Dissolved Ozone Meter

- Operating Instructions -

Edaphic Scientific Pty Ltd

www.edaphic.com.au

info@edaphic.com.au

Contents

1 Preface

The battery-operated Multi-sensor Measuring System has been developed for the determination of the analytes H_2S/sulphide resp. total sulphide amount, dissolved oxygen, dissolved hydrogen and ozone. Additionally some further sensors have been integrated into the measuring system depending on the analyte which has to be determined. These additionally sensors are e.g. temperature, pH and they are also visible at the display. Beyond it, the customer can feed additionally general measuring conditions like salinity (for oxygen measurements) if this is required by the analyte which has to be measured. The chemical and physical data are shown at the display as raw data or as calculated value with their units. This is also valid for the additionally measuring data like temperature or pH. The measuring device is also useful to store and to use the calibration data of up to 10 different chemical sensors (H_2S, oxygen, ozone, hydrogen, hydrogen peroxide). It is possible too, to calibrate the pH sensor by means of the Multi-sensor Measuring System.

The perfect functioning and operational safety of the measuring device can only be ensured, if the user observes the safety precautions as well as the specific safety guidelines stated in the present operating instruction and in the description of the micro-sensors special features. If the non compliance of this instructions leads to a fault, the repair is not covered by the guarantee.

2 Structure and components, system equipment

The Multi-sensor measuring system MS 08 can be delivered with the following sensor combinations:

A H_2S-sensor with combined pH/temperature-sensor (for measurements within the range 0-8,5 pH)
B Oxygen sensor with temperature sensor
C Ozone sensor with temperature sensor
D Hydrogen sensor with temperature sensor
E Hydrogen peroxide sensor with temperature sensor

The sensor electronics allows the exchange both between H_2S-/H_2O_2-/oxygen sensors, oxygen/hydrogen and between oxygen/ozone sensors. This means, that a change between the determination of H_2S and hydrogen peroxide and oxygen, or between hydrogen and oxygen, or between oxygen and ozone is possible only by exchanging the sensor heads. But if a change between ozone, H_2S, hydrogen or H_2O_2 is requested, a second sensor electronic device is necessary.

