



## ***GfG Instrumentation***

***G888 / G999 product introduction***

***Bob Henderson***

***President***

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***Internet: [www.goodforgas.com](http://www.goodforgas.com)***

## GfG Instrumentation

### G888 / G999 product introduction



## *GfG Instrumentation*



*World-wide manufacturer of gas  
detection solutions*



## *GfG Instrumentation mbH*



- *Worldwide headquarters in Dortmund, Germany*
- *Founded in 1961*
- *An industry leader in development and production of gas measurement technology for over 58 years*
- *Over 300 employees worldwide*

# One of the World's Leading Manufacturers of Gas Detection Products



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***GfG Instrumentation, Inc.***



*Headquarters in Ann Arbor, Michigan, USA*

*Responsible for sales for North America and South America*

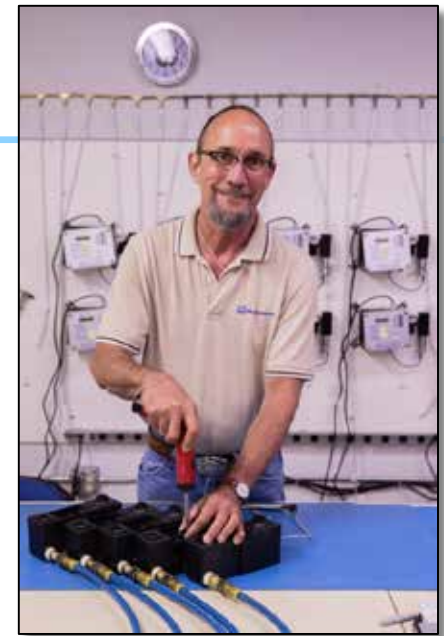
## GfG Sales Team Structure

*Sales Team – 20 local salesmen across USA*

- *Central Zone – Mark Ahrens*
- *Western Zone – Michael Calvo*
- *Southeast – Bill Rankin*
- *Fixed Systems – Jeff Allsworth*

*Sales Rep Groups:*

- *Northeastern USA (Sullivan Sales)*
- *Rocky Mountains / Midwest (Shur Sales)*
- *Latin America (Intecon, Inc.)*



## Need help?

Toll free (USA and Canada): 800-959-0329

Direct: 1-734-769-0573

Customer service e-mail:  
service@goodforgas.com

Sales Territory Map and Contact List:

<https://goodforgas.com/wp-content/uploads/2019/11/Sales-Territory-Map-V44.pdf>

**GFG Instrumentation  
Sales Territory Map**

<b>GFG Director of Sales</b> Michael Calvo <a href="mailto:mcalvo@goodforgas.com">mcalvo@goodforgas.com</a> / (714) 599-2500			
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	<b>Engineered Fixed Systems</b> Jeff Allsworth <a href="mailto:jallsworth@goodforgas.com">jallsworth@goodforgas.com</a> (734) 761-5987	<b>OEM</b> David Bartley <a href="mailto:dbartley@goodforgas.com">dbartley@goodforgas.com</a> (734) 761-5598	
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<b>Northeast Region</b> The Sullivan Group <a href="http://www.SullivanSafety.com">www.SullivanSafety.com</a>		<b>Rocky Mountain/Midwest Region</b> Shur Sales and Marketing, Inc. <a href="http://www.shur-sales.com">www.shur-sales.com</a>	
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State area numbers for The Sullivan Group indicate the telephone area code.

**GFG Instrumentation**

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 Website: [www.goodforgas.com](http://www.goodforgas.com) 400, 44, 49, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100





- **Excellent support / excellent pricing / excellent discounts**
  - *Great products!*
  - *Rapid shipment*
  - *No stocking order for best pricing*
- **GfG sells exclusively through stocking distributors**
  - *We don't sell direct to end-users!*
  - *Exclusively sold through GfG network of value-added resellers*
- **We support our distributors**
  - *Demo discounts*
  - *Loaners*
  - *Field sales support*
  - *Training*



**GfG Instrumentation**  
WORLDWIDE MANUFACTURER OF GAS DETECTION SOLUTIONS

SUPPORT  
800-959-0329

TRANSLATE  
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LOGIN

HOME ABOUT PRODUCTS ▾ SUPPORT NEWS CONTACT

**PORTABLE EQUIPMENT**  
SINGLE GAS DETECTORS  
MULTI GAS DETECTORS  
ACCESSORIES

**Durable, Compact Smart Sensor Design**

Highly Configurable  
Wide Range Sensors  
Full 3 Year Warranty  
Optional Draw Pump

**INSTRUMENTATION & SUPPORT**

We are committed to the protection of life & property by designing, developing & producing the safest & most reliable gas detection equipment available, & to continuously make improvements through constant attention to customer expectations & advancing industry standards.

**PORTABLE GAS MONITORS**

**MICRO IV SINGLE GAS DETECTOR**

**G300 SINGLE GAS DETECTOR**

**G450 4 GAS MULTI-GAS DETECTOR**

**G460 1-6 GAS MULTI-GAS DETECTOR**

**GfG PRODUCT SEARCH**

Search for products

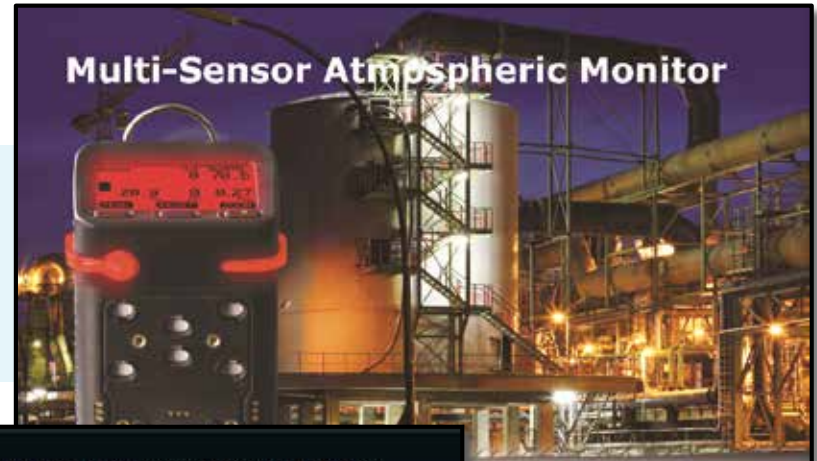
**GfG PRODUCTS**

PORTABLE GAS MONITORS

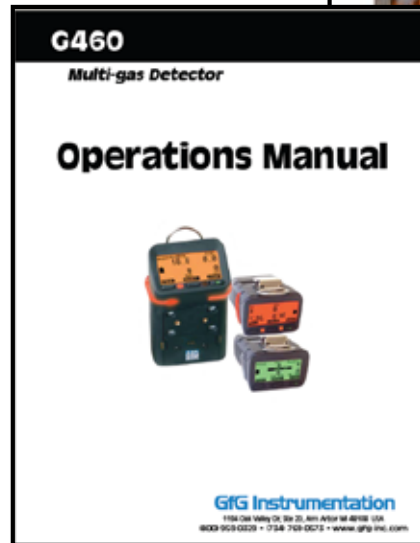
MULTI GAS DETECTORS

RESPIRATORY AIR MONITORS

**Sales Support:**  
[www.Goodforgas.com](http://www.Goodforgas.com)



- Data sheets
- Price lists
- Manuals
- Software
- Application Notes
- Product comparisons
- Presentations
- Training videos
- ...and more!



### Choosing the best detection technologies for measuring combustible gas and VOC vapors

...single sensor (or type of sensor) is not sufficient for detecting all types of dangerous vapors. This is why workers are exposed to multiple hazards events with multiple sensors

...commonly used sensors are for the measurement of gas, vapors, carbon monoxide and hydrogen (leakage) of equipment, instruments are at least these four sensors. However, many toxic sensors are not capable of measuring all of the hazards that are potentially present.

...designed as portable gas detectors are extremely long when they are designed to measure. They often are frequently unaware of the limitations, errors in ways that result in inaccurate readings, important for instrument users to understand gas in their instrument cannot properly measure if they can.

...is that there is an extremely wide range of all types of sensors available for use in portable instruments. Not because one type of sensor for a particular gas does not mean there are no other limitations, is that the instrument must be able to make use of the most appropriate technologies (Figures 2 and 3).

...in methane and hydrogen sulfide sensors are not a single type of gas. There is very little in readings these sensors provide. The only

...gas as oxygen sensor responds to it oxygen. Electrochemical sensors designed to measure a particular gas may not be able to specify. Although sensor manufacturers design their products to minimize responsiveness to gases other than the one they are supposed to measure, no design is perfect. For instance, CO sensors may also respond to hydrogen as well as some vapors produced by acetone, alcohols and other volatile organic compounds (VOCs). Since most interfering effects are positive, the possibility that the sensor may occasionally provide higher than actual readings for CO is generally not regarded as a safety concern. It just means that workers have the affected area a little sooner. Similarly, hydrogen sulfide sensor readings can be affected by exposure to nitrogen and sulfides such as methanol and cyanide vapors.

...The sensor with the most important limitation is the traditional "catalytic" or "pellistor" type present lower explosive limit (LEL) combustible gas sensor. In spite of the millions of combustible sensor equipped atmospheric monitors in service around the world, there is still a lot of misunderstanding and misrepresenting when it comes to the performance characteristics and limitations of this very important type of

Figure 2: Ability to support the sensor sensors is critical. The G460 Multi-sensor Atmospheric Monitor from GIG Instrumentation is capable of measuring up to six different atmospheric hazards at the same time.

