

Water-Proof Oxygen Meter for Oxygen in Gases With Integrated Temperature and Pressure Measuring

As of version 1.0

Operating Manual

GMH 5695



-  Please carefully read these instructions before use!
-  Please consider the safety instructions!
-  Please keep for future reference!



WEEE-Reg.-Nr. DE 93889386

Contents

1	GENERAL NOTE	3
2	SAFETY	3
2.1	INTENDED USE.....	3
2.2	SAFETY SIGNS AND SYMBOLS.....	3
2.3	SAFETY GUIDELINES	3
3	PRODUCT DESCRIPTION	4
3.1	SCOPE OF SUPPLY	4
3.2	OPERATION AND MAINTENANCE ADVICE	4
4	START OF OPERATION	4
5	OPERATION	5
5.1	DISPLAY ELEMENTS.....	5
5.2	PUSHBUTTONS	5
5.3	CONNECTIONS	6
5.4	POP-UP CLIP.....	6
6	OXYGEN MEASURING IN GASES- PLEASE NOTE	7
6.1	CHOICE OF SENSING ELEMENTS	7
6.2	APPLICATION OF THE DIFFERENT SENSOR TYPES GGO ..., GOO ... AND GGA	7
7	CALIBRATION OF THE SENSOR	8
7.1	ONE POINT CALIBRATION (' <i>CAL 1-PT</i> ')	8
7.2	2 / 3-POINT CALIBRATION (' <i>CAL 2-PT</i> ', ' <i>CAL 3-PT</i> ').....	8
7.3	EVALUATION OF SENSOR STATE (<i>ELEC</i>)	8
8	CONFIGURATION	9
9	REPLACING BATTERIES	11
10	OPERATION OF THE LOGGER	11
10.1	„FUNC-STOR“: STORING SINGLE MEASUREMENT SETS	11
10.2	„FUNC-CYCL“: AUTOMATIC RECORDING WITH SELECTABLE LOGGER-CYCLE-TIME.....	12
11	REAL TIME CLOCK (“CLOC”)	12
12	ALARM (“AL.”)	13
13	GLP	13
13.1	CALIBRATION/ADJUSTMENT INTERVAL (C.INT)	13
13.2	CALIBRATION/ADJUSTMENT MEMORY (READ CAL)	13
14	ADJUSTMENT OF TEMPERATURE INPUT	13
15	INSPECTION OF THE ACCURACY / ADJUSTMENT SERVICES	14
16	UNIVERSAL OUTPUT	14
16.1	INTERFACE.....	14
16.2	ANALOG OUTPUT	15
17	RESHIPMENT AND DISPOSAL	15
17.1	RESHIPMENT	15
17.2	DISPOSAL INSTRUCTIONS.....	15
18	ERROR AND SYSTEM MESSAGES	16
19	SPECIFICATION	17

1 General Note

Read this document carefully and get used to the operation of the device before you use it. Keep this document within easy reach near the device for consulting in case of doubt.

Mounting, start-up, operating, maintenance and removing from operation must be done by qualified, specially trained staff that have carefully read and understood this manual before starting any work.

The manufacturer will assume no liability or warranty in case of usage for other purpose than the intended one, ignoring this manual, operating by unqualified staff as well as unauthorized modifications to the device. The manufacturer is not liable for any costs or damages incurred at the user or third parties because of the usage or application of this device, in particular in case of improper use of the device, misuse or malfunction of the connection or of the device.

The manufacturer is not liable for misprints.

2 Safety

2.1 Intended Use

The instrument is measuring oxygen in air and gas mixtures either as partial pressure or as concentration in %vol.

For the measuring an external sensor of the type GOO-..., GGO... or GGA ... has to be connected to the 7-pole bayonet socket.

Due to the properties of the sensor, it has to be calibrated regularly (e.g. at fresh air = 20.95%) to get precise values. If the sensor is used up, this will be detected during the calibration, the sensor has to be regenerated or replaced before continuing with measuring.

The safety requirements (see below) have to be observed.

The device must be used only according to its intended purpose and under suitable conditions.

Use the device carefully and according to its technical data (do not throw it, strike it, ...)

Protect the device from dirt.

2.2 Safety signs and symbols

Warnings are labeled in this document with the followings signs:



Caution! This symbol warns of imminent danger, death, serious injuries and significant damage to property at non-observance.



Attention! This symbol warns of possible dangers or dangerous situations which can provoke damage to the device or environment at non-observance.



Note! This symbol point out processes which can indirectly influence operation or provoke unforeseen reactions at non-observance.

2.3 Safety guidelines

This device has been designed and tested in accordance with the safety regulations for electronic devices. However, its trouble-free operation and reliability cannot be guaranteed unless the standard safety measures and special safety advises given in this manual will be adhered to when using the device.

1. Trouble-free operation and reliability of the device can only be guaranteed if the device is not subjected to any other climatic conditions than those stated under "Specification".

If the device is transported from a cold to a warm environment condensation may cause in a failure of the function. In such a case make sure the device temperature has adjusted to the ambient temperature before trying a new start-up.

2.  **DANGER** If there is a risk whatsoever involved in running it, the device has to be switched off immediately and to be marked accordingly to avoid re-starting. Operator safety may be a risk if:
- there is visible damage to the device
 - the device is not working as specified
 - the device has been stored under unsuitable conditions for a longer time.
- In case of doubt, please return device to manufacturer for repair or maintenance.
3. When connecting the device to other devices the connection has to be designed most thoroughly as internal connections in third-party devices (e.g. connection GND with protective earth) may lead to undesired voltage potentials that can lead to malfunctions or destroying of the instrument and the connected devices.
4.  **DANGER** Do not use these products as safety or emergency stop devices or in any other application where failure of the product could result in personal injury or material damage. Failure to comply with these instructions could result in death or serious injury and material damage.
5.  **DANGER** This device must not be used at potentially explosive areas! The usage of this device at potentially explosive areas increases danger of deflagration, explosion or fire due to sparking.

