GfG Instrumentation

G888 / G999 product introduction

Bob Henderson
President
GfG Instrumentation, Inc.
1194 Oak Valley Drive, Suite 20
Ann Arbor, Michigan 48108

Toll free (USA and Canada): (800) 959-0329
Direct: +1-734-769-0573

Internet: www.goodforgas.com

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GfG Instrumentation

G888 / G999 product introduction

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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*

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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

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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 (Inteccon, Inc.)*

Need help?

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

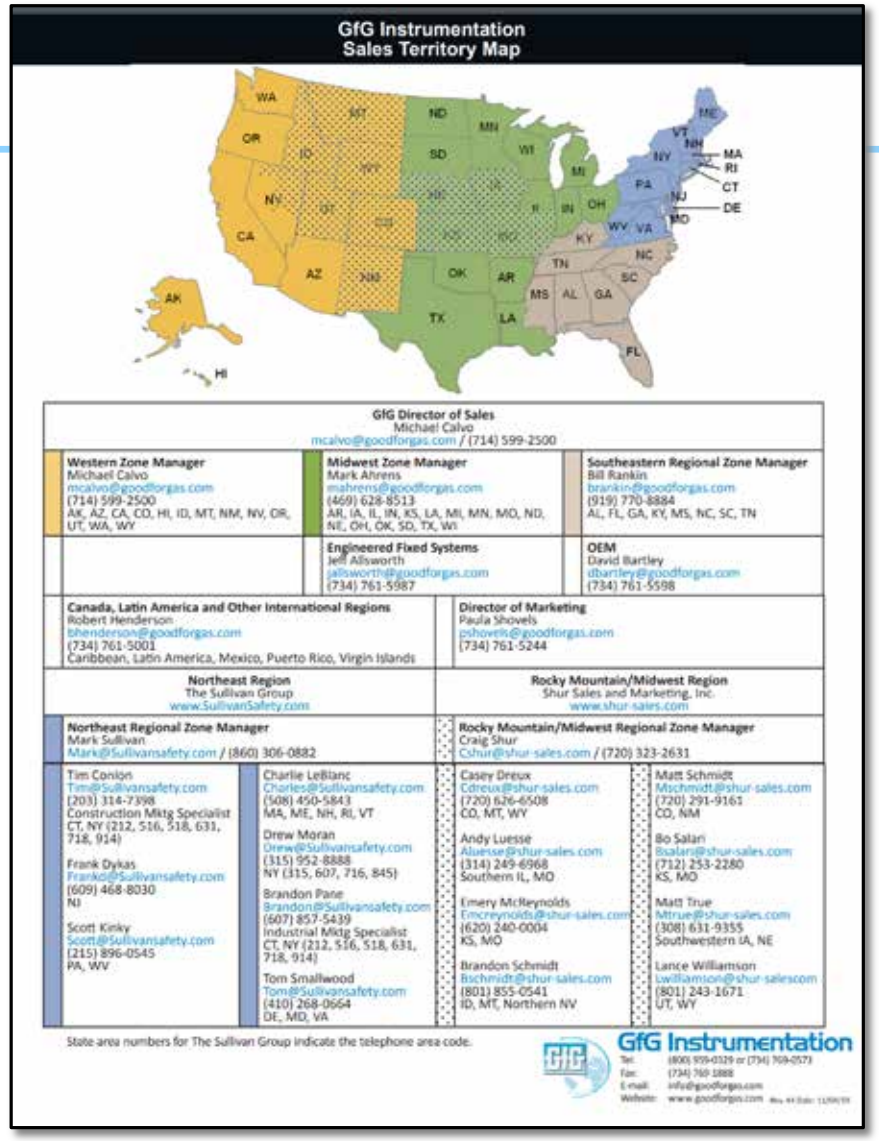
Direct: 1-734-769-0573

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



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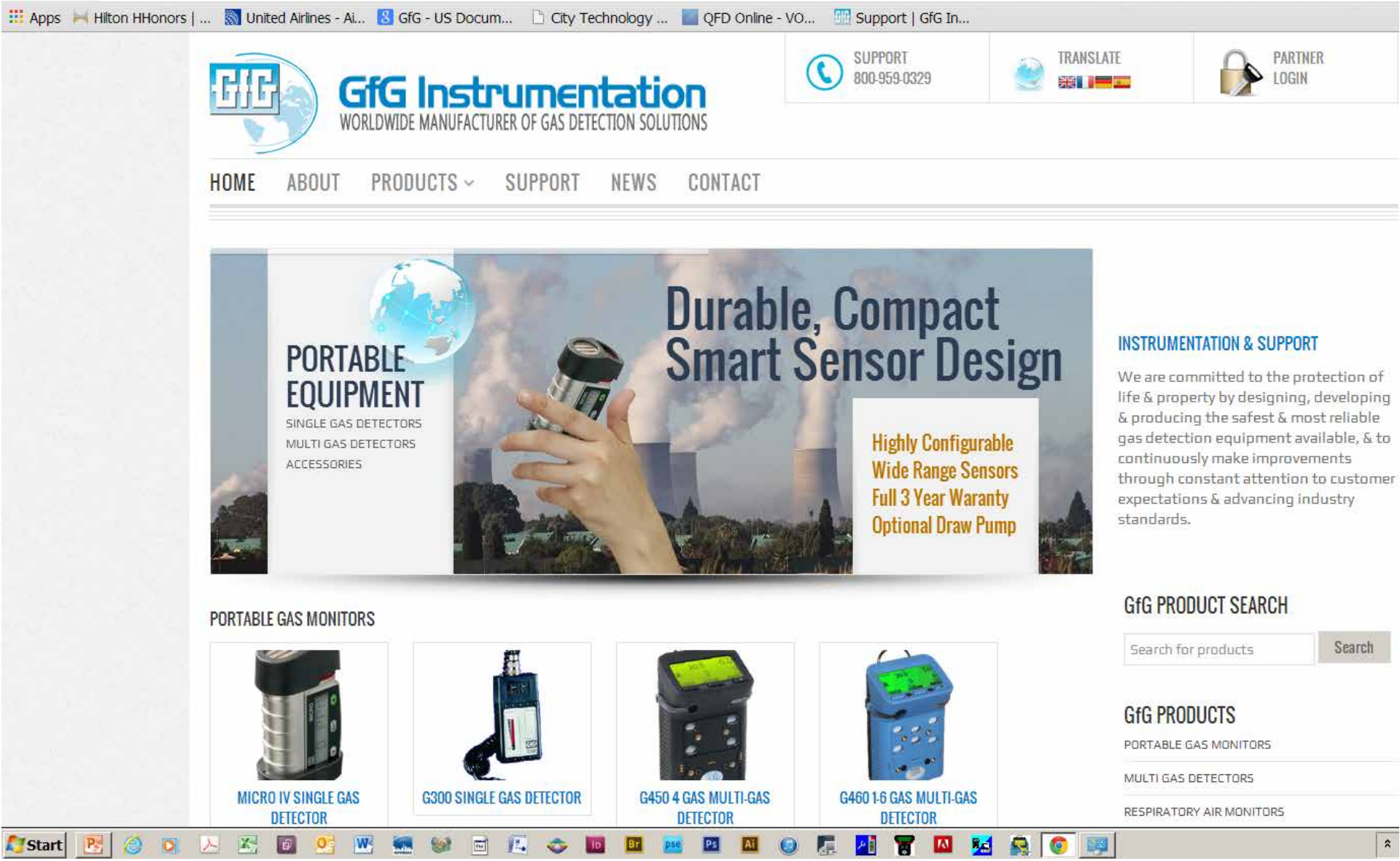
Channel strategy

- ***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*

www.Goodforgas.com website



Sales Support: www.Goodforgas.com

Data sheets

Price lists

Manuals

Software

Application Notes

Product comparisons

Presentations

Training videos

...and more!

