

G460

Multi-gas Detector

Operations Manual



GfG Instrumentation

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GfG Products for Increased Safety

Congratulations on your purchase of a high technology product from GfG – you have made an excellent choice!

Our detectors are characterized by reliability, safety, peak performance and economic efficiency. They comply with national and international directives.

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

Please take note of these instructions before putting the device into operation!

If you have any questions, please feel free to contact us.

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Introduction

For Your Safety

Like any piece of complex equipment, the GfG G460 will do the job it is designed to do only if it is used and serviced in accordance with the manufacturer's instructions.

CAUTION: For safety reasons, this equipment must be operated and serviced by qualified personnel only. Read and understand the instruction manual completely before operating or servicing this device.

The warranties made by GfG with respect to the product are voided if the product is not used and serviced in accordance with the instructions in this manual. Please protect yourself and your employees by following them. The above does not alter statements regarding GfG's warranties and conditions of sale and delivery.

Application and Purpose

The G460 is a handheld detector for personal protection from atmospheric hazards. The detector measures continuously in diffusion mode and gives visual and audible alarms if a gas-induced danger arises. The G460 meets the following approval:



Classified as intrinsically safe for use in
Class I, Division 1, Group A, B, C, and D
Hazardous locations Temp code T3
CSA C22.2 No. 152
ANSI / ISA-12.13.01-2000
UL 913

Design



Operation

GfG recommends frequent verification of accuracy. The safest course of action is to verify accuracy with a known concentration of gas prior to each day's use. If the readings are less than 90% or greater than 120% (-10% to +20% accuracy) the detector must be calibrated before use.

In compliance with c-CSA (Canada) the following requirements must be observed:

CAUTION: Before each use, sensitivity must be tested on a known concentration of CO, H₂S and combustible gas (depending on which sensors are installed) equivalent to 25 to 50% of the full scale concentration. Accuracy must be within -0 to +20% of the actual measurement.

Accuracy may be corrected by performing an AutoCal[®] adjustment (see calibration).

Detection Mode

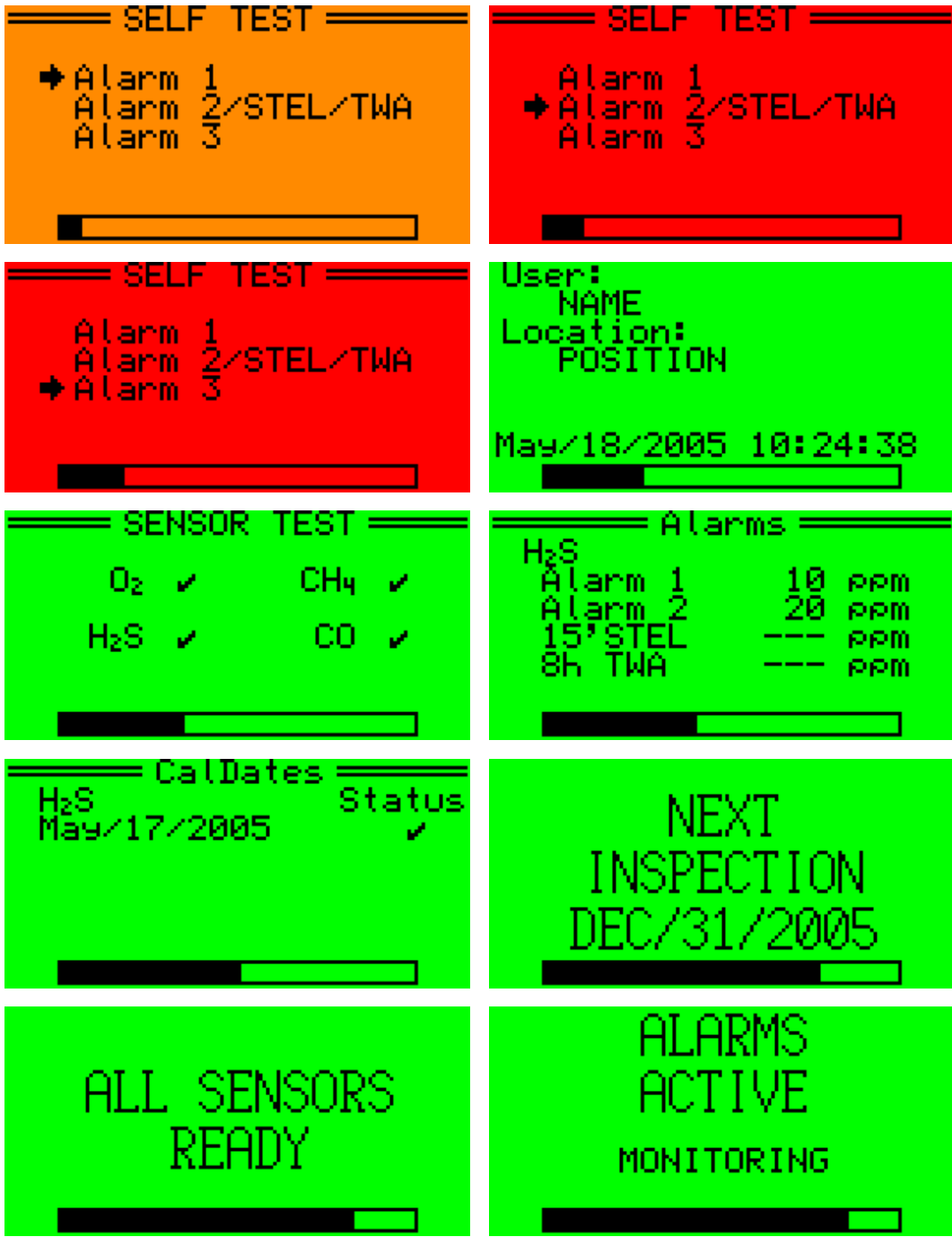
Turning the Device On



Turn the G460 on in an environment known to be free from gases and / or vapors.

Press the right key to turn the G460 on.

After turning the G460 on, the display gives a short message about the detector, the user, the location (this message can be set in service mode). Should the date for the next inspection pass, the G460 gives an audible signal and the display reads "Inspection Overdue." The display also shows every gas being measured, its detection range and the set alarm thresholds.



NOTE: GfG recommends that you “bump check” the sensors before each day’s use to confirm their ability to respond to gas by exposing the detector to a gas concentration which will exceed the alarm set point of the sensors.

Turning the Device Off

To turn the G460 off, hold the right key (**ZOOM**) for approximately 5 seconds.

Display Illumination

Whenever you press a key or any alarm condition is activated, the display illumination turns on. It turns off automatically after approximately 10 seconds, or when the alarm condition is corrected.

Individual Gas Display / Rotating the Display

The display can be rotated 180° by pressing the right and the left keys simultaneously.

The G460 allows the user to store and display time-weighted averages (TWA), short-term exposure levels (STEL), peak values (MAX) and minimum values (MIN). The stored values have the following meanings:

- STEL: The STEL (short-term exposure level) is the average value of the gas concentration over a period of time, which is determined by the short-term period. Short-term exposure levels are used to evaluate exposure peaks. The short-term period is typically set to 15 minutes.
- TWA: The time-weighted average (TWA) is the average value of the gas concentration over an 8 hour working shift. For calculating the total dose, the G460 uses all gas levels measured since the detector was turned on.
- MIN / MAX: Minimum and peak values measured since the detector was switched on or since the stored values were reset.

Press **ZOOM** briefly to view one gas at a time (**ZOOM** mode). Pressing **ZOOM** momentarily while in **ZOOM** mode will cycle to the next detected gas.

To read the stored values, press and hold the right key while in zoom mode. Press the key repeatedly to display all other measurement values and the battery capacity one after the other.



