Lovibond® Water Testing

Tintometer® Group

SD 400 Oxi L

Sauerstoff • Oxygen • Oxygène

www.lovibond.com

novatech INTERNATIONAL
sales@novatech-usa.com
www.novatech-usa.com
Tel: (866) 433-6682 Fax: (866) 433-6684
Tel: (281) 359-8538 Fax: (281) 359-0084

(866) 433-6682 • (281) 359-8538 • sales@novatech-usa.com • www.novatech-usa.com

CE

EC Declaration of Conformity

Name of the manufacturer: Tintometer GmbH

Schleefstraße 8 - 12
44287 Dortmund
Germany

declares that this product

Product name: **SD 400 Oxi L**

conforms to the following standards which are specified in the Council Directive for the harmonization of legal regulations of the Member States over electromagnetic compatibility (2004/108/EC) and the Low Voltage Directive (2006/95/EC).
For the evaluation of the product in regard to electromagnetic compatibility, the following standards were consulted:

EN 61326-1: 2006 (Table 3, Class B)
EN 61326-1: 2006 (Annex 3, Class B)

This declaration is issued on behalf of the manufacturer by the responsible person,

Dortmund, 20 January 2015

Cay-Peter Voss, Managing Director

(GB) Table of contents

1. General information

Read this document carefully and familiarize yourself with the operation of the instrument before using it. Keep this document ready to hand and in the immediate vicinity of the instrument so that you or technical staff can refer to it at all times in case of doubt.

Assembly, set-up, operation, maintenance and shut-down may only be performed by technically qualified personnel. The technical personnel must carefully read and understand the operating manual prior to beginning all work.

The liability and warranty of the manufacturer for damages and consequential damages are voided in the event of improper use, non-observance of this operating manual, use by insufficiently qualified personnel as well as unauthorized changes to the instrument.

The manufacturer is not liable for costs or damages arising through the use of this instrument, especially in the case of improper use or misuse or faults to the connections or the instrument.

The manufacturer assumes no liability from printing errors.

2. Safety

2.1 Intended use

The SD 400 Oxi L is designed for the measurement of dissolved content of oxygen in water. Suitable oxygen sensors (available in the standard delivery contents) are used for the measurement. The sensor is connected via a 4-pin bayonet connection. The measurement is taken on the sensor membrane at the end of the oxygen sensor.
Due to the type of sensor used, the instrument must be calibrated regularly to achieve precise measurement values. The sensor must be regenerated or replaced if necessary before performing other measurements.
The safety instructions in this operating manual must be observed (see below).
The instrument may only be used under the conditions and for the purposes for which it was designed.
The instrument must be handled with care (do not throw, drop, etc.) and used in accordance with the technical data. It must be protected against soiling.

2.2 Safety instructions

This instrument is built and tested in accordance with the safety provisions for electronic measurement instruments. The fault-free function and operational safety of the equipment can only be guaranteed if common, general safety precautions as well as the instrument-specific safety instructions in this operating manual are observed.

1. Functional and operational safety of the device can only be adhered to under the climatic conditions specified in the chapter "Technical data".
If the instrument is transported from a cold environment to a warm environment, a fault of the functionality may arise due to the build-up of condensation. In this case, it is necessary to wait until the instrument's temperature adjusts to the room temperature before use.

2. If it is suspected that the instrument cannot be used without possibly imposing a danger, it should be turned off immediately and the potential danger be identified before the equipment is used again. The safety of the user may be diminished if the instrument
- exhibits visible damages.
- no longer works as specified.
- was stored for an extended period in unsuitable conditions.

In case of doubt, send the instrument to the manufacturer for repair or maintenance.

3. This instrument is not suitable for safety applications, Emergency Stop equipment or applications in which a malfunction could cause injuries and / or material damage. If this notice is not observed, severe health hazards and property damage may occur.

4. This instrument may not be used in a potentially explosive environment. Operation in a potentially explosive environment causes an increased risk of detonation, fire or explosion as a result of spark formation.

