Micro IV

Single Gas Detector

Operations Manual

GfG Instrumentation

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Introduction

For Your Safety

This manual describes the proper use of the product and serves to prevent dangers. This manual must be carefully read by all individuals who have or will have the responsibility of using or servicing this product. As with any piece of complex equipment, the GfG Micro IV will do the job it is designed to do only if it is used and serviced in accordance with the manufacturer's instructions. If the product is not used and serviced in accordance with the instructions in this manual the warranty will be rendered void. The above does not alter statements regarding GfG's warranties and conditions of sale and delivery. Before operating the detector, use the operational beep to check the battery status, the alarm signal, and the device's readiness for operation.

Application and Use

The Micro IV is meant for personal safety in ambient conditions. It is a pocket-sized detector for your personal protection from gas hazards. The detector operates continuously in diffusion mode and triggers visual and audible alarms if dangerous gas concentrations build up. The Micro IV is approved for use in potentially explosive areas and carries the following approval:

> c-UL-us
> Class 1, Div. 1, Groups A, B, C, D
> Temperature Code T3C

General Description

The Micro IV is a very small and convenient single gas detector. Depending on the sensor it can be used to monitor toxic gases, hydrogen, or oxygen. The Micro IV stores long-term and short-term average values (TWA, STEL). The event logger records when the alarm was triggered, which kind of alarm was activated (A1, A2, A3, STEL, TWA), and what gas concentration was measured. An infrared interface enables data transfer to a docking station.

Detection Principle

For measuring toxic gases and oxygen the Micro IV uses electrochemical (EC) sensors.

Electrochemical Sensor (EC)

The electrochemical cells contain an electrolyte, a working electrode (anode), a counter electrode (cathode), and, depending on the sensor type, a reference electrode. The cell adapts to the gas that is to be monitored via specific electrodes and a suitable electrolyte. The electrochemical reaction generates an electrical signal that is proportional to the gas concentration. GfG sensor cells utilize capillary diffusion barrier technology which, in combination with an additional temperature compensation, prevents inaccuracies caused by changing atmospherical pressure and temperature.

Design

Disfusion Inlet

Visual Alarm

Audible Alarm

LCD Display

Battery Cover

Buttons

Rubber Boot

Operation

Detection Mode

The detection mode provides various functions, which the user must know for proper operation of the Micro IV gas monitor.

Turning the Monitor On

Turn the Micro IV on before you enter a confined area. Only this prevents accidents caused by gas hazards. To turn on the monitor simply insert the battery or, if the battery is already in place, briefly push ▲.

During the first stage of the warm-up the Micro IV will check to see if a valid sensor is installed. If not, the LED flashes and the display reads **SENS.ERR**. This error message is displayed until a valid sensor is plugged in.

Micro IV then does a complete self-check. Both LEDs light up briefly, and the buzzer sounds for approximately 1 second. A test of display segments (all segments switch on) and battery capacity is displayed (see Check Battery Capacity). The warm-up time of the sensor is indicated by a countdown in the display (only during initial activation or after replacing the battery).

Once the self-check is complete, the Micro IV turns to detection mode. The LCD display indicates the gas and the concentration, e.g.:

| Display | 0.0 PPM | alternating with | 0.0 CO |

Either a visual or an audible confidence beep (in regular intervals) can be activated during the detection mode. This signal ensures that the detector is ready for operation. This signal can be turned on or off (see ConfidenceBeep).

Display Illumination

The display illumination will be turned on for approximately 5 seconds by pressing any button briefly.

Peak and Minimum Values, Short-term and Long-term Averages

The Micro IV is equipped with memory for peak and average values. Push ▲ to read the minimum value measured by the oxygen sensor or the peak value measured by the TOX sensor. For TOX models you can push ▲ again to indicate STEL and TWA values. For OX sensors the display shows the minimum value first. Pushing ▲ again indicates the maximum value. If you do not hit any key, the detector turns to the standard display mode after 5 seconds without making any changes. While the peak or average values are displayed, you can delete the value by pushing QUIT. The stored value can also be deleted by turning the detector off or by removing the battery.

Turning the Monitor Off

The current consumption of the Micro IV is very low. A single AA battery is sufficient for continuous operation for up to 6 months, depending on alarm and display conditions.

Turn OFF	Press ▲ for approximately 5 seconds (hold until the display reads off).

Alarm

Should the gas concentration exceed a pre-set threshold, visual and audible alarms are triggered immediately.
The Micro IV has several alarm thresholds:

Detectors for:	Display	Alarm Thresholds	
Toxic Gases	A 1	Alarm 1, exceeding	..
	A 2	Alarm 2, exceeding	..
	A 3	Alarm 3, exceeding	..
Oxygen	A 1	Alarm 1, falling below	..
	A 2	Alarm 2, falling below	..
	A 3	Alarm 3, exceeding	..

The A1, A2, and A3 thresholds are instantaneous concentration alarms.

The alarms for TLV and STEL can be activated with the configuration program.

Alarm Signals

The alarms are distinguished by means of different flash and sound frequencies of the visual and audible alarm signals:

Alarm	Audible and Visual Alarm	Alarm Signal	Priority	
A 1	Slow sound and flash frequency	2 x 〘 2 x ☼	low	
A 2	Medium sound and flash frequency	4 x 〘 4 x ☼	medium	▲
A 3	Fast sound and flash frequency	8 x 〘 8 x ☼	high	

The LCD display indicates the gas and the alarm threshold, e.g.

