

VOLTCRAFT[®]

Operating manual

EN

DO-400

Oxygen measuring device

Permanently connected oxygen sensor

Waterproof



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1 Legal address of the manufacturer

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WEEE reg. no. DE 28001718



2 About this documentation

2.1 Foreword

Read this document carefully and familiarise yourself with the operation of the product before you use it. Keep this document ready to hand and in the immediate vicinity of the product so that it is available to the personnel/user for reference at all times in case of doubt.

The product was developed according to the state of the art and fulfils the requirements of the applicable European and national Directives. All corresponding documents are available from the manufacturer.

Only technically qualified persons are permitted to carry out commissioning, operation, maintenance and decommissioning. The qualified personnel must have carefully read and understood the operating manual before beginning any work.

2.2 Purpose of the document

- This document describes the operation and maintenance of the product.
- Provides important information for working safely and efficiently with the product.
- In addition to the quick reference guide with all relevant legal and safety content in hard copy, this document is a detailed reference option for the product.

2.3 Correctness of content

The contents of this document were checked for corrected and are subject to a continuous correction and updating process. This does not rule out potential errors. In the event that errors are discovered or in case of suggestions for improvement, please inform us immediately via the indicated contact information in order to help us make this document even more user-friendly.

2.4 Layout of this document

Description

Each chapter is explained at the beginning in the description.

Prerequisite

All mandatory prerequisites are then listed for each step.

Instruction

Tasks to be carried out by the personnel / user are represented as numbered instructions. Adhere to the sequence of the specified instructions.

Representation

Shows an illustrative instruction or a configuration of the product.

Formula

Some instructions include a formula for a general understanding of a configuration, programming or a setting of the product.

Outcome of an action

Result, consequence or effect of an instruction.

Emphases

In order to simplify legibility and provide a clearer overview, various sections / information are emphasised.

- *1234* Display elements
- *Mechanical controls*
- **Product functions**
- *Product labels*
- Cross-reference [▶ p. 5]
- *Foot notes*

2.5 Further information

Software version of the product:

- V1.2 or later

For the exact product name, refer to the type plate on the rear side of the product.



NOTE

For information about the software version, press and hold the ON button to switch on the product for longer than 5 seconds. The series is shown in the main display and the software version of the product is shown in the secondary display.

3 Safety

3.1 Explanation of safety symbols



DANGER

This symbol warns of imminent danger which can result in death, severe bodily injury, or severe property damage in case of non-observance.



DANGER

This symbol indicates danger for living tissue as well as a variety of materials, which can be damaged or destroyed when coming into contact with this chemical. Caustic effect, protective equipment required!



DANGER

This symbol indicates danger for all life forms, which can result in death or acute or chronic damage to the health after inhaling, swallowing or absorbing this chemical through the skin.



CAUTION

This symbol warns of potential dangers or harmful situations which can cause damage to the device or to the environment in case of non-observance.



NOTE

This symbol indicates processes which can have a direct influence on operation or can trigger an unforeseen reaction in case of non-observance.



NOTE

This symbol instructs the use of eye protection which protects the eyes from harmful influences when working with powerful light, UV radiation, laser, chemicals, dust, splinters or weather influences.



NOTE

This symbol instructs the use of protective gloves which offer protection from mechanical, thermal, chemical, biological or electrical hazards.

3.2 Foreseeable misuse

The fault-free function and operational safety of the product can only be guaranteed if generally applicable safety precautions and the device-specific safety instructions for this document are observed.

If these notices are disregarded, personal injury or death, as well as property damage can occur.

**DANGER****Incorrect area of application!**

In order to prevent erratic behaviour of the product, personal injury or property damage, the product must be used exclusively as described in the chapter Description [► p. 10] in the operating manual.

- Do not use in safety / Emergency Stop devices!
- The product is not suitable for use in explosion-prone areas!
- The product must not be used for diagnostic or other medical purposes on patients!
- The product is not intended to come into direct contact with food. For measurement in foods, samples must be taken and discarded after the measurement!

3.3 Safety instructions

This product has been designed and tested according to the safety requirements for electronic measuring devices.