3 Product Description

3.1 Scope of supply

The scope of supply includes:

- Handheld instrument GMH 5695 with 2 AAA-Batteries (oxygen sensor usually is ordered separately. For choice please refer to chapter 6.1 and 6.2)
- Operating manual
- Short form manual

3.2 Operation and maintenance advice

1. Battery operation:

If 'bAt' is shown in the lower display the battery has been used up and needs to be replaced. However, the device will operate correctly for a certain time. If 'bAt' is shown in the upper display the voltage is too low to operate the device; the battery has been completely used up. Battery change: p.r.t. chapter 9.



The battery has to be taken out, when storing device above 50°C. We recommend taking out battery if device is not used for a longer period of time. After recommissioning the real-time clock has to be set again.

2. Treat device and sensor carefully. Use only in accordance with above specification. (do not throw, hit against etc.). Protect plug and socket from soiling.

3. USB or mains operation:

When connecting a mains cable or USB interface cable, please take care to connect only allowed components.



The output voltage of a connected power supply unit has to be between 4.5 and 5.5 V DC. Don't apply overvoltage!

We recommend operation with interface cable USB 5100. Then device is supplied by the USB interface of the connected PC or USB power supply adapter.

4 Start of Operation

Connect sensor, switch instrument on with .



After the segment test the instrument shows „Err“ shortly, if it was user adjusted. The device starts measurement afterwards.

5 Operation

5.1 Display elements



Main display:

- 1
 - Oxygen concentration in % (% O₂ Vol) or
 - Oxygen partial pressure (hPa or mmHg)

(choice via -key)

2 **Secondary display:** sensor temperature or absolute pressure (alternating, please refer to chapter 8 *Lcd.2*)

3 Main display units

4 State of battery or sensor, if  was pressed

5 Shows, if minimum/maximum/memorized measuring value is in display

6 **OK:** Signals, if oxygen and temperature is stable

7 **CAL:** Signals, if automatic calibration is in progress

8 Shows, if logger function is chosen.

Is blinking, if cyclic logger is running

9 Pressure unit of internal sensor

5.2 Pushbuttons



On / off key, backlight

press shortly: activate backlight or switch on instrument
press longer: switch off instrument



Set / Menu:

press shortly: Change oxygen display unit
press for 2 sec. (menu): invoke configuration menu



min / max:

press shortly: min. or max. value is displayed
press for 2 sec: the corresponding value is deleted



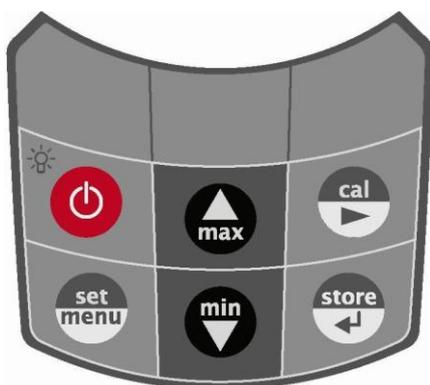
Configuration (please refer to chapter 8):

enter values, or change settings



cal:

press shortly: display of sensor state rating
press for 2 sec: start sensor calibration



Store/Enter:

with Auto-Hold off: hold and save current measuring value ('HLD' is displayed)

with Auto-Hold on: start new measuring, It is finished, when "HLD" shows in display please refer to chapter 8 or if logger activated: calling the logger functions (please refer to chapter 9)



Configuration (please refer to chapter 8):

confirm settings, return to measuring

5.3 Connections



Universal output: interface, supply, analog output (see chapter 16)

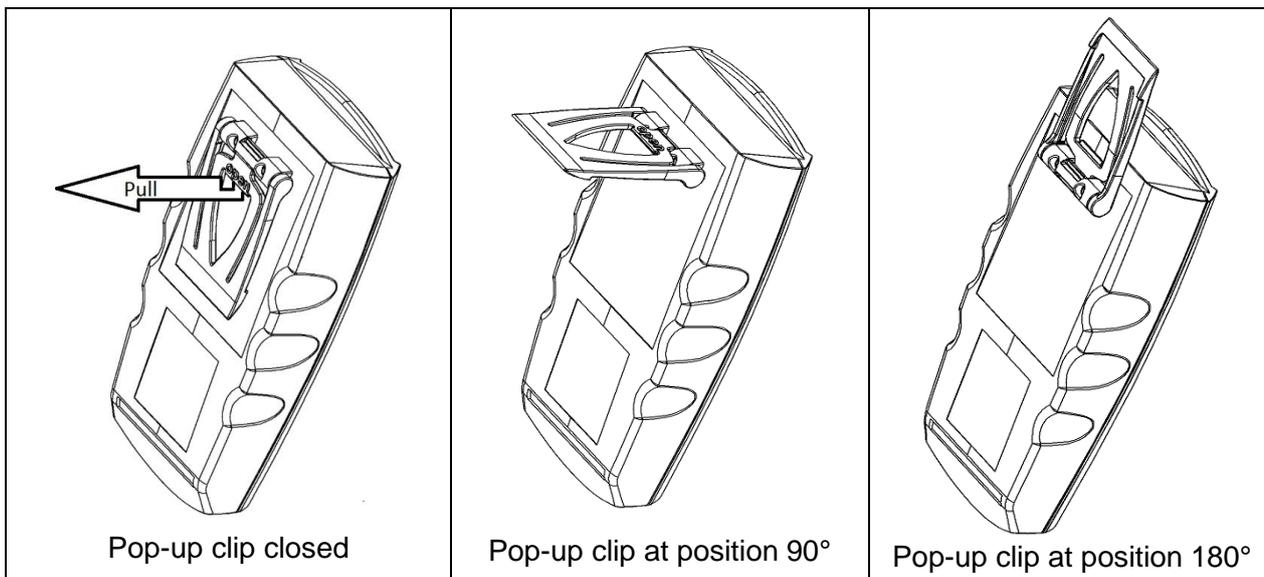
7-pole bayonet socket: connection for sensor and temperature probe