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Technical support and downloads

- www.goodforgas.com
  - *Application Notes, Technical Notes and Presentations*
  - *Articles*
  - *Comprehensive library of gas detection resources*

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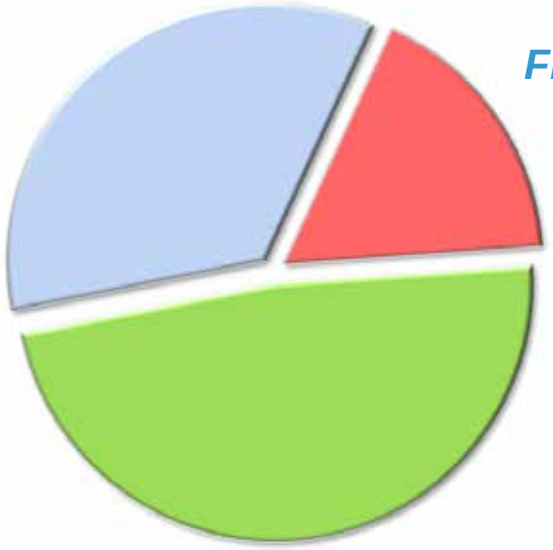
Sales by product category as percent total GfG, Inc. sales

RAM / Airline



Fixed

Portables

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Real-time Air Monitoring (RAM)

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

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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

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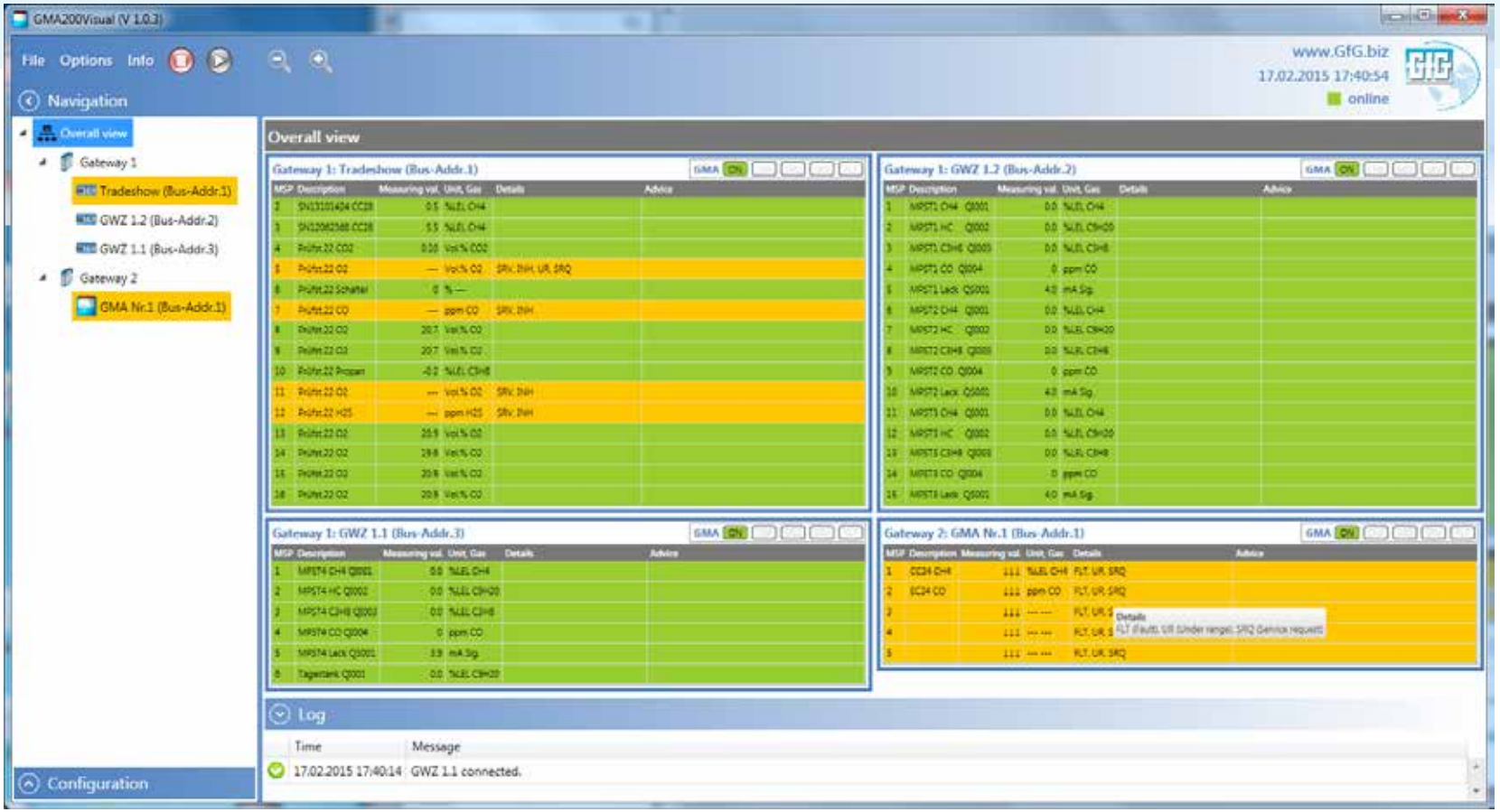
Wirelessly integrated fixed and portable systems