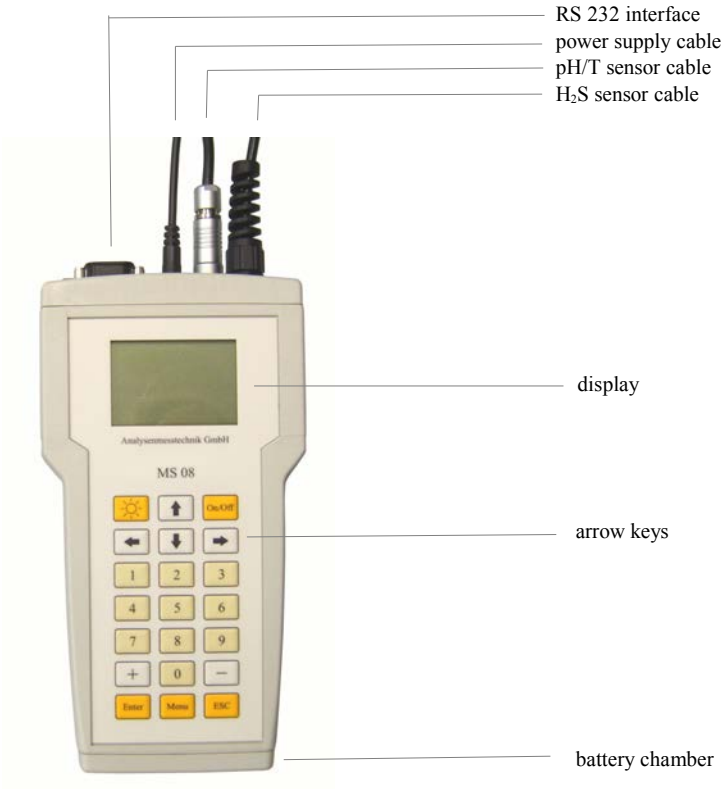


Fig.1: measuring system, standard equipment

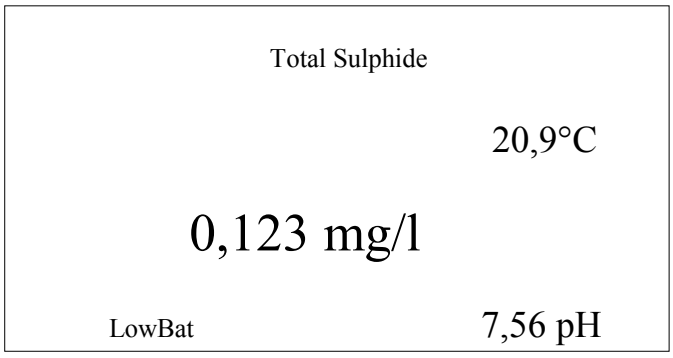


Fig. 2: Typical display of the measuring device (Total Sulphide amount measurement)

In the first line from above is visible the analyte, which has to be determined (ozone, oxygen, total Sulphide, H_2S), or alternatively the measured sensor current (instead of the analytes name "current" is visible). Next to it at the right edge of the display the actual measured temperature is shown in "Degrees Celsius -°C".

In the second line of the display is indicated the concentration in "mg/l" or the saturation in "%" (only for oxygen) or the current of the chemical sensor with the unit "pA" (picoampere).

At the bottom of the display right is indicated during measurement of the analyte "Total Sulphide" the topical pH-value or, when measuring the oxygen amount "Oxygen" the topical salinity value, which has typed in before starting with the measurement.

Furthermore you can see at the display "LowBat". The meaning is explained below in chapter 3.1 "General operating instructions".

3 Operation

3.1 General Operating Instructions

The Multi-sensor Measuring System is operated only by means of the numeric keyboard. After switching on the instrument starts with the last used sensor data and adjustments (e.g. as in fig. 2).

The operation of the measuring device is *menu driven* and self explaining in essential parts. All permanent changes in adjustments have to be "entered". Corrections are possible by pressing "Esc".

The measuring device contains **not an automatically sensor identification !** This means, that all stored calibration data and the measuring analyte have to be selected before starting with new measurements, if the measuring mode/sensor has to be changed. The last used sensor and the calibration data have been stored, so that these data will be visible again after a new start. **Please take care, that the topical adjustments and the right sensor have to be checked/selected very carefully immediately before starting with measurements !**

The display of the measuring device may show after switching on and/or during the measurement the following:

"LowBat"

If "LowBat" is displayed, the 6 mignon batteries are discharged in the Multi-sensor measuring device (approx. every 24 hours depending on quality of batteries). When exchanging these batteries, please switch off the measuring device first with "On/Off". Now you can open the battery case by simultaneously pressing the small buttons on the sides of the instrument. Now exchange the batteries and take care on correct polarity of the batteries. Press on the battery cover to close the instrument.

3.2 Putting into operation

Before putting into operation make sure, that only the delivered power supply unit is used. Other power supply units may damage the instrument.

This is not covered by the guarantee. If you should use batteries, make sure, that the batteries are not discharged in order to avoid a later interruption during your measurements.

Before putting into operation, please realize all cable connections. Please check always before every diving of the sensor into the probe, if the connection between sensor head and sensor housing is really waterproof. Otherwise water could destroy the sensor and/or the electronics. In this case the repair is not covered by the guarantee.

Pay your attention also to the waterproof connection between the micro-sensor respectively. the additional sensors (pH/ temperature) on the one side and the cable on the other side.

It is recommended, that both the micro-sensor and the additional sensor have the sensitive tips on one level. For adjustment please use the clamp.

For putting into operation of the measuring device please press the key **"On/Off"**.