Example – Zoom Display for H₂S:

- Top left: Maximum value
- Top right: Actual gas concentration
- Bottom left: Short-term exposure level (STEL)
- Bottom right: Time-weighted average (TWA)

Battery

A fully charged G460 battery pack has a capacity of up to 25 hours of continuous operation in diffusion mode. The operational time may be reduced by sampling intervals or alarms. The remaining battery capacity is indicated by the battery symbol on the left side of the display. The black area represents the remaining capacity.

When the capacity falls to 4% power save mode is displayed and the G460 gives both a visual (red alarm LED and an “discharged” battery symbol in the display) and an audible warning.

Alarms

If the measured gas concentration exceeds a pre-set threshold, the detector immediately gives audible, visual and vibrating alarms. The display also indicates the exceeded alarm threshold which caused the alarm. A loud acoustic alarm (103 dB at 30 cm), bright flashing LEDs and a vibrating alarm warn of dangerous gas concentrations. In case of a gas alarm the whole display turns orange or red, depending on the gas concentration and the exceeded alarm threshold.

The G460 provides three instantaneous alarms for oxygen (O₂) and combustible gases (CH₄), and two alarms for toxic gases (CO, H₂S). The G460 warns the user of dangerous conditions caused by oxygen deficiency or enrichment and levels of combustible and toxic gases which exceeds the alarm threshold.

For toxic gases there is an additional alarm for exceeded time-weighted averages and short-term exposure levels (TWA and STEL).

Alarm Type	Sensors	Number of Alarms	Description
Instantaneous Value (AL)	Oxygen Combustible gases Toxic gases	3 3 2	An instantaneous alarm is activated immediately if the gas concentration exceeds or falls below a pre-set threshold. The alarm values are adjustable.
Short Term Value (STEL)	Toxic gases	1	The short-term value (STEL) is the average concentration over a short period of time (e.g. 15 minutes). The STEL alarm is not latching; it resets automatically as soon as the concentration falls below the threshold.
Long Term Value (TWA)	Toxic gases	1	The long-term value (TWA) refers to an 8-hour shift and calculates the average concentration. The TWA alarm cannot be reset. It is only de-activated if the detector is switched off.

Resetting Latching Alarms

When alarm 2 and 3 are set to latching you must reset an activated alarm by pressing the **RESET** key. Alarm 1 will automatically reset when the gas danger has passed.

If the detection range of the LEL sensor is exceeded, the display will read "OVER RANGE" instead of a value for gas concentrations above 110% LEL. To protect the sensor from damage, the device turns off the sensor. However, the audible and visual alarms and the "OVER RANGE" message remain active. The alarms must be reset by pushing the **RESET** key. The display will read: "Fresh air?" **If you have made sure that there is no combustible gas in the vicinity of the CH₄ sensor**, press yes to resume detection.

STEL, TWA, Maximum / Minimum Values

When you turn the G460 on, the unit begins to measure continuously in diffusion mode. All concentrations are shown on the display. In addition, short term and long-term averages (STEL and TWA) are calculated for toxic gases; for non-toxic gases peak and minimum values (MAX and MIN) are stored. The stored values can be read from the display by accessing the applicable display mode.

WARNING: To avoid possible personal injury, do not turn off the detector during a work shift. TWA, STEL and MAX readings are reset when the G460 is turned off.

Peak – Adjusting Peak Values



During peak mode (activated by pressing the left key **PEAK**), peak values can be monitored and displayed. The display shows an animated symbol in the bottom left corner.

Within *zoom display* the peak value will be displayed instead of the gas concentration.

Pressing **RESET** during peak mode will reset the peak memory to the current gas concentration. Pressing **RESET** during zoom display will reset the peak memory and the peak value memory to the current gas concentration.

By pressing **PEAK** again peak mode is deactivated.

Service Mode

Hold the middle key (RESET) for approximately 5 seconds to activate service mode. In the service mode the program parameters of the G460 can be adjusted and changed. A menu highlights the different adjustment possibilities. Several menu points require an access code (0011) to prevent accidental modification of important functions. In service mode all alarms are deactivated.

All adjustments in service mode are menu-controlled. The 3 keys stand for

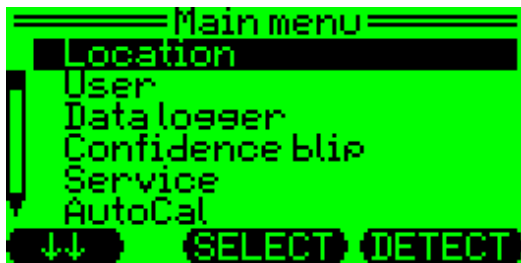
the function which is shown in the bottom line of the display. The main menu is displayed first when you enter service mode.

Main Menu

The menu points are:

1. **Location** (the physical location of the G460)
2. **User** (user identity)
3. **Datalogger** (adjust datalogger function)
4. **Confidence blip** (adjust intervals)
5. **Service** (start service menu)
6. **AutoCal[®]**
7. **Options** (adjust alarm volume and display contrast)

The keys' functions are explained in the bottom line of the display. In the main menu the keys have the following functions:



Left key (←) scroll down)

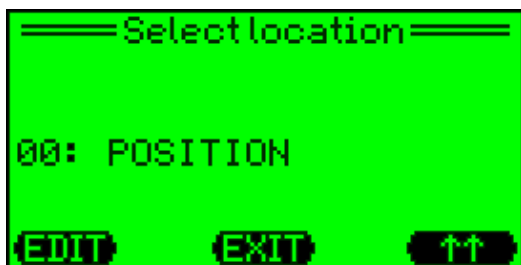
Middle key (**SELECT**) select menu point

Right key (**DETECT**) back to detection mode

Location – Entering a Location

From a deposited table one location out of a hundred possible locations can be selected. The first two digits stand for the number of the table entry. With the exception of “00” all other 99 entries can only be edited with a PC. Within “00” up to 15 letters / figures can be entered, which will be stored as **operational place** in the G460. Entry is automatically completed when the cursor reaches the end mark (>).

When **Location** is selected by the middle key (**SELECT**), the following is displayed, and the keys have the following functions:



First a location number is specified:

EDIT - Change location name

EXIT - Back to main menu

↑ - Change location number

After selecting a location number (by pressing the right key – **↑↑**) the location entry will be displayed. To change the location, press the left key (**EDIT**).

The following is displayed, and the keys have the following functions:



- ABC↓** - Select symbol – move down
- <<>>** - Enter the blinking letter for figure and move the cursor to the right
- 012↑↑** - Select symbol - move up

User – Entering User Name

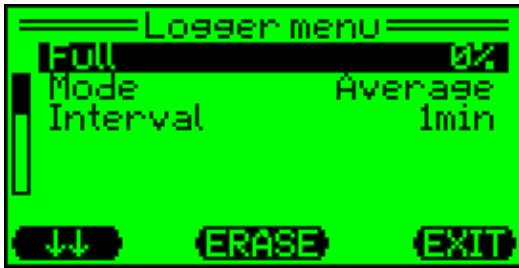
From a deposited table one entry out of ten possible entries can be selected. The first two digits stand for the number of the table entry. Except for “00,” the other 9 entries can only be edited with a PC. Within “00” up to 15 characters can be entered, which will be stored as “**IDENTIFICATION**” in the G460. Entry is automatically completed when the cursor reaches the end mark (>). The entry process for user name (ID) is the same as that of the location entry.