**DANGER****Potassium hydroxide!**

The electrode contains potassium hydroxide. This causes burns. All contact with the skin, clothing and eyes should be avoided. Nevertheless, should contact occur, take the following measures.

- Eyes: Flush with flowing water for at least 15 minutes, seek medical attention!
- Skin: Wash with large amounts of water for several minutes!
- Clothing: Remove immediately!
- If swallowed: Drink large amounts of water, do not induce vomiting and seek medical attention!

**CAUTION****Erratic behaviour!**

On suspicion that the product can no longer be operated without danger, it must be decommissioned and prevented from recommissioning with appropriate labelling. The safety of the user can be impaired by the device if, for example, if it shows visible damage, it no longer works as specified or if it was stored for an extended period of time under unsuitable conditions.

- Visual inspection!
- In case of doubt, send the product to the manufacturer for repair or maintenance!

**NOTE**

If the product is stored at a temperature above 50 °C, or is not used for an extended period of time, the batteries must be removed. Leaks from the batteries are avoided as a result.

**NOTE**

This product does not belong in children's hands!

For this purpose, also refer to

 Technical data [[▶ 28](#)]

3.4 Intended use

The product is designed for analysis of the oxygen concentration and/or oxygen saturation in freshwater and salt water. It is used, for example, for the monitoring of wells, sewer lines and aquaria. A minimum flow to the sensor of approx. 30 cm/sec is necessary for a correct measurement.

See Technical data [[▶ p. 28](#)].

3.5 Qualified personnel

For commissioning, operation and maintenance, the relevant personnel must have adequate knowledge of the measuring process and use of the measurements, for which purpose this document makes a valuable contribution. The instructions in this document must be understood, observed and followed.

In order to ensure that no risks arise from the interpretation of the measurements in the concrete application, the user must have additional technical knowledge, because the user is liable in case of damage/danger due to misinterpretation as a result of inadequate technical knowledge.

4 Description

4.1 Scope of delivery

Please check to ensure the completeness of the product after opening the package. You should find the following components:

- Quick reference guide
- Handheld measuring device, ready for operation, including batteries
- Permanently connected oxygen sensor

4.2 Job description

The product offers precision, speed and reliability in a compact, ergonomic housing. Additional impressive features include the dust-proof and waterproof design in accordance with IP 65/67 and the 3-line illuminated display, which offers overhead display at the push of a button. The product can be switched on, switched off and configured and the measurements and parameters can be adjusted and held with the operating elements. The product with maintenance-friendly galvanised O₂ sensor is an entry-level device suitable for everyday use. Concentrations in mg/l or ppm and saturation in percentage can be read directly without using tables. Calibration with environmental air takes place at the push of a button. Use of a GSKA protective cap is recommended for field use in bodies of water in order to protect the membrane.

5 The product at a glance

5.1 The DO-400 / -410



LCD Display








DO-400 / -410



DO-400 / -410

5.2 Display elements

Display

 Battery indicator	Evaluation of the battery status
 Unit display	Display of units, if applicable, with unstable symbol or type of mode, min/max/hold
 Main display	Measurement of the current O ₂ value or value for min/max/hold
 Auxiliary display	Corresponding temperature for the displayed O ₂ value with unit.
 Bar graph	Progress for calibration and visualisation of the electrode evaluation



NOTE

The unit display shows a rotating circle segment in the first position as long as the measurement is unstable, if the position is unoccupied by the unit display.

5.3 Operating elements



On / Off button

Press briefly	Switch on the product Activate / deactivate lighting
Long press	Switch off the product Reject changes in a menu

**Up / Down button**

Press briefly

Display of the min/max value

Change value of the selected parameter

Long press

Reset the min/max value of the current measurement

Both simultaneously

Rotate display, overhead display

**Function key**

Press briefly

Freeze measurement

Return to measurement display

Call up next parameter

Long press, 2s

Start menu configuration, CONF appears in the display

Long press, 4s

Start automatic calibration, CAL appears in the display

6 Bases for measurement

6.1 Oxygen sensor

6.1.1 Explanation

The oxygen sensor is an active sensor. It consists of a platinum cathode, a lead anode and potassium hydroxide (KOH) as an electrolyte. If oxygen is present, it is reduced on the platinum cathode and the sensor delivers a signal. If no oxygen is present, no signal is delivered. The anode is consumed by the oxygen measurement. The sensor ages. Furthermore, the sensor loses water through the permeable membrane, in particular, when it is stored in dry air. Therefore, it should be checked and maintained regularly and replaced as necessary.