3.3 Description of the menu items of the measuring program

3.3.1 Key description

On/Off

Switching on of the measuring device is realized by pressing the yellow key **"On/Off"**. The measuring signals of the sensors are renewed at the display every 1-2 seconds. Please take note, that the measuring device uses the last stored data for the calculation and display (sensor, analyte, calibration data, ...). If you are interested in correction of data, please press once **"Menu"**.

Pressing **"On/Off"** switches the measuring device off.

←	↑	→	↓

With these arrows you can click through the menu.

Menu

If you press **"Menu"**, the main menu of the measuring menu is called. After pressing this, the submenus are visible step by step as card-index box. You can select menu items using the right arrow key or the key **"Enter"**. If you want to adopt **numeric** inputs, you have to press **"Enter"**.

✸

With this key you can switch on and off the background lighting of the display.

Enter

All the data, which are not accepted automatically, have to be confirmed by pressing **"Enter"**.

3.3.2 Description of the menus

The measuring program is divided into the following menus:

Display	Display
	Sign
Sensor	Select
	Store
	Delete
Cal	Res. Current
	Slope
	Et
	pH
	AD-Channels
Special	Analyte
	Run

To reach these menus, please press after switching on the measuring device (**"On/Off"**) the key **"Menu"**. By means of the arrows ← or ↑ or → or ↓ you will reach the requested menu. For adopting the adjustments you have to choose **"Special"** followed by **"Run"** and confirm by pressing **"Enter"** or →. Attention: If you leave the menu by pressing the button **"Esc"**, all the inputs are lost.

1. "Display"

In the menu **"Display"** you can choose, which kind of display should be visible. For instance you can choose between the display of a concentration in mg/l, saturation in % (only in case of oxygen) or sensor current in pA. Furthermore an exchange between single and sum parameters (e.g. H_2S, total sulphide amount) is possible too. For changing the display please act as follows:

Press **"Menu"** and use the arrow keys to move to **"Display"**. Confirm the input with **"Enter"** or **→.** The arrow keys are also useful to move further to **"Concentration"** (= concentration) or **"Saturation"** (saturation) or **"Current"** (= current) or **"H_2S"** (= H_2S) or **"Total Sulphide"** (= total sulphide amount). Please press after this **"Enter"** (or →) and move to the menu **"Special"**. Use now the arrow ↓, to change to **"Run"** and press **"Enter"** (or →). Now the devices software takes over the new adjustments and the display shows now current or concentration values.

2. "Sensor"

In the menu **"Sensor"** happens the selection of an already stored sensor (with "Select"), the storage of the calibration coefficients with a number between 1 and 10 (with "Store") or the delete of an old sensor (with "Delete").

To move from the measuring mode to the menu **"Sensor"**, press **"Menu"**, use the arrows ↑ ↓ to move to the menu **"Sensor"** and use **"Enter"** or **→.** By means of ↑ or ↓ you can choose **"Select"**, **"Store"** or **"Delete"** followed by confirmation with **"Enter"** or **→.**

3. "Cal"

The menu **"Cal"** has been developed for the input of the calibration coefficients of the sensors. In case of using a pH-combined electrode, the calibration of this electrode is done in this menu.

If you move to **"Cal"**, a submenu is opened which depends in its structure on the selected analyte. Make your inputs step by step in the shown sequence and confirm with **"Enter"**. But do never use the menu "A/D-Channels".

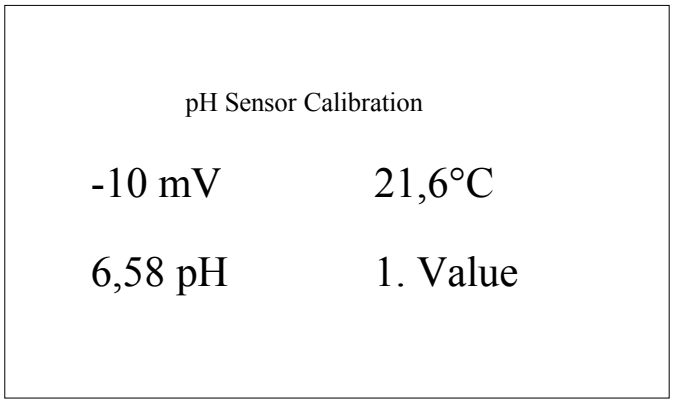
Attention ! It's not allowed for customers to change inputs in the menu "A/D-Channels".

