Operation Manual

Microtector II G460

1 to 7-Gas Detector

GfG Products For Increased Safety

Congratulations!

You decided for a high technology product of GfG. A good choice!

Our detectors are characterized by reliability, safety, best performance and economic efficiency.

They comply with national and international directives.

This manual will help you to operate the detector quickly and safely.

Please take note of the operational hints before putting into operation!

For any questions please feel free to contact us.

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Content

Introduction

For your safety

According to § 3 of the law about technical working media and consumer products for Germany according to "Geräte- und Produktsicherheitsgesetz (GPSG) this manual points out the proper use of the product and serves to prevent dangers. It must be read and adhered to by all persons who use, service, maintain and check this product. This detector can do the job designed to do only, if it is used, serviced, maintained and checked according to the instructions given by GfG Gesellschaft fuer Geraetebau. The warranties made by GfG with respect to the product are voided, if the product is not used, serviced, maintained and checked in accordance with GfG's instructions. The above does not alter statements regarding warranties and liabilities in GfG's general conditions of sale and delivery. Repairs must only be done by skilled personnel resp. by trained persons. Modifications and changes of the product require GfG's permission. Unauthorized modification of the product results in the exclusion of any liability for possible damage. Make sure that only genuine GfG accessories are used with the product. Repairs require the use of spare parts released by GfG.

Application and purpose

The G460 is a handheld detector for personal protection from hazards occurring by toxic or explosive gases and vapors and also by a lack of oxygen or oxygen surplus. The detector measures permanently in diffusion mode and gives a visual and audible alarm, if a gas-induced danger builds up. The G460 is approved for the use in explosion endangered areas and is subject to an EC-Type Examination Certificate issued by DEKRA EXAM GmbH, according to directive 94/9/EG (ATEX100a):

Certificate:	BVS 06 ATEX E 017 X		
Labelling:	⟨Ex⟩ II 2G	Ex ia de IIC T4	-20°C≤Ta≤+50°C (NiMH-II)
		Ex ia de IIC T3	-20°C≤Ta≤+50°C (NiMH)
		Ex ia de IIC T4/T3	-20°C≤Ta≤+45°/+50°C (Alkaline)

The temperature class of the detector depends on the supply module used. When using the „NiMH-II" accumulator, temperature class T4 is valid for ambient temperatures of –20°C to +50°C, while temperature class T3 is valid when using the „NiMH" accumulator. Both supply modules are identified by a black enclosure with an inside label showing the type and temperature class. When using the Alkaline batteries (grey housing), temperature class T4 is valid for ambient temperatures from -20°C to +45°C resp. temperature class T3 for ambient temperatures of -20°C to +50°C.

For the use in explosion endangered areas with a measurement function for the explosion protection there is a supplement for the G460 to the above mentioned EC-Type Examination Certificate of DEKRA EXAM GmbH according to guideline 94/9/EG. Basis of the test were the standards DIN EN 60079-29-1 „Gas detection instruments – requirements to the operational behavior of instruments for the measurement of combustible gases" and DIN EN 50271 "Electronic instruments for the detection and measurement of combustible gases, toxic gases or oxygen – requirements and testing for warning instruments, that use software and/or digital technology". Furthermore the G460 was examined on its measurement ability by DEKRA EXAM GmbH on the basis of the standards DIN EN 50104 "Electronic instruments for the detection and measurement of oxygen – requirements to the operational behavior and testing method" and DIN EN 45544-1/-2 "Electronic instruments for the direct detection and direct measurement of the concentration of toxic gases and vapours part 1: common requirements and testing methods" and part 2: requirements to the operational behavior of instruments for the measurement of concentration in threshold ranges". This is approved by the relevant Type Examination Certificate with the number PFG 09 G 001.

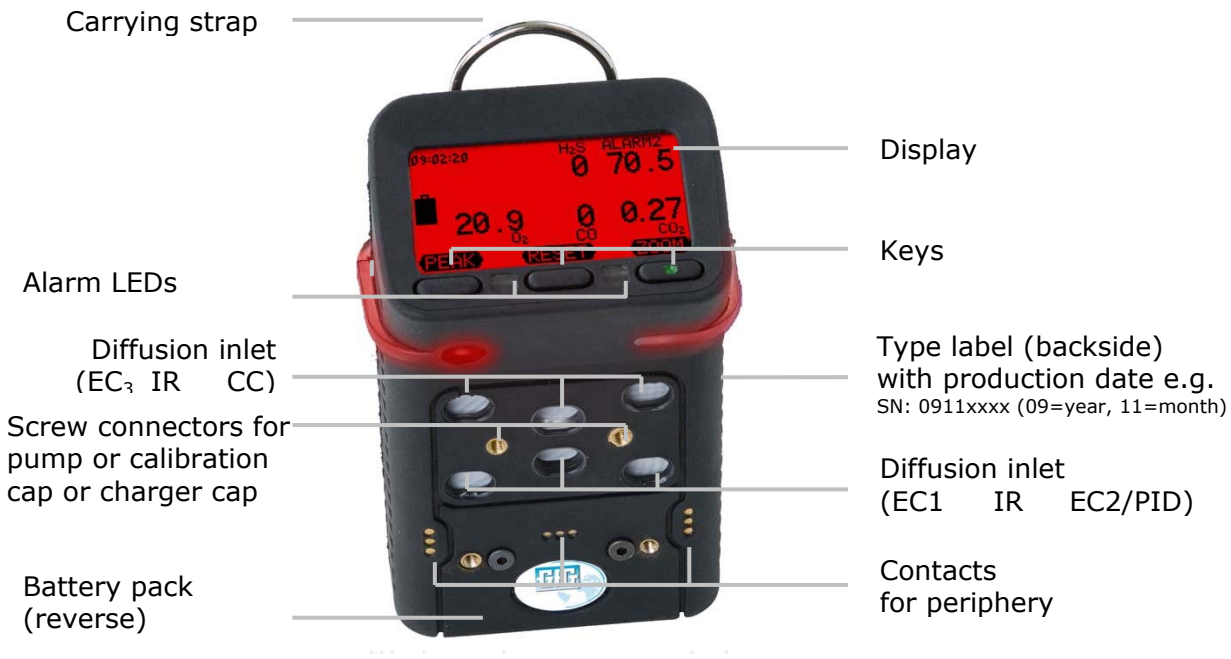
The tests of the measuring function contain following sensors and detection ranges:			
EC-Type Examination Certificate BVS 06 ATEX E 017 X (4. supplement)	MK211-6, MK211-7 MK227-5, MK231-5	for 0..100%LEL CH_4, C_3H_8, C_6H_{14} for 0..100%LEL C_3H_8, C_9H_{20}	(CC) (IR)
Type Examination Certificate PFG 09 G 001	MK224-5, MK231-5 MK344-4, MK369-6 MK427-5 MK429-5	for 0.02..5%Vol CO_2 for 2..500ppm, 5..500ppm CO for 0..25%Vol O_2 for 0.2..100ppm H_2S	(IR) (EC) (EC) (EC)

At [%]: The measuring function for n-nonane was tested in the range of 0..60%LEL.
The functions being marked with [#] were not subject of the test of the measurement function.

Special conditions for safe use

In explosion endangered areas the G460 must be used properly. This means that the detector must be carried at your body and must not be laid down unattended, to prevent an electrostatic charge of the clip. In case readings in gas-free environments show a permanent zero-point deviation, a zero-point adjustment is necessary. Especially after a heavy impact stress the zero-points of the sensors have to be checked and optionally re-adjusted. In case the CC sensor shows "over-range" after a stress impact, the alarm has to be reset in fresh air and the zero-point has also to be re-adjusted. If the G460 is operated continuously for more than one day, the instrument should be turned off and on again every 24 hours latest. Within the system option menu the deactivation of the latching alarm is not allowed for the use as a function tested measurement instrument. For functional and Ex-protection reasons only GfG approved micro SD-memory cards must be used (s. chapter "Accessories and Spare Parts").

Design

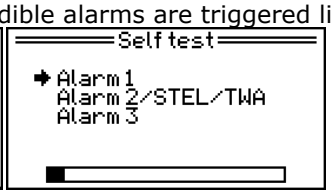


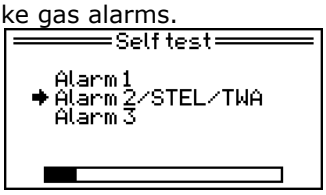
Operational Hints

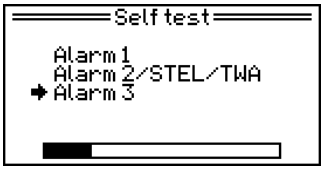
Switching On and Off

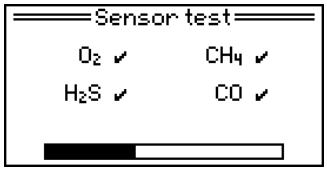
Press the right key shortly to switch the G460 on ◆.
To switch the G460 off, press the right key ◆ for approx. 5 seconds. Release the key when the display reads **SWITCH-OFF 0.**
During charging the standard detection mode is automatically switched off and the charging time is displayed.

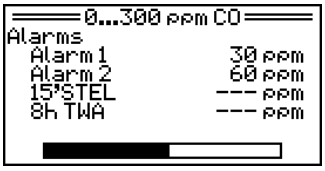
After switching on the G460 starts a self-test and displays information about the firmware version, the built-in sensors with detection ranges and alarm thresholds and the date of the next inspection. During the self test the visual and audible alarms are triggered like gas alarms.

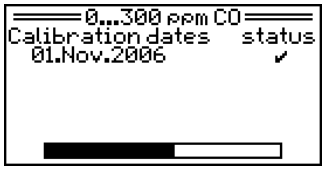


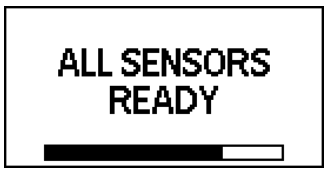












Alarm thresholds and calibration data are displayed for all sensors connected. Only as an example it is only CO which is being described here. Depending on the status of the sensors, the instrument may provide additional messages, which may have to be confirmed. Please refer to "Additional messages during detector start" for further information.

If you push the left key (**DETECT**), or if you do not hit any key, during the warm-up period, the detector goes to detection mode. By pressing the right key (**ZERO**) the automatic fresh air adjustment is started. When the detector is equipped with an oxygen sensor, its sensitivity is set to the normal 20.9Vol% oxygen which are present in fresh air.

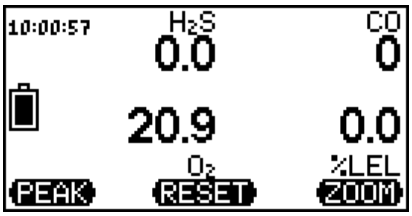
Once the self test is completed, the instrument is ready to use after about one minute. By hitting the middle key readings and messages can be reset.

Additional Messages during Detector Start

When started, the G460 tests the sensors and supervises their adjustment data. For sensors, which were not adjusted yet or whose adjustment is older than one year, the message "Calibration needed!" is displayed. The reduced adjustment interval of used-up sensors might result in the message "Calibration or replacement is needed!". Exhausted sensors are indicated by the message "Replacement needed!", when the detector is started. These messages must be acknowledged by key.

When a docking station is used for instrument check, the G460 may include intervals for bump test and calibration of sensors. The dates for the next bump test or for the next calibration are calculated automatically on the basis of the last check. Depending on what becomes necessary next, the date for the next bump test or for the next calibration will be indicated, when the detector is started. Should the relevant date be exceeded, the G460 indicates this as „overdue". This message must be acknowledged by key.

Detection Mode



The G460 is ready for operation, if all measurement values, the unit, the gas, the battery capacity and the time are displayed. With more than five measurement values being displayed, the clock will not be shown due to space restrictions. The detector check whether the preset thresholds for the individual gases are exceeded or deviated (O_2).

When more than two measurement values are displayed simultaneously, either the gas type or the unit is shown. By hitting the right key (ZOOM) measurement values can be displayed individually with gas type and unit.

Battery Capacity and Battery Alarm

The fully charged battery pack or fresh batteries of the G460 have a capacity (depending on sensor combinations) of approx. 5-170 hours of continuous operation (see technical data). The operational time may be reduced by activated alarms. In the top left corner of the display the remaining battery capacity is indicated by a battery symbol. The black area represents the remaining capacity. If the charging status reaches a low level which is shown as a blank battery symbol, the instrument switches to "energy-saving mode". In this mode the green background illumination will not be activated whenever you hit any key. In case of gas alarms also the red display illumination will not be triggered. The alarm will only be shown by the alarm LEDs and with a maximum volume of 90 db(A). If the charging status sinks even further, battery alarm is given acoustically. In this status the battery symbol flashes. The maximum remaining term is displayed every minute. After 15 minutes the instruments automatically shuts off with a clear acoustic signal. The display reads "OFF" for 5 minutes. Selecting the "Anti-Lazy-Battery" within the option menu the instrument does not automatically shut off after 15 minutes but when falling below a minimum voltage.

Alarms

Should the measured gas concentration exceed a pre-set threshold, the detector immediately gives an audible and visual alarm. The display indicates which gas has caused the alarm. An extremely loud acoustic alarm (103 dB(A) at 30 cm) and bright flashing alarm LEDs provide reliable warning for dangerous gas concentrations. In case of a gas alarm the colour of the whole display turns into orange or red depending on the alarm status. The G460 provides up to three alarm modes. The LO-alarm AL1 can be reset, while the HI-alarms AL2 and AL3 are latching (default). There are three alarm levels for oxygen and combustible gases (e.g. CH_4), and two thresholds for toxic gases (CO, H_2S). For toxic gases the G460 provides additional alarms for exceeding of short term exposure level (STEL) and time weighted average (TWA). For further information see "Alarm Thresholds – Standard Setpoints" and "Alarms – Adjusting the Alarm Thresholds". The alarm can also be triggered in combination with a vibration alarm, if the instrument provides a relevant "battery pack with integrated vibrator".

Kind of alarm	Sensors	Number of Alarms	Description
Instantaneous value (AL)	oxygen combust. gases toxic gases	3 3 2	An instantaneous alarm is activated immediately, if the gas concentration exceeds resp. falls below a pre-set threshold. The alarm thresholds are adjustable.
Short term exposure level (STEL)	toxic gases	1	The short term exposure level (STEL) is the average concentration over a period of 15 minutes. The STEL alarm is not latching. It resets automatically as soon as the concentration has fallen below the threshold.
Time weighted average (TWA)	toxic gases	1	The time weighted average (TWA) refers to an 8 hours shift and calculates the average concentration. The TWA alarm cannot be reset. It is only de-activated, if the detector is switched off.

The alarms are prioritized as follows: Power fault, overrange, AL3, TWA > AL2, STEL > AL1, underrange > temperature fault.

Reset of Alarms

The latching (default) alarms 2 and 3 can be reset by pressing the **RESET** key, if the gas concentration has fallen below or exceeded (O_2) the pre-set thresholds. Alarm 1 is not latching and resets automatically, when the alarm condition does not exist any longer. If the detection range of the CC sensor (e.g. CH_4) is exceeded, the display additionally reads „OVER RANGE" instead of the value, for gas concentrations above 110 % LEL. In this case the sensor is deactivated to avoid damage. The alarms and the message "OVER RANGE" remain. This alarm can only be reset by pushing the **RESET** key. Then the display asks:

Only if you made sure **that the sensor is not exposed to combustible gas but to fresh air only, you may answer this question with YES.** In this case the sensor turns on again and indicates gas concentrations after a short warm-up time!

