# LABORATORY OXYGEN METER

# CO-505

USER'S MANUAL

ELMETRON

USER'S MANUAL

# LABORATORY
# OXYGEN METER

## CO-505

Before use please read the instruction carefully!

# CONTENTS

# I. INTRODUCTION

# 1. EXPLOITATION NOTICES

Dear User!

We present you a device distinguished by accuracy according to the technical data and by high stability of the displayed results. We believe that measurements would not cause you any trouble and that the meter would operate without any inconvenience. **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 the dissolved oxygen measurements depends on the sensor calibration and regular conservation which consists in replacing the membranes, electrolyte and cleaning the electrodes. **Neglecting of these activities after some time would make measurements impossible. Please turn your attention to the fact that stabile measurement is possible only with simulated or natural measured water flow.**
The essential feature of our products is their low failure frequency. However, if your meter fails, our firm immediately performs its warranty repair.
**We wish you a pleasant and trouble-free work with our meter.**

## 2. CHARACTERISTICS OF THE METER

The **CO-505** dissolved oxygen meter belongs to the newest generation of measuring devices which offer wide range of additional functions. The meter ensures high accuracy and repeatability of readings. The electronic elements of the newest generation used in the meter made its memory independent from power supply. The internal clock is powered from battery which holds its charge for many years. The meter is equipped with a custom, backlit LCD display, which enables observing the measured function simultaneously with the temperature value. Additional graphic symbols make working easier.
Main features of **CO-505** are:

- high accuracy and stability of readings;
- automatic and manual temperature compensation;
- possibility of compensation of the salinity influence on the oxygen measurements
- measurement and automatic compensation of the atmospheric pressure influence on the dissolved oxygen concentration;
- possibility of introducing the time of calibration validity and signalling its expiry;
- remembering the measurements results with time, date, individually or taking series of measurements with set time interval;
- USB port;
- large LCD backlight display with brightness control;
- real clock and date.

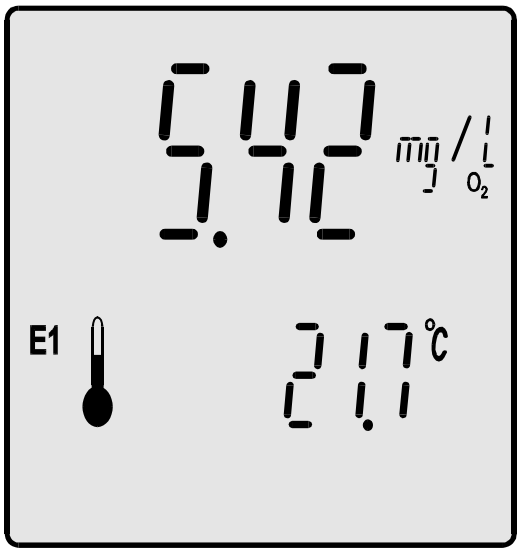
## 3. WHAT IS THE METER DESIGNED FOR

Dissolved oxygen meter **CO-505** is a precise and easy-to-use meter designed for measurements of oxygen dissolved in water in % of saturation or mg/l and atmospheric pressure measurement in hPa. The meter may also be used for accurate temperature measurement of solutions and air in ℃.
The meter is used in chemical, pharmaceutical, power industries, in water treatment stations, laboratories, agriculture, universities, scientific laboratories etc.
The meter is prepared to work with galvanic oxygen sensor manufactured by our company. It may cooperate also with Pt-1000 temperature probe with Chinch connector.
The meter may collect measurements taken as single or series of measurements with set time interval.
The built in USB port enables sending the data to the PC. There is a possibility of sending current results of measurements or the stored data together with date and time thay have been collected.
In case of necessity to collect series exceeding the memory capacity it is possible to use a special PC software offered by our company.

## 4. THE OUTSIDE VIEW

In the upper part of the meter there is an LCD display (Pic. 1), on which depending on the chosen function following symbols are displayed:
- result of the oxygen measurement in % or mg/l
- time and date.

A particular function is chosen with specific button which is signalised by lighting LED diode placed on this button.
The temperature value in $^{o}C$ is displayed simultaneously with the result. Symbols of units are displayed next to the results.




Pic. 1.

Beside the temperature value there is a symbol (automatic temperature compensation) or a symbol (manual temperature compensation) displayed. ***CAL*** symbol on the left side of the display informs that the meter is in the calibration mode. The number of the chosen electrode is displayed on the left side (E1, E2, E3). It informs which of the characteristics would be taken into consideration during all calculations. Flashing symbol of the electrode number informs that the characteristic has been deleted, the calibration validity has expired (point 6.5), or that the last calibration has shown that the electrode had lost its efficiency. The number of detected calibration point is displayed during calibration between the upper and lower rows of digits (P1, P2, P3, P4, P5).

When pressing the MODE button, all parameters introduced by the user and the atmospheric pressure value are displayed.

The keyboard (Pic. 2) placed under the display is used for switching the meter on and off, choosing the measuring function, calibration, entering the parameters and memorising the results.


- switches the meter on and off;


- chooses the dissolved oxygen measuring function;


- displays the time and date;


- holding this button enters the calibration mode (*CAL* symbol displayed). Short press in this mode confirms the calibration result;

