

Instruction manual

VWR[®] DISSOLVED OXYGEN METER DO-230

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I. INTRODUCTION

1. PACKAGE CONTENT

The standard set includes:

1. **DO-230** dissolved oxygen meter.
2. Dissolved oxygen sensor with temperature sensor.
3. Accessories for the sensor: two membranes, electrolyte – 30 ml, sodium sulphite – 50 g.
4. Plastic case.
5. 5V/1000mA power adapter.

2. EXPLOITATION NOTICES

Dear User!

Wide range of additional functions requires careful reading of the manual, in other case some of the features may stay unused or using the meter may be troublesome.

Accuracy of oxygen measurements depends on the sensor's calibration and regular conservation which consists in replacing the membranes, electrolyte and cleaning the electrodes. **Neglecting these activities after some time would make measurements impossible. Please turn your attention to the fact that stable measurement is possible only with natural or simulated water flow.**

We wish a pleasant and trouble-free work with our meter.

3. CHARACTERISTICS OF THE METER

Two kinds of power source: the rechargeable battery and the power adapter, enable work in field and long-lasting measurements in laboratory. The meter's memory is independent from power supply. Waterproof housing enables working in difficult conditions. Minimised size and weight facilitate field work.

The most important features of **DO-230** are:

- measuring of oxygen dissolved in water in % or mg/l, oxygen content in air in % and temperature of solutions or air in °C, °F or K;
- automatic and manual temperature compensation;
- compensation of the salinity and the atmospheric pressure influence on the oxygen concentration measurement;
- storing of the calibration date and parameters of oxygen sensor;
- possibility of introducing the date of calibration validity termination and signalling its expiry;
- cooperation with Pt-1000 resistor temperature sensor;
- signalling of the reading stabilisation;
- storing measurement results with time and date;
- real time clock with date;
- automatic switch off after time set by the user.

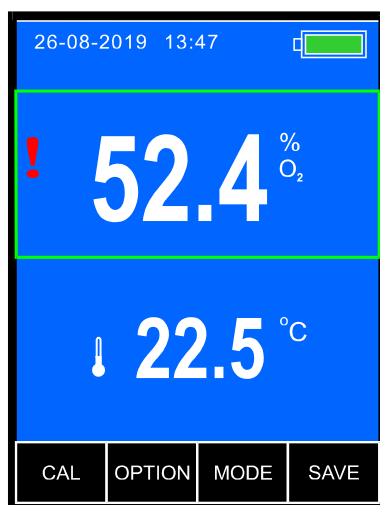
4. THE OUTSIDE VIEW

On the front wall of the meter there is a graphic LCD placed (Pic. 1), which displays the following measurement functions:

- oxygen concentration measurement in % or mg/l;
- temperature measurement.

At the top of the LCD the current time and date are displayed.

Choosing particular functions is described in the chapter 6.1. Symbols of the units are displayed next to the reading.



Pic. 1.

The automatic temperature compensation is signalled by the  symbol, the manual compensation – by the  symbol (next to the temperature reading).

The exclamation symbol (Pic. 1.) is displayed on the left in the following situations marked with the colours:

- yellow** - the calibration validity date expired;
- red** - characteristic erase, the sensor calibration necessary.

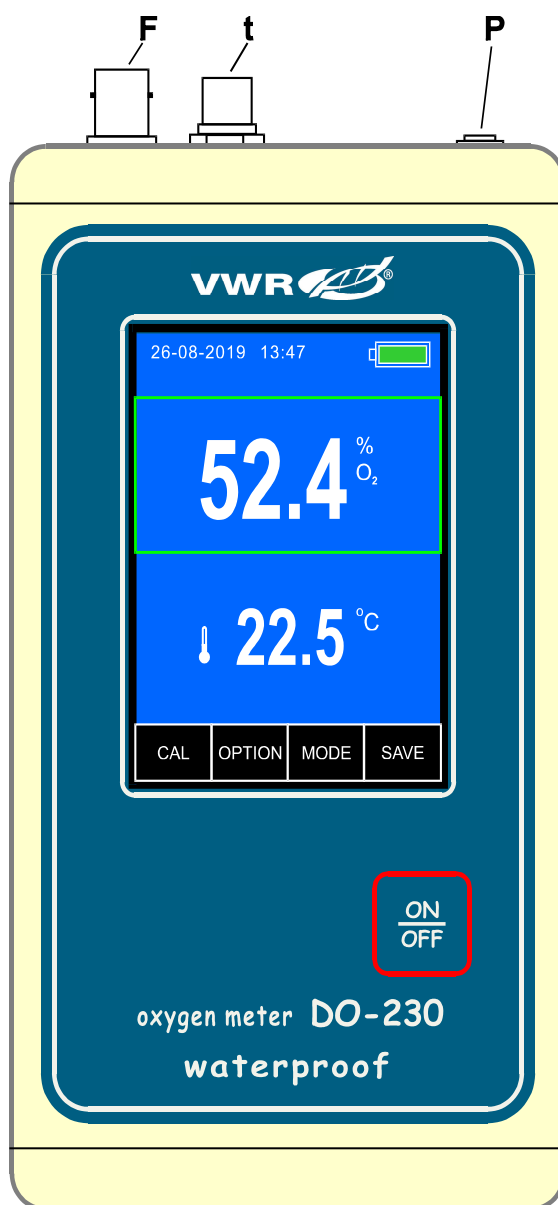
The rechargeable battery condition is signalled by the  symbol.

The  button (Pic. 2) placed below the display is used for switching the meter on and off.

In case of recording readings, the  button is locked until the recording process is stopped or finished.

In the upper wall of the meter connectors are placed with the symbols given below:

- F** - **BNC-50** input for connecting the dissolved oxygen sensor;
- t** - **Chinch** input to connect the temperature probe;
- P** - input for connecting the power adapter;



Pic. 2.

5. THE METER'S MAINTENANCE

The meter is equipped with a graphic touch screen. The maintenance consists in pressing particular keys and windows which appear on the screen. Grey captions in the windows and keys inform that these elements are not active in this particular operating mode. Particular keys, connected with the measurement function (i.e. **CAL** or **MODE**) become active after selecting the chosen function. To select, press the screen in a freely chosen spot of the chosen function. Around this spot a frame will display. To deselect, press the spot again. If the chosen function has a possibility of calibration, the **CAL** key becomes active. If it has additional parameters, the **MODE** key also becomes active. The **CAL** key is the only key in the meter that responds exclusively to a long press (about 2 sec.). It prevents from accidental erase of the electrode (sensor, cell) calibration data.