3. Product description

3.1 Delivery contents

- SD 400 Oxi L in carrying case
- 4 (AA) batteries
- Oxygen sensor with storage flask
- Micro SD card with calibration data and operating manual in various languages
- Quick instruction guide

4. Set-Up

4.1 Inserting the batteries

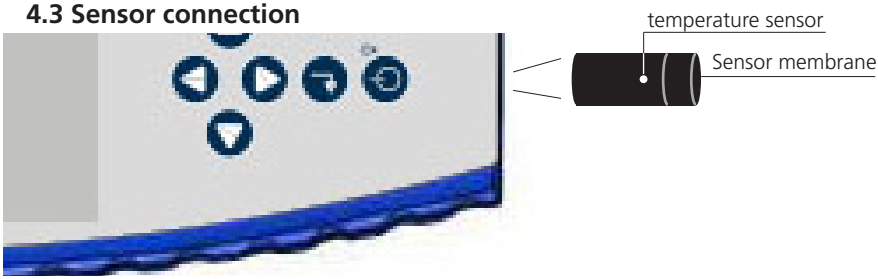
The battery compartment is located on the back of the SD 400 Oxi L device. To remove the batteries, the battery compartment lid is opened and removed. The 4 AA batteries are inserted according to the polarity. Then the battery compartment lid is replaced and closed securely.

ATTENTION: If the battery indicator in the display blinks, the batteries must be replaced. If the instrument is being used for an extended period of time for measurements or the reading of measurement values, we recommend operating the instrument via an external power source.

4.2 External power supply

A set comprising a Micro USB cable and wall mount is available (optional) for the external power supply. The Micro USB cable can be connected to a PC or to the wall mount adapter for electrical supply. If an external energy source is used, the battery symbol in the display is replaced with "USB".

4.3 Sensor connection



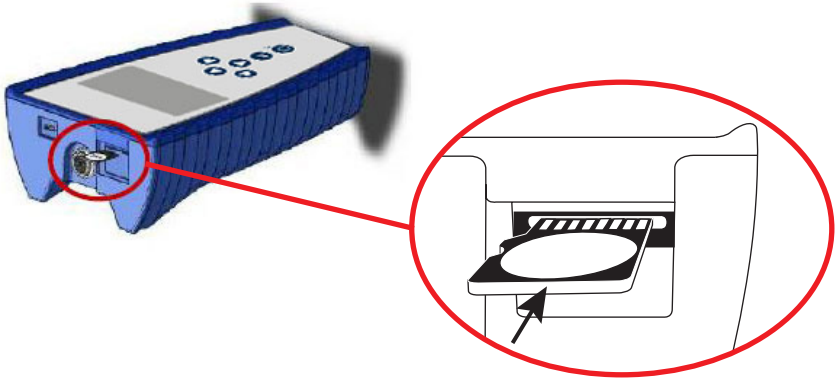
Connecting or removing the sensor on the instrument:
1. In order to connect the sensor to / from the equipment, the sensor connecting plug is connected to the jack on the equipment and tightened clockwise. Please ensure that the nose and the recess of the polarity reversal safeguard fit together correctly.
2. In order to remove the sensor from the device, the connecting plug is unscrewed anticlockwise and the plug is pulled out of the jack.

4.4 Sensor

The sensor of the SD 400 Oxi L is an optical oxygen sensor. The sensor is waterproof in accordance with IP67 and is equipped with an integrated temperature sensor. The durable cable is connected to the measuring device by means of a 4-pin plug.
During measurement, it must be ensured that the temperature sensor is also fully immersed in the sample.
During the measurement, it takes a while for equilibrium to be reached and the dissolved oxygen is to be diffused through the membrane with the luminophores.
The membrane is sensitive and damages due to scratching, abrasion or from organic solutions (e.g. acetone) falsify results.
The sensor must always be kept moist. For this purpose, the storage flask included in the scope of delivery contents should be fitted on to the sensor and screwed tight (see also 6.2 Safekeeping). It can also be used as a calibration flask.
A Micro SD card, also included in the scope of delivery contents, contains the sensor-specific calibration data.

The following parts are essential for oxygen measurement with the SD 400 Oxi L device:

1. Sensor membrane on the tip of the sensor: The optical fluorescence measurement for oxygen measurement takes place at the tip of the sensor membrane.
2. Micro SD card: The relevant data for the sensor is stored on the SD card. If the SD card is inserted in the measuring instrument, the serial number of the sensor membrane is displayed when switched on. With replacement of the sensor membrane, the SD card should also be replaced. It is included in the scope of delivery contents and can be found in the memory card insert of the instrument (see the top of the next page).



