

# **Multi-sensor Measuring Instrument MS 08 for H<sub>2</sub>S/H<sub>2</sub>O<sub>2</sub>/O<sub>2</sub>/O<sub>3</sub>/H<sub>2</sub>/pH/temperature**

**- Operating Instructions -**



 **daphic scientific**  
leaders in the science of light, gas & water

Edaphic Scientific Pty Ltd

[www.edaphic.com.au](http://www.edaphic.com.au)

[info@edaphic.com.au](mailto:info@edaphic.com.au)

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# 1 Preface

The battery-operated Multi-sensor Measuring System has been developed for the determination of the analytes H<sub>2</sub>S/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<sub>2</sub>S, 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<sub>2</sub>S-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<sub>2</sub>S-/H<sub>2</sub>O<sub>2</sub>-/oxygen sensors, oxygen/hydrogen and between oxygen/ozone sensors. This means, that a change between the determination of H<sub>2</sub>S 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<sub>2</sub>S, hydrogen or H<sub>2</sub>O<sub>2</sub> is requested, a second sensor electronic device is necessary.

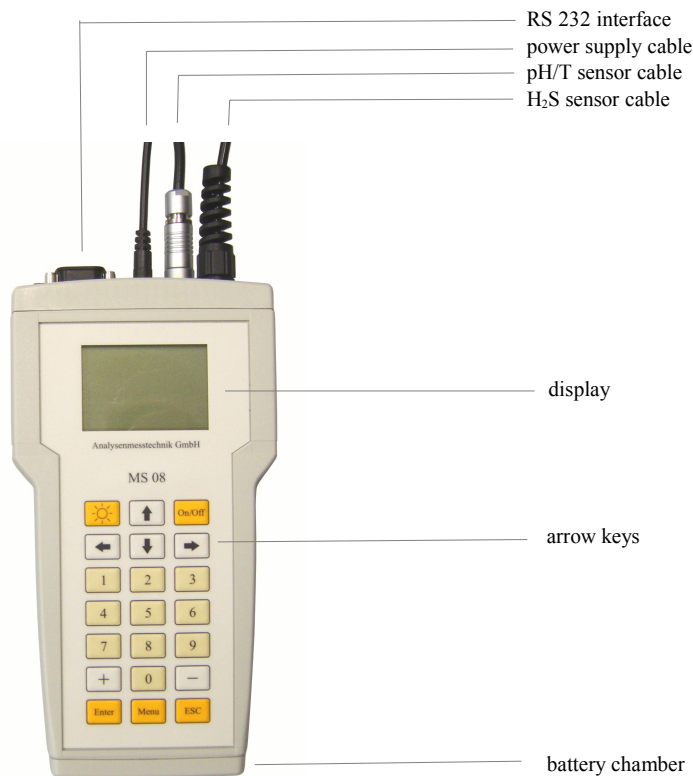


Fig.1: measuring system, standard equipment

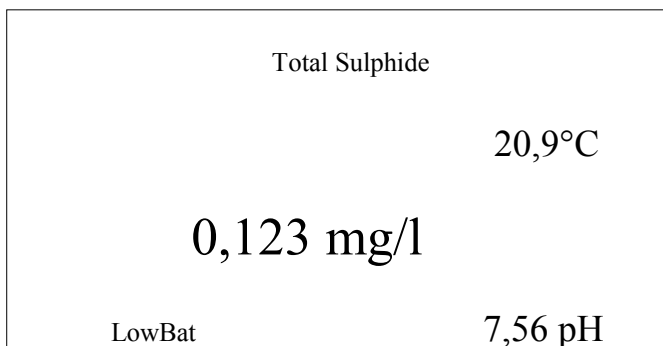


Fig. 2: Typical display of the measuring device (Total Sulphide amount measurement)

In the first line from above is visible the analyte, which has to be determined (ozone, oxygen, total Sulphide, H<sub>2</sub>S), 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.



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.



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:

<b>Display</b>	Display
	Sign
<b>Sensor</b>	Select
	Store
	Delete
<b>Cal</b>	Res. Current
	Slope
	Et
	pH
	AD-Channels
<b>Special</b>	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<sub>2</sub>S, 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<sub>2</sub>S" (= H<sub>2</sub>S) 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 keyboard. 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



"pH"

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".

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:

pH Sensor Calibration	
-10 mV	21,6°C
6,58 pH	1. Value

Now please wait for the adjustment of "mV" and temperature. Correct by means of the arrows  $\uparrow$  or  $\downarrow$  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:

pH Sensor Calibration	
-200 mV	21,6°C
10,02 pH	2.Value

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  $\uparrow$  and  $\downarrow$  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  $\uparrow$   $\downarrow$ .

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 irreversibly, 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<sub>2</sub>S/H<sub>2</sub>O<sub>2</sub>/O<sub>2</sub>/O<sub>3</sub>/H<sub>2</sub> 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 distilled 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**