Entering incorrect value, attempt of calibration when the meter doesn't recognise the standard or attempt to turn the meter off when the result memorising proceeds are signalised by a triple warning sound, irrespective of the chosen sound settings.

6. SWITCHING THE METER ON AND OFF

After switching the meter on with the  button, the memory test proceeds. If the test ends successfully, the meter enters the measurement screen with settings entered before switching it off previously. In case of detecting the manufacturer's calibration data loss, the following information will appear:



Pressing the  button accepts standard manufacturer's calibration parameters and enters the measurement screen. Such situation will be repeating each time the meter is switched on and requires sending the meter to the manufacturer for servicing. In case of the user's data loss (i.e. the oxygen sensor characteristic), the following information will appear:



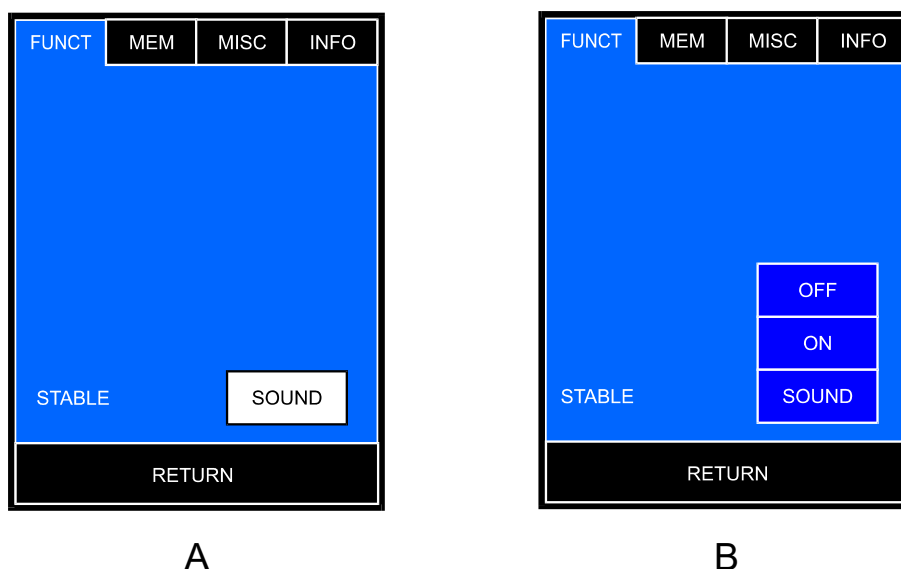
Pressing the  button accepts and records in the memory standard pH electrode characteristic and enters the measurement screen. In such case, calibration of the pH electrode is necessary. Analogical situation occurs in case of other measuring functions. Repeating of the situation after switching the meter on again informs about the EEPROM memory malfunction and requires sending the meter to the manufacturer for servicing.

Switch the meter off by pressing the  button. If the meter is powered only by the internal rechargeable battery, it turns off after the time of non-use set by the user (description in the chapter 15.3). This function is deactivated during calibration, while memorising results and connecting with a computer or power adapter.

6.1. Stabilised reading

The stabilised reading signalisation is active only for the reading marked with a frame. If the measured value meets the criterium of the stabilised reading, it is signalised by green colour of the frame and additionally with a sound if it has been activated. In this mode the meter does not record changes of the measured value in a certain range and does not display them. The meter escapes the stabilised reading mode after exceeding this range, the frame changes its colour to white and the meter displays the current measurement value.

To choose the stabilised reading signalisation, on the measurement screen press the **OPTION** button, the options screen will display with the **FUNCTIONS** tab open containing the previously set configuration (Pic. 3A).



Pic. 3

The window for choosing the stabilised reading signalisation mode is placed below (Pic. 3B):

- | | |
|--|---|
| <div style="background-color: #0056b3; color: white; padding: 2px 5px; display: inline-block;">OFF</div> <div style="background-color: #0056b3; color: white; padding: 2px 5px; display: inline-block;">ON</div> | <ul style="list-style-type: none">- the stabilised reading signalisation is off;- the stabilised reading signalised with changing the frame colour from white to green (only for reading marked with a frame); |
| <div style="background-color: #0056b3; color: white; padding: 2px 5px; display: inline-block;">SOUND</div> | <ul style="list-style-type: none">- the stabilised reading signalised by colour change and sound. |

Return to the measurement screen by pressing the **RETURN** button.

7. PREPARATION TO WORK

Before starting measurements:

- connect the oxygen sensor to the **F** (BNC-50) connector;
- if work with temperature probe is planned, connect it to the **t** (Chinch/RCA) temperature connector;
- if work with power adapter is planned, connect it to the **P** input;
- switch the meter on by pressing the  button.

7.1. Choosing the kind of the temperature compensation

The meter switches to the automatic or manual temperature compensation mode itself. Connecting the temperature probe switches the automatic temperature compensation on. Next to the reading the  symbol is displayed. After disconnecting the probe the meter enters the manual temperature compensation mode. Instead of the  symbol the  is displayed. In case of the manual temperature compensation the temperature value is set on the temperature measurement parameters screen.

II. OXYGEN CONCENTRATION MEASUREMENT

8. BASIC INFORMATION ABOUT THE OXYGEN MEASUREMENT

Measurement of dissolved oxygen in water solutions is performed with use of the oxygen sensor. The basic element of the sensor is a teflon semi-permeable membrane, which enables penetration of oxygen contained in the measured solution, into the electrolyte – inside of the sensor. The sensor generates a cell; the cell's voltage depends on the oxygen content in the electrolyte.

The meter enables measurement of oxygen concentration in water solutions in % and in **mg/l** and measurement of oxygen saturation in air in %. Calculation of the mg/l value is based on the saturation measurement in % and the temperature measurement. During mg/l measurements, the salinity and atmospheric pressure parameters should be additionally entered. The measurement of saturation in % does not depend on these factors.