Pressure Port: Tube Connection for ambient pressure compensation of oxygen sensor

5.4 Pop-up clip

Handling:

- Pull at label “open” in order to swing open the pop-up clip.
- Pull at label “open” again to swing open the pop-up clip further.



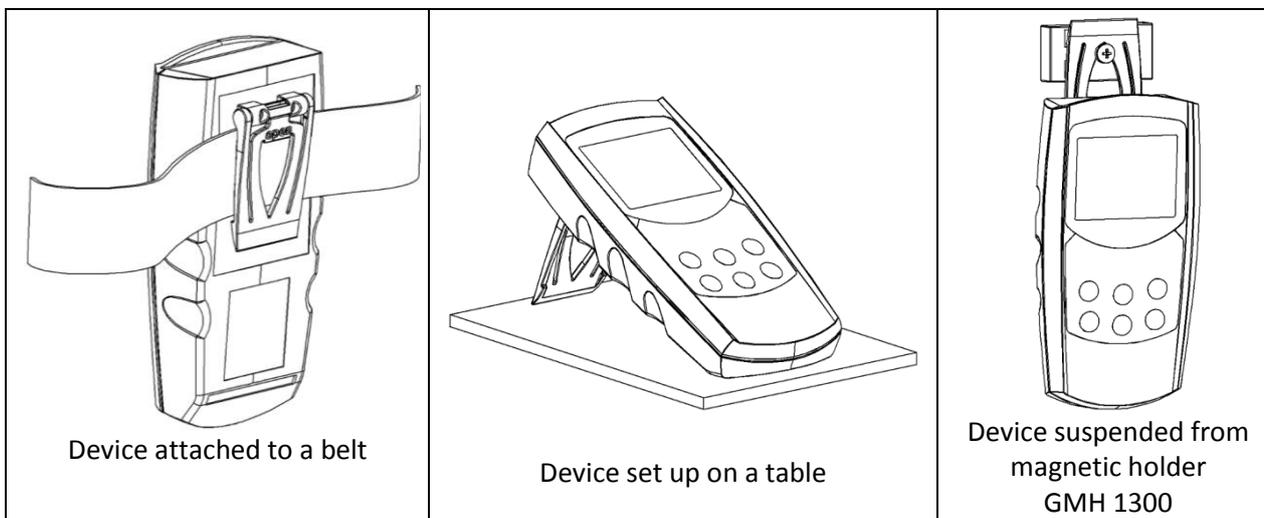
Pop-up clip closed

Pop-up clip at position 90°

Pop-up clip at position 180°

Function:

- The device with a closed pop-up clip can be plainly laid onto a table or attached to a belt, etc.
- The device with pop-up clip at position 90° can be set up on a table, etc.
- The device with pop-up clip at position 180° can be suspended from a screw or the magnetic holder GMH 1300.



Device attached to a belt

Device set up on a table

Device suspended from magnetic holder GMH 1300

6 Oxygen Measuring in Gases- Please Note

The instrument is designed for measuring the oxygen partial pressure or the oxygen concentration (%vol, calculated from partial pressure and ambient pressure) in gases. Please keep in mind:

- **The sensor has to be calibrated regularly, e.g. at fresh ambient air**
- **The calibration and the measuring are pressure depending!**
The instrument automatically measures the ambient pressure, be sure, that instruments pressure is the same like the pressure at the sensors membrane. For the full automatic compensation a precision pressure sensor is integrated in the instrument.
- **The sensor temperature has to be the same like the gas temperature!**
*Temperature differences may falsify the results!
Please have in mind that temperature adoption of the sensor and the air may take several hours.
A suitable ventilation or gas flow around the sensor would speed up this process significantly.*

The sensor consists of a sensing element (GOEL xxx) enclosed in a sensor housing (GGO/ GGA/GOO). When purchasing a Sensor GGO/GGA/GOO xxx, a sensor element is already integrated, e.g. a GGO 570: contains housing GGO and a sensor element GOEL 370.

6.1 Choice of Sensing Elements

GOEL 370:

Universal sensor element with special protection measures especially for diving application ("Nitrox"). Very long life time, also suitable for applications with larger CO₂ concentrations.

GOEL 380:

Fast responding for low oxygen concentration e.g. protection atmosphere below 1%, max 25%. For applications without larger CO₂ concentrations.



Sensors are not allowed to be used in „under-Water-Diving-Application (e.g. Rebreather)

DANGER

6.2 Application of the different sensor types GGO ..., GOO ... and GGA

GGO (closed sensor)



For measurements at atmosphere and in systems without over or under pressure the GGO... is sufficient. Additionally the GGO can be screwed tightly into systems with small over or under pressure. Attention! Mind the maximum pressure and the maximum

pressure difference at the membrane.

If instrument and sensor pressure are different, please connect the pressure port of instrument to measuring pressure, otherwise it will be compensated wrong!

