H69.0.21.6C-03

GREISINGER
Member of GHM GROUP

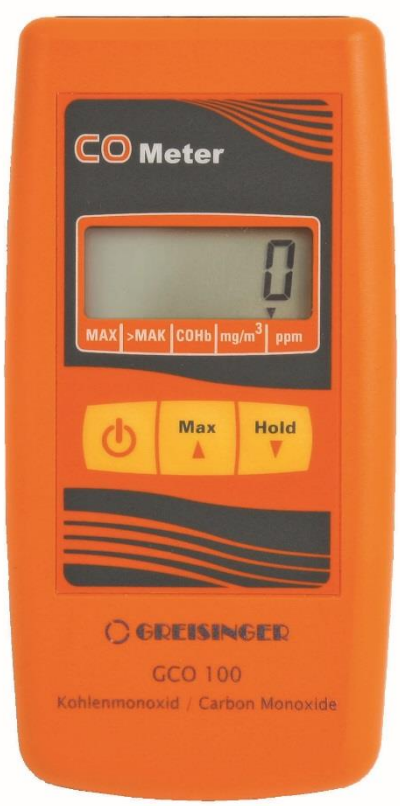
Operating Manual

Carbon Monoxide (CO) Measuring Instrument
with alarm function

as of version 1.4

GCO 100

Please note our new name:
Senseca Germany GmbH
Hans-Sachs-Straße 26, 93128 Regenstauf, Germany
Documents are in the process of being changed.



CE

Made in Germany

WEEE-Reg.-Nr. DE 93889386

☞ Please carefully read these instructions before use!

☞ Please consider the safety instructions!

☞ Please keep for future reference!

GHM GROUP - Greisinger
GHM Messtechnik GmbH | Hans-Sachs-Str. 26 | 93128 Regenstauf | GERMANY
Tel.: +49 9402 9383-0 | info@greisinger.de | www.greisinger.de

GHMGROUP
Specialists by Competence.

Content

1 GENERAL ADVICE 2

2 SAFETY 3

2.1 INTENDED USE 3
2.2 SAFETY SIGNS AND SYMBOLS 3
2.3 SAFETY GUIDELINES 3

3 PRODUCT SPECIFICATION 4

3.1 SCOPE OF SUPPLY 4
3.2 OPERATING AND MAINTENANCE ADVICE 4

4 OPERATION 5

4.1 DISPLAY ELEMENTS 5
4.2 PUSHBUTTONS 5
4.3 CONNECTIONS 5
4.4 POP-UP CLIP 5

5 RESHIPMENT AND DISPOSAL 6

5.1 RESHIPMENT 6
5.2 DISPOSAL INSTRUCTIONS 6

6 GENERALS OF CO-MEASURING 7

7 CONFIGURATION OF THE INSTRUMENT 8

8 ALARM FUNCTIONS 9

9 ADJUSTMENT 9

9.1 ADJUSTMENT MENU 9
9.2 AUTOMATIC ZERO POINT ADJUSTING 9
9.3 ADJUSTMENT WITH REFERENCE GAS 10

10 SYSTEM MESSAGES 11

11 THE SERIAL INTERFACE 11

11.1 INTERFACE 11
11.2 SUPPORTED INTERFACE FUNCTIONS 11

12 SPECIFICATION 12

1 General Advice

Read through this document attentively and make yourself familiar to the operation of the device before you use it. Keep this document in a ready-to-hand way in order to be able to look up in the case of doubt.

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 safety requirements (see below) have to be observed.
The device must be used only according to its intended purpose and under suitable conditions.

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

The instrument is a high value CO-Measuring instrument for the measuring of up to 1000ppm (0.1Vol %) CO in ambient air.
Via the adjustable alarm function the instrument warns the user optically (display) and acoustically (integrated horn) when dangerous concentrations are present.
Warning! The device must not be used as a sole monitoring device for the personal safety! Please refer to safety guidlines below!
The measuring inlet is at the opening of the front plate.

Applications

- control and maintenance of heating systems
- monitoring air quality (signalling exceeding of the maximum allowed working place concentration MAK)
- detection of CO in the breath of smokers
- detection of CO-toxication of victims of fires (Fire brigades)
- and much more...

2.2 Safety signs and symbols

Warnings are labelled 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. 

   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 device and the connected devices.

