

Operating Manual

Hand-held Measuring Device

GMH 3691

for Gaseous Oxygen and Temperature

with Alarm Function, input of atmospheric pressure
and 1- resp. 2-Point-Kalibration

Version 1.3



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How to Operate and Maintain Device:

a) When to replace battery:

If Δ and 'bAt' are shown in the lower display the battery has been used up and needs to be replaced. The device will, however, 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.

Please note: The battery has to be taken out, when storing device above 50°C.

We recommend to take out battery if device is not used for a longer period of time.

b) Treat device and sensor carefully. Use only in accordance with above specification. (do not throw, hit against etc.).

Protect plug and socket from soiling.

Make sure to use sensors that are suitable for the device. Unsuitable measuring probes may lead to the destruction of the measuring device and the measuring probes.

c) When connecting the electrode the connector may not lock to the jack correctly. In such a case hold the connector not at the case but at the buckling protection of the cable during the plug in.

Don't connect electrode canted! If plug is entered correctly, it will slide in smoothly.

To disconnect sensor do not pull at the cable but at the plug

d) Mains operation:

When using a power supply device please note that operating voltage has to be 10.5 to 12 V DC.

Do not apply overvoltage!! Cheap 12V-power supply devices often have excessive no-load voltage. We, therefore, recommend using regulated voltage power supply devices. Trouble-free operation is guaranteed by our power supply GNG10/3000.

Prior to connecting the plug power supply device with the mains supply make sure that the operating voltage stated at the power supply device is identical to the mains voltage.



Safety Requirements:

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".
2. 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.
3. If device is to be connected to other devices (e.g. via serial interface) the circuitry has to be designed most carefully. Internal connection in third party devices (e.g. connection GND and earth) may result in not-permissible voltages impairing or destroying the device or another device connected.

Warning: If device is operated with a defective mains power supply (short circuit from mains voltage to output voltage) this may result in hazardous voltages at the device (e.g. sensor socket, serial interface).

4. 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.

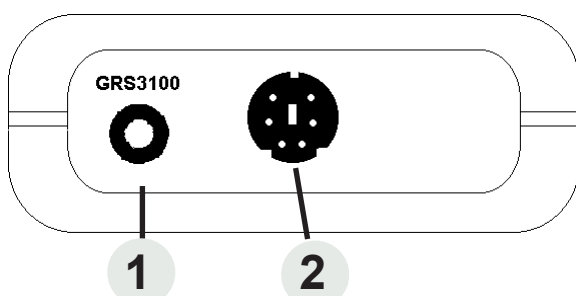
In case of doubt, please return device to manufacturer for repair or maintenance.

5. **This device only serves as supervision by the monitoring of essential or other for the customer important systems.**

It must not be used instead of compulsory approval monitoring devices as it is not planned for that purpose.

If this device is used for the monitoring of such systems on its own, the manufacturer will not assume liability for damages whatsoever.

Connections

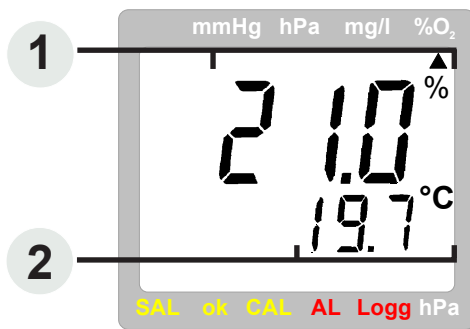


1 Interface: Connection for electrically isolated interface adapter (accessories: GRS 3100 or GRS3105)

2 Connection for oxygen sensor with integrated temperature probe

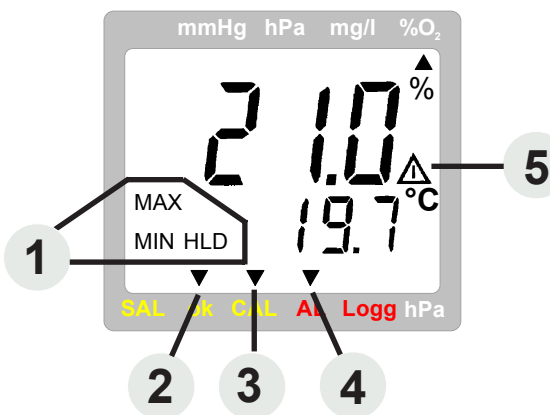
The **mains socket** is located at the left-hand side of the measuring instrument.