GOO 370 / 380 (open sensor)



The sensor is equipped with drillings at the end and because of its special construction the measuring gas streams optimally around the sensor. No pressure can appear while gas blows to the sensor, which otherwise would result in erroneous measures. The temperature

compensation speed of the sensor also is optimised by this design.

Especially the measuring of gases from compressed gas bottles, where the expansion of the gas leaving the bottle lowers the temperature, is optimised with regard to the temperature compensation and pressure errors. The gas flow should be chosen in a suitable range, where no overpressure can happen, esp. if the sensor is connected directly to the source e.g. by means of a tube.

GGA (closed sensor with pressure port)



Especially at **systems with over or under pressure** or at dynamic pressure due to gas flow this type is optimal. It can be screwed tightly into systems with small over or under pressure.

Attention! Mind the maximum pressure.

The instrument pressure port is connected directly to the sensor port. Then the actual pressure at the

membrane will be measured and compensated automatically.

7 Calibration of the Sensor

In order to compensate for ageing of the sensor, the sensor has to be calibrated at regular intervals. The device is equipped with an easy-to-use calibration functions. We recommend to calibrate the sensor at least all 7 days, or to get maximum precision, before each measuring series.

7.1 One Point Calibration ('CAL 1-Pt')

The calibration adjusts the sensor to the oxygen content of the atmosphere (20.95%). Therefore simply expose the sensor to the ambient air (sufficient ventilation in closed rooms has to be ensured)

Start calibration: press -key for 2 seconds

The display will show 'Pt. 1', and as soon the values for oxygen and temperature are stable, the calibration will be finished

Then the sensor state resulting of the successful calibration will be shown for a short time (evaluation in 10% steps: xx% ELEC).

7.2 2 / 3-Point Calibration ('CAL 2-Pt, CAL 3-Pt')

The sensor will be automatically calibrated to the oxygen content of the atmosphere (20.95%) and one or two additional concentrations. As reference gases usually Nitrogen (0% vol O₂) or pure oxygen are used

1. **Start calibration: press -key for 2 seconds**
2. **First calibration reference: (Pt.1)**

As first reference at a 3-point calibration, the zero reference has to be applied (NULL), at a 2-point calibration either 100% or 0%(NULL).

The display will show 'Pt. 1', and the referring reference which should be applied:

- NULL for 0% oxygen
- 0.2 for pure oxygen

As long as the display blinks, no valid reference is recognised by the instrument.

As soon the values for oxygen and temperature are stable, the calibration of the first point will be finished. The instrument tells you to apply the next reference (possible references are blinking in the display).

3. **Second calibration reference: (Pt.2)**

The display will show 'Pt. 2', and the referring reference which should be applied:

- Pt. 1 for ambient air
- 0.2 for pure oxygen
- NULL for 0% oxygen

As long as the display blinks, no valid reference is recognised by the instrument.

As soon the values for oxygen and temperature are stable, the calibration of the second point will be finished. At 2-point calibration the calibration will be finished and the sensor state resulting of the successful calibration will be shown for a short time (evaluation in 10% steps: xx% ELEC).

At 3-point calibration the instrument tells you to apply the next reference (possible reference is blinking)

4. **Third calibration reference: (Pt.3)**

The display will show 'Pt. 3', and the referring reference which should be applied:

As soon the values for oxygen and temperature are stable, the calibration of the second point will be finished. At 2-point calibration the calibration will be finished and the sensor state resulting of the successful calibration will be shown for a short time (evaluation in 10% steps: xx% ELEC).



In case of error messages being displayed during the calibration process, please refer to our notes at the end of this manual! If a calibration cannot be carried out after an extended period of time, at least one of the measuring values is unstable (oxygen partial pressure, temperature).

Please check your measuring arrangements!

7.3 Evaluation of Sensor State (ELEC)

Watch sensor state: press key "CAL" shortly oncedisplay show for a short time xx% ELEC.

It will show the sensor state resulting of the last successful calibration carried out.

The valuation is displayed in 10 percent steps: 100% means optimal sensor condition. Lower values are indicating that the sensor life time will be reached soon.

Remark: But also an erroneous pressure may be the cause of low valuation values.

8 Configuration



Some menu points depend on current device settings (e.g. some points are locked if logger memory contains data sets).

To change device's settings, press "menu"  for 2 seconds. This will activate the configuration menu (main display: "SET"). Pressing "menu"  changes between the menus points, pressing  jumps to the referring parameters, which can be selected with key .

The parameter value can be changed with  or . Pressing "menu"  again jumps back to the main configuration menu and saves the settings.

Pressing "enter"  finishes the configuration.



Pressing "menu" and "store" at the same time for more than 2 seconds will reset the device to factory defaults.

If there are data sets stored and logger is set to "manual recording" ("Func Stor") the first menu point displayed is "rEAd Logg" (p.r.t. chapter 10.1)

If no key is pressed for more than 2 minutes the configuration will be aborted. All changes will be discarded!

