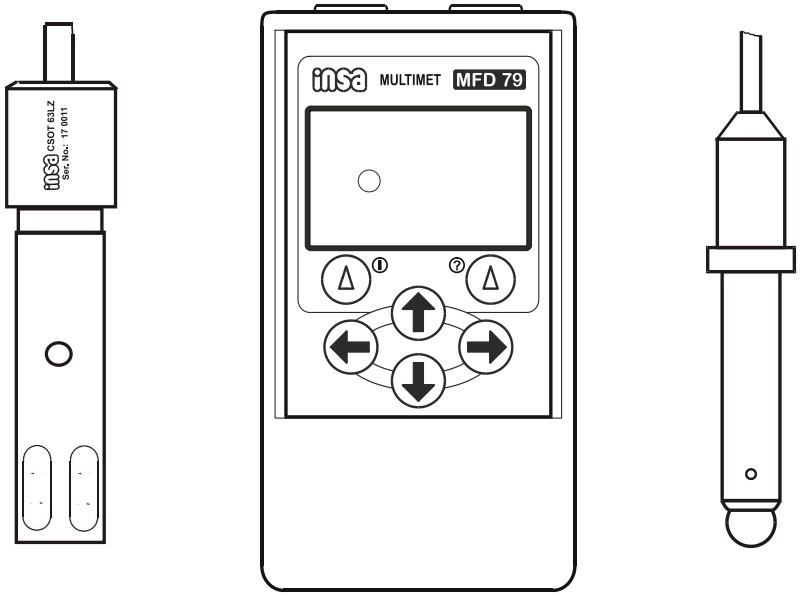
MULTI-PARAMETER METER

MFD 79OPTO



Operating and maintenance instruction manual

insa s.r.o. Zelenečská 3, 198 00 Praha 9
Tel. +420 2 8186 7488, Fax +420 2 8186 9508
e-mail: info@insa.cz, http://www.insa.cz

▪ CONTENTS

▪ EXPLANATORY NOTES

In this manual, following signs are used:

Ignoring of this warning can lead to a damage of instrument or to a wrong measuring (control).

Ignoring of this warning can lead to an irreversible damage of instrument, of technological equipment or to a health jeopardy.

Information, how to dispose of waste

The frame highlights the symbols of control keys.

1. RANGE OF APPLICATION

The Multiparameter meter MFD 79OPTO enables the measuring of pH value, ORP, oxygen concentration and temperature in the laboratory, in technological plants as well as in the field.

For the measuring of pH 61K-S and pH 69K-S electrodes can be used, for ORP measurement Pt 61K-S sensor For the measuring of oxygen concentration, the sensors CSOT 53LZ-S must be used. The part of the oxygen sensor CSOT 53LZ-S is also a temperature sensor (-4,0 to 40,0°C). As long as you measure the oxygen concentration and the temperature, only, no other sensor is necessary. The temperature, measured by the thermistor of the oxygen sensor, can also be used for the correction of the temperature dependence of the pH electrode.

The instrument is equipped with a memory block for storing of approximately 700 measured values. Time information of recorded values is relative only.

For display of measured values and for communication with the operator, an graphic display LCD is installed.

The instrument is supplied either from two AA batteries or two AA rechargeable batteries.

▪ 2. DELIVERY SIZE

The delivery consists of the meter MFD 79OPTO.

Parts of the delivery are further:

- **Short form of operation and maintenance manual** **1 pc**
- **AA battery** **2 pc**

Optional accessories:

- **Transport case TB 03**

Sensors:

- **Optical oxygen and temperature sensor CSOT 53LZ-S - sensor in protective sleeve, convenient for field measuring**
- **pH sensor pH 61K-S**
- **pH sensor pH 69K-S (pH sensor with temperature sensor)**
- **ORP sensor Pt 61K-S**

Spare parts

- **Membrane Head MH 21 O2L**
- **Sealing ring Φ10x1,8**
- **pH/ORP electrodes cover CPH 1**
- **pH/ORP electrodes preservation solution**

▪ 3. SAFETY PRECAUTIONS

The MFD 79OPTO meter was fabricated and tested according to ČSN EN 610 10.

For a safe operation of the instrument, use only the recommended sensors and observe following instructions:

Use only the original net adapter delivered with your meter. Otherwise, you may risk a damage of the instrument or electrical accident to persons. Keep the connecting cable of the net adapter clean and undamaged. Avoid its damage by aggressive agents, high temperature or mechanical effects.

The instrument contains batteries. Exhausted batteries remove from instrument and liquidate by prescribed way.

The instrument must not be used for other reasons then those, it was manufactured for.

The instrument must not be voluntarily modified.

Any repairs of the instrument only a workplace, authorized by the manufacturer, may perform.

The instrument must not be operated in environments, which do not guarantee a safe operation, e.g. in a hazardous area containing vapours of inflammable liquids or a flammable dust.

The instrument must not be exposed to a temperature higher than 50°C. At higher temperatures, the damage of batteries and consequently even an irreversible damage of the whole instrument is imminent!

If the user wouldn't respect some of the above mentioned warnings and if in a casual connection with this a damage would occur, the manufacturers liability is excluded.

- **Certification**

The company imsa s.r.o. confirms, that this instrument was thoroughly fully tested and was in accordance with all specifications, mentioned in this manual, when dispatched from the factory.
The meter **MFD 79OPTO** was tested according to following standards:
ČSN EN 61010, ČSN EN 25814, ČSN EN 61187, ČSN EN 61010-1, EN 50082-1, light industry category, ČSN 55011-1, light industry category

▪4. INSTRUCTIONS FOR PUTTING INTO OPERATION

4.1. INSTALLATION OF THE BATTERY

The instrument is powered from two AA batteries or rechargeable batteries. Batteries are fitted in the lower rare part of the casing. We insert batteries by taking off the lid of the battery space (secured by a screw), and putting batteries in proper polarity in. Be sure that lid is fixed correct and tight.

Lifetime of batteries is approx. 700 hours (without backlight). Lifetime of rechargeable batteries is shorter. **Backlight on, reduces lifetime considerably.**

Symbol ▭ in the bottom of the display indicates almost unloaded battery and blinking symbol ▭ means that battery is practically empty.

4.2. ARRANGEMENT OF CONTROL ELEMENTS

For communication with the operator, the instrument is equipped with six keys. Their arrangement shows fig. 1.

Functions of the keys are as follows:

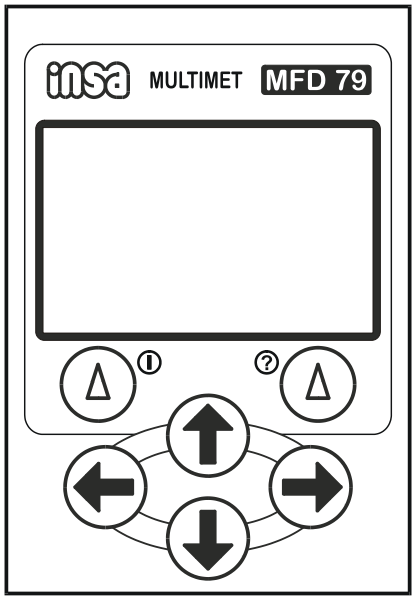


Fig.1. Control elements of the MFD 79OPTO meter

By pressing the Δ key we execute the function marked on the display above this key - MENU, BACK, CANCEL, etc. With long pressing this key (through a few seconds) we turn instrument on and off. We **turn the instrument off always from the mode measuring** (display shows measured values).

By pressing the ⓐ key we execute again the function marked on the display above this key - CALIBRATE, OK, SAVE, LIGHT ON etc. With long pressing of this key - in any mode - we raise function help to this mode.
Function of the keys ⮌, ⮍, ⮏ and ⮊ in main mode is shown on the instrument display – using these keys we choose basic modes of the instrument. In other modes by means of the keys ⮌ a ⮊ we shift choices to the left and right (with the ⮍, ⮏ keys - up and down) and/or we make constants (numbers) greater, smaller.
In the mode **Measuring** we can go by pressing ⮌ key directly to the mode calibration.
If the instrument is not in the mode measuring for time longer than 10 minutes and no key was activated, then it goes automatically to mode measuring. As long as of any reason is it not desirable, pressing of any key is necessary before elapsing of waiting time.