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



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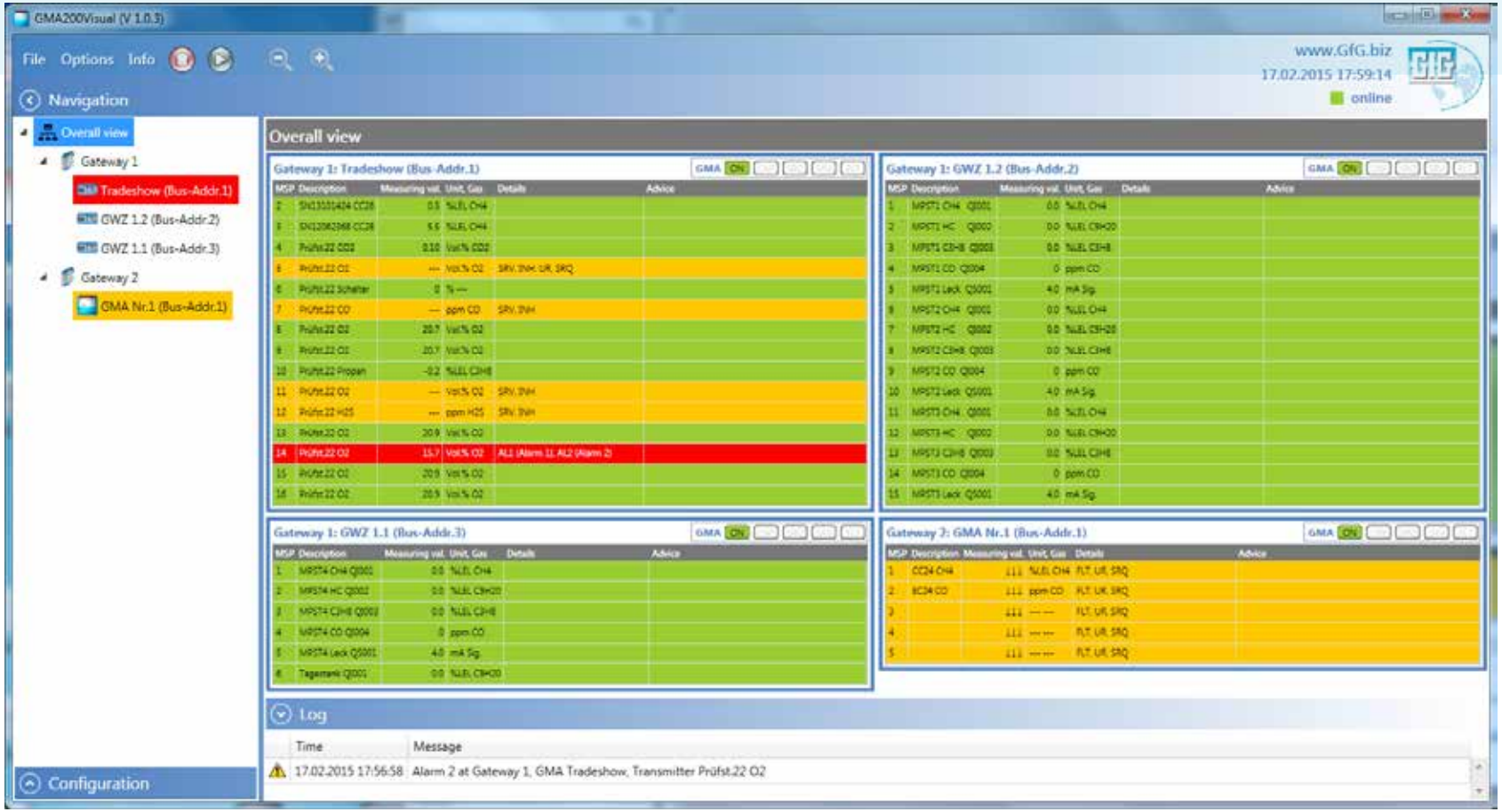
GMA200 Visualization Software

Overall system view with high alarm (alarm 2) condition



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Leading GfG portable gas detectors

Micro IV
single-gas detector

G450
4-gas detector

G460
1 - 7 gas detector

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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°C temperatures*

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G460 Multi-gas Monitor

- *Up to SEVEN channels detection*
- *Comprehensive range of interchangeable smart sensors:*
  - *O_2 standard warranty: 5-year*
  - *LEL, CO, H_2S: 3-year warranty*
  - *IR LEL gas: 3-year warranty*
  - *IR CO_2: 3-year warranty*
  - *Available with PID and wide selection of substance-specific toxic gas sensors*

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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!*

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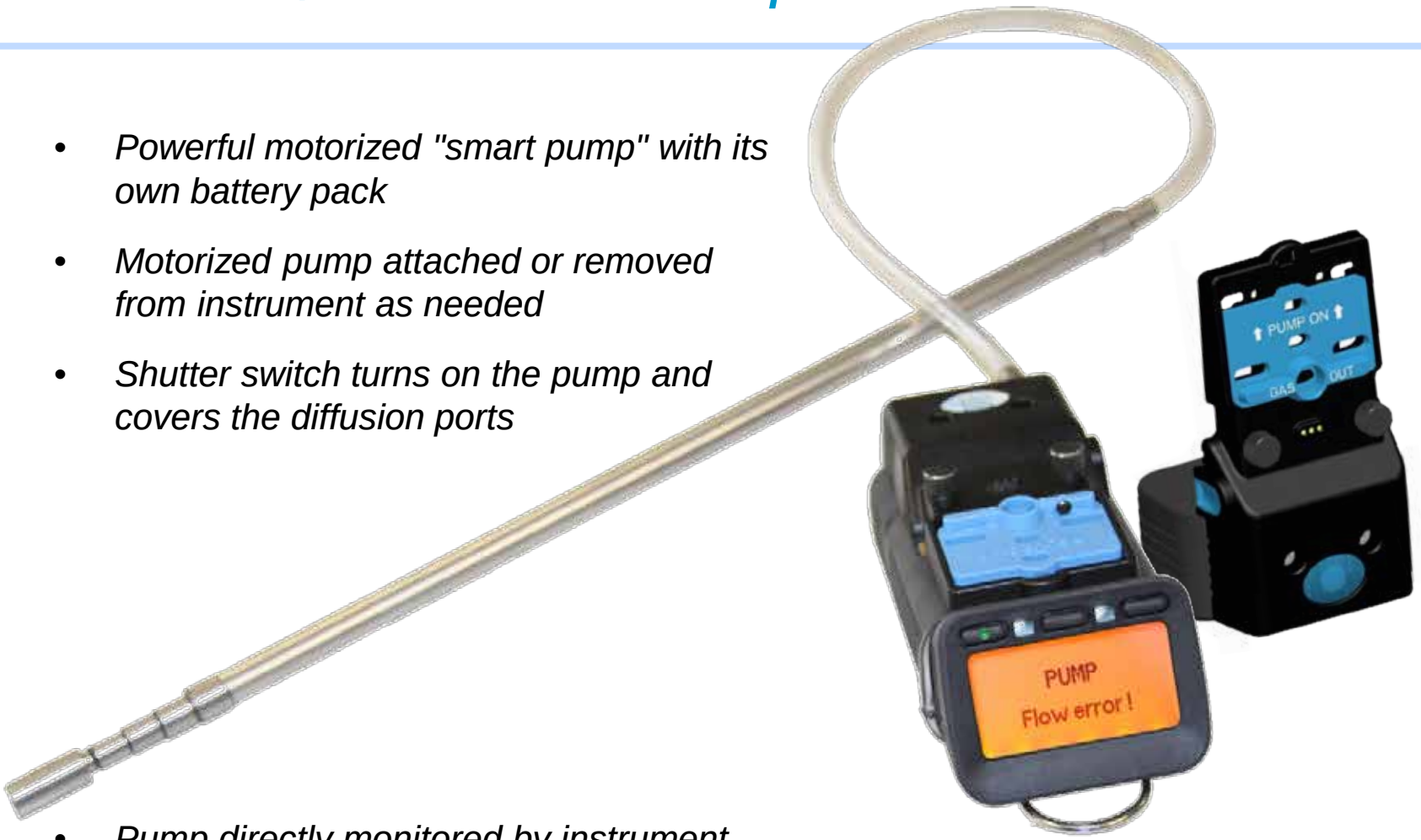
G450 / G460 Motorized Pump