Menu	Parameter	Value	Description		
		 or 			see
Set Configuration: General configuration					
SEt Conf	Ch 2	P 02 hPa	Oxygen partial pressure display in hPa	**	
		P 02 mmHg	Oxygen partial pressure display in mmHg		
rES		H ₁	Best O ₂ resolutions		
		L ₀	Low O ₂ resolution, calm value display (standard)		
Lcd.2		t	Second. display always temperature		
		P	Second. display always absolute pressure		
		P t	Second. display alternates between temperature and abs. pressure		
Unit	t	°C	All temperatures in degree Celsius (ex works setting)		
		°F	All temperatures in degree Fahrenheit		
CALP		1-Pt	Simple one point calibration at air		
		2-Pt / 3-Pt	2 or 3- calibration at air and 0% (e.g. N ₂) or 100 %		
C. Int		1 ... 365	Calibration reminder period (in days)		
		off	No calibration reminder		
Auto HLD		on	Auto measuring value identification Auto Hold (when logger = off)		
		off	Standard hold function on key press (when logger = off)		
P.off		1 ... 120	Power-off delay in minutes. Device will be automatically switched off as soon as this time has elapsed if no key is pressed/no interface communication takes place. (ex works setting 20min)		
		off	Automatic power-off function deactivated (continuous operation)		
L. tE		off	Background Illumination deactivated		
		5...120	Turn off illumination after 5... 120s (factory settings: 10 s)		
		on	Illumination always on		
Out		off	Interface off -> minimal power consumption		
		SEr	Serial interface activated (ex works setting)		
		dAC	Analog output activated		
Adr		01,11,21, ... 91	Base address for serial interface communication (ex works setting 01)		

	dA, n	$Conc$	Analog output is corresponding to concentration in %		
		$P, 02$	Analog output is corresponding to partial pressure in hPa or mmHg		
	$dAL0$	$0.0..100.0 \%O_2$	Measuring value that should correspond to output 0 V e.g. for 0.0 %		
	$dAL1$	$0.0..100.0 \%O_2$	Measuring value that should correspond to output 1 V e.g. for 100.0 %		
SET Corr	Set Corr: Input adjustment				**
	$OFFS$ °C or °F	$-5.0\text{ }^{\circ}\text{C} .. 5.0\text{ }^{\circ}\text{C}$ or $-9.0\text{ }^{\circ}\text{F} .. 9.0\text{ }^{\circ}\text{F}$	The zero point of the temperature measuring is shifted for the entered value. This can be used to compensate sensor and instrument deviations		**
		oFF	No zero adjustment for temperature measurement (=0.0°)		
	$SCAL$ °C or °F	$-5.00 .. 5.00\ %$	The slope of the temperature measurement is corrected by this value. This can be used to compensate sensor and instrument deviations		**
		oFF	No slope adjustment for temperature measurement (=0.00)		
	$OFFS$ hPa	$-20 .. 20\ \text{hPa}$	The zero point of the pressure measuring is shifted for the entered value. This can be used to compensate sensor deviations		**
oFF		No zero adjustment for pressure measurement (=0 hPa)			
SET AL	Set Alarm				
	$AL, 1$	$on / no,5o$	Monitoring Oxygen: Alarm on with buzzer / Alarm on without buzzer		
		oFF	No alarm monitoring for oxygen		
	AL, n	$Conc$	Monitoring Oxygen: Concentration in %		
		$P, 02$	Monitoring Oxygen: Partial pressure in hPa or mmHg		
	$ALLo$	e.g. $0.0..100.0\ %$	Min alarm limit oxygen (not if AL. 1. oFF)		
	ALh	e.g. $0.0..100.0\ %$	Max alarm limit oxygen (not if AL. 1. oFF)		
	$AL, 2$	$on / no,5o$	Temperature monitoring : Alarm on with buzzer / Alarm on without buzzer		
oFF		No alarm monitoring for temperature			
$ALLo$	$-5.0 .. 50.0\text{ }^{\circ}\text{C}$	Min alarm limit temperature (not if AL. 2. oFF)			
ALh	$-5.0 .. 50.0\text{ }^{\circ}\text{C}$	Max alarm limit temperature (not if AL. 2. oFF)			
SET Lo66	Set Logger				
	$Func$	$CYCL$	Cyclic logger function	*	17
		$Stor$	Store: manual recording		
oFF		No logger activated			
$CYCL$	$0:01 ... 60:00$	Cycle time in [minutes:seconds] for cyclic logger	**		
SET CLOC	Set Clock				
	$CLOC$	HH:MM	Clock: set time hours:minutes		
	$YEAR$	YYYY	Year: set year		
	$DATE$	TT.MM	Date: set date day.month		



(*) If logger memory contains data sets parameters marked with (*) cannot be called.
You have to clear memory to change these parameters!

(**) If logger is running parameters marked with (**) cannot be called.

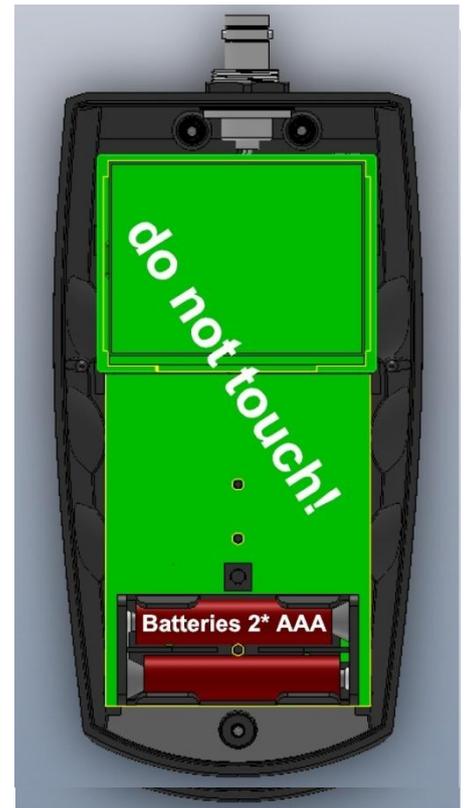
9 Replacing Batteries

Before changing batteries, please read the following instruction and follow it step by step.

Not following the instruction may cause harm to the instrument or the protection against ingress of water and dust may be lost!