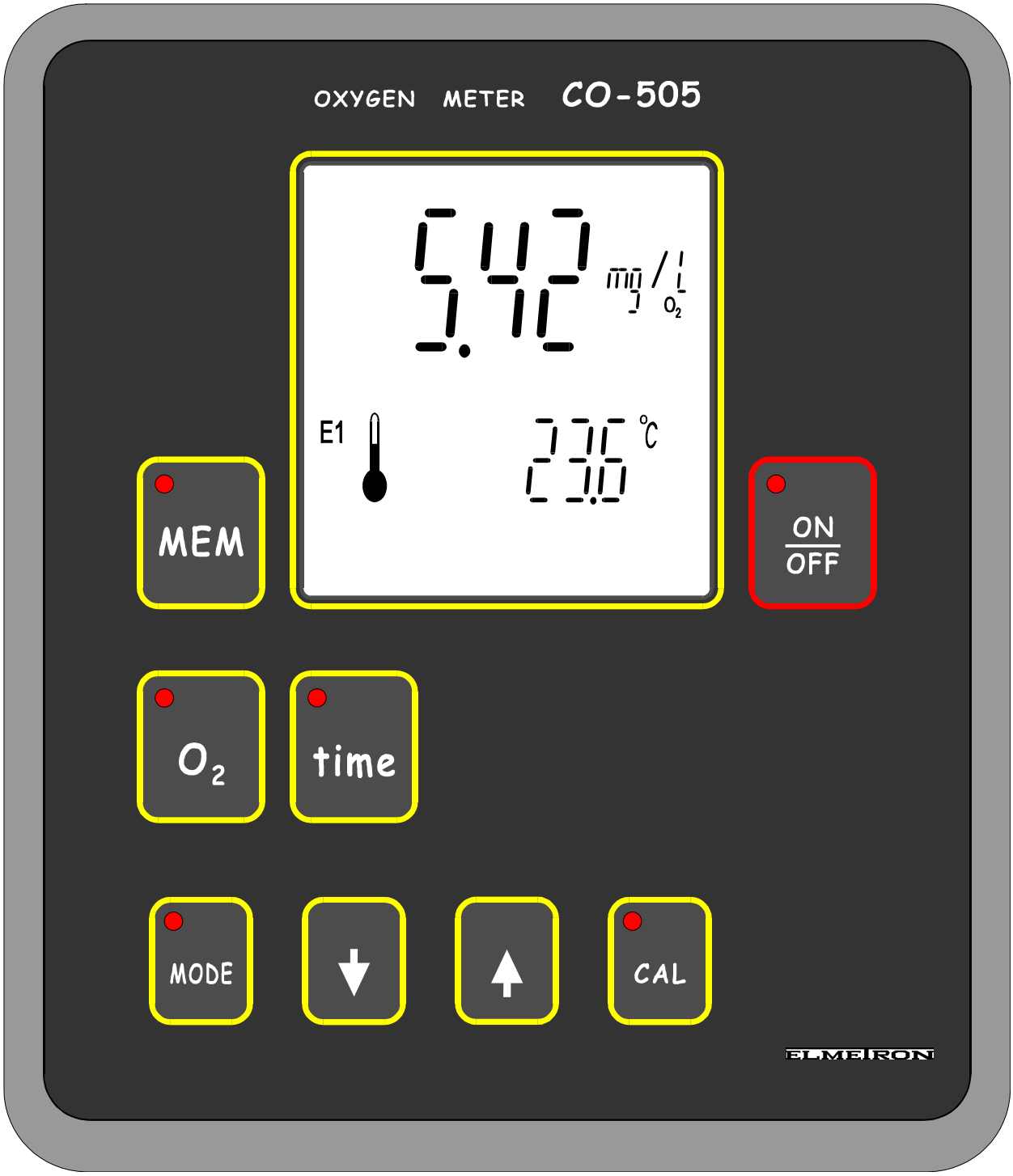

- short press causes memorising single results or measuring series, holding enters the stored results readout mode;


- chooses the entered parameter;

- buttons for entering the parameters.

On the back wall of the meter there are inputs placed with the symbols given below:

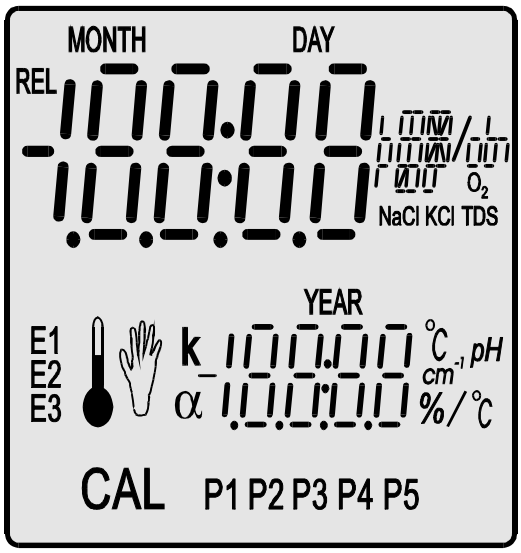
**$O_2$** - connector for dissolved oxygen sensor;
**temp** - the **Chinch** connector for temperature probe;
**USB** - then USB port for connecting the meter with the PC;
**POWER** - connector for power adapter.


OXYGEN METER CO-505
5.42
1.11
mg/l
O2
E1
23.6
°C
MEM
ON
OFF
O2
time
MODE
CAL
ELMETRON

Pic. 2.

## 5. SWITCHING THE METER ON AND OFF

After switching it on by pressing the ON OFF button, the meter tests the memory and the display on which all symbols are being displayed (Pic. 3).




Pic. 3.

If the test ends successfully, after about 1.5 s the meter switches automatically to the measuring mode, in which it was switched off. Displaying of the HELP sign informs that the meter has lost the factory settings and requires service repair. If after 1,5 s all symbols are continuously displayed, it informs that the sensors' calibration parameters have been lost.

After pressing the CAL button the meter adopts standard characteristics:
- shift = 0% $O_2$, characteristic slope = 100% $O_2$ for the oxygen sensor

and enters the measuring mode. It will be necessary to calibrate the oxygen sensor.

The meter is switched off by pressing the ON OFF button.

# 6. PREPARATION TO WORK

Before starting work:
- join the power adapter plug to the **Power** input;
- join the dissolved oxygen sensor to the **$O_2$** connector;
- in case of using the temperature probe it should be connected with the Chinch temperature input - **temp**;
- in case of working with a PC join the cable with the **USB** port;
- switch the meter on by pressing the 

button.