Display	27.5 A2	alternating with	27.5 H$_2$S

Oxygen Monitoring

Sour gases like CO_2 and SO_2 are easily absorbed by the electrolyte of the oxygen sensor. This results in an increased oxygen signal of, for example, approximately 0.3% of the measurement value per 1% volume CO_2. The oxygen sensor, therefore, cannot be recommended for continuous measurement in concentrations above 25% volume CO_2. If the carrier gas is a gas with a molecular weight that is different from that of nitrogen, the display values may also be incorrect.

There are no oxygen sensor cross-sensitivities for toxic gas concentrations within the TLV range.

Battery

The Micro IV is powered by one 1.5 V AA alkaline cell. This battery allows continuous operation for up to 6 months. The operational time may be reduced by frequent alarms, by display indication (versions with display), or by the confidence beep. The correct battery type is: **Duracell MN 1500 or Energizer AA.**

Battery Alarm

The Micro IV monitors the battery voltage continuously and gives a warning if it falls below the minimum voltage (equivalent to approximately 5% of the battery capacity). A low battery is indicated by an audible alarm.

Audible Battery Alarm	Alarm Signal
Fast sound frequency (2 strokes)	2 x ◖▭ 6 second pause; 2 x ◖▭, etc.

The LCD display indicates the battery capacity "XX bAT" e.g.

Display	5 bAT

The remaining capacity after the first battery alarm allows detection for at least another 15 minutes. For safe operation the battery should be replaced as soon as possible.

Should the battery voltage become so low that proper functioning is no longer possible, the detector turns off automatically. The display reads **OFF**.This reading is shown until the battery is replaced or until the battery is completely exhausted.

Battery Replacement (only in safe areas, i.e. outside of Ex-areas)

The Duracell MN 1500 or Energizer AA battery must be inserted or replaced in a safe area only. Check for correct polarity when installing the battery (insert the positive pole first). Once the battery is in place, the Micro IV performs a self-check, testing the visual and audible alarms.
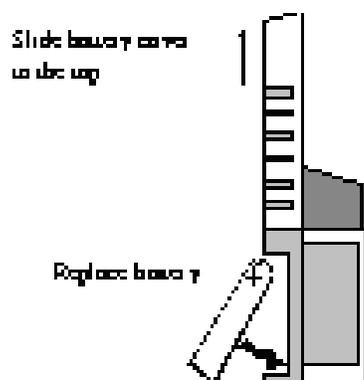
For battery replacement slide the battery cover up. Then take the old battery out and replace it with a new one.
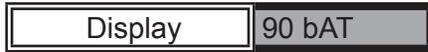
Note:
- **Only use the approved battery type for operation in hazardous areas!**
- Check for correct polarity of the new battery!
- Insert the battery + pole first!

Check Battery Capacity

The remaining battery capacity is shown after pressing ▼ briefly.

The capacity is also shown in the LCD display: e.g. 90 bAT = 90% battery capacity

Display	90 bAT

In addition to this, the detector performs a self-check after the device is turned on.

Time and Date

By pressing ▼ for approximately 2 seconds, the display shows the time. The date is shown by pressing ▼ again briefly while the time is displayed. The indication is done in the typical format for your country. The time and date of the Micro IV can be set automatically with the DS220 Docking Station or with a configuration adapter. Replacing the battery resets the time and date to 01.01.1980 0:00.

Service Mode

In the service mode you can check the confidence beep and the calibration (sensor adjustment). Adjustment procedures are done with the keypad.

Activation

Activation of Service Menu	Press QUIT and ▼ simultaneously, and hold for approximately 2 seconds.

Display	Service

Once you activate the service menu, you can select individual menu points one after the other by pressing ▼. These menu points are:

Key	Display	Information
▼ QUIT		Press both keys for approximately 2 seconds.
	SERVICE	Service mode activated.
▼		
	BEEP	Edit confidence beep settings.
▼		
	AUTO ZPT	Adjust zero point.
▼		
	AUTO CAL	Calibrate the device.
▼		
	EXIT	Press QUIT to exit the service mode.
▼		Back to the first option.

Menu points are shown in the display. They can be selected with QUIT. The service menu is deactivated by selecting EXIT or automatically after 30 seconds if you do not hit any key.

Confidence Beep

In the standard setting the alternating display of gas and unit indicates that the detector is operating in detection mode. An additional audible or visual confidence beep can be activated, reminding the user in regular intervals that the detector is working. The confidence beep interval is 1 minute. The confidence beep can also be turned off again.

Key	Display	Information
▼ QUIT		Press both keys for approximately 2 seconds.
	SERVICE	Service mode activated.
▼		
	BEEP	
QUIT		Change confidence beep settings.
	BEEP OFF	No confidence beep. Select with QUIT.
▼		
	BEEP OPT	Visual LED confidence beep. Select with QUIT.
▼		
	BEEP ACH	Loud audible confidence beep. Select with QUIT.
▼		
	BEEP ACL	Audible confidence beep. Select with QUIT.
▼		

Zeroing – Adjust Zero Point

Adjusting the zero point sets the Micro IV to its default zero point value. For toxic gases (e.g. CO, H_2S), clean ambient air can be used to adjust the zero point. The default value for toxic gases is 0 ppm. O2 sensors must be zeroed with 100% N2 calibration gas and a calibration adapter or the docking station.

During the zero point adjustment, the instantaneous value and the type of gas are displayed, alternating with ZPT. If an error occurs during the adjustment, the display shows ERROR. Possible malfunctions include faulty sensors or gas concentrations beyond the valid tolerance. In this case please call GfG service. To reset these errors press QUIT. The Micro IV switches back to detection mode after successful adjustment.