The quality of the oxygen sensor has a major effect on the measurement accuracy. Complications arising during measurements are caused mainly (98%) by the sensor, not the device. In many cases, the problems are the result of neglecting basic sensor maintenance activities by the user. It is worth remembering that during measurement the sensor absorbs oxygen from the environment of the membrane.

The sensor's manufacturers recommend the minimal flow-rate of the tested water, assuring a stable result. When this requirement is not complied, the result will regularly decrease. During measurements in stagnant solutions the flow can be partly simulated by keeping the sensor in slow rotary motion. In laboratory conditions, i.e. performing measurements in a vessel, the flow can be forced with a magnetic stirrer. However, when measuring low O₂ saturation, intensive stirring can cause increase of oxygen content in the tested solution. Transferring water samples to the laboratory can alter their O₂ concentration. **The best results can be achieved only in conditions recommended by the manufacturer of the sensor in the operation manual.**

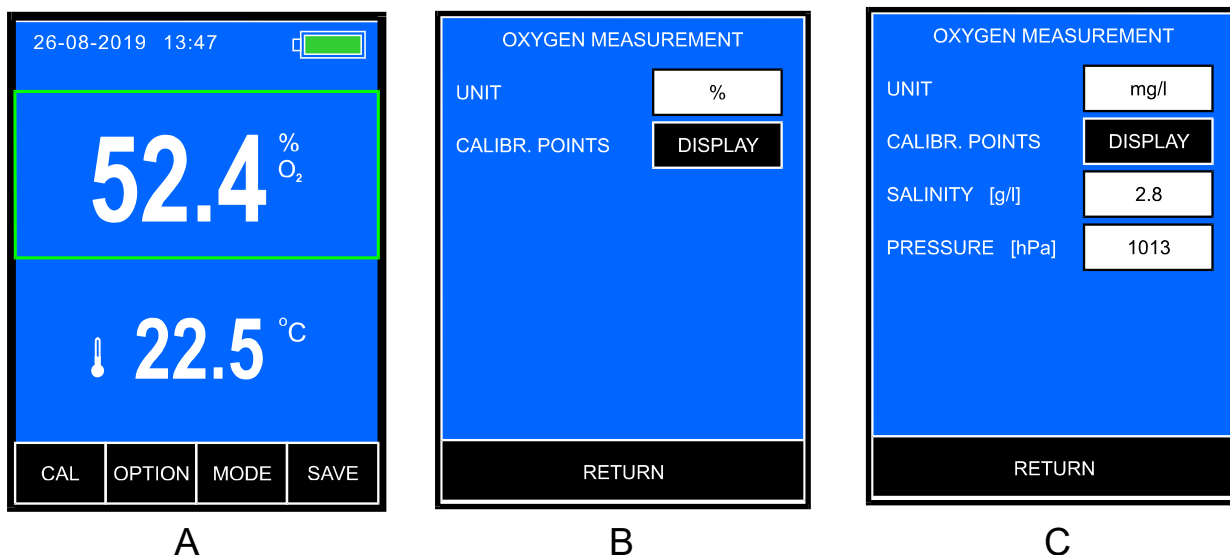
Long-lasting storage of the sensor without performing any measurements (more than 2 months) requires removing the electrolyte. After this period the container must be filled with a fresh electrolyte and the sensor stored in distilled water for about 24 hours.

Accurate measurement result is determined by the condition of the membrane. The membrane must be free of any cracks (appearing of electrolyte-drops or white spots when dry). Before measurement the sensor should be activated by storing in distilled water for about 15 minutes. Strongly polluted wastewater after some time causes clogging of the membrane, which is recognised by inability to calibrate the device at 100% oxygen content (the calibration range becomes too narrow). In both cases the membrane should be replaced according to the manufacturer's instructions. When replacing the membrane and replenishing the electrolyte it is important to pay attention if there are no air bubbles in the container beneath the membrane, because otherwise the measurements would be falsified. In such case the container should be twisted off and the bubbles removed by tapping it against the table, next the electrolyte should be refilled and the sensor assembled.

Depending on thickness of the membrane, awaiting time for a stable result is about 1 - 1,5 min. Accuracy of the measurement is connected with the temperature of calibration and measurement. The greater the difference of these temperatures, the greater the measurement error. For measurements of concentration in the range $30 \div 80\%$, it is sufficient to make one-point calibration in 100% oxygen concentration. For measurements in solutions with low oxygen content (about a few %) the calibration should be also made in 0% solution. Clean water contains about $60 \div 80\%$ oxygen. Waste water and chemical solutions are in general less saturated with oxygen but liquids with forced aeration are much more saturated than clean water. When performing accurate measurements, the sensor's manufacturers recommend carrying out calibration just before the measurement since after some time the sensor's parameters are changing. Even the best oxygen sensors have so-called drift about $\pm 1\%/24$ h. Wide measuring range in the **DO-320** meter enables making measurements in water permeated with oxygen, i.e. with blooming and growing plants, where during the photosynthesis process large quantities of oxygen are produced.

9. ENTERING THE OXYGEN MEASUREMENT PARAMETERS

The oxygen meter parameters screen is entered by pressing the oxygen reading (the frame will display around it – Pic. 4A), and next the **MODE** button. On this screen (Pic. 4B) choose the unit and the salinity and the atmospheric pressure value. After entering parameters, return to the measurement screen pressing the **RETURN** button.



Pic. 4

9.1. Unit

The reading can be displayed in % of the oxygen saturation or in **mg/l**. By pressing the **UNIT** window, choose:

- measurement of the oxygen concentration in water in %
- measurement of the oxygen concentration in water in mg/l
- measurement of percentage of the oxygen content in air.

9.2. Calibration points and date

After pressing the **DISPLAY** button the screen with calibration points, validity time and last calibration date. Marker next to the point value informs, that the last calibration was performed in this particular point. The calibration points values are fixed and cannot be changed.

9.3. Calibration validity time

The meter stores the calibration validity time of the oxygen sensor. Termination of this time is signalled with yellow sensor number. To set the calibration validity time, press the **VALIDITY** window, the numerical keyboard will appear to enter the number of days and confirm with the **OK** button.