## 6.1. Choosing the kind of temperature compensation

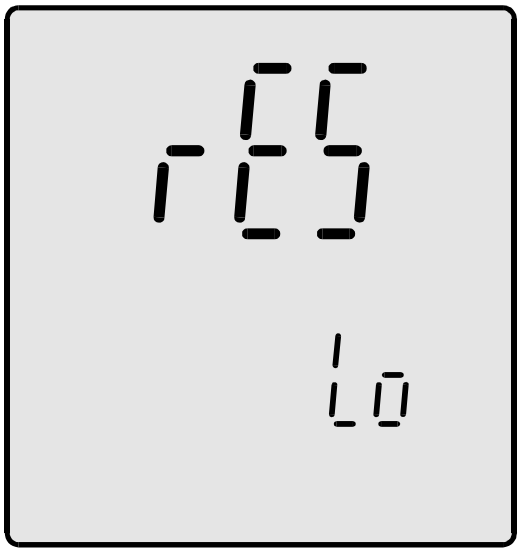
The meter switches to the automatic temperature compensation mode automatically after connecting the temperature probe, after disconnecting it the meter enters the manual temperature compensation mode. In the ATC mode, next to the displayed temperature the  symbol appears. Manual temperature compensation is indicated by the  symbol next to the value entered by the user, its value may be changed with use of the  ,  keys.

## 6.2. Changing resolution of the measurements

The measurement results may be displayed with a chosen resolution. In order to change it:

- in the measuring mode press the MODE button, a rES (resolution) sign will be displayed. (Pic.4);
- using keys ↓ , ↑ choose:

  Lo - low resolution of the measurement;
  Hi - high resolution of the measurement.




Pic 4

For the oxygen measurement:

Lo - resolution of the measurement 1% or 0,1mg/l;
Hi - resolution of the measurement 0.1% or 0.01 mg/l.

Return to the measuring mode by pressing the chosen function button.

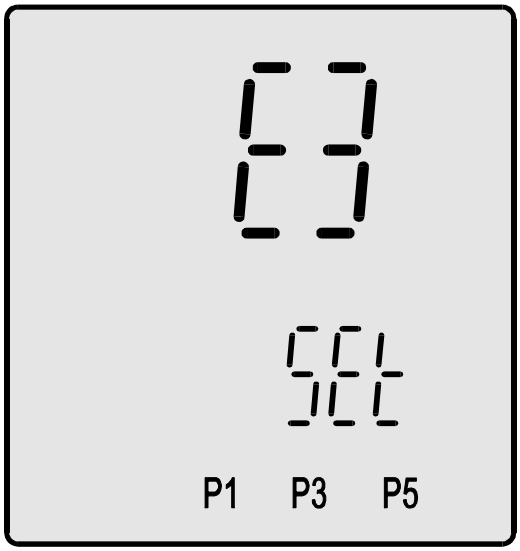
### 6.3. Changing the sensor number

If there is more than one sensor's characteristic stored in the meter's memory, it is possible to replace the sensor without the need of calibration. This option is quite useful in case of working with more than one sensor. It is necessary to connect the sensor calibrated earlier, marked with the number which responds to the number stored in the memory and choose this number.
In order to do so, in the measuring mode:

- press the MODE button till the moment of displaying E1, E2 or E3 symbol in the upper row of the display, than using the ↓ , ↑ buttons choose the sensor number. Under this number the calibration results will be stored (pic.5). Below the sensor number one of the following signs will be displayed:

  CLr - under this number there is no characteristic stored and the producer's values are provided. In the measuring mode the sensor number will be flashing.
  SEt - under this number there are values of the last calibration stored.

Additionally, the points in which the sensor is calibrated are shown under the sensor number.



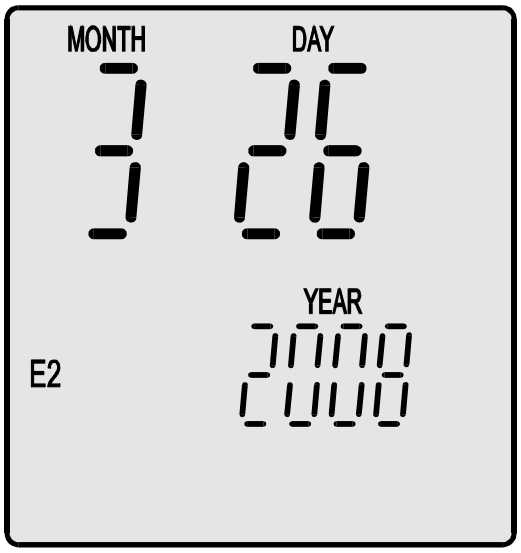

Pic. 5.

- return to the measuring mode by pressing the chosen function button.

## 6.4. Readout of the last calibration date

The meter remembers the calibration dates of all sensors. Before starting work it is possible to check the last calibration date.
In order to do so, in the measuring mode:

- press the MODE button till the moment of displaying in the upper row of the display the sensor number (E1, E2 or E3 symbol);
- using the ↓, ↑ buttons choose the sensor number of which calibration date is to be checked and press the CAL button. The last calibration date will be displayed in the following format: month – day - year (below), Pic. 6. On the left the sensor number is displayed.
- **Flashing date informs about expiration of the sensor's calibration validity. Introducing the calibration time has been described in the section 6.5.**




Pic. 6.

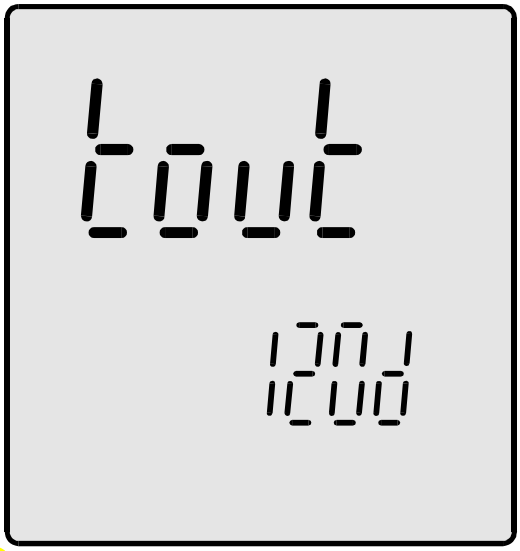
The meter memorises the date during calibration. If the date in the meter's clock is changed after calibration, the date of calibration validity expiration will be faulty signalised. It is important to set the current date before calibration.