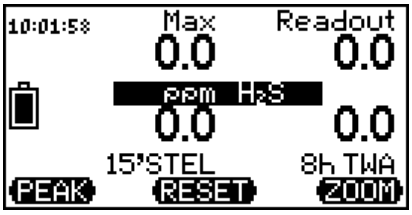
For further details please refer to „Special Notes for LEL Monitoring".

STEL, TWA, Peak, Minimum Values

After switching the detector on, measurement is effected continuously in diffusion mode. In this mode, all concentrations are shown in the display. In addition, short term and long-term averages (STEL and TWA) are calculated for toxic gases, and for non-toxic gases peak and minimum values (MAX and MIN) are stored. The stored values can be read from the display, if you turn to the relevant display mode by means of the right key (**ZOOM**, see below).

Flip-Flop Display, Zoom Display

The display can be turned by 180° by pressing the right and the left key simultaneously and then releasing them. This allows easy reading when carrying the detector on the belt. For activating the zoom display, press the right key (**ZOOM**). Press the key shortly to display one value. Repeated pressing of this key displays the individual measurement values of the individual sensors in zoomed reading one after the other: When a zoomed value is displayed, press **ZOOM** long to change to the following detail reading:

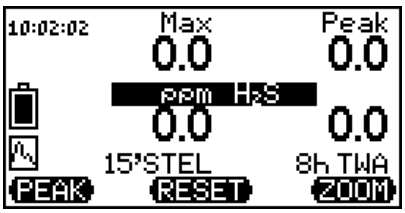


Example of zoom display for H_2S:

Top left: Peak value
Top right: Current gas concentration
Bottom left: STEL value (15 minutes)
Bottom right: TWA value (8 hours)

Pressing **ZOOM** a certain time changes from one to the other zoom modes. After one zoom mode being activated, the display returns back to normal mode after approx. 10 seconds.

Peak – Display of Peak Values



During peak mode (activation by left key **PEAK**) peak values can be monitored and displayed. The display shows an animated symbol in the left bottom corner. Within *zoom display* the peak value will be displayed in the top right corner instead of the actual gas concentration.

Pressing **RESET** during peak mode, the peak memory will be reset to the current gas concentration. Pressing **RESET** during zoom display, the peak memory and the peak value memory will be reset to the current gas concentration. By pressing **PEAK** again, the peak mode is deactivated.

Turn On / Off Lights

The G460 is optionally available with a rechargeable battery pack with lights. The lights can be switched on by keeping the left key pressed for approx. 3 seconds, and turned off by pressing this key shortly. The lights are useful e.g. when the device is linked to a cord and let down into a sewer system. Using the lights can prevent the device from being dipped into water.

Display Illumination

The display illumination is turned on for approx. 10 seconds whenever you hit any key. It turns off automatically after that time. Should the battery or accumulator be almost exhausted, the display illumination cannot be activated any longer.

Storing Measurement Data with the Data Logger

The measurement data can be stored in an integrated data logger or on a detachable micro SD card. A special activation of the data storage is not necessary. With the internal data logger about 1800 events for all measurement values and further information can be stored, containing date, time, location, alarms and special events. Within the main menu under "data logger" different functions of the data storage can be set. It provides a selection of the storage of average values, peak values or instantaneous values as well as the storage interval from 1 second to 60 minutes. The default setting of storing is a loop memory. The oldest event will be overwritten when the data loggers is full. The measurement data of the Microtector II can be read on a PC by means of a charging adaptor, a USB-interface and the GfG-Interface software. The configuration of the data logger can be changed with the interface program. Nearly an unlimited amount of measuring points for all measurement values and other information can be stored on the micro SD card, including date, time, location, user, alarm status, battery status and present device configuration. The measurement data are stored as an average with an interval of one minute resp. five seconds in case of alarm. Two text files are generated each month. The file *M.TEXT contains data from the measurement operation and the file *C.TXT contains data from the charging processes. Depending on the intensity of use and alarms being triggered, the files have a size of about 1-2 MB at the end of the month. With a 1GB micro SD card data can be saved for a theoretic period of more than 40 years. The micro SD card can be removed by switching the instrument off and opening the battery pack. Using an SD-card reader data can be read on a PC or be displayed with a text editor or spreadsheet program. Data can be opened in Excel by using mouse and performing drag & drop. After adjusting the width of the column a diagram of the records can be generated. The micro SD-card must be formated with a FAT (FAT16) and not with the FAT32 file system.

Influence of Oxygen and Interfering Gases

It is to be considered, that the measurement of gas and/or vapour concentrations in the range below 100% LEL cannot be done accurately, if the oxygen concentration at the same time is below 10 %-Vol.. In this case the CC sensor suffers from a lack of oxygen, which is necessary for the "catalytic combustion". If the oxygen sensor detects such a low concentration, the display reads "????" instead of the LEL value. When the oxygen concentration exceeds 10 %-Vol., the LEL value will be displayed correctly again. The EX-approval does not cover the use of the detector in oxygen enriched atmospheres. Certain components, known as „sensor or catalyst poisons", may affect the signal behaviour of the CC sensor. The "sensitivity", i.e. the capability of the sensor to give signals, is reduced. Components of this kind are e.g. sulphuric, lead or silicone compounds.

Special Notes for LEL Monitoring

For LEL monitoring the G460 may use a catalytic combustion (CC) sensor. Due to this principle the G460 cannot distinguish between measurement values in the LEL range and those in the high Vol.-% range (e.g. > 20 Vol.-% CH_4). Concentrations of more than 110 % LEL might also damage this sensor. To prevent such a damage, the sensor is turned off, when gas concentrations of more than 110 % LEL are measured. Only pressing the key **RESET** and confirming the question "Fresh Air?" by means of key **YES** the sensor is turned on again. Oxygen concentrations of less than 10 %-Vol. do not allow the CC sensor to correctly detect combustible gases and vapours. The paragraph „Influence of Oxygen and Interfering Gases" provides additional information.

HI%-Measurement of Methane resp. Natural Gas[#]

In standard detection mode methane (CH_4) can be measured within a range of 0..100 %LEL by using either a catalytic combustion sensor (CC) or an infrared sensor (IR). In this mode all gas alarm thresholds are monitored. If the instrument is equipped with a special HI%-IR sensor (MK227-5 or MK231-5), monitoring of higher ranges of up to 100 %-Vol. CH_4 is possible. By pressing the middle and left key simultaneously the mode will be switched to HI%-range. In this mode no gas alarms will be monitored. Apart from deactivated gas alarms also the confidence bleep and optionally the catalytic combustion sensor are deactivated. The display shows in the left top corner the **HI%**-symbol. The measurement value of the infrared sensor is shown in %-Vol. CH_4 and the position for the measurement values of the catalytic combustion sensor remains blank. The pressure dependence of the IR sensor explained within the "Sensor Specifications" must be noticed. If the gas concentration falls below 5 %-Vol. CH_4 the %LEL range can be re-activated by hitting the middle and left key simultaneously. Gas alarm, confidence bleep and optionally catalytic combustion sensor are re-activated as well.

Service Mode

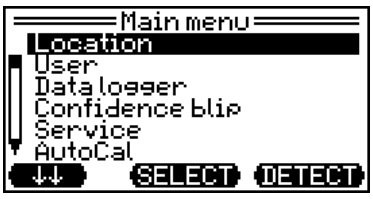
Press the middle key (**RESET**) for approx. 5 seconds to activate the service mode. In the service mode the G460 can be adjusted by changing of program parameters. Certain menu points require the access code „0011" to prevent accidental change of important functions by unauthorized persons. During the service mode all alarms are deactivated. The main menu is the first menu point in the service mode.

Main Menu

The menu points of the main menu are:

1. **Location** (= Entering a location)
2. **User** (= Entering of identity)
3. **Data logger** (= Adjustment of data logger functions)
4. **Signal** (= Setting of confidence bleep intervals)
5. **Service** (= Starting the service menu)
6. **AutoCal** (= AutoCal adjustment with fresh air or with test gas)
7. **Options** (= Anti-Lazy-Battery, contrast, alarm volume)

Menu control: The function of the key is explained by the display reading above the relevant key.

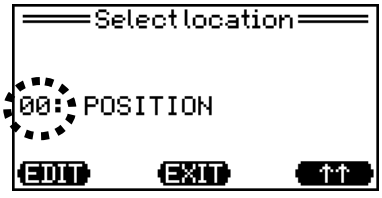


Left key (↓↓) = Scroll down
Middle key (**SELECT**) = Selection of marked menu point
Right key (**DETECT**) = Back to detection mode

Location – Entering a Location

From a deposited table one location out of hundred possible locations can be selected. The first two digits stand for the number of the table entry. Except of the table entry "00" all other 99 entries can only be edited by means of a PC. Within the table entry "00" up to 15 letters / figures can be entered, which will be stored as "**Location**" on the G460.

If **Location** is selected by pressing the middle key (**SELECT**), the following reading is displayed:



During location selection a consecutive number is determined first:

EDIT = Confirming of consecutive number
EXIT = Back to main menu
↑↑ = Changing of consecutive number

After confirming the consecutive number by pressing the left key (**EDIT**), the location entry will follow:

The function of the keys is as follows:

ABC↓↓ = Change of symbol – moving forward in alphabetical order
<<>> = Enters the blinking letter or figure and moves the cursor to the right
012↑↑ = Change of symbol – moving back in alphabetical order

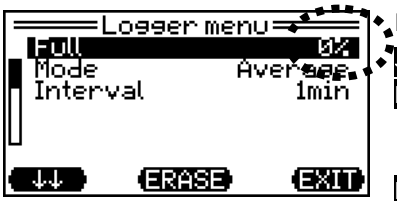
User – Entering User Name

From a deposited table one out of ten possible entries can be selected. The first two digits stand for the number of the table entry. Except of the table entry "00" all other 9 entries can only be edited by means of a PC. Within the table entry "00" up to 15 letters / figures can be entered, which will be stored as "**IDENTIFICATION**" on the G460. Entry is completed automatically, when the cursor reaches the end mark "**>**". Entering the user name (ID) is done in the same way as entering the location.

Data Logger Settings

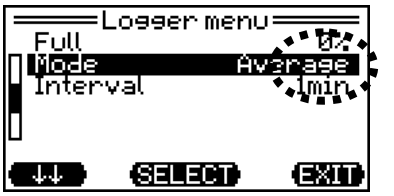
Within the menu point **"Data Logger"** different settings can be done:

Full - Deleting data from data logger (indication of storage occupancy)
Mode - Selection of instantaneous, average or peak value
Interval - Interval of data recording (adjustable from 1 second to 60 minutes)

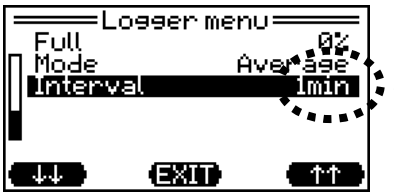


Parameter **Full** shows the occupancy of the data logger.

↓↓ = Scroll down to next parameter
ERASE = Deletes data. A security check is effected
"Delete data?" Confirm with the right key **YES**,
resp. deny with the left key **NO**.
EXIT = Back to main menu



If parameter **Mode** was selected with **SELECT**, instantaneous value, average value or peak value (PEAK) can be chosen.
Press **EXIT** to return to the recorder menu. The selected mode will be kept.

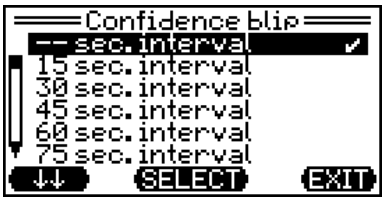


Interval:
The data recording interval can be selected by ↓↓ and ↑↑ between 1 second and 60 minutes.

The recorded data can be read and transmitted to a PC by means of the drop-in charger or the smart charger cap and an optional USB adapter cable.

Signal – Selection of Confidence Bleep

Within the menu point **"Signal"** the interval for releasing the confidence bleep can be chosen in which the G460 triggers a confidence bleep during activated alarm monitoring. Default setting of the interval is 60 seconds.



The confidence bleep can be set in intervals of 15 to 90 seconds or be deactivated (enter "--").

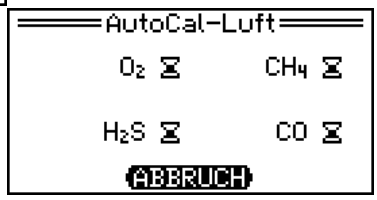
SELECT↑ **=** Selection
EXIT **=** Confirm interval and back to main menu
↓↓ **=** Scroll down

AutoCal – AutoCal-Adjustments

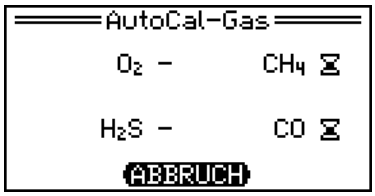
Within the menu point AutoCal, several sensors can be calibrated simultaneously with fresh air (ZERO) or test gas (CAL). Normally all sensors except of the CO_2 sensor can be set with fresh air without any further adjustment. For adjustments with test gas the sensors have to be activated according to the test gas / mixture being used (s. chapter "AutoCal Air …" and "AutoCal Gas …". The menu point AutoCal can be selected within the main menu, but s also activated automatically, when the "Smart Cap" or the "Smart Charger Cap" is mounted.

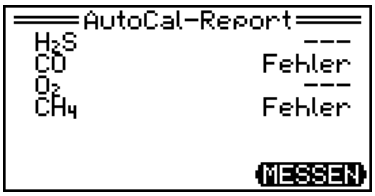
The following functions can be chosen:

ZERO = AutoCal with fresh air
CAL = AutoCal with test gas
EXIT = Back to main menu



AutoCal adjustment with fresh air successful





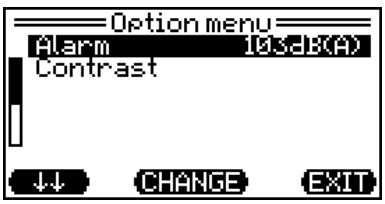
AutoCal adjustment with test gas mixture not successful (e.g. due to wrong test gas concentration)

An AutoCal adjustment with fresh air is only successful, if the measured value does not differ by more than ±10% full scale from the nominal value 0.0 resp. not more than ±5.2 %-Vol. O_2 from the nominal value 20.9 %-Vol. O_2. A successful AutoCal adjustment with test gas is only completed, if the measured value does not differ by more than 25% from the nominal "CalGas" value (see sensor menu "Calibration"). In case of higher deviations the related sensor is marked with "Fault" in the subsequent AutoCal-report. In this case an adjustment with "ZERO" resp. "CAL" or in the docking station is necessary. The adjustment with gas-free fresh air can be done in diffusion mode. Only when zeroing the CO_2 sensor you should not use ambient air, as it always contains a small CO_2 content, which would result in wrong CO_2 measurement values. This is why the zeropoint of the CO_2 sensor should only be adjusted in sensor menu "Zeroing" or in the docking station, using CO_2-free zero gas. This can be e.g. synthetic air, 100 %-Vol. N_2 or specially cleaned air (CO_2-free). Zero gas (gas-free air) and test gas can be supplied with a volume flow of 0.5 to 0.6 l/min by means of the "Smart Cap" or the "Smart Charger Cap".