5. Operation

5.1 Display elements

When the instrument is switched on, it initialises. The serial number of the connected sensor appears in the display during this process. For this purpose, the sensor must be connected and the SD card must be inserted. Then the instrument is in measurement mode and the following display appears:

A.	Date
B.	Time
C.	Salinity correction On/Off
D.	Battery status
E.	Temperature display in °C or °F
F.	Oxygen saturation in %
G.	Display of the pressure value
H.	Display of the oxygen value in mg/l or ppm
I.	System settings for display A,B,C,E,H and J
J.	Performance of the single-point calibration or calibration settings
K.	Call-up of stored measurement data
L.	Saved measurement values
M.	Auto Power-Off: P0: permanently on; P1: 10 minutes after the last button is pressed
N.	An hourglass indicates that the calibration is in progress
O.	Oxygen measurement, dissolved

5.2 Controls

On/Off switch, Light On/Off
Confirmation of the entry, press and hold: End measurement/calibration process
In configuration mode or in calibration mode: Adjust display/values (INCREASE/DECREASE)
Cursor movement through the menu or through configuration mode (RIGHT/LEFT)

6 Sensor maintenance

6.1 Cleaning

Cleaning the sensor after each use extends the service life of the sensor membrane.
1. The sensor must be rinsed off with distilled water after each use. No aggressive solutions or alcohols may be used.
2. Carefully remove any type of dirt on the sensor membrane with a cloth, particularly if the measurements are conducted in solutions containing chemicals. Ensure that the sensor membrane is not damaged by scratches.

6.2 Safekeeping

The oxygen sensor must be stored in a moist environment in the supplied storage flask when it is not being used for measurements.

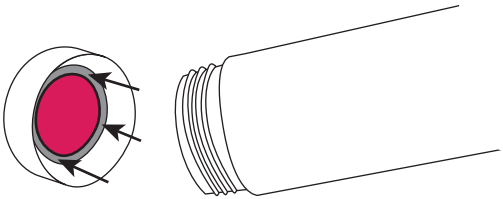
The sensor can be stored in clean water or water-saturated air for short storage periods of up to one week or between measurements.
For extended storage periods, the sensor should be stored in the storage flask, which contains a moist sponge. In order to prevent soiling the sponge, a hygienic working environment is recommended, as well as the use of distilled water. It should be checked regularly to ensure that the sponge does not dry out.
If the sensor is stored dry, measurement values may deviate with the next measurement. Before measurement the sensor must be rehydrated and recalibrated as necessary.

6.3 Replacement of the sensor membrane

The sensor membrane must be replaced if:
- The membrane is damaged (chemically, mechanically)
- No stable measurements are obtained
- The service life of the membrane has elapsed

Even if no chemical or mechanical damages have occurred, the sensor membrane should be replaced at least every 2 years in order to obtain precise measurement results (refer to "Accessories" for the item number).

Replacement process:
In order to replace the membrane cap, the old membrane cap is turned clockwise to loosen it from the sensor.
Please check whether the O-ring on the membrane is correctly positioned and has not deteriorated (see below). The thread may be rubbed with some lubricating grease. If the O-ring is damaged, it must also be replaced. It is included in the scope of delivery contents of the new sensor cap.
Remove the new sensor membrane from the packaging and inspect the inside and outside to determine whether it is absolutely dry and clean. Otherwise, use a lens cleaning cloth to clean or dry it (see "Accessories").



The new sensor membrane is placed on the sensor tip and screwed in place anticlockwise. Only hand-tighten the membrane; otherwise leaks or damage may occur. The sensor should then be stored as described in 6.2 "Safekeeping". The Micro SD card supplied with the new sensor membrane should be inserted in the memory card slot of the instrument. After the probe has been connected to the instrument, the instrument should be switched on. When switching on, the serial number of the new sensor membrane is shown in the display. The new sensor membrane should then be calibrated. (see "Calibration", section 8)

7. Basic device settings

The following settings can be made in the CONFIG configuration menu:
Year - Month - Day
Hour : Minute
S_{ON}, S_{OFF} (Salinity Correction)
mg/l, ppm
°C, °F
P0, P1
Language

The values/settings can be selected with the arrow keys (UP/DOWN). The cursor can be moved within CONFIG or in the menu with the arrow keys (RIGHT/LEFT).