This device must not be run with a defective or damaged power supply unit.
Danger to life due to electrical shock!

4. 

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.
The device must not be used as a sole monitoring device for the personal safety!

5. 

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.

6. This device is not constructed for use in medical applications.

7. 

Caution, acid! The sensor contains small amounts of sulphuric acid. This can cause severe chemical burns. If leaking, avoid contact!
If there was contact:
- to skin: Flush contacted area with large amounts of water for several minutes.
- to clothing: remove contaminated clothing.
- to eyes: Flush with large amounts of water for several minutes, obtain medical treatment.

After swallowing:
- give large volumes of water. DO NOT induce vomiting! Obtain medical treatment.

3 Product Specification

3.1 Scope of supply

- Device GCO 100, incl. 9V battery block
- Operation manual
- Calibration protocol

3.2 Operating and maintenance advice

- 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.

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.

- Mains operation with power supply

When using a power supply please note that operating voltage has to be 10.5 to 12 V DC. Do not apply overvoltage!! Cheap 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 GNG10/3000.Prior to connecting the power supply to the mains makes sure that the operating voltage stated at the power supply is identical to the mains voltage.

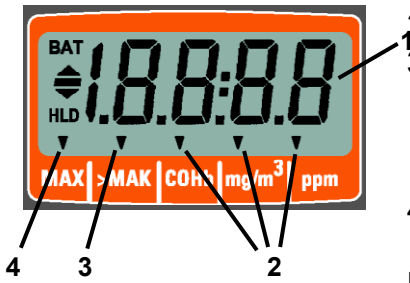
- Treat device and probes carefully. Use only in accordance with above specification. (do not throw, hit against etc.). Protect from soiling, especially in the area of the gas inlet at the front plate.

- Avoid condensation at the sensor, if there was condensation, let the device dry sufficiently

Do not use solvents or silicone containing substances around the sensor opening, otherwise the measuring might be disturbed or the sensor might even be destroyed!

4 Operation

4.1 Display elements

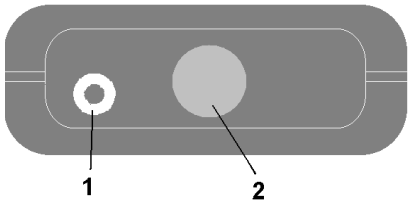


1: Main display	Display for the current, frozen or max. CO-value
2: unit arrows	display in ppm, mg/m^3 or %COHb
3: MAK-warning	Flashes, if the allowed value for maximum working place concentration isexceeded. (maximum exposition value for daily 8 hours work = MAK)
4: MAX-arrow	The max. value since power-on will be displayed. Press >2s: max. value will be reset
BAT	Indicates low battery
HLD	Measured value is ‚frozen' (key 3)

4.2 Pushbuttons

Left key:	on/off-button, for power-off press longer
Middle key:	Max: display of the maximum measured value (MAX-arrow in display)
Right key:	Hold: hold (frozen) of the current measure value ('HLD' in display)

4.3 Connections



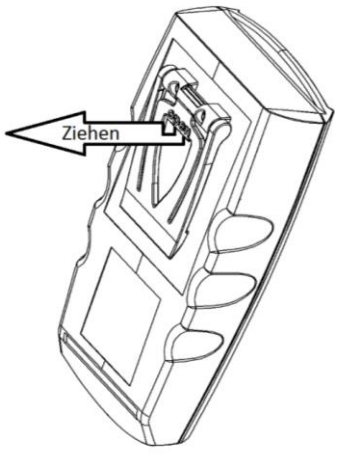
1. Interface: Connect to optically isolated interface adapter (accessory: GRS 3100, USB3100, ...)
2. Sensor opening

The mains socket is located at the left side of the instrument

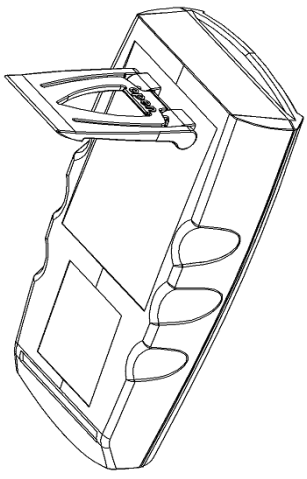
4.4 Pop-up clip

Handling:

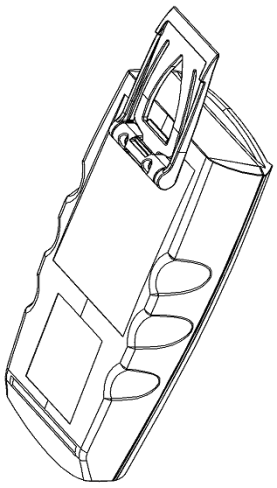
- Pull at label “open” in order to swing open the pop-up clip.
- Pull at label “open” again to swing open the pop-up clip further.