**GIG Instrumentation**  
 1100 Oak Valley Dr. Ste 20, Ann Arbor MI 48106 USA  
 800-929-0229 • 734-769-0272 • [www.gig-inc.com](http://www.gig-inc.com)

### Confined Space performance

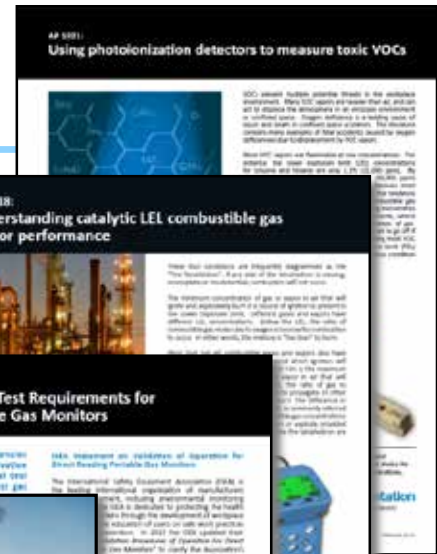
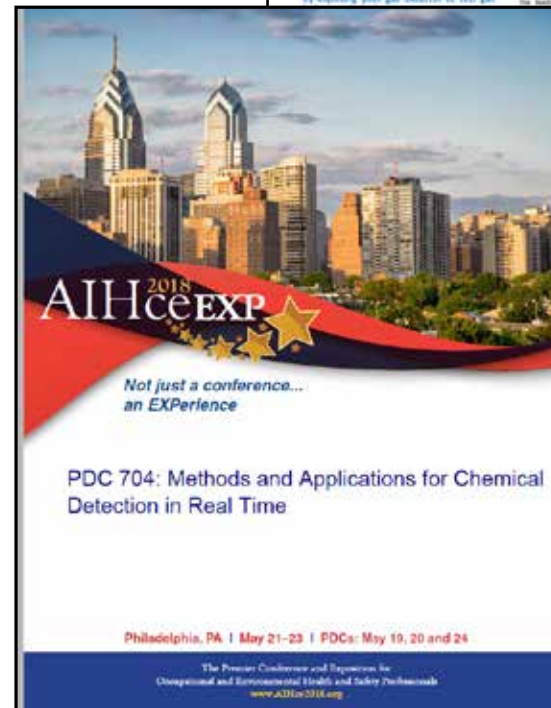
...toxic VOCs

...GIG Instrumentation

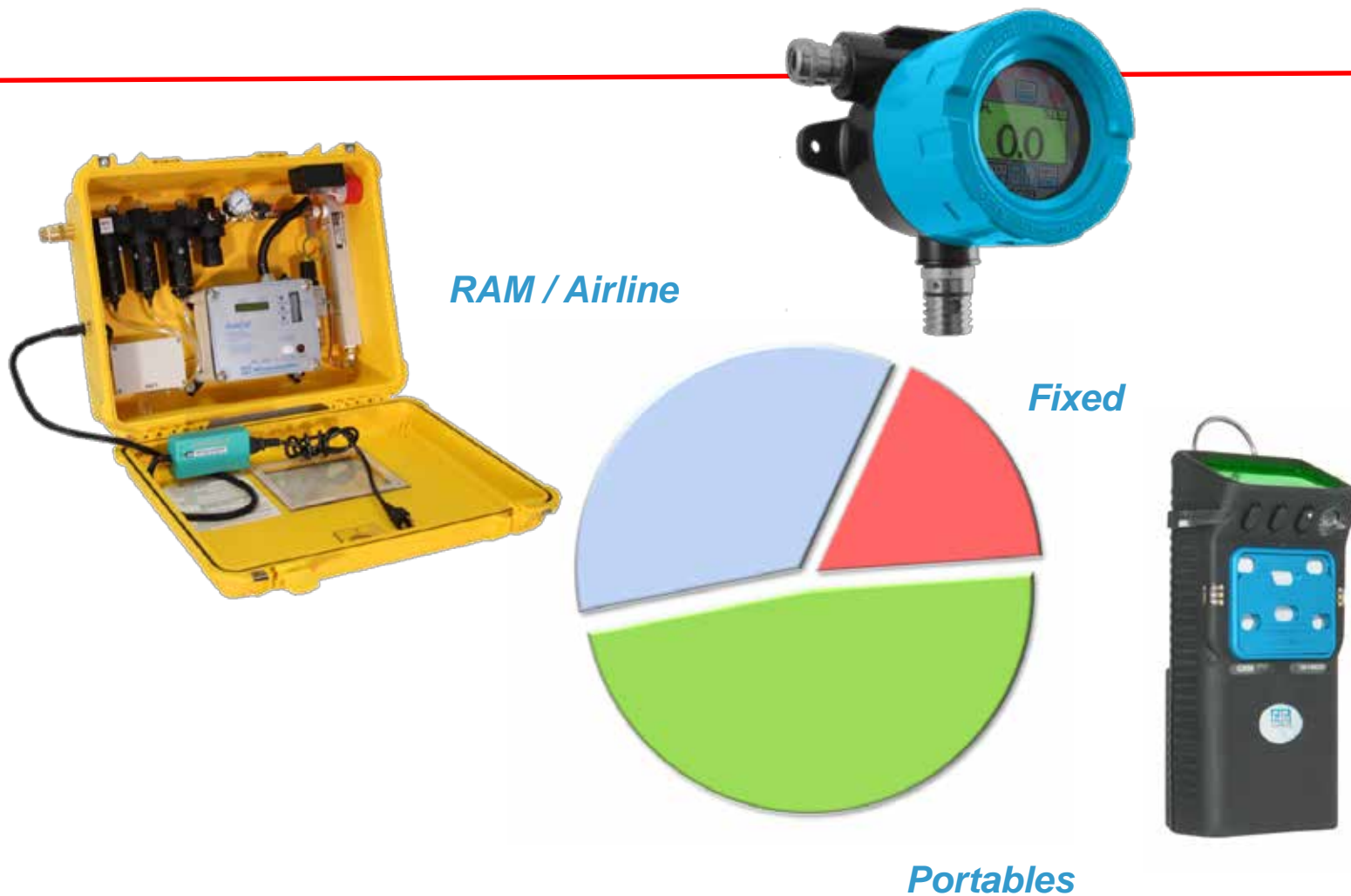
...Supplier Of Gas Detection Solutions

# Technical support and downloads

- [www.goodforgas.com](http://www.goodforgas.com)
  - Application Notes, Technical Notes and Presentations
  - Articles
  - Comprehensive library of gas detection resources



# Sales by product category as percent total GfG, Inc. sales





## *Real-time Air Monitoring (RAM)*

*Fully portable and wall  
mounted panels for CO  
monitoring and purification of  
compressed breathing air*

## **GfG Instrumentation**

*Fixed Gas Detection Systems:  
Technology based solutions for unique applications*



## Fixed gas detection systems

Comprehensive line of fixed transmitters and controllers able to detect over 500 gases







## *Wirelessly integrated fixed and portable systems*

*Fixed gas transmitters equipped with WILAN or ISM RF gateways*

*Realtime readings from fixed and portable instruments displayed on same monitor or PLC*



# GMA200 Visualization Software

Comprehensive system information via digital gateway – Overall system view

The screenshot displays the GMA200Visual (V.1.0.3) software interface. The top menu includes File, Options, and Info. The navigation pane on the left shows a tree structure with 'Overall view' selected, containing sub-items for Gateway 1 (Tradeshow, GWZ 1.2, GWZ 1.1) and Gateway 2 (GMA Nr.1). The main area is titled 'Overall view' and contains four data tables, each with a 'GMA' status indicator.

**Gateway 1: Tradeshow (Bus-Addr:1)**

MSP	Description	Measuring val.	Unit	Gas	Details	Advice
2	SH1201404 CCH8	0.5	%LFL	CH4		
3	SH1202368 CCH8	5.5	%LFL	CH4		
4	PfHst.22 CO2	0.05	Vol-%	CO2		
5	PfHst.22 O2	—	Vol-%	O2	SRV. SRV. UR. SRQ	
6	PfHst.22 Schmelz	0	%	—		
7	PfHst.22 CO	—	ppm	CO	SRV. SRV.	
8	PfHst.22 O2	20.7	Vol-%	O2		
9	PfHst.22 O2	20.7	Vol-%	O2		
10	PfHst.22 Propan	-0.2	%LFL	CH8		
11	PfHst.22 O2	—	Vol-%	O2	SRV. SRV.	
12	PfHst.22 H2S	—	ppm	H2S	SRV. SRV.	
13	PfHst.22 O2	20.8	Vol-%	O2		
14	PfHst.22 O2	20.8	Vol-%	O2		
15	PfHst.22 O2	20.8	Vol-%	O2		
16	PfHst.22 O2	20.8	Vol-%	O2		

**Gateway 1: GWZ 1.2 (Bus-Addr:2)**

MSP	Description	Measuring val.	Unit	Gas	Details	Advice
1	MSPT1 CH4 Q001	0.0	%LFL	CH4		
2	MSPT1 HC Q002	0.0	%LFL	CH400		
3	MSPT1 CH8 Q003	0.0	%LFL	CH8		
4	MSPT1 CO Q004	0	ppm	CO		
5	MSPT1 LACK Q0001	4.0	mA	Sp		
6	MSPT2 CH4 Q001	0.0	%LFL	CH4		
7	MSPT2 HC Q002	0.0	%LFL	CH400		
8	MSPT2 CH8 Q003	0.0	%LFL	CH8		
9	MSPT2 CO Q004	0	ppm	CO		
10	MSPT2 LACK Q0001	4.0	mA	Sp		
11	MSPT3 CH4 Q001	0.0	%LFL	CH4		
12	MSPT3 HC Q002	0.0	%LFL	CH400		
13	MSPT3 CH8 Q003	0.0	%LFL	CH8		
14	MSPT3 CO Q004	0	ppm	CO		
15	MSPT3 LACK Q0001	4.0	mA	Sp		

**Gateway 1: GWZ 1.1 (Bus-Addr:3)**

MSP	Description	Measuring val.	Unit	Gas	Details	Advice
1	MSPT4 CH4 Q001	0.0	%LFL	CH4		
2	MSPT4 HC Q002	0.0	%LFL	CH400		
3	MSPT4 CH8 Q003	0.0	%LFL	CH8		
4	MSPT4 CO Q004	0	ppm	CO		
5	MSPT4 LACK Q0001	3.8	mA	Sp		
6	Tagetank Q001	0.0	%LFL	CH400		

**Gateway 2: GMA Nr.1 (Bus-Addr:1)**

MSP	Description	Measuring val.	Unit	Gas	Details	Advice
1	CCH CH4	111	%LFL	CH4	PLT. UR. SRQ	
2	EC4 CO	111	ppm	CO	PLT. UR. SRQ	
3	111	---	---	---	PLT. UR. SRQ	
4	111	---	---	---	PLT. UR. SRQ	Details
5	111	---	---	---	PLT. UR. SRQ	PLT. UR. SRQ Under range: SRQ Device request
6	111	---	---	---	PLT. UR. SRQ	

**Log**

Time	Message
17.02.2015 17:40:14	GWZ 1.1 connected.

The interface also includes a 'Configuration' button at the bottom left and a 'GfG' logo in the top right corner.