Avoid unnecessary opening of the instrument!

1. Open the 3 Phillips screws at the backside of the instrument.
2. Lay down the still closed instrument, so that the display side points upwards.
The lower half of the housing incl. the electronics should be kept lying down during battery change.
This avoids loss of the 3 sealing rings placed in the screw holes.
3. Lift off upper half of housing. Keep an eye on the six function keys, to be sure not to damage them.
4. Change carefully the two batteries (Type: AAA).
5. Check: Are the 3 sealing rings placed in the housing?
Is the circumference seal of the upper half sound and clean?
6. Close the housing, taking care that it is positioned correctly, otherwise the sealing may be damaged. Afterwards press the two halves together, lay the instrument with display pointing downwards and screw it together again
Take care to screw only until you feel increasing resistance, higher screwing force does not result in higher water protection!



10 Operation of the Logger

The device supports two different logger functions:

- „Func-Stor“: Manual recording by key press “store”
Additional input of measuring point (L-Id) is needed
- „Func-CYCL“: Automatic recording at intervals of set cycle time

For the evaluation of the data the software GSOFT3050 (version V3.6 or higher) has to be used. The software also allows easy configuration and starting of the logger.

When the logger is activated (Func Stor or Func CYCL) the hold function is no more available, the key “store” is solely used for the operation of the logger functions.

10.1 „Func-Stor“: Storing Single Measurement Sets

Each time when “store” (key 6) is pressed a measurement and its time stamp will be recorded.

The recorded data can be viewed either in the display (when calling the configuration an additional menu “REAd LoGG” is displayed, see below) or by means of the interface and a PC with GSOFT3050-software.

The logger stores the current measuring, independent from the stability of the value.

- Max. number of data sets: 1000
- A data set contains:
- oxygen concentration % Vol
 - oxygen partial pressure in hPa or mmHg
 - temperature value at the time of recording in °C or °F
 - absolute pressure in hPa abs or mmHg abs
 - measuring point L-Id (only for “Func-Stor”)
 - time and date of the recording

After each recording „St. XX“ will be displayed for a short time. XX represents the number of the recording.

Input of the measuring point “L-Id”: Selection of measuring point via keys ▲ or ▼.

Number 0...19999 or text assigned to number 1...40

(comfortable assignment of texts can be done with gratis software GMHKonfig)

Confirm input with „store“.

When logger memory contains recordings already:

When “store” is pressed for 2 seconds, the choice for clearing the logger memory will be displayed:



Clear all recordings



Clear the last recording



Clear nothing (cancel menu)

The selection can be made by ▲ (key 2) and ▼ (key 5). "Quit" (key 6) enters the choice.

If the logger memory is full, the display will show:



Viewing Recorded Data

Within the "LoGG Stor" function the logger data can be viewed directly in the display not only by means of a computer (like at "Func CYCL"): press 2 seconds "set" (key 4): The first menu displayed now is "rEAd LoGG" (read logger data). After pressing ▶ (key 3) the measurement recorded last will be displayed, changing between the different data referring to the measurement also is done by pressing ▶.

Changing the measurement is done by pressing the keys ▲ or ▼.

10.2 „Func-CYCL“: Automatic Recording With Selectable Logger-Cycle-Time

The Logger-Cycle-Time is selectable (p.r.t. Configuration). For example "CYCL" = 1:00: A measuring is recorded after each 60 seconds.

Max. number of data sets: 10000
 Cycle time: 0:01...60:00 (minutes:seconds, min 1s, max 1h), selectable in the configuration
 A data set contains:

- oxygen concentration % Vol
- oxygen partial pressure in hPa or mmHg
- temperature value at the time of recording in °C or °F
- absolute pressure in hPa abs or mmHg abs

Recording time: > 20 days with fresh battery (with output activated: OUT = SEr)
 With mains adapter: limited just by memory and cycle time, up to 333 days

Starting a recording:

By pressing "Store" (key 6) for 2 seconds the recording will be initiated. After that the display shows 'St.XXXX' for a short time whenever a measuring is recorded. XXXXX is the number of the measuring 1..9999.

If the logger memory is full, the display will show:



The recording automatically will be stopped.

Stopping the recording manually:

By pressing "Store" (key 6) the recording can be stopped manually. Then the following choice appears:



Stop the recording



Do not stop the recording

The selection can be made by ▲ (key 2) and ▼ (key 5). "Quit" (key 6) enters the choice.



If you try to switch off the instrument in the cyclic recording operation you will be asked once again if the recording should be stopped.

*The device can only be switched off after the recording has been stopped!
 The Auto-Power-Off-function is deactivated during recording!*

Clear Recordings:

When "store" is pressed for 2 seconds, the choice for clearing the logger memory will be displayed:



Clear all recordings



Clear nothing (cancel menu)

The selection can be made by ▲ (key 2) and ▼ (key 5). "Quit" (key 6) enters the choice.

11 Real Time Clock ("CLOC")

The real time clock is used for chronological assignment of the logger data and calibration points. Please check the settings when necessary.

12 Alarm (“AL.”)

There are 3 possible settings:

off (AL.oFF), on with buzzer (AL.on), on without buzzer (AL.no.So).

Alarm is given in the following cases (if alarm active, AL.on or AL.no.So):

- Lower alarm boundary (AL. Lo) under-run
- Upper alarm boundary (AL. Hi) over-rum
- Sensor error
- Low battery (bAt)
- Err.7: system error (always with buzzer!)

In case of an alarm (and when polling the interface) the ‘PRIO’-flag is set in the returned interface message.