- *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*

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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*

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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

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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 <u>how</u> to perform atmospheric monitoring*

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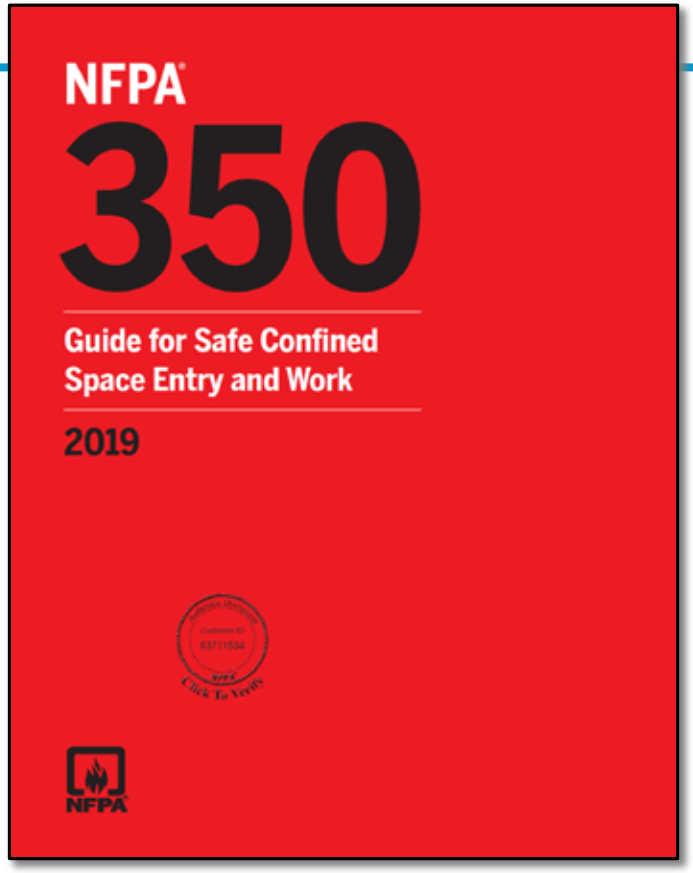
Calibration/Monitor Checks

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



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"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*

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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!*

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G450 ecoBump Kit

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 m... atmospheric monitoring of confined ... bump tested by the Gas Tester prior t... A bump test is a brief exposure of t... sensors to specified target gas(es) to ... alarm functionality."

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

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

The complete silkaine G450 ecoBump k... USD. The rechargeable G450 eco... includes a rechargeable battery pack, ... and 110-240 VAC power adapter) is onl...

G450 ecoBump Kits and Accessories

Part Number	Product	Price
G450-11410E	G450 ecoBump kit with alkaline G450 with O2, LEL, CO and H2S sensors, standard accessories, push-button regulator, cylinder of test gas and foam lined carrying case.	$895.00
G450-11420E	G450 ecoBump kit with rechargeable G450 with O2, LEL, CO and H2S sensors, charging cradle, wall 110 - 240 VAC wall power adapter, cylinder of test gas and foam lined carrying case.	$1125.00
1450-EXT6	Extended 6 year sensor warranty for all 4 G450 sensors (O2/LEL/CO/H2S)	$300.00
1450-921	G450 Motorized Smart pump with alkaline battery pack, with sample probe, filters and 50' sample tubing.	$375.00
1450266	Protective leatherette holster with carry strap for G450 instrument.	$75.00
7801-030	Replacement cylinder of ecoBump test gas with 200 ppm CO, 40 ppm H2S, 2.5% methane and 10% O2. (ecoBump test gas for bump testing only, not for span calibration adjustment).	$150.00

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

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

GfG Instrumentation, Inc.

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GfG Instrumentation

G888 / G999 product introduction

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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*

smart GasDetection Technologies

Compact size!

Almost one third smaller than G450 and G460

Smaller than most 4 gas personal instruments!

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Compact size!

Almost one third smaller than G450 and G460

Smaller than most 4 gas personal instruments!

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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

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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_2, NO_2, SO_2, H_2, etc.)

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Three color "Traffic Signal" display

Back lit, three-color, full graphics LCD

Top mounted display with wrap around (360º) 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*

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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

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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

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Charging times

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)*

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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*

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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

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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

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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

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GfG TeamLink Server

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

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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*
  - ***C**atalytic LEL sensors* — *CC*
  - *IR and dual IR sensors* — *IR1, IR2*
- ***G999C***
  - *Electrochemical sensors* — *EC1, EC2, EC3*
  - ***C**atalytic LEL sensors* — *CC, CC/TC*
  - *Dual Infrared sensors* — *IR1, IR2/IR3*
- ***G999P***
  - *Electrochemical sensors* — *EC1, EC2, EC3*
  - ***P**hotoionization sensor PID*
  - *IR and dual IR sensors* — *IR1, IR2/IR3*
- ***G999E***
  - ***E**lectrochemical sensors* — *EC1, EC2, EC3, **EC4***
  - *IR and dual IR sensors* — *IR1, IR2/IR3*

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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*

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Lead free O_2 sensor detection principle

- *Oxygen passively diffuses into sensor where it is converted into H_2O*
- *Power from instrument battery used to reverse the reactions and "pump" the O_2 back out*
- *Reactions:*

  Sensing: $O_2 + 4H^+ + 4e^- \longrightarrow 2\ H_2O$

  Counter: $2\ H_2O \longrightarrow O_2 + 4H^+ + 4e^-$

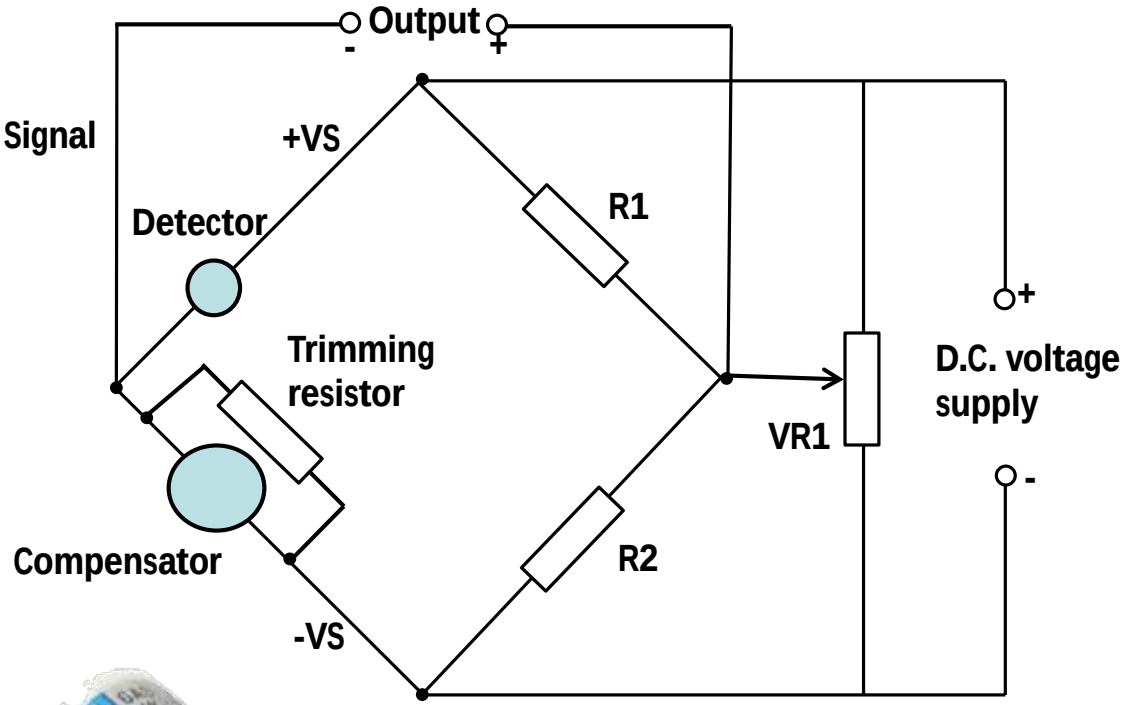
- *Amount electricity required to remove reaction product and return sensor to ground state (by generating O_2 at counter electrode) proportional to concentration of oxygen present*