- EDIT** - Change location name
- EXIT** - Return to main menu
- ↑↑** - Change identification number

Datalogger

Within the “datalogger” menu point different settings can be accessed:

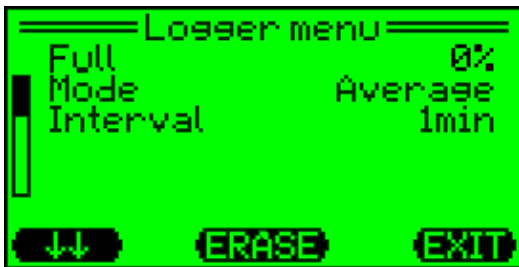


Full shows the used percentage of the datalogger memory

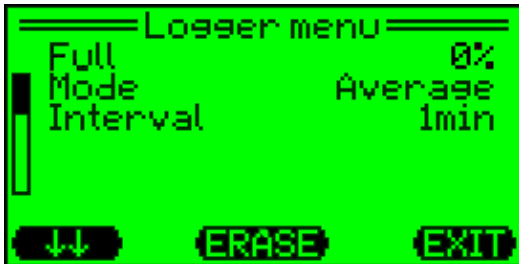
↓ - Jump to the next parameter

ERASE - Deletes data. A security prompt will appear (delete data?) → confirm with yes (right key), deny with no (left key)

EXIT - Back to main menu



If **Mode** is selected, the instantaneous value (Instant), average value (Average) or peak value (Peak) can be chosen with the left or right key.



If **Interval** is selected, the data recording interval can be set between 1 second and 60 minutes by pressing **↓** and **↑**

Datalogger (sample screen shots)

GfG Data Download Software

File Device Edit View Options Window Help

GfG42.tmp

Datalogger G450
Serialno.: 05090039
User:

Date	Time	CO ppm	CH4 %LEL	O2 Vol%	H2S ppm	Event	Signal
6/15/2000	12:30:49 PM	2	0.0	17.3	0		Off
6/15/2000	12:30:52 PM	2	0.0	17.4	0		Off
6/15/2000	12:30:55 PM	2	0.0	17.5	0		Off
6/15/2000	12:30:58 PM	0	0.0	17.6	0		Off
6/15/2000	12:31:01 PM	0	0.0	18.1	0		Off
6/15/2000	12:31:04 PM	0	0.0	18.8	0		Off
6/15/2000	12:31:07 PM	0	0.0	19.3	0		Off
6/15/2000	12:31:10 PM	0	0.0	19.4	0		Off
6/15/2000	12:31:13 PM	0	0.0	19.5	0		Off
6/15/2000	12:31:16 PM	0	0.0	19.6	0		Off
6/15/2000	12:31:19 PM	0	0.0	19.6	0		Off
6/15/2000	12:31:22 PM	0	0.0	19.7	0		Off
6/15/2000	12:31:25 PM	0	0.0	19.8	0		Off
6/15/2000	12:31:28 PM	0	0.0	18.9	0		Off
6/15/2000	12:30:14 PM			18.9	0		Off
6/15/2000	12:30:14 PM	0	0.0	19.0	0		Off
6/15/2000	12:30:17 PM	0	0.0	2.2	10		Off
6/15/2000	12:30:17 PM	0	0.0	2.0	10		Off
6/15/2000	12:30:20 PM	0	0.0	2.3	10		Off
6/15/2000	12:30:23 PM	0	0.0	2.8	9		Off
6/15/2000	12:30:26 PM	0	0.0	3.3	9		Off
6/15/2000	12:30:29 PM	0	0.0	3.4	9		Off
6/15/2000	12:30:32 PM	0	0.0	3.3	8		Off
6/15/2000	12:30:35 PM	0	0.0				Off

G450/...

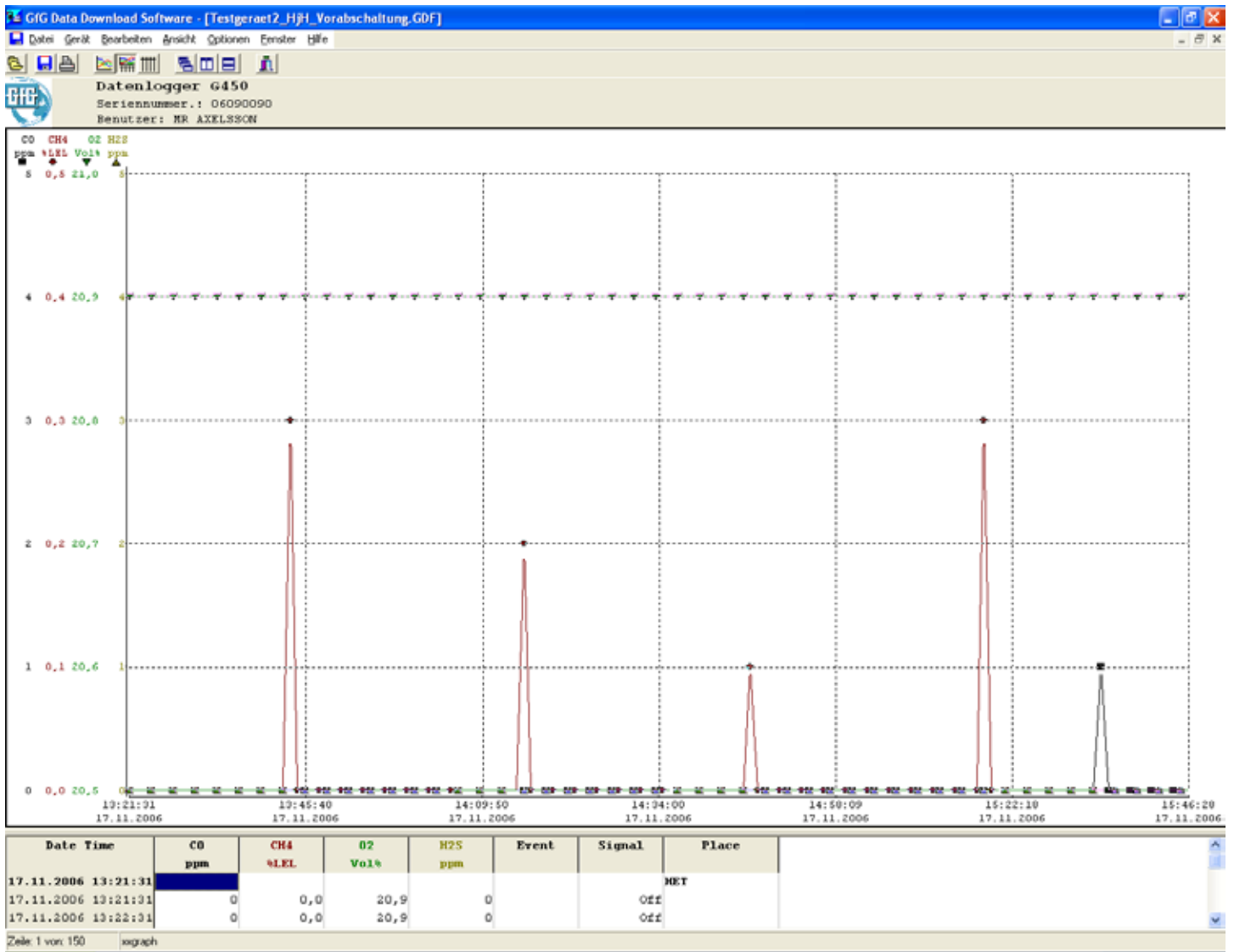
Line: 18 from 106

G450/05090039

General Datalogger User Time Date Online Data Sensor

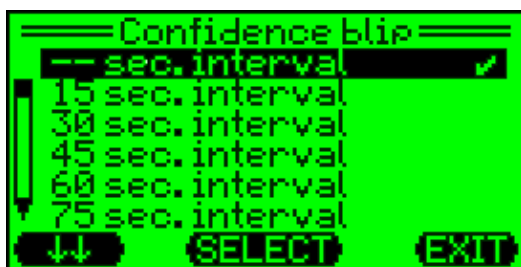
Time	Value	Gas	Alarm	State
12:30:27	0 ppm H2S			
	4 ppm CO			
	16.6 Vol% O2		AL1 AL2	
	0 %LEL CH4			
	2.806 V U-BAT			

GfG



Confidence Blip

Within the Confidence blip menu point, the interval between confidence blips can be chosen.