Return to the readout of the sensor number by pressing the MODE button, or to the measuring mode by pressing any of the function buttons.

## 6.5. Entering the calibration validity time

The meter remembers the time of calibration validity for three sensors. After this time has been exceeded, the meter signals with flashing sensor number (E 1, E2 or E3 symbol) that it is necessary to calibrate this sensor.
In order to set the time validity of calibration, in the measuring mode of the chosen function:

- press the MODE button till the moment of displaying a tout (time out) symbol in the upper row. The number of days till the next calibration will be displayed below (Pic. 7);




- with the ↓ , ↑ buttons enter the requested number of days till the next calibration. After choosing time of one day and pressing the ↓ button instead of digital values the --- symbol appears and the function of reminding about the next calibration is blocked.

Pic. 7.

Return to the measuring mode by pressing the $O_2$ button.

# II. DISSOLVED OXYGEN MEASUREMENT

# 7. BASIC INFORMATION ABOUT THE DISSOLVED 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, which voltage depends on the oxygen content in the electrolyte.

The meter enables measurement in % of oxygen saturation and in **mg/l**. Calculation of the mg/l value is based on the saturation measurement in % and the temperature measurement. During mg/l measurements, the values of salinity and atmospheric pressure should be additionally introduced. The saturation measurement 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 problems result from the lack of basic maintaining activities of the sensor from the user's side.** It is worth remembering that during measurement the sensor absorbs oxygen from the environment of the membrane. **The sensor's manufacturers give recommendations concerning the minimal flow-rate of the tested water, assuring a stable result.** When this requirement is not complied, **the reading will regularly decrease.** During measurements in stagnant solutions the flow can be partly simulated by keeping the sensor in motion with a suitable speed. In laboratory conditions, i.e. performing measurements in a vessel, the flow can be forced with a magnetic stirrer. **However, when measuring low $O_2$ saturation, intensive stirring can cause increase of oxygen content in the tested solution.** Transferring water samples to the laboratory can alter their $O_2$ 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 of the electrolyte. After this period the container must be refilled 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.

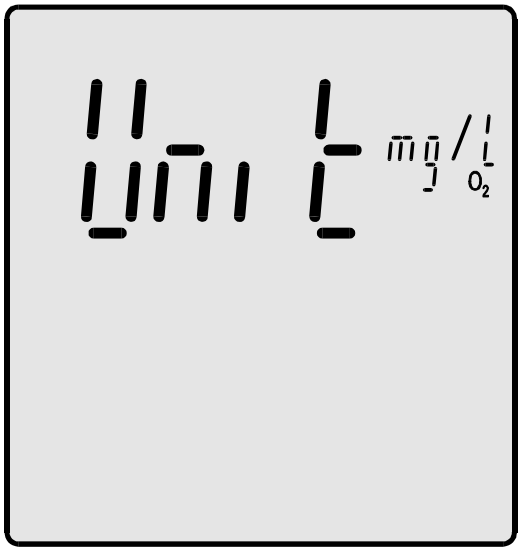
Depending on thickness of the membrane, awaiting time for a stable result comes to about 1 - 1,5 min. Accuracy of the measurement is connected with the temperature of calibration and measurement. The greater the difference of these temperatures, the greater the measurement error. For measurements of concentration in 30 ÷ 80% range, it is sufficient to make one-point calibration in 100% oxygen concentration. In case of measurements in solutions with low oxygen content (about a few %) calibration should be also made in 0% solution. Clean water contains about 60 ÷ 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 ±1%/24 h. Wide measuring range in the **CO-505** dissolved oxygen 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.

# 8. ENTERING THE OXYGEN METER PARAMETERS

## 8.1. Changing the unit

The measurement result may be displayed in % of the oxygen saturation or in **mg/l**. In order to choose the unit:

- in the oxygen measuring mode press the MODE button till the Unit (unit) sign displays in the lower row of LCD;
- with the ↓ , ↑ buttons choose the symbol:
  **%** - measurement in % of oxygen saturation
  **mg/l** – measurement in mg/l (Pic. 8).




Pic. 8.

- return to the measuring mode by pressing the $O_2$ button.

## 8.2. Compensation of the salinity influence

Salinity of the solution decreases the oxygen solubility in water and 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.

## 8.3. Manual introduction of the salinity value

The salinity value may be determined on the basis of known conductivity of the measured solution. Table 1 shows actual dependence between salinity and conductivity counted in NaCl. In order to enter the salinity value:

- measure conductivity of the solution with any conductivity meter and read the salinity value from the table;
- in the oxygen measuring mode press and hold the 

button till in the lower row of the LCD the SAL (salinity) sign displays;
- with the  ,  buttons in the upper row of the LCD enter the salinity value read from the table;
- enter the oxygen measuring mode by pressing the 

button.

**Measurement in % of saturation 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 | | |

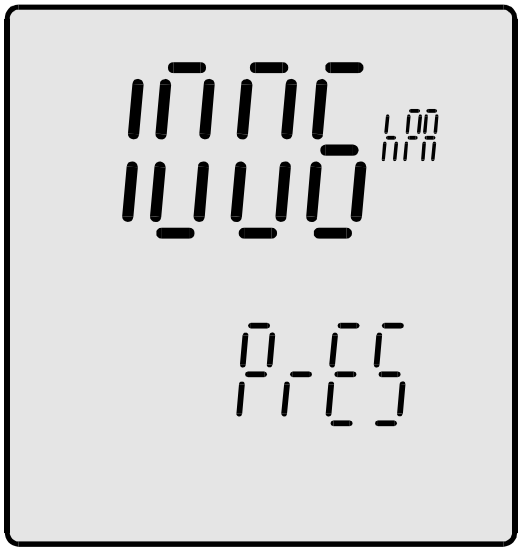
Table 1. Determining the salinity in g/l NaCl on the basis of conductivity in mS/cm (in the temperature 25$^{o}$C).