# GMA200 Visualization Software

Overall system view with high alarm (alarm 2) condition

The screenshot displays the GMA200 Visualization Software (V 1.0.3) interface. The top right corner shows the website 'www.GfG.biz', the date '17.02.2015 17:59:14', and the status 'online'. The navigation tree on the left shows the following structure:

- Overall view
  - Gateway 1
    - Tradeshow (Bus-Addr.1) - **High Alarm**
    - GWZ 1.2 (Bus-Addr.2)
    - GWZ 1.1 (Bus-Addr.3)
  - Gateway 2
    - GMA Nr.1 (Bus-Addr.1)

The main area shows four data tables, each representing a gateway. The 'Overall view' table for Gateway 1: Tradeshow (Bus-Addr.1) is highlighted in red, indicating a high alarm condition. The log at the bottom shows the following message:

17.02.2015 17:56:58 Alarm 2 at Gateway 1, GMA Tradeshow, Transmitter PrüfSt.22 O2

MSP-Description	Measuring val.	Unit	Gas	Details	Advice
1	SN1331424	CC28	0.1	%LEL CH4	
2	SN1206298	CC28	5.5	%LEL CH4	
3	PrüfSt.22	CO2	0.10	Vol% CO2	
4	PrüfSt.22	CO	---	Vol% CO	SRV. 20k UR, SRQ
5	PrüfSt.22	Schwarz	0	%	
6	PrüfSt.22	CO	---	ppm CO	SRV. 20k
7	PrüfSt.22	CO	20.7	Vol% CO	
8	PrüfSt.22	CO	20.7	Vol% CO	
9	PrüfSt.22	Propan	-0.2	%LEL C3H8	
10	PrüfSt.22	CO	---	Vol% CO	SRV. 20k
11	PrüfSt.22	H2S	---	ppm H2S	SRV. 20k
12	PrüfSt.22	CO	20.8	Vol% CO	
13	PrüfSt.22	CO	15.7	Vol% CO	AL1 Alarm 1, AL2 Alarm 2
14	PrüfSt.22	CO	20.9	Vol% CO	
15	PrüfSt.22	CO	20.9	Vol% CO	
16	PrüfSt.22	CO	20.9	Vol% CO	

MSP-Description	Measuring val.	Unit	Gas	Details	Advice
1	MPST1	CH4	Q001	0.0	%LEL CH4
2	MPST1	HC	Q000	0.0	%LEL CH20
3	MPST1	CH4	Q003	0.0	%LEL CH4
4	MPST1	CO	Q004	0	ppm CO
5	MPST1	Leak	Q001	4.0	mA 5g
6	MPST1	CH4	Q002	0.0	%LEL CH4
7	MPST1	HC	Q002	0.0	%LEL CH20
8	MPST1	CH4	Q003	0.0	%LEL CH4
9	MPST1	CO	Q004	0	ppm CO
10	MPST1	Leak	Q001	4.0	mA 5g
11	MPST1	CH4	Q001	0.0	%LEL CH4
12	MPST1	HC	Q002	0.0	%LEL CH20
13	MPST1	CH4	Q003	0.0	%LEL CH4
14	MPST1	CO	Q004	0	ppm CO
15	MPST1	Leak	Q001	4.0	mA 5g

MSP-Description	Measuring val.	Unit	Gas	Details	Advice
1	MPST4	CH4	Q001	0.0	%LEL CH4
2	MPST4	HC	Q002	0.0	%LEL CH20
3	MPST4	CH4	Q003	0.0	%LEL CH4
4	MPST4	CO	Q004	0	ppm CO
5	MPST4	Leak	Q001	4.0	mA 5g
6	Tagemerk	Q001	0.0	%LEL CH20	

MSP-Description	Measuring val.	Unit	Gas	Details	Advice
1	CC4	CH4	111	%LEL CH4	FLT UR, SRQ
2	BC4	CO	111	ppm CO	FLT UR, SRQ
3			111	---	FLT UR, SRQ
4			111	---	FLT UR, SRQ
5			111	---	FLT UR, SRQ

## Leading GfG portable gas detectors



*Micro IV  
single-gas detector*



*G450  
4-gas detector*



*G460  
1 - 7 gas detector*

## G450 / G460 Multi-Gas Detector

- *Interchangeable rechargeable (NiMH) or alkaline battery packs last over 20 hours per charge*
- *Top-mounted, three color, full graphics LCD*
- *Durable IP-67 water resistant design*
- § *Rated for continuous use in  $-30^{\circ}\text{C}$  temperatures*



## G460 Multi-gas Monitor

- *Up to SEVEN channels detection*
- *Comprehensive range of interchangeable smart sensors:*
  - *O<sub>2</sub> standard warranty: 5-year*
  - *LEL, CO, H<sub>2</sub>S: 3-year warranty*
  - *IR LEL gas: 3-year warranty*
  - *IR CO<sub>2</sub>: 3-year warranty*
  - *Available with PID and wide selection of substance-specific toxic gas sensors*



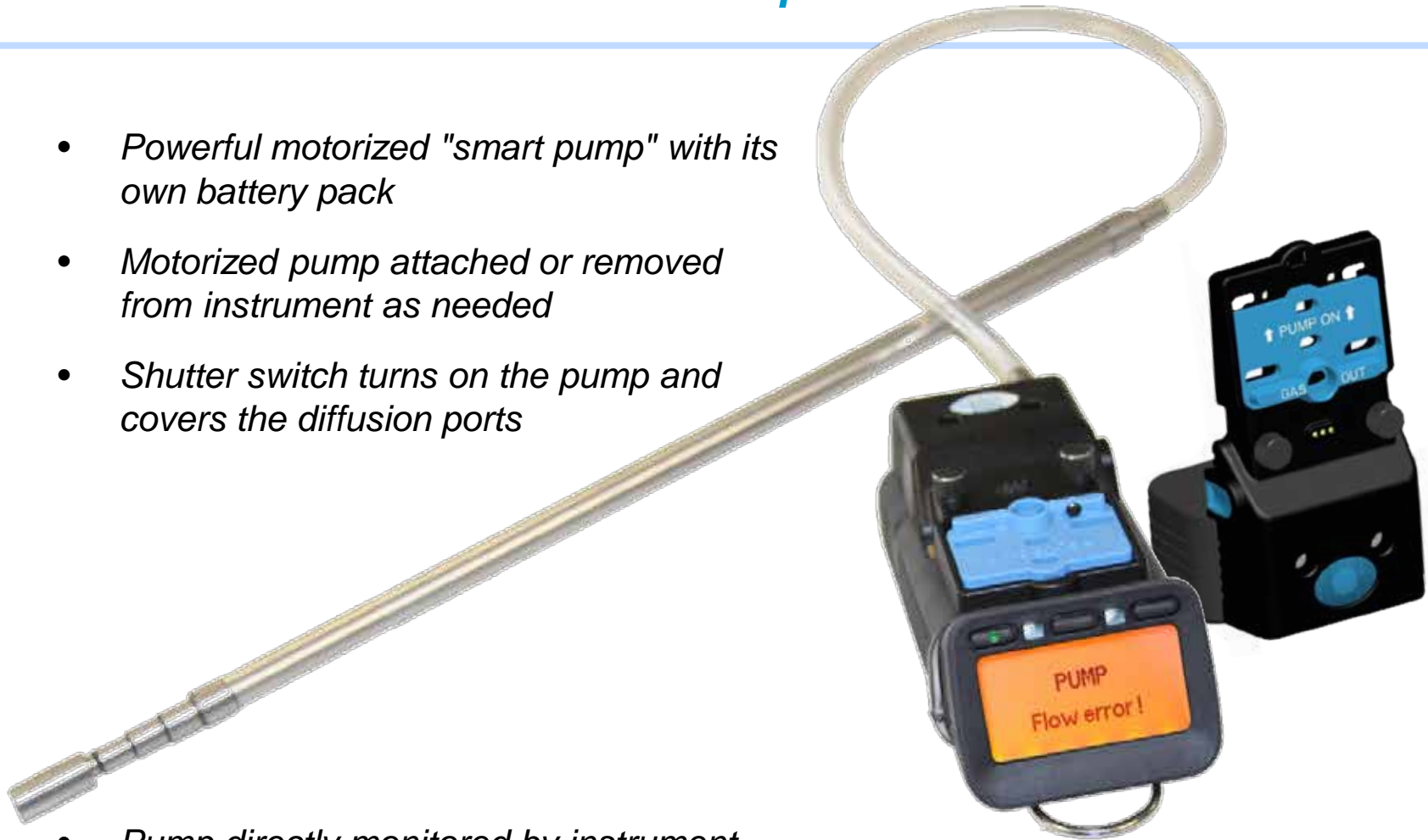
# G450 Confined Space Gas Detector

- *One to four sensors*
- *Full 3-year warranty on all sensors*
- *Interchangeable rechargeable (NiMH) or alkaline battery packs provide over 20 hours of continuous operation*
- *Super durable IP-67 water resistant design*
- *Extremely cost effective pricing!*



## G450 / G460 Motorized Pump

- *Powerful motorized "smart pump" with its own battery pack*
- *Motorized pump attached or removed from instrument as needed*
- *Shutter switch turns on the pump and covers the diffusion ports*



- *Pump directly monitored by instrument*
- *Low flow and pump malfunction alarms*



## Confined Space Entry Requirements



- *In 1993 OSHA enacted 29 CFR 1910.146 “Permit-Required Confined Spaces”*
- *Provisions apply to general industry*
- *1910.146 does not apply to industries with their own vertical standards:*
  - *Agriculture*
  - *Construction*
  - *Shipyard employment*

## 1926 Subpart AA

*June 2015: New OSHA CS rule adds many additional construction activities and types of spaces*

*29 CFR 1926 includes a lengthy list of confined spaces that are covered by the new rule*

*Significant expansion of CS market in the USA – huge opportunity for GfG, Inc.*

*Construction contractors prefer low cost, minimum feature instrument – alkaline G450 outstanding compliance choice!*



# Confined space market dimensions and opportunities

## Confined space (4 gas / 5 gas):

USA / Canada: \$350 M USD / year

Latin America: \$50 M USD / year

## Special CS considerations in North America:

Regulations very strict

Recent OSHA changes have expanded market

Every team member needs instrument

Mandatory pre-entry checks require pump

Standby safety watch uses pump continuously for entire entry

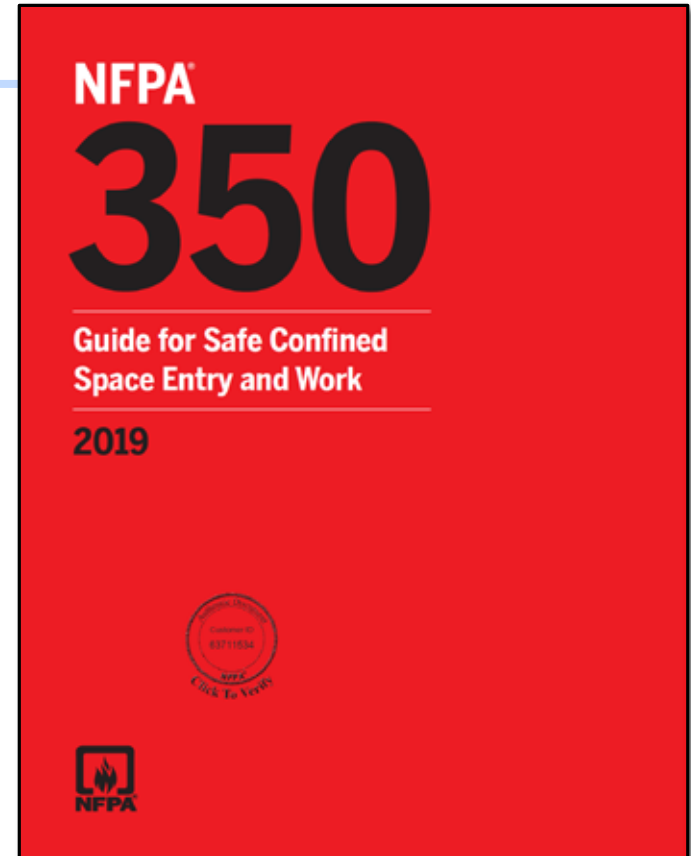
Industrial work shift typically 12 hours