"Residue Current"	In this menu the residual current of the sensor has to be entered. This residue current has to be determined always in liquids (never on air), which does not contain the analyte to be determined. This requires to activate the submenu "Display" and "current" (see also 1. of this chapter) before starting.
"Slope"	Feed in the sensors slope at 20°C (=a20) by means of the alphanumeric key-board. This coefficient you will also find on the sensors calibration sheet, if a calibrated sensor has been ordered.
"Et"	"Et" is the sensors temperature correction factor, which has been determined practically just before delivery, provided that a calibrated sensor has been

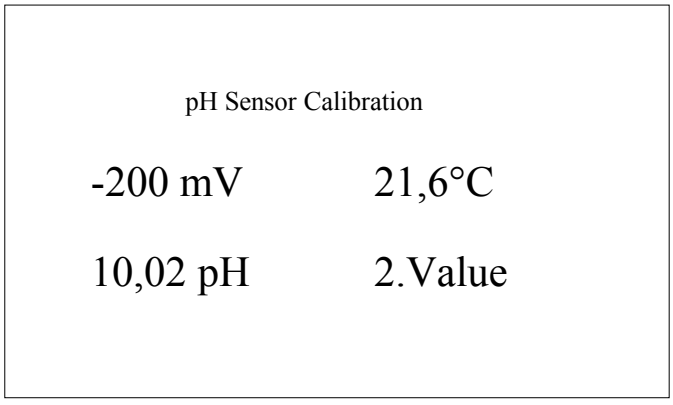
ordered. Therefore for every sensor exists a specific equation with the variable factors $a_{0...3}$. The values for $a_{0...3}$ you will also find at the sensors calibration sheet (below, right in the formula). Feed in these coefficients in the designated lines and confirm every a coefficient with "Enter".

"pH"

Some analytes need as auxiliary parameter the pH value. For this purpose a pH-combined electrode can be used, which can be integrated into the clamp. The calibration of the pH sensor is possible by means of the measuring device in the menu **"Cal"**. Have you selected an analyte requiring a pH measurement (e.g. total sulphide = total sulphide amount), in the menu **"Cal"** exists a submenu **"pH"**, which you can reach by means of the arrows. After this press now **"Enter"**. The display shows now "ASY" (for asymmetry) and S25 (slope of the electrode at 25°C). If you are only interested in looking to the values of ASY and S25 without changing anything, please press now the key **"Esc"** or select **"Cancel"** followed by pressing **"Enter"** to return into the **"Cal"** menu.
If you select **"Reset"** the instrument adopts the standard values for ASY and S25.
If you are interested in a new calibration, please select **"New"** and dive in the pH sensor into the first buffer solution. Now follows a display like:



Now please wait for the adjustment of "mV" and temperature. Correct by means of the arrows ↑ or ↓ the pH until the value has reached the pH from the bottle with the buffer (please consider the temperature). Afterwards press **"Enter"**. Now the following picture is shown:



Rinse the pH sensor carefully with distilled water and dive in the sensor afterwards into the second buffer. Wait again for the adjustment of "mV". Correct by

means of the arrows ↑ and ↓ the pH until the value has reached the pH from the bottle with the buffer (please consider the temperature). Press now **"Enter"** to store the calibration and to return into the main menu. If you want to check the values for ASY and S25 please act as described above.

Practical information: Please use two different buffers with a minimum pH difference of 3 pH for calibration. The pH value, which is expected later in your sample, should be in the middle of the two calibration solutions.

If during the calibration the display shows values far away from the required value please press **"Esc"** and start a reset as described above.