Pop-up clip closed



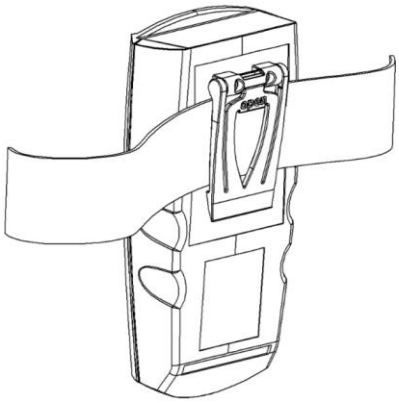
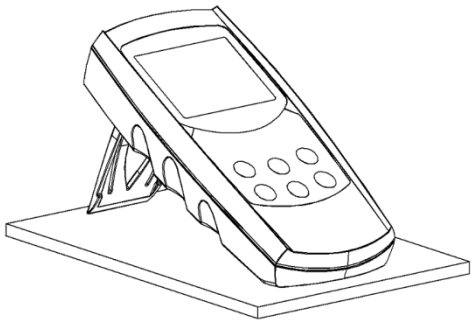
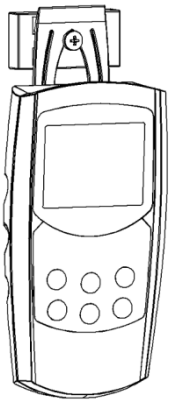
Pop-up clip at position 90°



Pop-up clip at position 180°

Functions:

- 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

5 Reshipment and Disposal

5.1 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.

5.2 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.

6 Generals of CO-measuring

Carbon monoxide (CO) is combustible and highly toxic. It is invisible, taste- and odourless, the relative density is 0,97 (a bit lighter than air).
Already smallest concentrations can be dangerous for humans (depending of physical constitution)::

30ppm	Maximum allowed working place concentration (MAK) for 8-hours of work per day
70..100ppm	Flue like symptoms after some hours: sniffing nose, headaches, excoriated eyes, short breath
150...300ppm	medium exposure: dizziness, sleepiness and nausea, even vomiting
400ppm	extreme exposure: headache
800ppm	extreme exposure: headache, dizziness, nausea and limb twitching after 45min, unconsciousness within 2h
1600ppm	headache, dizziness, nausea within 45min, death after 2 hours

CO is produced when burning carbon containing substances (Wood, coal, oil, petrol, gas, cigarettes...), especially when not enough oxygen is available. In fresh uncontaminated air the CO-concentration is near zero. Transportation, heating and industry exhausts are increasing CO concentrations in urban areas.

There could be measured CO also in the breath of smokers:

None smokers	<6ppm
Light smoker	6...10ppm
Smoker	10...20ppm
Strong smoker	>20ppm

Like with alcohol concentration in blood, also the CO is decomposed in the blood: around every 5h the CO content is cut by half. Via the CO concentration of exhaled air, the saturation of the CO in blood haemoglobin can be derived.
The carboxy-haemoglobin in % can be displayed directly by the instrument: %COHb (p.r.t. Configuration of the instrument). This value is an estimation of the carboxy-haemoglobin of blood via the exhaled breath.
The calculation above 5ppm is done according to: M.J. Jarvis, M. Belcher, C. Vesey and D.C.S. Hutchison, Low cost carbon monoxide monitors in smoking assessment. Thorax 41 (1986), pp. 886-887

Procedure for the measuring of exhaled gas

We suggest to use the ESA-100 adapter and the T-piece (picture at right) in combination with a suitable mouthpiece (accessories).

- switch on instrument, respectively reset the max-value by pressing Max key for 2 seconds
- inhale deeply and hold your breath 20 seconds, if possible (now CO migrates from the blood to the air)
- exhale slowly and complete via the T-piece (preferably with mouthpiece)
- read the Maximum value by pressing the Max key shortly

If no T-piece is available, an estimation can be done, by exhaling/blowing in the direction of the sensor-opening at a distance of fewer than 5 cm.
Wait sufficiently between measurings to allow the sensor to dry and to degrade CO of the previous measuring, if there was some.

