G450
Multi-gas Detector

Field Operation Manual

GfG Instrumentation
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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 such defect or to furnish a new part (at the option of GfG Instrumentation) in exchange for any part of any product 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 examinations 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 or by a non-authorized service center. No agent or reseller of GfG Instrumentation may alter the above statement.

This warranty is expressly in lieu of any and all other warranties and representations, express or implied, including but not limited to, the warranty of fitness for a particular purpose. GfG will not be liable for loss or damage of any kind connected to the use of its products or failure of its products to function or operate properly.

The G450 has a limited lifetime warranty to the original purchaser (as long as the instrument is in service). Accessories (battery packs and chargers, sampling pumps and other components), which by their design are consumed or depleted during normal operation, or which may require periodic replacement are warranted for one year from the date of purchase. O_2, LEL, CO, and H_2S sensors are covered for 3 years from date of purchase.

Introduction

The purpose of this manual is to provide day-to-day basic information for the G450. The G450 is a handheld detector for personal protection from gas hazards. The instrument measures continuously in diffusion mode and gives visual and audible alarms if a gas-induced danger arises.

The G450 is a safety device and it is up to the user to ensure proper action is taken in the event of an alarm.

The following signal words, as defined by ANSI Z535.4-1998, are used in this guide.

⚠**DANGER** indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠**WARNING** indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠**CAUTION** indicates a potentially hazardous situation, which if not avoided, may result in moderate or minor injury.

Safety Information

The G450 must only be operated as specified in this manual, otherwise the instrument's protection may be diminished. Please refer to ISA-RP12.13, Part II-1987 for guidance in use of this instrument.

The G450 is MSHA approved for use with or without the G400 MP-2 pump, MSHA approval number is 22-A160003-0.

Warnings

⚠**WARNING** Never substitute any component as this may compromise the G450s intrinsic safety.

⚠**WARNING** 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 the G450.

⚠**WARNING** Instrument should be calibrated before first time use and then on a regular basis. Length of interval will depend on frequency of use and contaminants and/or poisons being exposed to the sensors.

⚠**WARNING** If the combustible sensor may be exposed to a known poison (silicon, sulfur, halogenated compounds, etc), GfG recommends checking it against a known concentration of calibration gas before use.

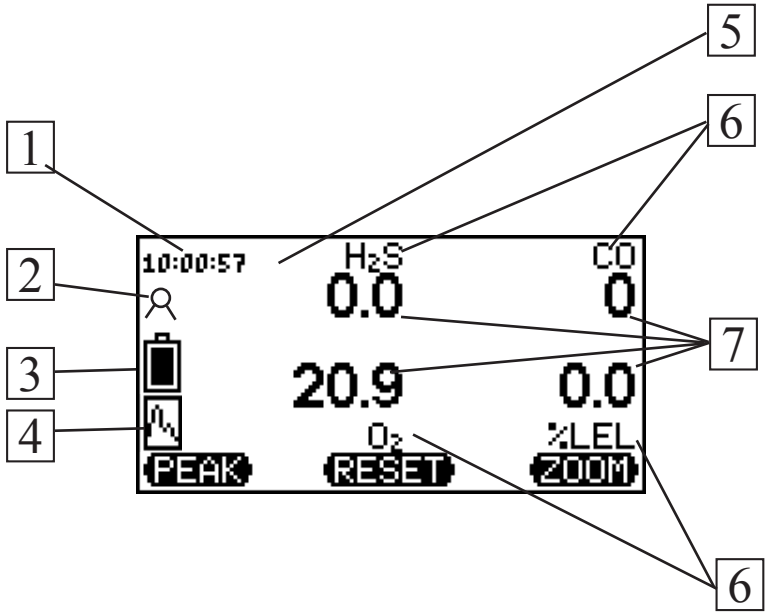
⚠**WARNING** The Model G450 Multi-Gas Detector is MSHA approved for use with the following requirements:

1. MSHA approved for use with any of the following battery packs: P/N 1450-202, P/N 1450-211, or P/N 1450-212. These battery packs may only be changed in fresh air only.
2. Battery packs P/N 1450-211 and P/N 1450-212 may only be charged in fresh-air locations.
3. Battery pack P/N 1450-202 cells may only be replaced with two Duracell MN1500 LR6 AA batteries. Both cells are to be replaced at the same time with identical part number cells. P/N 1450-202 must include the alkaline battery cover plate (P/N 1403-202).
4. The Model G450 Multi-Gas Detector must display methane in the Percent-by-Volume mode (0-5Vol %) for compliance determinations required by 30 CFR Part 75, Subpart D.
5. MSHA approved for use with or without the G400 MP-2.
6. The Model G450 Multi-Gas Detector is to be calibrated according to the procedures in the Field Operations manual P/N 7004-452 only.