## 8.4. Automatic compensation of the air pressure influence

**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. The meter enables automatic compensation thanks to build-in atmospheric pressure sensor. This influence is automatically counted during measurements in **mg/l**.

There is possibility of reading the atmospheric pressure value:

- in the oxygen measuring mode press the MODE button till a PrES (pressure) sign appeares in the lower row of the LCD (Pic. 9);
- in the upper row there is the value of atmospheric pressure in hPa displayed;




Pic. 9.

- enter the oxygen measuring mode by pressing the $O_2$ button.

**During the oxygen measurement in % of saturation the atmospheric pressure has no influence on the result.**

## 9. CALIBRATION OF THE DISSOLVED OXYGEN SENSOR

In order to eliminate the measurement error arising from the individual characteristic of the sensor its calibration should be carried out. This procedure should be performed always before operation with a new sensor, after replacing the membrane or in case of high measurement accuracy requirements. Sensors have so-called “signal drift” associated with the interval between calibration and measurement. Longer interval decreases the measurement accuracy. Calibration is also recommended if the temperature of the tested solution differs significantly from the temperature in which the probe was calibrated, because then an additional error arises. **In such case it is recommended to prepare calibration solutions with the temperature at least approximate to the predicted temperature of the tested solutions.**

If it is impossible to calibrate the device, the membrane of the sensor must 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 one- or two-point calibration in standard solutions. The meter has two values of the calibration points introduced: P1=0% and P2=100%. During calibration in **0% oxygen concentration solution** (e.g. saturated sodium sulfate solution) its flow has to be provided by rounded moves with the sensor in the substance. The **100%** point calibration is made in the air after washing the remids of the 0% solution from the sensor very accurately with distilled water.

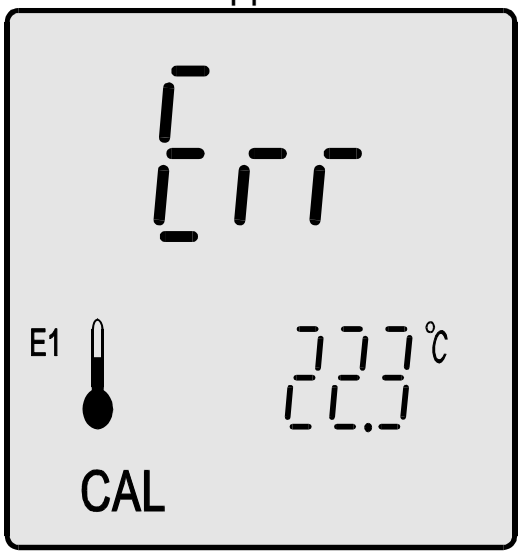
It is assumed that $O_2$ content in the air corresponds to 100% of saturation, what enables simplified calibration to be carried out.

One-point calibration is made only for 100% of oxygen saturation. In this case, the sensor has to be put in distilled water for several minutes before the calibration.

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

In order to calibrate the meter:
- place the sensor in a vessel with 0% saturation solution;
- choose the measurement of the saturation in % according to chapter 8.1;
- press and hold the CAL button till till the moment of appearing the ***CAL*** symbol in the lower left corner of the display, the meter will enter the calibration mode and automatically change the unit to %;
- after stabilisation of result press the CAL button. The result flashes, what informs about memorising the value of calibration; at the same time corrected value of the measurement (0%) will be displayed in the upper row of the LCD;
- take the sensor out, **wash it accurately in distilled water** and put it into 100% oxygen saturated solution ensuring the liquid flow or leave it on the air;
- after stabilisation of the result press the CAL button;
- the result flashes, what informs about memorising the calibration data; at the same time corrected value of the measurement (100%) will be displayed in the upper LCD row;
- enter the measuring mode by pressing the $O_2$ button.

If after pressing the CAL button the meter can't detect the value of the sample solution (0% or 100%), an Err sign displays for a moment in the place of the result (Pic. 10). In such case it is necessary to check the condition of the membrane and the applied solutions.




Pic. 10.

**In case of choosing the sensor number, entering the calibration mode and escaping it without making calibration, the stored characteristics will be erased and the standard one will be adopted.**

# 10. OXYGEN CONCENTRATION MEASUREMENT

Before starting the oxygen concentration measurement the meter should be prepared for work (chapter 6) and the oxygen sensor calibrated (chapter 9). 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 counted 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.** If higher accuracy is required, the interval from the last calibration must be additionally taken into consideration (signal drift). If the salinity of the tested solution is insignificant, the measurement can be started without entering its value (value 0.00 g/l should be entered). **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. The salinity value is introduced according to the section 8.2.