"Salinity" In case of the dissolved oxygen determination in "mg/l" the salinity has to be considered for the calculation. The salinity value has to be determined with a separate measuring device. Please feed in the salinity value with the unit ‰ (per mill) in the submenu **"Salinity"** and confirm with **"Enter"**.

4. "Special"

In the menu **"Special"** you can choose the analyte (oxygen, ozone or total sulphide) when pressing **"Analyte"** and **"Enter"** followed by the selection of the analyte by means of the arrows ↑ ↓.

Beyond it, in this menu it is possible to store all adjustments typed in before with **"Run"** followed by **"Enter"**.

3.4 Accessories and function extension

The measuring system consists of different components, which can be added step by step if required. This allows customers to find an optimised solution for their analytical problems. Additionally applications become possible by ordering further components at any time.

RS 232 Interface

If you want to connect the Multi-sensor measuring instrument to a PC, you need a null modem cable. This is not included in the standard delivery. Then you can use your own software which is able to read out and store text from the RS232, for example the Hyperterminal program in case of Windows-based PCs. During measurement an ASCII string dataset is transmitted every 2 seconds. After this the data can be imported easy into any well-known calculation programs like Lotus 1-2-3 or Excel).

The RS 232 protocol is as follows:

Baudrate: 9600 bits
Databits: 8
Parity: none
Stop bit: 1

Protocoll: none

4 Maintenance

To save battery capacity you should switch on the device only, if you want to measure. Take care, that the batteries have enough capacity before starting with your measurement. Please read again the chapter 3.1 general operating instructions. Please keep in mind, that some sensors may be damaged irreversible, if the sensors are used for measurements with discharged batteries. The same is valid, if the cable connections are not correct and the sensors are dived into the analyte.

Please read additionally the remarks for the sensors in chapter 5 "Description of the $H_2S/H_2O_2/O_2/O_3/H_2$ micro-sensors special features".

If the non-compliance with this instructions leads to a fault, the repair is not covered by the guarantee.

Do not forget to rinse the sensors very carefully with destilled water after the measurements have been finished **and before switching off the measuring device**.

In case of using batteries prevent a damage of the measuring device because of a leakage of the battery. For long time storage we recommend to remove the batteries.

Protect the measuring device against water and against aggressive chemicals !

A P P E N D I X

5 Description of the micro-sensors special features

Amperometric O_3-micro-sensor

5.1 Preface

The determination of dissolved ozone in aqueous solutions is difficult due to the high chemical reactivity of ozone, especially in trace amounts. It is nearly impossible to avoid any loss of analyte during sampling, even though working very carefully. Gas-liquid-equilibriums and the very fast chemical reactions with other compounds (ozone is a strong oxidant) lead to a fast loss of the analyte in the liquid phase and therefore to uncertain measuring results.

The amperometric ozone micro-sensor has been developed for the analysis of ozone containing, aqueous samples. The main advantages of this micro-sensor, compared with the other commercially available analytical systems are: high economic efficiency, low detection limits, low analyte consumption, fast response times and high local and signal resolution. Because of the low analyte consumption the sensors membrane has not to be streamed, so that sample stirring is not necessary.

The laboratory sensor with integrated electronic device contains an exchange sensor head to allow the exchange after the sensor has reached the life time and to exchange between ozone and O_2 sensor heads, if the customer is interested in.

The perfect functioning of the amperometric ozone micro-sensor can only be ensured, if the user observes the safety precautions as well as the specific safety guidelines stated in the present operating instruction.