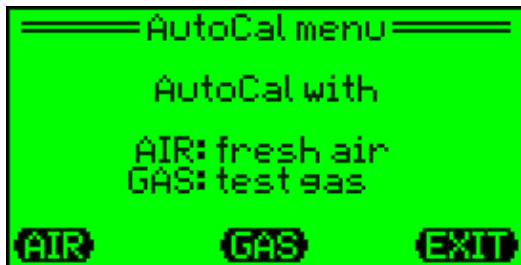
The confidence blip can be heard in intervals of 15 to 90 seconds or be deactivated (- -).

- ↓ - Scroll down
- SELECT** - Confirm interval
- EXIT** - Return to main menu

AutoCal®

The AutoCal® menu point can be selected in the main menu or occurs automatically when the calibration adapter (Smart Cap) is connected.

Within the AutoCal® menu point the device can be calibrated with fresh air (ZERO) or test gas (CAL).

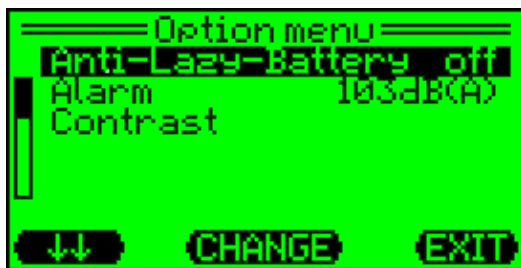


- AIR** - AutoCal® with fresh air
- GAS** - AutoCal® with test gas
- EXIT** - Back to main menu

Options

Within Options you can adjust

- Anti-Lazy battery syndrome
- The buzzer volume (90 dB or 103 dB)
- The screen contrast: 1 (very low) up to 15 (very high)



- ↓** - Scroll down
- CHANGE** - Change selected parameter
- EXIT** - Back to main menu

Note: Rechargeable batteries inherently have a tendency to loose capacity over time. Some of this loss manifest itself as “voltage depresion” (aka Lazy Battery). With GfG’s advanced battery management technology, some of the lost capacity can be restored using the “Anti-Lazy Battery” feature. The overall battery life can be extended if this feature is used at least once every three months.

Service Menu

Enter the service menu by selecting **Service**. Within the service menu the G460 program parameters can be adjusted.

This menu point is only accessible with the code “0011.” The code prevents important functions from being changed by mistake or by unauthorized persons. In service mode all alarms are suppressed.



ABC↓↓

- Previous digit

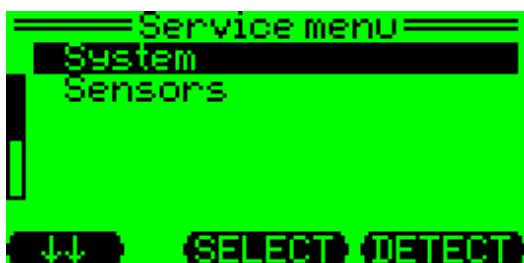
<<>>

- Enter (cursor moves automatically to the next position). By holding the key the last entry will be deleted and the cursor will move one position back.

012↑↑

- Next digit

After entering code “0011,” you enter the service menu (see System Menu) and can perform general adjustments (zeropoint, span, alarms, calibration, etc).

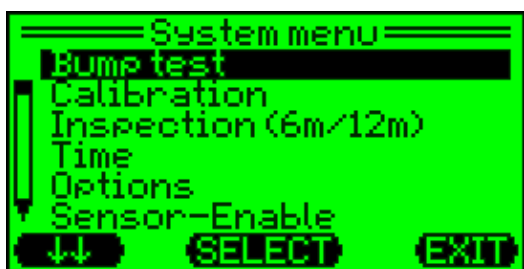


Select Sensors to adjust sensor-specific functions (alarms, calibration, etc).

DETECT - Back to detection mode

System Menu

Within the System menu the following adjustments are possible:



Bump Test

- Date of next bump test

Calibration

- Date of next calibration

Inspection

- Date of next inspection

Time

- Date and time

Options

- Change language, vibrating alarm, latch and auto save settings

Sensor-Enable

- Turn sensors on or off

AutoCal® - Air

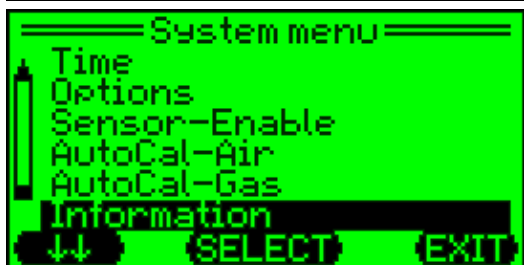
- Enable AutoCal® to zero specific sensors

AutoCal® - Gas

- Enable AutoCal® to adjust the sensitivity of specific sensors

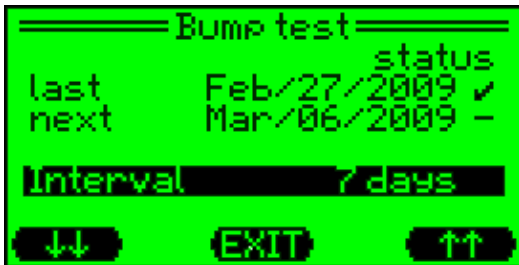
Information

- Software version, instrument serial number, battery type, etc.



Bump Test

The date of the next bump test can be entered under the **Bump Test** menu. When the date arrives, the G460 will automatically sound an alarm. If the bump test date passes, the G460 will give a reminder every time it is switched on.

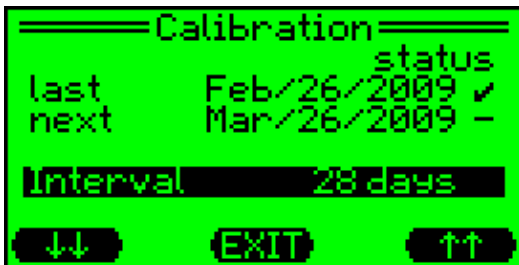


To change the interval:

- ↓↓ - Decreases value
- EXIT - Confirms value
- ↑↑ - Increases value

Calibration

The date of the calibration can be entered under the **Calibration** menu. When the date arrives, the G460 will automatically sound an alarm. If the calibration date passes, the G460 will give a reminder every time it is switched on.



To change the interval:

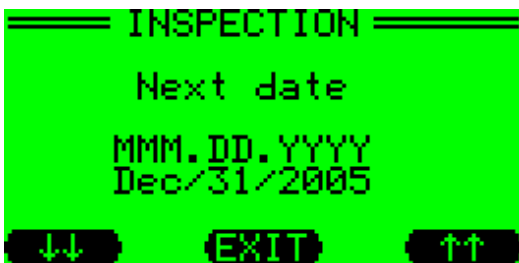
- ↓↓ - Decreases value
- EXIT - Confirms value
- ↑↑ - Increases value

Inspection

The date of the next maintenance or inspection can be entered under the **Inspection** menu. When the date arrives, the G460 will automatically sound an alarm. If the inspection date passes, the G460 will give a reminder every time it is switched on.



- >> - Moves to the next parameter
- SELECT - Selects the blinking parameter
- EXIT - Back to system menu



- To change a parameter:
- ↓ ↓ - Decreases value
 - EXIT - Confirms value
 - ↑ ↑ - Increases value

Time

The time and date can be adjusted under the **Time** Menu.



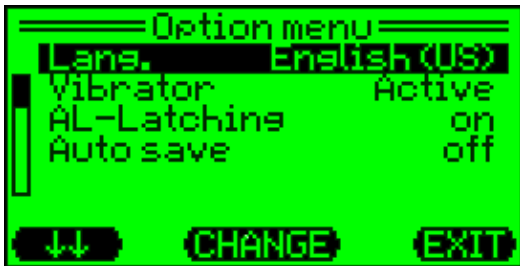
- >> - Moves to the next parameter
- SELECT - Selects the blinking parameter
- EXIT - Back to system menu



- To change a parameter:
- ↓ ↓ - Decreases value
 - EXIT - Confirms value
 - ↑ ↑ - Increases value

Options

In the **Options** menu point, the language can be changed, the vibrating alarm can be activated or deactivated and the latching and auto save features can be turned on or off.