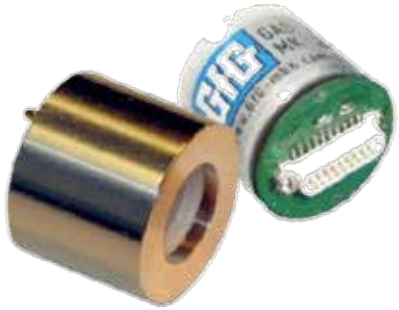
Lead free O_2 Sensor Advantages

- *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!*





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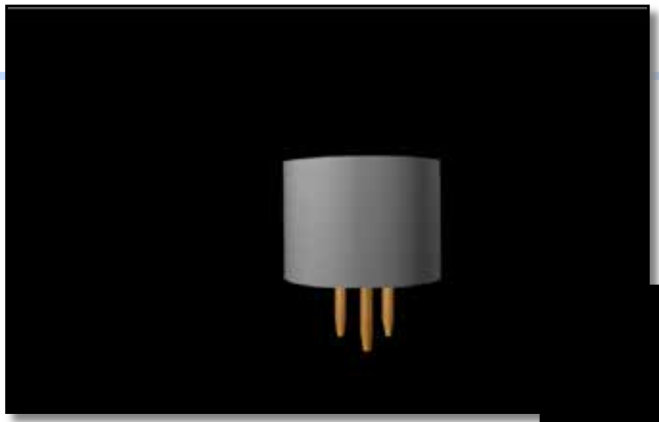
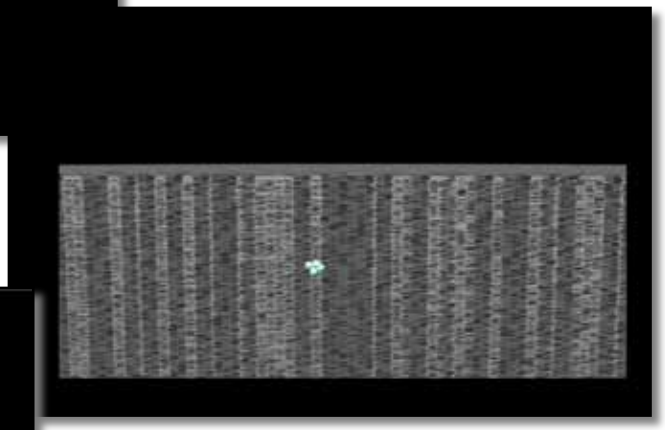
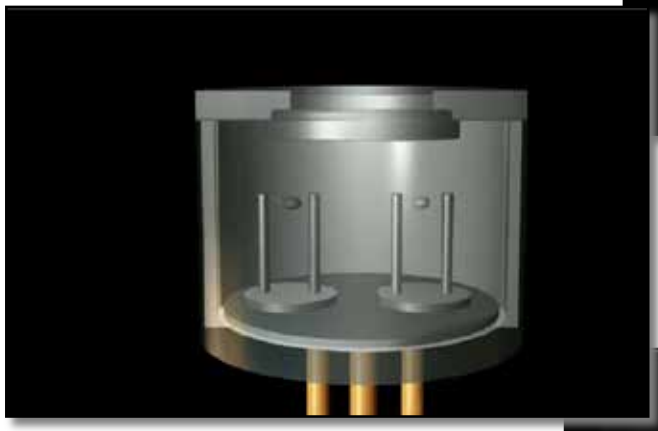
Catalytic Sensor Structure



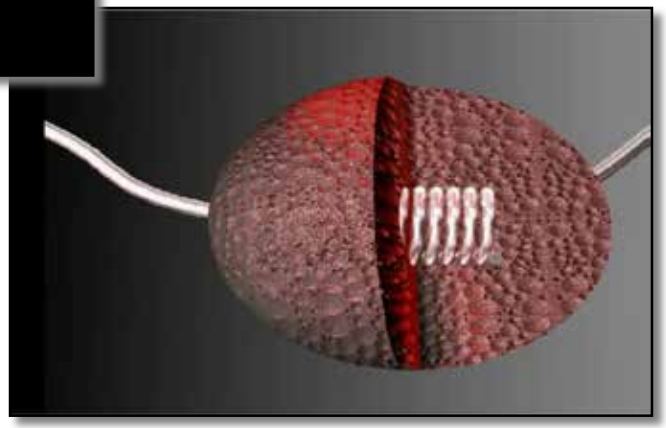
Catalytic combustion (CC) type LEL sensor is typically housed in robust, stainless steel flame proof enclosure



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:* $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

  To oxidize one molecule CH_4 *three molecules enter bead, and three molecules produced as by-products*