9.4. The salinity influence compensation

Oxygen solubility in water is decreased by its salinity which has to be taken into consideration during measurements in mg/l. **1 g/l of salinity change causes about 0.5% of the oxygen saturation change.** The meter enables entering the salinity value in g/l and counts the change of oxygen saturation in mg/l.

9.4.1. Manual introduction of the salinity value

The salinity value may be determined on the basis of the conductivity value of the measured solution. Table 1 shows the real dependence between conductivity and salinity in conversion to NaCl.

After choosing the manual mode the **SALINITY** window will appear (Pic. 4C) for entering the salinity value. To enter, press the **SALINITY** window, the numerical keyboard will appear for entering the salinity value and confirm with the **OK** button.

Measurement in % does not require entering the salinity value.

mS/cm	g/l	mS/cm	g/l	mS/cm	g/l
1	0.49	28	16.87	55	34.34
2	1.00	29	17.52	56	34.99
3	1.52	30	18.17	57	35.64
4	2.08	31	18.82	58	36.28
5	2.63	32	19.46	59	36.93
6	3.19	33	20.11	60	37.58
7	3.74	34	20.76	61	38.23
8	4.29	35	21.41	62	38.87
9	4.85	36	22.05	63	39.52
10	5.40	37	22.70	64	40.17
11	6.00	38	23.35	65	40.81
12	6.61	39	23.99	66	41.46
13	7.21	40	24.64	67	42.11
14	7.83	41	25.29	68	42.75
15	8.45	42	25.93	69	43.40
16	9.07	43	26.58	70	44.05
17	9.70	44	27.23	71	44.70
18	10.35	45	27.87	72	45.34
19	11.01	46	28.52	73	45.99
20	11.66	47	29.17	74	46.64
21	12.31	48	29.82	75	47.28
22	12.96	49	30.46	76	47.93
23	13.61	50	31.11	77	48.58
24	14.26	51	31.76	78	49.22
25	14.91	52	32.40	79	49.87
26	15.56	53	33.05	80	50.63
27	16.22	54	33.70		

Table 1. Determining the salinity in g/l NaCl on the basis of conductivity in mS/cm (at the temperature 25°C).

9.5. Atmospheric pressure influence compensation

The concentration of oxygen saturated in water determined in mg/l depends directly on the atmospheric pressure value, which means that 10% pressure change causes also 10% oxygen saturation change. If the atmospheric pressure value differs significantly from 1013 hPa, it should be calculated into the measurement. The meter enables introducing of the atmospheric pressure value and calculates it into changes in the oxygen concentration.

9.5.1.Entering the atmospheric pressure value

To enter the atmospheric pressure value, press the **PRESSURE** window (Pic. 4C), the pressure values will appear to choose and confirm with the  button.

Measurement in % does not require entering the atmospheric pressure value.

10. CALIBRATION OF THE OXYGEN SENSOR

The meter cooperates with a galvanic membrane sensor of our production with measurement accuracy equal $\pm 1\%$, provided that the measurement is performed at the same temperature as calibration. The bigger the difference in the measurement and calibration temperature, the lower the accuracy. It is $<3\%$ when the temperature difference is $\pm 5\text{ }^{\circ}\text{C}$ and 5% for the difference $\pm 10\text{ }^{\circ}\text{C}$. The calibration is performed to eliminate the measurement error arising from the individual characteristic of the sensor and should be repeated always before measurement with new sensor, after replacing the membrane or in case of high measurement accuracy requirements. Characteristic feature of sensors is a „signal drift“, which means that the longer interval between calibration and measurement, the lower measurement accuracy. Calibration is also recommended if temperature of the tested solution differs significantly from temperature in which the probe was calibrated, because then an additional error arises. **In such case it is recommended to prepare calibration solutions having approximate temperature to the predicted temperature of the tested solutions.**

If it is impossible to calibrate the device, the membrane of the sensor should be replaced according to the manufacturer's instruction. This situation usually takes place if the membrane is strongly polluted or ruptured (sometimes almost invisibly). After replacing the membrane the sensor should be conditioned in water for 24 hours. Applied oxygen sensors require 1- or 2-point calibration in standard solutions. The meter has two values of the calibration points recorded: $P1=0\%$ and $P2=100\%$. 2 point calibration is carried out in **0% of oxygen concentration solution** (i.e. **saturated** sodium sulphide) and calibration in 100% of oxygen saturation is made in the air. **In such case the membrane has to be immersed in distilled water for a few minutes before calibration.** It is assumed that O_2 content in the air corresponds to 100% of saturation, what enables simplified calibration to be carried out.

1 point calibration is made only for 100% of oxygen saturation.

In case of measurement of oxygen content in air let the fresh air in into the room. Usually, 1-point calibration in air is sufficient, as the zero point of the meter is at its resolution level.

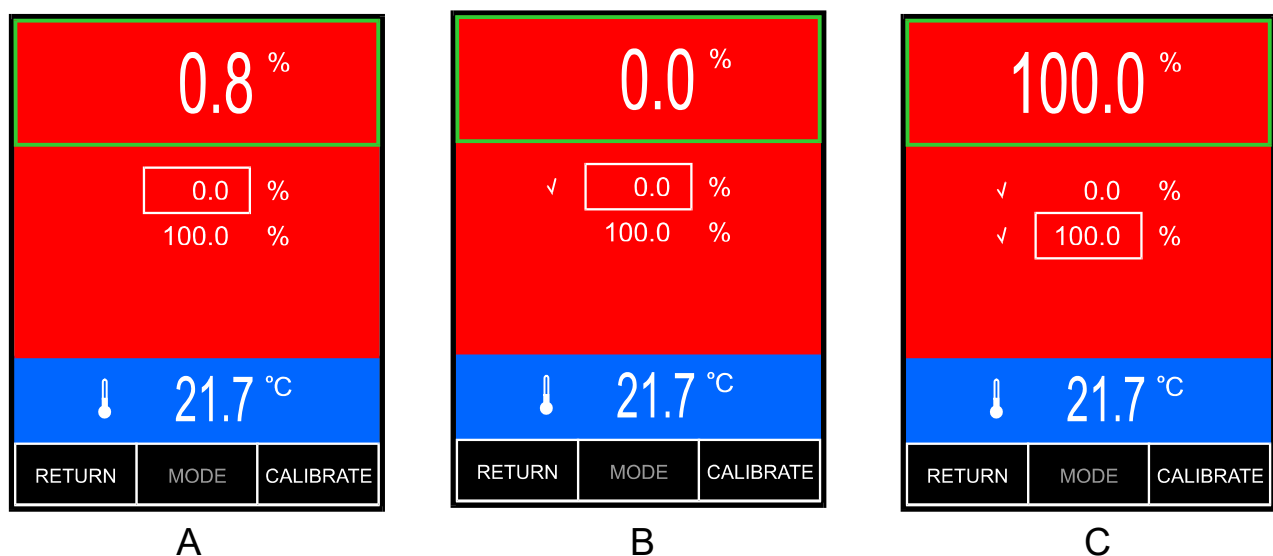
Entering the calibration mode under the chosen sensor number erases the characteristic stored in the memory under this number.