>>

- Moves to the next parameter

SELECT

- Selects the blinking parameter

EXIT

- Back to system menu

Latching Alarm Function

The detector is shipped with the latching alarm function disabled. If the alarms are set to latch, the audible and visual alarms will persist until the alarm is acknowledged by pressing the center key (**RESET**). To enable latching alarms, press the left key (**⇐**) until **Latching** is highlighted. Press the center key (**CHANGE**) to enable latching alarms.

Sensor – Enable

Each individual sensor can be activated or deactivated for each measurement. This function is necessary for applications in which a gas does not need to be measured or if the G460 will be upgraded with different sensors.



ON or OFF indicates the status of the sensor (active or inactive).

⇓

- Scroll down

On/Off

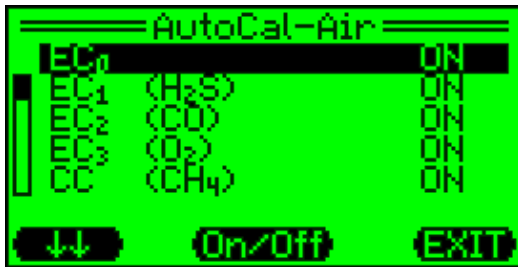
- Turns sensor on or off

Exit

- Return to system Menu

AutoCal® – Air

This menu point is to enable AutoCal® for sensors, using fresh air (zero calibration). Generally all sensors will be zero calibrated and show “ON.”



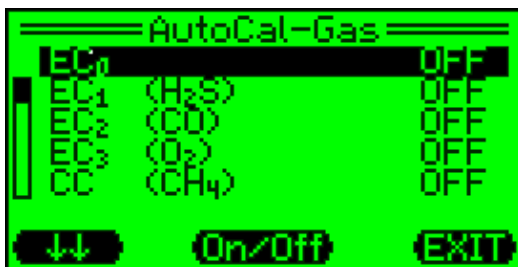
On/Off

Exit

- Scroll down to next sensor
- Calibration/non-calibration of sensor in AutoCal® program
- Return to service Menu

AutoCal® – Gas

This menu point is to enable AutoCal® for sensors, using a test gas (gas calibration). Generally all sensors (except O₂) will be calibrated and show “ON.”



On/Off

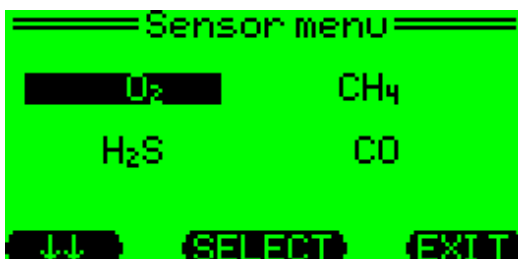
Exit

- Scroll down to next sensor
- Calibration/non-calibration of sensor in AutoCal® program
- Return to service Menu

Sensor Menu

The following functions refer to individual sensors in the G460. In the sensor menu each individual sensor can be selected. The adjustments are only valid for the selected sensor.

For a description of sensor-specific adjustments, the O₂ sensor is being used as an example. The adjustment options are the same for all sensors.

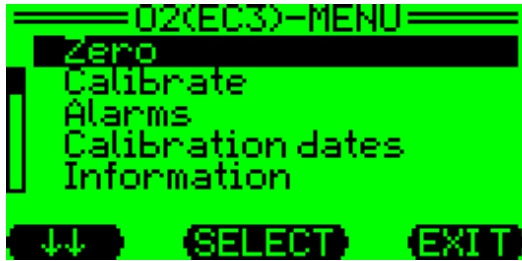


SELECT

Exit

- Move to next sensor
- Select sensor
- Return to service Menu

For each sensor, the following adjustments can be made:

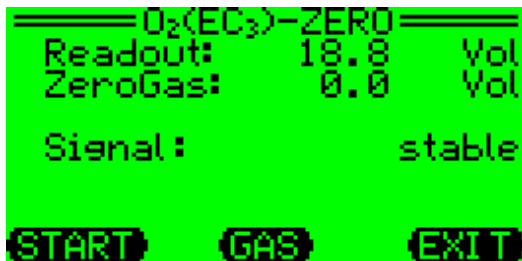


- Zero - Adjust the zero point
- Calibrate - Sensitivity calibration with test gas
- Alarms - Adjust alarm thresholds
- Calibration dates - View the date and status of the last calibration and zero
- Information - View sensor information

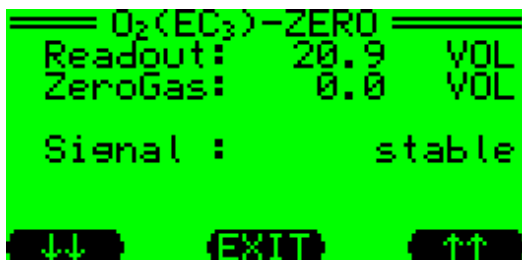
- Move to next menu point
- Select menu point
- Return to service menu

Zeroing – Adjust Zero Point

To adjust the zero point, the sensor menu point Zero must be selected.



- Start zero point adjustment
- Enter zero gas concentration
- Back to “O2 menu”



After entering GAS the display reads:

- Zero gas value decreases by one unit
- Enter Value
- Zero gas value increased by one unit

NOTE: To set the zero point for oxygen, supply the unit with 100% nitrogen through a calibration adapter.

Calibration

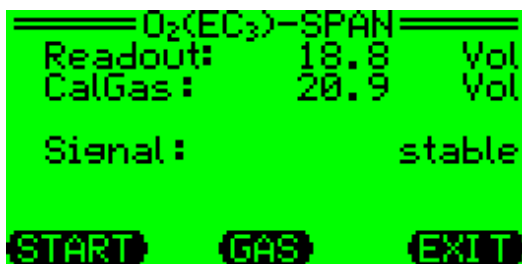
During calibration, the sensitivity of the G460 is adjusted. Before starting calibration, make sure that the zero point adjustment has been done.

For calibration you need a suitable test gas, e.g.:

Detection Range	Test Gas
TOX	Carbon monoxide (CO), hydrogen sulfide (H ₂ S)
OX	Fresh air or test gas with 20.9% volume oxygen (O ₂) in nitrogen (N ₂)
EX	Methane (CH ₄)

NOTE: Please call GfG for the correct calibration gas for your instrument.

To adjust sensitivity, the sensor menu point Calibrate has to be selected.



- START** - Start calibration
- GAS** - Enter calibration gas concentration
- EXIT** - Return to O₂ Menu



After entering GAS the display reads:

- ↓↓ - Decreases calibration gas value by one unit
- EXIT** - Saves value
- ↑↑ - Increases calibration gas value by one unit

Alarms – Adjust Alarm Thresholds

The G460 provides 3 alarm thresholds for each non-toxic gas (O₂, CH₄). For each toxic gas (H₂S, CO) 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 and short-term averages can be set.



After selecting the sensor menu point Alarms the following reading is displayed (here, for an O₂ sensor):

- ↓ - Scroll down
- EDIT - Change alarm threshold
- EXIT - Back to O₂ menu

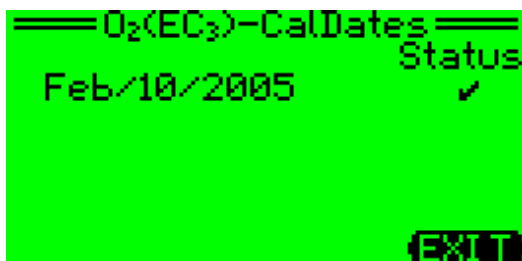
After selecting the alarm thresholds by pressing EDIT (e.g.: Alarm 1), the value can be entered:



- ↓ - Decreases alarm value by one unit
- EXIT - Back to Alarm menu
- ↑ - Increases alarm value by one unit

WARNING: If alarm points are set to off (--), the user will not be notified of an alarm condition. This could result in injury or death.