7 Configuration of the instrument

To configure the instruments according to Your needs proceed like follows::

- Switch off instrument.
- Switch on and press **max-key** **during the segment test**, until the display shows the first parameter ‚P_oF'
- Edit parameter by pressing up or down ( ) keys.
- Jump to the next parameter with key

Parameter **key**	value **keys**	meaning
P_oF	**Auto Power-Off**	
	0 ... 120	**Auto Power-Off** in minutes. If there won't be pressed any key and no interface communication takes place for the time of the power off time setting, the device will be switched off automatically to save battery power.
	oFF	automatic power-off is deactivated (continuous operating)
Unit	**Unit of the CO-display**	
	Unit	Selection of the display unit "ppm" (factory setting)
	Unit	Selection of the display unit "mg/m³"
	Unit	Selection of the display unit " %COHb"
AL	**Alarm function**	
	oFF	No alarm
	on	Alerting over display and buzzer (factory setting)
	no.So	Alerting only via display
AL.Hi	**Alarm boundary** (not available if alarm function is deactivated: AL = oFF)	
	0 ... 1000	Alarm boundary in the selected display unit, factory setting: 10ppm
rAIL	**Warning boundary for maximum working place concentration**	
	0 ... 100	Value for warning boundary in the selected display unit. Setting for Germany: 30ppm, value may vary for different countries.
	oFF	Warning for maximum working place concentration f is deactivated
Adr.	**Base address of the interface**	
	01 ... 91	Base address (refer to „the serial interface")
Init	**Reset settings to Ex-Works**	
	no	Settings are kept
	YES	Settings of configuration and adjustment menue are reset to ex-works settings

Pressing again stores the settings, the instruments restarts (segment test)

Please note: If there is no key pressed within the menu mode within 120 seconds, the configuration will be cancelled, the entered settings are lost!

8 Alarm functions

There are 3 possible settings for the alarm function: off (AL oFF), on with horn (AL on) and on without horn (AL no.So)
The alarm will be issued under the following circumstances:
- measuring value higher or equalling upper alarm limit 'AL.Hi'
- sensor error
- measuring values exceeding/falling below measuring ranges
- battery voltage too low or error in device ('Err.7')

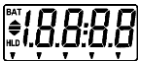
The alarm is supported by the interface, thus, it can be monitored by a connected computer.
The acoustic alarm is depending of the value. It is an interrupting tone, increasing in intensity with the value, above 300ppm the tone is permanent.
Visual alarming: „AL.Hi" flashes in the display
Additionally the exceeding of the MAK value is signalled with the MAK-arrow independently from the alarm settings.
Because the maximum working place concentration differ from country to country, this value is adjustable.

9 Adjustment

The adjustment of the GCO100 is stable within 5% within in a year.
The measuring precision can be checked by means of suitable test-gas mixtures and the suitable testing accessories. Alternatively the instrument can be sent to the manufacturer for test and recalibration.
Attention! If the adjustment is altered, the included Calibration protocol is no more valid!

9.1 Adjustment menu

To adjust a measuring offset and scale proceed like follows:

- Switch off instrument.
- Switch on
  and press **"Hold"-key during the segment test** (), until the display shows the first parameter "OFFS"
- Press "up" or "down" key, the currently selected offset adjustment appears.
- Choose the desired value by pressing "up" or "down" key. (max. selectable values: ±20ppm)
- Enter by pressing On/Off-key: OFFS appears in the display again
- Selsect the next parameter by pressing On/Off-key: SCAL appears in the display
- Press "up" or "down" key, the currently selected scale appears
- Choose the desired value by pressing "up" or "down" key. (28.00 ... 62.00 nA/ppm).
- Store the values by pressing 'On/Off' key. The instrument will restart (segment test).