Options – Anti-Lazy-Battery, Alarm Volume, Display Contrast

Menu point "Options" allows the following settings:

- When "**Anti-Lazy-Battery**" is activated the level for the automatic shut down due to a nearly discharged battery pack is reduced, i.e. the discharging time of the battery pack is extended. This setting is only active until the instrument is turned off.
- The buzzer volume can be changed to: 103dB(A), 90dB(A) or 0dB(A). For safety reasons, adjustment to 0dB(A) is only possible after entering a service code. During operation a 0dB-symbol is shown in the top left corner of the display. In this case all acoustic signals (gas alarm, fault, battery alarm and confidence bleep) are deactivated, so the user has to check the display permanently for possible hazards.
- The display contrast can be changed from 1 = very low up to 15 = very high).



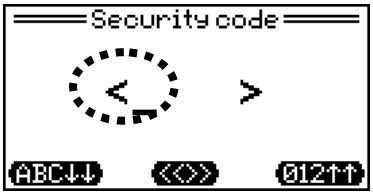
↓↓ = scroll down
CHANGE = Change selected parameter
EXIT = Back to main menu

Tolerance band on / off

In standard detection mode the G460 suppresses small fluctuations around the zeropoints of sensors for toxic and combustible gases. For the oxygen measurement small fluctuations around 20.9 %-Vol. O_2 (fresh air) will be suppressed. The displayed value is kept at 0 until the gas concentration will have reached 200 % of the tolerance band value. This tolerance band is a default setting but can be deactivated: When going to service mode, enter <**REAL**> for deactivation or <**BAND**> for activation of the tolerance band instead of the normal access code. For more details about the tolerance band values see chapter "Sensor Types and Detection Ranges".

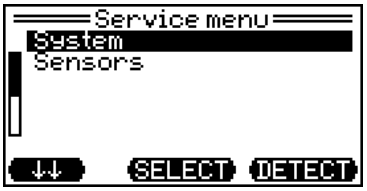
Service Menu

Enter the service menu by selecting **"Service"**. Within the service menu the G460 can be adjusted by changing program parameters. The menu points are only accessible with the code „0011". The code prevents important functions being changed by mistake or by unauthorised persons. In service mode no alarms can be released.



ABC↓↓ = one letter ahead
<<>> = confirms letter *(cursor moves automatically to the next digit)*. Holding the key deletes the last entry, the cursor moves one position backwards.
012↑↑ = one letter

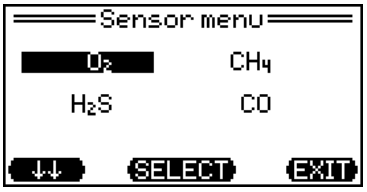
When entering code 0011, the display reads:



Menu point **System** allows performing general adjustments (see section „System Menu"). Within the menu point **Sensors** you can set sensor-specific functions (zeropoint, span). You can also call for information or set alarm thresholds.
Press **DETECT** to leave the service menu and to return to detection mode.

Sensor Menu – Sensor-specific Functions

Following functions refer to individual sensors of the G460. In service menu every sensor can be selected individually. The adjustments are only valid for the selected sensor.
For the following function description of sensor-specific adjustments the CH_4 resp. O_2 sensor is being mentioned as an example. The adjustment possibilities, however, are also valid for the other sensors.



Entering possibilities:
↓↓ = Move to next sensor
SELECT = Select sensor
EXIT = Back to service menu

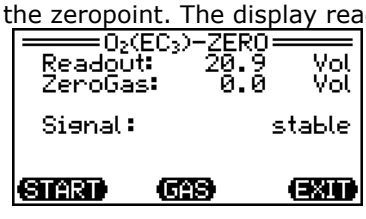
For every sensor following adjustments can be done:

Zero	(= Zeropoint adjustment)
Calibrate	(= Sensitivity adjustment)
Alarms	(= Adjustment of alarm thresholds)
Calibration dates	(= Date & status of last calibration und zeroing)
Information	(= Sensor information: MK type, serial number, detection range, temperature range)
Unit and type of gas	= Selection of displayed CH_4-unit (%LEL/%-Vol.) resp. displayed type of gas

↓↓ = Move to next menu point
SELECT = Select menu point
EXIT = Back to service menu

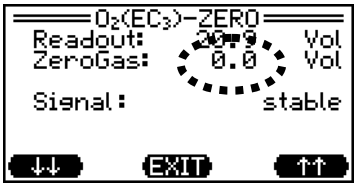
Zeroing – Adjustment of Zeropoint

For adjustment of the zeropoint the sensors have to be supplied with gas-free air resp. the carbon dioxide sensor and the oxygen sensor (*1) with 100 %Vol nitrogen. The zero gas can be supplied with a flow of 0.5 to 0.6 l/min by means of the "Smart Cap" or "Smart Charger Cap". Select menu point "ZeroGas" to adjust the zeropoint. The display reads:



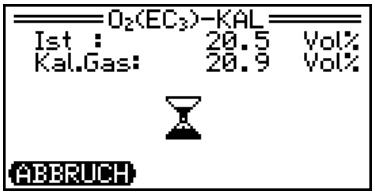
START = Start zeropoint adjustment
GAS = Enter zero gas concentration
EXIT = Back to „O_2 menu"

Usually the value for zero gas is 0.0, so this value does not need to be changed. For special applications, however, the zero gas concentration value could be increased slightly after pushing key GAS. After entering **GAS** the display reads:



↓↓ = Decrease zero gas value by one unit
EXIT = Confirm value and back to menu point "ZeroGas"
↑↑ = Increase zero gas value by one unit

By entering START the zero point adjustment starts:



ABORT = Aborting the adjustment and switching to the CH_4-menu

When the detector measures a constant value, after a stabilization time of 10 seconds, the adjustment is executed and confirmed with "OK". For CC, IR and O_2 sensors the stabilization time is slightly longer but generally limited to 3 minutes.

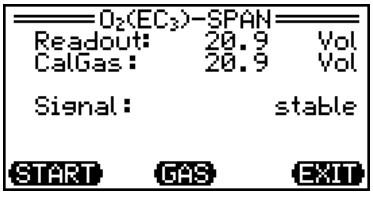
At (*1): The zeropoint adjustment of the oxygen sensor is done with 100%Vol nitrogen by the manufacturer. For monitoring of the usual alarm thresholds of ≥17%Vol O_2 a readjustment by the user is not necessary. In this case an adjustment of the sensitivity is sufficient.

Calibration – Sensitivity Adjustment

During calibration the gas sensitivity of the sensor is adjusted. Before starting sensitivity calibration, the zeropoint adjustment has to be completed. For a sensitivity calibration a suitable test gas is needed, e.g.

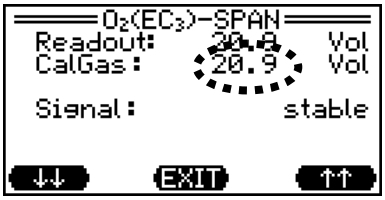
Detection range	Test gas
TOX	Carbon monoxide (CO), Hydrogen sulphide (H_2S) or other gases
OX	Fresh air or test gas with 20.9 Vol% oxygen (O_2) in nitrogen (N_2)
EX	Methane (CH_4), Propane (C_3H_8) or other combustible gases (*2)

You can see the recommended test gas from the test report of your G460. For calibration the test gas concentration should be between 30% and 70% of full scale. The test gas can be supplied by means of the "Smart Cap" or "Smart Charger Cap" with a flow of 0.5…0.6 l/min.
For adjusting the sensitivity the sensor menu point „Calibration" has to be selected.



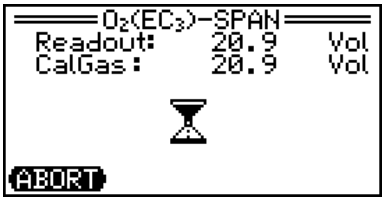
START = Start sensitivity calibration
GAS = Enter calibration gas concentration
EXIT = Back to „O_2 menu"

Entering **GAS** allowsto set the test gas concentration within a range of 10…105% full scale:



↓↓ = Decreases calibration gas value by one unit
↑↑ = Increases calibration gas value by one unit
EXIT = Confirms value and goes back to „O_2 menu

Entering **Start** starts the sensitivity calibration:



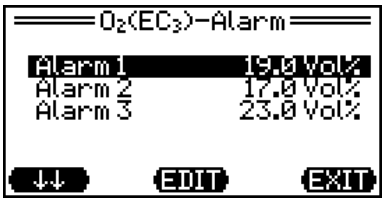
ABORT = Stop calibration and back to "O_2" menu

When the detector measures a constant value, after a stabilization time of 25 seconds, the adjustment is executed and confirmed with "OK". Generally the stabilization time is limited to 3 minutes.
At (*2): The sensitivity adjustment of sensors that measure certain combustible gases within LEL-range, e.g. n-hexane, n-nonane or other similar "heavy" vapours, is not uncomplicated. Apart from the availability of such a test gas it is to be considered that when the gas is supplied, the stabilization time my take several minutes. Alternatively the sensitivity adjustment can be performed with a suitable reference gas (e.g. propane). The IR sensor MK227-5, for example, can be supplied with a reference gas of 0.85%-Vol. C_3H_8 (propane) and adjusted to 67%LEL n-hexane or 80%LEL n-nonane. The cross sensitivities for the sensors are described in chapter "Sensor Specifications".

Alarms – Adjusting the Alarm Thresholds

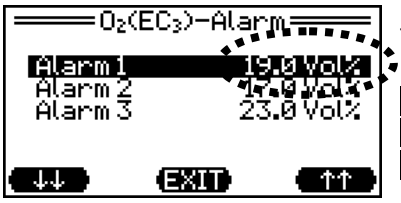
The G460 provides 3 alarm thresholds for each non-toxic gas (O_2, CH_4). For the toxic gases (e.g. H_2S, CO, CO_2) the G460 provides 2 alarm thresholds. The alarms are triggered when the gas concentration exceeds or falls below the threshold. For toxic gases an additional alarm for exceeded long-term (TWA) and short-term (STEL) averages can be activated.

After selecting the sensor menu point "**Alarms**" the following reading is displayed (here: selection of O_2):



↓↓ = Scroll down
SELECT = Select menu point
EXIT = Back to sensor menu

After selecting the alarm thresholds (e.g.: Alarm 1) the value can be entered:

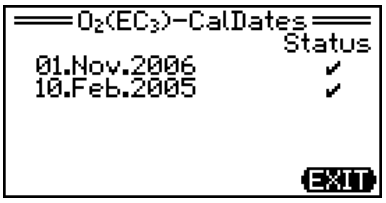


The selected alarm threshold is flashing, the value can be changed now:

↓↓ = Decrease alarm value by one unit
EXIT = Back to sensor menu
↑↑ = Increase alarm value by one unit

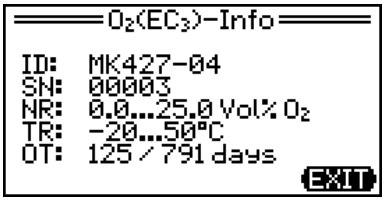
Except for the %LEL detection range all threshold values can be adjusted freely within the detection range or can be deactivated. (0 resp. "----") completely. For %LEL detection ranges the threshold values are adjustable to a maximum of 60%LEL.

Calibration Data - Date & Status of last calibration



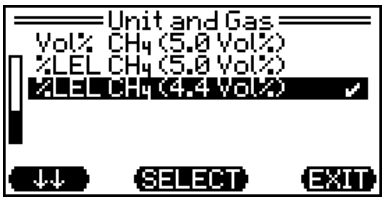
The sensor menu point „CalDates" indicates the date of the last three sensitivity calibrations and if the calibration was successful (√) or not (✗).

Information – Sensor Information



In this menu point specific information for the sensor are displayed:
- ID = Type of sensor
- SN = Serial number
- NR = Nominal detection range
- TR = Temperature range
- OT = Operating time of sensor, e.g. 125 of 791 days

Unit and Gas - Selection of Detection Range

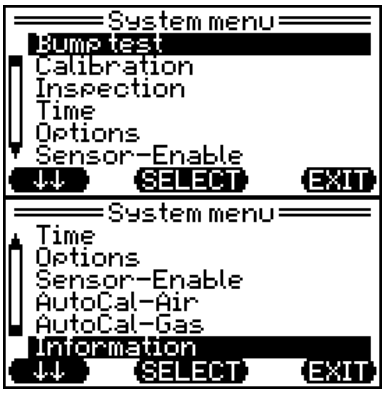


In this menu point you can set the unit for CH_4 to %LEL or %Vol. The volume concentrations in brackets correspond to full scale deflection. This allows to set the detection range to the country-specific LEL value.

When the unit or the gas type were changed, the instrument has to be re-started after the service program has been left, before a bump-test or an AutoCal adjustment in a docking station is performed.

System Menu – General Settings

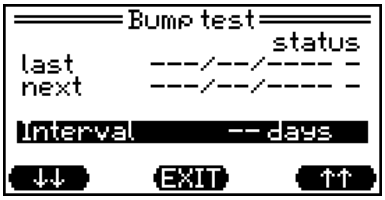
Selecting „System" in this menu point, the following reading is displayed:



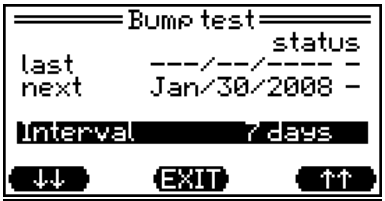
- **Bump test** (status, date of last and next bump test, interval)
- **Calibration** (status, date of last and next calibration, interval)
- **Inspection** (date of next inspection)
- **Time** (date and time)
- **System options** (selection of menu language, vibration alarm on/off, latching alarm on/off, autostore on/off)
- **Sensor selection** (activation resp. de-activation of individual sensors)
- **AutoCal** – air (release of sensors for adjustment with fresh air)
- **AutoCal** – gas (release of sensors for adjustment with test gas)
- **Information** (info about detector type, firmware version, serial number and battery type)

Bump Test – Date and Interval

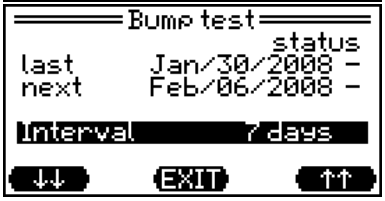
The bump test (check of sensor values and alarms) can be done easily and quickly by means of the docking station DS400. The bump test is started automatically, the intervals for the bump test are stored in the Microtector II. The bump test interval is activated once the first bump test was done in the docking station.



Bump test interval not activated



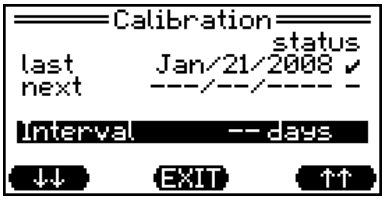
Bump test interval activated
next bump test required immediately



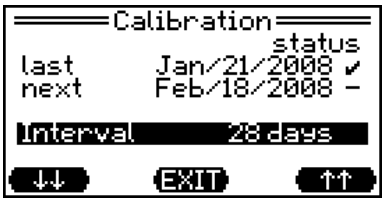
Bump test on January 30, 2008 was alright
next bump test required in 7 days

Calibration (ZERO+CAL) – Date and Interval

The calibration (adjustment of zeropoint and sensitivity) can easily be done fully automatic with the docking station DS400 very quick and simple. The intervals for calibration are stored in the G460 and activated once the first calibration was done in the docking station.