The current settings are selected with the ENTER button and the instrument returns to measuring mode.

7.1 Language selection

The default language is English. Other languages can be selected in the CONFIG menu. The menu item CONFIG or SETUP is selected using the arrow keys (RIGHT/LEFT). The desired language can be selected with the arrow keys (UP/DOWN). Press ENTER to confirm. The following languages are available: English, German, French, Spanish, Italian, Portuguese, Dutch and Chinese (simplified).

7.2 Date and time

Date:
Select the CONFIG menu with the arrow keys (RIGHT/LEFT) and confirm with ENTER. The YEAR display blinks. The display is changed with the arrow keys (UP/DOWN). Then the MONTH and/or DAY can be selected with the arrow keys (RIGHT/LEFT). Change the respective display with the arrow keys (UP/DOWN). The current settings are selected by pressing the ENTER button and the instrument returns to measuring mode. Alternatively, you can proceed to the time selection with the RIGHT arrow key.

Time:
Select the CONFIG menu with the arrow keys (RIGHT/LEFT) and confirm with ENTER. The HOURS display is selected with the arrow keys (RIGHT/LEFT). The display is changed with the arrow keys (UP/DOWN). Then the MINUTES can be selected with the arrow keys (RIGHT/LEFT). Change the display with the arrow keys (UP/DOWN). The current settings are selected by pressing the ENTER button and the instrument returns to measuring mode. Alternatively, you can proceed to the salinity correction with the RIGHT arrow key.

7.3 Salinity correction

As the salt content in the probe increases, the solubility of oxygen in water decreases. Therefore, it is necessary to enter the values of the salt content before measuring the oxygen with such samples so that the salinity correction is automatically carried out during the oxygen measurement.
S_{OFF} means that the salinity correction is deactivated if, for instance, fresh water samples or water samples with a very low ion content are being measured.
The salinity correction can be activated (S_{ON}) in CONFIG. The known salt concentration of the sample to be measured is entered in ppt or in mS/cm. This value is then used for the salt compensation. The current settings are selected by pressing the ENTER button and the instrument returns to measuring mode. Alternatively, you can proceed to the concentration display with the RIGHT arrow key:

1. Select CONFIG with the arrow keys (RIGHT/LEFT) and confirm with ENTER.
2. The S_{OFF} is selected with the arrow keys (RIGHT/LEFT). The salt correction is activated with the arrow keys (UP/DOWN): S_{ON} and confirm with ENTER.
3. The desired unit (ppt or mS/cm) is selected and confirmed with ENTER.
4. The value can be increased/decreased with the arrow keys (UP/DOWN). The cursor can be moved to the next position with the arrow keys (RIGHT/LEFT). The value is confirmed with ENTER.
5. Now the salt content will be compensated for according to the displayed oxygen values.

7.4 Selecting units

Concentration display (mg/l or ppm)
Select the CONFIG menu with the arrow keys (RIGHT/LEFT) and confirm with ENTER. The display of the CONCENTRATION is selected with the arrow keys (RIGHT/LEFT). The arrow keys (UP/DOWN) are used to select mg/l or ppm. The current settings are selected by pressing the ENTER button and the instrument returns to measuring mode. Alternatively, you can proceed to the temperature with the RIGHT arrow key.

Temperature
Select the CONFIG menu with the arrow keys (RIGHT/LEFT) and confirm with ENTER. The display of the TEMPERATURE UNIT is selected with the arrow keys (RIGHT/LEFT). The arrow keys (UP/DOWN) are used to select °C or °F. The current settings are selected by pressing the ENTER button and the instrument returns to measuring mode. Alternatively, you can proceed to the Auto Power-Off function with the RIGHT arrow key.

7.5 Auto Power-Off

The display P0 means that the automatic shut-down function is deactivated and the instrument remains switched on continuously.
The display P1 means that the instrument switches off automatically after 10 minutes (after the last use of a button).
We recommend activating the shut-down function in order to extend the service life of the sensor and the batteries.
If the automatic shut-down function is activated (P1 display), a 30-second countdown is shown in the display before the instrument switches off. You can then select with the arrow keys (RIGHT/LEFT) whether the device should be switched off or not. The current settings are selected by pressing the ENTER button and the instrument returns to measuring mode. Alternatively, you can proceed to the date display with the RIGHT arrow key.