DANGER

Potassium hydroxide!

The electrode contains potassium hydroxide. This causes burns. All contact with the skin, clothing and eyes should be avoided. Nevertheless, should contact occur, take the following measures.

- Eyes: Flush with flowing water for at least 15 minutes, seek medical attention!
- Skin: Wash with large amounts of water for several minutes!
- Clothing: Remove immediately!
- If swallowed: Drink large amounts of water, do not induce vomiting and seek medical attention!



NOTE

Protective goggles must be worn for all of the following activities!



NOTE

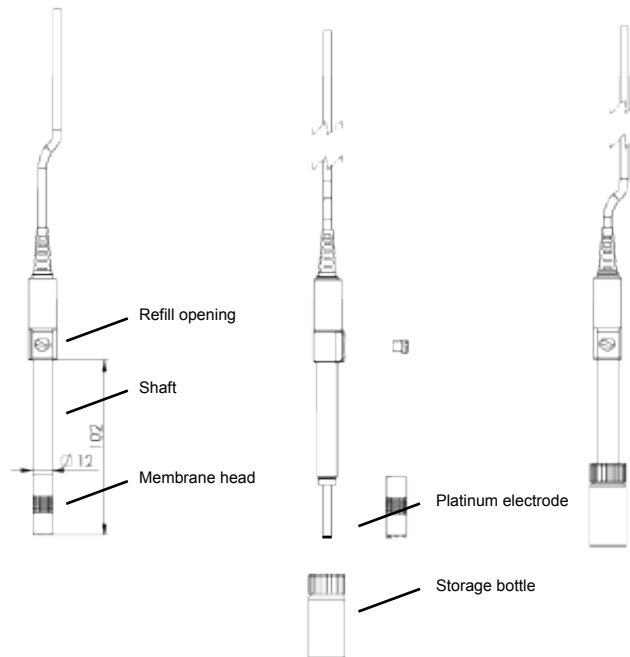
Protective gloves must be worn for all of the following activities!



NOTE

Always store the oxygen sensor damp. It should always be stored in a storage bottle filled with water or in a container filled with water. After storage for an extended period, any potential deposit layers, such as algae, must be cleaned off of the membrane with a soft paper towel prior to measurement.

6.1.2 Design



Platinum electrode	If oxygen is present, it is reduced on the platinum electrode and the sensor delivers a signal. Soiling on the platinum electrode or between the membrane and electrode can influence the measurement.
Storage bottle	The storage bottle is provided to keep the membrane moist. The service life of the sensor is extended as a result. Distilled or deionised water is in the storage bottle; do not add any other liquids!
Membrane head	The membrane head is covered with a thin plastic membrane. Faulty measurements will occur if the membrane is damaged or there are large air bubbles or even an air bubble ring on the membrane. This can also be the cause if a sensor can no longer be calibrated. The GWOK 02 membrane head is a spare part and can be re-ordered separately.
Refill opening	Electrolyte must be filled or added for the initial commissioning of a sensor which is delivered dry, when performing maintenance or after use at high temperatures.

6.1.3 Service life

The sensor signal deteriorates relatively quickly at the end of the service life of the sensors. The electrode evaluation in %, therefore, can only be used as a guide value. A value of 70% does not mean that exactly 70% of the service life is still available, rather that the electrode signal has 70% of a comparison signal.



NOTE

The sensor evaluation is updated by the measuring device after a successfully performed calibration of the oxygen sensor.

The nominal service life can be reduced significantly due to use. Influential factors include:

- Storage / operating temperature
- Contamination of the measured water

- Mechanical stress of the sensor membrane
- Storage in dry air
- Continuous use in elevated carbon dioxide concentrations

6.1.4 Operating position

The oxygen sensor should be arranged vertically upwards with the connecting cable. A slight angle of inclination does not impair the measurement.

6.1.5 Measurement accuracy

The measurement accuracy can be impaired by:

- An inadequate flow below the necessary value of approx. 30cm/sec.
- The water temperature and sensor temperature must be the same. The most accurate measurements are provided when the measuring temperature is calibrated.