Calibration on January 21, 2008 was alright Calibration interval not activated



Calibration on January 21, 2008 was alright
Next calibration required in 28 days

Inspection – Date of next Inspection

To remind you of the date for the next maintenance resp. inspection, you can enter a date. When it expires, the G460 automatically triggers an alarm. When the entered date is expired, the G460 reports a reminder every time it is switched on.
Select "**Inspection**" in the service menu.

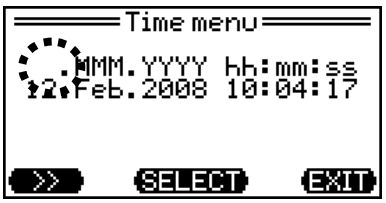
Here the parameter to be changed can be selected (day, month and year).

EXIT = Back to system menu
SELECT = Select the blinking parameter
>> = Move to next parameter

To change a parameter, following options are available:
↓↓ = Decrease value
EXIT = Confirm value
↑↑ = Increase value

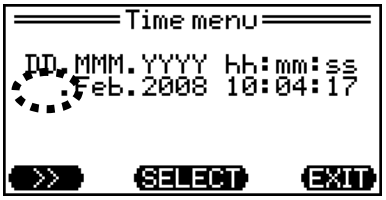
Time – Date and Time of the Instrument

The instrument provides a clock for the indication of date and time. There is no automatic switching between summer and winter time. This clock is buffered by a lithium cell that is supposed to last for 20 years.



The blinking parameter is chosen by pressing **SELECT**.

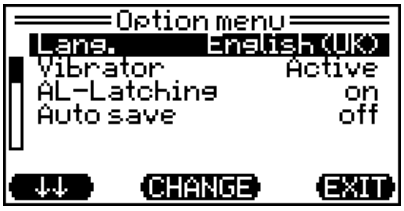
With **>>** you move to the next parameter.
With **EXIT** you go back to system menu.



To change a parameter, following options are available:
↓↓ = Decrease value
EXIT = Confirm value
↑↑ = Increase value

System Options – Language, Vibration Alarm, Latching Alarm, SD Card Check, Auto Save

The menu point "**System options**" provides information about the selected language, the status of the vibration alarm, the latching alarm function and the autostore function.

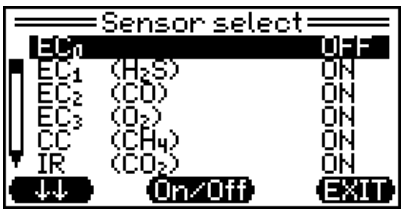


↓↓ = Scroll down
CHANGE = Change language resp. vibration alarm
EXIT = Back to service menu

All options can be changed. **„Language"** allows to chose German, English (UK), English (US) and French. Under **„Vibrator"** (if available in the battery pack) you can turn the vibration alarm on or off. **„AL-Latching"** determines whether gas alarms 2 and 3 can only be reset by pressing the RESET key or whether these alarms reset automatically as soon as the gas concentration has fallen below the thresholds The deactivation of latching alarms is not allowed for the use as a function tested instrument. In **"SD-card check"** you can select, if the presence of a SD card and the relevant measurement data storage is to be monitored. **"Auto save"** selects whether leaving the service mode saves all changes automatically or whether saving the changes must be confirmed by keystroke.

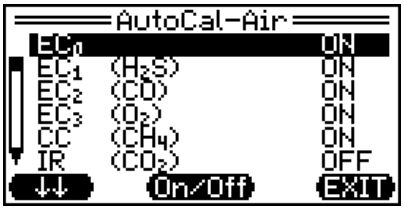
Sensor Selection – Activation / Deactivation

Every sensor can individually be activated or de-activated. This function is necessary for applications, in which a gas does not need to be measured or if a sensor is to be taken out and not being replaced.



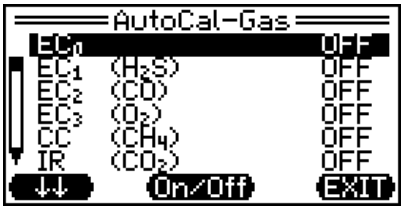
On = Sensor active
Off = Sensor inactive
If the display does not indicate a (Gas), this means that the sensor is not available or is not recognized.
↓↓ = Scroll down to next sensor
On/Off = Activation / De-activation of sensor
EXIT = Back to service menu

AutoCal-Air – Sensor Release for AutoCal Adjustments



Determination of sensors for which the automatic adjustment with fresh air is possible. Except of the IR sensor for CO_2, all sensors show "ON" and are enabled for automatic calibration with fresh air.
↓↓ = Scroll down to next sensor
On/Off = Calibration/non-calibration of sensor in AutoCal program
EXIT = Back to service menu

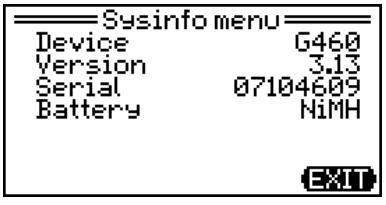
AutoCal-Gas – Sensor Release for AutoCal Adjustments



Determination of sensors for which the automatic adjustment with test gas is possible. Generally all sensors show "Off". Should several sensors be calibrated simultaneously with a test gas mixture, you can select these sensors.
↓↓ = Scroll down to next sensor
On/Off = Calibration/non-calibration of sensor in AutoCal program
EXIT = Back to service menu

Information – Detector, Firmware Version, Serial Number, Supply Module

In the system menu point "**Information**" you gain information about the detector type, the firmware version, the serial number of the detector, and the type of supply module.



EXIT = Back to service menu

Charging of Rechargeable Battery Pack

Caution: The detector must not be charged in hazardous locations.
The charge contacts must be kept clean (s. chapter "Cleaning").

The rechargeable battery pack in the G460 can be recharged by means of the **drop-in charger (charger tray)**. There are two versions available, one with and one without fixing straps. The version with straps may also be fixed at the wall.
The charger tray is being supplied either by a plug-in mains adapter or by a car charging cable. The charger tray limits the charging voltage for the G460 to max. 6V. The charging process is divided into quick and trickle charge mode. The green LED indicates that the charger tray is ready for operation. The yellow LED indicates the charging mode (off: no detector in charger tray; lit permanently: quick charge; flashing: trickle charge).
When the rechargeable battery pack is completely exhausted, the quick charge mode takes approx. 4.5…5 hours. Then the charger tray automatically turns to trickle charge, so it is not possible to overcharge the battery pack. Both charging modes are indicated in the display of the G460. When the charger turns to trickle charge, the battery pack has reached at least 90 % of its capacity. To reach 100% capacity, you should allow another 8 hours in trickle charge mode. With an optional USB adapter cable, the charger tray allows to download the data from the G460 data logger and to transfer them to a PC.


Charger tray with bracket

Alternatively the rechargeable battery pack module in the G460 can be charged with the **Smart Charger Cap**. The Smart Charger Cap is to be fixed to the G460 by means of two knurled screws.

The Smart Charger Cap is also supplied by a plug-in mains adapter or by a car charging cable. The Smart Charger Cap limits the charging voltage for the G460 to max. 6V. The charging process and the signals from the green and yellow LEDs are identical to what was described for the charger tray. The Smart Charger Cap and an optional USB adapter cable also allow to download data from the G460 data logger and to transfer them to a PC.

The Smart Charger Cap also allows to re-calibrate the detector (see picture at right). This cannot be done, however, during charging.

To maintain the full capacity of the battery pack permanently, it is important to make sure that the drop-in charger is only used for charging the battery pack, depending on the operational time and frequency, but not as a depository of the instrument for weeks. The following table shows recommendations for charging the battery pack depending on the frequency of use:


Smart Charger Cap

	Detector used	Charging recommendation
1.	More than 3h a day	Charge after use
2.	Less than 3h a day	Charge every 2. or 3. day
3.	1x per week	Charge 1 day before next use
4.	1x per month; more than 3h	Charge after use as well as 1 day before next use
5.	1x per month; less than 3h	Charge 1 day before next use
6.	1x per quarter or less	Charge after use as well as 2 days before next use

At 4., 5., 6.: If the instrument is only used occasionally, the battery pack should be charged after each use, because parts of the sensor electronics have to be provided with energy even when power is off. In case the instrument was not used for a long time and the battery pack is discharged completely, the instrument should be charged about 2 days before the next use. Possibly the battery pack will then be charged for a short time only (e.g. 11min) in the quick charge mode, switching to trickle charge mode afterwards. A normally discharged battery pack will be charged to 90% of its normal capacity in about 4 to 4.5 hours in quick charge mode. After

another 8 hours in trickle charge mode the battery pack reaches 100% of its normal capacity. In case you do not get the normal operational time from a fully charged battery pack, this may be caused by the "Lazy-Battery-Effect". This effect changes the discharging behavior in a way that despite of a fully charged battery pack the battery indication quickly shows an empty symbol, although the instrument can still be operated for a long time.

Lazy-Battery-Effect on NiMH Battery Packs and its Clearance

Due to temperatures above 50°C, inappropriate use or incorrect charging the NiMH battery packs may become subject to the so-called "Lazy-Battery-Effect", which reduces the operational time of the detector. This can happen, if the detector never discharges the battery pack completely, or if the battery pack is charged too often or for too long. You should avoid, therefore, to start several charging processes a day, or to permanently leave the detector in the charger for several days or weeks.

The "Lazy-Battery-Effect" issue can in most cases be solved by discharging the NiMH battery pack completely. This is why from firmware version 3.23 the menu point "Anti-Lazy-Battery" was added within the "Main Menu/Options". With this function activated, the instrument works as usual. For discharging the battery pack completely, however, the detector should not be switched off manually. The "Anti-Lazy-Battery" option reduces the threshold for the automatic switch off unrecurringly, so the instrument will remain activated after the 15min battery alarm, until a minimum voltage is reached. The battery alarm will still be given every minute, and the remaining operational time will be displayed in minutes with negative sign. In case of a strong "Lazy-Battery-Effect" it is recommended that that this option is repeatedly activated after charging the battery pack.

Replacement of Alkaline or Rechargeable Batteries

Caution: The detector must not be opened in hazardous areas, i.e. the alkaline resp. rechargeable battery pack module must not be changed in such locations.

Turn the detector off before you replace the alkaline or rechargeable battery pack module. For replacing the supply module unscrew the two screws at the front of the detector and pull the complete module backwards, or push it backwards through one of the screw holes. The reverse of the casing holds an Allen key for these screws.

For replacing the alkaline batteries in the battery module use a thin subject to push the two battery cells out through the PCB holes. Take care of the correct polarity when fitting the new 1.5V AA batteries (see battery holder). These batteries have always to be purchased from GfG as the manufacturer of the detector. Internal controls ensure the exclusive use of batteries which comply with the EC-Type Examination Certificate.

The correct battery type is: **DURACELL PROCELL MN1500 LR6 AA**.

The AA battery module or a new rechargeable battery pack module can now be fit. Fix the new supply module by means of the two screws.

Annex

Cleaning

Polluted enclosures can be cleaned with a damp cloth. Do not use solvents and detergents! It is important to make sure that the external charge contacts of the G460 and the charge contact pins of the charging adapter are kept clean. In case of bad contacts of the charging adapter the NiMH-battery pack will only be charged incompletely or not at all.

Maintenance and Inspection

Maintenance and inspection include a regular check and adjustment of sensitivity and zeropoint. A bump test of the device is necessary as well. Depending on ambient conditions, gas monitoring devices may show a different behaviour. Regardless of maintenance it is important, therefore, to test and, if required, adjust the device before they are used (see DIN EN 60079-29-2 chapter 9.2 as well as, in Germany, BG-Chemistry guidelines T 021 and T 023). This test comprises following checks:

- Visual check for mechanical damages
- Visual check of gas inlets
- Charging status of battery / rechargeable battery pack
- Response to zero gas and test gas and alarm triggering

The response behaviour of oxygen sensors can be checked with appropriate test gas (<18 %-Vol. O_2) in combination with the docking station, the "Smart Cap" or the "Smart Charger Cap". The simplest way of checking the response behaviour is to expose the sensor to slowly exhaled air.

Service - Repair

DIN EN 60079-29-2 "… Gas measuring devices – Selection installation, use and maintenance of devices for measurement of combustible gases and oxygen", DIN EN 45544-4 „... Electrical devices for direct detection and direct concentration measurement of toxic gases and vapours, part 4: Guideline for selection, installation, use and maintenance" as well as the relevant national directives are to be adhered to.
Service, in Germany referring to "Explosion Protection Diretives" and „BGR 500, chapter 2.33" (formerly: UVV Gase), comprises maintenance, inspection and repair of gas monitoring devices. Guidelines T 021 and T 023 of BG Chemistry describe proper measures. The function test has to be executed before first operation and at least once a year and comprises:

- Status of the zeropoint
- Charging status of the battery
- Pump and diffusion inlet
- Display with zero gas and standard test gas and adjustment, if necessary
- Alarm signal release, e.g. with alarm test gas
- Constantly amplified signal with standard test gas
- Response time

The check must be done by an expert, and the result must be confirmed in writing. Any repair of the G460 must generally be done according to the manufacturer's instructions and with genuine spare parts.

Calibration Accessories

For checking the sensitivity the instrument has to be exposed to test gas. By using the "Smart Cap" or the "Smart Charger Cap" the diffusion inlets can be covered, so the sensors can be supplied with test gas at a flow of 0.5…0.6 l/min.. Alternatively and for certain gases this check can also be done in the docking station DS400.

Attention: Test gases, especially toxic gases, can be hazardous. Make sure that test gases are not inhaled. Workplaces where test gas is used for calibration, should be ventilated sufficiently, depending on the kind of gas, its concentration and amount. In special cases an exhaust resp. a gas drain is recommended. Always adhere to the safety advises on gas bottles and to the safety data sheets of the test gases.

Test with Docking Station DS400

The bump test required by T 021 resp. T023 as well as the adjustment of the Microtector II can be done easily and quickly by means of the docking station DS400. The bump test starts automatically and takes approx. 20 seconds. Adjustment is started by just pushing one button, and is completed within a few minutes. The test result is indicated by a green and a red LED. Detailed values are shown in the display of the detector (bump test report, AutoCal-Air report, AutoCal-Gas report). You do not need a PC for bump test r calibration; all relevant data are automatically stored on a SD card in the docking station.
The first bump test of a Microtector II G460 in the docking station can automatically activate the interval for bump test and adjustment.
Before using the docking station please read and adhere to the relevant operation manual.

