



Operating manual
Oxymeter
HM 691
for dissolved Oxygen and Temperature





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1 General instructions

1.1 Dangers and precautions



Please carefully read the following instructions before putting into operation! The symbols used in the instruction manual are to make you careful, before hand, regarding safety considerations and dangers. But all these symbols cannot substitute the text of the associated safety instructions in any way. Therefore, the instructions should also be always read completely!



This symbol indicates likely danger for persons, material or environment. The information provided in the associated text should be duly followed to avoid any kind of risk.



This symbol refers to important application notes and tips, which are necessary for successful working and should to be absolutely followed to ensure good results.

1.2 Product-specific safety instructions

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.



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

Transporting the device from a cold to a warm environment condensation may result 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.

The circuitry has to be designed most carefully if the device should be connected to other devices. 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.



Operating the device with a defective mains power supply (e.g. short circuit from mains voltage to output voltage) may result in hazardous voltages at the device (e.g. at sensor socket).

Whenever there may be 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.

Do not use these product as safety or emergency stop device, 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.



1.3 Application cautions

First Usage: If the electrode was disconnected from the device, pull off the protection flask and expose the electrode at least 2 - 3 hours to the air before the first calibration or measuring.



Battery Operation: The battery has been used up and needs to be replaced, if Δ and „bAt“ are shown in lower display. The device will, however, continue operating correctly for a certain time. The battery has been completely used up, if 'bAt' is shown in the upper display. The battery has to be taken out, when storing device above 50°C.

Hint: We recommend to remove the battery if device is not used for a longer period of time!

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.

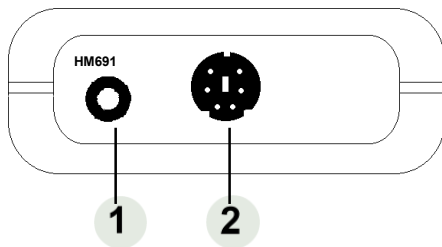
When connecting the electrode the connector may not lock to the jack correctly. In such a case hold the connector not at the case but at the buckling protection of the cable during the plug in. Don't connect electrode canted! If plug is entered correctly, it will slide in smoothly. To disconnect sensor do not pull at the cable but at the plug



Mains Operation: When using a power supply unit please note that operating voltage has to be 10.5 to 12 V DC. Do not apply overvoltage!! Simple 12V-power supplies often have excessive no-load voltage. We, therefore, recommend using regulated voltage power supplies. Trouble-free operation is guaranteed by our power supply NG-12V-HQ. Prior to connecting the plug power supply with the mains supply make sure that the operating voltage stated at the power supply is identical to the mains voltage.

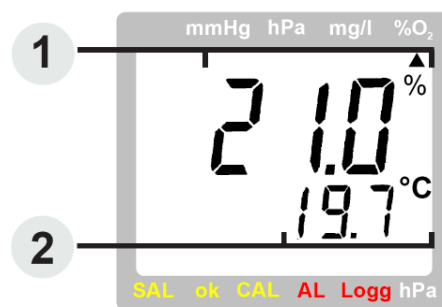


2 Connections



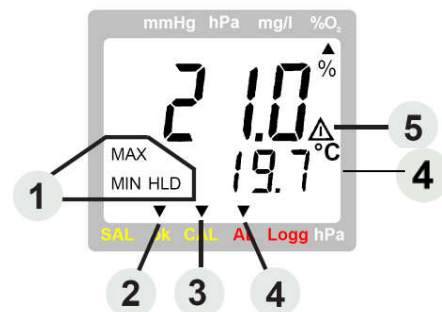
- 1 **Interface:** Connection for electrically isolated interface adapter (accessories: HM-SERINT or HM-USBINT)
- 2 **Connection for oxygen sensor** with integrated temperature probe
The mains socket is located at the left-hand side of the measuring instrument.

3 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)

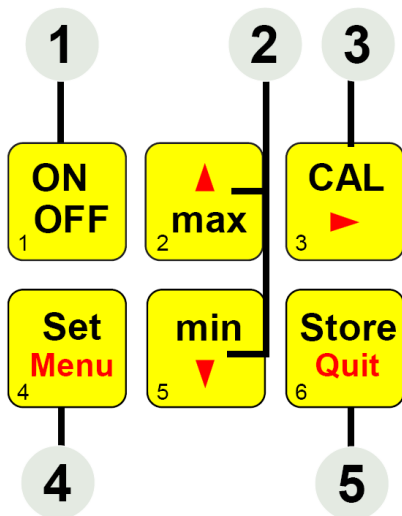
3.1 Special Display Elements



- 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



4 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.

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5 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 "5" (key 2) or "6" (key 5).

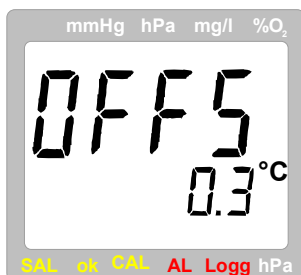
Use key "Store" (key 6) to leave configuration and to store settings.

5.1 'Pressure Abs.': Input of Absolute Pressure



500 .. 2000 hPa abs. The calculated oxygen values will refer to the entered absolute pressure.

5.2 'Offset': Zero Point Displacement When Temperature is Measured



-3.0°C ... 3.0°C or -5.4°F ... 5.4°F:

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

Off:

Zero displacement not activated (=0.0°)

5.3 '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.