6.1.6 Residue

Visible residue collecting as a reaction product in the interior of the membrane cap on the lead-oxide lead anode is red or brown from reaction with oxygen and lead carbonate and is white from reaction with carbon dioxide. These substances can collect on the membrane, but do not normally impair the measuring function and can be mostly removed in the course of maintenance of the sensor. Prior to screwing on the membrane cap, they should be removed as far as possible in order to prevent particles from being trapped between the membrane and the platinum cup. A rapid or excessive formation of lead carbonate after commissioning is an indication of air in the sensor. This is usually due to incomplete filling or a leak due to improper fitting of the cap / fill screw or membrane leak.

6.2 Instructions for oxygen measurement

The following must be observed when measuring dissolved oxygen:

- The storage bottle must be removed before the measurement.
- The sensor must have been calibrated.
- The sensor and the liquid to be measured must have the same temperature. The temperatures of the two must match.
- The sensor must be immersed at least 3 cm into the liquid to be measured.
- A flow speed of at least approx. 30 cm/sec is necessary for exact measurements. Either stir continuously or use an appropriate stirring device
- The measurement is sensitive to jarring! Therefore, make sure that the container is not struck with the sensor while stirring, because this can significantly impair the measured value.
- The oxygen partial pressure, oxygen concentration in mg/l and oxygen saturation in % are calculated from the sensor signal and temperature. In accordance with DIN38408-C22, the measurement is relative to water-vapour-saturated air.

6.2.1 Salinity correction

With increasing salinity *SR*, which is the value for the salt content in the water, the solubility of oxygen in water decreases, i.e. with the same oxygen partial pressure, fewer mg of oxygen are dissolved per litre of water. To determine this oxygen concentration, therefore, the salinity of the medium must be entered first; see Configuring parameters of the configuration menu [► p. 22]. A salinity correction is not necessary in freshwa-

ter; the value is 0. A salinity of approx. 35 PSU is normal for sea water. The salinity correction is adjusted to aqueous media having a chemical composition corresponding to sea water. The International Oceanographic Tables (IOT) are used as a basis for the correction.

6.2.2 Environmental pressure, water depth and air pressure

The environmental pressure, water depth and air pressure play an important role at the place of measurement for the following points:

- Calculation of oxygen saturation in % *SRt*. Clean water can achieve 100 % saturation in air. There must be no oxygen-depleting processes, such as biological decaying processes, chemical effects or oxygen enhancing processes, such as excessive ventilation or photosynthesis. This could result in an oversaturation above 100%.
- Calculation of the oxygen concentration in mg/l
- The valuation of calibration

Adjusting the pressure parameter on the product is recommended prior to calibration. In the scope of measuring accuracy, specifying the current air pressure in the region based on meteorological data or the standard pressure based on sea level is sufficient.

For example:

0 m above NN: 1013 hPa
 300 m above NN: 978 hPa
 600 m above NN: 943 hPa
 1000m above NN: 899 hPa

6.3 Commissioning, filling and maintenance of the sensor

Description	The sensor is delivered dry. Therefore, the sensor is well-suited for storage. The sensor must be filled in good time before the measurement. A wait time of approx. 2 hours after filling should be planned in order to allow the sensor to stabilise. Commissioning with initial filling, filling and maintenance of the sensor are explained in the following chapter.
Prerequisite	<ul style="list-style-type: none"> – Protective goggles – Protective gloves – A suitable screwdriver – Pipette – Household towel – KOH electrolyte – A spare GWOK 02 membrane head, if applicable
Instruction	<ol style="list-style-type: none"> 1. Unscrew the membrane head. 2. Unscrew the seal screw from the refill opening.



NOTE

If the sensor was already filled and deposits have formed, it should be cleaned with KOH via the fill opening or removed. Loose residue can be rinsed out in the process. The platinum cup on the front of the membrane must be clean. Remove any soiling or electrolyte solution with a paper towel.