4.3. CONFIGURATION – SENSOR SELECTION, DISPLAY OF MEASURED VARIABLES

Prior to the beginning of measuring, we determine which variables the instrument has to measure and on which lines of the display they will be displayed.

Configuration we will make in the following way:

With long pressing – of the ⓐ key - we turn instrument on. After accomplishing of the start-up diagnostic instrument goes to measuring mode – there are measured values on the display. We press the ⓐ key again – shortly this time and we have the main menu on the display (Fig. 2). By means of ⮍ key we select **DISPLAY - ITEMS** mode and there is an overview of measured variables on the particular lines on the following display. By means of ⮍, ⮏ keys we select single lines (selected line is displayed in reverse mode) and with ⮌ and ⮊ keys we select variable which will be measured and on this line displayed. There are following variables to be selected – oxygen concentration **<mg/l>**, oxygen saturation **<%>**, pH value **<pH>**, oxidation reduction potential **<ORP>**, temperature measured by oxygen sensor **<Temp.O_2>** and temperature measured by pH sensor **<Temp.pH> (provided pH sensor is equipped with temperature sensor)**. If we select **- - - -** , the appropriate line will be empty and will not be displayed. Selection is not limited in any way. It is possible to display one variable in one line only or one variable in all lines e.g. If there are more than two variables (two lines) selected, than it is possible by pressing ⮍ or ⮏ keys to shift lines up and down. It is advisable to place empty lines on the last positions. These lines will not be displayed at all.

Oxygen we can display in mg/l and % of saturation on two lines simultaneously. After selection of oxygen in particular line we can – by pressing ⓐ (**CONFIGURE O_2**) key - go to the display on which we can adjust actual value of barometric pressure during measurement if needed.

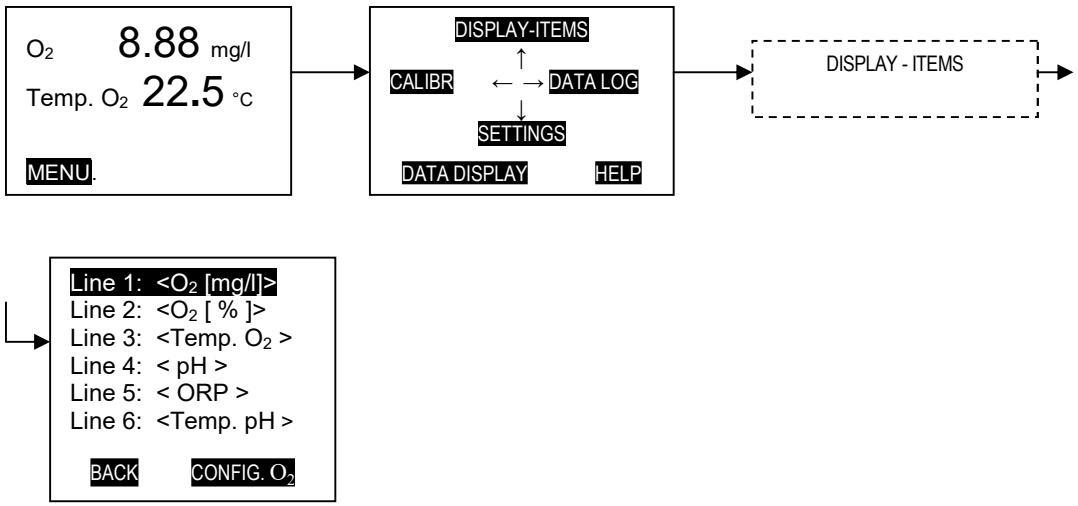


Fig.2. Configuration – sensor selection

Likewise as for oxygen we can configure pH measurement. By pressing Δ (**CONFIGURE pH**) key we go to the display on which we can choose way of compensation pH value according to actual temperature and select our ones buffers for pH calibration (Fig.3).

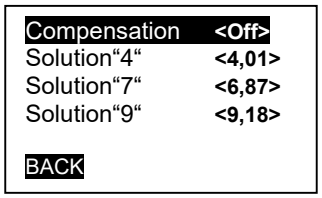


Fig.3. Configuration – pH measurement

There are tree options how to compensate pH measurement. First one is compensation by oxygen sensor (**<T-O_2 >**), second – compensation by temperature sensor of pH electrode (**<T-pH >**) and last one option is no compensation (**<Off >**) – compensation is switched off. Falls we measure pH between 5,0 and 9,0 and temperature fluctuates between 5° and 40°C we recommend to switch compensation off.

On the other lines of this display is possible to determine – by means of ⊂ and ⊃ keys – values of buffers that will be used for calibration. From the factory are preset buffers according to IEC PUB 746.2 – 4,01, 6,86 and 9,18 (25°C). To secure correct calibration we recommend using of these buffers.

4.4 CONNECTION OF SENSORS

Sensors are to be connected to the instrument as shown in the fig. 4.

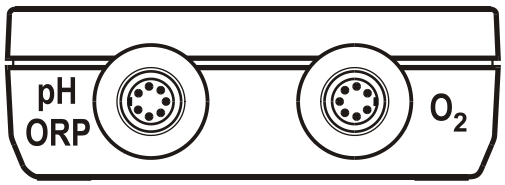


Fig.4 Connection of sensors to the instrument

It have to be used pH 61K-S or pH 69K-S electrodes for pH measurement, Pt 61K-S for ORP and CSOT 53LZ-S sensor for oxygen.

When pH or ORP sensor is before using placed in sensor cover with preservation solution 3M KCl, than we remove simply cover and we can immediately measure. But sensor is dry than we prepare for measuring so, that we immerse it into a potable water or a buffer 6,87 (7,00), for one to two hours.

The preparation of oxygen sensor CSOT 53LZ-S is described in the in the following chapter.

To maintain IP protection it is necessary to use delivered hood for unused input (connector).

4.5 OXYGEN SENSOR PREPARATION – MEMBRANE HEAD EXCHANGE

When putting the sensor into operation or replacing the worn off membrane head, observe following procedure:

If necessary clean the sensor thoroughly.

Exchange of the membrane head is extremely easy.

We simply screw the worn-of membrane head of and screw new membrane head on.

Tighten the membrane head with delicacy **but firm**. The head must fit perfectly tightly on the silicone O-ring on which it fits. If the membrane head is not tight the sensor could be damaged irreversibly.

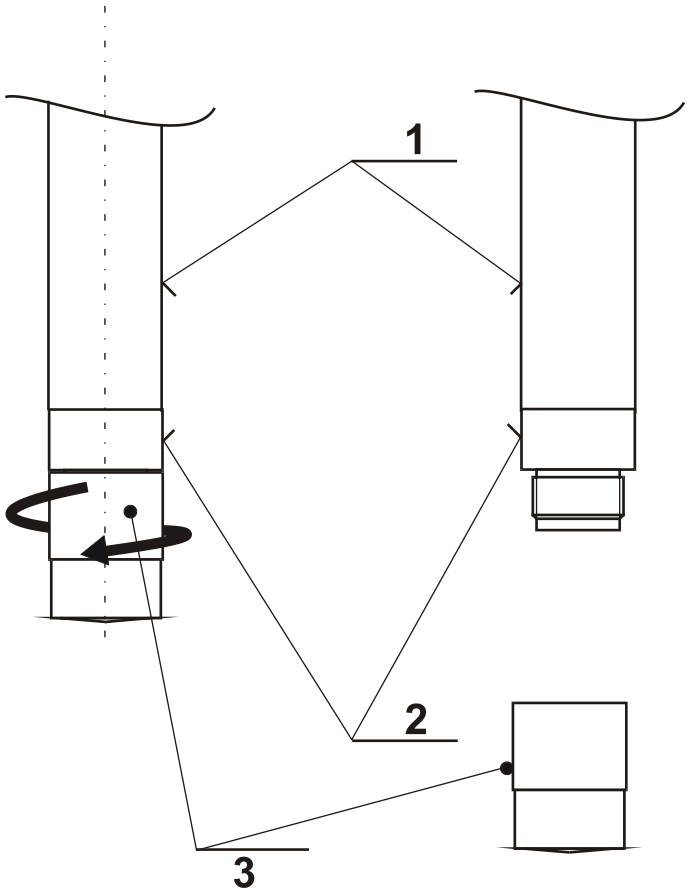


Fig.5 Sensor CSOT 53LZ-S – membrane head exchange

5. CALIBRATION

The instrument enables three methods of calibration.

