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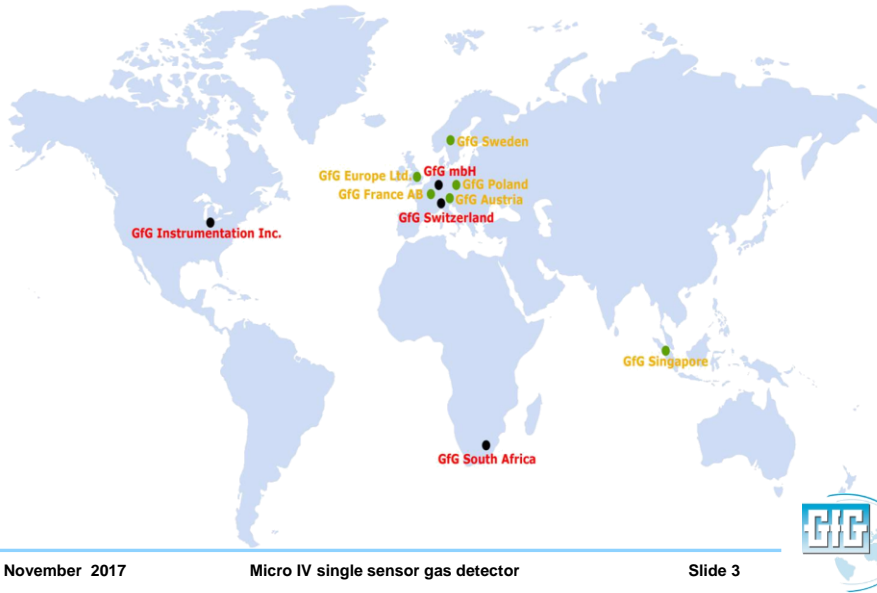


GfG Instrumentation

*World-wide manufacturer of
gas detection solutions*



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



November 2017

Micro IV single sensor gas detector

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GfG Instrumentation mbH



- ***Worldwide headquarters in Dortmund, Germany***
- ***An industry leader in development and production of gas measurement technology for over 50 years***
- ***Founded in 1961***
- ***Over 300 employees worldwide in 2012***

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Micro IV single sensor gas detector

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GfG Instrumentation, Inc.



- **Headquarters in Ann Arbor, Michigan, USA**
- **Responsible for manufacturing, design, and sales support for North and South America**
- **Originally founded in 1963 as Dynamation, Inc.**

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Micro IV single sensor gas detector

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GfG Instrumentation

Exceptional designs with best cost of ownership in the gas detection industry



September 12, 2014

GfG Instrumentation company overview

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GfG Product Applications



- *Confined space*
- *Fire Service*
- *Emergency response*
- *Oil industry*
- *Chemical industry*
- *Steel industry*
- *Water / waste water*
- *Sewer entry*
- *Telecommunications*
- *Municipal departments*
- *Refrigeration systems*
- *Power generation*
- *Pulp and paper*



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Micro IV single sensor gas detector

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Portable gas detectors



**Micro IV
single-gas
detector**



**G450
4-gas
detector**



**G460
1 - 6 gas
detector**



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Micro IV single sensor gas detector

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MICRO IV Single Sensor Gas Detector

- **Compact and affordable single gas detector**
- **Available for wide range of toxic gases, hydrogen or oxygen**
- **Stores long-term and short-term average values (TWA, STEL)**
- **Event logger standard**
- **Data logger standard**
- **Display backlight standard**
- **Vibrator alarm standard**
- **IR Communication Interface**



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Micro IV single sensor gas detector

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MICRO IV Single Sensor Gas Detector

- **Small and lightweight**
- **Extremely robust**
- **Very loud buzzer 95 dB(A)**
- **Bright alarm**
- **Easy and fast sensor replacement**
- **Up to 6 month continuous operation with one battery**
- **Leave turned on, or turn off when not in use to extend battery life**
- **3 alarm thresholds per gas**
- **Certification: c-UL-us Intrinsically Safe for use in Class I, Div. 1, Groups A, B, C, and D Hazardous Locations**



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Micro IV single sensor gas detector

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MICRO IV Single Sensor Gas Detector

- **Display shows in large letters alternating:**
 - **Current gas and gas concentration**
 - **Detection range**
- **Confidence beep adjustable**
- **Keys for Switching ON/OFF**
- **Custom setup with configuration software**



Unique attachable Micro IV motorized pump

- **Simple slide on design**
- **Add to any Micro IV whenever needed**
- **Pump powered by its own alkaline battery**



Data-logging standard!