Key	Display	Information
▼ QUIT		Press both keys for approximately 2 seconds.
	SERVICE	Service mode activated.
▼		
	BEEP	
▼		
	AUTO ZPT	
QUIT		Adjust zero point.
	0 ZPT	Default value.
▼		
	e.g.: 1 CO or 1 H_2S	Current Value. Alternating until sensor is adjusted or an error is indicated.
▼		If there is no error, detection restarts after 1 minute.
	ZPT ERR	Sensor error.
QUIT		Confirm error. Start detection.

Calibration – Sensitivity Calibration

The test gas adjustment sets the Micro IV to a gas specific default value. For toxic gas sensors make sure that the fresh air adjustment is performed before calibration. For sensitivity calibration the correct test gas is needed. For toxic gases, refer to the test report of your detector. For oxygen use clean ambient air.

Calibration procedure for toxic gases:
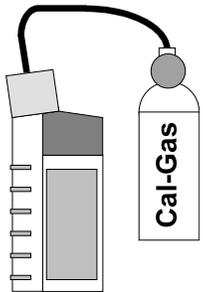
Put the calibration adapter over the diffusion inlet of the Micro IV. To avoid mistakes in calibration due to gas absorption make sure that the Micro IV is exposed to a constant test gas flow for approximately 3 minutes. The flow rate should be between 0.5 and 0.6 l/min. (1.0 l/min. for Cl2, ClO_2, O_3, and HCl gases).

Before starting, the display shows the calibration gas concentration, which can be changed by means of ▼ and ▲. Push QUIT to start calibration.

Key	Display	Information
▼ QUIT		Press both keys for approximately 3 seconds.
	SERVICE	Service mode activated.
▼		
	BEEP	
▼		
	AUTO ZPT	
▼		
	AUTO CAL	
QUIT		Select sensitivity calibration.
	CAL 200	Programmable default value.
▼ , ▲		Reduce or increase default value.
QUIT		Start sensitivity calibration with default value.
	200 CAL	Default value.
	e.g: 199 CO or 50 H_2S	Current Value. Alternating until sensor is adjusted (calibrated) or an error is indicated.
		If there is no error, detection restarts after 1 minute.
	CAL ERR	Sensor error.
QUIT		Confirm error. Start detection.

The display readings during and after test gas calibration are the same as those for fresh air adjustment. Once the sensitivity calibration is completed successfully, the Micro IV automatically returns to detection mode after 1 minute..

NOTE: Zero point adjustment and sensitivity calibration are simplified considerably with the DS220 Docking Station.

Sensor Replacement

The sensors may only be replaced in safe areas.
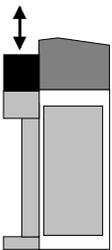
Before replacing the sensor, the battery must be removed as described previously. Slide the battery cover off the casing completely. Now pull the sensor out and replace it with a new one. Re-assembly is done in reverse order.

Configuration Program

The optional configuration program allows the user to connect the Micro IV to a PC with an adapter and to change the settings below:
- Alarm thresholds (exceeding, falling below, latching)
- Alarm activation and deactivation
- Block zero point adjustment and sensitivity calibration
- Event logger storage capacity (from 0 up to 1024 events)
- Data logger interval (from 30 up to 300 seconds)
- Event logger readout and PC data storage
- Data logger readout and PC data storage
- Calibration gas concentration
- Confidence beep time interval (from 6 up to 90 seconds)
- Signal adjustments, e.g.: keypad response or confidence beep (off, low, high)

Data Logger

The Micro IV is equipped with an event logger and a data logger. The event logger stores 128 events together with the measured gas concentration. When event 129 occurs, the first (oldest) event will be overwritten. The data logger is able to store 8685 measuring points, which complies with a runtime of 6 days at an interval of 60 seconds. The data logger is also designed as a loop memory.

The stored data with date and time can be downloaded to a PC with the relevant software installed.

Appendix

Cleaning

Give the Micro IV a quick visual check after use. Use a damp cloth to remove stains or dirt from the casing. Never use solvents or cleaning agents!

Service and Repair

Service is defined as maintenance, inspection, and repair of gas warning equipment. The function test must be done at least once a year and checks:

- The charge status of the battery
- The readings at zero gas and standard test gas (if necessary, the device compensates for variations)
- Alarm activation (with alarm test gas)
- Response time

This test has to be done by a qualified person, and written confirmation should be filed. In case the Micro IV needs to be repaired, this has to be done according to the manufacturer's instructions, using only genuine spare parts. Please contact GfG service.

Maintenance and Inspection

Maintenance and inspection describe measures that maintain the proper working status of the Micro IV. They include a regular check and adjustment of sensitivity and zero point. In addition to this, the working order of the detector must be checked as well.