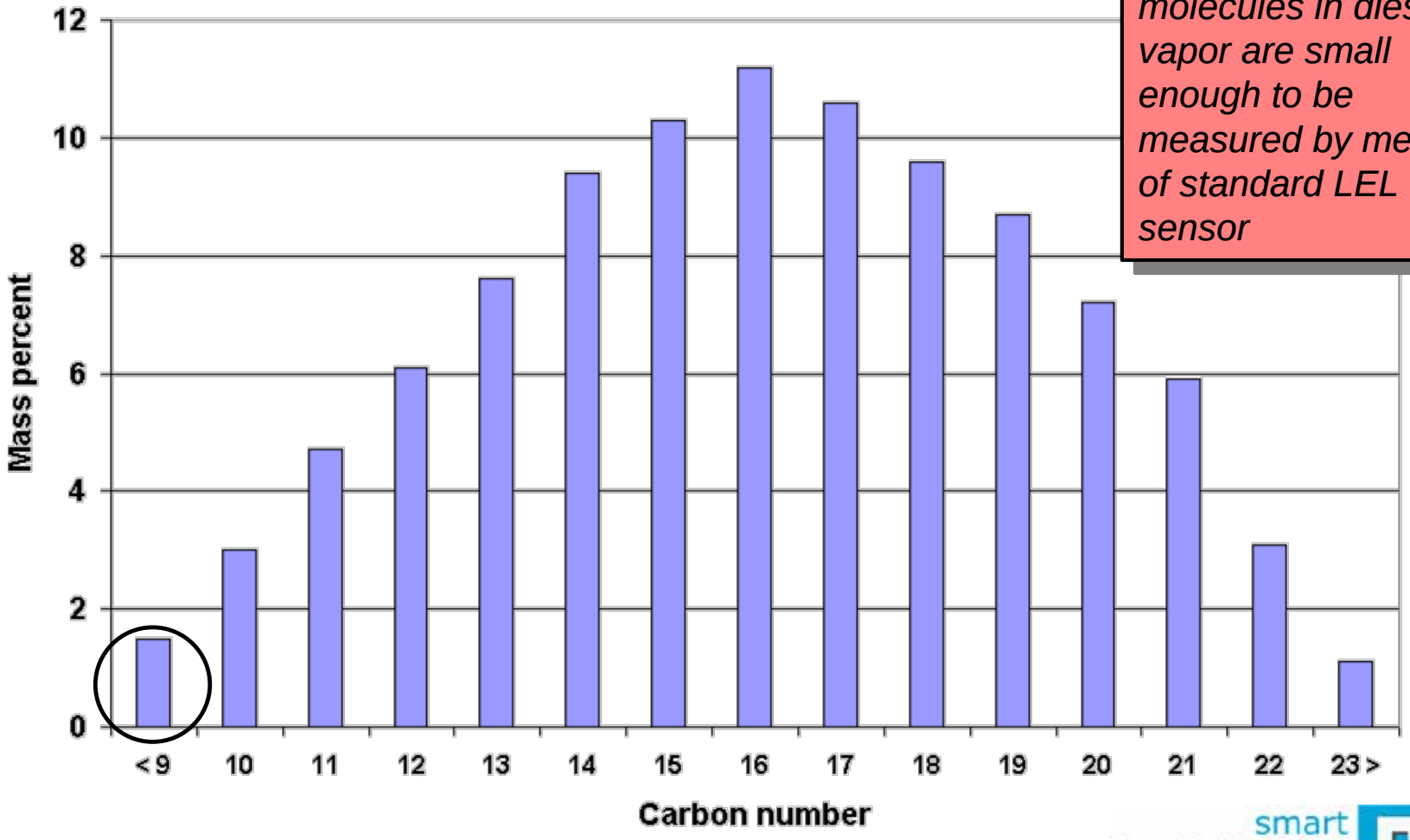
- *Oxidation of pentane:* $C_5H_{12} + 8O_2 \rightarrow 5CO_2 + 6H_2O$

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

- *Oxidation of nonane:* $C_9H_{20} + 14O_2 \rightarrow 9CO_2 + 10H_2O$

  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)



Less than 2% of molecules in diesel vapor are small enough to be measured by means of standard LEL sensor

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_2 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*

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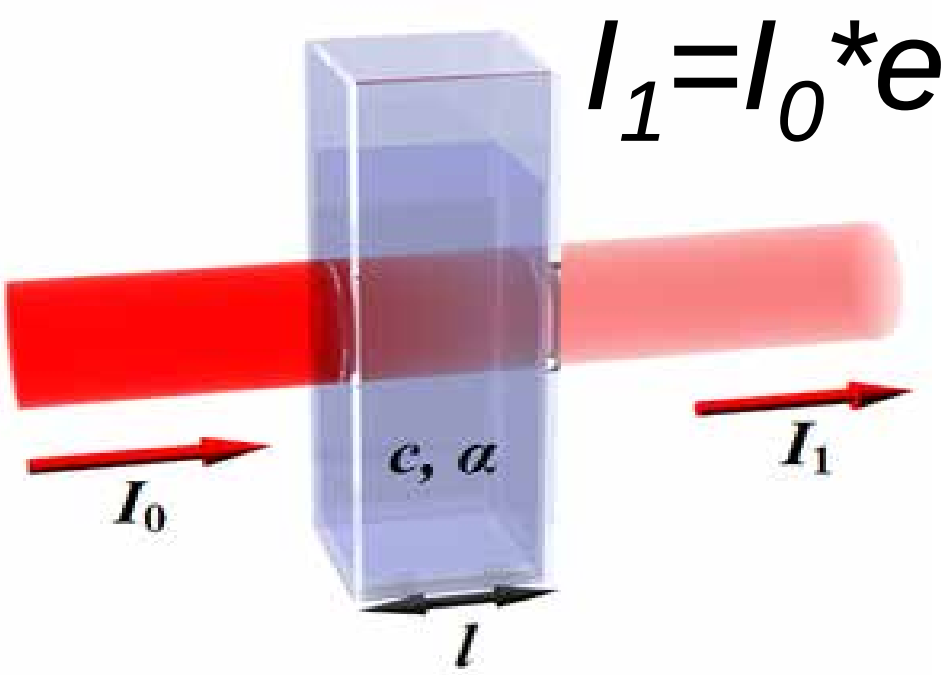
Combustible gas NDIR sensor advantages and limitations

- *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_2) 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



Optical path-length matters...

- 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*
- α *is the absorption coefficient or the molar absorptivity of the absorber*

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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[1]	Expected response at 20% LEL target gas[2]
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[3]	6% LEL to 26% LEL
Hydrogen	No response
Acetylene	No response

[1]For any gases not listed, please contact Honeywell Analytics to find the best solution for your application.

[2]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.

[3]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.