## 10.1. Measurement with automatic temperature compensation

In order to make the measurement with automatic temperature compensation:

- connect the temperature probe with the meter;
- choose the resolution according to the section 6.2 and choose the number of the oxygen sensor according to the section 6.3;
- insert the oxygen sensor and the temperature probe to the measured solution;
- turn the meter on with the 

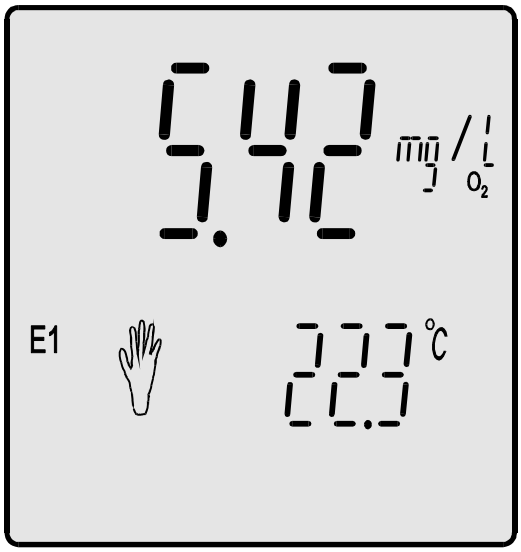
button;
- with the 

button choose the oxygen measuring function;
- choose the unit according to the section 8.1;
- in case of accurate measurements in **mg/l** enter the salinity value (section 8.2);
- check or simulate the flow of the measured solution;
- wait till the result stabilises (about 1 ÷ 1.5 min - depends on the probe) and read the result.

## 10.2. Measurement with manual temperature compensation

In order to make measurement with manual temperature compensation:
- disconnect the temperature probe from the meter;
- turn the meter on by pressing the ON/OFF button;
- with the $O_2$ button choose the oxygen measuring mode;
- choose the unit according to the section 8.1;
- in case of accurate measurements in **mg/l** enter the salinity value (section 8.2);
- insert the oxygen sensor to the measured solution;
- measure the temperature of the solution;
- with the ↓ , ↑ buttons enter the temperature value of the measured solution into the lower row of LCD (pressing both ↓ , ↑ buttons simultaneously sets the value to 20 $^{o}$C);
- check or simulate the flow of the measured solution;
- after stabilisation read the result (Pic. 11).

When collecting series of measurements, it is possible to currently adjust the temperature compensation to the solution temperature changes.




Pic. 11.

**Caution:** in case of measurements in solutions with low salinity check according to the chapter 8.2, weather the introduced salinity value is 0.00 g/l.

# III. ATMOSPHERIC PRESSURE MEASUREMENT

## 11. ATMOSPHERIC PRESSURE MEASUREMENT

The meter enables atmospheric pressure measurement. In order to read its value:

- turn the meter on by pressing the ON/OFF button;
- with the $O_2$ button choose the oxygen concentration mode (**$O_2$**);
- press the MODE button till the moment of displaying the PrES (pressure) sign in the lower row;
- in the upper row the value of the pressure in hPa will be displayed (Pic. 12);


Pic. 12.

- return to the measuring mode by pressing the $O_2$ button.

# IV. TEMPERATURE MEASUREMENT

## 12. TEMPERATURE MEASUREMENT

The temperature measurement is made as follows:

- switch the meter on by pressing the 

button;
- connect the temperature probe to the Chinch connector, the  symbol will be displayed;
- put the temperature probe to the measured solution;
- wait till the value stabilises and read the result in the lower row of numbers.

The meter cooperates with the Pt-1000 probe. Depending on its class the accuracy of the measurement changes.

**CAUTION:** break in the circuit of the temperature probe switches the meter to the manual temperature compensation mode. It is signalised by changing of the  symbol to the  symbol. On the display there is shown the value of the temperature entered by the user.
Blinking -50℃ value while making measurement in positive temperature informs about short circuit in the temperature probe.

# V. OTHER

## 13. CLOCK WITH DATE

After choosing the **time** mode with the time button the meter will display the current time. Pressing of the MODE button displays interchangeably: the date, backlight mode, auto switch off time and the software version number.

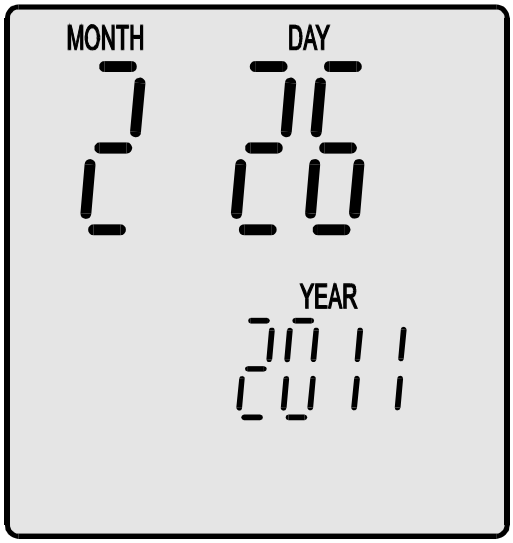
### 13.1. Clock

The time is displayed in two rows on the display (pic. 13). In the upper one hours and minutes are displayed and the lower one displays seconds. The way of changing hours is described in the section 13.3.


Pic. 13.

### 13.2. Date

The date is displayed as follows: Month – Day – Year. (Pic. 14). In the upper row the month and day are displayed and in the lower row – the current year.




Pic. 14.

### 13.3. Setting time and date

The mode of setting the currently displayed parameter (hour or date) is entered by pressing and holding the CAL button. The position which we are going to change starts flashing, the value can be changed with the , buttons. Pulsating position is chosen by pressing the CAL button. Seconds are not set, they reset after the mode has been left. Press the time button to leave the setting mode.
The clock is powered with a lithium battery which lasts for 10 years. Flashing of the clock readings after the meter has been connected to the power supply informs about loss of the clock settings. It is necessary to introduce new settings. If such situation occurs each time the meter is being switched on, it has to be sent to our firm in order to have the battery replaced.

### 13.4. The LCD backlight mode

In the **time** mode press the MODE button till a LCd sign displays in the upper row (Pic. 15). In the lower row the oFF, Auto or on parameter will be displayed.

- oFF the backlight is switched off;
- Auto mode of automatic switching on of the backlight for 60 seconds after each press of any button;
- on the backlight is always on.