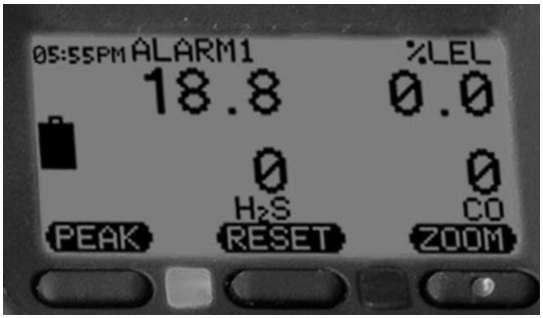
Design

Item	Description
1	Hook for carrying strap
2	Alarm LEDs
3	Horn
4	Screw connectors for pump
5	Display
6	Push buttons
7	Diffusion inlets
8	Contacts for accessories
9	Battery pack screws
10	Battery pack (accessible from back)

Display



Item	Description
1	Clock
2	Flashlight indicator
3	Battery charge level indicator
4	Peak indicator
5	Alarm Status (backlight) Green - No alarms Orange - Alarm 1 Red - Alarm 2 or 3
6	Gases
7	Gas Readings



Push Button	Description
1	Activate Peak Hold to turn on optional flashlight
2	Reset latching alarm Hold to enter service mode
3	View one gas at a time or STEL/TWA Press to turn on monitor (when off) Hold to turn off monitor (approximately 5 seconds)
1 + 3	Rotate the display 180°
2 + 3	Enter calibration mode

Battery Installation

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

MSHA approved for use with any of the following battery packs: P/N 1450-202, P/N 1450-211, or P/N 1450-212. These battery packs may only be changed in fresh air only.

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

When the alkaline batteries have to be replaced, use the allen wrench 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.

WARNING: **Battery pack P/N 1450-202 cells may only be replaced with two Duracell MN 1500 LR6 "AA" batteries. Both cells are to be replaced at the same time with identical part number cells. P/N 1450-202 must include the alkaline battery cover plate (P/N 1430-202), to prevent power interruption if the detector is dropped or jarred.**

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

WARNING: **Battery packs: P/N 1450-211 and P/N 1450-212 may only be charged in fresh-air locations.**

Calibration Procedure

WARNING: **The Model G450 Multi-Gas Detector is to be calibrated according to the procedures in this Field Operation manual (P/N 7004-452) only.**

Calibration is a two step procedure. The first step is the Fresh Air AutoCal® adjustment. In this step the readings of the sensors are automatically adjusted to equal the values expected in fresh air, (20.9% O_2, 0% LEL combustible gas, and 0 ppm (parts per million) for toxic sensors such as CO and H_2S).

To perform a Fresh Air AutoCal® adjustment:

1. Make sure the instrument is located in a fresh air environment (20.9% oxygen, and no measurable flammable or toxic contaminants)
2. Turn the instrument on and allow the readings to stabilize fully.
3. Attach the calibration adapter to the instrument.
4. The instrument will automatically recognize that the adapter is attached, and display the AutoCal® menu screen.
5. Push the “Air” button to initiate the Fresh Air adjustment.
6. The instrument will automatically count down, then begin the adjustment process.
7. The display will list the sensors installed, and show a checkmark by each sensor as the adjustment is completed.
8. After completing the fresh air adjustment the instrument will return to normal operation.
9. Make sure to remove the calibration adapter before using the instrument to detect gas.

The second step in a full calibration is the AutoCal® Gas adjustment. In this step the sensitivity of the sensors is automatically adjusted while the sensors are exposed to known concentration calibration gas.

A single cylinder of all-in-one (Quad Mix) calibration gas may be used to automatically calibrate CO, H_2S and LEL sensors all at the same time.

To initiate AutoCal® Gas calibration using all-in-one (Quad-Mix) calibration gas:

1. Make sure the instrument has been properly Fresh Air adjusted before proceeding to the Gas calibration.
2. Attach the calibration adapter to the instrument. (If the adapter is already attached, momentarily remove and replace the adapter to display the AutoCal® menu screen.)
3. Turn the regulator on to begin flowing calibration gas to the sensors and press “Gas”.
4. You will be prompted to verify that gas has been applied. Press “Yes” to continue.
5. Allow the instrument to count down.
6. The display will show an hourglass icon by each sensor while it is being adjusted; then a check mark when the adjustment is complete.
7. Make sure to remove the calibration adapter before using the instrument to detect gas.