- **One point calibration** (quick calibration) is an operative calibration in **one point** of those variables, where a more frequent calibration is presumed – pH and ORP. We activate this calibration by pushing the ⊂ key in the mode **Measuring** or choosing mode calibration in main menu.

  The oxygen is possible to calibrate also in this way, but oxygen measurement is practically calibration free.

- **Two point calibration is** a pH calibration in two points. We activate this calibration in the same way as one point one.

- **Service calibration** is the basic calibration, made in the factory.

5.1. CALIBRATION - pH

Steepness of the glass electrode (change of voltage of electrode cell with change of pH) is different for each electrode and alters with time. Also the zero point of the electrode (ISO pH, asymmetric potential) alters in the course of time.

Those changes, caused by ageing of the electrode, can be eliminated through calibration. During the calibration, the instrument sets the transmission constants so, that the output data (pH value on display) correspond exactly with the actual measured value.

▪ **The frequency of calibration depends only on the quality of electrodes, on the medium the electrode is working in, and on the required measuring accuracy. For each new application or a new type of sensor, it is necessary to check the frequency of calibration by a more frequent revision of measuring quality with standard solutions. The interval for calibration can be from 1x within a few hours to 1x within a few months.**

5.1.1. pH calibration – buffers

The setting of correction constants of the instrument according to the properties of the used electrodes is made by means of calibration solutions (buffers) with a defined pH.

It is appropriate to use buffers in accordance with the recommendation IEC PUB. 746.2., for the calibration. Such buffers, the manufacturer of the instrument delivers. For an orientation operational setting, other buffers can be used, as well.

It is necessary to realize, that the quality of the buffers affects the accuracy of the measuring in a crucial extent. Soiled or contaminated buffers must be rejected, immediately. The best way is to make a calibration with new buffers, always. High quality buffers must be replaced by fresh ones once in a year, at least.

5.1.2. pH calibration - procedure

We execute the setting of correction constants by means of one or two buffers with a defined pH. The two-point calibration is made by means of two standard solutions, the one point calibration by means of one solution. We make the two-point calibration, principally, when replacing the pH sensor or when we are under suspect of an incorrect function of the sensor. During a current checking, we make the calibration on the shortened way, i.e. by means of one standard solution only.

The first buffer (two point calibration) should have pH near to the zero point of the electrode (usually pH 7). The other solution (for both calibration modes) should have pH in the area, in which we will carry out the measuring (usually pH 4,01 or pH 9,18). Both solutions are to be poured into appropriate vessels, which were thoroughly washed with clean potable water, first.

For the calibration we need: buffer(s), cotton wool and distilled water or potable water.

5.1.2.1. Two point calibration

We pass into the mode **Calibration** by pushing ↶ key in the mode **Measuring** or choosing mode calibration in main menu (Fig. 6).

On the display we have an offer of measured variables for calibration. By means of ↑, ↓ and ⓐ **(CALIBRATE)** keys we select pH.

There is information **pH Calibration / 1 point (quick) >>/ 2 points (full) >>** on the display. By means of the ↓ key we select 2 points calibration and press ⓐ (GO) key afterwards. On the display we have **Choose and adjust buffer solution: / Solution „4“ <4.01> / Solution „7“ <6.86> / Solution „9“ <9.18>**. By means of the ↑, ↓ keys we select first buffer – e.g. 6.87 – (chosen line is displayed in reverse mode). We can displayed value of the chosen buffer with ↶ and ↷ keys make more precisely or even change still. We press ⓐ **(ACCEPT)** key. On the display we can read – **Wash and dry the sensor** and **Insert sensor in to buffer solution pH x.xx** (e.g 6.86). We rinse the electrode with distilled or potable water, dry slightly with cotton wool, insert it into chosen buffer and press ⓐ **(OK)** key. On the display there is information **Preview: x.xx** and **Wait for the input to stabilize**.
On the top line we can see pH value of the measured buffer, calculated according to the constants acquired during the foregoing calibration, will appear. From this value, we can see how the electrode approaches the stabilized value and how this value is far from the value of used buffer. We can also observe, whether the measured value becomes stable quickly enough. On the lower line, there is a time stamp, which informs about the time in which the instrument will read the values of the buffer. When the waiting time is over, the instrument will pick-up the measured value automatically and will shift the mode of calibration to the next step. If the electrode stabilizes more quickly, it is possible to shorten the waiting time by pushing the ⓐ **(SAVE)** key.

The instruction **Choose and adjust buffer solution** will appear on display and a calibration in the other buffer (pH 4,01 or 9,18) follows. The procedure is the same like for the first buffer.

When the calibration is ready – and if everything is in order – the information **Calibration complete** will appear on display, for several seconds, and the instrument will pass over into the measuring mode.

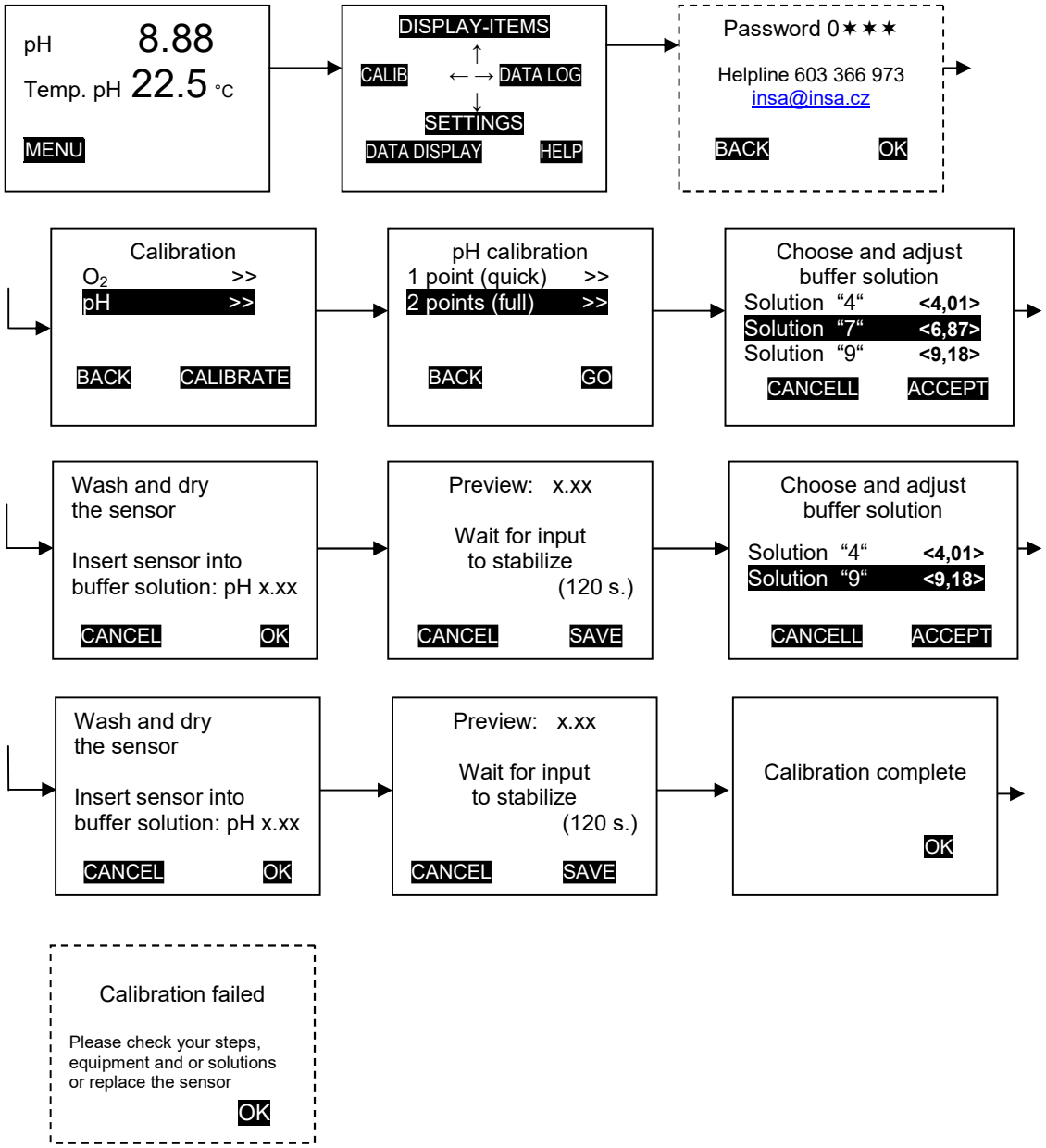


Fig.6. Two point pH calibration

5.1.2.2. One point calibration

We pass into the mode **Calibration** by pushing ↵ key in the mode **Measuring** or choosing mode calibration in main menu (Fig. 7).