5.2 Technical data*)

Ozone laboratory sensor with integrated electronic device:

- ☞ measuring principle: - membrane covered, amperometric micro-sensor
  - 3-electrode technique
- ☞ separation of the sensors electrolyte from the sample by means of a very thin permeation membrane which is only permeable for gases
- ☞ integrated electronic device for provision of polarization voltage
- ☞ sensor housing made of titanium, pressure stability: 10 bar
- ☞ titanium protection cage (no warranty in case of broken glass !)
- ☞ measuring range: 20 µg/l…10 mg/l ozone
- ☞ streaming of the membrane or stirring of the analyte is not necessary
- ☞ the sample is in contact with the materials glass, silicone and titanium
- ☞ accuracy of the sensor: ± 2%
- ☞ response time $t_{90\%}$: < 4.5 seconds, $t_{100\%}$: < 9 seconds
- ☞ temperature range for measuring and storage: 0°C ... 30°C
- ☞ polarization time: 5-10 minutes (depends on breaks)
- ☞ average life time: 5 ... 10 months, depends on kind of sample and on ozone stress
- ☞ sensor slope drift: continuously, approx. -20% in 6 months
- ☞ further features: high local and signal resolution
- ☞ cross sensitivities: not observed in case of oxygen and chlorine; signal may be influenced by hydrogen peroxide, if the concentration is higher than 2% H_2O_2

*) Changes for technical improvement are reserved.

5.3 Preparation and measurement

5.3.1 Putting into operation, Determination of the residual current

Please check up the link between the sensor head and the housing **always before every putting into operation**. This link has to be absolutely watertight. If the sensor was immersed into a solution without correct interfacing, the sensor and/or the electronic device may be damaged. In this case the repair will not be covered by the guarantee.

Before putting into operation, please realize all cable connections as described in chapter 3.2 of this operating instructions and switch on the measuring device with **"On/Off"**. The sensor starts the polarization automatically. The polarization has been finished after some minutes. After this the sensor is ready for use. But before starting with measurements you have to determine the residual current in ozone-free water (never on air). Store this residual current by pressing **"Menu"**, moving to the sub-menu **"Display"** and confirming with **"Enter"** (or use the arrow key →). Please use again **“Enter”** or the arrow key → and change using the arrow keys ↓ and ↑ to the display **"Current"**. Confirm again with **"Enter"**. Move by means of the arrows to the menu **"Special"** and press **“Enter”**. Go to **"Run"** and confirm again with **"Enter"**. Observing the display of the measuring device you can wait for the adjustment of the residual current. Please write down this value.

After the residual current is adjusted, please store by choosing **"Menu"** - **"Cal"** and confirm with **"Enter"**, select **"Res. Current"** and confirm (**“Enter”** or key →). Type in the measured residual

current with the correct sign by means of the numeric keyboard and press again **"Enter"**. After this please type in too the other delivered calibration data, such as **"Slope"** (= sensor slope $a_{20°C}$) and **"Et"** (temperature correction coefficients $_{a0...3}$). If a calibrated sensor has been ordered, you will find $a_{0...3}$ and $a_{20°C}$ at the enclosed calibration sheet.

To store all these adjustments please move to **"Special"** followed by **"Run"** and confirm with **"Enter"**. You will return automatically to the measuring mode.

As the last step of the preparations you can change from current display to concentration display. For this choose **"Menu"** - **"Display"** - **"Enter"**, use the arrows to move to **"Ozone"**, press again **"Enter"** and store by choosing **"Special"** - **"Run"** and again **"Enter"**.

Now you can start with your measurements.

5.3.2 Measurement

Measurements are possible in flow through systems with the AMT flow through cell or *in-situ* by immersing the sensor into the analyte solution (in-situ measurements):

1. in-situ measurement

Immerse the sensor/sensor tip into the solution and read the concentration at the display. Make sure, that the measuring device uses the correct sensor data. This includes, that the temperature sensor is placed on the correct point to ensure that the concentration is calculated accurately. If you have to dismount the clamp with temperature and ozone sensor, please make sure, that the temperature sensor shows the same temperature as in the near of the ozone micro-sensor tip (you can simulate this of course).