Before safety related measurements are performed, you should check:

- The charge status of the battery
- The display (with zero gas and with test gas)
- Alarm activation

Accessories

Description	Part Number
Data download station	1419-204
6-detector docking station	1419-201
Sampling pump	1318-911
Rubber boot	1318214

Spare Parts

Description		Part Number
DURACELL MN1500 AA battery		4002-001
Battery cover		1318315
Calibration adapter with tubing		7770-201
Calibration adapter with tubing for reactive gases (HCl and Cl_2)		7770-201C
Ammonia (NH_3) sensor	0 to 200 ppm	1318250
Ammonia (NH_3) sensor	0 to 500 ppm	1318500
Carbon monoxide (CO) sensor	0 to 300 ppm	1318232
Carbon monoxide - reduced Hydrogen (CO-H) sensor	0 to 300 ppm	1318233
Carbon monoxide - reduced Hydrogen (CO-H) sensor	0 to 500 ppm	1318261
Chlorine (Cl2) sensor	0 to 10 ppm	1318245
Hydrogen sulfide (H_2S) sensor	0 to 100 ppm	1318236
Oxygen (O_2) sensor	0 to 25% volume	1318231
Ozone (O_3) sensor	0 to 1 ppm	1318257
Phosgene ($COCl_2$) sensor	0 to 1 ppm	1318248
Phosphine (PH_3) sensor	0 to 10 ppm	1318242
Hydrogen Fluoride (HF) sensor	0 to 10 ppm	1318264
Sulfur dioxide (SO_2) sensor	0 to 10 ppm	1318150
Tetrahydrothiophene (THT) sensor	0 to 10 mg/m^3	1318168

Spare parts and accessories should be stored at an ambient temperature of 32 to 86°F (0 to 30°C). The storage time should not exceed 5 years. For batteries and sensors shorter storage times of 6 months are applicable. When storing oxygen sensors, please note that their expected lifetime is reduced.

Sensors and Detection Ranges

Sensor Type (ID)	Detection Range	Gas	Resolution	T-Band *
MK342-5	0-25% volume	Oxygen(O_2)	0.1% volume	±0.3% volume
MK343-5	0-300 ppm	Carbon monoxide(CO+)	1.0 ppm	±3.0 ppm
MK344-5	0-300 ppm	Carbon monoxide(CO)	1.0 ppm	±3.0 ppm
MK344-6	0-1,000 ppm	Carbon monoxide(CO)	1.0 ppm	±5.0 ppm
MK345-5	0-100 ppm	Hydrogen sulfide(H_2S)	**0.1 ppm	±1.0 ppm
MK345-6	0-500 ppm	Hydrogen sulfide(H_2S)	**0.1 ppm	±3.0 ppm
MK346-5	0-10 ppm	Sulfur dioxide(SO_2)	0.05 ppm	±0.3 ppm
MK347-5	0-100 ppm	Nitrogen monoxide(NO)	1.0 ppm	±3.0 ppm
MK348-5	0-50 ppm	Nitrogen dioxide(NO_2)	0.2 ppm	±0.6 ppm
MK349-5	0-1 ppm	Phosgene (PGN)($COCl_2$)	0.01 ppm	±0.02 ppm
MK399-5	0-500 ppm	Ammonia(NH_3)	5.0 ppm	±10.0 ppm
MK393-5	0-200 ppm	Ammonia(NH_3)	1.0 ppm	±3.0 ppm
MK353-5	0-10 ppm	Phosphine(PH_3)	0.05 ppm	±0.05 ppm
MK369-5	0-300 ppm	Carbon monoxide(CO-H)	1.0 ppm	±3.0 ppm
MK369-6	0-500 ppm	Carbon monoxide(CO-H)	1.0 ppm	±4.0 ppm
MK376-5	0-25% volume	Oxygen(O_2)	0.1% volume	±0.3% volume
MK377-5	0-20 ppm	Saline (SIL)(SiH_4)	0.05 ppm	±0.10 ppm
MK379-5	0-20 ppm	Ethylene oxide (ETO)(C_2H_4O)	0.1 ppm	±0.3 ppm
MK389-6	0-2,000 ppm	Carbon monoxide(CO)	1.0 ppm	±4.0 ppm
MK390-5	0-10 ppm	Chlorine(Cl_2)	0.1 ppm	±0.1 ppm
MK391-5	0-2 ppm	Chlorine dioxide (CLO)(ClO_2)	0.01 ppm	±0.03 ppm
MK392-5	0- 30 ppm	Hydrogen chloride(HCl)	0.2 ppm	±0.4 ppm
MK393-5	0-200 ppm	Ammonia(NH_3)	1.0 ppm	±3.0 ppm
MK396-5	0-2,000 ppm	Hydrogen(H_2)	2.0 ppm	±10.0 ppm
MK402-5	0-1% volume	Hydrogen(H_2)	0.01% volume	±0.02% volume
MK403-5	0-4% volume	Hydrogen(H_2)	0.01% volume	±0.05% volume
MK405-5	0-100 mg/m^3	Tetrahydrothiphen (THT) (C_4H_8S)	0.5 mg/m^3	±1.0 mg/m^3
MK409-5	0-50 ppm	Hydrogen cyanide(HCN)	0.5 ppm	±1.5 ppm
MK411-5	0-1 ppm	Ozone(O_3)	0.01 ppm	±0.02 ppm
MK412-5	0-10 ppm	Hydrogen Fluoride(HF)	0.1 ppm	±0.3 ppm

* T-Band = Tolerance band
** 0.1 ppm available at special request

Sensor Specifications

MK342-5 / MK 376-5 - Electrochemical sensor for oxygen (O2)

Response time		T_{20}: <10 seconds T_{90}: <20 seconds
Pressure	800 to 1,200 hPa:	Maximum ±0.2% volume or ±2.5% of detection range (1,000 hPa)
Humidity	0 to 99% r.h.:	Maximum ±0.2% volume or ±2.5% of detection range (50% r.F.)
Temperature	-4 to 122°F (-20 to 50°C):	Maximum ±0.5% volume or ±2.5% of display (68°F or 20°C)
Expected lifetime:		MK342-5: 1 year in air / MK376-5: 2 years in air