13 GLP

GLP (Good Laboratory Practice) includes regular check of devices and accessories. For oxygen measurements it is highly important to ensure correct sensor calibration/adjustment.

The device provides the following functions to help with this.

13.1 Calibration/Adjustment Interval (C.Int)

You can input the interval after which the device reminds you to recalibrate.

The interval times should be chosen according to the application and the stability of the sensor. “CAL” flashes on the display as soon as the interval has expired.

13.2 Calibration/Adjustment Memory (rEAd CAL)

The last 16 calibrations are stored with results and date and can be read out.

Show Memory:

Historical calibration data can be comfortably read out via PC software GMHKonfig and GSOF3050 or displayed directly at the device:

	Press for 2 seconds: The display will show:	
	Press several times until this is displayed:	
Press shortly: switch between:		
	<ul style="list-style-type: none"> - ELEE = Overall evaluation in % - SL.1 = Slope 0% - Air *¹) - SL.2 = Slope Air – 100% *¹) - Display of date+time of data set 	
	Change between the different calibration data sets	
	Quit calibration data set display	

*¹at the 1 and 2-Punkt-calibration is SL.1 = SL. 2
at 3-point calibration there are in dependent slope for the two segments.

14 Adjustment of temperature input

The temperature input can be adjusted with offset and scale. A reasonable adjustment presumes reliable references (e.g. ice water, controlled precision water bath, etc.).

If the inputs are adjusted (i.e. offset and scale are different from default settings) the device will shortly display “Corr” after turned on.

Default setting for offset and scale are ‘off’ = 0.0, i.e. inputs are not changed.

Zero point correction: **Displayed value = measured value – OFFS**

Zero point and slope correction: **Displayed value = (measured value – OFFS) * (1 + SCAL / 100)**
Displayed value °F = (meas. value °F - 32°F - OFFS) • (1 + SCAL / 100)

15 Inspection of the Accuracy / Adjustment Services

The instrument can be sent to the manufacturer for adjustment and function test. Only the manufacturer can check all systems on correct them if necessary.

Calibration certificates – DKD-certificates – other certificates:

If device should be certificated for its accuracy, it is the best solution to return it to the manufacturer. (please specify references, e.g. 20.9 and 100%).

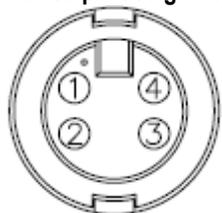
If the instrument is certified with its sensor, this proves for example the linearity of the measuring chain, regular recalibration by the user is still necessary!

16 Universal Output

The output can be used as serial interface (for USB5100 interface converter). If the output is not needed, it is strongly recommended to deactivate it (Out OFF) to lower power consumption. This increases battery life time.

If the device is used together with interface adapter USB 5100 the device is supplied from the interface.

device pin assignment:



- 1: external supply +5V, 50mA
- 2: GND
- 3: TxD/RxD (3.3V Logic)
- 4: +U_{BAC}, analog output



Only suitable adaptor cables are permitted (accessories)!

16.1 Interface

The following standard software packages are available:

- **GSOFT3050:** Operating and evaluation software for the integrated logger function
- **EBS20M / -60M:** 20-/60-channel software for measuring value display
- **GMHKonfig:** Configuration Software (for free on internet)

In case you want to develop your own software we offer a **GMH3000-development package** including:

- a universally applicable Windows functions library ('GMH3x32e.DLL') with documentation, can be used by all 'established' programming languages, suitable for:
Windows XP™, Windows Vista™, Windows 7™, Windows 8™
- Programming examples Visual Studio 2010 (C#, C++ and VB), Testpoint™, LabView™, etc.

The device has 4 channels:

- oxygen concentration in % vol
- oxygen partial pressure in hPa or mmHg
- temperature value at the time of recording in °C or °F
- absolute pressure in hPa abs or mmHg abs

Supported interface-functions:

1	2	3	4	Code	Name/Function	1	2	3	4	Code	Name/Function
x	x	x	x	0	read nominal value	x	x	x	x	199	read measuring type in display
x	x	x	x	3	read system status	x	x	x	x	200	read min. display range
x				12	read ID-no.	x	x	x	x	201	read max. display range
x	x	x		22	read min alarm limit	x	x	x	x	202	read unit of display
x	x	x		23	read max alarm limit	x	x	x	x	204	read decimal point of display
x	x	x	x	176	read min. measuring range	x				208	read channel count
x	x	x	x	177	read max. measuring range	x				222	read turn-off-delay
x	x	x	x	178	read measuring range unit	x				223	Set turn-off-delay
x	x	x	x	179	read measuring range decimal point	x				240	Reset
x	x	x	x	180	read measuring type	x				254	read program identification



The measuring and range values read via interface are always in the selected display unit!

16.2 Analog output

An analog voltage 0-1V can be tapped at the universal output socket (mode: "Out dAC").
The analog output can be easily scaled with DAC.0 and DAC.1.

Please take care not to load the analog output too heavily, otherwise the output value will be distorted and the power consumption will rise. Loads up to approx. 10 kOhm are unproblematic.

If the displayed value goes beyond DAC.1 the output voltage will be 1V.

If the displayed value falls below DAC.0 the output voltage will be 0V.

In error case (Err.1, Err.2, ----, etc.) the output voltage will be slightly higher than 1V.

17 Reshipment and Disposal

17.1 Reshipment



All devices returned to the manufacturer have to be free of any residual of measuring media and other hazardous substances. Measuring residuals at housing or sensor may be a risk for persons or environment



Use an adequate transport package for reshipment, especially for fully functional devices.
Please make sure that the device is protected in the package by enough packing materials.