2. flow through measurement

Insert the sensor into the flow through cell (please order extra) in a manner, that the long hole of the micro-sensors protection cage is across the fitting at the side of the flow through cell. If the O-ring is lost in the flow through cell, the seal is sufficient. Connect now the tube with the analyte solution with the tube on the bottom of the flow through cell, so that the sensor is streamed directly. Put the other tube end of the flow through cell into a waste. Now start slowly with pumping the solution through the cell. As flow rate we recommend 1-5 ml/min. When filling the flow through cell the first time, take care, that no gas bubbles are enclosed in the flow through cell. Therefore turn round the flow through cell for some seconds, so that the solution output is up. Please take not, that because of adsorption/desorption equilibriums at the vessel and tube walls and because of the high chemical reactivity of ozone, it takes some minutes for an adjustment of the steady state. This adjustment time depends on the ozone concentration, on the flow rate and on the measuring breaks. A general rule is, that you have to change the volume of the cell 5 times until the adjustment. In case of trace amounts it may take some more time.

5.3.2.1 Calibration

Fundamental

For accurate measurements an accurate calibration is required. The frequency of calibration depends

on the demands concerning accuracy and on the ozone stress. We offer the calibration as service by means of an electrochemical generator for the on-line generation of dissolved ozone standard solutions. Apart from this, every delivered new sensor is calibrated, provided that a calibrated sensor was ordered. A check up of the calibration/sensor slope is recommended after approximately 120 measuring hours, or after long breaks of some weeks.

If you have been ordering a calibrated sensor, you will find at the end of this brochure the sensor slope $a_{20°C}$ and the factors for the temperature compensation (E_T).

If your sensor is not calibrated, first you have to determine the sensor slope $a_{20°C}$ before starting with measurements. In addition - if it's not possible for you to calibrate at the measuring temperature, the temperature correction factors (E_T) for your special temperature range have to be determined. For that purpose it is recommended to put the sensor into a flow through cell (available from AMT) and pump slowly (1...5 ml/min) an ozone-solution through the cell. If the flow through cell is immersed completely into cold water or ice water - a slow increase of temperature is realised and you can read the value at every temperature for a constant concentration at the display. After this a simple calculation of E_T is possible.

Calibration

- insert the sensor into the flow through cell (please order extra)
- connect the tube with the analyte solution with the tube at the bottom of the flow through cell, so that the sensor is streamed directly
- put the other tube end into a waste bottle
- pump the solution through the cell (recommended: 1...5 ml/min)
- read about 5 different current-concentration pairs (within the range 0...400 pA)
  Do not forget to subtract the residual current from the measured current !
- read the value for the temperature of the solution
- calculate the slope at the measuring temperature (mg/l : pA = a_{Tm} after linear regression
- use the correct E_T (= temperature correction factor according to the enclosed table or to the determined E_T's)
- calculate the $a_{20°C}$ - value by means of equation 1:

$$a_{20^\circ C} = \frac{a_{Tm}}{E_T} \qquad (1)$$

a_{Tm} = sensor slope at measuring temperature; $a_{20°C}$ = sensor slope at 20°C.

For a check up of the sensor slope $a_{20°C}$ act as described before.

5.3.2.2 Temperature dependence

Every electrochemical sensor shows a dependence of temperature. That means, that the sensor signal changes with temperature changes too, although the concentration is still the same. The amperometric ozone sensor works at temperature ranges of 0 ... 30°C. Please note, that temperature changes of some degrees may lead to some short troubles caused by equilibrium interferences inside the sensor. In this case please wait some seconds and go on after a new adjustment. The temperature has to be measured or has to be known for every ozone determination.

If a calibrated sensor has been ordered, for every temperature you will find a temperature correction factor (E_T) on the last page of this operating instructions. At this calibration sheet you will also find a

mathematical equation with the coefficients $a_{0...3}$, which you have to type into the menu item **"Cal" - "Et"** if this has not been done already by the manufacturer the first time.

5.3.2.3 Errors and troubles during measurements

If the sensor is used as described before and, if the sensor is not stressed with H_2 without polarizing the sensor, there should be no trouble during measurements.