Third party real-time wireless monitoring increasingly important and popular option



# NFPA 350: Guide for CS entry for Fire Service

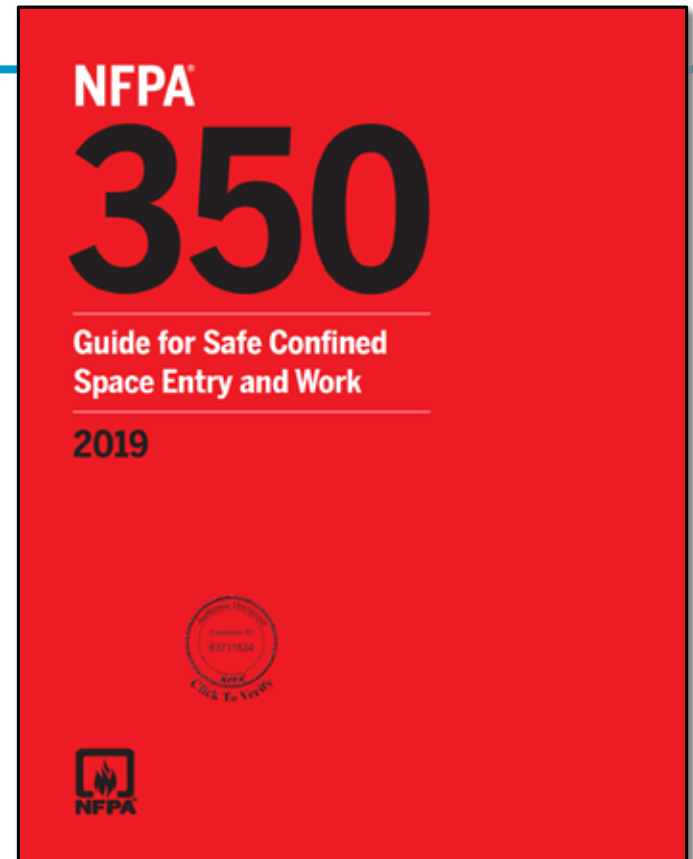
- *Complements and supports existing OSHA regulations such as:*
  - *1910.146 General Industry*
  - *1926 Subpart AA Construction Standard*
  - *1915, Subpart B Shipyard Employment Standards*
- *Addresses gaps in existing standards*
  - *OSHA regulations tell you WHAT to do not HOW to do it*
  - *NFPA 350 tells you how to perform atmospheric monitoring*



## Calibration/Monitor Checks



- *Zeroing*
- *Span Calibration*
- *Bump Test*
- *Function Test*



## ***“Bump Test” required before each day’s use!***

- *“Bump test” (function check) is a qualitative test in which the sensors are exposed to gas and the alarms are activated*
- *“Bump test” confirms that gas is capable of reaching the sensors, that the response time (time to alarm) is within normal limits, and that the alarms are activated and function properly*
- *“Bump test” does not verify the accuracy of the readings of the sensors when exposed to gas*
- *Takes 20-45 sec. to perform*



## Low cost G450 ecoBump Kits

- *G450 ecoBump kits have everything customers need for day-to-day use*
- *Convenient and affordable solution*
- *One compact ecoBump cylinder delivers over 250 daily bump tests!*



# NFPA® 350 requires a bump test before each day's use

The G450 ecoBump kit from GfG Instrumentation makes it easy and convenient!

NFPA® 350, "Guide to Safe Confined Space Entry and Work" makes it absolutely clear: Gas monitors used for atmospheric monitoring of confined spaces should be bump tested by the Gas Tester prior to each day's use."



Atmospheric hazards are a leading cause of accidents and injuries during confined space entry and rescue. NFPA® 350 includes procedures for atmospheric monitoring, as well as requirements for maintaining, calibrating and testing the direct reading atmospheric monitors used to test the air.

Section 7.10.1 specifies that, "Gas monitoring of confined space bump tested by the Gas Tester prior to entry. A bump test is a brief exposure of the sensors to specified target gas(es) to alarm functionality."

The G450 ecoBump kit makes this convenient. The kit includes a depend gas, direct reading gas monitor for O2, combustible gas (%LEL), CO and is powered by means of interchangeable rechargeable battery packs that provide continuous operation per charge or per batteries.

The foam lined, water-proof carrying push-button regulator and a complete enough test gas for up to 200 bump tests. Simply turn the instrument adapter, and push the regulator button and verify that the alarms are activated.

The complete alkaline G450 ecoBump kit USD. The rechargeable G450 ecoBump kit includes a rechargeable battery pack and 110-240 VAC power adapter (is optional).



USA and Canada  
Latin America  
Germany  
South Africa  
Asia Pacific  
Europe  
Saskatchewan



Complete rechargeable G450 ecoBump kit with instrument, charging cradle, regulator, test gas and foam lined carrying case.



G450 with Motorized Smart Pump, capable of sampling from up to 100 yards away from instrument.



USA and Canada  
Latin America  
Germany  
South Africa  
Asia Pacific  
Europe  
Saskatchewan

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Website: www.gfginc.com info@gfginc.com

4/2017\_02\_08\_01

# G450 ecoBump Kit





## GfG Instrumentation

### G888 / G999 product introduction





***Introducing the latest multigas detectors from GfG Instrumentation***

*G888: compact, one-to-seven gas atmospheric monitor*

*G999: compact, one-to-seven gas atmospheric monitor with internal motorized pump*



## *Introducing the G888 personal atmospheric monitor*



*Compact size!*

*Up to 7 gases in an instrument smaller than most 4 gas personal instruments*

*Rechargeable battery pack provides up to 23 hours continuous operation*

*Safe and dependable nickel metal hydride (NiMH) battery technology*

*No concerns from dangerous Li-ion batteries*

## Compact size!

*Almost one third smaller than  
G450 and G460*

*Smaller than most 4 gas  
personal instruments!*



## ***Compact size!***

*Almost one third smaller than  
G450 and G460*

*Smaller than most 4 gas  
personal instruments!*



## ***Introducing the G999 atmospheric monitor***

*Internal motorized pump for continuous  
sampling from remote locations*

*Sample from locations up to 300 feet  
(100 m) or more away from instrument*

*Slide on-off pump switch allows  
instrument to be operated in either  
diffusion or pumped operation*

*Compact size means G999 can be used  
as personal monitor*

*Twice as much power – internal 4 NiMH  
cell battery pack*



# Oil and Chemical Industry Opportunities

## **Confined space versus 4 gas personal protection in oil industry**

*In the past, most workers at refinery and oil / gas production sites in USA / Canada equipped with basic 4 gas personal instrument*

*Increasingly, CS entry at refinery done with PID and LEL equipped instrument*

*Increasingly, personal protection instruments are including additional sensors (such as CO<sub>2</sub>, NO<sub>2</sub>, SO<sub>2</sub>, H<sub>2</sub>, etc.)*



## Three color "Traffic Signal" display

Back lit, three-color, full graphics LCD

Top mounted display with wrap around (360°) LED alarm indicator

LCD includes flip and zoom function

Rugged, double shot molded housing includes integral rubberized boot

Durable high-tension steel alligator belt clip





## Standard features now include:

- *Flashlight LED*
- *Man-down alarm*
- *Red / green flash for Bump Test or Calibration due status*



## *G888 battery packs based on safe and proven nickel metal hydride (NiMH) technology*

*NiMH batteries provide up to 23 hours of continuous operation for typical 4 gas instrument*

*NiMH batteries provide excellent cycle life and low temperature performance*

*Typical run-time after two years for properly maintained NiMH battery packs is usually around 16 hours*

*No concerns due to dangerous Li-ion batteries*

*No runaway charging or flammability issues*



## **Charge G888 by USB connection via “Smart” calibration adapter or optional cradle**

*Just like charging a cell phone!*

*Charge from any USB port*

*Optional cradle for charging via  
110 – 240 VAC*



## Use same cradle for G888 and G999

- Charge G888 with either smart cap or cradle
- Charge G999 with cradle only

### G888

- Approx. 6h when the battery is empty
- Approx. 4h after one shift (EC+CC sensors)

### G999

- Approx. 6h when the battery is empty
- Approx. 3h after one shift (EC+CC sensors)



## *Easy to use!*

*Operation identical to other GfG instruments*

*Calibration easy and automatic*

*DS 400 Docking Station works with new G888 and G999*

*All you need to do is install a new cradle and update the firmware in your existing docking station*

*Same cradle works for both G888 and G999*



## Low cost TS 400 “Test Station” for “Bump test” and Calibration Adjustment

*TS-400 requires very little power*

*Power via USB connection, or cell  
phone type wall power adapter*



## Realtime wireless communication

*Optional radio frequency (RF) transmitter*

*Realtime wireless communication of readings and alarms*

*Sophisticated wireless “Man down” alarm provides immediate information of movement at base station as well as at instrument*

*Powerful ISM RF transmitter provides much greater reach than WIFI or Bluetooth connection*

*915 MHz (US) 1000 feet (300 meters)*

*868 MHz (EU) 2,300 feet (700 meters)*



## Optional wireless communication

*Plug-in RF transceiver turns laptop or computer into base station*

*Install software, plug-in dongle, and your computer ready for use as a base station for wirelessly integrated G888 / G999 gas detection system*





## Optional “TeamLink ” Server

*Compact self-contained RF base station for local control and 2-way communication with up to 10 instruments*

*No computer required!*

*Built in indicators and alarms track RF communication status*

*Alarm condition immediately communicated to throughout local network and communication hub*



# GfG TeamLink Server

Compact self-contained server carries same IS certifications as G888 and G999 instruments





## *The information you need*

*Whenever you want*

*Wherever you want*

*In real time!*



## Full size 4 Series and proprietary GfG sensors

- **5 sensor positions / up to 7 channels**
  - *Optional dual channel IR CO2 / IR LEL*
  - *Optional dual channel COSH*
  - *Wide range of substance specific O2 and EC toxic sensors*
  - *User selectable range and resolution for many EC sensors*



## Four different versions of G888 / G999 boards

### Version of board determines which sensors can be installed

- **G888C**
  - Electrochemical sensors EC1, EC2, EC3
  - Catalytic LEL sensors CC
  - IR and dual IR sensors IR1, IR2
- **G999C**
  - Electrochemical sensors EC1, EC2, EC3
  - Catalytic LEL sensors CC, CC/TC
  - Dual Infrared sensors IR1, IR2/IR3
- **G999P**
  - Electrochemical sensors EC1, EC2, EC3
  - Photoionization sensor PID
  - IR and dual IR sensors IR1, IR2/IR3
- **G999E**
  - Electrochemical sensors EC1, EC2, EC3, **EC4**
  - IR and dual IR sensors IR1, IR2/IR3