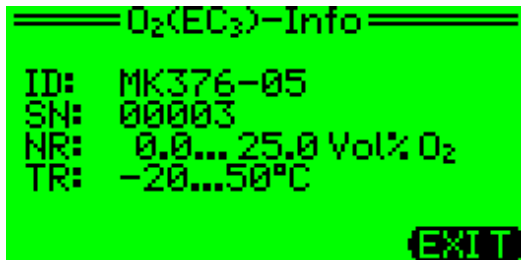
Calibration Dates



Within the sensor menu point Calibration dates, the date of the last calibration can be displayed, as well as if the calibration was successful (✓) or not (✗).

Information

In this menu point, specific information for the sensor can be displayed:



Type of sensor (ID)	-	Type of sensor
Serial number (SN)	-	Serial number
Detection range (NR)	-	Detection range
Temperature range (TR)	-	Temperature range

CH4 Unit

A unit equipped with a CH₄ sensor has an additional Unit and gas menu point in which you can set the CH₄ sensor to detect in % LEL or % volume along with a variety of combustible gases.

Activate Lights

The G460 provides an optional battery pack with lights. The lights can be switched on or off by holding down the left key for approximately 5 seconds. The lights are useful when the device is tied to a cord and lowered down into a sewer system. Using the lights can prevent the device from being dunked under water.

Replacing the Batteries and the Rechargeable Battery Pack Module

NOTE: Batteries must not be replaced in hazardous locations. Replace only in non-hazardous locations.

Turn the detector off before you replace the batteries. To replace the batteries or the supply module, unscrew the two screws on the front of the detector and pull the whole module backwards or insert the allen wrench through one of the screw holes to push the module backwards.

When the alkaline batteries have to be replaced, use a thin object to push the two battery cells out through the PCB holes. When inserting new batteries, check for the correct polarity (see plastic holder). Use only size AA batteries, Duracell MN1500 LR6. Secure the supply module by replacing the two screws.

Charging the Optional NiMH Battery Pack

WARNING: The detector must not be charged in a hazardous location. Only charge in non-hazardous atmospheres of 4 to 122°F (-20 to 50°C). Charge the detector using only the recommended charging adapter. Do not use any other charging adapter, as a fire or an explosion may result. Do not connect the charging adapter to voltages other than those used in North America, or an explosion may result.



The rechargeable G460 battery pack module can be charged with the GfG Drop-in Charger. The Drop-in Charger is also available as a vehicle charging unit. Make sure the maximum connected voltage does not exceed 30 V. To charge the G460, simply slide the device into the charging unit. The G460 will beep and then display either “quick charge” or “trickle-charge.” These two modes indicate the charge status of the G460. When the rechargeable battery pack is completely depleted, it will take approximately 6 hours to recharge in quick-charge mode. Then the Drop-in Charger will automatically switch to trickle-charge mode so that it is impossible to overcharge the battery pack. Both charging modes are indicated on the G460’s display. When the charger changes to trickle-charge mode, the battery pack has reached at least 80% of its capacity. An additional 2-3 hours of trickle-charge will fully charge the detector. The G460 will keep charging as long as it is plugged into the charger. Charging can be stopped by removing the G460 from the Drop-in Charger or by unplugging the charger.

Cleaning

The casing can be cleaned with a damp cloth. Never use solvents or detergents!

Maintenance and Inspection

Maintenance includes service, calibration and adjustment, as well as repair if it is necessary. Gas monitoring devices can react differently depending on environmental conditions. It is important, independent from maintenance duties, to test the device before putting it into operation each day. Bump testing before each use is highly recommended.

Service – Repair

WARNING: To avoid personal injury or damage to the detector, use only the specified replacement parts.

A function test must be executed before the first operation and at least once a year. This test comprises (depending on use and sensor exposure to poisons and contamination):

- Check zero point
- Charge battery (optional)
- Check pump (optional) and diffusion inlets
- Test display with standard test gas (bump test) and adjust, if necessary
- Check alarm signals
- Test response time

NOTE: GfG recommends that you “bump check” the sensors before each day’s use to confirm their ability to respond to gas by exposing the detector to a gas concentration which will exceed the alarm set point of the sensor.

Any G460 repair must be done according to the manufacturer’s instructions and with genuine spare parts. Return to GfG for proper service.

Accessories and Replacement Parts

	Part Number		
Aspirator, hand (with wand)	7711-450		
Batteries, alkaline (AA)	4002-001		
Battery hardware kit (includes 6 screws and hex key)	4003-450		
Battery pack, alkaline (without batteries) with vibrator	1450-202		
Battery pack, rechargeable NiMH with vibrator	1450-211		
Battery pack, rechargeable NiMH with vibrator and lights	1450-212		
Cable, data downloading / USB interface (for PC)	1650231		
Calibration adapter with tubing	7771-450		
Calibration connector	1450225		
Charger, plug-in (110 VAC) wall pack (for use with drop-in charger)	4001-650		
Charger, vehicle	4001-650V		
Crocodile clip	943450		
Datalogging kit – alkaline (cable, software and drop-in cradle charger)	1450235		
Datalogging kit – rechargeable (cable and software)	1450235R		
Drop-in cradle charger (charge and data transfer)	1450220		
Regulator, (for aluminum calibration gas cylinders) 0.5 lpm fixed flow rate with pressure gauge and on / off knob	2603-025		
Regulator, (for steel calibration gas cylinders) 0.5 lpm fixed flow rate with pressure gauge and on / off knob	2603-020		
Sensor - carbon monoxide, (CO)	0 - 500 ppm	1318232	
Sensor - hydrogen sulfide, (H ₂ S)	0 - 100 ppm	1318236	
Sensor - methane, (CH ₄) (combustible gases)	0 - 100 %LEL	1460710	
Sensor - oxygen, (O ₂)	0 - 25% volume	1318231	
Sensor - COSH	CO	0 - 300 ppm	1650730
	H ₂ S	0 - 100 ppm	
Sensor - PID	0 - 2,000 ppm	1460704	
Software, datalogging (CD only)	1450233		

Spare parts and accessories should be stored at ambient temperatures of 32 to 86°F (0 to 30°C). Storage time should not be longer than 5 years. Electrochemical sensors should not be stored for more than 6 months. When you store oxygen sensors, be aware that storage reduces the expected lifetime of the sensor. When storing spare sensors, make sure that the ambient atmosphere is free from corrosive substances and sensor poisons.

Sensor Types and Detection Ranges

Warning: To avoid personal injury, use only sensors specifically designed for this detector.