But if it is observed, that it takes the sensor much too long for adjustment of the residual current (more than 15 minutes without any traces of ozone around the sensor tip), this is caused by the fact, that ozone has passed the sensor membrane without polarizing the sensor. Another characteristic after long ozone uptake is an essential higher residual current.

Caused by natural aging the sensor slope decreases within the sensors life. Therefore we recommend calibration intervals depending on the demanding of accuracy.

If the sensor is used for *in-situ* measurements, do not forget to check up the link between sensor head and sensor housing (waterproof ?) and sensor housing and cable before starting with measurements. This is necessary after long breaks and of course after exchange of the sensor head. If water comes between sensor/sensor head and/or sensor/cable, this may lead to short circuits of the electrodes and may destroy the sensor or its electronic device. Nevertheless, if this has happened, the sensor should be stored and dried on air (not in a drying device, no more than 30°C). Please check the residual current from time to time and decide, if the sensor could be used again.

Although the sensor contains an integrated electronic device to minimize influences caused by electric fields and magnetic effects, some smaller troubles may appear occasionally in the near of strong magnetic or electric fields. If these troublemakers are well known, please switch off them if possible. Please note too, that measurements in air or in other gases are impossible because the signals become very unstable caused by the moist sensor tip.

Most of the "troubles" during measurements are not caused by the sensor itself, but more by the high reactivity of ozone solutions. Some “troubles” are due to the fact of inhomogeneous solutions (e.g. concentration gradient in beakers, etc.). Please avoid too the existence of a gaseous phase above your analyte solution.

Inhomogeneous standard solutions may also lead to rapid changing concentrations and of course to rapid changing measuring values (visible only because of the very fast response time of the micro-sensor).

Please take note, that when rapid changing temperatures are observed, the sensor is shocked for some seconds (warm to cold leading to fast decreasing signals, negative values are possible !; cold to warm leading to fast increasing signals). It will take the sensor now some minutes to return to the real value because the equilibriums inside the sensor adjust again.

5.3.2.4 Switching off

After measurements have been finished, rinse off the sensor tip with distilled water. Dive in the still polarized sensor with its sensor tip for 5 minutes into a ozone free solution (e.g. distilled water). Check up by means of the display, if the sensor has reached again a concentration value of around 0,000 mg/l (or around its starting residual current if the current display is used). If necessary, rinse the sensor again with destilled water. Now you can pull off the flow through cell, if it has been used. Now you can switch off the measuring device with **"On/Off"**. If requested, now you can also disconnect the cables.

Attention ! If ozone permeates through the membrane without polarizing the sensor, a decrease of the sensor's slope and signal resolution may appear. A damage of the sensor is also possible ! Repair work caused by this is not covered by the guarantee !

5.3.2.5 Exchange of sensor heads

This sensor allows a very simple exchange of the sensor head. But not only ozone measurements are possible. If you order an AMT-oxygen-sensor head too, you have the possibility to change between ozone and O_2 sensor tip without any new electronic or mechanic adjustments.

For exchanging the sensor tip, please act as follows:
Dry the sensor (**Do not touch the glassy sensor tip !**) first some minutes on air. Pull off the old sensor head (not screw !) carefully and avoid the get in of water into the plug and socket. Plug in the new sensor head considering that the red points on plug and socket are faced each other. Take care that there is a noticeable click in to place. Otherwise there is a danger of get in of water (sensor may be damaged !) leading to a loss of guarantee.

5.4 Maintenance

Mechanical stress of the sensor body and of the sensor tip, especially cross forces have to be avoided. That's why the sensor body is protected by a titanium safety cap with three holes. Do not twist off this cap during measurement !

But if a twist off is requested still, this is possible without warranty and on your own risk as well as measurements in sediments or mud.

The integration of the sensor or the measuring device into other measuring systems is possible only by one's own risk. There is no warranty for electrical and mechanical damages.

The sensor is maintenance-free, if it is carefully rinsed with distilled water after every measurement. But you should store the sensor protected, if it is not used for a longer time. Make sure, that no ozone or vapours of organic compounds can permeate into the sensor.