MK343-5 - Electrochemical sensor for carbon monoxide (CO) (DualTox)

Response time		T_{20}: <10 seconds T_{90}: <40 seconds
Pressure	800 to 1,200 hPa:	Maximum ±3ppm or ±7% of display (1,000 hPa)
Humidity	15 to 90% r.h.:	Maximum ±3ppm or ±7% of display (50% r.F.)
Temperature	-14 to 104°F (-10 to 40°C):	Maximum ±3ppm or ±7% of display (68°F or 20°C)
Temperature	-4 to 122°F (-20 to 50°C):	Maximum ±3ppm or ±15% of display (68°F or 20°C)
Cross sensitivities:		H_2S: ≈250%, H_2: <40%, NO_2: ≈60%, SO_2: ≈50%, NO: ≈30%, Cl_2: 0 to 100% (*1)
Expected lifetime:		3 years

MK344-5 /-6 - Electrochemical sensor for carbon monoxide (CO)

Response time		T_{20}: <10 seconds T_{90}: <40 seconds
Pressure	800 to 1,200 hPa:	Maximum ±3ppm or ±7% of display (1,000 hPa)
Humidity	15 to 90% r.h.:	Maximum ±3ppm or ±7% of display (50% r.F.)
Temperature	-14 to 104°F (-10 to 40°C):	Maximum ±3ppm or ±7% of display (68°F or 20°C)
Temperature	-4 to 122°F (-20 to 50°C):	Maximum ±3ppm or ±15% of display (68°F or 20°C)
Cross sensitivities:		H_2S: ≈7%, H_2: <40%, C_2H_4: <85%, NO: <9%, NO_2: 0 to 20%, SO_2: 0%, Cl_2: 0%, C_2H_6O: 0% (*1)
Expected lifetime:		3 years

MK345-5 /-6 - Electrochemical sensor for hydrogen sulfide (H_2S)

Response time		T20: <10 seconds T90: <40 seconds
Pressure	800 to 1,200 hPa:	Maximum ±3ppm or ±10% of display (1,000 hPa)
Humidity	15 to 90% r.h.:	Maximum ±3ppm or ±10% of display (50% r.F.)
Temperature	-14 to 104°F (-10 to 40°C):	Maximum ±3ppm or ±10% of display (68°F or 20°C)
Temperature	-4 to 122°F (-20 to 50°C):	Maximum ±3ppm or ±15% of display (68°F or 20°C)
Cross sensitivities:		SO_2: ≈20%, NO_2: ≈20%, NO: <2%, CO: <0.5%, H_2 <0.1% (*1)
Expected lifetime:		3 years

MK346-5 - Electrochemical sensor for sulfur dioxide (SO_2)

Response time		T90: <30 seconds
Pressure	800 to 1,200 hPa:	Maximum ±0.2ppm or ±5% of display (1,000 hPa)
Humidity	15 to 90% r.h.:	Maximum ±0.2ppm or ±5% of display (50% r.F.)
Temperature	-4 to 122°F (-20 to 50°C):	Maximum ±0.2ppm or ±5% of display (68°F or 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)

Response time		T90: <30 seconds
Pressure	800 to 1,200 hPa:	Maximum ±1ppm or ±7% of display (1,000 hPa)
Humidity	15 to 90% r.h.:	Maximum ±1ppm or ±7% of display (50% r.F.)
Temperature	-4 to 122°F (-20 to 50°C):	Maximum ±2ppm or ±7% of display (68°F or 20°C)
Cross sensitivities:		NO_2: <30%, H_2S: ≈10%, CO: 0%, SO_2: 0% (*1)
Expected lifetime:		2 to 3 years
Warm-up time:		From 3 minutes up to 1 day, depending on the length of time the detector has been turned off

(*1): Displayed value with reference to the supplied gas concentration, which lies in the range of the TLV value.

MK348-5 - Electrochemical sensor for nitrogen dioxide (NO_2)

Response time		T90: <30 seconds
Pressure	800 to 1,200 hPa:	Maximum ±0.3ppm or ±5% of display (1,000 hPa)
Humidity	15 to 90% r.h.:	Maximum ±0.3ppm or ±5% of display (50% r.F.)
Temperature	-4 to 122°F (-20 to 50°C):	Maximum ±0.3ppm or ±5% of display (68°F or 20°C)
Cross sensitivities:		Cl_2: ≈100%, H_2S: ≈8%, CO: 0%, SO_2: 0%, NO: 0% (*1)
Expected lifetime:		3 years

MK349-5 - Electrochemical sensor for phosgene ($COCl_2$)

Response time		T90: <150 seconds
Pressure	800 to 1,200 hPa:	Maximum ±0.02ppm or ±10% of display (1,000 hPa)
Humidity	10 to 95% r.h.:	Maximum ±0.02ppm or ±10% of display (50% r.F.)
Temperature	-4 to 104°F (-20 to +40°C):	Maximum ±0.02ppm or ±10% of display (68°F or 20°C)
Cross sensitivities:		$C_2H_6O=CO_2=CO=Cl_2=H_2=HF=PH3=SO_2$: 0% $HCN=H_2S$: 0% (longer exposure to gas can poison the sensor) (*1)
Expected lifetime:		1 to 1.5 years

MK353-5 - Electrochemical sensor for phosphine (PH_3)