On the display we have an offer of measured variables for calibration. By means of ↑, ↓ and ⓒ (CALIBRATE) keys we select pH and **1 point (quick)**

subsequently. The further procedure is identical with the one for a complete calibration in the first buffer.

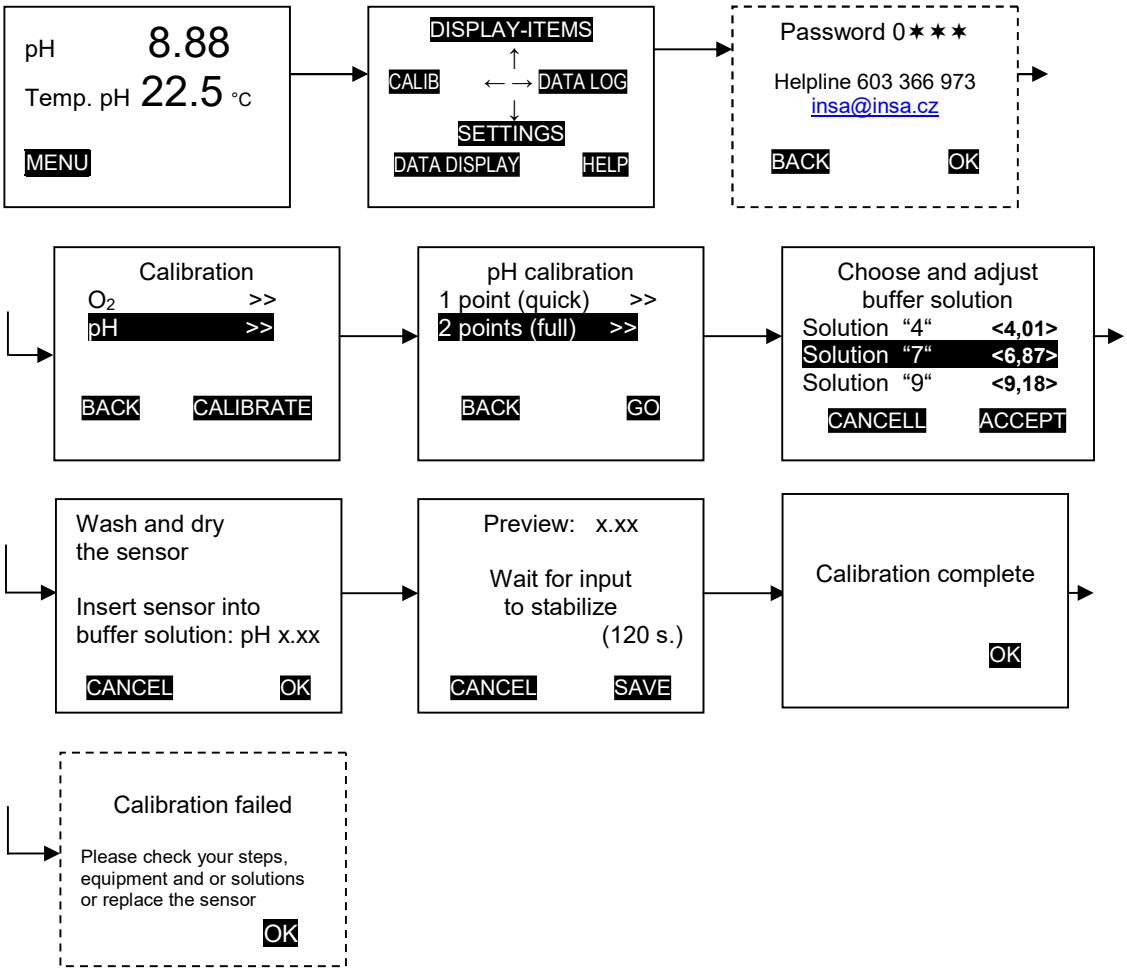


Fig.7. One point pH calibration

5.1.3. pH calibration - evaluation

The instrument evaluates automatically the constants of the sensor, acquired during each calibration, and gives information about the result of it. If everything is in order, i.e. the steepness of the sensor is in the interval 85 to 105% and the ISO potential is lower than ±90 mV, the information **Calibration complete** will appear on display and the instrument will pass into the measuring mode, automatically.

If the constants are outside of this band the information **Calibration failed** is on the display. The reason for an invalid calibration could be as follows:

The wrong buffers.

In the course of the 2.points calibration is applied – by mistake – one buffer twice.

Electrode pH (or temperature sensor) is wrong.

5.2. CALIBRATION- ORP

The ORP value is measured by means of a cell, consisting of a metallic measuring electrode and a reference (mostly argentochlorid) electrode. Due to the contamination of surfaces of both electrodes and to the ageing of the inner solutions, the properties of the cell are changing, during the operation. These changes which will appear by a shift of the zero point of the electrode can be eliminated by a calibration. During the calibration, the instrument will set the transmission constants so that the input value (ORP value on display) corresponds exactly with the really measured value.

The frequency of calibration depends on the quality of electrodes, on the environment in which the electrodes work and on the required measuring accuracy. For each new application, it is necessary to verify the calibration frequency by a more often checking of the measuring quality, using the reference solution, and to find the optimal calibration period.

5.2.1. ORP calibration – reference solution

The adjustment of correction constants of the meter according to the properties of the used electrode is to be made, by means of a reference solution with a defined ORP.

For a correct calibration, it is advisable to use the standard solution SS ORP 11, delivered by the manufacturer of the instrument. ORP potential of this solution is +225 mV **against silver/silver chloride electrode** (+432 mV against standard hydrogen electrode).

It is necessary to become conscious, that the quality of the standard solution influences the measuring accuracy in a crucial extent. Soiled or contaminated solution must be rejected, immediately. The reference solution SS ORP 11 must be replaced by a fresh one, once in 12 months, at least.

5.2.2. ORP calibration - procedure

We adjust the correction constants by means of a reference solution with a defined ORP. The solution is to be poured into a proper vessel, which was carefully washed with potable water in advance. For the calibration, we need: standard solution, cotton wool and distilled or potable water.

Easy and correct adjustment of calibration constants enables the function **Calibration**. We pass into the mode **Calibration** by pushing ⮌ key in the mode **Measuring** or choosing mode calibration in main menu (Fig. 8).

On the display we have an offer of measured variables for calibration. By means of ⮍, ⮏ and ⓐ (CALIBRATE) keys we select ORP.

.On the display we can read – **Insert sensor in to reference solution** and **Adjust value** **+225 mV**. Value of reference solution we can change at will by ⮌ and ⮎ keys. We rinse the electrode with distilled or potable water, dry slightly with cotton

wool, insert it into solution and press ⊙△ (OK) key. On the display there is information **Preview: x.xx** and **Wait for the input to stabilize**.

On the top line we can see pH value of the measured buffer, calculated according to the constants acquired during the foregoing calibration, will appear. From this value, we can see how the electrode approaches the stabilized value and how this value is far from the value of used buffer. We can also observe, whether the measured value becomes stable quickly enough. On the lower line, there is a time stamp, which informs about the time in which the instrument will read the values of the buffer. When the waiting time is over, the instrument will pick-up the measured value automatically and will shift the mode of calibration to the next step. If the electrode stabilizes more quickly, it is possible to shorten the waiting time by pushing the ⊙△ (SAVE) key.