7.6 Backlight

The backlight of the display is switched on and off by pressing the ON/OFF button. The backlighting does not switch off automatically. In order to extend the battery life, we recommend not leaving the light switched on continuously.

8 Calibration

8.1 General information

If no saturated air is available for a single-point calibration, the storage flask can be used to obtain 100 % water-saturated air.

The dissolved oxygen concentration is dependent on the temperature (T), the pressure (BP) and the salt content (S).

T means automatic temperature compensation (ATC); NO means that no temperature compensation is performed.
BP means that the automatic pressure compensation is performed; NO means that no pressure compensation is performed.
S means salinity and is defined as NaCl, Mg-sulphate and Ca-sulphate, etc., dissolved in water. The salt concentration can be determined based on the conductivity. In order to be able to consider the salt compensation in the measurement of the oxygen, the salt concentration is entered in ppt (parts per thousand) or in mS/cm (see 7.3 "Salinity correction"). The oxygen concentration is specified in consideration of the manually entered salt concentration as saturation in %.

8.2 Single-point calibration

There are two possibilities for performing a single-point calibration:

1. Calibration in air-saturated water:
The water is continuously flushed with air by blowing the water with a fan until complete saturation for a period of approximately 10 minutes.
The sensor is held in the air-saturated water until both the temperature and the oxygen display (mg/l or Sat%) have reached a stable value.
If no air-saturated is available for a single-point calibration, the storage flask can be used to obtain 100 % water-saturated air (see point 2).

2. Calibration in water-saturated air:
The sensor is exposed to the air with a relative air humidity of 100 %. For this purpose, the storage sleeve with water-soaked sponge is screwed on the sensor and a waiting period of at least 15 minutes is observed until the measurement value has stabilised.

Performance of the single-point calibration:
1. CAL is selected with the arrow keys (RIGHT/LEFT) and confirmed with ENTER.
2. The single-point calibration selection appears in the display and is confirmed with ENTER.
3. The prompt to place the sensor in 100 % air-saturated water is displayed. Press ENTER to start the calibration.
4. The display shows that the calibration is in progress.
5. The display shows when the calibration has finished. In order to exit calibration mode, press ENTER.

Comments:
1. Please follow Steps 1 to 5 for the single-point calibration.
2. If an error message is shown in the display, the process is ended with ENTER.
3. The calibration in air-saturated water and water-saturated air are performed identically.
4. The calibration process can be interrupted by pressing and holding the ENTER button for 2 seconds.

Resetting to factory settings
In order to reset the instrument to the factory settings, CAL is selected. Calibration settings is selected with the arrow keys and confirmed with ENTER. Factory settings appears in the dialogue and is then confirmed with ENTER.

9. Measurement

9.1 Salinity/chloride compensation

S_{OFF}: Factory setting; is selected when testing fresh water samples that contain practically no ions.
S_{ON}: If the salinity correction is activated (see 7.3), the conductivity (in ppt or mS/cm) of the water sample to be measured is entered and automatically compensated for in the measurement.
Chloride compensation: If chloride is present in the sample, the chloride concentration can be entered as salt concentration:
Salt concentration (in ppt) = chloride concentration (in ppt) x 1.80655.

For example, a chloride content of 20 ppt equals a salt content of 36.13 ppt (20 x 1.80655).

9.2 Automatic temperature and pressure measurement

The instrument adapts the instrument's settings to the measured temperature and/or the measured environmental pressure in order to factor in dynamic fluctuations in the environment.

9.3 Oxygen measurement without salinity correction

If S_{OFF} is shown in the display, the salt correction is deactivated. The displayed oxygen value indicates the oxygen content of fresh water.