Response time		T90: <90 seconds
Pressure	800 to 1,200 hPa:	Maximum ±0.05ppm or ±10% of display (1,000 hPa)
Humidity	15 to 90% r.h.:	Maximum ±0.05ppm or ±10% of display (50% r.F.)
Temperature	-4 to 122°F (-20 to 50°C):	Maximum ±0.05ppm or ±10% of display (68°F or 20°C)
Cross sensitivities:		H_2: ≈3%, SO_2: ≈20%, SiH_4: ≈90%, GeH_4: ≈85%, B_2H_6: ≈35%, AsH_3: 0%, C_2H_4: <2%, CO: <0.1% (*1)
Expected lifetime:		2 to 3 years
Warm-up time:		

MK369-5 /-6 Electrochemical sensor for carbon monoxide (CO-H)

Response time		T20: <10 seconds T90: <30 seconds
Pressure	800 to 1,200 hPa:	Maximum ±3ppm or ±10% of display (1,000 hPa)
Humidity	15 to 90% r.h.:	Maximum ±3ppm or ±10% of display (50% r.F.)
Temperature	-4 to 122°F (-20 to 50°C):	Maximum ±3ppm or ±15% of display (68°F or 20°C)
Cross sensitivities:		H_2: <10%, NO: <9%, H_2S: 0%, SO_2: 0% (*1)
Expected lifetime:		2 to 3 years

MK377-5 - Electrochemical sensor for saline (SiH_4)

Response time		T90: <70 seconds
Pressure	800 to 1,200 hPa:	Maximum ±0.1ppm or ±10% of display (1,000 hPa)
Humidity	15 to 90% r.h.:	Maximum ±0.1ppm or ±10% of display (50% r.F.)
Temperature	-4 to 122°F (-20 to 50°C):	Maximum ±0.1ppm or ±10% of display (68°F or 20°C)
Cross sensitivities:		PH_3: ≈110%, GeH_4: ≈95%, AsH_3: ≈90%, B_2H_6: ≈40%, SO_2: ≈20%, C_2H_4: ≈2%, CO: <1%, H_2: <0.05% (*1)
Expected lifetime:		2 to 3 years

MK393-5 - Electrochemical sensor for ammonia (NH_3)

Response time		T90: <60 seconds
Pressure	800 to 1,200 hPa:	Maximum ±1ppm or ±10% of display (1,000 hPa)
Humidity	10 to 95% r.h.:	Maximum ±1ppm or ±10% of display (50% r.F.)
Temperature	-4 to 122°F (-20 to +50°C):	Maximum ±1(2)ppm or ±10(20)% of display (68°F or 20°C)
Cross sensitivities:		H_2S: ≈10%, CO: ≈0%, CO_2: ≈0%, H_2: ≈0% (*1)
Expected lifetime:		2 to 3 years
Warm-up time:		From 4 minutes up to 5 days, depending on the length of time the detector has been turned off

(*1): Displayed value with reference to the supplied gas concentration, which lies in the range of the TLV value

MK379-5 - Electrochemical sensor for ethylene oxide (C_2H_4O)

Response time		T90: <120 seconds
Pressure	800 to 1,200 hPa:	Maximum ±1ppm or ±15% of display (1,000 hPa)
Humidity	15 to 90% r.h.:	Maximum ±2ppm or ±15% of display (50% r.F.)
Temperature	32 to 86°F (0 to +30°C): -4 to 122°F (-20 to 50°C):	Maximum ±1ppm or ±15% of display (68°F or 20°C) Maximum ±2ppm or ±20% of display (68°F or 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% u.a. (*1)
Expected lifetime:		2 to 3 years
Warm-up time:		From 4 minutes up to 7 days, depending on the length of time the detector has been turned off

MK389-6 - Electrochemical sensor for carbon monoxide (CO)

Response time		T20: <10 seconds T90: <30 seconds
Pressure	800 to 1,200 hPa:	Maximum ±3ppm or ±7% of display (1,000 hPa)
Humidity	15 to 90% r.h.:	Maximum ±3ppm or ±7% of display (50% r.F.)
Temperature	14 to 104°F (-10 to 40°C): -4 to 122°F (-20 to 50°C):	Maximum ±3ppm or ±7% of display (68°F or 20°C) Maximum ±3ppm or ±15% of display (68°F or 20°C)
Cross sensitivities:		H_2: ≈25%, NO: ≈25%, $H_2S=NO_2=SO_2=CO_2= Cl_2=NH_3$: 0% (*1)
Expected lifetime:		3 to 4 years

MK390-5 - Electrochemical sensor for chlorine (Cl_2)

Response time		T90: <30 seconds
Pressure	800 to 1,200 hPa:	Maximum ±0.2ppm or ±10% of display (1,000 hPa)
Humidity	10 to 95% r.h.:	Maximum ±0.2ppm or ±10% of display (50% r.F.)
Temperature	-4 to 122°F (-20 to 50°C):	Maximum ±0.2ppm or ±10% of display (68°F or 20°C)
Cross sensitivities:		F_2: ≈44%, ClO_2: ≈22%, NO_2: ≈12%, H_2S: ≈-3%, HCl: <2%, CO: 0%, SO_2: 0% (*1)
Expected lifetime:		2 to 3 years

MK391-5 - Electrochemical sensor for chlorine dioxide (ClO_2)

Response time		T90: <120 seconds
Pressure	800 to 1,200 hPa:	Maximum ±0.05ppm or ±10% of display (1,000 hPa)
Humidity	10 to 95% r.h.:	Maximum ±0.05ppm or ±10% of display (50% r.F.)
Temperature	-4 to 122°F (-20 to 50°C):	Maximum ±0.05ppm or ±10% of display (68°F or 20°C)
Cross sensitivities:		Cl_2: ≈90%, H_2S: ≈-0.2%, $H_2=CO_2=CO=GeH_4=B_2H_6$: 0%, available but not defined: NO_2, O_3, and F_2 (*1)
Expected lifetime:		2 to 3 years