In case of choosing the sensor's number, entering the calibration mode and escaping it without making calibration, the characteristic stored previously will be erased and a standard characteristic will be applied. The characteristic erase is signalled with red colour of the sensor number on the screen.

To calibrate, follow the instructions:

- enter the calibration mode: select the dissolved oxygen measurement on the measurement screen, press and hold the **CAL** button until the background changes its colour to red, the meter enters the calibration mode and automatically changes the unit to % O₂ (if the previous setting was to mg/l O₂). The previous sensor characteristic is erased;
- put the oxygen sensor into the 0% oxygen saturated solution (saturated sodium sulphide). The meter will mark the recognised calibration point value with a frame (Pic. 5.A);
- when the reading stabilises, press the **CALIBRATE** button. Next to the 0% calibration point a marker appears, what informs about recording the calibration value, at the same time the measurement value will be corrected to 0% (Pic. 5.B).;
- take the sensor out, **rinse it accurately with distilled water** and put into the 100% oxygen saturation solution providing the flow or leave it in the air;
- when the reading stabilises, press the **CALIBRATE** button. Next to the 100% calibration point (20.9% for measurement in the air) a marker appears, what informs about recording the calibration value, at the same time the measurement value will be corrected to 100% (20.9% for measurement in the air), Pic. 5.C. If the reading is still different, wait until it stabilises and press the **CALIBRATE** button again.
- return the measurement mode by pressing the **RETURN** button.

If the meter cannot recognise the 0% or 100% value (the frame does not appear), it will signalise the error after pressing the **CALIBRATE** button with a tripple warning sound. In such case check the membrane condition and the applied standards.



Pic. 5.

11. MEASUREMENT OF OXYGEN CONCENTRATION IN WATER

Before starting the oxygen concentration measurement the meter should be prepared for work (chapter 7) and the oxygen sensor calibrated (chapter 10). The measurement in % of saturation does not require additional measurements of the temperature, salinity or atmospheric pressure. **However, frequent measurements in mg/l depend on these factors.** This influence is corrected automatically by the device, which takes into consideration the temperature value measured by the sensor or - in case of manual compensation - the value entered by the user. The oxygen sensor is equipped with an additional system compensating the temperature influence on the membrane. Because of limited accuracy of this compensation the highest accuracy can be achieved by calibrating the sensor at the same temperature at which the measurement will be carried out. **The measurement error increases together with the difference between the calibration and measurement temperatures and results from characteristic features of the sensor, not the device.** For the applied sensor this error is about $< 3\%$ at a $\pm 5^{\circ}\text{C}$ temperature difference and increases to 5% at a $\pm 10^{\circ}\text{C}$ temperature difference.

If higher accuracy is required, the interval from the last calibration must be additionally taken into consideration (signal drift). If salinity of the tested solution is low, the compensation may be turned off before the measurement (point 9.4). **Before making accurate measurements, the salt content in the tested solution should be determined.** The easiest way to determine salinity is conductivity measurement with conversion to NaCl and choose automatic or manual salinity compensation according to the section 9.4.

11.1. Measurement with automatic temperature compensation

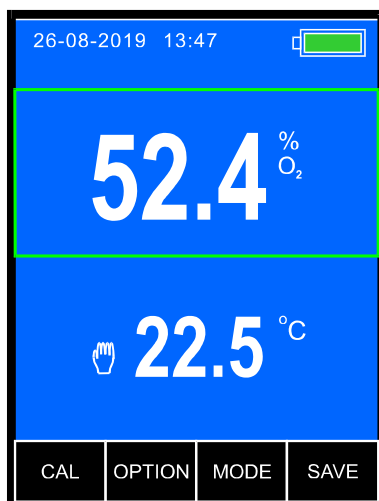
Follow the instructions:

- connect the oxygen sensor and temperature probe to the meter;
- put the probe and the sensor to the measured solution;
- turn the meter on with the  button;
- choose the unit according to the section 9.1;
- for accurate measurement of oxygen concentration in **mg/l** enter the salinity value (section 9.4);
- check or simulate the solution flow;
- wait about $1 \div 1.5$ min until the reading stabilises (depending on sensor) and read the value.

11.2. Measurement with manual temperature compensation

Follow the instructions:

- disconnect the temperature probe;
- turn the meter on with the  button;
- choose the unit according to the section 9.1;
- for accurate measurement of oxygen concentration in **mg/l** enter the salinity value (section 9.4);
- put the DO sensor to the measured solution;
- measure the solution temperature with a thermometer and enter the value according to the point 13.2;
- check or simulate the solution flow;
- check the reading when it stabilises (Pic. 6).



Pic. 6

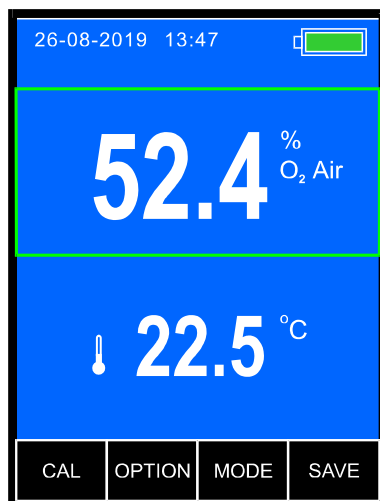
Note: in case of solutions with low salinity check according to the section 9.4 if the entered salinity value is equal 0.