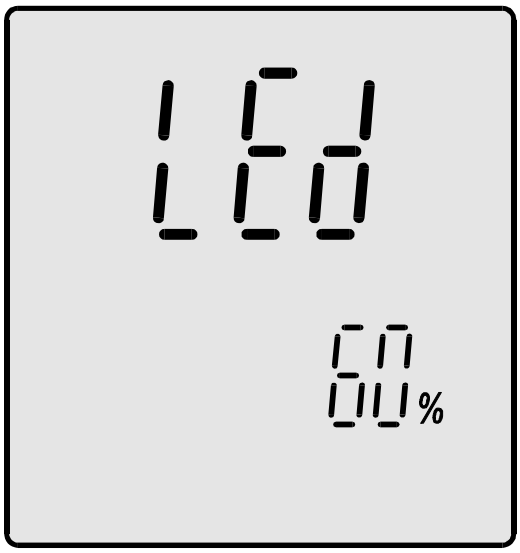

Pic. 15.

With the , buttons choose the backlight mode.

Return to the **time** mode after pressing the time button.

### 13.5. The brightness control

Controling brightness of the backlight is especially important in case of working in various lighting conditions. While choosing the backlight mode (section 13.4) it is possible to control the brightness by pressing the CAL button shortly. In the place of Auto or on parameter the value of brightness in % displays. With the ↓ , ↑ buttons it is possible to set the brightens value from 10 ÷ 100%, every 10%.

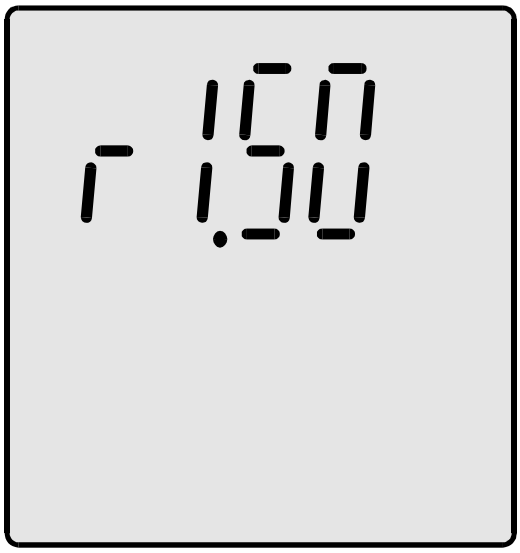



Pic. 16.

Return to the backlight mode be pressing the MODE button, and to the measuring mode by pressing any function button.

### 13.6. Readout of the software version number

In the **time** function press the MODE button till the software version number displays (Pic. 17).



Pic. 17.

Return to the **time** mode by pressing the time button.

# 14. STORING AND READOUT OF THE RESULTS

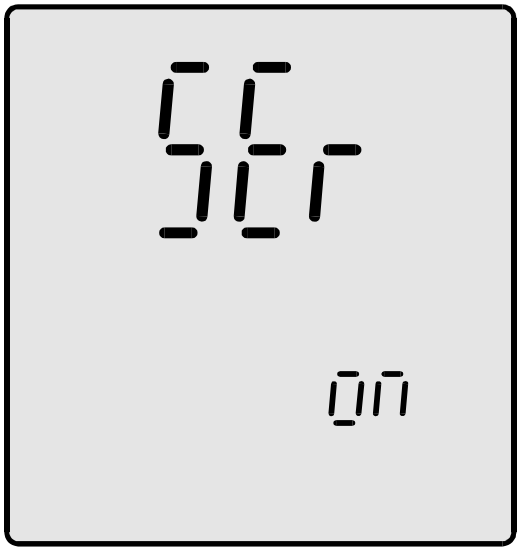
The meter enables storing of 4000 results of the currently measured function. The results are stored in EEPROM memory, which is non-volatile, so the data isn't lost even after complete lack of power. Before starting work it is necessary to choose the parameters of storing or readout of the stored results.

## 14.1. Parameters of storge and readout from the memory

The parameters are changed in the readout mode. It may be entered from every measuring function by pressing and holding the MEM button, until on the display the number of the last stored result will be displayed. This number is displayed on turns with the stored result.
Before memorising, choose the way of collecting results: on request or automatically in series, and also the way of displaying the result.

Next presses of the MODE button show screens with following parameters which may be changed:

a. SEr - taking or printing series or single results.




Pic. 18.

With the ↓ , ↑ buttons choose in the lower row on or oFF symbol (Pic. 18.). Choosing on activates storing the results automatically and oFF - storing singly, after every press of MEM button.

b. int - time interval during series taking (Pic. 19).


Pic. 19.

Length of the time interval is displayed in the lower row of digits, and the informative symbol int in the upper row.

The ↓ , ↑ buttons are used for setting the chosen time in minutes and seconds. The shortest interval is 1 second and the longest - 60 minutes. Holding the button increases change rate (repetition).
In case of choosing the SEr parameter to oFF the position int is not displayed.

c ALL - the way of displaying the stored results
- on - successively: number of the sample, result, time and date of memorising the result.
- oFF - successively: number of the sample and the result.

Changing with the ↓ , ↑ buttons.

Return to the results readout display after pressing the MEM button.
Exit from the readout mode after pressing the chosen measuring function button.

### 14.2. Memorising single redouts

If storing of single results has been chosen according to previous section, every press of the MEM button memorises the result. The results are stored as the next ones after the latest stored. In case of checking the results stored earlier and not returning to the last one, the results won't be deleted and the value will be stored under the first empty position. In case of storing the result beginning with the chosen number, first delete the results starting from this particular number (as described in the section 14.5) and next start memorising the results by pressing the MEM button.
While memorising the result, its number is being displayed for a moment.

If after having pressed the MEM button instead of a number an End sign is displayed, it informs that the maximal number of results to store has been reached.

### 14.3. Storing the measuring series

It is necessary to:
choose the way of collecting the results serially (point 14.1.a);
- enter the time interval (point 14.1.b);
- delete the stored results starting from the chosen one (section 14.5);
- by the appropriate button choose the function of which results are going to be stored;
- with the MEM button start collecting series. The measurements will be collected starting from the first free number.