Trouble Shooting

	Fault / Message	Cause	Solution
1.	Alarm LEDs flashing, display off	Insufficient supply voltage	Charge resp. replace battery pack
		Hardware or program sequence fault	Call GfG service
2.	"Bootloader" shown permanently with red display illumination	Program memory fault	Transfer firmware to the device or call GfG service
3.	"FAULT! RAM"	RAM fault	Switch device off and on or call GfG service
4.	"FAULT! EEP"	Device parameter memory fault	
5.	"FAULT! BAT"	Battery voltage measurement fault	
6.	"FAULT! ALG"	Program sequence fault / Algorithm	
7.	"Clock chip does not work!" "Time set back to …"	Hardware fault	Reset message, set clock or call GfG service
8.	"Time set back to …"	Clock not set or buffer battery empty	Reset message, set clock or call GfG service
9.	"Sensor defect!"	Sensor faulty or not available	Switch device off and on or call GfG service
10.	"Data faulty!"	Sensor data fault	Switch device off and on or call GfG service
11.	"Put sensor in EC1!"	EC sensor in wrong slot	Open device, correct sensor position, then close device
12.	"Put sensor to EC2 or EC3!"		
13.	"Sensor not existing. Deactivate sensor in system menu!"	Sensor not present	Reset message, deactivate sensor in system menu or call GfG service
14.	"Check alarms!"	Sensor was replaced by another type	Check and if necessary change alarm setting in service menu
15.	"Gas not supported!"	Kind of gas not supported or old firmware version	Remove sensor or perform firmware update
16.	"SC card not existing!"	No SD card in the slot	Insert SD card or deactivate "SD-Card check" in service menu
17.	"SC card faulty!"	No SD card in the slot or error when writing data	Reset message or re-start device or change card
18.	"No sensors!"	No sensor activated in service menu	Activate available sensor in service menu
19.	Gas indication "START" ("STRT")	Sensor still in start up phase	Wait several seconds
20.	Gas indication "????"	Detection with CC sensor not possible due to oxygen indication <10%Vol	If occurring in fresh air adjust or replace the oxygen sensor
21.	Gas indication "----" / "ERROR"	No gas indication due to faulty sensor or sensor data	Deactivate sensor in service menu or call GfG service
22.	Gas indication "UNDER" or	Massive under-run of detection range	Adjust zeropoint

	"UNDER RANGE"		
23.	Gas indication "OVER" or "OVER RANGE"	Gas concentration too high or high cross sensitivity (EC sensors) or activated protective circuit (CC sensors)	Leave the high gas concentration area and reset message for CC sensor and confirm in fresh air atmosphere
24.	Gas indication "FAULT" ("FLT")	IR sensor signal faulty	If occurring repeatedly, call GfG service
25.	Gas indication "TEMP" or "TEMP ERROR"	Sensor operated out of specified temperature range or hardware defect at 0°C<Ta<30°C	Return to normal temperature range or call GfG service
26.	Gas indication "POWER" or "POWER ERROR"	Power supply of sensor is interrupted	If occurring repeatedly, call GfG service
27.	Gas indication "P+T"	see gas indication "TEMP" and "POWER"	see above
28.	"Gas concentration too high!"	Gas concentration still above 5%Vol when changing from HI% range top %LEL range	Wait until gas concentration has fallen below 5%Vol and repeat range change
29.	"Remove charger!"	Alkaline batteries not rechargeable	Disconnect device from charger
30.	"Remove battery pack!"	Instrument cannot be switched off due to hardware defect	Remove battery pack from device or call GfG service
31.	"No sensors for AutoCal-Air (Gas) enabled!"	No sensors enabled for automatic fresh air resp. test gas adjustment	Enable sensor(s) for automatic adjustment in service menu
32.	"Zero failure – measurement value too high!" (too low)	Possibly gas present or too positive (negative) zeropoint deviation	Adjust zeropoint in gas-free environment or call GfG service
33.	"Calibration failure – measurement value too low!" (too high)	Wrong test gas concentration or sensor sensitivity too low (high)	Check test gas and nominal value or call GfG service
34.	"Zero (calibration) failure – signal unseizable!"	Extreme sensor signal deviation or hardware defect	Repeat process or call GfG service
35.	"Storing failure!"	Parameters cannot be saved when leaving service menu	Switch device off and on, then repeat settings in service menu, or call GfG service

Accessories and Spare Parts

	Description	**Part No.**
1.	Alkaline battery pack without batteries (#)	1450200
2.	Alkaline battery pack with vibrator without batteries (#)	1450202
3.	Alkaline battery (pack of 10) (#)	1450204
4.	Rechargeable NiMH-II battery pack	1450206
5.	Rechargeable NiMH-II battery pack with vibrator	1450207
6.	Rechargeable NiMH-II battery pack with lights	1450208
7.	Rechargeable NiMH-II battery pack with vibrator and lights	1450209
8.	Smart Charger Cap (charge, calibrate, data transfer)	1450215
9.	Plug-in charger 100-240VAC (EU adapter)	1450216
10.	Charging cable for cars (#)	1450218
11.	Drop-in charger G400-DIC1 / Drop-in charger G400-DIC2 [#]	1450219/23

12.	Drop-in charger G400-DIC1S / Drop-in charger G400-DIC2S (with strap) [#]	1450220/24
13.	Smart cap (for calibration only)	1450225
14.	Transportat and storing case (plastic) (#)	1450229
15.	USB Interface cable for PC	1450232
16.	Data logger set 1 with GfG interface software for Microtector II	1450233
17.	microSD-card with adaptor	1460200
18.	Docking station DS400 with DIC1D / DIC2D [#]	1450401/02
19.	MK211-6 Sensor for 100%LEL combustible gases and vapours	1460710
20.	MK211-7 Sensor for 100%LEL combustible gases (with increased poison resistance)	1460711
21.	MK222-2 Isobutylene sensor, 500ppm C_4H_8 [#]	1460703
22.	MK222-3 Isobutylene sensor, 2000ppm C_4H_8 [#]	1460704
23.	MK224-5 Carbon dioxide sensor, 5 Vol.-% CO_2 (Infrared)	1460781
24.	MK227-5 Sensor for combustible gases and vapors, 100%LEL CH_4 (Infrared)	1460770
25.	MK227-5 Sensor for combustible gases and vapors, 100%LEL + 100%Vol. CH_4 [#] (IR)	1460773
26.	MK 231-5 Dual-sensor for combustible gases and vapors, 100%LEL CH_4 and for carbon dioxide 5%Vol CO_2 (Infrared)	1460774
27.	MK231-5 Dual-sensor for combustible gases and vapors, 100%LEL + 100%Vol CH_4 [#] and carbon dioxide 5%Vol CO_2 (Infrared)	1460778
28.	MK344-5 Carbon monoxide sensor, 300ppm CO (no warning from H_2S) [#]	1460733
29.	MK344-4 Carbon dioxide sensor, 500ppm CO (no warning from H_2S)	1460734
30.	MK344-6 Carbon monoxide sensor, 1000ppm CO (no warning from H_2S) [#]	1460735
31.	MK346-5 Sulfur dioxide sensor, 10ppm SO_2 [#]	1460737
32.	MK347-5 Nitrogen monoxide sensor, 100 ppm NO [#]	1460744
33.	MK348-5 Nitrogen dioxide sensor, 30ppm NO_2 [#]	1460738
34.	MK353-5 Phosphine sensor, 10ppm PH_3 [#]	1460742
35.	MK369-5 Carbon monoxide sensor, 300ppm CO (reduced H_2-sensitivity) [#]	1460732
36.	MK369-6 Carbon monoxide sensor, 500ppm CO (reduced H_2-sensitivity)	1460751
37.	MK379-5 Ethylene oxide sensor, 20 ppm C_2H_4O [#]	1460741
38.	MK380-5 Dual sensor for carbon monoxide, 500ppm CO and hydrogen sulphide, 100ppm H_2S [#]	1460730
39.	MK383-5 Oxygen sensor, 25 %Vol O_2 (2 years) [#]	1460793
40.	MK389-6 Carbon monoxide sensor, 2000ppm CO [#]	1460752
41.	MK390-5 Chlorine sensor, 10 ppm Cl_2 [#]	1460746
42.	MK392-5 Hydrogen chloride sensor, 30ppm HCl [#]	1460749
43.	MK393-5 Ammonia sensor, 200ppm NH_3 [#]	1460754
44.	MK396-5 Hydrogen sensor, 2000ppm H_2 [#]	1460750
45.	MK399-6 Ammonia sensor, 1000ppm NH_3 [#]	1460761
46.	MK402-5 Hydrogen sensor, 1 Vol.-% H_2 [#]	1460758
47.	MK403-5 Hydrogen sensor, 4 Vol.-% H_2 [#]	1460759
48.	MK404-5 Silane sensor, 40ppm SiH_4 [#]	1460762
49.	MK409-5 Hydrogen cyanide sensor, 50ppm HCN [#]	1460755
50.	MK427-5 Oxygen sensor, 25 Vol.-% O_2 (3-years)	1460791
51.	MK429-5 Hydrogen sulfide sensor, 100ppm H_2S	1460763
52.	MK429-6 Hydrogen sulfide sensor, 500ppm H_2S [#]	1460764

Spare parts and accessories should be stored at ambient temperatures of 0...30°C. Storage time should not exceed 5 years. Electrochemical sensors should not be stored for more than ½ year. When you store oxygen sensors be aware of the fact that storage reduces the expected lifetime of the sensor. When storing spare sensors make sure that the ambient atmosphere is free of corrosive media and sensor poisons. For NiMH battery packs a storing time of only one year is applicable. Before storing the battery pack has to be charged completely. If detectors are stored for more than ½ year the battery pack should be removed.

Hints for a non-polluting disposal of old parts

According to §11 of GfG's general terms and conditions the buyer is committed for a non-polluting disposal of the instrument and its components according to §§11, 12 of the ElektroG. On request the parts may be adequately disposed off by GfG in Dortmund.

Sensor Types and Detection Ranges

Slot	Sensor type	Detection range	Gas		Resolution	T-Band (*1)
EC1	MK380-5 [#]	0 … 500 ppm 0 … 100 ppm	CO H_2S	Carbon monoxide Hydrogen sulfide	1 ppm 0.5 ppm	±3 ppm ±1.5 ppm
EC1 **EC2** **EC3**	MK344-4	0 … 500 ppm	CO	Carbon monoxide	1 ppm	±3 ppm
	MK344-5 [#]	0 … 300 ppm	CO	Carbon monoxide	1 ppm	±3 ppm
	MK344-6 [#]	0 … 1000 ppm	CO	Carbon monoxide	1 ppm	±5 ppm
	MK346-5 [#]	0 … 10 ppm	SO_2	Sulfur dioxide	0.1 ppm	±0.2 ppm
	MK353-5 [#]	0 … 10 ppm	PH_3	Phosphine	0.05 ppm	±0.05 ppm
	MK369-5 [#]	0 … 300 ppm	CO	Carbon monoxide	1 ppm	±3 ppm
	MK369-6	0 … 500 ppm	CO	Carbon monoxide	1 ppm	±3 ppm
	MK383-5 [#]	0 … 25 Vol.-%	O_2	Oxygen	0,1 Vol.-%	±0,3 ppm
	MK389-6 [#]	0 … 2000 ppm	CO	Carbon monoxide	1 ppm	±4 ppm
	MK393-5 [#]	0 … 200 ppm	NH_3	Ammonia	1 ppm	±3 ppm
	MK396-5 [#]	0 … 2000 ppm	H_2	Hydrogen	2 ppm	±50 ppm
	MK399-6 [#]	0 … 1000 ppm	NH_3	Ammonia	5 ppm	±10 ppm
	MK402-5 [#]	0 … 1 Vol.-%	H_2	Hydrogen	0.01 Vol.-%	±0.02 Vol.-%
	MK403-5 [#]	0 … 4 Vol.-%	H_2	Hydrogen	0.01 Vol.-%	±0.05 Vol.-%
	MK404-5 [#]	0 … 40 ppm	SiH_4	Silane	0.1 ppm	±0.4 ppm
	MK409-5 [#]	0 … 50 ppm	HCN	Hydrogen cyanide	0.5 ppm	±1.5 ppm
	MK427-5	0 … 25 Vol.-%	O_2	Oxygen	0.1 Vol.-%	±0.3 Vol.-%
	MK429-5	0 … 100 ppm	H_2S	Hydrogen sulfide	0.2 ppm	±1.0 ppm
	MK429-6 [#]	0 … 500 ppm	H_2S	Hydrogen sulfide	0.5 ppm	±1.0 ppm
EC2 **EC3**	MK347-5 [#]	0 … 100 ppm	NO	Nitrogen monoxide	1 ppm	±3 ppm
	MK348-5 [#]	0 … 30 ppm	NO_2	Nitrogen dioxide	0.2 ppm	±0.6 ppm
	MK379-5 [#]	0 … 20 ppm	C_2H_4O	Ethylene oxide	0.1 ppm	±0.3 ppm
	MK390-5 [#]	0 … 10 ppm	Cl_2	Chlorine	0.1 ppm	±0.1 ppm
	MK392-5 [#]	0 … 30 ppm	HCl	Hydrogen chloride	0.2 ppm	±0.4 ppm
PID **(EC2)**	MK222-2 [#]	0 … 500 ppm	C_4H_8	Isobutylene	0.1 ppm	±0.3 ppm
	MK222-3 [#]	0 … 2000 ppm	C_4H_8	Isobutylene	0.5 ppm	±1.0 ppm
CC (PL)	MK211-6 MK211-7	0 … 0.5 Vol.-% 0 … 100 %LEL	CH_4 CH_4	Methane Methane (*2)	0.02 Vol.-% 0.5 %LEL	±0.14 Vol.-% ±2.5 %LEL
IR	MK224-5	0 ... 5Vol.-%	CO_2	Carbon dioxide	0.010,.0.5Vol%	-
	MK227-5	0 … 100 %LEL 0… 100%Vol	CH_4 below CH_4	Methane (*2) s. Methane	0.2 .. 1.0%LEL 0.01 .. 0.5 %Vol	±1.2%LEL ±0.05%Vol
	MK231-5	0 … 5 %Vol 0 … 100%LEL 0 … 100%Vol	CO_2 CH_4 CH_4	Carbon dioxide Methane (*2) Methane	0.01..0.05 %Vol 0.2..1.0%LEL 0.01..0.5%Vol	- ± 1.2%LEL ± 0.05%Vol

at (*1): T-Band = Tolerance band
at (*2): or one of the following combustible gases and vapours

MK211-6	CH_4 (Methane), C_3H_8 (Propane), C_4H_{10} (Butane), C_5H_{12} (Pentane), C_6H_{14} (Hexane), H_2 (Hydrogen), C_2H_2 (Acetylene), C_2H_4 (Ethylene), CH_4O (Methanol), C_2H_6O (Ethanol), C_3H_8O (Isopropanol), $C_4H_{10}O$ (n-Butanol), C_3H_6O (Acetone), $C_3H_6O_2$ (Methylacetate), $C_4H_8O_2$ (Ethylacetate), C_4H_8O (Methylethylketone MEK), C_7H_8 (Toluene), $C_6H_{12}O$ (Methylisobutylketone MIBK), C_7H_{16} (Heptane), C_9H_{20} (n-Nonane)
MK211-7	CH_4 (Methane), C_3H_8 (Propane), C_4H_{10} (Butane), C_5H_{12} (Pentane), C_6H_{14} (Hexane), H_2 (Hydrogen), CH_4 (Methane), C_3H_8 (Propane), C_6H_{14} (n-Hexane), C_9H_{20} (n-Nonane)
MK227-5 MK231-5	CH_4 (Methane), C_3H_8 (Propane), C_6H_{14} (n-Hexane), C_9H_{20} (n-Nonane)

Sensor Specification

MK211-6 Catalytic combustion sensor for combustible gases and vapours

Detection range: 0.0 .. 100%LEL

Response time: t_{50}: ≤10 sec t_{90}: <20 sec for CH_4 (Methane) t_{50}: ≤12 sec t_{90}: <30 sec for C_3H_8 (Propane)
t_{50}: ≤40 sec t_{90}: <175 sec for C_6H_{14} (n-Hexane)

Pressure (70)80....120(130) kPa: max. ±5%LEL of range or ±10(15)% of display (referred to 100 kPa)

Humidity 0%...95% r.h.: max. ±7%LEL of range or ±10% of display (referred to 0% r.h. @40°C)

Temperature -20...+ 55°C: max. ±5%LEL of range or ±10% of display (referred to 20°C)

Cross sensitivities [#] @ 50%LEL:

Gas supply	CH_4 display	C_3H_8 display	n-Hexane display
2,00%Vol H_2	ca.85%LEL	ca.105% LEL	ca.140% LEL (theor.)
2,20%Vol CH_4	= 50% LEL	ca.60% LEL	ca.80% LEL
0,85%Vol C_3H_8	ca.41% LEL	= 50% LEL	ca.66% LEL
0,70%Vol C_5H_{12}	ca.39% LEL	ca.48% LEL	ca.63% LEL
0,70%Vol C_4H_{10}	ca.37% LEL	ca.44% LEL	ca.58% LEL
0,50%Vol C_6H_{14}	ca.27% LEL	ca.32% LEL	= 50% LEL
0,55%Vol C_7H_{16}	ca.22% LEL	ca.27% LEL	ca.42% LEL
0,55%Vol C_9H_{20}	ca.17% LEL	ca.22% LEL	ca.35% LEL

May vary from sensor to sensor and depend on the gas concentration and on the age of the sensor.