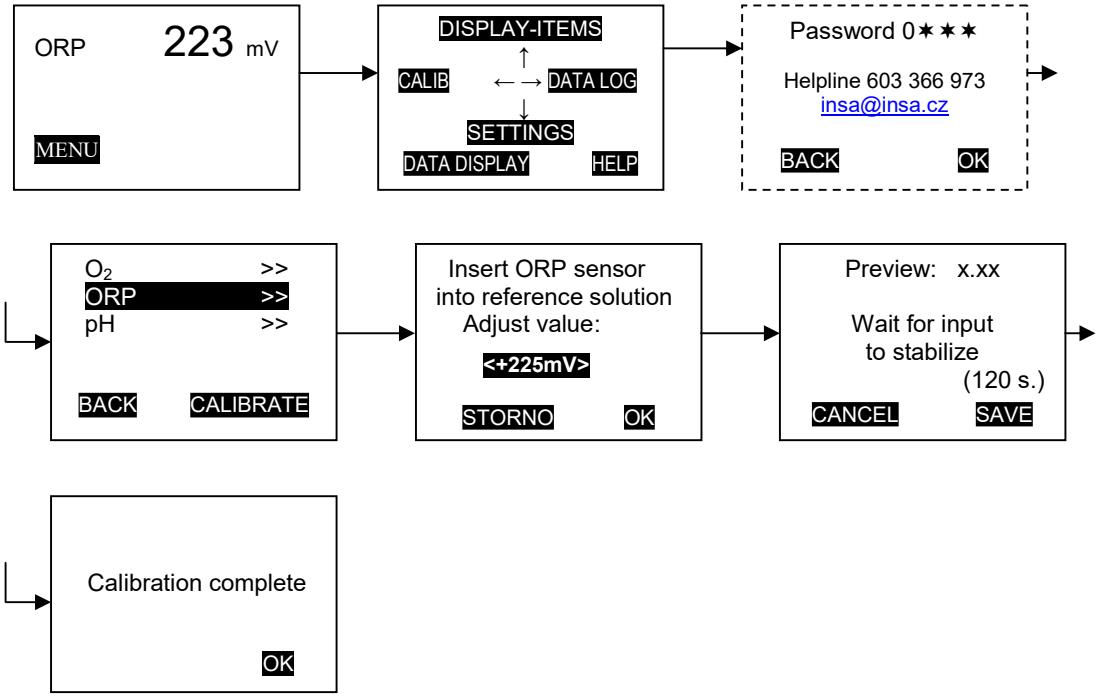


Fig.8. ORP calibration

5.3 CALIBRATION - OXYGEN

Calibration of the oxygen is performed only exceptionally in the case of suspicion of incorrect function of the instrument. Calibration is recommended after exchange of the membrane head.

The function CALIBRATION enables an easy and error-free calibration. We go to this mode by pushing the key ↵ in the mode **measuring** or choosing CALIBRATION in main menu.

By means of the ❨, ❩ and ⊙Δ (CALIBRATE) keys we choose O_2 >>, on the next display 1.point (quick) and on the following display we have instruction "**Cleanse and dry the sensor**" and "**Insert sensor into cover (approx. 10 min)**". We put the sensor into protective sensor case **(provided it was not there before)** and leave it for approx. 10 minute to stabilize temperature of the sensor. The thing is that temperature of the plastic membrane and the one of the thermometer block of the sensor - Fig.5, pos.2 – should be the same during calibration. Protective sensor case serves as a calibration block.

The sensor membrane must be dry, during the calibration – the sensor must measure the oxygen concentration in the air. If the sensor was in the water, prior to the calibration, wipe top of it slightly. The water drops on the other parts of the sensor make no problem.

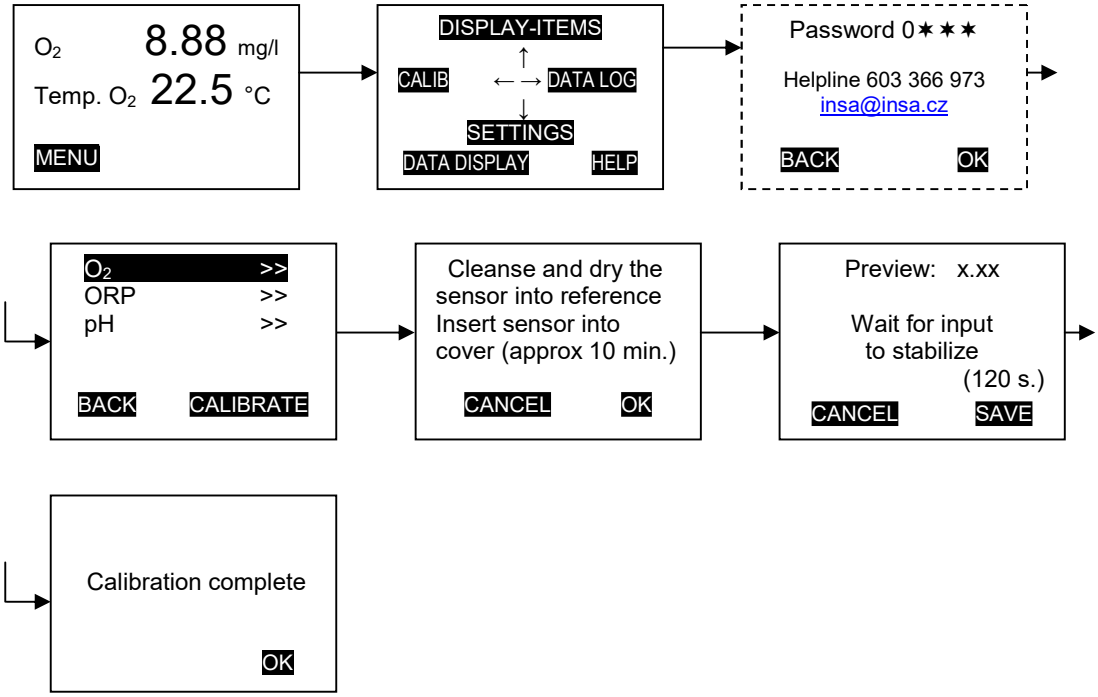


Fig.9. Oxygen calibration

After some 10 minutes (after placing into cover) we press ⊙Δ key and the value of oxygen concentration calculated due to the constants acquired during the last calibration on the upper line of the display, and the instruction "**Wait for input to stabilize**" on the lower part, will appear, as well as the time, for which the calibration will run, still. When the necessary time expired, the instrument accomplish calibration automatically, on the display appears for a few seconds "**Calibration complete**" and will pass into the measuring mode.

Note When working with the sensor, after some time (approx. 18 months if the sensor is not mechanically damaged) the membrane begins to lose its mechanical properties. This process appears by an unstable sensor signal and by increasing signal when the sensor is in the oxygen-free solution (e.g. in a

sulphite solution), instrument wouldn't show value 0.0, but a higher one. If the value on the instrument with sensor is higher than 0.20 mg/ (approx 2,5%), it is advisable to replace the membrane head.

Preparing the sulphite solution is in following way: *Add approx. 3 g (roughly a full teaspoon – a bigger amount doesn't make a problem) of natrium sulphite - $Na_2SO_3 7\ H_2O$ - to 1 l of water (potable water is good enough). Prepare the solution at least 6 hours before the test. On this way prepared solution can be used for about 3 months.*

If no damage of the plastic membrane occurs, its life-span is 18 months, at least.

If it is a problem for the user to prepare the sulphite, it's recommended a preventive replacement of the membrane head after approx. 18 months.

6. RECORDING OF MEASURED VALUES - GRAPH

The instrument enables to record approx 600 measured values. Each measured value is completed by a time stamp. There are two possible modes of recording. Basic one is **Advanced** mode. The instrument enables to choose any combination of measured values for recording in this mode. It is possible to record either at regular time intervals (mode **Time**) or at the moment when the determined levels of measured variable are exceeded.

If we work with this mode (and choose at least one variable for recording) than there is mark **M** to the right of the every recorded variable and information **START LOGGING** / **STOP LOGGING** in the right bottom corner of the display. In this mode we can choose whether, after complete filling of instruments memory, instrument further recording stops or recording will continue and the oldest recorded values will be overwritten.

Recorded values are recorded to single files – blocks. Start and end of block is determined by **START LOGGING** / **STOP LOGGING** key. Recorded values remain in memory after instrument is switched of. During exchange of batteries remain recorded values saved for approx 24 hours still.

Second recording mode is **Back-trace xx hrs.** mode. In this mode instrument records **all** measured variables in 1 minute, 10 minutes or 1 hour interval. After memory is being full, the oldest values are overwritten with latest ones. Total time of recording depends on number of recorded variables and selected interval. **After the instrument is switched off, all recorded values are deleted automatically**. Recording starts automatically after switching instrument on. During measurement there is no information about recording on display.

6.1. TIME SETTING

There is no real time clock in the instrument. That means that all time data are relative. In advanced mode they are related to the start of the relevant file (block). In back trace mode time is related to the moment of opening of the recording. Time data are negative.