Collecting series is signalised by flashing diode placed in the MEM button. Before each time the result is memorised, the number of the measurement is displayed for a moment. Collecting series may be stopped by pressing the MEM button, any function button or by filling up all the memory capacity. The next series can be started unless the memory capacity has been filled up.

### 14.4. Reviewing the results

Reviewing stored results is started in the measuring mode, by pressing and holding the 

button until the number of the last stored result displays on turns with its value.

Every press of the  or the  button shows the next or the previous number and the result with time and date **depending on which parameter of the ALL function has been chosen** (point 14.1.c).

In this mode the  ,  buttons work with repetition which means that after holding them the numbers are changing with increasing speed rate till they stop at the highest or the lowest number.
The reviewing mode is left by pressing any function button.

### 14.5. Deleting stored results

In order to delete stored results:

- press and hold the 

button;
- with buttons  ,  set the number of measurement from which deleting results from the memory is to be started;
- press and hold the 

button until there is a ––– sign displayed instead of the results; all the results from the chosen one up to the last one remembered are now deleted;
- press any function button to exit the reviewing mode.

Deleting all the results from the memory should be started beginning with the first number.

# 15. CO-OPERATION WITH A PC

Connecting the meter with a PC enables storing the data directly on the computer, what makes a possible number of results to store unlimited. The PC should be equipped with a USB connector. For transmission a special software prepared by our firm should be used. The software is delivered on a CD. After inserting the CD to a drive the installation program starts automatically. During installation it is necessary to follow the given instructions.

In the back wall of the meter there is a USB connector placed, which enables connecting with a PC using a cable. After connecting, turn on the meter and the PC and launch the transmission software. We have two options available:

- “Collect series” is used for collecting results of a current measurement. After choosing this option a window with the result of a current measurement displays. Only the elements which are marked in the field “Send” will be collected and stored. It is necessary to set the number of measurements which are to be stored and storage intervals. On the basis of this data the software will count the time of collecting the whole series. The series are stored in temporary file. In case of lack of power the collected data will be stored in a file “NoNamexx”. Collecting is started by pressing the “Collect” button.

- “Download data from memory” enables sending the chosen part or whole of the data stored in the meter’s memory to a file. In option “Collect” we mark the data we want to be sent. The transfer is started by pressing the button “Download”.

**Caution:** the meter and the PC should be switched on **after** connecting the cable.

# 16. TECHNICAL DATA

## OXYGEN MEASUREMENT:

| Range | Resolution | Accuracy |
|---|---|---|
| 0 ÷ 600.0 % | 0.1 % | Of probe* ±1 digit |
| 0 ÷ 60.00 mg/l | 0.01 mg/l | Of probe* ±1 digit |

* Accuracy given in the “Oxygen Probe” section.

Temperature compensation range: 0.0 ÷ 40.0 $^{o}$C
Salinity compensation range: 0.0 ÷ 50.0 g/l
Atmospheric pressure compensation range: 800 ÷ 1100 hPa
Probe calibration:
Two point 0% and 100% $O_2$
One point in 100%$O_2$
Oxygen probe: membrane, galvanic

## ATMOSPHERIC PRESSURE MEASUREMENT:

| Range | Resolution | Accuracy* (±1 digit) |
|---|---|---|
| 800 ÷ 1100 hPa | 1 hPa | ±2 hPa |

## TEMPERATURE MEASUREMENT:

| Range | Resolution | Accuracy* (±1 digit) |
|---|---|---|
| - 50.0 ÷ 199.9 $^{o}$C | 0.1 $^{o}$C | ±0.1 $^{o}$C |

* accuracy of the meter. Final accuracy of the measurement depends on the accuracy of the used Pt-1000 probe

TEMPERATURE PROBE: platinum resistor Pt-1000

ACCURACY OF THE PROBE IN RANGE 0 ÷ 100 $^{0}$C:

for Pt-1000b resistor: ±0.8 $^{0}$C
for Pt-1000$^{1}/_{3}$b resistor: ±0.27 $^{0}$C

**OTHER:**

| | |
|---|---|
| MEMORY CAPACITY: | 4000 results |
| OPERATING TEMPERATURE: | 0 ÷ 40 ºC |
| POWER: | 12V/100mA stab. power adapter |
| POWER CONSUMPTION: | |
| 0% backlight | 420 mW |
| 100% backlight | 660 mW |
| DISPLAY: | LCD 69 x 73 mm |
| DIMENSIONS: | 200 x 180 x 50 mm |
| WEIGHT: | 620g |

## 17. EQUIPMENT

The standard equipment for the meter is:

1. COG-1 dissolved oxygen sensor;
2. Pt-1000B temperature probe (standard);
3. 12V/100mA stabilised power adapter;
4. Software for collecting the data on the PC;
5. USB cable;
6. User's manual with warranty.

The additional equipment available for this meter is:

1. Pt-1000 1/3B temperature probe with higher accuracy.

# W A R R A N T Y

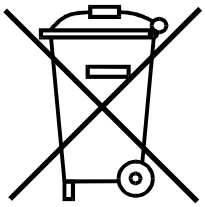
The ELMETRON company ensures a 24-month warranty for the **CO-505** dissolved oxygen meter number:

.....

In case of damage the producer will repair the meter within 14 days from the day of delivery.
The warranty doesn't cover the damages caused by usage not in conformity with the user's manual, using wrong power adapter, mechanical damages and damages caused by repairs made by unauthorised persons.

**NOTICE:** Before sending the meter to us please contact the firm by phone or email.
When sending the meter, the oxygen sensor, temperature probe and power adapter should be also included.

Date of production.....
Date of sale.....
Date of warranty expiry.....



ELMETRON® Sp. j.
41-814 Zabrze Witosa 10 Poland
tel. (+48) 32 2738106 fax (+48) 32 2738114
www.elmetron.com.pl
e-mail: info@elmetron.com.pl