Please note: ***If during the changing of the offset adjust no key is pressed within 120 seconds, the input will be aborted. Eventually made changes won't be stored!***

9.2 Automatic zero point adjusting

To compensate a deviation of the zero point proceed like following:

- Switch on instrument and bring it to a CO-free atmosphere (fresh air or good vented room without any CO sources)
- If there was measured at higher CO levels before, please wait at least 3 minutes.
- press **Hold-key 5 seconds**, until the display shows "**nuLL**"

The zero point adjusting is now performed automatically and will be stored in the instrument. The instrument will automatically show the measured value after successful adjustment.
If the adjusting could not be performed (display shows nuLL permanently), there is a higher CO-value in the ambient air or the sensor is defect. Turn device off and on to return to measuring –
Note: zero point adjusting was not stored.
The zero point can be viewed in the adjustment menu at parameter "OFFS".

9.3 Adjustment with reference gas

The instrument can be adjusted to a reference gas by means of a test gas cap and the suitable test gas bottle with gas valve. Depending on the application two concentration are offered as standard:

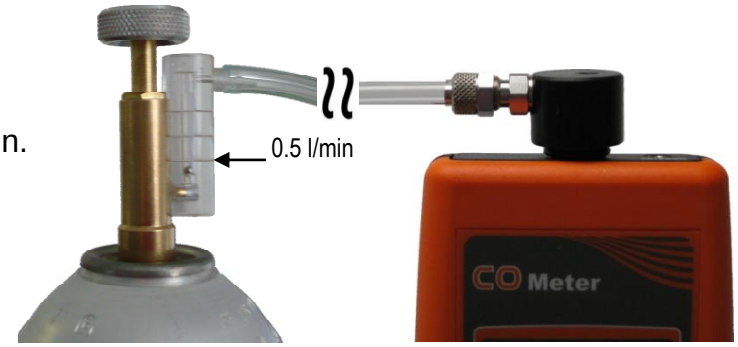
"GZ-02" 12l disposable test gas bottle cont. 12l of 30ppm CO
"GZ-03" 12l disposable test gas bottle cont. 12l of 300ppm CO
Ca. 10 calibrations can be done per bottle.

Additionally needed:
"GZ-04" Gas Valve unit MiniFlo
"GZ-10" test gas cap for GCO100

Preparation of device:
Perform automatic zero point adjusting first (pr.t. chapter 9.2).
The Instrument as well as the gas bottle should have adjusted to room temperature.
Set the instruments display to the unit [ppm], if another one is displayed (p.r.t. chapter 4)

Preparation of the test gas and accessories
Screw the closed gas valve unit "GZ-04 MiniFlo" on the gas bottle
Screw the test gas cap "GZ-10" to the instrument
Connect the test gas cap "GZ-10" to the valve unit via the hose
The Gas bottle has to stand upright, for the flow-display
of the gas valve unit is able to work properly

Scale Adjustment
Keep bottle upright, open valve slowly,
until the ball in the flow indicator shows 0.5 l/min.
(lowest marking of indicator).
Wait until the measurement display at
has stabilised (ca. 1min), and write down the
displayed value. Close the valve accurately an
disconnect the bottle from the instrument.



Correction of scale value
If the displayed value differs from the nominal test gas concentration, the scale has to be adjusted.
For this read the “old” scale value ("Scal") from the adjustment menu (p.r.t. chapter 5.1)
Calculate the new scale like follows:

Scal_new = Scal_old * display at gas concentration / gas concentration

Enter Scal_new to the adjustment menu "Scal", and close the menu.
The instrument is now adjusted.

Attention:
The referring calibration protocol is then no more valid!
The ex works settings can be recalled with the "Init-YES" function of the configuration menu (p.r.t chapter 7).

10 System messages

Er. 1 = measuring range has been exceeded, measured value is to high
Er. 2 = measuring range is undershot, measured value is to low
-- = Sensor error: Value could not be calculated
Er. 7 = System fault - the device has detected a system fault (defective or far outside allowable ambient temperature range)
If **"BAT"** is displayed at the left side of display, the battery is weak, measuring can be continued for a short period.
If **"bAt"** is displayed in the main display the battery is used up and needs to be replaced. Measuring is no more possible.