Displays



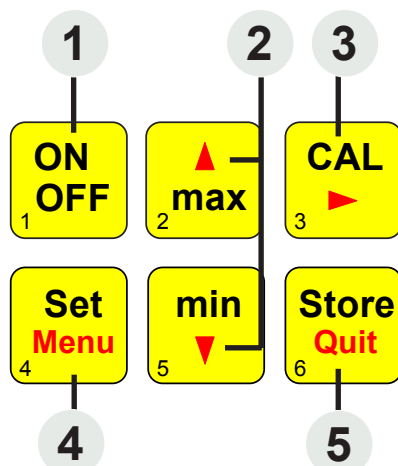
- 1 Main display**
measuring value displayed:
 - Oxygen concentration in % (%O₂)
 - Oxygen partial pressure (hPa)
- 2 Secondary display**
measuring value displayed:
 - Sensor temperature (°C or °F)

Special Display Elements:



- 1 Min/Max/Hold:** indicates if min., max. or hold values are displayed in the main and/or secondary display.
- 2 ok-arrow:** indicates that oxygen and temperature values have been stable for a longer period of time
- 3 CAL-arrow:** indicates that an automatic oxygen calibration is carried out.
- 4 Alarm-arrow:** indicates an alarm by blinking
- 5 Warning triangle:** indicates a low battery

Pushbuttons



- 1** On/off key
- 2** min/max when taking measurements:
 - press shortly: min. or max. meas. value will be displayed
 - press for 1 sec.: the min. or max. value will be deleted
 up/down when configuring: entering/changing of settings.
- 3** CAL:
 - press shortly: show state of the electrode
 - press for 2 sec: start oxygen calibration
- 4** Set/Menu:
 - press shortly (Set): change between oxygen concentration[%] and oxygen partial pressure [hPa].
 - press for 2 sec. (Menu): configuration call-up
- 5** Store/Quit:
 - measuring: holds current meas. value ('HLD' in display)
 - Set/Menu: acknowledge setting, return to measuring.

Configuration

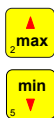
For configuration of the device press "Set"-key (key 4) for 2 seconds.

Choose between the individual values that can be set by pressing the "Set"-key (key 4) again.

The individual values are changed by pressing the keys "▲" (key 2) or "▼" (key 5).

Use key "Store" (key 6) to leave configuration and to store settings.

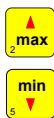
'Pressure Abs.': Input of Absolute Pressure



500 .. 2000 hPa abs.

The calculated oxygen values will refer to the entered absolute pressure

'Offset': Zero Point Displacement When Temperature is Measured



-3.0°C .. 3.0°C

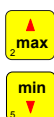
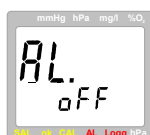
or
-5.4°F .. 5.4°F

off:

The zero point of the measurement will be displaced by the value set to compensate for sensor and measuring device deviations.

Zero displacement not activated (=0.0°)

'AL.': Alarm Functions



off:

alarm function switched off

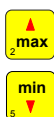
no.So:

alarm function active, alarm will be displayed by the 'AL'-arrow.

on:

alarm function active, alarm will be displayed by the 'AL'-arrow, additionally a short alarm will be sounded every 2 s.

'AL.Lo': Lower Alarm Limit (if alarm is active, only)

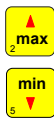


0.0 .. 100.0%:

enter lower alarm limit.

the values entered have to be smaller or equal to the lower alarm limit (s.a.).

'AL.Hi': Upper Alarm Limit (if alarm is active, only)

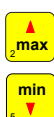


0.0 .. 100.0%:

enter upper alarm limit.

the values entered have to be smaller or equal to the lower alarm limit (s.a.).