3. Fill the pipette with the KOH electrolyte and initially fill the membrane head to $\frac{3}{4}$ full. Rinse off the excess electrolyte.
4. Slowly fill the sensor via the fill opening. In the process, tilt the sensor from side to side and tap the shaft to force out air bubbles. The sensor holds approximately 5 ml. If air bubbles no longer appear and the refill opening is filled up to the rim with KOH, screw the in the seal screw again.
5. Rinse off excess KOH and screw the sensor on with the membrane head. In the process, if there are any recognisable air bubbles under the membrane, KOH must be added.
6. After filling, the sensor should rest for 2 hours before a calibration is started.

Outcome of an action

The sensor has now been refilled. A sensor evaluation during the calibration should produce a result of 100%.



NOTE

Should it no longer be possible to calibrate the sensor or it only delivers unstable measurements, it must be maintained and/or the membrane head must be replaced

7 Maintenance

7.1 Operating and maintenance notices



NOTE

If the product is stored at a temperature above 50 °C, or is not used for an extended period of time, the batteries must be removed. Leaks from the batteries are avoided as a result.



NOTE

The electrode should be stored in dry rooms at a temperature between 10 °C and 30 °C. If the storage temperature range is exceeded or undercut, the electrode can be destroyed. It should always be stored wet in distilled or deionised water.

7.2 Battery

7.2.1 Battery indicator

If the empty frame in the battery display blinks, the batteries are depleted and must be replaced. However, the device will still operate for a certain length of time.

If the **bAt** display text appears in the main display, the battery voltage is no longer adequate for operation of the product. Now the battery is fully depleted.

7.2.2 Changing battery



DANGER

Danger of explosion!

Using damaged or unsuitable batteries can generate heat, which can cause the batteries to crack and possibly explode!

- Only use high-quality and suitable alkaline batteries!



CAUTION

Damage!

If the batteries have different charge levels, leaks and thus damage to the product can occur.

- Use new, high-quality batteries!
- Do not use different types of batteries!
- Remove depleted batteries and dispose of them at a suitable collection point!



NOTE

Unnecessary screwing places the water-tightness of the product, among other things, at risk and should be avoided.



NOTE

Read the following handling instructions before replacing batteries and follow them step by step. If disregarded, the product could be damaged or the protection from moisture could be diminished.

Description

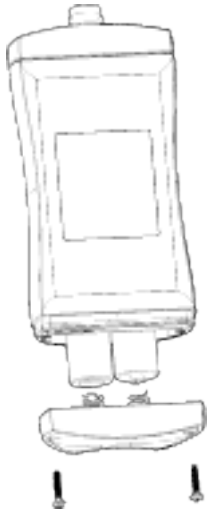
Proceed as follows to replace the batteries.

Prerequisites

- The product is switched off.

Instruction

1. Unscrews the Phillips screws and remove the cover.
2. Carefully replace the two Mignon AA batteries. Ensure that the polarity is correct! It must be possible to insert the batteries in the correct position without using force.
3. The O-ring must be undamaged, clean and positioned at the intended depth. In order to facilitate assembly and avoid damage, a suitable grease can be applied.
4. Fit the cover on evenly. The O-ring must remain at the intended depth!
5. Tighten the Phillips screws.



Outcome of an action

The product is now ready for use again.

7.3 Calibration and adjustment

7.3.1 Automatic calibration in the air

Description

The following steps describe how to calibrate the product automatically.

Prerequisite

- The product is switched on.



NOTE

Calibration takes place in air saturated with water vapour. The GCAL 3610 calibration container or the storage bottle can be used for this purpose. The membrane of the electrode must be dry for the calibration. Prior to performing the calibration of the membrane, dab away water droplets from the membrane with a soft, dry cloth. The following must be observed when using the storage bottle:

Only insert the electrode far enough into the storage bottle that the membrane does not come into contact with the water in the bottle.

Unscrew the lid of the storage bottle and only position it so that a small exchange of air and pressure equalisation can take place

Instruction

1. Place the electrode in the calibration container. If necessary, wait until the temperature has equalised and a stable value has been achieved.
2. Press the *Function* key for 4 seconds to open the **Calibration** menu. The display shows \overline{ERL} .
3. Release the *Function* key.
4. The product determines the correct value automatically.