Expected lifetime: 3 years in clean air

MK211-7 Catalytic combustion for combustible gases and vapours (with increased poison resistance)

Detection range: 0.0 .. 100%LEL

Response time: t_{50}: ≤10 sec t_{90}: <20 sec for CH_4 (Methane)
t_{50}: ≤12 sec t_{90}: <30 sec for C_3H_8 (Propane)
t_{50}: ≤40 sec t_{90}: <230 sec for C_6H_{14} (n-Hexane)

Pressure (70)80....120(130) kPa: max. ±5%LEL of range or ±10(15)% of display (referred to 100 kPa)

Humidity 0%...95% r.h.: max. ±7%LEL of range or ±10% of display (referred to 0% r.h. @40°C)

Temperature-20(-10)...(+40)+55°C: max. ±5(7)%LEL of range or ±10(20)% of display (referred to 20°C)

Cross sensitivities [#] @ 50%LEL:

Gas supply	CH_4 display	C_3H_8 display	n-Hexane display
2,00%Vol H_2	ca.85%LEL	ca.105% LEL	ca.140% LEL (theor.)
2,20%Vol CH_4	= 50% LEL	ca.60% LEL	ca.80% LEL
0,85%Vol C_3H_8	ca.41% LEL	= 50% LEL	ca.66% LEL
0,70%Vol C_5H_{12}	ca.39% LEL	ca.48% LEL	ca.63% LEL
0,70%Vol C_4H_{10}	ca.37% LEL	ca.44% LEL	ca.58% LEL
0,50%Vol C_6H_{14}	ca.27% LEL	ca.32% LEL	= 50% LEL

May vary from sensor to sensor and depend on the gas concentration and on the age of the sensor.

Expected lifetime: 3 years in clean air

MK222-2/-3 Photo-ionisation sensor for toxic combustible vapours resp. VOC

Detection range: 0..500/2000ppm i-C_4H_8 (Isobutylene) an more

Response time: t_{90}: <30 s

Ionisation potential: 10.6 eV

Cross sensitivities: Kerosene: approx.250%; C_8H_8: 250%; C_7H_8: 190%; C_6H_6: 190%; Diesel: approx.110; Benzene: approx.90%; C_3H_60: 83%; C_8H_{18}: 45%; C_7H_{16}: 40%; H_2S: 30%; C_6H_{14}: 22%; NO: 14%; NH_3: 11%; C_5H_{12}: 10%; C_4H_{10}=0%; C_3H_8=0%; CH_4=0%; H_2=0%

Expected lifetime: 3 years

MK224-5/MK231-5 Infrared sensor for carbon dioxide CO_2

Detection range: 0.02 .. 5.0%Vol (25.0%Vol[#]) Zero point drift ≤ 0.03%Vol

Response time: t_{50}: ≤ 20 sec t_{90} ≤ 50 sec t_{10} ≤ 50 sec (decay time @ CO_2)

Pressure 70...130 kPa: <1.6% of display per 1% pressure change (referred to 100 kPa)

Humidity 0%...95% r.h.: max. ±0.01Vol% or ±2% of display (referred to 50% r.h. @ 20°C)

Temperature -20...+55°C: max. ±0.01Vol% or ±10% of display (referred to 20°C)

Long term stability per month: max. ±0.01Vol% or ±2% of display (laboratory conditions)

Expected lifetime: 6 years

MK227-5/MK231-5 Infrared sensor for combustible gases and vapours

Detection range: 0 .. 100%LEL (100%Vol CH_4 [#])

Response time: t_{50}: ≤ 20 sec t_{90} ≤ 45 sec (@ CH_4 Methane)
t_{50}: ≤ 25 sec t_{90} ≤ 66 sec (@ CH_4 Propane)
t_{50}: ≤ 30 sec t_{90} ≤ 99 sec (@ CH_4 n-Hexane)
t_{50}: ≤ 35 sec t_{90} ≤ 371 sec (@ CH_4 n-Nonane)

Pressure 70...130 kPa: <1.5% of CH_4 display per 1% pressure change (referred to 100 kPa)
<1.2% of C_3H_8 display per 1% pressure change (referred to 100 kPa)

Humidity 0%...95% r.h.: max. ±2%LEL or ±15% of display (referred to 0% r.h. @ 40°C)

Temperature -20...+50°C: max. ±2%LEL or ±10% of C_3H_8 display (referred to 20°C)

Cross sensitivities [#] @ 50%LEL:

Gas supply	CH_4 display	C_3H_8 display	n-Hexane display	n-Nonane display
0,85%Vol C_3H_8	ca.145%LEL	= 50% LEL	ca.67% LEL	ca.80% LEL
0,70%Vol C_5H_{12}	ca.130%LEL	ca.46% LEL	ca.62% LEL	ca.75% LEL
0,70%Vol C_4H_{10}	ca.110% LEL	ca.42% LEL	ca.57% LEL	ca.69% LEL
1,00%Vol C_3H_8O	ca.97% LEL	ca.39% LEL	ca.53% LEL	ca.64% LEL
0,50%Vol C_6H_{14}	ca.88% LEL	ca.37% LEL	= 50% LEL	ca.60% LEL
0,55%Vol C_7H_{16}	ca.87% LEL	ca.36% LEL	ca.49% LEL	ca.59% LEL
1,10%Vol $C_4H_8O_2$	ca.76% LEL	ca.34% LEL	ca.45% LEL	ca.55% LEL
0,35%Vol C_9H_{20}	ca.65% LEL	ca.31% LEL	ca.41% LEL	= 50% LEL
2,20%Vol CH_4	= 50% LEL	ca.26% LEL	ca.35% LEL	ca.42% LEL
0,90%Vol C_4H_8O	ca.49% LEL	ca.26% LEL	ca.34% LEL	ca.41% LEL
0,55%Vol C_7H_8	ca.29% LEL	ca.18% LEL	ca.24% LEL	ca.29% LEL
1,25%Vol C_3H_6O	ca.26% LEL	ca.16% LEL	ca.22% LEL	ca.27% LEL

May vary from sensor to sensor and depend on the gas concentration and on the age of the sensor.

Expected lifetime:	6 years

MK344-4/ /-5[#] /-6[#] Electrochemical sensor for carbon monoxide CO

Detection range:	2.. 500oom (300/1000ppm [#]) zero point drift ≤ 3ppm
Response time:	t_{50}: <20 s t_{90}: <65 s t_{10}: <70 s (decay time)
Pressure (70)90...110(130) kPa:	max. ±2ppm or ±12(14)% of display (referred to 100 kPa)
Humidity 5%...95% r.h.:	max. ±1ppm or ±2% of display (referred to 50% r.h. @ 20°C)
Temperature-10(-20)...+40(55)°C:	max. ±3(5)ppm or ±5(10)% of display (referred to 20°C)
Long term stability[#] per month:	max. ±1ppm or ±2% of display (laboratory conditions)
Cross sensitivities:	H_2S<4%; C_2H_4<50%; H_2<40%; NO<9%; NO_2<±5%; SO_2=0%; Cl_2=0%; C_2H_60=0% (*1)
Expected lifetime:	3 years

MK346-5 Electrochemical sensor for sulfur dioxide SO_2[#]

Detection range:	0 .. 10ppm
Response time:	t_{50}: < 30s t_{90}: < 75s
Pressure 80...120 kPa:	max. ±0.2ppm or ±5% of display (referred to 100 kPa)
Humidity 15%...90% r.h.:	max. ±0.2ppm or ±5% of display (referred to 50% r.h.)
Temperature -20...+50°C:	max. ±0.2ppm or ±5% of display (referred to 20°C)
Cross sensitivities:	NO_2≈-100%; CO<1%; H_2S:0%; NO:0%; (*1)
Expected lifetime:	3 years

MK347-5 Electrochemical sensor for nitrogen monoxide NO[#]

Detection range:	0 .. 100ppm
Response time:	t_{50}: < 15s t_{90}: < 40s
Pressure 80...120 kPa:	max. ±1ppm or ±7% of display (referred to 100 kPa)
Humidity 15%...90% r.h.:	max. ±1ppm or ±7% of display (referred to 50% r.h.)
Temperature -20...+40(50)°C:	max. ±2(4)ppm or ±7% of display (referred to 20°C)
Cross sensitivities:	NO_2<30%; H_2S≈10%; CO:0%; SO_2:0%; (*1)
Expected lifetime:	2...3 years
Einlaufzeit:	3 minutes up to 1 day – depending on the time the detector had been turned off

MK348-5 Electrochemical sensor for nitrogen dioxide NO_2 [#]

Detection range:	0 .. 30ppm
Response time:	t_{50}: <10 s t_{90}: <30 s
Pressure 80...120 kPa:	max. ±0.3ppm or ±5% of display (referred to 100 kPa)
Humidity 15%...90% r.h.:	max. ±0.3ppm or ±5% of display (referred to 50% r.h.)
Temperature -20...+50°C:	max. ±0.3ppm or ±5% of display (referred to 20°C)
Cross sensitivities:	Cl_2≈100%; H_2S≈-8%; CO:0%; NO:0%; SO_2:0% (*1)
Expected lifetime:	3 years

MK353-5 Electrochemical sensor for phosphine PH_3[#]

Detection range:	0 .. 10ppm
Response time:	t_{50}: < 20s t_{90}: < 60s
Pressure 80...120 kPa:	max. ±0.05ppm or ±10% of display (referred to 100 kPa)
Humidity 15%...90% r.h.:	max. ±0.05ppm or ±10% of display (referred to 50% r.h.)
Temperature -20...+50°C:	max. ±0.05ppm or ±10% of display (referred to 20°C)
Cross sensitivities [#]:	SiH_4:90%; GeH_4:90%; AsH_3:65%; B_2H_6:35%; SO_2:20%; CO:0,5%; H_2:0,1%; (*1)
Expected lifetime:	2...3 years

MK369-6 / -5 Electrochemical sensors for carbon monoxide CO

Detection range:	5 .. 500ppm (300ppm[#]) zero point drift ≤10ppm
Response time:	t_{50}: <20 s t_{90}: <50 s t_{10}: <50 s (decay time) The sensor used during high concentrations beyond the upper detection range for several minutes, a decaying zero point in CO in fresh air is certain.
Pressure (70)90...110(130) kPa:	max. ±1ppm or ± 2(8)% of display (referred to 100 kPa)
Humidity 15%...95% r.h.:	max. ±1ppm or ± 2% of display (referred to 50% r.h. @ 20°C)
Temperature -20...+40(55)°C:	max. ±3[6]ppm or ±5(10)% of display (referred to 20°C)
Long term stabilty per month:	max. ±1ppm or ±1% of display (laboratory conditions)
Cross sensitivities:	H_2S<±3%; C_2H_4:60%; NO:35%; NO_2<10%; H_2<5%; SO_2=0% (*1)
Expected lifetime:	2...3 years

MK379-5 Electrochemical sensor for Ethylen oxide C_2H_4O [#]

Detection range:	0 .. 20ppm
Response time:	t_{50}: < 30s t_{90}: < 120s
Pressure 80...120ka:	max. ±1ppm or ±15% of display (referred to 100 kPa)
Humidity 15%...90% r.h.:	max. ±2ppm or ±15% of display (referred to 50% r.h.)
Temperature -(20)0...+40[50]°C:	max. ±1[2]ppm or ±15(20)% of display (referred to 20°C)
Cross sensitivities:	CO≈40%; CH_4O≈150%; C_2H_2≈125%; CH_2O≈120%; CH_4S≈100%; C_2H_4≈80%; C_2H_6O≈55%; $C_4H_{10}O$≈40%; C_7H_8≈20%; MEK≈10%; and others
Expected lifetime:	2...3 years
Warm-up time:	4 minutes up to 7 days – depending on the time the detector had been turned off

MK380-5 Electrochemical sensor for carbon monoxide CO and hydrogen sulfide H_2S (COSH) [#]

Detection range:		0 .. 25%Vol
Response time:		t_{50}: <20 s t_{90}: <50 s
Pressure	80...120 kPa:	max. ±3(1)ppm or ±7(10)% CO (H_2S) reading (referred to 100 kPa)
Humidity	15%...90% r.h.:	max. ±3(1)ppm or ±7(10)% CO (H_2S) reading (referred to 50% r.h.)
Temperature	-20...+50°C:	max. ±3(1)ppm or ±15(10)% CO (H_2S) reading (referred to 20°C)
Cross sensitivities	CO reading:	H_2S: 0...40%; H_2≈20%; SO_2<20%; NO_2<2%; NO<0.3%; Cl_2: 0% (*1)
Cross sensitivities	H_2S reading:	CO<2%; NO_2≈-20%; SO_2: 8...20%; NO<3%; H_2: 0.03%; Cl_2:0% (*1)
Expected lifetime:		3 years

MK383-5 Electrochemical sensor for oxygen O_2 [#]

Detection range:		0 .. 25%Vol
Response time:		t_{20}: <6 s t_{90}: <20 s
Pressure	80...120 kPa:	max. ±0.2Vol.% or ±2.5% of range (referred to 100 kPa)
Humidity	0%...90% r.h.:	max. ±0.2Vol.% or ±2.5% of range (referred to 50% r.h.)
Temperature	-20...+50°C:	max. ±0.5Vol.% or ±2.5% of display (referred to 20°C)
Expected lifetime:		2 years in air

MK389-6 Electrochemical sensor for carbon monoxide CO [#]

Detection range:		0 .. 2000ppm
Response time :		t_{50}: <10 s t_{90}: <30 s
Pressure	80...120 kPa:	max. ±2ppm or ±7% of display (referred to 100 kPa)
Humidity	15%...90% r.h.:	max. ±2ppm or ±7% of display (referred to 50% r.h.)
Temperature	-(20)10...+40[50]°C:	max. ±2[3]ppm or ±7(15)% of display (referred to 20°C)
Cross sensitivities:		H_2:33%; NO:25%; NH_3:0.1%; H_2S:0%; NO_2:0%; SO_2:0%; CO_2:0%; Cl_2:0% (*1)
Expected lifetime:		3...4 years

MK390-5 Electrochemical sensor for chlorine Cl_2 [#]