12. MEASUREMENT OF OXYGEN CONTENT IN AIR

Before starting the oxygen content measurement, the meter should be prepared for work (chapter 7) and the oxygen sensor calibrated (chapter 10). The oxygen content measurement does not require additional measurements of temperature, salinity and atmospheric pressure.

In order to make measurement:

- connect the oxygen sensor to the **O2** connector (pic. 2);
- leave the oxygen sensor in the air;
- switch the meter on with the  button;
- choose the unit according to the chapter 9.1;
- wait until the reading stabilises and check it (Pic. 7).



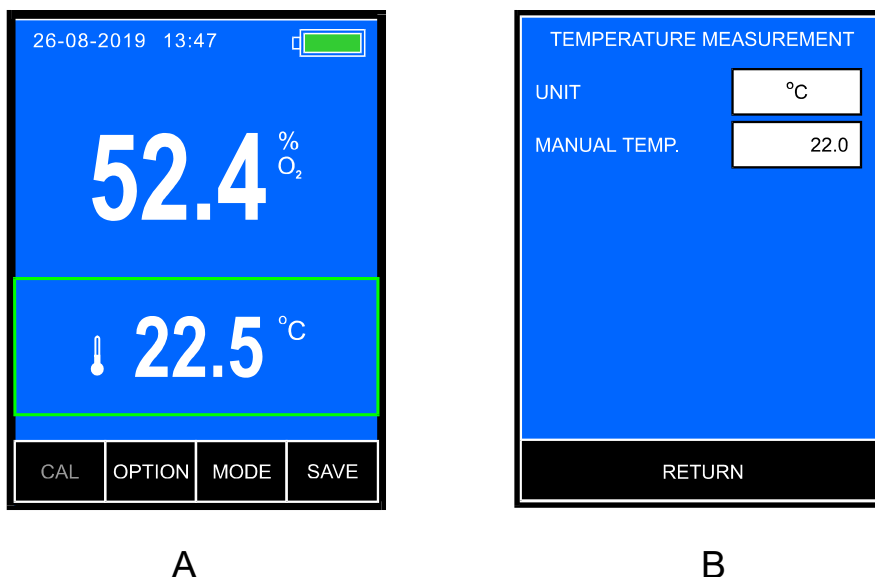
Pic. 7

Note: during measurement of the oxygen content in air next to the reading (on the left) the **%O₂ Air** symbol is displayed to differentiate it from the reading of percentage of the dissolved oxygen concentration in water.

III. TEMPERATURE MEASUREMENT

13. SETTING THE TEMPERATURE MEASUREMENT PARAMETERS

The temperature measurement parameters window is entered by selecting the temperature reading (Pic. 8A) and next the **MODE** button (Pic. 8B). The screen enables choosing unit and entering the manual temperature compensation value.



Pic. 8

After setting the parameters return to the measurement screen by pressing the **RETURN** button.

13.1. Unit

The reading may be displayed in °C, K or °F.

By pressing the **UNIT** window choose the measurement unit.

13.2. Temperature of the manual compensation

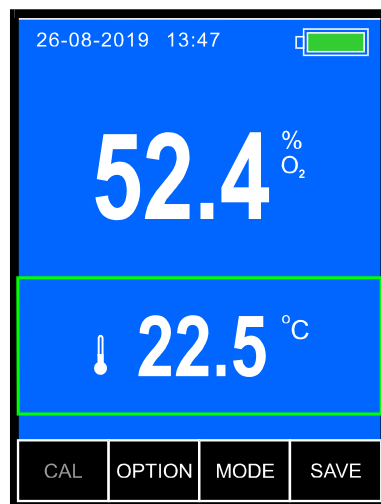
After disconnecting the temperature probe the meter switches to manual compensation automatically and calculates in the entered temperature value. To enter this value, press the **MANUAL TEMP.** window, the numerical keyboard will appear to enter the value and confirm with the **OK** button.

14. TEMPERATURE MEASUREMENT

Follow the instructions:

- turn the meter on by pressing the  button
- connect the temperature probe to the Chinch connector, the  symbol will appear on the screen;
- immerse the temperature probe into the solution;
- wait till the value stabilises and read the result.

The meter cooperates with Pt-1000 platinum resistor sensor and the final accuracy of the temperature measurement is dependent on the sensor's class.



Pic. 9

NOTE: break in the temperature probe's circuit switches the meter to the manual temperature compensation mode. It is signalled by change of the  symbol to the  symbol. Instead of the measured temperature value, the value inserted by the user is displayed.

Displaying of -50°C value in red while making measurement at positive temperature informs about short circuit in the temperature probe.

IV. OPTIONS

15. OPTIONS SCREEN

Enter the **OPTIONS** screen by pressing the **OPTION** button in the measurement screen. The **OPTIONS** screen contains the following tabs:

- FUNCT.** - choose the stabilised reading signalisation mode;
- MEM.** - viewing the memorised measurement results;
- MISC.** - choose the language, set the economical mode, time and date;
- INFO** - the software version, the serial number and the factory calibration date.

15.1. Functions

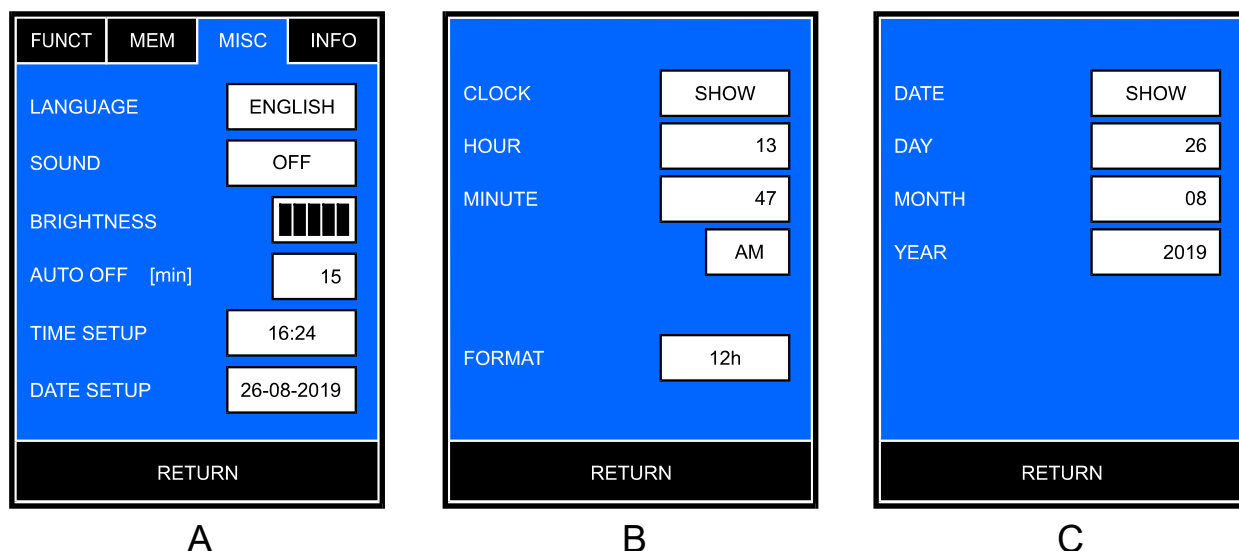
For the description of the **FUNCT.** tab, see the chapter 6.1.