*IR, EC and O2 are plug and play “smart” sensors  
CC and PID sensors installed in dedicated sensor positions*

- **Smart sensors**

- EC-Sensors
- IR-Sensors



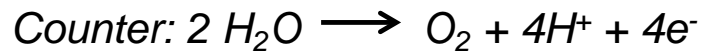
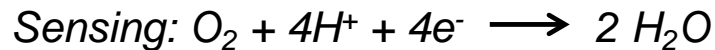
- **Plug-in sensors**

- CC-Sensor
- PID-Sensor



## Lead free O<sub>2</sub> sensor detection principle

- Oxygen passively diffuses into sensor where it is converted into H<sub>2</sub>O
- Power from instrument battery used to reverse the reactions and “pump” the O<sub>2</sub> back out
- Reactions:



- Amount electricity required to remove reaction product and return sensor to ground state (by generating O<sub>2</sub> at counter electrode) proportional to concentration of oxygen present



## Lead free O<sub>2</sub> Sensor Advantages

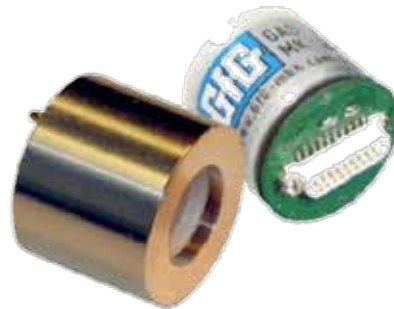
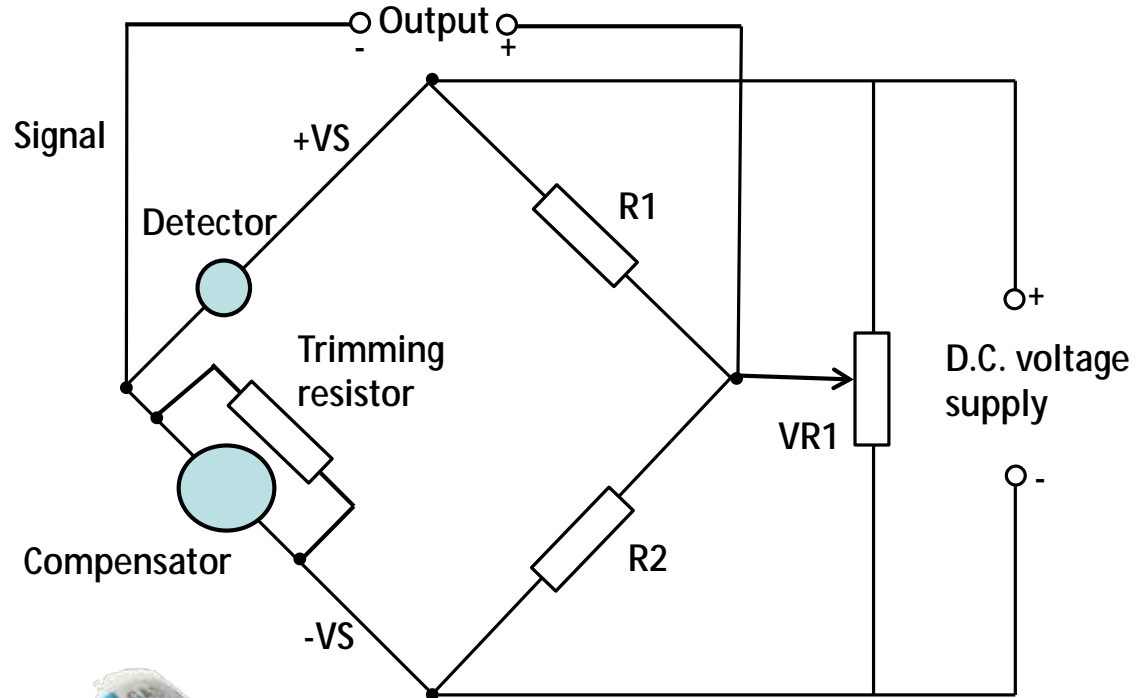


- *Advantages:*
  - *Non-consuming detection technique (sensor does not lose sensitivity or consume itself over time)*
  - *No build-up of internal pressure over life of sensor*
  - *Limited electrolyte / nothing to leak!*
  - *No internal membranes which are subject to damage or stress due to pressure changes*
  - *Warranted for 5 years, expected life 5 to 6 years*

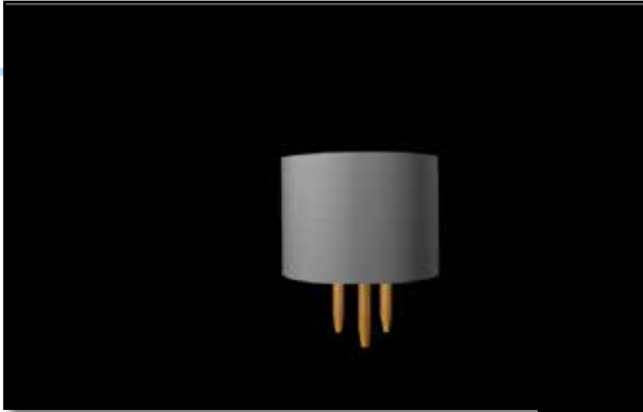


# Catalytic “Hot Bead” Combustible Sensor

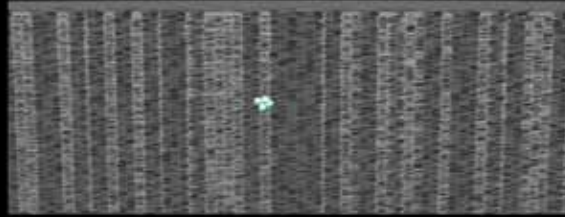
- *Detects combustible gas by catalytic oxidation*
- *When exposed to gas oxidation reaction causes the active (detector) bead to heat*
- *Requires oxygen to detect gas!*



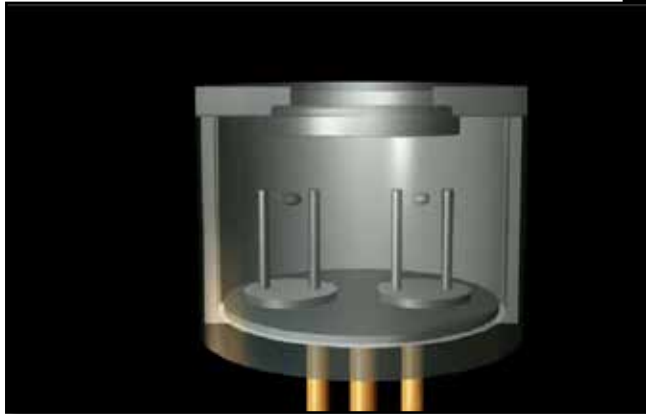
## Catalytic Sensor Structure



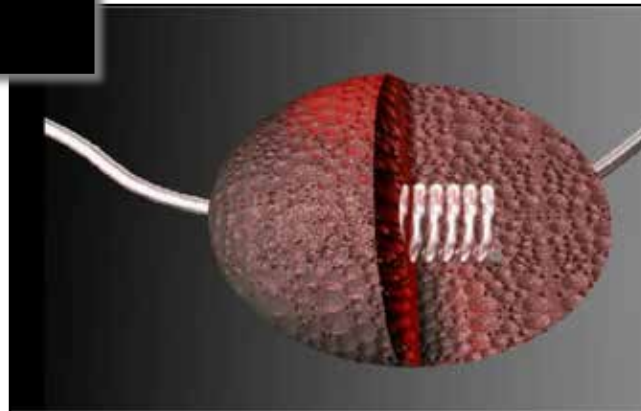
*Catalytic combustion (CC) type LEL sensor is typically housed in robust, stainless steel flame proof enclosure*



*Gas molecules diffuse into sensor through flame arrestor*



*Once inside the sensor molecules diffuse to the active bead, where they are oxidized*



*Oxidation heats active bead to higher temperature. Difference in temperature is proportional to the concentration of gas.*

## Conditions created by oxidation of large molecules affects diffusion of molecules into the sensor

- Oxidation occurs on step-by-step basis and proceeds only when molecules are in physical contact with catalyst coated surfaces within the bead
- The very hot reaction by-products create convective currents as they rapidly diffuse away from the catalyst surfaces in the bead
- Water vapor produced by oxidation of larger molecules creates a significant net outward flux, impeding diffusion of new molecules into the bead
- Oxidation of methane:  $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$

*To oxidize one molecule  $\text{CH}_4$  three molecules enter bead, and three molecules produced as by-products*

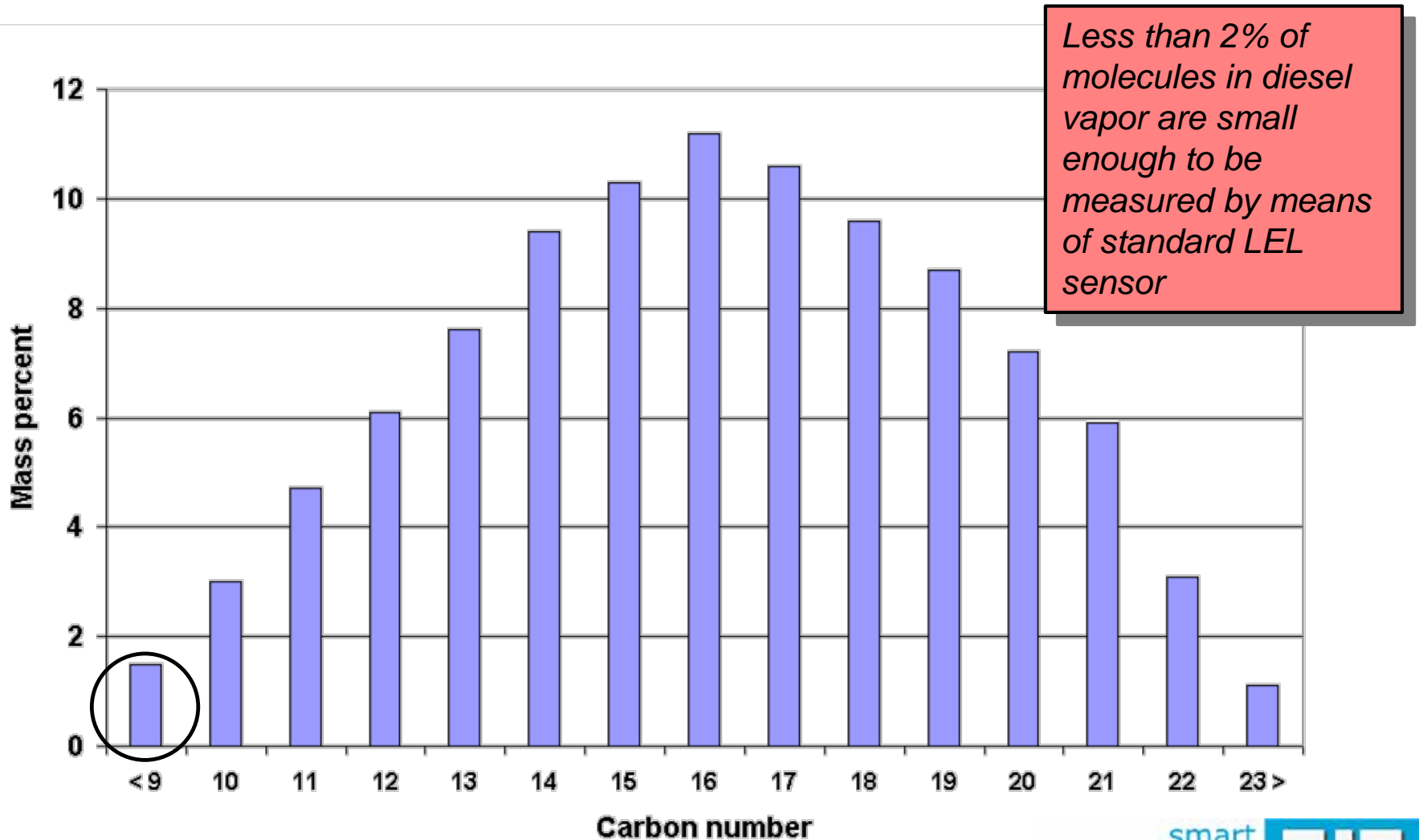
- Oxidation of pentane:  $\text{C}_5\text{H}_{12} + 8\text{O}_2 \rightarrow 5\text{CO}_2 + 6\text{H}_2\text{O}$