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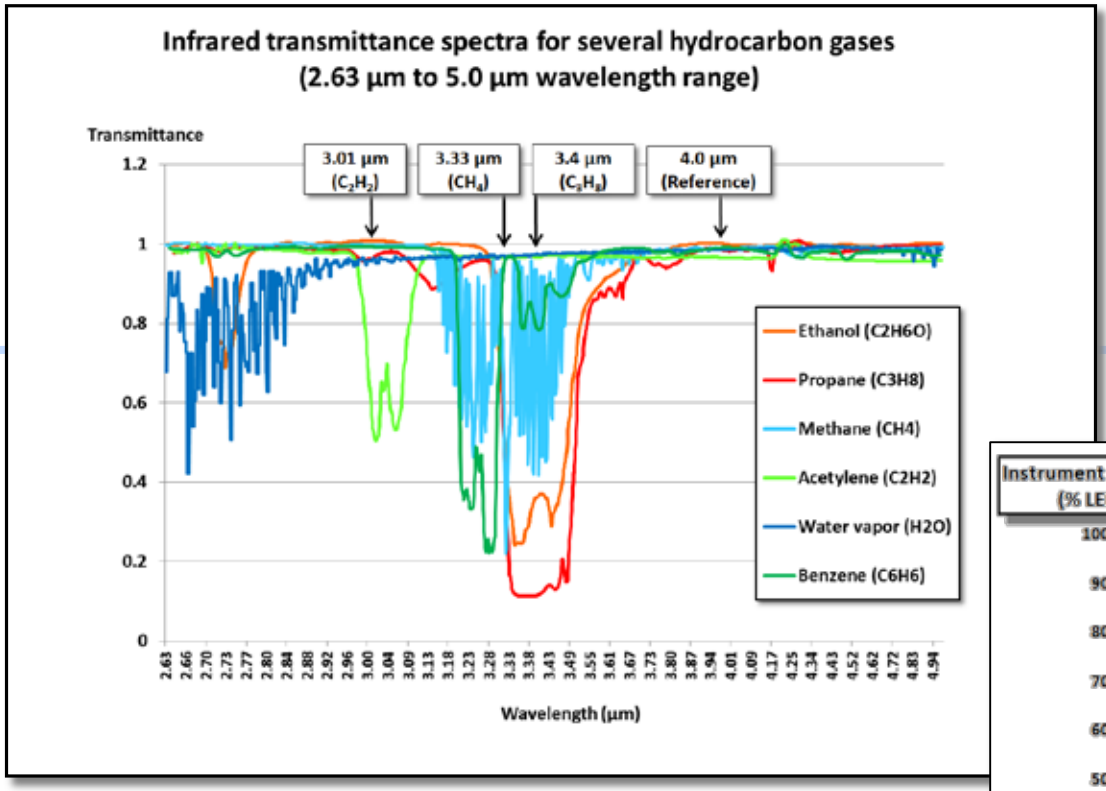
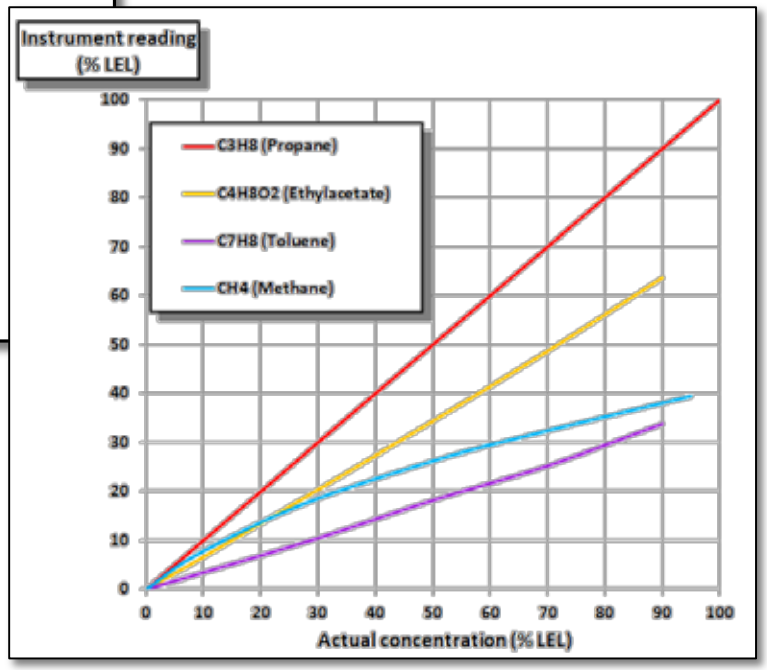


GfG has better IR LEL sensor with better software



- *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*

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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!*

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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 <u>double</u> the power*
  - *Optional internal pump*
  - *Shutter type on / off switch*
    - *Pump does not draw power when off*
    - *G999 operates in diffusion when pump off*

G888 G450 G460 G999

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)*

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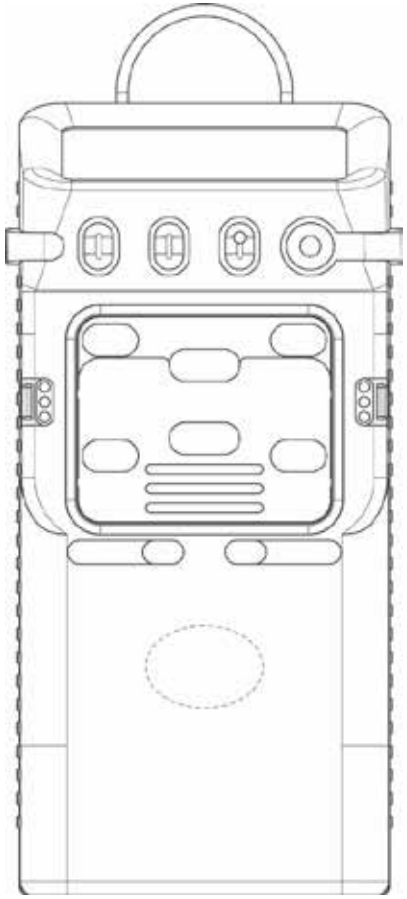
Optional ISM wireless RF communication

- ***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*



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TeamLink Server

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*

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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

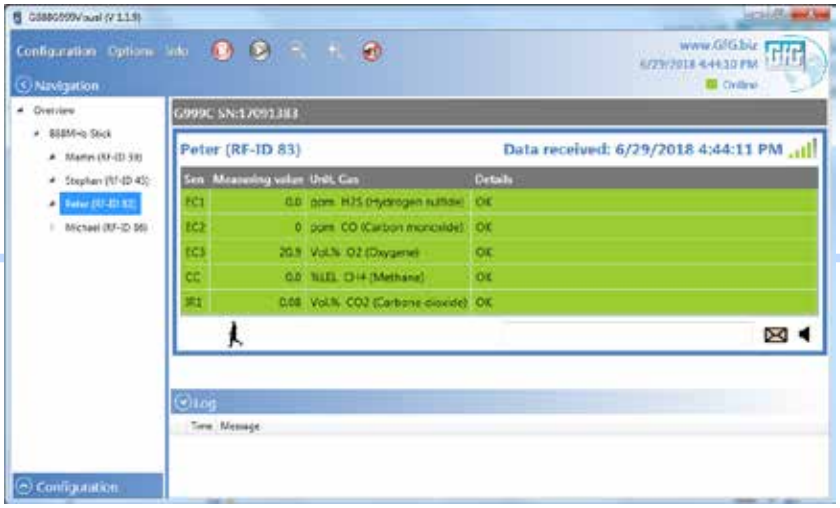
General

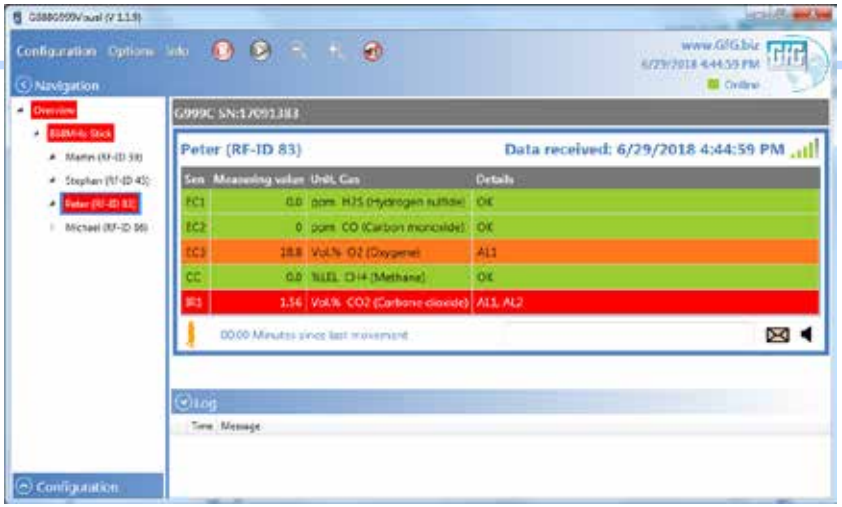
- *Display of online measured gas from up to 20 devices on the PC*
- *Sending short messages to G888 / G999 users (pager function)*
- *Simulation of G888 / G999 measurements for training purposes*