Sensors may initially fail the Fresh Air or Gas Calibration adjustment. It is usually worthwhile to repeat the failed procedure at least once.

1. Make sure that the sensors (especially the combustible sensor) have had a chance to warm up completely before beginning the Fresh Air or Cal Gas adjustment. Five minutes is usually sufficient.
2. Before making a Fresh Air adjustment, make sure that the calibration adapter and tubing do not contain trapped calibration gas.
3. Make sure the air used for the Fresh Air adjustment does not contain measurable contaminants such as solvent vapors, cigarette smoke or engine exhaust.
4. Make sure that the calibration gas cylinder has not run out of gas.
5. Make sure the calibration gas cylinder, tubing and adapter are properly connected to the instrument.
6. If the sensor still fails calibration, consult the GfG factory for additional advice.
7. Any sensor that fails to calibrate properly must be replaced before using the instrument.

Alarms

If the measured gas concentration exceeds a pre-set threshold, the monitor will give audible and visual alarms.

Alarm Type	Sensors	# of alarms	Description
Instantaneous Value (AL)	Oxygen Combustibles 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 exposure limit (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 time weighted average (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.*
Over Range	All	1	The screen will display ↑↑↑
Under Range	All	1	The screen will display ↓↓↓

***Note**: To avoid possible personal injury, do not turn off the detector during a work shift. TWA, STEL and Max readings are reset when the G450 is turned off.

If the detection range of the LEL sensor is exceeded, the display will read "↑↑↑", indicating it is 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 "↑↑↑" 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 CH_4 sensor**, press yes to resume detection.

Service

Service consists of the maintenance, inspection and repair of the gas monitoring device. A function test should be performed before each day's use.

- 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

Any repair of the G450 must be done according to the manufacturer's instructions and with genuine parts.

Troubleshooting

Symptom	Solution
No power	Check/charge battery
No gas response	Check/replace sensor (see complete user manual)
Alarms in clean (fresh) air	Perform autozero

Specification

Dimensions: 2.95x4.33x2.17 in (75x110x55 mm)

Weight: 10 oz (280 g) with O_2/LEL/CO/H_2S sensors

Climate conditions:

Temperature: -4 to +122°F (-20 to +50°C)
Humidity: 5 to 95% r.h. (non-condensing)
Pressure: 700 to 1300 hPa

Alarm Conditions: Alarm 1, Alarm 2, Alarm 3, TWA, STEL, battery, confidence blip

Vibrating alarm: standard

Audible alarm: 103 dB at 30 cm (1 foot)

Display: Illuminated LCD full graphic display

Visual alarm: Bright, 360° wraparound LEDs plus heterochromatic (green/orange/red) backlight display

Backlight: Automatic when a button is pressed or any alarm condition is activated

Self-test: Initiated upon start up.

Calibration: Manual or automatic.

User options: Location ID, User ID, Confidence blip, audible alarm levels (103 dB, 95 dB, or off), display contrast, time, next inspection date, language selection, adjustable alarm levels, disable vibrating alarm, latching alarm 2, sensor deactivation, security code, set span values, autosave and datalogging (mode and interval)

Battery operating time: Up to 25 hours

Approved batteries: GfG NiMH rechargeable battery pack or Duracell MN1500 LR6

Battery charger: GfG cradle or smart cap charger

Charge: up to 6 hours

Warranty: Limited lifetime on instrument and electronics; 3 yrs from date of purchase for O_2, LEL, CO, and H_2S sensors.

Approvals: cCSAus

Approved: Class I, Division 1, Group A, B, C, and D
Class I, Zone 0: Ex ia IIC T3

Standards: ATEX: II 2G EEx ia d IIC T3/T4
CSA C22.2 No. 152-M1984
UL 913
ANSI / ISA-12.13.01-2000

EMI/RFI resistance: EMC directive 89/336/EEC

Caution

⚠**WARNING** Never substitute any components as this may compromise the G450s intrinsic safety.

⚠**WARNING** 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.

⚠**WARNING** Do not use the detector if it is damaged. Before you use the detector, inspect the case. Look for cracks or missing parts.

⚠**WARNING** If the detector is damaged or something is missing, contact GfG Instrumentation, Inc. immediately.

⚠**WARNING** Calibrate the detector before first-time use and then on a regular schedule, depending on use and sensor exposure to poisons and contaminants.

⚠**WARNING** 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.

⚠**WARNING** 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).

⚠**WARNING** The combustible sensor is factory calibrated to 2.5% vol. methane.

⚠**WARNING** High off-scale readings may indicate an explosive concentration.