*To oxidize one molecule of pentane, nine molecules enter bead, and 11 molecules produced as by-products*

- Oxidation of nonane:  $\text{C}_9\text{H}_{20} + 14\text{O}_2 \rightarrow 9\text{CO}_2 + 10\text{H}_2\text{O}$

*To oxidize one molecule of nonane, 15 molecules enter bead, but 19 need to leave the sensor*

# Typical carbon number distribution in No. 2 Diesel Fuel (liquid)



# Non-dispersive infrared (NDIR) sensors



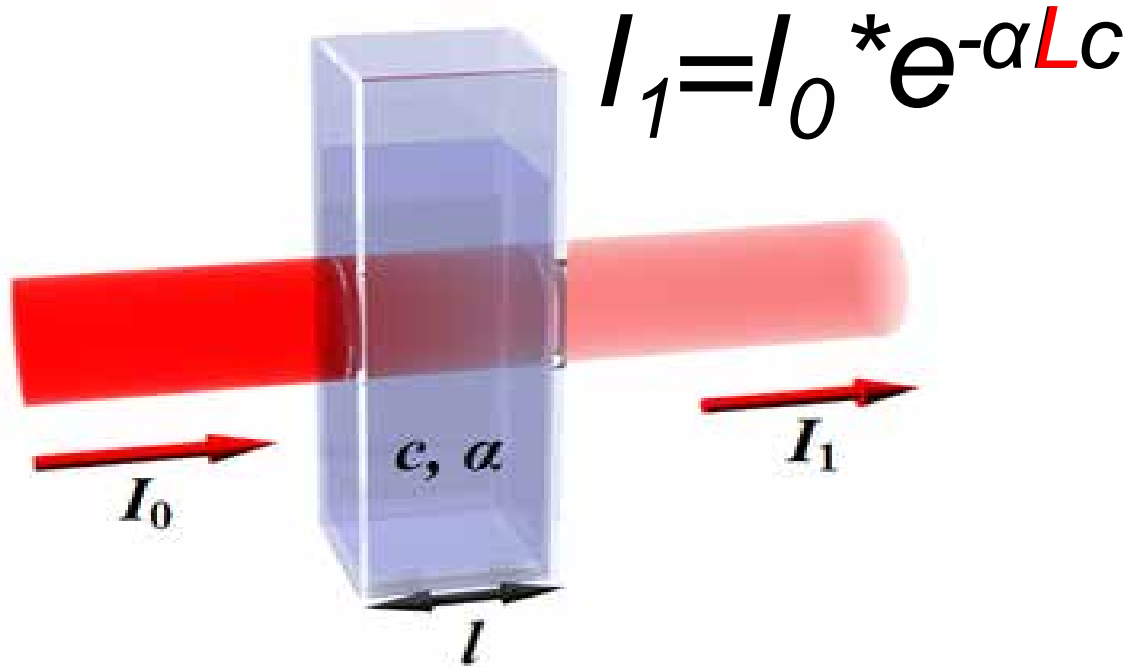
- *Many gases absorb infrared light at a unique wavelength*
- *In NDIR sensors the amount of IR light absorbed is proportional to the amount of target gas present*
- *Advantages:*
  - *Sensor cannot be poisoned*
  - *Does not require O<sub>2</sub> to detect gas*
  - *Can be used for high-range measurement*
  - *Responds well to large hydrocarbon molecules that cannot be measured by means of standard LEL sensor*

# Combustible gas NDIR sensor advantages and limitations



- *Limitations:*
  - *Molecule must include chemical bonds that absorb at the wavelength(s) used for measurement*
  - *Without sophisticated programming to correct readings, readings only accurate for the linearized gas used to calibrate the sensor*
  - *Not all combustible gases can be detected!*
    - *Hydrogen (H<sub>2</sub>) cannot be detected*
    - *Acetylene cannot be detected at wavelengths used in portable instruments*
    - *NDIR sensors with short optical path-lengths have limited ability to measure gases with lower relative responses*
    - *Which gases can be detected depends on the sensor design!*

## Beer-Lambert Law



- $I_0$  is the intensity of the incident light
- $I_1$  is the intensity after passing through the material
- $L$  is the distance that the light travels through the material (the path length)
- $c$  is the concentration of absorbing species in the material
- $\alpha$  is the absorption coefficient or the molar absorptivity of the absorber

**Optical path-length matters...**

## Performance of IR LEL sensors differs from performance of catalytic LEL sensors

- *Read the owner's manual!*
- *Make sure to verify with manufacturer before attempting to use the sensor to measure unsaturated hydrocarbons, aromatic VOCs or other gases not specifically listed in the owner's manual!*



### Appendix B

## Detectable Combustible Gases

Gas <sup>1</sup>	Expected response at 20% LEL target gas <sup>2</sup>
Methane	20% LEL
Propane	15% LEL to 45% LEL
Butane	15% LEL to 35% LEL
Pentane	15% LEL to 45% LEL
Hexane	8% LEL to 28% LEL
Methanol/Ethanol <sup>3</sup>	6% LEL to 26% LEL
Hydrogen	No response
Acetylene	No response

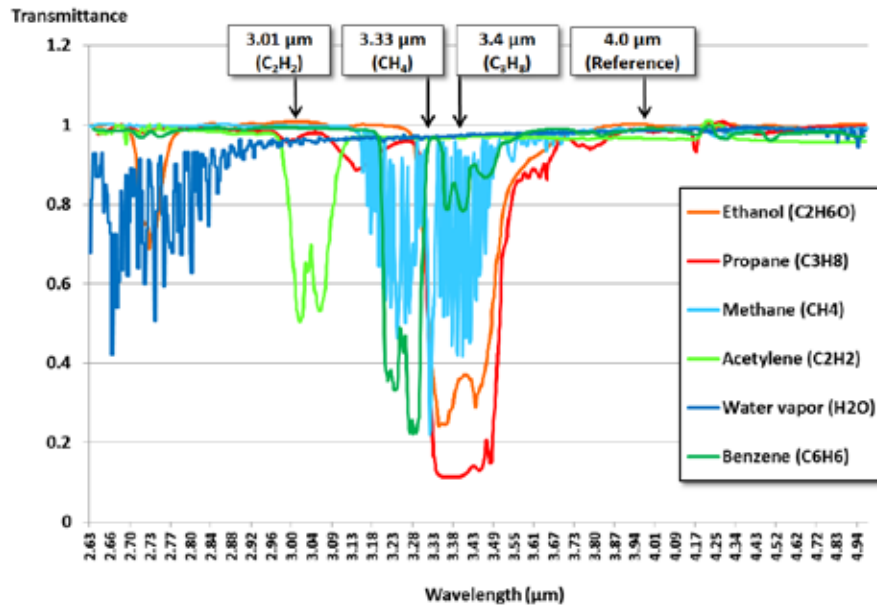
<sup>1</sup>For any gases not listed, please contact Honeywell Analytics to find the best solution for your application.

<sup>2</sup>The BW Clip4 LEL sensor is optimized to see methane. While the unit can detect and respond to the other combustible gases listed in the above table, the accuracy of the readings may be in-consistent. If the primary need is to detect a specific combustible gas other than methane, please contact Honeywell Analytics to discuss an alternative product.

<sup>3</sup>Please use caution when using the BW Clip4 around Methanol and/or Ethanol. The BW Clip4 CO sensor may become inhibited by prolonged exposure to concentrations of Methanol and/or Ethanol thus causing the unit to alarm. This condition can last up to 12 hours before the CO sensor recovers to normal levels.

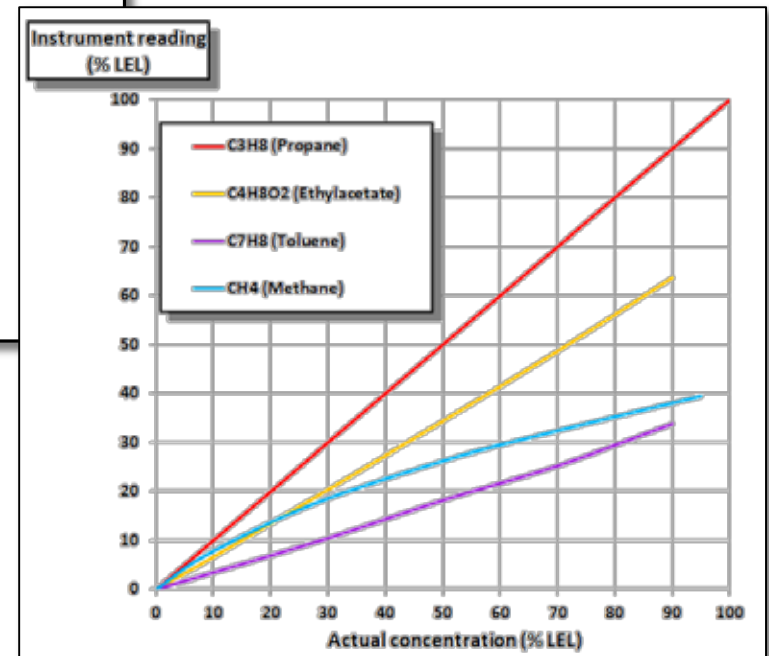


### Infrared transmittance spectra for several hydrocarbon gases (2.63 $\mu\text{m}$ to 5.0 $\mu\text{m}$ wavelength range)