Detection range:		0 .. 10ppm
Response time:		t_{50}: < 10s t_{90}: < 30s
Pressure	80...120 kPa:	max. ±0.2ppm or ±10% of display (referred to 100 kPa)
Humidity	10%...95% r.h.:	max. ±0.2ppm or ±10% of display (referred to 50% r.h.)
Temperature	-20...+50°C:	max. ±0.2ppm or ±10% of display (referred to 20°C)
Cross sensitivities:		ClO_2:50%; F_2:40%; NO_2:20%; O_3:20%; SO_2:18%; CO_2:0%; CO:0%; H_2S:0%; H_2:0% (*1)
Expected lifetime:		2...3 years

MK392-5 Electrochemical sensor for Hydrogen chloride HCl [#]

Detection range:		0 .. 30ppm
Response time:		t_{50}: < 30s t_{90}: < 90s
Pressure	80...120 kPa:	max. ±1ppm or ±10% of display (referred to 100 kPa)
Humidity	10%...95% r.h.:	max. ±1ppm or ±10% of display (referred to 50% r.h.)
Temperature	-20...+50°C:	max. ±1ppm or ±10% of display (referred to 20°C)
Cross sensitivity:		AsH_3:350%; PH_3:300%; H_2S:65%; NO:45%; SO_2:40%; HCN:35%; Cl_2:6%; NO_2:3%; NH_3:0.1%; CO:0%; CO_2:0%; H_2:0%; (*1)
Expected lifetime:		2...3 years

MK393-5 Electrochemical sensor for ammonia NH_3 [#]

Detection range:		0 .. 200ppm
Response time:		t_{50}: < 20s t_{90}: < 60s
Pressure	80...120 kPa:	max. ±1ppm or ±10% of display (referred to 100 kPa)
Humidity	10%...95% r.h.:	max. ±1ppm or ±10% of display (referred to 50% r.h.)
Temperature	-(20)10...+50°C:	max. ±1(2)ppm or ±10(20)% of display (referred to 20°C)
Cross sensitivities:		H_2S:10%; CO:0%; CO_2:0%; H_2:0%; (*1)
Expected lifetime:		2...3 years

MK396-5 Electrochemical sensor for hydrogen H_2 [#] (*2)

Detection range:		0 .. 2000ppm
Response time :		t_{50}: <30 s t_{90}: <90 s
Pressure	800...120 kPa:	max. ±10ppm or ±10% of display (referred to 100 kPa)
Humidity	15%...90% r.h.:	max. ±10ppm or ±10% of display (referred to 50% r.h.)
Temperature	-20...+50°C:	max. ±20ppm or ±20% of display (referred to 20°C)
Cross sensitivities:		C_2H_4≈80%; NO≈35%; HCN≈30%; CO<20%; H_2S<20%; NO_2:0%; SO_2:0%; Cl_2:0%; HCl:0% (*1)
Expected lifetime:		2...3 years

MK399-6 Electrochemical sensor for ammonia NH_3 [#]

Detection range:		0 .. 100ppm
Response time:		t_{50}: < 20s t_{90}: < 90s
Pressure	80...120 kPa:	max. ±5ppm or ±10% of display (referred to 100 kPa)
Humidity	10%...95% r.h.:	max. ±5ppm or ±10% of display (referred to 50% r.h.)
Temperature	-20...+50°C:	max. ±5ppm or ±10% of display (referred to 20°C)
Cross sensitivities:		SO_2:-200%; H_2S:10%; CO:0%; Cl_2:0%; NO_2:0%; H_2:0%; (*1)
Expected lifetime:		2...3 years

MK402-5 Electrochemical sensor for hydrogen H_2 [#] (*2)	
Detection range:	0 .. 1.00%Vol
Response time:	t_{50}: <40 s t_{90}: <70 s
Pressure 80...120 kPa:	max. ±0.01Vol% or ±10% of display (referred to 100 kPa)
Humidity 15%...90% r.h.:	max. ±0.01Vol% or ±10% of display (referred to 50% r.h.)
Temperature -20...+50°C:	max. ±0.02Vol% or ±20% of display (referred to 20°C)
Cross sensitivities:	NO_2:-400%; CO:150%; H_2S:20%; C_2H_4:ja; NH_3:0%: CO_2:0%; Cl_2:0%; SO_2:0%; HCN:0% (*1)
Expected lifetime:	2...3 years

MK403-5 Electrochemical sensor for hydrogen H_2 [#] (*2)	
Detection range:	0 .. 4.00%Vol
Response time:	t_{50}: <40 s t_{90}: <60 s
Pressure 80...120 kPa:	max. ±0.01Vol% or ±10% of display (referred to 100 kPa)
Humidity 15%...90% r.h.:	max. ±0.01Vol% or ±10% of display (referred to 50% r.h.)
Temperature -20...+50°C:	max. ±0.02Vol% or ±25% of display (referred to 20°C)
Cross sensitivities:	H_2S:220%; C_2H_4:ja; NH_3:0%; CO_2:0%; CO:0%; Cl_2:0%; HCN:0%; NO:0%; NO_2:0% (*1)
Expected lifetime:	2...3 years

MK404-5 Electrochemical sensor for Silane SiH_4 [#]	
Detection range:	0 .. 40ppm
Response time:	t_{50}: < 10s t_{90}: < 60s
Pressure 80...120 kPa:	max. ±0.1ppm or ±10% of display (referred to 100 kPa)
Humidity 20%...95% r.h.:	max. ±0.1ppm or ±10% of display (referred to 50% r.h.)
Temperature -20...+30(40)°C:	max. ±0.2(0.5)ppm or ±10% of display (referred to 20°C)
Cross sensitivities:	PH_3:130%; AsH_3:100%; B_2H_6:48%; H_2S:35%; SO_2:20%; NO_2:-20%; HCN:3%; NH_3:0%; CO_2:0%; CO:0%; Cl_2:0%; H_2:0%; HCl:0%; (*1)
Expected lifetime:	2 years

MK409-5 Electrochemical sensor for Hydrogen cyanide HCN [#]	
Detection range:	0 .. 50ppm
Response time:	t_{50}: < 25s t_{90}: < 60s
Pressure 80...120 kPa:	max. ±0.5ppm or ±10% of display (referred to 100 kPa)
Humidity 10%...95% r.h.:	max. ±0.5ppm or ±10% of display (referred to 50% r.h.)
Temperature -20...+50°C:	max. ±0.5ppm or ±15% of display (referred to 20°C)
Cross sensitivities:	NO_2:-70%; NO:5%; CO:0%; CO_2:0%; H_2:0%; H_2S:0%; (*1)
Expected lifetime:	2 years

MK427-4 / -5 Electrochemical sensor for oxygen O_2	
Detection range:	0 .. 25.0%Vol
Response time:	t_{20}: <8 s t_{90}: <25 s
Pressure (70)80...130 kPa:	max. ±0.4(0.6)Vol.% or ±2(3)% of range (referred to 100 kPa)
Humidity 0%...95% r.h.:	max. ±0.5Vol.% or ±2.5% of range (referred to 50% r.h. @ 20°C)
Temperature (-20)-10...+55°C:	max. ±0.5(0.8)Vol.% or ±2.5(4.0)% of display (referred to 20°C)
Expected lifetime:	3 years in air

MK429-5/-6 Electrochemical sensor for hydrogen sulfide H_2S	
Detection range:	0.2 .. 100ppm (500ppm[#]) Zero point drift < 0.4ppm
Response time:	t_{50}: <15 s t_{90}: <30 s (decay time)
Pressure 70...130 kPa:	max. ±0.2ppm or ±5% of display (referred to 100 kPa)
Humidity 5%...95% r.h.:	max. ±0.2ppm or ±2% of display (referred to 50% r.h. @ 20°C)
Temperature -20...+40(55)°C:	max. ±0.2ppm or ±5(16)% of display (referred to 20°C)
Long term stability per month:	max. ±0.2ppm or ±2% of display (laboratory condition)
Cross sensitivities:	SO_2≈20%; NO_2≈-20%; CO<1%; NO<0.2%; H_2<0.1%; (*1)
Expected lifetime:	3 years

zu (*1): Displayed value with reference to the supplied gas concentration in the range of ch von WEL (TLV)
zu (*2): Not approved for LEL monitoring for applications of primary explosion protection

Alarm Thresholds – Standard Setpoints

Standard setting of alarm thresholds for toxic gases without exposition alarm

Detection range	Alarm 1	Alarm 2	STEL	TWA
0 … 20ppm C_2H_4O	2ppm (*1)	4ppm	-	-
0 … 500/2000ppm C_4H_8	100ppm	200ppm	-	-
0 … 300/500/1000/2000ppm CO	30ppm	60ppm	-	-
0 … 5,0Vol.% CO_2	0.5Vol.%	1.0Vol.%	-	-
0 … 10ppm Cl_2	1ppm (*1)	2ppm (*1)	-	-
0 … 100/500ppm H_2S	10ppm	20ppm	-	-
0 … 30ppm HCl	5ppm	10ppm	-	-
0 … 50ppm HCN	10ppm	20ppm	-	-
0 … 200/1000ppm NH_3	50ppm	100ppm	-	-
0 … 100ppm NO	25ppm	50ppm	-	-
0 … 30ppm NO_2	5ppm	10ppm	-	-
0 … 10ppm PH_3	0,3ppm (*1)	0,4ppm (*1)	-	-
0 … 40ppm SiH_4	5ppm	10ppm	-	-
0 … 10ppm SO_2	2ppm	4ppm	-	-

at (*1): WEL monitoring cannot be recommended with the available sensor technology

Standard setting of alarm thresholds for toxic gases with exposition alarm following to TRGS900

Detection range	Alarm 1	Alarm 2	STEL (15')	TWA (8h)
0 … 20ppm C_2H_4O	2ppm (*1)	6ppm	4ppm	2ppm (*1)
0 … 500/2000ppm C_4H_8	100ppm	200ppm	200ppm	100ppm
0 … 300/500/1000/2000ppm CO	30ppm	120ppm	60ppm	30ppm
0 … 5.0Vol.% CO_2	0.5Vol.%	3.0Vol.%	2.0Vol.%	0.5Vol.%
0 … 10ppm Cl_2	1ppm (*1)	2ppm (*1)	1ppm (*1)	0.5ppm
0 … 100/500ppm H_2S	10ppm	20ppm	10ppm	10ppm
0 … 30ppm HCl	5ppm	10ppm	5ppm	5ppm
0 … 50ppm HCN	10ppm	20ppm	10ppm	10ppm
0 … 200/1000ppm NH_3	50ppm	100ppm	50ppm	50ppm
0 … 100ppm NO	25ppm	50ppm	35ppm	25ppm
0 … 30ppm NO_2	5ppm	10ppm	5ppm	5ppm
0 … 10ppm PH_3	0,3ppm (*1)	0,4ppm (*1)	0,2ppm (*1)	0,1ppm
0 … 40ppm SiH_4	5ppm	15ppm	10ppm	5ppm
0 … 10ppm SO_2	2ppm	4ppm	2ppm	2ppm

at (*1):WEL monitoring cannot be recommended with the available sensor technology.

Standard setpoints of alarm thresholds for combustible gases and oxygen

Detection range	Alarm 1	Alarm 2	Alarm 3
0 … 25Vol.% O_2	19.0Vol.% (⇓)	17.0Vol. (⇓)	23.0Vol.% (⇑)
0 … 2000ppm H_2 (*2)	1000ppm	1500ppm	2000ppm
0 … 1.0/4.0Vol.% H_2 (*2)	0.20Vol.%	0.40Vol.%	0.60Vol.%
0 … 5.0Vol.% CH_4	1.00Vol.%	2.00Vol.%	3.00Vol.%
0 … 100%LEL CH_4 (*3)	20.0%LEL	40.0%LEL	60.0%LEL

at (*2): Not approved for LEL monitoring in applications subject to primary explosion protection.
at (*3): or another one of the following combustible gases and vapours

LEL values as per IEC 79-20 resp. data base CHEMSAFE			
4.0%Vol. H_2	(hydrogen)	5.5%Vol. CH_4O	(methanol)
4.4%Vol. CH_4	(methane)	3.1%Vol. C_2H_6O	(ethanol)
2.3%Vol. C_2H_2	(acetylene)	2.5%Vol. C_3H_6O	(acetone)
2.3%Vol. C_2H_4	(ethylene)	3,2%Vol. $C_3H_6O_2$	(methylacetate)
2.5%Vol. C_2H_6	(ethane)	2.7%Vol. $C_3H_6O_2$	(ethyl formate ETF)
1.7%Vol. C_3H_8	(propane)	2.0%Vol. C_3H_8O	(iso-propanol)
1.4%Vol. C_4H_{10}	(butane)	1.8%Vol. C_4H_8O	(methyletylketone MEK)
1.4%Vol. C_5H_{12}	(pentane)	2.2%Vol. $C_4H_8O_2$	(ethylacetate)
1.0%Vol. C_6H_{14}	(n-hexane)	1.7%Vol. $C_3H_{10}O$	(n-butanol)
1.1%Vol. C_7H_{16}	(heptane)	1.2%Vol. $C_6H_{12}O$	(methylisobutylketone MIBK)
0.7%Vol. C_9H_{20}	(n-nonane)	1.1%Vol. C_7H_8	(toluene)

Technical Data

Type:	G460		
Detection principle:	Electrochemical (EC):	for toxic gases and oxygen	
	Photo-ionisation (PID):	for toxic combustible vapours (in ppm range)	
	Cat. combustion (CC):	for combustible gases and vapours (up to 100 %LEL)	
	Infrared (IR):	for combustible gases and vapours and carbon dioxide	
Detection ranges:	see "Sensor Types and Detection Ranges"		
Response time t_{90}:	see "Sensor Specification"		
Expected sensor life:	2...6 years - see "Sensor Specification"		
Gas supply:	Diffusion with a flow velocity of 0 .. 6 m/s or Pump by means of attachable electrical sampling pump G400-MP1[1]		
Display:	Illuminated LCD full graphic display, automatical size adjustment for optimal readout, display of battery capacity, gas concentration as instantaneous and peak value		
Alarm:	Depending on gas 3 or 2 instantaneous and 2 dosimeter alarms, battery alarm. Visual and audible warning and display indication, colouring of display depending on alarm status (orange/red) Buzzer: 103 dB(A) (reducible to 90 dB(A))		
Zeropoint and sensitivity calibration:	Manually or automatically with calibration program or test gas supply by using "Smart Cap" or "Smart Charger Cap" with 0.5..0.6 l/min.		
Power supply:	1. NiMH rechargeable module (black housing), 2500mAh rechargeable Im = 600mA (max. charging currrent) Um = 6V DC (max. voltage) or 2. Alkaline battery module (grey housing), not rechargeable with 2x AA Mignon 1.5V Type: DURACELL PROCELL MN1500 LR6 AA		
Operational time (*1) NiMH-II:	approx. 11h (EC+CC);	approx. 20h (EC+CC_{CH4});	approx. 130h (EC)
	approx. 8h (EC+IR+CC);	approx. 12h (EC+IR+CC_{CH4});	approx. 30h (EC+IR)
	approx. 9h (EC+PID+CC);	approx. 14h (EC+PID+CC_{CH4});	approx. 40h (EC+PID)
	approx. 6h (EC+PID+IR+CC); (EC+PID+IR)	approx. 10h (EC+PID+IR+CC_{CH4});	approx. 17h
Alkaline:	approx. 8h (EC+CC);	approx. 14h (EC+CC_{CH4});	approx. 170h (EC)
	approx. 5h (EC+IR+CC);	approx. 6h (EC+IR+CC_{CH4});	approx. 28h (EC+IR)
	approx. 6h (EC+PID+CC);	approx. 9h (EC+PID+CC_{CH4});	approc. 40h (EC+PID)
Climate conditions:			
for operation	-20...+50°C | 5...95% r. h. | 700...1300 hPa		
for storage	-25...+560°C | 5...95% r. h. | 700...1300 hPa (recommended 0...+30°C)		
Enclosure:			
Material:	Rubberized plastic		
Dimensions:	75 x 110 x 55 mm (W x H x D)		
Weight:	approx. 350 g (depending on sensor configuration)		
Protection:	IP67		
Approvals and Certificates:			
Labelling and ignition protection:	⟨Ex⟩ II2G	Ex ia de IIC T4 -20°C≤Ta≤+50°C	for NiMH-II (black)
		Ex ia de IIC T3 -20°C≤Ta≤+50°C	for NiMH (black)
		Ex ia de IIC T4/T3 -20°C≤Ta≤+45°C/+50°C	for Alkaline (grey)
EC-Type Examination Certificate:	BVS 06 ATEX E 017 X	(for measuring function and electronic EX-protection) (s. chapter "Application and Purpose")	
Type Examination Certificate:	PFG 09 G 001	(for measuring function) (s. chapter "Application and Purpose")	
Electro-Magnetic Compatibility:	DIN EN 50270 : 2006	Radio shielding:	Type class I
		Interference resistance:	Type class II

(*1): The operational time will be decreased by hitting keys (display illumination & lights) and by alarms being triggered.