Outcome of an action

After successful completion of the calibration the assessment of the electrode condition is displayed briefly in percent. An aged or contaminated electrode, incorrect adjustment of the pressure, contamination of the platinum electrode or a damaged membrane can be the cause for a lower evaluation.

If the calibration is not completed successfully an error message is displayed. *ERR* appears in the display See Error and system messages [▶ p. 26]. Confirm the error message pressing the *Function key*. The product restarts and the value of the last successful calibration is restored.

8 Operation

8.1 Commissioning

8.1.1 Explanation

Description	The product is switched on with the <i>On/Off button</i> . It may be necessary to configure the product after switching on. See Configuration [▶ p. 21].
Prerequisite	– Sufficiently full batteries are inserted in the product.
Instruction	– Press <i>On/Off button</i> .
Outcome of an action	Information about the configuration of the product appears in the display.

<i>P_{OFF}</i>	Automatic shut-off	Automatic shut-off activated. The product is switched off if no buttons have been pressed after the adjusted time
<i>ε_{0F}</i>	Zero point correction	If a zero point correction of the temperature sensor was made
<i>ε_{SL}</i>	Gradient correction	If a gradient correction of the temperature sensor was made
<i>SRL</i>	Salinity correction	Links when the salinity correction is active

The product is now ready for measurement.



NOTE

The product must be calibrated to the electrode prior to starting the measurement. See Calibration and adjustment service.

8.2 Configuration

8.2.1 Explanation

The following steps describe how to adapt the product for your purposes.



NOTE






There are various configuration parameters available depending on the product version and configuration. They can differ depending on the product version and configuration.

8.2.2 Opening the configuration menu

Description	In order to configure the product, you must first open the Configuration menu. The menu is opened as shown in the illustration.
Prerequisite	– The product is switched on.
Instruction	<ol style="list-style-type: none"> 1. Press the <i>Function key</i> for 2 seconds to open the Configuration menu. 2. <i>ε_{0F}</i> appears in the display. Release the function key. 3. By briefly pressing the <i>Function key</i>, you can scroll through the parameters. Select the parameter you would like to configure.

4. When you have selected the desired parameter, change the parameter to the desired value with the *Up button* and the *Down button*.
5. The changes are saved after running through the entire **Configuration** menu. **Star** appears in the display. The **Configuration** menu can be exited from any arbitrary parameter by pressing and holding the *Function key* for 2 seconds. The changes made up to that point are saved.

Representation

Call up menu	Next parameter	Change value	Save changes	Discard changes
				
2s		Press: Single step Hold: Rapid change	2s	2s

Outcome of an action

The **Configuration** menu is closed after the last parameter.



NOTE

If the product is switched off without saving the configuration, the last save value is reproduced on the next start-up of the product.

8.2.3 Configuring parameters of the configuration menu

Description

The following representation shows the available parameters and various configuration options.



Prerequisite

- The **Configuration** menu is open. See Opening the configuration menu [▶ p. 21].

Instruction

1. Select the desired parameter you would like to configure.
2. Adjust the desired configuration in the selected parameter with the *Up button* and *Down button*.
3. The available configuration options are listed for each parameter in the following representation.

Representation

Parameter	Values	Meaning
		
Input		
<i>inP</i>	<i>SRt</i> % <i>ConC</i> mg/l <i>ConC</i> ppm	Oxygen saturation in per cent Oxygen concentration in mg/l Oxygen concentration in ppm
Pressure		
<i>SEt.P</i>	<i>500</i> .. <i>4000</i>	Environmental pressure in hPa, corresponding to mbar
Salinity correction		
<i>SRl</i>	<i>0</i> .. <i>70</i>	Salinity in the measuring medium in PSU, corresponding to g/kg

Shut-off time		
<i>PoFF</i>	<i>oFF</i>	No automatic shut-off
	<i>15 30 60 120 240</i>	Automatic shut-off after a selected time in minutes, during which no buttons have been pressed
Backlighting		
<i>Lt EE</i>	<i>oFF</i>	Backlighting deactivated
	<i>15 30 60 120 240</i>	Automatic shut-off of the backlighting after a selected time in seconds, during which no buttons have been pressed
	<i>on</i>	No automatic shut-off of the backlighting
Temperature unit		
<i>Unit</i>	<i>°C</i>	Temperature display in °C
	<i>°F</i>	Temperature display in °F
Factory settings		
<i>Init</i>	<i>no</i>	Use current configuration
	<i>YES</i>	Reset product to factory settings. <i>Init done</i> appears in the display

Outcome of an action

The changed value is saved and the **Configuration** menu is closed. *Star* appears in the display. If necessary, the product is restarted automatically in order to adopt the changed values.