As instrument does not possess full-value clock, time data are rather not accurate. It is possible to precise them in **Settings** and further **More settings** and Clock adj. ±[min/day] <0.>.

In the same display we can select recording mode – either Advanced or Back trace one and time interval of back trace mode.

.

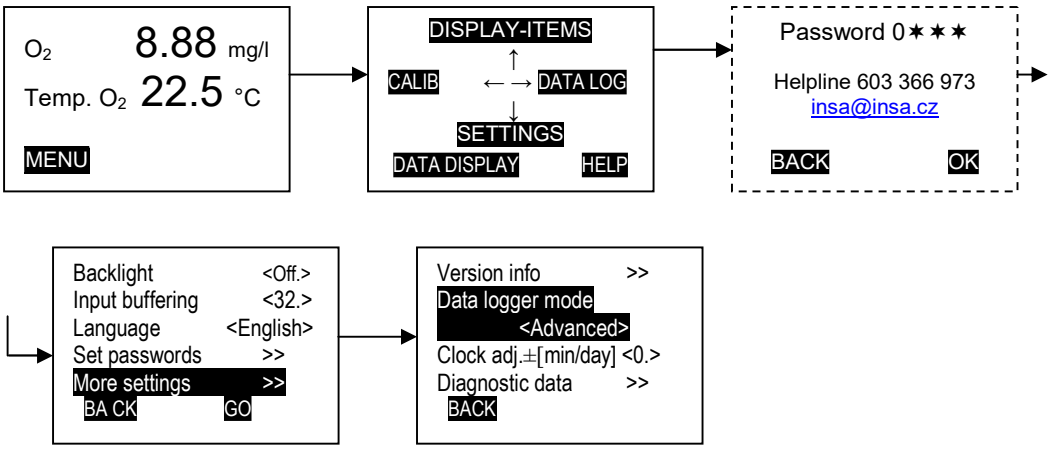


Fig.10. Recording mode setting, clock adjustment

6.2. VARIABLES FOR RECORDING AND INTERVAL SETTING (ADVANCED MODE)

We go to the **Data logger** mode from measuring mode by pressing ➲ key or choosing data logger mode in main menu. On the display we have either (No data) or recorded data and in the right bottom corner **OPTIONS**.

After pressing the ⓐ (**OPTIONS**) key we activate **Data-logger setup** on the next display and now we see display on which we can choose way of recording and variables to be recorded. By means of the ➚, ➘ keys we activate **Trigger** and we can choose recording of all selected variables in regular time intervals irrespective changes of the measured value – **Time** mode - or recording by determined changes of selected variable. Selection we make by ➲ and ➲ keys.

If we select time, than we set on the next line, again by means of ➲ and ➲ keys, interval of recording from one second to 99 hours, 59 minutes, 59 seconds. If we choose recording derived of changes of selected variable (by pressing ➲ and ➲ keys are single variables gradually offered and in the same time also differences on the next line) we can on the next line set **Difference**, by exceeding of which the

instrument will carry out a recording of **all** values, we have chosen for recording. We enter the difference 10 mV, e.g. (0,1 pH unit etc.). That means, that the instrument will record the measured values always, when the level 10 mV (pH 0,1) will be exceeded, from above or from below. If, e.g., the measured value alternates between 105 to 165 mV (pH 6,95 to 7,55), the values 110, 120, 130, 140 and 150 mV (pH 7,00, 7,10, 7,20, 7,30, 7,40, 7,50) and **the actual values of all variables selected for recording** are recorded, simultaneously.

On the following lines we select variables for recording so that we choose either **Store** or (**Ignore**). On the bottom line we determine whether – when memory is full – instrument stops recording – **When full <Stop>** or begins overwrite the oldest values – **When full <Overwrite>**.

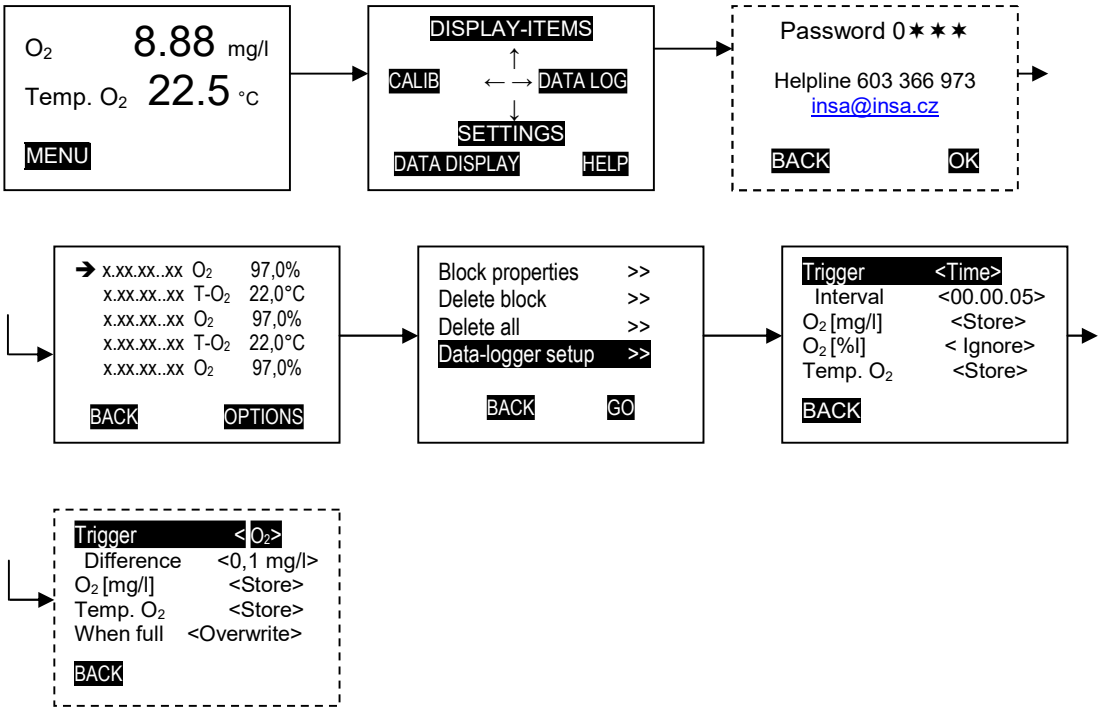


Fig.11. Recording mode – variables for recording and interval setting

6.3. START AND TERMINATING OF RECORDING

In Back-trace mode recording is starting automatically by switching instrument on and terminating also automatically by turning instrument off.

In Advanced mode recording is starting and terminating by **START LOGGING** / **STOP LOGGING** key. By each new start are recorded values stored in new file – block determined by new number.

6.4. MEASURED VALUES RECORD VIEWING AND DELETING

Back-trace mode.

When we record in Back-trace mode and we are in measurement mode (there are measured values on the display) then after **short** pressing of the ➲ key we have on the display graph of the variable placed on the **first line of the display**. If we want display graph of other variable, we shift by means of the ➀, ➁ keys to the top line and press the ➲ key again.