11 The serial interface

11.1 Interface

By means of the serial interface and a suitable electrically isolated interface adapter (USB 3100, USB 3100 N, GRS 3100 or GRS 3105) the device can be connected to a computer for data transfer.
With the GRS 3105 up to 5 devices of the GMH3xxx- series can be connected to one interface (see also manual of GRS 3105). As a precondition the base addresses of all devices must not be identical, make sure to configure the base addresses accordingly (refer menu point "Adr." in chapter 7).
To avoid transmission errors, there are several security checks implemented e.g. CRC.
The following standard software packages are available:

- **GMHKonfig:** Software for a comfortable editing of the device (e.g. Material selection…)
- **EBS 20M / 60M:** 20-/60-channel software to display the measuring values

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 the most programming languages. Suitable for Windows XP™, Windows Vista™, Windows 7™, Windows 8/8.1™, Windows 10™
• Programming examples Visual Basic 4.0™, Delphi 1.0™

The device has 2 channels:	Channel 1: CO-concentration	[ppm], [mg/m³] or [%COHb]
	Channel 2: temperature (nearly)	[°C]

Note: The measuring-/ alarm- and display range values read back from the interface are always in the selected measurement unit!

11.2 Supported interface functions

Code	name/function	code	name/function	code	name/function
0	Read measurement value	178	Read measuring range unit	204	Read display decimal point
3	Read system state	179	Read meas. range decimal point	208	Read number of channels
7	Read max. measured value	180	Read kind of measuring or sensor	222	Read power-off time
12	Read ID number	199	Read kind of measuring or display	223	Set power-off time
23	Read max alarm limit	200	Read min. display range	240	Reset
176	Read min. measuring range	201	Read max. display range	254	Read Program version
177	Read max. measuring range	202	Read display unit		

Note for operation with GAM3000:
Keep in mind that the instrument just support max-, not min-alarm !
Therefore the control-output of the GAM3000 could not be used, just the alarm output!

12 Specification

Measuring principle electrochemical CO measuring cell

Measuring range 0 ... 1000 ppm CO-concentration

Display ranges 0 ... 1000 ppm CO-concentration
0 ... 1250 mg/m³ CO- concentration *(conversion of the ppm value with factor at norm-conditions)*
0 ... 60.0 % COHb (estimation of the carboxy-haemoglobin of blood via exhaled breath gas)

Resolution 1 ppm, 1 mg/m³ or 0.1 % COHb

Reaction time in ambient: diffusion < 50 sec
T90 at 0,5l/min gas flow: < 20sec

Life time meas. cell >5 years at proper usage at air
suggested test interval: every 6months (depending on precision requirements)

Accuracy linearity **<**±5 % of measured value ±1 digit, repeatability **<**±5 % of measured value
(at range 0 ... 500 ppm). Calibration protocol in scope of supply

Interference

gas	concentration (ppm)	residence time (minutes)	display (ppm CO)
hydrogen sulphide	25	5	0
sulphur dioxide	50	600	<1
nitrogen dioxide	50	900	-1
nitric oxide	50	5	8
chlorine	2	5	0
hydrogen	100	5	20
Carbon dioxide	5000	5	0
ammonia	100	5	0
ethanol	2000	30	5
iso-propanol	200	120	0
acetone	1000	5	0
acetylene	40	5	80

Nominal temperature 25°C

Ambient condition temperature -10 ... +50 °C , for short time -20 ... +50 °C
humidity 15 ... 90 %RH (non-condensing), for short time 0 ... 90 %RH

Storage temperature -10 ... +50 °C

Housing impact-resistant ABS, membrane keyboard, transparent panel,
Front side IP65, integrated pop-up clip for table top or suspended use.

Dimensions 142 x 71 x 26 mm (L x W x D)

Wight approx. 155 g

Power supply 9V-battery (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: GNG10/3000)

Power consumption < 0,20mA (with standard battery > 1500 operating hours)

Display approx. 11 mm high, 4½-digit LC-display with additional elements

Pushbuttons 3 membrane keys for on/off, menu handling, MAX/Hold-function, etc.

Hold-/Maxfunction by keypress the current measuring will be “frozen” (HLD), max. measured value will be stored (MAX)

Alerting adjustable alarm rail, value depending alarm sound, display alarm: flashing „AL.Hi“
additionally signalling of exceeding of the MAK-value („>MAK“-arrow)

Power-Off-function the device will be automatically switched of if no key is pressed or 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 minutes or can be completely deactivated

Directives / standards The instruments confirm to following European Directives:
2014/30/EU EMC Directive
2011/65/EU RoHS
Applied harmonized standards:
EN 61326-1 : 2013 emissions level: class B,
emi immunity acc. to table A.1
Additional fault: <1%
EN 50581 : 2012.