9.4 Oxygen measurement with salinity correction

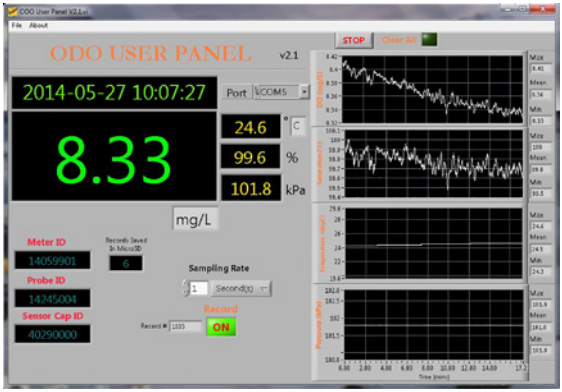
If the oxygen content in water containing salt is determined, the salt concentration of the sample is entered manually (in ppt or mS/cm) in order to correctly display the dissolved oxygen value of the sample. The unit "ppt" is defined as parts per thousand in water, while "mS/cm" reflects the conductivity of the water. If the salt content (in ppt or mS/cm) is known and entered manually, the salt correction is carried out automatically by the instrument.
The salt content is entered as described under section 7.3.

9.5 Saving and viewing measurement values

The measurement values shown in the display can be saved with the SAVE function in the menu as follows:
1. The menu item SAVE is selected with the arrow keys (RIGHT/LEFT) and confirmed with ENTER.
2. DATA SAVED is shown in the display.
3. Confirm with ENTER. The data shown in the display is saved with time and date.
Using appropriate software, the saved data can be transferred from the Micro SD card to a PC (see section 9.6). The stored data can also be shown on the display as follows:
1. MEM is selected with the arrow keys (RIGHT/LEFT) and confirmed with ENTER.
2. The menu display shows: DISPLAY SAVED DATA and DELETE ALL DATA and CANCEL. Selection can be made with the arrow keys (UP/DOWN) and confirmation with ENTER.

9.6 Software for data transmission

The software for the data transmission and data display on a PC is stored on the Micro SD in the instrument. To install the program, setup.exe is copied from the SD card to the PC running Windows® and executed. The data is automatically collected and displayed on the user panel as follows:
Attention: The min/max/mean values are only based on the last 10,000 data entries.



Installation of the user program takes place as follows:
1. Remove the SD card from the memory card slot in the measuring device.
2. The SD card is inserted in a card reader (not included in the scope of deliver contents) and connected to the PC.
3. The "setup" file is opened from the SD card by double-clicking and the installation is carried out.
4. Before the instrument is switched on, the SD card must be re-inserted in the memory card slot in the instrument.
Attention: Please ensure that the card is inserted correctly in the memory card slot.

10 Error messages

Display - Error message	Possible cause	Measure
Micro SD card read error	No SD card in the measuring device, SD card not readable or SD card not inserted correctly in the memory card slot.	Insert the SD card correctly or replace it with a new card in order to check whether the problem pertains to the SD card or the memory card slot.
Sensor communication error	No signals sent from the instrument	Check the cable and connection
Oxygen measurement outside of measuring range	The oxygen concentration is higher than the measuring range of the device	Use suitable measurement samples
Battery symbol blinking	Low battery capacity	Replace batteries or external power supply via USB connection
Single-point calibration error	The calibration time was too long or it was interrupted by pressing and holding the ENTER button	Press any key to continue if the calibration was interrupted by the user or check whether the sensor membrane has exceeded the recommended service life
No display appears when switching on	a) No batteries in the device or incorrectly inserted b) Voltage too low	a) Insert batteries and ensure correct polarity b) Replace batteries and check battery contacts
No response after pressing a button	a) Defective keypad b) Circuit board or software error	Contact retailer
Long response time	a) Sensor cap dirty or defective b) Temperature fluctuations	a) Clean or replace sensor membrane b) Keep temperature constant

Large measurement value fluctuations	a) Temperature fluctuations b) Sensor cap dirty or defective c) Sensor not sufficiently immersed in the sample d) Sensor damaged e) External electronic fault	a) Keep temperature constant b) Clean or replace sensor membrane c) Immerse sensor sufficiently deep in the sample (at least 3 cm) d) Replace sensor e) Switch off or remove external sources of interference

11. Instrument upgrade

In general, it is not necessary to perform an upgrade. If software updates are available, they can be downloaded from our homepage: www.lovibond.com.

12. Returns

All instruments which are sent back to the manufacturer must be free from measurement substance remains and other harmful substances. Measurement substance remains on the housing or on the sensor can endanger persons or the environment.