'CAL': Choice of Calibration



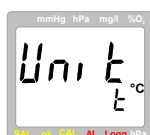
Air:

simple 1 point calibration at atmospheric air (=20,95%)

2-Pt:

2 point calibration: one point = air, another point can be entered manually

'Unit t': Selection of Temperature Unit °C /°F



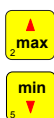
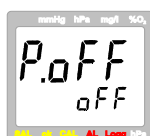
°C:

All temperature values in degrees Celsius

°F:

All temperature values in degrees Fahrenheit

'Power.off': Selection of Power-off Delay



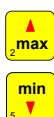
1 .. 120:

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.

off:

automatic power-off function deactivated (continuous operation, e.g. in case of mains operation)

'Address': Selection of Base Address



01, 11, 21, ..., 91:

Base address for interface communication.

Channel 1 will be addressed by the base address set, channels 2, 3 and 4 will have the following addresses.

(Example: base address 21 - channel 1 = 21, channel 2 = 22, channel 3 = 23, ...)

Using the interface converter GRS3105 it is possible to connect several devices to a single interface. As a precondition the base addresses of all devices must not be identical. In case several devices will be connected via one interface make sure to configure the base addresses accordingly.

Special Functions - please note:

Input of absolute pressure ('P.Abs')

To get most accurate measurements the absolute pressure should be inspected both before calibration and measuring. The determining pressure is the actual pressure at the sensor membrane. Keep in mind that gas flows may change the absolute pressure at the membrane and therefore may cause measuring errors!

Zero point displacement ('Offset') temperature

A zero point displacement can be carried out for the temperature measurements:

$$\text{temperature displayed} = \text{temperature measured} - \text{offset}$$

Standard setting: 'off' = 0.0°, i.e. no zero displacement taking place. The zero displacement is mainly used to compensate for sensor deviations. An offset, if any, will be displayed for a short while upon switching on of the device.

Alarm functions

If the alarm function has been activated (p.r.t. configuration), an alarm will be issued under the following circumstances:

- measuring value smaller or equalling lower alarm limit 'AL.Lo'
- measuring value higher or equalling upper alarm limit 'AL.Hi'
- no electrode connected or error in sensor
- measuring values exceeding/falling below measuring ranges
- battery voltage too low
- error in device ('Err.7')

The alarm function is supported by the interface, thus, it can easily be monitored by a computer connected.

Oxygen Measuring - please note

When measuring gases, please consider the following:

- Calibration and measuring are depending of the absolute pressure at the sensor!

Therefore check absolute pressure before calibration and measuring.



- Sensor temperature and gas temperature should be the same!

Temperature differences may cause additional measuring errors! It may take from several minutes up to several hours (depending on the measurement setup) until both temperatures are adjusted.

Temperature differences may cause additional measuring errors! In worst case conditions it may take up to several hours until both temperatures are adjusted. A suitable flow of the gas around the sensor element increases the adjustment significantly.

Application of the different sensor types GGO 369 und GOO 369

GGO 369 (closed sensor)

For measurements at atmosphere and in systems without over or under pressure the GGO 369 is sufficient. Additionally the GGO can be screwed impermeable to systems with a known pressure. (Attention: please note the specified operating pressure for one-sided strain).

The actual pressure has to be entered (p.r.t. 'Configuration'). The pressure will be compensated and no additional measuring error will occur.

GOO 369 (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 measurements. At 'P.Abs' the atmospheric pressure has to be entered.

The temperature compensation speed of the sensor also is optimized by this design. The measuring gas escapes into the air. Especially the measuring of gases from compressed gas bottles, where the expansion of the gas leaving the bottle lowers the temperature, is optimized 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.

Calibration of The Oxygen Sensor

In order to compensate for ageing of the sensor, the sensor has to be calibrated at regular intervals.

The device is equipped with two easy to handle calibration functions. We recommend to calibrate at least once a week or, for optimum measuring results, directly before starting the measuring process.

Check the absolute pressure which you have preset in the device before carrying out any calibration!

1-Point air calibration ('CAL Air')

Electrode has to be subjected to air (make sure that rooms are thoroughly aired).