MK392-5 - Electrochemical sensor for hydrogen chloride (HCl)

Response time		T90: <90 seconds
Pressure	800 to 1,200 hPa:	Maximum ±1ppm or ±10% of display (1,000 hPa)
Humidity	10 to 95% r.h.:	Maximum ±1ppm or ±10% of display (50% r.F.)
Temperature	-4 to 122°F (-20 to 50°C):	Maximum ±1ppm or ±10% of display (68°F or 20°C)
Cross sensitivities:		PH_3: 300%, H_2S: 28%, Cl_2: 20%, HCN: 7%, CO: 1%, $C_2H_6O=CO_2=H_2=HF=N_2$: 0% (*1)
Expected lifetime:		2 to 3 years

MK393-5 - Electrochemical sensor for ammonia (NH_3)

Response time		T90: <60 seconds
Pressure	800 to 1,200 hPa:	Maximum ±1ppm or ±10% of display (1,000 hPa)
Humidity	10 to 95% r.h.:	Maximum ±1ppm or ±10% of display (50% r.F.)
Temperature	-4 to 122°F (-20 to 50°C):	Maximum ±1ppm or ±15% of display (68°F or 20°C)
Cross sensitivities:		CO: 0%, CO_2: 0%, H_2: 0%, C_2H_6O: 0%, Cl_2: 0%, HCN: 0%, N_2: 0%, H_2S: 0% (in minute range) (*1)
Expected lifetime:		2 to 3 years

(*1): Displayed value with reference to the supplied gas concentration, which lies in the range of the TLV value

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

Response time		T90: <90 seconds
Pressure	800 to 1,200 hPa:	Maximum ± 5ppm or ±10% of display (1,000 hPa)
Humidity	15 to 90% r.h.:	Maximum ± 5ppm or ±10% of display (50% r.F.)
Temperature	-4 to 122°F (-20 to 50°C):	Maximum ±10ppm or ±20% of display (68°F or 20°C)
Cross sensitivities:		CO: <20%, H_2S: <20%, NO: 30%, HCN: ≈30%, SO_2:0% , NO_2: 0%, Cl_2: 0%, HCl: 0%, C_2H_4: ≈80% (*1)
Expected lifetime:		2 to 3 years

MK402-5 - Electrochemical sensor for hydrogen (H_2) (*2)

Response time		T90: <90 seconds
Pressure	800 to 1,200 hPa:	Maximum ±0.01% volume or ±10% of display (1,000 hPa)
Humidity	10 to 90% r.h.:	Maximum ±0.01% volume or ±10% of display (50% r.F.)
Temperature	-4 to 122°F (-20 to 50°C):	Maximum ±0.02% volume or ±20% of display (68°F or 20°C)
Cross sensitivities:		CO: <15%, Cl_2: ≈800% (*1)
Expected lifetime:		2 to 3 years

MK403-5 - Electrochemical sensor for hydrogen (H_2) (*2)

Response time		T90: <90 seconds
Pressure	800 to 1,200 hPa:	Maximum ±0.01% volume or ±10% of display (1,000 hPa)
Humidity	10 to 90% r.h.:	Maximum ±0.01% volume or ±10% of display (50% r.F.)
Temperature	-4 to 122°F (-20 to 50°C):	Maximum ±0.02% volume or ±25% of display (68°F or 20°C)
Cross sensitivities:		CO: <15% (*1)
Expected lifetime:		2 to 3 years
Warm-up time:		From 4 minutes up to 3 days, depending on the length of time the detector has been turned off

MK405-5 - Electrochemical sensor for tetrahydrothiophen (THT) (C_4H_8S)

Response time		T90: <30 seconds
Pressure	800 to 1,200 hPa:	Maximum ±1mg/m³ or ±10% of display (1,000 hPa)
Humidity	10 to 95% r.h.:	Maximum ±1mg/m³ or ±10% of display (50% r.F.)
Temperature	14 to 113°F (-10 to 45°C):	Maximum ±2mg/m³ or ±15% of display (68°F or 20°C)
Cross sensitivities:		CO_2: 0% 4 mg/m³ at 1,000 ppm CO, 150 mg/m³ at 1% volume H_2, 2 mg/m³ at 2 ppm SO_2 216 mg/m³ at 1,300 ppm CH_4O, -3 mg/m³ at 10 ppm NO_2

MK409-5 - Electrochemical sensor for hydrogen cyanide (HCN)

Response time		T90: <60 seconds
Pressure	800 to 1,200 hPa:	Maximum ±0.5 ppm or ±10% of display (1,000 hPa)
Humidity	10 to 95% r.h.:	Maximum ±0.5 ppm or ±10% of display (50% r.F.)
Temperature	-4 to 122°F (-20 to 50°C):	Maximum ±0.5 ppm or ±15% of display (68°F or 20°C)
Cross sensitivities:		NO_2: -120%, Cl_2: ≈-20%, CO: 0%, CO_2: 0%, H_2: 0%, HF: 0%, NO: 0%, PH_3: 0% (*1)
Expected lifetime:		2 years

MK411-5 - Electrochemical sensor for ozone (O3)