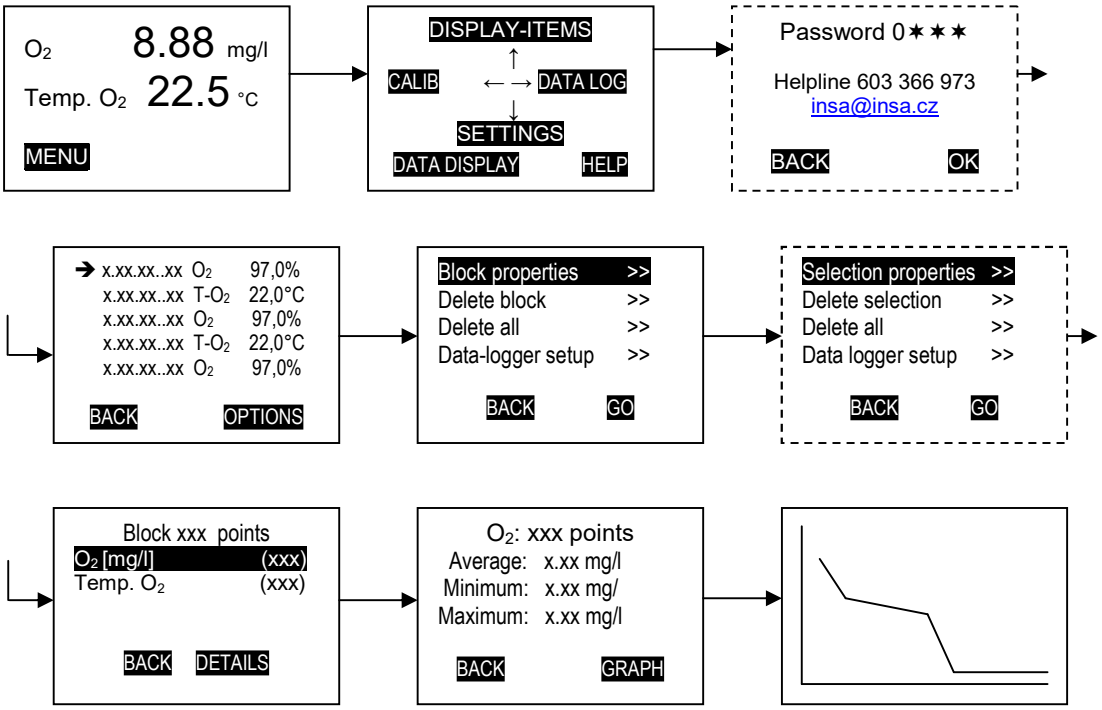


Fig. 12. Recording mode – recording viewing

Scales on the both coordinate axes are set automatically; in the graph there are displayed all recorded values of the single variable. If the display is not optimal we can by **long** pressing of the ➳ and ➲ keys scale of horizontal axis (by the ➀, ➁ keys on vertical axis) increase and/or decrease. By **short** pressing of the keys we shift graph to the right/left.

To have display not disturbed by markings we can remove them by **short** pressing of the ⓐ key.

W e abandon graph by ⓐ key.

Advanced mode.

We have measured values on the display. There is mark **M** to the right side of the lines of the registered variables. The mark changes (blinks) slightly in the moment of recording. By short pressing of the ➲ key we display recorded values divided into single files – blocks with cursor - ➔ - on the beginning of the first block (in case we browsed through logging before, the cursor is on the place it was by the end of browsing). By means of ➀, ➁ keys we go through the logging.

After pressing the ⓐ **OPTIONS** key we have display with offer **Block properties** etc. When we open “Block properties” we can select single variable and open another display on which we see how many points of the variable were recorded, average, maximal and minimal values of it and after pressing ⓐ **GRAPH** key to display graph. With the graph we behave in the same way as by “Back-trace” mode.

Displays “Block properties” and “Graph” are created to the block before which cursor is placed (can be on any place).

Graph we can display by long pressing of the ➲ key in measurement mode also. In this case we have on the display graph of the variable placed on the **first line of the display** and on which we have displayed all values recorded in all blocks (files). **When variable displayed on the first line is not recorded – no graph appears.**

On the display with recorded values we can create even new block (selection) of recorded values, so that we place cursor ➔ on the beginning of the selection and by pressing of the ➲, (➲) key we create a selection. Information on “Block properties“, “Graph“ are related to this new block (selection). Deleting of the block we make by ➲ or ➲ key.

7. INSTRUCTIONS FOR MEASURING

7.1 DAMPING SETTING

The instrument enables to set the magnitude of damping of signals from the sensors to the optimal value. If the damping is too small, the statement (measured value) on the display will get stable quickly, but after the stabilization it is not very stable. If the damping is too big, the stabilization of the measured value on the display is slow.

From the production, the damping is set on the value 16. If this value is inconvenient, it is possible to change it in the mode **SETTINGS→ Input buffering**. By means of the ↶ and ↷ keys (Fig. 1) we set the required damping. The bigger is the damping – the slower the stabilization of the measured value and the more stable the statement on the display will be.

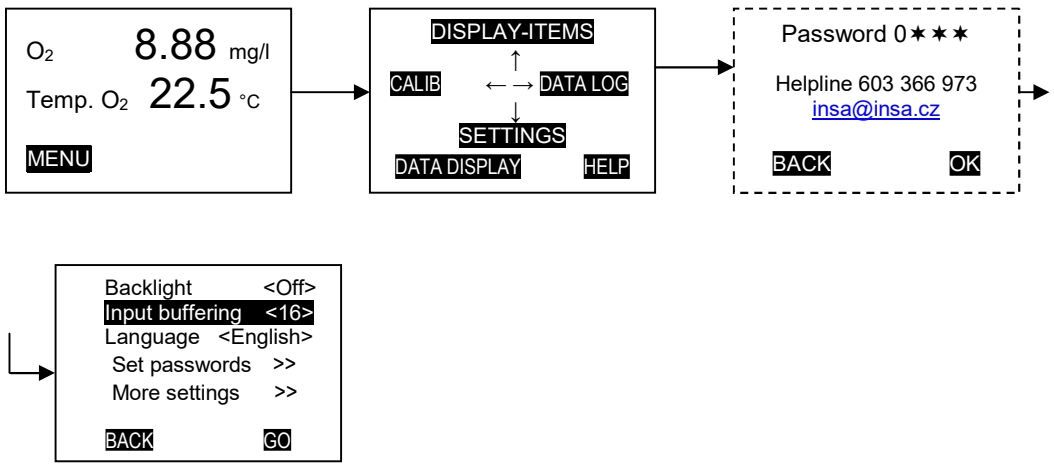


Fig.13. Display of function damping

7.2 BACKLIGHT SETTING

Instruments display is provided with backlight, that makes us possible to read measured values and also other information on display in dark light conditions comfortably. As backlight **reduces lifetime of batteries** it is possible the backlight switch on and off. As far as the backlight is on than after each pressing of any key backlight switches on for a few seconds. Backlight is possible to turn off and on according Fig.13 - **SETTINGS→ Backlight** by means of the ↶ and ↷ keys.

7.3. MEASURING pH and ORP

The quality of measuring is given by the quality and condition of the sensor, first of all, and by the quality of buffers – see also instructions for calibration. A soiled sensor will influence the measured value, significantly. In order to secure a correct measuring, it is necessary to avoid a contamination of the sensor surfaces, mainly by non-conducting and impermeable coatings. An intensive streaming of the measured liquid can considerably reduce the development of deposits, often.

Glass electrodes must not be used in acidic solutions of fluorides. The samples contai-nting a substance, which can clog the ceramic frit of the reference system (e.g. ions, which create little soluble salts with the solution of the reference electrode, like silver, mercury, tetraborate etc.), reduce considerably the lifespan of the electrode.

If we need to clean the electrodes, we proceed according to the recommendations of the manufacturer of them. Basically, we use a short time (up to 5 minutes) exposition in a diluted HCl (concentration 1M), for the removal of deposits with calcium, potassium or metal hydroxides. For removal of fatty substances, spirit, aceton, organic solvents or, preferably, the cleaning solutions delivered by the manufacturers of the electrodes can be used. We wet a cotton wool in them and clean the sensor. After the cleaning, we wash carefully the sensor with distilled or potable water. After the exposition in HCl, the properties of the sensor stabilize, for approx. 30 minutes.

If we don't measure, it is appropriate to keep the electrodes pH and ORP in a solution of KCl, c = 3,0 mol/l.

According to the standard ČSN ISO 10523, the measured value is to be read with the stirring switched off.

7.4 OXYGEN MEASURING

For the oxygen measuring, we must use the sensors CSOT 53LZ-S, manufactured and delivered by the company inSa s.r.o.. Those sensors have zero consumption of oxygen, during the measuring, and it is possible to measure with them precisely, even in those cases, when the water motion is very small or zero.

It is necessary to be aware, that quality of measuring results can be obtained with a clean sensor, only. The function of sensor is disturbed mainly by oil or fat layers, deposited on the sensor membrane. Also biological deposits on the membrane can considerably influence the function. We clean the sensor membrane so, that we wipe it slightly with cotton wool, wetted with clean potable water or in alcohol.

During the measuring, the sensor must be immersed in the measured water 10 mm above the metallic block (Fig. 2, pos. 2), at least, in which the temperature sensor is placed. The sensor may be immersed in the measured water completely; **nevertheless sensor is not designed for continuous immersing in water**.

If taking measurement in nitrification basin of WWTP be aware that fluctuation of oxygen concentration due to aeration cause always an unstable measurement.