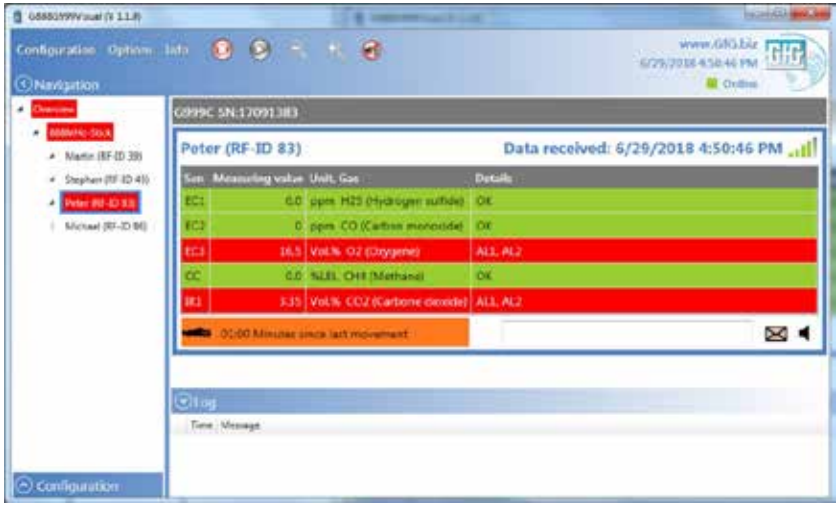
Hardware Requirements

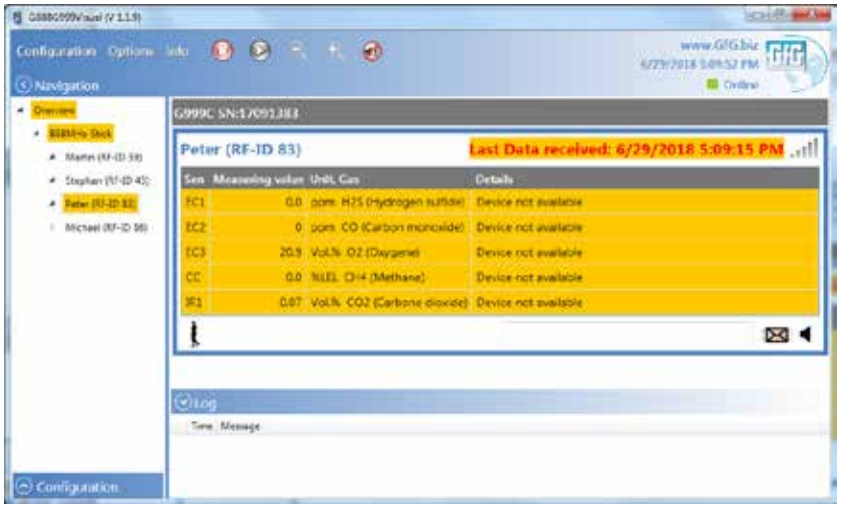
- *Android tablet or smart phone, or Windows laptop or desktop PC*
- *915MHz-USB dongle for laptop base station (868MHz-USB donngle for Europe)*
- *G888/G999 with corresponding wireless modules*

G888 / G999
Visualization Software









GfG Instrumentation

Best cost of ownership in the gas detection industry!

<u>Very</u> 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_2 / LEL / CO / H_2S/ SO_2)
Alkaline: $1220.00
NiMH: $1340.00

G888 four gas
NiMH: $995.00

G999 four gas
Pumped
NiMH: $1395.00

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
Sensor warranty and expected life				
CC LEL	3-year (5 year expected)	3-year (5 year expected)	3-year (5 year expected)	3-year (5 year expected)
O_2	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_2S	3-year (5 year expected)	3-year (5 year expected)	3-year (5 year expected)	3-year (5 year expected)
IR LEL / IR CO_2	NA	3-year (5 year expected)	3-year (5 year expected)	3-year (5 year expected)

	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
Display				
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
Battery and charging options				
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
Run time (for typical sensor configurations)				
CC LEL / 3-yr O_2 / CO / H_2S	20 hours	20 hours	23 hours	47 hours
CC LEL / 5-yr O_2 / CO / H_2S	NA	20 hours	23 hours	47 hours
IR LEL / 5-yr O_2 / CO / H_2S / H_2	NA	24 hours	23 hours	47 hours
IR LEL / IR CO_2 / 5-yr O_2 / COSH / H_2	NA	20 hours	23 hours	47 hours
IR LEL / IR CO_2 / 5-yr O_2 / PID / COSH / H_2	NA	9 hours	NA	24-hour

Support Materials on www.goodforgas.com
Comparative features GfG portables

	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
Alarms				
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
Data-logging	Standard	Standard	Standard	Standard
On-board data storage	1800 intervals	1800 intervals	30,000 intervals	30,000 intervals
Motorized remote sampling pump				
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
Real-time wireless communication	No	No	Yes	Yes
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 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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	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
Display			
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
Battery and charging options			
Rechargeable battery technology	Lithium polymer (Li^+ 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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	MSA Altair 4XR	GfG G888	GfG G999
Run time (for typical sensor configurations)			
CC LEL / lead-free O_2 / dual channel COSH	24 hrs. (22 hrs. when Bluetooth® on)	23 hours	47 hours
CC LEL / lead-free O_2 / CO / H_2S	NA	23 hours	47 hours
IR LEL / lead-free O_2 / CO / H_2S / H_2	NA	23 hours	47 hours
IR LEL / IR CO_2 / lead-free O_2 / CO / H_2S / H_2	NA	23 hours	47 hours
IR LEL / IR CO_2 / lead-free O_2 / PID / COSH / H_2	NA	NA	24-hour
IR LEL / IR CO_2 / lead-free O_2 / CO / H_2S / NO_2	NA	23 hours	47 hours
Sensor warranty and expected life			
CC LEL	4-year (5 year expected)	3-year (5 year expected)	3-year (5 year expected)
Lead-free O_2	4-year (5 year expected)	5-year	5-year
IR LEL / IR CO_2	NA	3-year (5 year expected)	3-year (5 year expected)
Dual-channel CO/H2S (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_2S	NA	3-year (5 year expected)	3-year (5 year expected)
NO_2	4-year (only available as dual-channel CO/NO_2 sensor)	3-year	3-year
SO_2	4-year (only available as dual-channel H_2S/SO_2 sensor)	2-year (3 year expected)	2-year (3 year expected)
PID	NA	NA	PID sensor: lifetime, PID lamp: 2 yr.
H_2, Cl_2, ClO_2, EtO, HCN, NO, PH_3	NA	2-year	2-year
NH_3, HF, HCl, O_3	NA	1-year (2-year expected)	1-year (2-year expected)

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Support Materials on www.goodforgas.com
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
Alarms			
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
Data-logging	Standard	Standard	Standard
On-board data storage	3,000 intervals	30,000 intervals	30,000 intervals
Motorized remote sampling pump			
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
Real-time wireless communication			
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.

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