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Translation

2nd Supplement

(Supplement in accordance with Directive 94/9/EC Annex III number 6)

to the EC-Type Examination Certificate
BVS 06 ATEX E 017 X

Equipment: **Gas detector type G460**

Manufacturer: **GfG Gesellschaft für Gerätebau mbH**

Address: **44143 Dortmund, Germany**

Description
The Gas detector type G450 can be modified according to the descriptive documents as mentioned in the pertinent test and assessment report and shall then be marked as:

Gas detector type G460

The gas detector type G460 is a portable instrument with a built in power-supply battery.
It is used for the detection of gases (3 electro-chemical cells or, as an option, 2 electro-chemical cells and 1 PID-sensor – PID-sensor type piD-TECH Sensor Plus, part no. ZPP60180** (DEMKO 06 ATEX 0547796U) manufactured by Baseline-Mocon Inc. – as well as 1 sensor of Flameproof Enclosure and 1 infrared sensor) in ambient air under atmospheric conditions. The measurement values are shown on a built-in display. If the preset limits are reached, a visual alarm and an audible alarm and, optionally, a vibrating alarm are produced.

The gas detector type G460 is powered by an NiMH battery supply pack which may be charged and exchanged only outside the hazardous area or by an alkaline battery pack.
The alkaline battery supply pack consists of 2 cells (size AA) that may only be changed outside the hazardous area.
The supply units are colour-marked to distinguish them when mounted.

The Essential Health and Safety Requirements of the modified equipment are assured by compliance with:

EN 60079-0:2004	General requirements
EN 60079-1:2004	Flameproof enclosure 'd'
EN 60079-7:2003	Increased safety 'e'
EN 60079-11:2007	Intrinsic safety 'i'.

The marking of the equipment shall include the following:

II 2G Ex ia de IIC T4/T3

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(until 31.03.2007 EXAM BBG Prüf- und Zertifizier GmbH)

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Parameters

1 Type of protection and ambient temperature range of the complete device type G460 with different combination of individual components:

	Type of protection	Ambient temperature range
Gas detector with NiMH battery pack (colour: black)	Ex ia de IIC T3	-20 °C ≤ T_a ≤ +50 °C
Gas detector with alkaline battery pack (colour: grey)	Ex ia de IIC T4 Ex ia de IIC T3	-20 °C ≤ T_a ≤ +45 °C -20 °C ≤ T_a ≤ +50 °C

2 NiMH battery pack:

Nominal voltage			2.4	V
Nominal capacity			2500	mAh
Maximum charging voltage	U_m	DC	6	V

3 Alkaline battery pack:

Nominal voltage			3	V

The approved Alkaline battery types are listed in the manufacturer instructions of GfG Gesellschaft für Gerätebau mbH.

Special conditions for safe use

The measurement function for explosion protection is not subject of this EC-Type Examination Certificate.

Test and assessment report

BVS PP 06.2017 EG as of 16.05.2007

DEKRA EXAM GmbH
Bochum, dated 16. May 2007

Signed: Dr. Eickhoff — Certification body

Signed: Dr. Wittler — Special services unit

We confirm the correctness of the translation from the German original.
In the case of arbitration only the German wording shall be valid and binding.

44809 Bochum, 03.07.2007
BVS-Rip/Ar E 0773/07

DEKRA EXAM GmbH

Certification body — Special services unit

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Translation

3rd Supplement

(Supplement in accordance with Directive 94/9/EC Annex III number 6)

to the EC-Type Examination Certificate
BVS 06 ATEX E 017 X

Equipment: **Gas detector type G450 and type G460**

Manufacturer: **GfG Gesellschaft für Gerätebau mbH**

Address: **44143 Dortmund, Germany**

Description
The gas detectors type G450 and type G460 can be modified according to the descriptive documents as mentioned in the pertinent test and assessment report

The gas detectors can also be powered by the NiMH battery pack (Ex ia IIC T4). The electrical circuit as well as the inserted sensors were partially modified.

The Essential Health and Safety Requirements of the modified equipment are assured by compliance with:

EN 60079-0:2006	General requirements
EN 60079-1:2004	Flameproof enclosure 'd'
EN 60079-7:2003	Increased safety 'e'
EN 60079-11:2007	Intrinsic safety 'i'

The marking of the equipment shall include the following:

II 2G Ex ia d IIC T4/T3 for type G450

II 2G Ex ia de IIC T4/T3 for type G460

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3 NiMH and NiMH-II battery pack:

Nominal voltage			2.4	V
Nominal capacity			2500	mAh
Maximum charging voltage	U_m	DC	6	V

4 Alkaline battery pack:

Nominal voltage	3	V

The approved Alkaline battery types are listed in the manufacturer instructions of GfG Gesellschaft für Gerätebau mbH.

Special conditions for safe use

The measurement function for explosion protection is not subject of this EC-Type Examination Certificate.

Test and assessment report

BVS PP 06.2017 EG as of 01.09.2008

DEKRA EXAM GmbH
Bochum, dated 01. September 2008

Signed: Dr. Jockers	Signed: Dr. Eickhoff
Certification body	Special services unit

We confirm the correctness of the translation from the German original.
In the case of arbitration only the German wording shall be valid and binding.

44809 Bochum, 07.07.2009
BVS-Rip/Ar E 1036/09

DEKRA EXAM GmbH

Certification body	Special services unit

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Parameters

1 Type of protection and ambient temperature range of the complete device **type G450**
with different combination of individual components:

	Type of protection	Ambient temperature range
Gas detector with NiMH battery pack (marking Ex ia IIC T3) (colour: black)	Ex ia d IIC T3	-20 °C ≤ T_a ≤ +55 °C
Gas detector with NiMH-II battery pack (marking Ex ia IIC T4) (colour: black)	Ex ia d IIC T4	-20 °C ≤ T_a ≤ +55 °C
Gas detector with Alkaline battery pack (colour: grey)	Ex ia d IIC T4 Ex ia d IIC T3	-20 °C ≤ T_a ≤ +45 °C -20 °C ≤ T_a ≤ +55 °C

2 Type of protection and ambient temperature range of the complete device **type G460**
with different combination of individual components:

	Type of protection	Ambient temperature range
Gas detector with NiMH battery pack (marking Ex ia IIC T3) (colour: black)	Ex ia de IIC T3	-20 °C ≤ T_a ≤ +50 °C
Gas detector with NiMH-II battery pack (marking Ex ia IIC T4) (colour: black)	Ex ia de IIC T4	-20 °C ≤ T_a ≤ +50 °C
Gas detector with Alkaline battery pack (colour: grey)	Ex ia de IIC T4 Ex ia de IIC T3	-20 °C ≤ T_a ≤ +45 °C -20 °C ≤ T_a ≤ +50 °C

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DEKRA

Translation

4th Supplement

(Supplement in accordance with Directive 94/9/EC Annex III number 6)

to the EC-Type Examination Certificate

BVS 06 ATEX E 017 X

Equipment: Gas detectors type G450 and G460

Manufacturer: GfG Gesellschaft für Gerätebau mbH

Address: D-44143 Dortmund

Description

The Essential Health and Safety Requirements with respect to the measuring function for explosion protection are assured by application of:

EN 60079-29-1:2007
EN 50271:2001

This supplement to the EC-type examination certificate covers devices with software version 3.31 and infrared-sensors with software version 2.07.

This supplement to the EC-type examination certificate covers the measuring function for methane, propane and n-hexane with the measuring range 0 to 100 % LEL (sensors MK221-0/-1 and MK211-6/-7), for propane with the measuring range 0 to 100 % LEL and n-nonane with concentrations up to 60 % LEL (sensors MK227-5 and MK231-5).

Test report

Test report PFG-no. 41300209P dated 30/11/2009

Special conditions for safe use

- The system option "AL latching" shall be set "on".
- After an extreme impact the zero of the sensors shall be checked and, if necessary, adjusted.
- The indications with zero gas and test gas shall be tested before every use.

DEKRA EXAM GmbH

Bochum, dated 30/11/2009

Signed: Müller — Certification body

Signed: Kiesewetter — Special services unit

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Translation

Type Examination Certificate

- Gas detectors -

PFG 09 G 001

Equipment: Gas detectors type G450 and type G460

Manufacturer: GfG Gesellschaft für Gerätebau mbH

Address: D-44143 Dortmund

The certification body of DEKRA EXAM GmbH certifies that this equipment has been found to comply with the requirements of the standards or "Berufsgenossenschaftlichen Informationen", respectively,

EN 50104:2002 + A1:2004
EN 45544-1:1999
EN 45544-2:1999
EN 50271:2001
BGI 836 (July 2009)

with regard to the measuring function for oxygen (measurement of oxygen deficiency and enrichment) in the measuring range 0 - 25 %(v/v) (sensors MK381-0/-5 and MK427-0/-5), for hydrogen sulphide in the measuring range 0.2 - 100 ppm (sensors MK429-0/-5) or 0.4 - 100 ppm (sensors MK386-0/-5), for carbon monoxide in the measuring range 2 - 500 ppm (sensors MK344-0/-4) or 5 - 500 ppm (sensors MK369-0/-6 and MK384-0/-5) and for carbon dioxide in the measuring range 0.02 - 5 %(v/v) (sensors MK231-5 and MK224-5).

This type examination certificate covers equipment with software version 3.31 and infrared-sensors with software version 2.07.

On the basis of DIN EN 45011, this certification includes a type examination. The examination and test results and the design of the equipment are recorded in the test report PFG-Nr. 41300209P.

If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the annex to this certificate.

The manufacturer declares the conformity of the manufactured products with the certified design by marking them with the number of this type examination certificate.

DEKRA EXAM GmbH

Bochum, dated 30. November 2009

Signed: Müller — Certification body

Signed: Kiesewetter — Special services unit

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Annex to

Type Examination Certificate

PFG 09 G 001

Description of the gas detector

The gas detection apparatus type G450 and G460 are portable devices for the measurement of combustible gases and vapours mixed with air, of oxygen and of toxic gases.

Devices type G450 can be equipped with a catalytic combustion sensor for the measurement of combustible gases and vapours, a sensor for the measurement of oxygen and two sensors for the measurement of toxic gases.

Devices type G460 can be equipped with a catalytic combustion sensor for the measurement of combustible gases and vapours, a sensor for the measurement of oxygen, two sensors for the measurement of toxic gases and an infrared sensor for the measurement of of combustible gases and vapours and/or carbon dioxide.

It is not necessary that all sensors are equipped. A rechargeable NiMH-battery pack serves as power supply.

Type of protection

Ex II 2 G Ex ia d IIC T4/T3 (type G450)

Ex II 2 G Ex ia de IIC T4/T3 (type G460)

Special conditions for safe use

Not applicable

Additional Information

- The measuring function of the device for combustible gases and vapours according to directive 94/9/EC is subject of the 4th supplement to the EC-type examination certificate BVS 06 ATEX E 017 X.
- This type examination certificate includes the following accessories:
  - docking station DS 400 (software version 2.20) (part no. 1450401)
  - Calibration cap "Smart Cap" (part no. 1450225)
  - Smart Charger Cap (part no. 1450215)
  - Drop In Charger G400-DIC1 (part no. 1450219)
  - Drop In Charger G400-DIC2 (part no. 1450223)
- The data logger is not subject of this type examination certificate.

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EC- Declaration of Conformity

G460 MICROTECTOR II

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Edited: 21.06.2007 Amended: 10.03.2009

GfG Gesellschaft für Gerätebau mbH develops, produces and sells gas sensors and gas warning devices, which are subject to a **quality management system** as per DIN EN ISO 9001 Subject to supervision by means of a **quality system** -Certificate No. BVS 03 ATEX ZQS / E 187- issued by the notified body, DEKRA EXAM GmbH, is the production of electrical apparatus of instrumentation Group I and II, categories M1, M2, 1G and 2G for gas sensors, gas detectors, gas warning systems in ignition protection classes explosion- proof encasing, increased safety, encapsulation and intrinsical safety, as well as their measuring function.

The portable Detector **G460** complies with **directive 94/9/EC** for devices and protective systems for proper use in explosion endangered areas (ATEX directive) and with **council directive 2004/108/EC** for electromagnetic compatibility.

For electrical explosion protection		BVS 06 ATEX E 017 X		
Labelling	⟨Ex⟩ II 2G	Ex ia de IIC T4	-20°C≤Ta≤+50°C	(NiMH-II)
	⟨Ex⟩ II 2G	Ex ia de IIC T3	-20°C≤Ta≤+50°C	(NiMH)
	⟨Ex⟩ II 2G	Ex ia de IIC T4/T3	-20°C≤Ta≤+45°C/+50°C	(Alkaline)
	CE 0158			

The directives have been complied with under consideration of the standards mentioned below:

- **Electrical explosion protection**

  Electrical apparatus for potentially explosive atmospheres.

  - General requirements — EN 60079-0
  - Flameproof enclosure „d“ — EN 60079-1
  - Increased safety “e” — EN 60079-7
  - Intrinsic safety „i“ — EN 60079-11

  Sensor MK 222 — EN 50014 / EN 50020

- **Safe and accurate measuring function**

  - Gas detectors- Performance requirements of detectors for flammable gases — EN 60079-29-1
  - Electrical apparatus for the detection and measurement of combustible gases, toxic gases or oxygen. Requirements and tests for apparatus using software and/or digital technologies. — DIN EN 50271

- **Electromagnetic compatibility**

  - Electrical apparatus for the detection and measurement of combustible gases, toxic gases and oxygen. — EN 50270

The evaluation of the basic safety and health requirements has been done, documented and filed by a notified body with register no. 0158 (*DEKRA EXAM* GmbH, Dinnerdahlstraße 9 D-44809 Bochum).
The EMC testing laboratory EM TEST GmbH, Kamen has been charged with testing and evaluation of the electromagnetic compatibility.

Always adhere to the safety notes of the operation manual 205-003.34.

Dortmund, 10.03.2010

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H.J. Hübner
President CEO

ATEX EG-Kon059/ Siebrecht