Start calibration: press -key for 2 sec.

The display will show 'CAL'; calibration will be automatically completed as soon as the measuring values for oxygen and temperature are stable.

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


2-Point calibration ('CAL 2-Pt')

The electrode will be automatically calibrated to the oxygen concentration of atmospheric air (20.95%) and additionally to a second oxygen concentration of your choice.

1. Start calibration: press -key for 2 sec.

2. Choice of first calibration point:

The calibration can be carried out starting with the "manual value" or the fixed value "air".

To change the selection for the first calibration point between "manual value" (display = '----') and "atmospheric air" (display = 'air') press -key.

Please note: If You started editing the manual value once, the change to "air" is no more possible.

3. Calibration point 1: (Pt.1)

Expose sensor to the chosen gas and wait until temperatures of gas and sensor have adjusted.

Calibration point = manual value:


- enter current oxygen concentration of your gas with  and -keys. (input range: 0.0..10.0%; 30.0..100.0%)

Please note: If no key is pressed within 2 minutes, the entry will be cancelled and the display returns to "----".

Calibration point = Air:

- the calibration will carried out to a value of 20.95%

As long as the display is flashing, the sensor signal is not stable.

After detection of a stable value - permanent display - the calibration value can be acknowledged by .

4. Calibration point 2: (Pt.2)

same procedure as calibration point 1

5. After successful ending of the calibration the electrode state resulting of the calibration will be shown for a short time (evaluation in 10% steps)



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 in unstable (oxygen content, temperature). Please check your measuring arrangements.

Valuation of sensor state (ELEC)

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

It will show the electrode 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 a erroneous pressure entry may be the cause of low valuation values.

The Serial Interface

All measuring and setting data of the device can be read and changed by means of the serial interface and a suitable electrically isolated interface adapter (GRS3100 or GRS3105). In order to avoid transmission errors, there are several security checks implemented.

The following **standard software packages** are available for data transfer:

- EBS9M** 9-channel software to display all measuring value (channel 1..4)
- EASYCONTROL**: Universal multi-channel software (EASYBUS-, RS485-, or GMH3000- operation possible) for real-time recording and presentation of measuring data in the ACCESS®-data base format.

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

- a universally applicable Windows functions library ('GMH3000.DLL') with documentation that can be used by all 'serious' programming languages, suitable for:
Windows 3.1™, Windows 3.11 for Workgroups™, Windows 95™, Windows 98™, Windows NT™
- Programming examples Visual Basic 4.0™, Delphi 1.0™, Testpoint™

The following interface functions will be supported:

Oxygen concentration	Oxygen partial pressure	Temperature	abs. pressure		
Channel 1	Channel 2	Channel 3	Channel 4	DLL-Code	Name/function
x	x	x	x	0	Read nominal value
			x	1	Set nominal value
x	x	x	x	3	Systemstatus lesen
x	x	x	x	6	Read min. value
x	x	x	x	7	Read max. value
x				12	Read ID-no.
x				22	Read min. alarm limit
x				23	Read max. alarm limit
x				32	Read configuration flags
x				102	Set min. alarm limit
x				103	Set max. alarm limit
x				160	Set configuration flags
x				174	Delete min. value
x				175	Delete max. value
x	x	x	x	176	Read min. meas. range
x	x	x	x	177	Read max. meas. range
x	x	x	x	178	Read meas. range unit
x	x	x	x	179	Read meas. range decimal point
x	x	x	x	180	Read meas. range meas. mode
		x		194	Set display unit
x	x	x	x	199	Set display meas. mode
x	x	x	x	200	Read display min.
x	x	x	x	201	Read display max.
x	x	x	x	202	Read display unit
x	x	x	x	204	Read display decimal point
x				208	Read channel count
x				210	Read electrode state
		x		216	Read offset correction
		x		217	Set offset correction
x				222	Read power-off delay
x				223	Set power-off delay
x				240	Reset device
x				254	Read program identification