⚠**WARNING** Only the combustible gas detection portion of this instrument has been assessed for performance by MSHA.

⚠**WARNING** 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.

⚠**WARNING** For use only in hazardous locations where oxygen concentrations do not exceed 20.9% volume (v/v).

⚠**WARNING** 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.

⚠**WARNING** Extended exposure of the G450 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.

⚠**WARNING** Do not test the combustible sensor's response with a butane cigarette lighter; doing so can damage the sensor.

⚠**WARNING** Do not expose the detector to electrical shock and/or severe continuous mechanical shock.

⚠**WARNING** 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.

⚠**WARNING** Electromagnetic interference (EMI) signals may cause incorrect operation of this detector

Sensor Specifications

Electrochemical sensor for oxygen O_2

Response time:		t50: <10 sec	t90: <20 sec
Pressure:	800...1200 hPa:	max. ±0.2Vol.% or ±2.5% of range	(referred to 1000 hPa)
Humidity:	0%...90% r.h.:	max. ±0.2Vol.% or ±2.5% of range	(referred to 50% r.F.)
Temperature:	-20...+50°C:	max. ±0.5Vol.% or ±2.5% of display	(referred to 20°C)
Typical life expectancy:		3 years in air	

Electrochemical sensor for carbon monoxide CO

Response time:		t50: <15 sec	t90: <45 sec
Pressure:	800...1200 hPa:	max. ±3ppm or ±7% of display	(referred to 1000 hPa)
Humidity:	15%...90% r.h.:	max. ±3ppm or ±7% of display	(referred to 50% r.F.)
Temperature:	-10...+40°C:	max. ±3ppm or ±7% of display	(referred to 20°C)
Temperature:	-20...+50°C:	max. ±3ppm or ±15% of display	(referred to 20°C)
Cross sensitivities:		C2H4<100%; C2H2<90%; Cl2<40%; H2<30%; NO<30%; NO2<30%; H2S=0%; SO2=0%; NH3=0%; C2H6O=0% (*1)	
Typical life expectancy:		3 years	

Electrochemical sensor for hydrogen sulfide H_2S

Response time:		t50: <15 sec	t90: <45 sec
Pressure:	800...1200 hPa:	max. ±2ppm or ±10% of display	(referred to 1000 hPa)
Humidity:	15%...90% r.h.:	max. ±2ppm or ±10% of display	(referred to 50% r.h.)
Temperature:	-10...+40°C:	max. ±2ppm or ±10% of display	(referred to 20°C)
Temperature:	-20...+50°C:	max. ±2ppm or ±15% of display	(referred to 20°C)
Cross sensitivities:		SO2≈ 20%; NO2<-20%; CO<1%; NO<0,2%; H2<0,1%; (*1)	
Typical life expectancy:		3 years	

Catalytic combustion sensor for combustible gases and vapors

Response time:		t90: <30 sec	
Pressure:	950....1100 hPa:	max. ±5% of range or ±15% of display	(referred to 1000 hPa)
Humidity:	5%...90% r.h.:	max. ±5% of range or ±15% of display	(referred to 55% r.h.)
Temperature:	-20...+ 50°C:	max. ±3% of range or ±10% of display	(referred to 20°C)
Relative response to other gases at 2.5% vol.:	2.00Vol.% H2: approx. 0.70Vol.% C4H10: approx. 2.20Vol.% C5H12: approx. 0.85Vol.% C3H8: approx. 0.50Vol.%		
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.			
Typical life expectancy:		3 years	
Tolerance range:	0.25% CH_4	≤ 28%	
	0.5% CH_4	≤ 21%	
	1.0% CH_4	≤ 14%	
	2.0% CH_4	≤ 10%	

Accessories and Replacement Parts

Part Number	Description
4002-001	Batteries, alkaline (AA)
4003-450	Battery hardware kit (includes 6 screws and hex key)
1450-202	Battery pack, alkaline (without batteries) with vibrator
1450-211	Battery pack, rechargeable NiMH with vibrator
1450-212	Battery pack, rechargeable NiMH with vibrator and lights
1650231	Cable, data downloading / USB interface (for PC)
7771-450	Calibration adapter with tubing
1450225	Calibration connector
4001-650	Charger, plug-in (110 V AC) wall pack (for use with drop-in charger)
4001-650V	Charger, vehicle
1450001	Oxygen (O_2) sensor
1450005	Combustible (CH_4) sensor
1450004	Carbon Monoxide (CO) sensor
1450003	Hydrogen Sulfide (H_2S) sensor

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GfG Instrumentation
Worldwide Manufacturer of Gas Detection Solutions

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