5.4 'AL.Lo': Lower Alarm Limit

(if alarm is active, only)

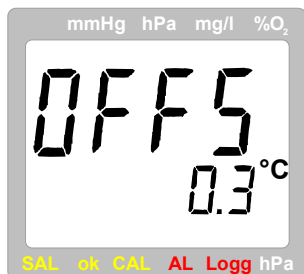


0.0 .. 100.0%:

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

5.5 '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.).

5.6 'CAL': Choice of Calibration



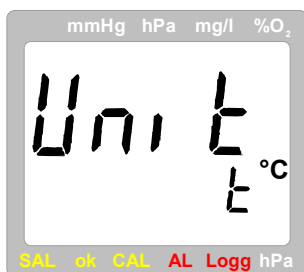
Air:

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

2-Pt:

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

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



°C:

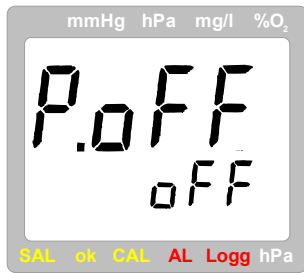
All temperature values in degrees Celsius

°F:

All temperature values in degrees Fahrenheit



5.8 '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)

5.9 '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 HM-SERINT5 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.



6 Special Functions - please note

6.1 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!

6.2 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.

6.3 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.



7 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.

7.1 Application of the different sensor types GGO 369 und GOO 369

7.1.1 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.

7.1.2 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 measurings. At ,P.Abs' the atmosphereic 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.



8 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!

8.1 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).

8.2 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  .



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.

8.3 Valuation of sensor state (ELEC)

Watch sensor state:

- ▶ press key "CAL" shortly once
- ▶ display show for a short time xx% ELEC

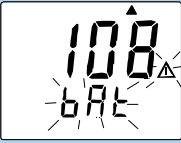

It will show the electrode state resulting of the last successful calibration carried out.

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.



9 Error and System Messages

Display	Meaning	Solution
	low battery voltage, device will continue to work for a short time If mains operation: wrong voltage	replace battery replace power supply, if fault continues to exist: device damaged
	low battery voltage If mains operation: wrong voltage	replace battery Check/replace power supply, if fault continues to exist: device damaged
No display or confused characters; device does not react on keypress	low battery voltage If mains operation: wrong voltage system error device defective	replace battery Check/replace power supply, if fault continues to exist: device damaged Disconnect battery or power supply, wait some time, re-connect return to manufacturer for repair
SenS Erro	No sensor or sensor defective	connect sensor sensor defective -> return sensor 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

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Err.11	Value could not be calculated	one of the measuring values required for calculation is missing sensor missing or damaged (overflow/underflow)
--------	-------------------------------	--

10 Error and System Messages during Oxygen Calibration

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

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11 The serial interface

By using an electrically isolated interface converter HM-SERINT oder HM-USBINT (accessory) the device can be connected to a PC. With the HM-USBINT it is possible to connect up to 5 instruments to a single interface (please also refer to HM-USBINT - manual). 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.

In order to avoid transmission errors, there are several security checks implemented (e.g. CRC).

Our software PCLOG is available for data recording. With the optional DLL functional library you are able to implement the datas to your own projects.

On your demand we can send you program examples for Visual Basic 6.0™, Delphi 1.0™, Testpoint™ or Labview.



Note: The measuring and range values read via interface are always in the selected display unit (°C/°F)!

11.1 Supported functions

Oxygen concentration	Oxygen partial pressure	Temperature	Absolute 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	Read system status
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 unit
x				23	Read max. alarm unit
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. measuring 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.



Oxygen concentration	Oxygen partial pressure	Temperature	Absolute pressure		
channel 1	channel 2	channel 3	channel 4	DLL Code	Name / function
x	x	x	x	201	Read display max.
x	x	x	x	202	Read display unit
x	x	x	x	204	Read decimal point of display
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

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12 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
Sensortemperature	± 0.2 °C
General description of oxygen measuring	
Nominal temperature	25 °C
Area conditions	temperature: 0 ... 50°C Allowable rel. humidity: 0...95 % RH (not condensing)
Storage temperature	-20 bis +70 °C
Boxing	
Dimensions	142 x 71 x 26 mm (L x W x D)
Weight	approx. 155 g
Material	impact-resistant ABS
Structure	membrane keyboard, transparent panel. Front side IP65, integrated pop-up clip for table top or suspended use
Output	3.5mm jack
Interface	Serial interface (3.5mm jack) can be connected to RS232 interface of a PC via electrically isolated interface adapter HM-SERINT, HM-SERINT5 or HM-INTUSB (see accessories).
Power supply	9V battery, type: IEC 6F22 (included in scope of supply) as well as additional d.c. connector (diameter of internal pin 1.9 mm) for external 10.5-12V direct voltage supply. (suitable power supply: NG-12V-HQ)
Power consumption	approx. 3.5 mA
Area conditions	Working temperature: 0 ... 50°C Storage temperature: -20 ... +70°C Allowable rel. humidity: 0...95 % RH (not condensing)
Display	2 four digit LCDs (12.4mm high and 7 mm high) for measuring values, and for min/ max memories, hold function, etc. as well as additional functional arrows.
Pushbuttons	6 membrane keys for on/off switch, selection of measuring range resolution, min. and max. value memory, HOLD-function etc.

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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
Min-/max-value memory	both the max. and the min. value for each measurement are memorized.
Hold function	Press button to store current measuring values
Power-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%

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