NOTE

The configuration is closed if no button is pressed for 2 minutes. Any changes made up to that point are not saved. *c.End* appears in the display.

8.2.4 Adjustment of the measuring input

Description

The temperature input can be adjusted with the zero point correction and the gradient correction. If an adjustment is made, you change the pre-adjusted factory settings. This is signalled with the *t.oF* or *t.5L* when the product is switched on. The standard settings of the zero point value and the gradient value is *0.00*. It signals that no correction is made.

In order to adjust the product, you must first open the **Adjustment** menu. The menu is opened as shown in the illustration.

Prerequisites

- Sufficiently full batteries are inserted in the product.
- The product is switched off.

Instruction

1. Press and hold the *Down button*.
2. Press the *On/Off button* to switch on the product and open the **Configuration** menu. Release the *Down button*. The display shows the first parameter.
3. By briefly pressing the *Function key*, you can scroll through the parameters. Select the parameter you would like to configure.

- When you have selected the desired parameter, change the parameter to the desired value with the *Up button* and the *Down button*.
- In order to save the new parameter value, press and hold the *Function key* for longer than 1 second.

Representation

Call up menu

Hold

Release

Outcome of an action

The **Configuration** menu is closed after the last parameter.**NOTE**

If the product is switched off without saving the configuration, the last save value is reproduced on the next start-up of the product.

8.2.5 Configuring parameters of the adjustment menu

Description

The following representation shows the available parameters and various configuration options.

Prerequisites

The **Adjustment** menu is open. See Adjustment of the measuring input [▶ p. 23].

Instruction

- Select the desired parameter you would like to configure.
- Adjust the desired configuration in the selected parameter with the *Up button* and *Down button*.
- The available configuration options are listed for each parameter in the following representation.

Representation

Parameter	Values	Meaning

Zero point correction

t.oF

0.00

No zero point correction

-5.00 .. 5.00

Zero point correction in °C. and/or at °F -9.00 .. 9.00

Gradient correction of the temperature

t.5L

0.00

No gradient correction

-5.00 .. 5.00

Gradient correction in %

Formula

Zero point correction:

$$\text{Displayed value} = \text{measured value} - t.oF$$

Gradient correction °C:

$$\text{Display} = (\text{measured value} - t.oF) * (1 + t.5L / 100)$$

Gradient correction °F:

$$\text{Display} = (\text{measured value} - 32 \text{ °F} - t.oF) * (1 + t.5L / 100) + 32 \text{ °F}$$

Example calculation

- Zero point correction t.oF to 0.00
- Gradient correction t.5L to 0.00
- Display unit Unit to °C
- Display in ice water -0.2 °C

- Display in ice water setpoint $t_{\text{aF}} = 0.0 \text{ }^{\circ}\text{C}$
- Display in water bath $36.6 \text{ }^{\circ}\text{C}$
- Display in water bath setpoint $t_{\text{5L}} = 37.0 \text{ }^{\circ}\text{C}$
- t_{aF} = display zero point correction – setpoint zero point
- $t_{\text{aF}} = -0.2 \text{ }^{\circ}\text{C} - 0.0 \text{ }^{\circ}\text{C} = -0.2 \text{ }^{\circ}\text{C}$
- $t_{\text{5L}} = (\text{setpoint gradient correction} / (\text{display gradient correction} - t_{\text{aF}}) - 1) * 100$
- $t_{\text{5L}} = (37.0 \text{ }^{\circ}\text{C} / (36.6 \text{ }^{\circ}\text{C} - (-0.2)) - 1) * 100 = 0.54$

Outcome of an action



The changed value is saved and the **Configuration** menu is closed.

NOTE

If the product is switched off without saving the configuration, the last save value is reproduced on the next start-up of the product.