Use suitable transport packaging for the return of the instrument, especially if it is still a functioning instrument. Make sure that the instrument is protected with sufficient insulating material in the packaging.

13. Disposal

Dispose of depleted batteries at a collection centre designated for this purpose.
The instrument may not be disposed of with the household waste. If the instrument needs to be disposed of, send it directly to us (with sufficient postage paid). We shall dispose of the equipment properly and in an environmentally friendly manner.

14. Technical data

Sensor	Optical (measurement of the luminescence life)
Oxygen, dissolved - Measurement range - Precision - Resolution	 0 – 50 mg/l or 0 – 500 % air saturation 0 – 20 mg/l or 0 – 200 %: ± 1 % of meas. or ±0.1 mg/l (higher value applies) >200 % or >20 mg/l: ± 10 % of meas. 0.1 %, 0.01 mg/l
Temperature - Measurement range - Precision - Resolution	 -5 – 50 °C (storage and operating temperature) ± 0.2 % 0.1 °C
Sensor membrane	Plastic
Dimensions Device Sensor	 approx. 162 x 97 x 50 mm (L x W x H) approx. 287 length, ø 33 mm incl. storage flask

Power supply	4 x AA Alkaline or 5 VDC Micro USB
Cable length	1.5 m, 3 m, 10 m cable length
Connections	4-pin, M9
Device weight	330 g (including batteries)
Data storage	Micro SD card
Reaction time	40 sec. up to 90 % of the measurement value is reached (T-90)
Flow	Not necessary
Salt compensation	Automatic after manual entry
Certificates	CE
Languages	English, German, French, Spanish, Italian, Portuguese, Dutch and Chinese (simplified)
Warranty	Device: 4 years, Sensor: 2 years
Sensor	IP 67

15. Accessories / replacement device

Article no.	**Description**
74 00 60	Electrode with 1.5 m cable
74 00 70	Electrode with 3 m cable
74 00 80	Electrode with 10 m cable
74 00 90	Set with USB cable and wall mount
74 01 00	Set with replacement membrane and Micro SD card
74 01 10	Metal sleeve for protection of the electrode (also sinking weight)
74 01 20	Storage flask
19 76 35	Cleaning cloth

Tintometer GmbH
Lovibond® Water Testing
Schleefstraße 8-12
44287 Dortmund
Tel.: +49 (0)231/94510-0
Fax: +49 (0)231/94510-20
sales@tintometer.de
www.lovibond.com

Germany

The Tintometer Ltd
Lovibond® House
Sun Rise Way
Amesbury
Salisbury
SP4 7GR
Tel.: +44 (0)1980 664800
Fax: +44 (0)1980 625412
sales@tintometer.com
www.lovibond.com

UK

Tintometer AG
Hauptstraße 2
5212 Hausen AG
Tel.: +41 (0)56/4422829
Fax: +41 (0)56/4424121
info@tintometer.ch
www.tintometer.ch

Switzerland

Tintometer Inc.
6456 Parkland Drive
Sarasota, FL 34243
Tel: 941.756.6410
Fax: 941.727.9654
sales@tintometer.us
www.lovibond.com

USA

Tintometer China
Room 1001, China Life Tower
16 Chaoyangmenwai Avenue,
Beijing, 100020
Tel.: +86 10 85251111 App. 330
Fax: +86 10 85251001

China

Tintometer South East Asia
Unit B-3-12, BBT One Boulevard,
Lebuh Nilam 2, Bandar Bukit Tinggi,
Klang, 41200, Selangor D.E
Tel.: +60 (0)3 3325 2285/6
Fax: +60 (0)3 3325 2287
lovibond.asia@tintometer.com
www.lovibond.com

Malaysia

Tintometer Brasilien
Caixa Postal: 271
CEP: 13201-970
Jundiaí – SP -
Tel.: +55 (11) 3230-6410
sales@tintometer.com.br
www.lovibond.com.br

Brazil

Tintometer Indien Pvt. Ltd.
B-91, A.P.I.E. Sanath Nagar,
Hyderabad, 500018
Tel: +91 (0) 40 4647 9911
Toll Free: 1 800 102 3891
indiaoffice@tintometer.com
www.lovibondwater.in

India

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