**GfG has better IR LEL sensor with better software**

- Long path length sensor allows excellent response to VOC and unsaturated HC gases
- GfG software uses lookup table with linearized curves for gases in the on-board IR LEL library
- Allows users to seamlessly switch from one gas to another



## Why use photoionization detector equipped instruments?

- *For most VOCs, you exceed the toxic exposure limit long before you reach 10% LEL*
- *PID equipped instruments are generally the best choice for measurement of VOCs at exposure limit concentrations*
- *Whatever type of instrument is used to measure these hazards, it is essential that the equipment is used properly, and the results are correctly interpreted*
- *The type of PID sensor you use matters!*



## Planar "3D" 2-electrode PID design



- *PID design:*
  - *Gap between window and electrodes increases "quenching" effect of water vapor on signal*
  - *Potential for drawing particulate contaminants into sensor*
  - *More ionic fragments left behind to be adsorbed onto electrodes and window*
- *Results:*
  - *Increased sensitivity to water vapor and humidity*
  - *Dangerously inaccurate (low) readings*
  - *Must clean lamp more frequently*

## 3-electrode PID Design



- *PID design:*
  - *Diffusion design includes "fence electrode" to provide mechanical short circuit between sensing and counter electrodes*
  - *Electrodes housed in replaceable "stack"*
  - *Diffusion of molecules into and out of glow zone means less ionic fragments or particulates left behind*
- *Results:*
  - *Reduced "moisture leakage" response due to humidity*
  - *More accurate readings*
  - *Clean lamp less frequently*

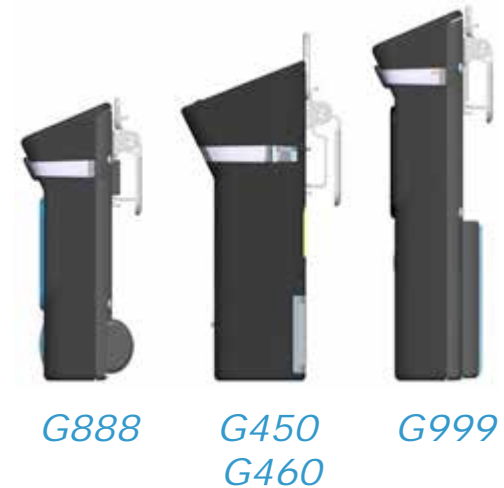
## Advantages compared to G450, G460 and MP-2 pump

- **G888 and G999**

- *More compact*
- *Charging contacts easier to clean*
- *Both sets of contacts used for charging (in G450 / G460 only one set used for charging)*
- *Man-down alarm standard*
- *Flashlight LED standard*

- **G999**

- *4 cell NiMH battery pack with double the power*
- *Optional internal pump*
- *Shutter type on / off switch*
  - *Pump does not draw power when off*
  - *G999 operates in diffusion when pump off*



# Advantages compared to G450, G460 and MP-2 pump

- **Datalogger**
  - Datalogging standard
  - Up to 12 measured values recorded simultaneously
  - 30,000 logged intervals in on-board memory
- **Communication**
  - Optional ISM RF wireless
  - Wired PC communication (through cradle) up to 3 times faster
  - IrDA interface is now part of the basic equipment
  - Bluetooth optional (near future)



# Optional ISM wireless RF communication

- **General information**
  - *Wireless RF option must be specified at time of purchase – cannot be added later*
  - *Use plug-in RF dongle for laptop base station, or*
  - *Use TeamLink server for complete 1 – 10 unit local system (no computer required)*
- **915MHz wireless module**
  - *For use in the USA and Canada*
  - *Without channel selection due to frequency hopping*
  - *Range approx. 1000 feet (300m) line of sight (data transfer rate 38,400 baud)*
- **868MHz wireless module**
  - *For use in Europe and (some) countries in Latin America*
  - *Channel selection: 101...111 and 129...132 (in the 50kHz grid)*
  - *Range approx. 2,300 feet (700 meter) line of sight (data transfer rate 2400 baud)*

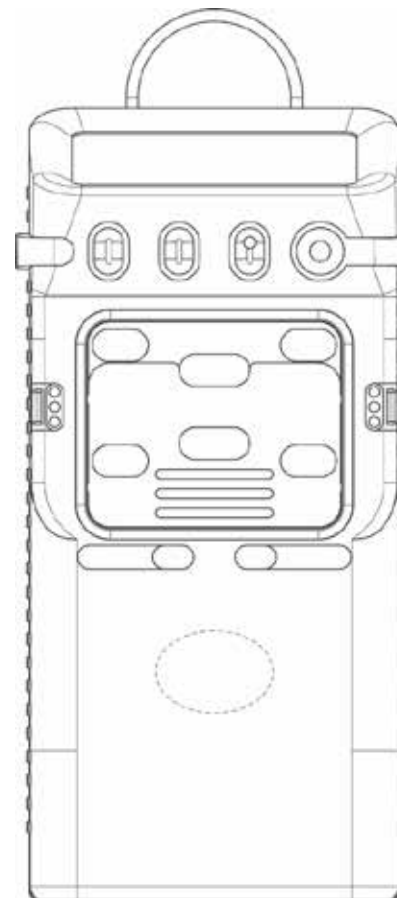
# Operation time per charge depends on configuration

- **G888 examples**

- approx. 13h EC+CC+IR
- approx. 14h EC+CC+915 MHz wireless
- approx. 23h EC+CC
- approx. 24h EC+IR
- approx. 26h EC+915 MHz wireless
- approx. 65h EC

- **G999 examples**

- approx. 17h EC+IR + Pump
- approx. 20h EC+CC+IR+915 MHz wireless
- approx. 22h EC+PID+IR+915 MHz wireless
- approx. 25h EC+WT
- approx. 26h EC+CC+IR
- approx. 52h EC+915 MHz wireless
- approx. 130h EC





## Wireless data link for 4 and 10 gas detectors

- Clone display of any instrument in network
- Display for gas alarm, measured value and man-down
- Data forwarding to base station
- LED panel for a quick overview
- Future version: Communication with base station via GSM



## Advantages of the basing TeamLink on G999

- Shares same power supply, display and other components (making certification easier)
- Same charger cradle
- Same leather holster



## *Wirelessly integrated fixed and portable systems*

*Fixed gas transmitters equipped with WILAN or ISM RF gateways*

*Realtime readings from fixed and portable instruments displayed on same monitor or PLC*



# G888 / G999 Visualization Software

## General

- *Display of online measured gas from up to 20 devices on the PC*
- *Sending short messages to G888 / G999 users (pager function)*
- *Simulation of G888 / G999 measurements for training purposes*



## Hardware Requirements

- *Android tablet or smart phone, or Windows laptop or desktop PC*
- *915MHz-USB dongle for laptop base station (868MHz-USB dongle for Europe)*
- *G888/G999 with corresponding wireless modules*



# G888 / G999 Visualization Software

Configuration Options Info  
www.GIG.biz  
6/29/2018 4:44:10 PM  
Online

Navigation  
Overview  
888No Deck  
Matti (RF-ID 38)  
Stephen (RF-ID 45)  
**Peter (RF-ID 83)**  
Michael (RF-ID 98)

G999C SN:17091383  
Peter (RF-ID 83) Data received: 6/29/2018 4:44:11 PM

Sen	Measuring value	Unit, Gas	Details
EC1	0.0	ppm, H2S (Hydrogen sulfide)	OK
EC2	0	ppm, CO (Carbon monoxide)	OK
EC3	20.9	Vol.% O2 (Oxygen)	OK
CC	0.0	%LEL, CH4 (Methane)	OK
BE1	0.08	Vol.% CO2 (Carbon dioxide)	OK

Log  
Time Message

Configuration

Configuration Options Info  
www.GIG.biz  
6/29/2018 4:44:59 PM  
Online

Navigation  
Overview  
**888No Deck**  
Matti (RF-ID 38)  
Stephen (RF-ID 45)  
**Peter (RF-ID 83)**  
Michael (RF-ID 98)

G999C SN:17091383  
Peter (RF-ID 83) Data received: 6/29/2018 4:44:59 PM

Sen	Measuring value	Unit, Gas	Details
EC1	0.0	ppm, H2S (Hydrogen sulfide)	OK
EC2	0	ppm, CO (Carbon monoxide)	OK
EC3	18.8	Vol.% O2 (Oxygen)	ALL
CC	0.0	%LEL, CH4 (Methane)	OK
BE1	1.14	Vol.% CO2 (Carbon dioxide)	ALL, AL2

00:00 Minutes since last movement

Log  
Time Message

Configuration

Configuration Options Info  
www.GIG.biz  
6/29/2018 4:50:46 PM  
Online

Navigation  
Overview  
**888No Deck**  
Matti (RF-ID 38)  
**Peter (RF-ID 83)**  
Michael (RF-ID 98)

G999C SN:17091383  
Peter (RF-ID 83) Data received: 6/29/2018 4:50:46 PM

Sen	Measuring value	Unit, Gas	Details
EC1	0.0	ppm, H2S (Hydrogen sulfide)	OK
EC2	0	ppm, CO (Carbon monoxide)	OK
EC3	16.5	Vol.% O2 (Oxygen)	ALL, AL2
CC	0.0	%LEL, CH4 (Methane)	OK
BE1	1.35	Vol.% CO2 (Carbon dioxide)	ALL, AL2

00:00 Minutes since last movement

Log  
Time Message

Configuration

Configuration Options Info  
www.GIG.biz  
6/29/2018 5:09:52 PM  
Online

Navigation  
Overview  
**888No Deck**  
Matti (RF-ID 38)  
**Peter (RF-ID 83)**  
Michael (RF-ID 98)

G999C SN:17091383  
Peter (RF-ID 83) Last Data received: 6/29/2018 5:09:15 PM

Sen	Measuring value	Unit, Gas	Details
EC1	0.0	ppm, H2S (Hydrogen sulfide)	Device not available
EC2	0	ppm, CO (Carbon monoxide)	Device not available
EC3	20.9	Vol.% O2 (Oxygen)	Device not available
CC	0.0	%LEL, CH4 (Methane)	Device not available
BE1	0.87	Vol.% CO2 (Carbon dioxide)	Device not available

Log  
Time Message

Configuration

## GfG Instrumentation

*Best cost of ownership in the gas detection industry!*

*Very competitively priced, especially compared to BW, RAE and MSA!*

*Typical MSRP pricing examples:*



**G450 4 gas**  
**Alkaline: \$755.00**  
**NiMH: \$825.00**

**G460 5 gas**  
**(O<sub>2</sub> / LEL / CO / H<sub>2</sub>S / SO<sub>2</sub>)**  
**Alkaline: \$1220.00**  
**NiMH: \$1340.00**

**G888 four gas**  
**NiMH: \$995.00**

**G999 four gas**  
**Pumped**  
**NiMH: \$1395.00**

# Support Materials on [www.goodforgas.com](http://www.goodforgas.com)

## Comparative features GfG portables

Product Comparison: GfG G450 and G460 vs. G888 and G999 Multi-Sensor Gas Detectors