Fault and System Messages

Display	Description	Remedy
	No sensor or sensor defective	connect sensor sensor defective -> return sensor to manufacturer for repair
	Battery voltage too low, the device will only continue operation for a short time	replace battery
	Battery voltage low In case of mains op.: wrong voltage	replace battery replace power supply, if error continues to exist: device damaged
No display or confused characters	- Battery voltage too low - If mains op.: power supply defective or wrong voltage/polarity - System error - Device defective	replace battery check/replace mains supply disconnect battery or power supply, wait for a short time, reconnect return to manufacturer for repair
Err.1	Values exceeding measuring range Sensor/cable defective	check: are there any values exceeding the measuring range specified? -> meas. value too high -> replace
Err.2	Values below measuring range Sensor/cable defective	check: are there any values below the measuring range specified? -> meas. value too low -> replace
Err.7	System fault	switch on again: if fault continues to exist, device is damaged -> return to manufacturer for repair
Err.9	No sensor or error in sensor Temperature display correct, oxygen display incorrect	connect suitable sensor sensor defective -> return to manufacturer for repair check: mini-DIN plug in sensor housing connected? open PG-glanding and pull up plug as far as possible
Er.11	Value could not be calculated	one of the measuring values required for calculation is missing sensor missing or damaged (overflow/underflow)

Error and System Messages During Oxygen Calibration

Display	Description	Remedy
Cal Err.1	Wrong temperature	temperature has to be between 5 and 40°C
Cal Err.3	Sensor slope to low	check calibration environment (p.r.t. 'How to calibrate oxygen electrode')
Cal Err.4	sensor slope to high	check calibration environment (p.r.t. 'How to calibrate oxygen electrode')
Cal Err.5	calculated offset to large	check calibration environment (p.r.t. 'How to calibrate oxygen electrode')
Cal Err.6	input signal (O ₂ -partial pressure) to high	check calibration environment (p.r.t. 'How to calibrate oxygen electrode')

Specification

Measuring ranges

Oxygen concentration	0.0...100.0 % O ₂
Oxygen partial pressure	0...1100 hPa
Sensor temperature	-20.0...50.0 °C
pressure range:	500...2000 hPa abs.

Accuracy device (±1Digit) (at 1000hPa abs. and nominal temperature)

Oxygen concentration	± 0.1% O ₂
Oxygen partial pressure	± 1 hPa
Sensor temperature	± 0.2 °C

Nominal temperature 25°C

Operating temperature 0 to +50°C

Relative humidity 0 to +95%r.h. (non-condensing)

Storage temperature -20 to +70°C


Housing dimensions 142 x 71 x 26 mm (L x W x D)
impact-resistant ABS plastic housing, membrane keyboard, transparent panel. Front side IP65, integrated pop-up clip for table top or suspended use.

Weight approx. 155 g (device incl. battery)

Alarm function: monitoring of alarm limits (% oxygen), measuring range limits (%oxygen and temperature) and device faults
alarm via display element and interface, additional audio alarm optional

Sensor connection: 6-pin Mini-DIN-socket

Interface serial interface (3.5mm jack), serial interface can be connected to RS232 interface of a PC via electrically isolated interface adapter GRS3100 or GRS3105 (see accessories).

Power supply 9V-battery, type IEC 6F22 (included) as well as additional d.c.connector (dia of internal pin 1.9 mm) for external 10.5-12V direct voltage supply.  (suitable power supply: GNG10/3000)

Power consumption approx. 1.5 mA, during audio alarm approx. 2 mA

Display 2 four-digit LCD-displays (12.4mm or 7mm high) for measuring values or for min., max., values, Hold-function etc. as well as additional arrows.

Pushbuttons 6 membrane keys altogether for on/off switch etc.

Min-/max-value memory both the max. and the min. value for each measurement are memorized.

Hold function press button to memorize current measuring values

Automatic-off-function Device will be automatically switched off if no key is pressed/no interface communication takes place for the time of the switch-off delay. The switch-off delay can be set to values between 1 and 120 min. it can be completely deactivated.

EMC: The GMH 3691 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 (89/336/EWG).
Additional fault: <1%

Disposal instruction:

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.