15.2. Memory

For the description of the **MEM.** tab, see the chapter 16.

15.3. Miscellaneous

This screen (Pic. 10A) the following parameters may be entered:



Pic. 10

LANGUAGE	- choosing the language: English, German, French, Italian, Spanish, Portuguese;
SOUND	- turning the buttons sound on / off;
BRIGHTNESS	- setting the display's brightness;
AUTO OFF	- the time of non-use until the meter turns off;
TIME SETUP	- after pressing the TIME SETUP window the screen will appear (Pic. 10B) to turn the time displaying on / off, choose the 12 / 24 clock mode and set the current time;
DATE SETUP	- after pressing the DATE SETUP a screen will appear (Pic. 10C), where the date display may be turned on/off and the current date may be set;

To choose the language, set sound or brightness, press the chosen window, a table will appear to choose the value.

To enter a numerical value, press the chosen window, a numerical keyboard will appear to enter the value and confirm with the **OK** button.

15.3.1. Automatic switch-off

Automatic switch-off mode prolongs an operating time with rechargeable batteries and prevents from discharging in case when the meter has been unintentionally left in operation.

The automatic switch-off mode is active only while working with the rechargeable batteries.

The function is deactivated for calibration, memorising results and work with the power adapter.

Entering zero for the **AUTO OFF** parameter deactivates this mode entirely.

15.3.2. *Setting the brightness and lighting time*

The brightness settings are very important while working in the field. Choose one of five brightness modes. The table below shows the influence of the brightness settings to the meter's operating time (for NiMH rechargeable batteries with a capacity of 2000mAh).

backlight	operating time
brightness 	55 h
brightness 	45 h
brightness 	35 h
brightness 	30 h
brightness 	26 h

15.4. Info

The INFO tab contains the software version, the serial number and the factory calibration date. (Pic. 11).



Pic. 11.

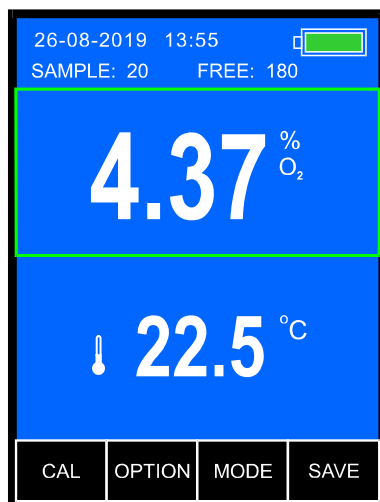
Return to the measurement mode by pressing the **RETURN** button.

16. MEMORISING READINGS, MEMORY READOUT

The meter enables recording readings of the displayed measurement functions. The readings are stored in memory even in case of power shortage. Before the measurement set the recording parameters for the readings.

16.1. Entering readings into the memory

Each press of the **SAVE** button memorises the reading. The information about the free and used memory capacity will display for a short time above the reading (Pic. 12). Before the readings collecting is started, the memory content may be deleted according to the next subchapter.

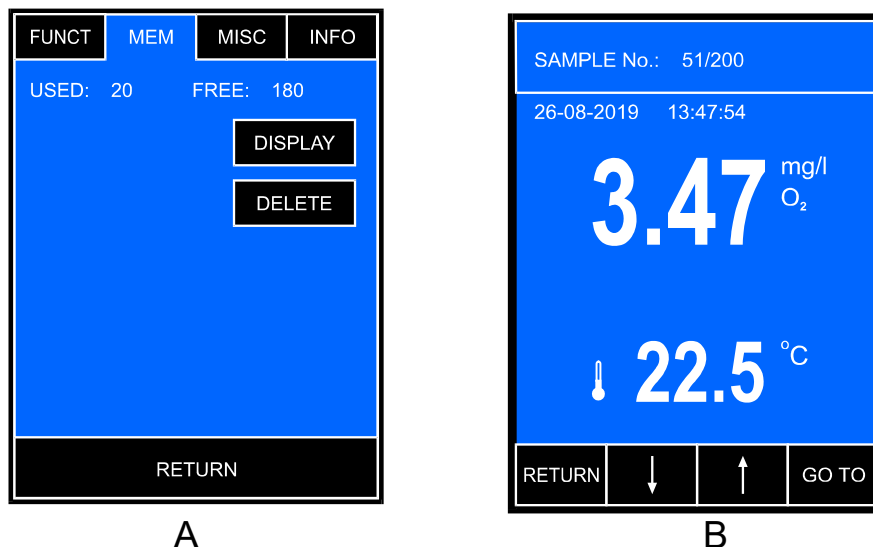


Pic. 12

16.2. Viewing and deleting readings

The stored readings may be viewed on the meter's screen. Follow the instructions:

- on the measurement screen press the **OPTION** button and choose the **MEM** tab on the options screen. A screen will appear with information about the memory usage and the **DISPLAY** and **DELETE** buttons (Pic. 13A);



Pic. 13

- press the **DISPLAY** button. A screen with the stored readings will display (Pic. 13B);
- change the displayed sample number with the ↓, ↑ buttons;
or
- press the **GO TO** button, a numerical keyboard will display to enter the number of the chosen sample and confirm with the **OK** button.