After finishing measurement we clean oxygen sensor, if necessary, flick rest of water off (in similar way as we do it with a thermometer) and screw protective sensor case on.

The separation membrane of the oxygen sensor is ageing. Therefore, it is

necessary to replace it as soon as the signal in sulphite is bigger than 0,2 mg/l of the signal, corresponding with the saturated state at the given temperature, as long as we measure in percents, it is approx. 0,25%.

If no damage of the sensor membrane during manipulation or if no sensor exposition outside of the range of temperature occurred, the lifespan of the membrane is 18 months at least.

If it is a problem for the user to prepare the sulphite, it's recommended a preventive replacement of the membrane head after approx. 18 months.

The description of the membrane head replacement can be seen in the chapter 4.5,

We keep the sensors, which are out of measuring, in a sensor protecting case.

The oxygen sensor must not be exposed to temperatures lower than -4,0°C and higher than 50,0°C.

7.5 TEMPERATURE MEASURING

When measuring temperature, we take care that the sensor is immersed by 30 mm, at least.

8. PASSWORDS SETTING

The access to some instrument functions can be conditioned by the password to avoid setting from unwanted changes (either by mistake or unauthorized person) or to hide unused functions. By passwords we can lock **Calibration, Display configuration** (is not possible to switch of/on measured variables, to change order of measured variables on the display), **Settings** (is not possible to change settings) and **Main menu** (access to main menu is locked, is possible to read display only).

- Enter password into the system

By pushing the key Δ we pass from the mode **Measuring** to **Main menu,** select the function SETTINGS and **Set passwords** by pressing keys ↑, ↓ and Δ on following one. On the actual display we select function we want to lock by password. Password consist of four signs 0 to 9 and ✶. Symbol ✶ is identical with number 0.

After opening the display **Set passwords** we can see all modes protected by passwords. At the and off every line is either **(free)** – mode is not protected by password or **(locked)** – mode is protected by password.

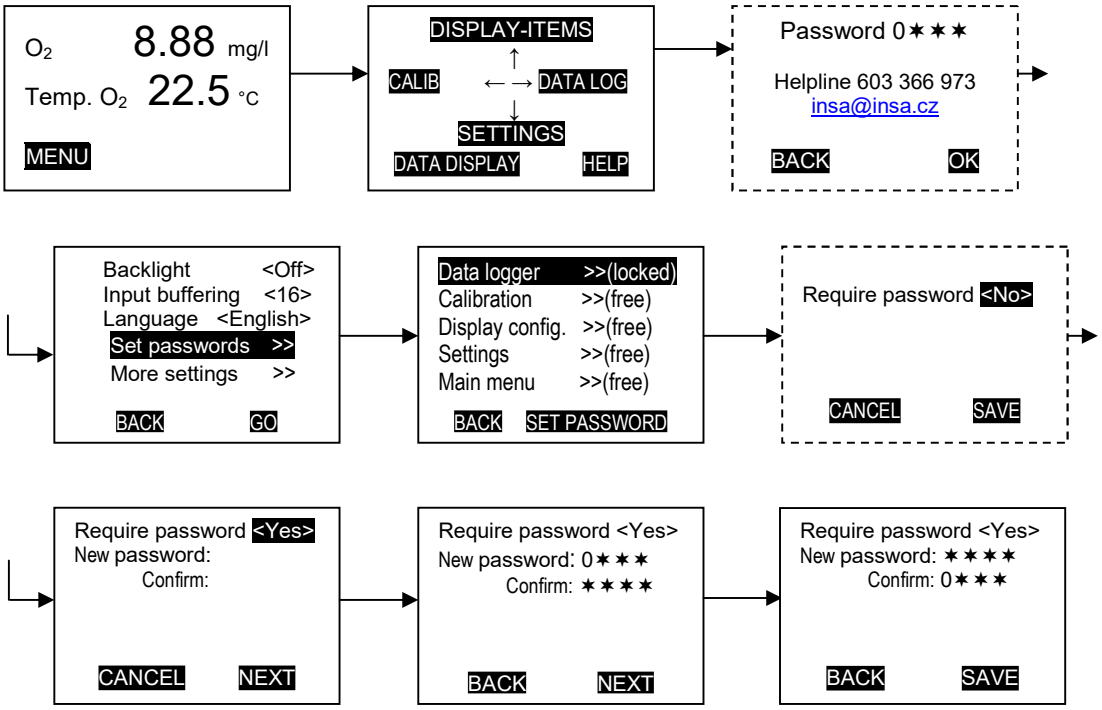


Fig. 14. Display of function passwords

9. METHOD OF OPERATION

The electric signals from the sensors are processed in the analogue circuits of the instrument, transferred to the numerical state by an analogue-digital converter and processed in the computer, which secures the setting of constant during the calibration, displaying of the measured values on a numerical display as well as other functions.

10. MECHANICAL CONSTRUCTION OF THE INSTRUMENT

The circuits of the instrument MFD 79OPTO are placed in a plastic box.

We protect the box from the impact of aggressive substances. For the cleaning of the box, we use water or alcohol. We take care, that we don't scratch the front shield of the instrument, under which the display is placed.

11. INSTRUCTIONS FOR MAINTENANCE AND REPAIRS

The electronic circuits of the transducer don´t require any maintenance. The reliability of the electronic circuits of the instrument is very high. Any problems during the measuring are caused by the sensors, almost in all cases.

12. TECHNICAL DATA

Measuring Range - ORP	±1000 mV
- pH	0,00 to 14,00
- temperature	-5,0 to 50,0°C
- oxygen	0,1 to 20,0 mg/l, 0,1 to 200,0%
Displaying of the Measured Value	graphic display with backlight,
Sensor pH	pH 21K-S, pH 29K-S
Temperature Compensation of pH electrode	automatic in the range -5 to 50°C
Basic Error - ORP	±0,5 mV
Basic Error - pH	±0,5% of the range
Additional Error at Change of Ambient Temperature	±1% of the range at a change by ±10°C (ORP, pH)
Basic Error of Measuring Temperature (T1)	±0,3°C (in range 0 to 40)
Sensor for Oxygen Measuring	CSOT 53LZS (temperature range -4 to 40°C, min. speed of medium 0 mm/s
Temperature Compensation	automatic in range 0 to 40°C
Basic Error of Oxygen Measuring Measured Medium (oxygen)	±2% of range (0 to 150%), 5% (150 to 200%)
Additional Error at Change of Ambient Temperature	±1% of range at change by ±10°C (oxygen)
Basic Error of Temperature Measuring (T3)	±0,3°C in range 0 to 40°C
Cover - instrument	IP 54 (with connected sensors)
- oxygen sensor	IP 67
Power supply	2 x AA battery or rechargeable battery
Dimensions	120x65x20 mm (wxhxd)
Weight	approx. 200 g

- **Ambient conditions**

Ambient Temperature	0 to+40°C (-4 to 50°C – oxygen sensor)
Relative Humidity	10 to 90%
Air Pressure	600 to 1060 hPa
Resistance to Vibrations and Shocks	specified in ČSN EN 61010-1
Resistance to Electromagnetic Emission	acc. to ČSN EN 50082-1, category – light industry
Electromagnetic Emission	acc. to ČSN EN 55011-1, category – light industry

Reference Conditions

Ambient Temperature	25±1°C
Relative Humidity	40 to 50% (temperature 25 ±1°C)
Air Pressure	980 to 1020 hPa
Electromagnetic Disturbance	negligible
Vibrations, Shocks	negligible

13. STORAGE

The instrument must be stored in a covered and dry store, in a protective cover, at a temperature between 0 to 40°C and a relative humidity up to 60%. During the sot-rage, the instrument must be protected against mechanical damage, meteorological effects and chemical fumes.

Sensors for measuring pH and ORP are to be stored at best in preserving solution (KCl 3 mol/l).

Sensors for oxygen measuring are to be stored with the membrane head slightly screwed of on the body of the electrode.

▪ 14. PROTECTING THE ENVIRONMENT

Dispose of packaging material at a public waste disposal site.

This instrument shall not be treated as household waste. Please, dispose it at your applicable collection point for the recycling electric & electronic equipment waste. The correct disposal of this product will help save valuable natural resources and help in preventing the potential negative impact on the environment and human health, which could be caused as a result of improper liquidation of waste. Please, ask your local authorities or the nearest waste collection centre for further details.