9 Error and system messages

Display	Meaning	Possible causes	Remedy
No display, unclear characters or no response when buttons are pressed	Battery depleted	Battery depleted	Replace battery
	System error	Error in the product	Send in for repair
	Product is defective	Product is defective	
<i>bAt</i>	Battery depleted	Battery depleted	Replace battery
<i>bAt Lo</i>	Battery depleted	Battery depleted	Replace battery
<i>CAL Err.2</i>	Slope is too low Incorrect oxygen reference	Electrode contaminated or defective	Perform calibration in damp environmental air Maintain the electrode
<i>CAL Err.3</i>	Slope is too high Incorrect oxygen reference	Electrode contaminated or defective	Perform calibration in damp environmental air Maintain the electrode
<i>CAL Err.4</i>	Incorrect calibration temperature	Temperature too low or too high	Range of 5..40 °C
<i>CAL Err.5</i>	Time exceeded during automatic calibration	Unstable electrode signal	Use calibration container Maintain the electrode
		Contaminated electrode	Restart calibration
		Temperature not equalised	
<i>Err.1</i>	Measuring range exceeded	Measurement too high	The measurement is above the permissible range
		Electrode or product defect	Check electrode Perform calibration
		Faulty calibration	Send in for repair
<i>Err.2</i>	Measuring range is undercut	Measurement too low	Check electrode Send in for repair
		Electrode or product defect	
<i>SYS Err</i>	System error	Error in the product	Switch product on/off Replace batteries Send in for repair

10 Disposal



NOTE

The device must not be disposed of with household waste. If the product is disposed of, please take it to a municipal collection point, where it will be transported to a disposal company in accordance with requirements of hazardous goods laws. Otherwise, return it to us, freight prepaid. We will then arrange for the proper and environmentally-friendly disposal. Please dispose of empty batteries at the collection points intended for this purpose.

11 Technical data

Measuring range	O ₂ concentration	O ₂ saturation	Temperature
	0.0 .. 20.0 mg/l 0.0 .. 20.0 ppm	0 .. 200 %	0 .. 50 °C 32 .. 122 °F
Accuracy (at nominal temperature)	±1.5 % of measured value ± 0.2 mg/l	±1.5 % of measured value ± 0.2 %	± 0.3 °C
Temperature compensation	0 .. 50 °C (or 32 .. 122 °F)		
Nominal temperature	25°C		
Measuring cycle	approx. 2 measurements per second		
Connections	Permanently connected oxygen sensor		
Display	3-line segment LCD, additional symbols, illuminated (adjustable white, permanent illumination)		
Additional functions	Min/Max/Hold		
O ₂ calibration	Automatic calibration in the air		
Housing	Break-proof ABS housing		
	Protection rating	IP65 / IP67	
	Dimensions L*W*H [mm] and weight	108 * 54 * 28 mm without electrode 130 g, incl. battery, without electrode 190 g, incl. battery and electrode	
Connections	Permanently connected oxygen sensor		
Operating conditions	Device	-20 to 50 °C; 0 to 95 % r.h. (temporarily 100 % r.h.)	
	Electrode	0 .. 40 °C	
Storage temperature	0 .. 40 °C		
Current supply	2*AA battery (included in the scope of delivery)		
	Current requirement/ battery life	approx. 0.8 mA, approx. 2.7 mA with lighting Service life > 3000 hours with alkaline batteries (without backlighting)	
	Battery indicator	4-stage battery status indicator, Replacement indicator for depleted batteries: "BAT"	
Auto-power-OFF function	The device switches off automatically if this is activated		
Directives and standards	<p>The devices conform to the following Directives of the Council for the harmonisation of legal regulations of the Member States:</p> <p>2014/30/EU EMC Directive</p> <p>2011/65/EU RoHS</p> <p>Applied harmonised standards:</p> <p>EN 61326-1:2013 Emission limits: Class B</p> <p>Immunity according to Table 2</p> <p>Additional errors: < 0.5 % FS</p> <p>EN 50581:2012</p> <p>The device is intended for mobile use and/or stationary operation in the scope of the specified operating conditions without further limitations.</p>		

12 Service

12.1 Manufacturer

Contact

If you have any questions, please do not hesitate to contact us:

VOLTCRAFT

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