To erase the memory content, in the **MEM** tab on the options screen (Pic. 13A) press and hold the **DELETE** button until in the line above the button the following information will display:

USED: 0 FREE: 200.

Return from the viewing mode by pressing the **RETURN** button.

17. POWER, REPLACING THE RECHARGEABLE BATTERIES

The meter is powered by two R6 rechargeable batteries or by power adapter with stabilised voltage 5V, which has to be connected to the **P** connector (Pic. 2). The batteries are necessary in order to keep the clock working. The degree of filling the  symbol in the top right corner of the LCD informs about the condition of the batteries. Red  symbol informs that charging is necessary. When the voltage drops below the minimal value, the meter turns off automatically. After connecting the power adapter the charging process begins, what is signalised by the  symbol filling up. When the symbol displays continuously, the charging process is finished. The meter may work while being charged. In order to replace the batteries, it is necessary to undo two screws in the lower wall of the meter, pull out the container with batteries and replace them, paying attention to insert the batteries according to their polarity. Next, put the new batteries into the meter and mount the wall. The wall has a sealing ring on the edge. While closing the meter, it is very important to pay attention to it - the ring should be put inside the housing in the whole perimeter. Next, do the screws till the moment of resistance (not too hard). Leaving the wall improperly screwed may cause the meter's inundation. This kind of failure is not repaired under the warranty conditions.

Caution: application of batteries instead of rechargeable batteries when using the power adapter may result in fire and damage the meter.

18. TECHNICAL DATA

OXYGEN MEASUREMENT IN WATER:

range	resolution	accuracy*
0 ÷ 300.0 %	0.1 %	±0.2 % ±1 digit
0 ÷ 30.00 mg/l	0.01 mg/l	±0.02 mg/l ±1 digit

* - accuracy of the oxygen sensor is given in its separate manual

Temperature compensation range: 0.0 ÷ 40.0 °C
 Salinity compensation range: 0.0 ÷ 50.0 g/l
 Atmospheric pressure compensation range: 800 ÷ 1100 hPa
 Probe calibration:
 two-point 0% and 100% O₂
 one-point in 100%O₂
 Oxygen sensor: membrane, galvanic

MEASUREMENT OF OXYGEN SATURATION IN AIR:

Range	Resolution	Accuracy*
0 ÷ 100.0 %	0.1 %	±0.2 % ±1 digit

* - accuracy of the oxygen sensor is given in its separate manual

Sensor calibration:
 two-point in 0% and 20.9% O₂
 or one-point in 20.9%O₂
 Oxygen sensor: membrane, galvanic

TEMPERATURE MEASUREMENT:

range*	resolution	accuracy** (±1 digit)
- 50.0 ÷ 200.0 °C	0.1 °C	±0.2 °C

* The accessories connected to the meter may have narrower working temperature range.

** Accuracy given for the meter. The final accuracy depends on the type of Pt-1000 probe.

Temperature probe: Pt-1000 platinum resistor

The probe's accuracy in range 0 ÷ 100 °C:

for Pt1000B resistor

±0.8 °C

for Pt1000A resistor

±0.35 °C

OTHER:

MEMORY CAPACITY:	200 results
OPERATING TEMPERATURE:	-5 ÷ 45 °C
POWER SUPPLY:	AA NiMH rechargeable battery x 2 5V/1000mA power adapter
POWER CONSUMPTION:	
0% brightness	70 mW
100% brightness	180 mW
recharging batteries	max. 2.4 W
DISPLAY:	LCD 2.8" 240 x 320
DIMENSIONS:	149 x 82 x 22 mm
WEIGHT:	260 g (with rechargeable batteries)

19. ORDERING INFORMATION

OSG-1t	spare DO sensor with a built in temperature sensor, 1m cable	664-0237
MS-OSG-1	Maintenance set for the DO sensor (set includes: 3 x spare membrane, 2 x 30 ml bottle of electrolyte, sand paper)	664-0238
TS-2B	stainless steel temperature sensor 1meter cable	442-1264
EH-10	Electrode holder	662-2352

20. TECHNICAL SERVICE

Web Resources

Visit the VWR website at **www.vwr.com** for:

- Complete technical service contact information
- Access to the VWR Online Catalogue, and information about accessories and related products
- Additional product information and special offers

Contact us For information or technical assistance contact your local VWR representative or visit. www.vwr.com.

21. WARRANTY

VWR warrants that this product will be free from defects in material and workmanship for a period of two (2) years from date of delivery. If a defect is present, VWR will, at its option and cost, repair, replace, or refund the purchase price of this product to the customer, provided it is returned during the warranty period. This warranty does not apply if the product has been damaged by accident, abuse, misuse, or misapplication, or from ordinary wear and tear. If the required maintenance and inspection services are not performed according to the manuals and any local regulations, such warranty turns invalid, except to the extent, the defect of the product is not due to such non-performance.

Items being returned must be insured by the customer against possible damage or loss. This warranty shall be limited to the aforementioned remedies. IT IS EXPRESSLY AGREED THAT THIS WARRANTY WILL BE IN LIEU OF ALL WARRANTIES OF FITNESS AND IN LIEU OF THE WARRANTY OF MERCHANTABILITY.

Compliance with local laws and regulations

The customer is responsible for applying for and obtaining the necessary regulatory approvals or other authorisations necessary to run or use the Product in its local environment. VWR will not be held liable for any related omission or for not obtaining the required approval or authorisation, unless any refusal is due to a defect of the product.

22. EQUIPMENT DISPOSAL



This equipment is marked with the crossed out wheeled bin symbol to indicate that this equipment must not be disposed of with unsorted waste. Instead it's your responsibility to correctly dispose of your equipment at lifecycle -end by handling it over to an authorized facility for separate collection and recycling. It's also your responsibility to decontaminate the equipment in case of biological, chemical and/or radiological contamination, so as to protect from health hazards the persons involved in the disposal and recycling of the equipment.

For more information about where you can drop off your waste of equipment, please contact your local dealer from whom you originally purchased this equipment.

By doing so, you will help to conserve natural and environmental resources and you will ensure that your equipment is recycled in a manner that protects human health.

Thank you

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