Plug	Sensor Part Number	Detection Range	Gas	Resolution	T-Band*
EC1	1650430	0-500 ppm	Carbon monoxide (CO)	1 ppm	±3 ppm
		0-100 ppm	Hydrogen sulfide (H ₂ S)	0.2 ppm	±0.2 ppm
EC1 EC2 EC3	1318232	0-300 ppm	Carbon monoxide (CO)	1 ppm	±3 ppm
	1318235	0-1000 ppm	Carbon monoxide (CO)	1 ppm	±5 ppm
	1318018	0-2000 ppm	Carbon monoxide (CO)	1 ppm	±4 ppm
	1318231	0-25% volume	Oxygen (O ₂)	0.1% volume	±0.3% volume
	1318258	0-2000 ppm	Hydrogen (H ₂)	2 ppm	±50 ppm
	1318260	0-1.00% volume	Hydrogen (H ₂)	0.01% volume	±0.02% volume
	1318259	0-4.00% volume	Hydrogen (H ₂)	0.01% volume	±0.05% volume
	1318236	0-100 ppm	Hydrogen Sulfide (H ₂ S)	0.1 ppm	±0.2 ppm
EC2 EC3	1318238	0-30 ppm	Nitrogen Dioxide (NO ₂)	0.2 ppm	±0.6 ppm
PID/ EC2	1460703	0-500 ppm	Isobutylene (C ₄ H ₈)	0.1 ppm	±0.2 ppm
	1460704	0-2000 ppm	Isobutylene (C ₄ H ₈)	0.5 ppm	±1.0 ppm
PL	1460710	0-100% LEL	Methane (CH ₄)	0.5% LEL	±2.5% LEL
		0-100% LEL	Propane (C ₃ H ₈)	0.5% LEL	±2.5% LEL
IR	1460780	0-5% volume	Carbon Dioxide (CO ₂)	0.10% volume	-

* T-Band = Tolerance band

Sensor Specifications

MK211-6 Catalytic combustion sensor for combustible gases and vapors (GfG part number 1460710)	
Response time:	t_{90} : <30 seconds
Pressure	950 to 1,100 hPa: Maximum $\pm 5\%$ of detection range or $\pm 15\%$ of display (1,013 hPa)
Humidity	5% to 90% r.h.: Maximum $\pm 5\%$ of detection range or $\pm 15\%$ of display (55% r.h.)
Temperature	-4 to 122°F (-20 to +50°C): Maximum $\pm 3\%$ of detection range or $\pm 10\%$ of display (68°F or 20°C)
Cross sensitivities at 50% LEL:	2.00Vol.% H2: approx.160%;0.70Vol.% C4H10: approx.72%; 2.20Vol.% CH4: 100%;0.70Vol.% C5H12: approx.71%; 0.85Vol.% C3H8: approx.85%;0.50Vol.% C6H14: approx.55%; The above information refers to the detection range for methane. It may vary from sensor to sensor and depends on the gas concentration and on the age of the sensor.
Expected lifetime:	3 years

MK222-2/-3 Photo-ionisation sensor for toxic combustible vapors Isobutylene $i-C_4H_8$ (GfG part number 1460703/1460704)	
Response time:	t_{90} : <30 seconds
Ionisation potential:	10.6 eV
Cross sensitivities:	Kerosene: approx.250%; C8H8: 250%; C7H8: 190%; C6H6: 190%; Diesel: approx.110; Benzine: approx.90%; C3H60: 83%; C8H18: 45%; C7H16: 40%; H2S: 30%; C6H14: 22%; NO: 14%; NH3: 11%; C5H12: 10%; C4H10=C3H8=CH4=H2=0%
Expected lifetime:	3 years

MK224-1 Infrared sensor for carbon dioxide CO ₂ (GfG part number 1460780)	
Response time	t_{50} : <20 seconds t_{90} : <60 seconds
Pressure	800 to 1,200 hPa: <1.7% of display per 1% pressure change (referred to 1,000 hPa)
Humidity	0% to 90% r.h.: Maximum ± 0.10 Vol% or $\pm 10\%$ of display (referred to 50% r.h.)
Temperature	-4 to 122°F (-20 to +50°C): Maximum ± 0.10 Vol% or $\pm 10\%$ of display (referred to 68°F or 20°C)
Expected lifetime:	6 years

MK348-5 Electrochemical sensor for nitrogen dioxide NO ₂ (GfG part number 1318238)	
Response time	t_{90} : <30 seconds
Pressure	800 to 1,200 hPa: Maximum ± 0.3 ppm or $\pm 5\%$ of display (referred to 1,000 hPa)
Humidity	15% to 90% r.h.: Maximum ± 0.3 ppm or $\pm 5\%$ of display (referred to 50% r.h.)
Temperature	-4 to 122°F (-20 to +50°C): Maximum ± 0.3 ppm or \pm of display (referred to 68°F or 20°C)
Cross sensitivity:	Cl ₂ \approx 100%; H2S \approx -8%; CO=SO ₂ =NO=0% (*1)
Expected lifetime:	3 years

MK369-5/-6 Electrochemical sensor for carbon monoxide CO (GfG part number 1318232)			
Response time		t_{50} : <10 seconds	t_{90} : <30 seconds
Pressure	800 to 1,200 hPa:	Maximum ± 3 ppm or $\pm 10\%$ of display	(referred to 1,000 hPa)
Humidity	15% to 90% r.h.:	Maximum ± 3 ppm or $\pm 10\%$ of display	(referred to 50% r.h.)
Temperature	14 to 104°F (-10 to +40°C):	Maximum ± 3 ppm or $\pm 10\%$ of display	(referred to 68°F or 20°C)
Temperature	-4 to 122°F (-20 to +50°C):	Maximum ± 3 ppm or $\pm 15\%$ of display	(referred to 68°F or 20°C)
Cross sensitivity:		$H_2S < \pm 3\%$; $C_2H_4 < 60\%$; $NO < 35\%$; $NO_2 < 10\%$; $H_2 < 10\%$; $SO_2 = 0\%$ (*1)	
Expected lifetime:		3 years	

MK376-5 Electrochemical sensor for oxygen O2 (GfG part number 1318231)			
Response time:		t_{50} : <10 seconds	t_{90} : <20 seconds
Pressure	800 to 1,200 hPa:	Maximum ± 0.2 Vol.% or $\pm 2.5\%$ of range	(referred to 1,000 hPa)
Humidity	15% to 90% r.h.:	Maximum ± 0.2 Vol.% or $\pm 2.5\%$ of range	(referred to 50% r.h.)
Temperature	-4 to 122°F (-20 to +50°C):	Maximum ± 0.5 Vol.% or $\pm 2.5\%$ of display	(referred to 68°F or 20°C)
Expected lifetime:		3 years	

MK380-5 Electrochemical sensor for carbon monoxide CO and hydrogen sulfide H ₂ S (COSH) (GfG part number 1650730)			
Response time:		t_{50} : <15 seconds	t_{90} : <45 seconds
Pressure	800 to 1,200 hPa:	Maximum ± 3 ppm or $\pm 7\%$ CO reading or $\pm 10\%$ CO reading	(referred to 1,000 hPa)
Humidity	15% to 90% r.h.:	Maximum ± 3 ppm or $\pm 7\%$ CO reading or $\pm 10\%$ CO reading	(referred to 50% r.h.)
Temperature	-4 to 122°F (-20 to +50°C):	Maximum ± 3 ppm or $\pm 15\%$ display	(referred to 68°F or 20°C)
Cross sensitivities CO-portion:		$H_2S \approx 0.40\%$; $H_2 \approx 20\%$; $SO_2 < 20\%$; $NO_2 < 2\%$; $NO < 0.3\%$; $Cl_2 = 0\%$ (*1)	
Cross sensitivities H ₂ S-portion:		$CO < 2\%$; $NO_2 \approx -20\%$; $SO_2 \approx 8.20\%$; $NO < 3\%$; $H_2 \approx 0.03\%$; $Cl_2 = 0\%$ (*1)	
Expected lifetime:		3 years	

MK396-5 Electrochemical sensor for hydrogen H ₂ (*2) (GfG part number 1318258)			
Response time:		t_{50} : <30 seconds	t_{90} : <90 seconds
Pressure	800 to 1,200 hPa:	Maximum ± 10 ppm or $\pm 10\%$ of display	(referred to 1,000 hPa)
Humidity	15% to 90% r.h.:	Maximum ± 10 ppm or $\pm 10\%$ of display	(referred to 50% r.h.)
Temperature	-4 to 122°F (-20 to +50°C):	Maximum ± 20 ppm or $\pm 20\%$ of display	(referred to 68°F or 20°C)
Cross sensitivities:		$C_2H_4 \approx 80\%$; $NO \approx 35\%$; $HCN \approx 30\%$; $CO < 20\%$; $H_2S < 20\%$; $NO_2 = SO_2 = Cl_2 = HCl = 0\%$ (*1)	
Expected lifetime:		2 years	

