring range/resolution of temperature	T [°C]	- 5.0 ... + 105.0	0.1
	Accuracy (± 1 digit)		
	Concentration [mg/l]	± 0.5 % of the measured value at an ambient temperature of 5 °C ... 30 °C	
	Saturation [%]	± 0.5 % of the measured value when measuring in the range of ± 10 K around the calibration temperature	
	Partial pressure [mbar]	± 0.5 % of the measured value at an ambient temperature of 5 °C ... 30 °C	
	Temperature compensation	< 2 % at 0 ... 40 °C	
	T [°C]	± 0.1	

Correction functions	Salinity correction	Fixed salinity of 30.0 can be switched on
	Air pressure correction	Automatic through installation of pressure sensor in the range 500 ... 1100 mbar
Dimensions and weight	Length [mm]	172
	Width [mm]	80
	Height [mm]	37
	Weight [kg]	Approx. 0.3
Power supply	Batteries	4 x 1.5 V alkali-manganese batteries, Type AA
	Operational life	Approx. 3000 operating hours
Mechanical structure	Type of protection	IP 66
Guidelines and norms used	EMC	EG guideline 89/336/EWG EN 61326 -1:1997 EN 61000-3-2 A14:2000 EN 61000-3-3:1995; FCC Class A
	Instrument safety	EG guideline 73/23/EWG EN 61010-1 A2:1995
	Climatic class	VDI/VDE 3540
	Type of protection	EN 60529:1991

FCC Class A Equipment Statement

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Test certificates cETLus, CE

8 Lists

This chapter provides additional information and orientation aids.

Abbreviations

The list of abbreviations explains the indicators and the abbreviations that appear on the display and in the manual.

Specialist terms

The glossary briefly explains the meaning of the specialist terms. However, terms that should already be familiar to the target group are not described here.

Index

The index will help you to find the topics that you are looking for.

Abbreviations

AR	AutoRead (drift control)
ARng	Automatic range switching Measuring instrument measures with highest resolution
°C	Temperature unit, degrees Celsius
Cal	Calibration
E3	Error message see chapter 6 WHAT TO DO IF...
LoBat	Batteries almost empty (Low Battery)
OFL	Display range exceeded (Overflow)
OxiCal	Automatic calibration for D. O. measurements
SAL	Salinity
SELV	Safety Extra Low Voltage
TP	Temperature measurement active (Temperature Probe)

Glossary

Adjusting	To manipulate a measuring system so that the relevant value (e. g. the displayed value) differs as little as possible from the correct value or a value that is regarded as correct, or that the difference remains within the tolerance.
AutoRange	Name of the automatic selection of the measuring range.
AutoRead	WTW name for a function to check the stability of the measured value.
Calibration	Comparing the value from a measuring system (e. g. the displayed value) to the correct value or a value that is regarded as correct. Often, this expression is also used when the measuring system is adjusted at the same time (see adjusting).
D. O. partial pressure	Pressure caused by the oxygen in a gas mixture or liquid.
Measured parameter	The measured parameter is the physical dimension determined by measuring, e. g. pH, conductivity or D. O. concentration.
Measured value	The measured value is the special value of a measured parameter to be determined. It is given as a combination of the numerical value and unit (e. g. 3 m; 0.5 s; 5.2 A; 373.15 K).
Measuring system	The measuring system comprises all the devices used for measuring, e. g. measuring instrument and probe. In addition, there is the cable and possibly an amplifier, terminal strip and armature.
OxiCal®	WTW name for a procedure to calibrate D. O. measuring systems in water vapor saturated air.
Oxygen saturation	Short name for the relative D. O. saturation. Note: The D. O. saturation value of air-saturated water and the D. O. saturation value of oxygen-saturated water are different.
Reset	Restoring the original condition of all settings of a measuring system.
Resolution	Smallest difference between two measured values that can be displayed by a measuring instrument.
Salinity	The absolute salinity S_A of seawater corresponds to the relationship of the mass of dissolved salts to the mass of the solution (in g/Kg). In practice, this dimension cannot be measured directly. Therefore, the practical salinity is used for oceanographic monitoring. It is determined by measuring the electrical conductivity.
Salt content	General designation for the quantity of salt dissolved in water.
Sample	Designation of the sample ready to be measured. Normally, a test sample is made by processing the original sample. The test sample and original sample are identical if the test sample was not processed.
Slope	The slope of a linear calibration function.

Slope (relative)

Designation used by WTW in the D. O. measuring technique. It expresses the relationship of the slope value to the value of a theoretical reference probe of the same type of construction.

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