Response time		T90: <60 seconds
Pressure	800 to 1,200 hPa:	Maximum ±0.03 ppm or ±10% of display (1,000 hPa)
Humidity	10 to 95% r.h.:	Maximum ±0.03 ppm or ±10% of display (50% r.F.)
Temperature	14 to 113°F(-10 to 45°C):	Maximum ±0.03 ppm or ±15% of display (68°F or 20°C)
Cross sensitivities:		Cl_2: 70-210%, ClO_2: 60-180%, NO_2: 60-80, F_2: ≈70 PH_3: 10 H_2: ≈0, HCN: 0.3%, CO=CO_2=HF: 0% (*1)
Expected lifetime:		2 years

MK412-5 - Electrochemical sensor for hydrogen fluoride (HF)

Response time		T50: <40 seconds T90: <90 seconds
Pressure	800 to 1,200 hPa:	Maximum ±0.2 ppm or ±10% of display (1,000 hPa)
Humidity	10 to 95% r.h.:	Maximum ±0.2 ppm or ±10% of display (50% R.H.)
Temperature	-4 to 104°F(-20 to 40°C):	Maximum ±0.2 ppm or ±10% of display (68°F or 20°C)
Cross sensitivities:		HCL: 66%, CL_2: 40%, CO=NO_2=H_2S=H_2=0%
Expected lifetime:		1 - 2 years

(*1): Displayed value with reference to the supplied gas concentration, which lies in the range of the TLV value.
(*2): Not approved for monitoring the lower explosion limit for primary explosion protection.

Alarm Thresholds – Standard Settings and Test Gas Chart
Instantaneous alarms as with the TRGS 900 (Version 2000)

Detection Range		Alarm 1	Alarm 2	Alarm 3	Cal. Gas
25% volume O_2	Oxygen	19.5 ⇩	17.0 ⇩	23.5 ⇧	20.9 % vol.
4.00% volume H_2	Hydrogen (*2)	0.2 (*2)	0.4 (*2)	0.6 (*2)	2.0 % vol.
2,000 ppm H_2	Hydrogen (*2)	1,000 (*2)	1,500 (*2)	2,000 (*2)	2,000.0
1,000/2,000 ppm CO	Carbon monoxide	35.0	200.0	300.0	200.0
300/500 ppm CO	Carbon monoxide	35.0	200.0	300.0	200.0
100 ppm H_2S	Hydrogen sulfide	10.0	15.0	100.0	20.0
500 ppm NH_3	Ammonia	20.0	40.0	200.0	100.0
200 ppm NH_3	Ammonia	20.0	40.0	200.0	100.0
100 ppm NO	Nitrogen monoxide	25.0	50.0	100.0	50.0
10.0 ppm SO_2	Sulfur dioxide	2.0	5.0	10.0	5.0
50.0 ppm HCN	Hydrogen cyanide	5.0	15.0	50.0	20.0
30.0 ppm HCl	Hydrogen chloride	5.0	10.0	30.0	10.0
20.0 ppm C_2H_4O	Ethylene oxide (ETO)	5.0 (*3)	10.0	20.0	10.0
20.0 ppm SiH_4	Silane (SIL)	5.0	10.0	20.0	10.0
10.0 ppm PH_3	Phosphine	0.3 (*3)	0.4 (*3)	1.0	5.0
2.00 ppm $COCl_2$	Phosgene (PGN)	0.1 (*3)	0.2 (*3)	1.0	1.0
100.0 mg/m³ C_4H_8S	Tetrahydrothiophen (THT)	25.0	50.0	100.0	37.0
50.0 ppm NO_2	Nitrogen dioxide	3.0	5.0	10.0	10.0
10.0 ppm Cl_2	Chlorine	0.5	1.0	10.0	10.0
1.00 ppm O_3	Ozone	0.1	0.2	1.0	1.0 (*4)
2.00 ppm ClO_2	Chlorine dioxide	0.1	0.2	1.0	1.0 (*4)
10.0 ppm HF	Hydrogen Fluoride	1.0	2.0	10.0	10 ppm HCL or 7 HF(*4)

(*2): Not approved for monitoring the lower explosion limit for primary explosion protection.
(*3): Reliable TLV (threshold limit value) monitoring is not possible with the sensor technology currently available.
(*4): Gas generator required.

Technical Data

Detector type:	Micro IV
Detection principle:	Electrochemical sensor (EC)
Detection ranges:	See Sensors and Detection Ranges
Response time t90:	See Sensor Specifications
Expected sensor life:	See Sensor Specifications
Climate effects:	See Sensor Specifications
Display:	LCD Display with backlight illumination
Alarm:	Visual and audible 3 instantaneous concentration alarms See Alarm Thresholds
Gas supply:	Diffusion
Zero point/Calibration:	With calibration adapter at a flow rate of 0.5 to 0.6 l/min *
Climate conditions: For operation: For storage:	 -4 to 131(113)°F (-20 to 55(45)°C) / 5 to 95% r.h. / 800 to 1,200 hPa See Sensor Specifications -13 to 131°F(-25 to +55°C) / 10 to 95% r.F. / 700 to 1300hPa (a temperature of 32 to 86°F (0 to +30°C) is recommended)
Power supply: Operational time:	1 AA 1.5V Type: DURACELL MN1500 or Energizer AA 6 months (time may be reduced depending on alarm frequency)
Casing Material: Dimensions: Weight: Protection:	 Polycarbonate, metalized 88x47x25 mm (HxWxD) 85.6 g Model with display, keypad, and O2 sensor IP 54
Approval:	c-UL-us Class 1, Div. 1, Groups A, B, C, D Temperature Code T3C

* 1.0 l/min. for Cl2, ClO_2, O_3, and HCl gases.

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
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