17.2 Disposal instructions



Batteries must not be disposed in the regular domestic waste but at the designated collecting points.

The device must not be disposed in the unsorted municipal waste! Send the device directly to us (sufficiently stamped), if it should be disposed. We will dispose the device appropriate and environmentally sound.

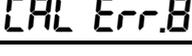
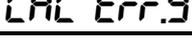
18 Error and System Messages

Display	Meaning	Remedy
	low battery voltage, device will continue to work for a short time	replace battery
	If mains operation: wrong voltage	replace power supply, if fault continues to exist: device damaged
	low battery voltage	replace battery
	If mains operation: wrong voltage	Check/replace power supply, if fault continues to exist: device damaged
No display or weird display	low battery voltage	replace battery
	If mains operation: wrong voltage	check/replace power supply, if fault continues to exist: device damaged
Device does not react on keys	system error	disconnect battery or power supply, wait some time, re-connect
	device defective	return to manufacturer for repair
	sensor error: no sensor cable connected	connect suitable sensor
	Sensor, cable or instrument defect	return to manufacturer for repair
	Value exceeding measuring range	Check: Is the value exceeding the specified measuring range? ->value too high!
	Wrong sensor connected	Check sensor
	Sensor, cable or instrument defect	return to manufacturer for repair
	Value below display range	Check: Is the value below the specified measuring range? ->value too low!
	Wrong sensor connected	Check sensor
	Sensor, cable or instrument defect	return to manufacturer for repair
	system error	return to manufacturer for repair

If "bAt" is flashing, the battery will be exhausted soon. Further measurements are possible for short time.

If "bAt" is displayed continuously the battery is ultimately exhausted and has to be replaced. Further measurements aren't possible any more.

Messages During Calibration/Adjustment

	either preset calibration interval has expired or last calibration is not valid	device has to be calibrated!
	wrong reference point at air	check sensor and reference gas
	slope too low	
	reference gas wrong	check sensor and reference gas
	sensor element is defect	replace sensor element
	slope too high	
	reference gas wrong	check sensor and reference gas
	sensor element is defect	replace sensor element
	incorrect calibration temperature	calibration can only be done at 0...50 °C
	Zero value to low/negative	
	sensor element is defect	replace sensor element
	zero value to high	
	reference gas wrong	check sensor and reference gas
	sensor element is defect	replace sensor element
	incorrect calibration pressure	check calibration pressure
	signal not stable / timeout	check sensor and reference gas
	sensor not known: cannot be calibrated	check sensor and wiring

19 Specification

Measuring ranges	Oxygen concentration	[Lo] 0.0 ... 100.0 % O ₂ (vol.) [Hi] 0.00...100.00 % O ₂ (vol.)	electrochemical sensors GGO / GOO / GGA
	Oxygen partial pressure	[Lo] -0 ... 1100 hPa O ₂ [Hi] -0.0 ... 1100.0 hPa O ₂	“ “ “
	Sensor temperature	-5.0 ... + 50.0 °C	NTC 10k (integrated in GGO / GOO / GGA cable)
	Absolute pressure	300 ... 5000 hPa abs.	integrated pressure sensor with pressure port
Accuracy (instrument without sensor, at 25°C, 1000 hPa abs)	Oxygen concentration	±0.1 % O ₂ (Vol)	
	Oxygen partial pressure	± 1 hPa	
	Sensor temperature	± 0.1 °C	
Accuracy	Absolute pressure	3 hPa or 0.1% of measured value (the higher one to be applied)	
Working conditions		-20 ... 50 °C; 0 ... 95 % r.H. (not condensing, sensor min -5°C)	
Nom. temperature		25°C	
Storage temp.		-25 ... 70 °C (sensor min -5°C)	
Connections	O ₂ & temperature	6 pole waterproof bayonet connector	
	Absolute pressure	Universal pressure port for tubes with 4 or 6mm inner-Ø	
	Interface / Analogue output / external supply	4 pole waterproof bayonet connector (USB adapter USB 5100)	
Display		LCD, white backlight, two 4½ digits 7-segment (main and auxiliary display) with additional symbols	
Calibration	automatic	1 -, 2- or 3-point calibration, 0%, 100% or ambient air (20.95%)	
Alarm		Buzzer / visual / interface 2 channels: selectable oxygen unit and temperature	
Additional functions		Min / max / hold / auto hold Analog output 0-1V, adjustable	
Data logger		Real-time clock Cyclic: 10000 data sets, cycle time 1s to 60 minutes Single: 1000 data sets, with measuring point input	
GLP		calibration memory adjustable calibration intervals (1 to 365 days, CAL warning after expiration)	
Housing		Break-proof ABS housing, incl. silicone protective cover	
	Protection class	IP65 / IP67	
	Dimensions L*W*H [mm]	Without pressure connection: 160 * 86 * 37 incl. silicone protective cover, pressure connection: length 11mm	
	Weight	approx. 250 g incl. battery and cover	
Power supply		2*AAA battery (included in scope of supply) or external	
	Current consumption	0.9 mA (for Out = oFF, equivalent to 1000 h), backlight ~10mA (auto-off)	
	Battery indicator	4-stage battery state indicator, Change battery display for exhausted battery: "bAt", warning: "bAt" flashing	
Auto-off function		Device will be automatically switched off if no key is pressed/no interface communication takes place for the time of the power-off delay. The power-off delay can be set to values between 1 and 120 min.; it can be completely deactivated.	
EMC		The device corresponds to the essential protection ratings established in the Regulations of the Council for the Approximation of Legislation for the member countries regarding electromagnetic compatibility (2004/108/EG) Additional fault: <1%	