				
	GfG G450	GfG G460	GfG G888	GfG G999
Size	75 X 110 X 55 mm	75 X 110 X 55 mm	68 X 100 X 39 mm	68 X 136 X 39
Weight (depending on configuration)	280 g	280 g	250 – 275 g	350 - 395 g
Standard Warranty: Instrument	Lifetime*	Lifetime*	Lifetime*	Lifetime*
Buttons	3	3	3	3
Number of gases measured	1 - 4	1 – 6	1 – 7	1 – 7
<b>Sensor warranty and expected life</b>				
CC LEL	3-year (5 year expected)	3-year (5 year expected)	3-year (5 year expected)	3-year (5 year expected)
O <sub>2</sub>	3-year (fuel cell)	5-year (lead free)	5-year (lead free)	5-year (lead free)
CO	3-year (5 year expected)	3-year (5 year expected)	3-year (5 year expected)	3-year (5 year expected)
H <sub>2</sub> S	3-year (5 year expected)	3-year (5 year expected)	3-year (5 year expected)	3-year (5 year expected)
IR LEL / IR CO <sub>2</sub>	NA	3-year (5 year expected)	3-year (5 year expected)	3-year (5 year expected)

# Support Materials on [www.goodforgas.com](http://www.goodforgas.com)

## Comparative features GfG portables

Page 2

	GfG G450	GfG G460	GfG G888	GfG G999
IP Rating	IP67	IP67	IP67	IP67
Housing	Polycarbonate w/ protective over-mold	Polycarbonate w/ protective over-mold	Polycarbonate w/ protective over-mold	Polycarbonate w/ protective over-mold
<b>Display</b>				
Top-mounted display	Yes	Yes	Yes	Yes
Display Size	Large	Large	Large	Large
Built-in zoom function for readings	Yes	Yes	Yes	Yes
Display changes color to indicate alarm	Yes	Yes	Yes	Yes
<b>Battery and charging options</b>				
Rechargeable battery technology	Nickel Metal Hydride (NiMH)	Nickel Metal Hydride (NiMH)	Nickel Metal Hydride (NiMH)	Nickel Metal Hydride (NiMH)
Alkaline battery option	Yes	Yes	No	No
Interchangeable battery packs	Yes: Alkaline and NiMH	Yes: Alkaline and NiMH	No	No
Internal battery pack	No	No	Yes	Yes
Charging time	6 hrs. (from completely depleted)	6 hrs. (from completely depleted)	6 hrs. (from completely depleted)	8 hrs. (from completely depleted)
Charging cradle (110 – 240 VAC)	Standard with NiMH	Standard with NiMH	Optional	Standard
USB charging via calibration cap	No	No	Yes	No
<b>Run time (for typical sensor configurations)</b>				
CC LEL / 3-yr O <sub>2</sub> / CO / H <sub>2</sub> S	20 hours	20 hours	23 hours	47 hours
CC LEL / 5-yr O <sub>2</sub> / CO / H <sub>2</sub> S	NA	20 hours	23 hours	47 hours
IR LEL / 5-yr O <sub>2</sub> / CO / H <sub>2</sub> S / H <sub>2</sub>	NA	24 hours	23 hours	47 hours
IR LEL / IR CO <sub>2</sub> / 5-yr O <sub>2</sub> / COSH / H <sub>2</sub>	NA	20 hours	23 hours	47 hours
IR LEL / IR CO <sub>2</sub> / 5-yr O <sub>2</sub> / PID / COSH / H <sub>2</sub>	NA	9 hours	NA	24-hour

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## Comparative features GfG portables

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	GfG G450	GfG G460	GfG G888	GfG G999
Built-in flashlight LED	Yes: Optional	Yes: Optional	Yes: Standard	Yes: Standard
Docking Station	Yes	Yes	Yes	Yes
<b>Alarms</b>				
Audible alarm	103 dB @ 30 cm	103 dB @ 30 cm	103 dB @ 30 cm	103 dB @ 30 cm
Vibrating alarm	Yes	Yes	Yes	Yes
Red / green Bump / Cal status LED	No	No	Yes	Yes
<b>Data-logging</b>				
On-board data storage	1800 intervals	1800 intervals	30,000 intervals	30,000 intervals
<b>Motorized remote sampling pump</b>				
Optional internal motorized pump	No	No	No	Yes
Optional attachable self-powered pump	Yes	Yes	No	No
Operable in diffusion w pump attached	Yes	Yes	NA	Yes
Pump draw	100 m	100 m	NA	100 m
<b>Real-time wireless communication</b>				
Wireless communication method	NA	NA	License free 915 MHz ISM RF	License free 915 MHz ISM RF
Wireless communication distance	NA	NA	300 m	300 m

\* Lifetime warranty on instrument, electronics and non-consumed components. Batteries and components that are consumed in normal operation are warranted for two years.



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## Product by Product Comparisons

### Product Comparison: MSA Altair 4XR vs. GfG G888 and GfG G999 Multi-Sensor Gas Detectors

			
	MSA Altair 4XR	GfG G888	GfG G999
Size	112 X 76 X 35 mm	68 X 100 X 39 mm	68 X 136 X 39
Weight (depending on configuration)	228 g	250 – 275 g	350 - 395 g
Standard Warranty: Instrument	4-Year	Lifetime*	Lifetime*
Buttons	3	3	3
Maximum sensors	3	5	5
Measurement channels	Up to 4	Up to 7	Up to 7
Individual sensors for simultaneous CO and H2S	No: Only dual channel COSH)	Yes: Individual or dual channel COSH	Yes: Individual or dual channel COSH

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## Product by Product Comparisons

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	MSA Altair 4XR	GfG G888	GfG G999
IP Rating	IP 67	IP 67	IP 67
Housing	Polycarbonate w rubberized boot	Polycarbonate w rubberized boot	Polycarbonate w rubberized boot
Operating temperature range (continuous)	- 20 to +50 °C	- 20 to +50 °C	- 20 to +50 °C
Operating temperature range (short term)	- 40 to +50 °C	- 40 to +50 °C	- 40 to +50 °C
Humidity	15-90% RH (non-condensing) continuous; 5 - 95% intermittent	5 - 95% RH (non-condensing) continuous	5 - 95% RH (non-condensing) continuous
Atmospheric pressure	800 mbar - 1200 mbar	800 mbar - 1200 mbar	800 mbar - 1200 mbar
<b>Display</b>			
Top-mounted display	No	Yes	Yes
Display Size	Large	Large	Large
Built-in zoom function for readings	No	Yes	Yes
Display changes color to indicate alarm	No	Yes	Yes
Built-in display back-light	Yes	Yes	Yes
<b>Battery and charging options</b>			
Rechargeable battery technology	Lithium polymer (Li <sup>+</sup> Ion)	Nickel Metal Hydride (NiMH)	Nickel Metal Hydride (NiMH)
Alkaline battery option	Yes	No	No
Charging time	4 hrs.	6 hrs. (from completely depleted)	8 hrs. (from completely depleted)
Charging cradle (110 - 240 VAC)	Optional	Optional	Standard
Charging via plug in adapter	Yes	No	No
Charging via calibration cap with USB cell phone power adapter	No	Yes	No

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## Product by Product Comparisons

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	MSA Altair 4XR	GfG G888	GfG G999
<b>Run time (for typical sensor configurations)</b>			
CC LEL / lead-free O <sub>2</sub> / dual channel COSH	24 hrs. (22 hrs. when Bluetooth® on)	23 hours	47 hours
CC LEL / lead-free O <sub>2</sub> / CO / H <sub>2</sub> S	NA	23 hours	47 hours
IR LEL / lead-free O <sub>2</sub> / CO / H <sub>2</sub> S / H <sub>2</sub>	NA	23 hours	47 hours
IR LEL / IR CO <sub>2</sub> / lead-free O <sub>2</sub> / CO / H <sub>2</sub> S / H <sub>2</sub>	NA	23 hours	47 hours
IR LEL / IR CO <sub>2</sub> / lead-free O <sub>2</sub> / PID / COSH / H <sub>2</sub>	NA	NA	24-hour
IR LEL / IR CO <sub>2</sub> / lead-free O <sub>2</sub> / CO / H <sub>2</sub> S / NO <sub>2</sub>	NA	23 hours	47 hours
<b>Sensor warranty and expected life</b>			
CC LEL	4-year (5 year expected)	3-year (5 year expected)	3-year (5 year expected)
Lead-free O <sub>2</sub>	4-year (5 year expected)	5-year	5-year
IR LEL / IR CO <sub>2</sub>	NA	3-year (5 year expected)	3-year (5 year expected)
Dual-channel CO/H <sub>2</sub> S (COSH)	4-year (5 year expected)	3-year (5 year expected)	3-year (5 year expected)
CO	NA	3-year (5 year expected)	3-year (5 year expected)
H <sub>2</sub> S	NA	3-year (5 year expected)	3-year (5 year expected)
NO <sub>2</sub>	4-year (only available as dual-channel CO/NO <sub>2</sub> sensor)	3-year	3-year
SO <sub>2</sub>	4-year (only available as dual-channel H <sub>2</sub> S/SO <sub>2</sub> sensor)	2-year (3 year expected)	2-year (3 year expected)
PID	NA	NA	PID sensor: lifetime, PID lamp: 2 yr.
H <sub>2</sub> , Cl <sub>2</sub> , ClO <sub>2</sub> , EtO, HCN, NO, PH <sub>3</sub>	NA	2-year	2-year
NH <sub>3</sub> , HF, HCl, O <sub>3</sub>	NA	1-year (2-year expected)	1-year (2-year expected)

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## Product by Product Comparisons

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	MSA Altair 4XR	GfG G888	GfG G999
Built-in flashlight LED	No	Yes	Yes
Docking Station	Yes	Yes	Yes
<b>Alarms</b>			
Audible alarm	95 dB @ 30 cm	103 dB @ 30 cm	103 dB @ 30 cm
Vibrating alarm	Yes	Yes	Yes
Red / green Bump / Cal status indicator	Yes	Yes	Yes
<b>Data-logging</b>			
On-board data storage	3,000 intervals	30,000 intervals	30,000 intervals
<b>Motorized remote sampling pump</b>			
Optional internal remote sampling pump	No	No	Yes
Optional attachable remote sampling pump	Yes	No	No
Operable in diffusion while pump installed	No	NA	Yes
Pump draw	45 m	NA	100 m
<b>Real-time wireless communication</b>			
Wireless communication method	Bluetooth®	License free 915 MHz ISM RF	License free 915 MHz ISM RF
Maximum direct communication distance	10 m	300 m	300 m

\* Lifetime warranty on instrument, electronics and non-consumed components. Batteries and components that are consumed in normal operation are warranted for two years.

***Thanks for the opportunity to discuss  
what's going on at GfG, Inc!***