MK396-5 Electrochemical sensor for hydrogen H ₂ (*2) (GfG part number 1318260)		
Response time:	t ₅₀ : <45 seconds	t ₉₀ : <90 seconds
Pressure	800 to 1,200 hPa: Maximum ±0.01Vol% or ±10% of display	(referred to 1,000 hPa)
Humidity	15% to 90% r.h.: Maximum ±0.01Vol% or ±10% of display	(referred to 50% r.h.)
Temperature	-4 to 122°F (-20 to +50°C): Maximum ±0.02Vol% or ±20% of display	(referred to 68°F or 20°C)
Cross sensitivities:	NO ₂ ≈ -400%; CO ≈ 150%; H ₂ S ≈ 20%; C ₂ H ₄ :n/d; NH ₃ =CO ₂ =Cl ₂ =SO ₂ =HCN=0 (*1)	
Expected lifetime:	2 years	

MK396-5 Electrochemical sensor for hydrogen H ₂ (*2) (GfG part number 1318259)		
Response time:	t ₅₀ : <45 seconds	t ₉₀ : <90 seconds
Pressure	800 to 1,200 hPa: Maximum ±0.01Vol% or ±10% of display	(referred to 1,000 hPa)
Humidity	15% to 90% r.h.: Maximum ±0.01Vol% or ±10% of display	(referred to 50% r.h.)
Temperature	-4 to 122°F (-20 to +50°C): Maximum ±0.02Vol% or ±25% of display	(referred to 68°F or 20°C)
Cross sensitivities:	H ₂ S ≈ 220%; C ₂ H ₄ :n/d; NH ₃ =CO ₂ =CO=Cl ₂ =HCN=NO=NO ₂ =0 (*1)	
Expected lifetime:	2 years	

MK429-5/-6 Electrochemical sensor for hydrogen sulfide H ₂ S (GfG part number 1318236)		
Response time:	t ₅₀ : <15 seconds	t ₉₀ : <45 seconds
Pressure	800 to 1,200 hPa: Maximum ±2ppm or ±10% of display	(referred to 1,000 hPa)
Humidity	15% to 90% r.h.: Maximum ±2ppm or ±10% of display	(referred to 50% r.h.)
Temperature	14 to 104°F (-10 to +40°C): Maximum ±2ppm or ±10% of display	(referred to 68°F or 20°C)
Temperature	-4 to 122°F (-20 to +50°C): Maximum ±2ppm or ±15% of display	(referred to 68°F or 20°C)
Cross sensitivities:	SO ₂ ≈ 20%; NO ₂ < -20%; CO < 1%; NO < 0,2%; H ₂ < 0,1%; (*1)	
Expected lifetime:	3 years	

(*1) Displayed value with reference to the supplied gas concentration

(*2) Not approved for LEL monitoring for applications of primary explosion protection

Technical Data

Type:	G460
Detection principle:	Electrochemical (EC): toxic gases and oxygen Catalytic combustion (CC): combustible gases and vapors (up to 100% LEL) Infrared (IR): Carbon dioxide
Detection range:	See Sensor Type and Detection Range
Response time t_{90}:	See Sensor Specifications
Expected sensor life:	3 years
Gas supply:	Diffusion
Display:	Illuminated full-graphic LCD, automatic size adjustment for optimal read out, battery capacity display, gas concentration as instantaneous and peak value
Alarm:	Depending on gas type; 2 or 3 instantaneous and 2 dosimeter alarms, low battery alarm Visual and audible warning and display indication, coloring of display depending on alarm status (orange/red) Buzzer: 103 dB (can be restricted to 90 dB)
Climate conditions:	
for operation:	-4 to 122°F (-20 to +55°C) / 5 to 95% r. F. / 70 to 130 kPa
for storage:	-13 to 122°F (-25 to +50°C) / 5 to 95% r. F. / 70 to 130 kPa (recommended 32 to 86°F (0 to +30°C))
Zero point and sensitivity calibration:	Manual or automatic with calibration program
Operational time:	Up to 25 hours
Power supply:	1. NiMH battery module, rechargeable $I_m=1$ A (maximum charging current) $U_m=30$ VDC (maximum voltage) or 2. Alkaline battery module, non-rechargeable with 2x size AA Duracell MN1500 LR6
Casing:	
Material:	Rubberized plastic
Dimensions:	4.3x3.0x2.2 inches (110x75x55 mm) (HxWxD)
Weight:	10.23 oz. (290 g)
Protection:	IP 67
Approvals:	
CSA Approval:	cCSAus Class I, Division 1, Group A, B, C and D Hazardous locations Temp code T3 CSA C22.2 No. 152 ANSI / ISA-12.13.01-2000

Caution

- Substituting components may hinder intrinsic safety.
- For safety reasons, this equipment must be operated and serviced by qualified personnel only. Read and understand the user manual completely before operating or servicing this device.
- Do not use the detector if it is damaged. Before you use the detector, inspect the case. Look for cracks or missing parts.
- If the detector is damaged or something is missing, contact GfG Instrumentation, Inc. immediately.
- Calibrate the detector before first-time use and then on a regular schedule, depending on use and sensor exposure to poisons and contaminants.
- GfG recommends that you “bump test” the sensors before each use to confirm their ability to respond to gas. To do this, expose the detector to a gas concentration that exceeds the alarm set points. Manually verify that the audible and visual alarms are activated. Calibrate if the readings are not within the specified limits.
- It is recommended that the combustible sensor be checked with a known concentration of calibration gas after any known exposure to catalyst contaminants/poisons (sulfur compounds, silicon vapors, halogenated compounds, etc).
- The combustible sensor is factory calibrated to 50% LEL methane. If monitoring a different combustible gas in the % LEL range, calibrate the sensor using the appropriate gas.
- High off-scale readings may indicate an explosive concentration.
- Only the combustible gas detection portion of this instrument has been assessed for performance by CSA International.
- Protect the combustible sensor from exposure to lead compounds, silicones and chlorinated hydrocarbons. Although certain organic vapors (such as leaded gasoline and halogenated hydrocarbons) may temporarily inhibit sensor performance, in most cases the sensor will recover after calibration.
- For use only in hazardous locations where oxygen concentrations do not exceed 20.9% volume (v/v).
- Any rapidly increasing reading followed by a declining or erratic reading may indicate a gas concentration beyond the upper scale limit, which may be hazardous.

- Extended exposure of the G460 to certain concentrations of combustible gases and air may stress detector elements, which can seriously affect the device's performance. If an alarm occurs due to a high concentration of combustible gases, recalibration should be performed, or if needed, the sensor replaced.
- Do not test the combustible sensor's response with a butane cigarette lighter; doing so can damage the sensor.
- Do not expose the detector to electrical shock and/or severe continuous mechanical shock.
- Do not attempt to disassemble, adjust or service the detector unless instructions for that procedure are contained in the manual and/or that part is listed as a replacement part.
- Electromagnetic interference (EMI) signals may cause incorrect operation of this detector.

Warranty

GfG Instrumentation warrants our products to be free from defects in material and workmanship when used for their intended purpose, and agrees to remedy any such defect or to furnish a new part (at the option of GfG Instrumentation) in exchange for any part of any product that we manufacture that under normal use is found to be defective; provided that the product is returned, by the purchaser, to GfG's factory, intact, for our examination, with all transportation costs prepaid, and provided that such examination reveals, in our judgment, that it is defective.

This warranty does not extend to any products that have been subjected to misuse, neglect, accident, or unauthorized modifications; nor does it extend to products used contrary to the instructions furnished by us or to products that have been repaired or altered outside of our factory. No agent or reseller of GfG Instrumentation may alter the above statements.

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GfG Instrumentation

Worldwide Manufacturer of Gas Detection Solutions

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