- ***Logging of all event data***
 - ***Date and time of alarm***
 - ***Type of alarm***
 - ***Gas concentration which triggered alarm***
- ***Consistent storage of data***
- ***Infrared interface for data transfer via DI 220 data transfer station***



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DI-220 Single Unit Docking / Data Transfer Station

- ***Use for:***
 - ***Calibration and bump testing***
 - ***Instrument setup and programming***
 - ***Download monitoring results to PC***



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Automatically records exposure events

Event Data Device 1

No	Date Time	Type	Value	STEL(15min)	TWA(8h)	Gas	BAT	MK
1	28.08.2006 16:05	Dev-OFF					85%	343-05 48563
2	28.08.2006 16:08	Dev-ON					90%	343-05 48563
3	28.08.2006 16:13	A1 ON	33	0	0	ppm CO	90%	
4	28.08.2006 16:13	A2 ON	73	0	0	ppm CO	75%	
5	28.08.2006 16:13	A1 OFF	29	1	0	ppm CO	85%	
6	28.08.2006 16:14	A2 OFF	0	1	0	ppm CO	80%	

Event Data Device 2

No	Date Time	Type	Value	STEL(15min)	TWA(8h)	Gas	BAT	MK
1	28.08.2006 16:05	Dev-OFF					65%	343-05 48568
2	28.08.2006 16:08	Dev-ON					70%	343-05 48568
3	28.08.2006 16:13	A1 ON	54	0	0	ppm CO	70%	
4	28.08.2006 16:13	A1 OFF	25	0	0	ppm CO	55%	



Automatically records time stamped monitoring results

DS220 Data

DV-SN	DV-ID	Sensor	BAT	Ver	Conf. Blip	DS-SN	DS-Ver
2	GfG	MK343-05/48568	70	2.14	OFF	6070887	2.06
4		MK343-05/48563	90	2.14	OFF	6070887	2.06
6	GfG	MK343-05/48567	95	2.14	OFF	6070887	2.06
5	GfG	MK343-05/48570	45	2.14	OFF	6070887	2.06
5	GfG	MK343-05/48570	45	2.14	OFF	6070887	2.06
2	GfG	MK343-05/48568	70	2.14	OFF	6070887	2.06
6	GfG	MK343-05/48567	95	2.14	OFF	6070887	2.06
4		MK343-05/48563	90	2.14	OFF	6070887	2.06

Test parameter

Test Gas	Gas Bottle	Test Date Time	Mode	Test Ready
200 ppm CO	IC-39MNRC	28.08.2006 15:52	Bump	Yes
200 ppm CO	IC-39MNRC	28.08.2006 15:52	Bump	Yes
200 ppm CO	IC-39MNRC	28.08.2006 15:52	Bump	Yes
200 ppm CO	IC-39MNRC	28.08.2006 15:52	Bump	Yes
200 ppm CO	IC-39MNRC	28.08.2006 15:57	CAL	Yes
200 ppm CO	IC-39MNRC	28.08.2006 15:57	CAL	Yes
200 ppm CO	IC-39MNRC	28.08.2006 15:57	CAL	Yes
200 ppm CO	IC-39MNRC	28.08.2006 15:57	CAL	Yes



Setup choices

Device Menu

Device Type	Serial No	Last Test	Last Calibration	Last Repairing	Inventory No
MICRO IV	8732494375	2005-04-10-08:52	2005-04-01-07:00	-	015
MICRO IV	8947613598	2005-06-17-06:59	2005-04-01-07:10	2005-01-01-07:00	028
MICRO IV	4580546578	2005-09-19-06:00	2005-09-01-07:00	-	006
MICRO IV	8985462145	2005-09-15-17:13	2005-02-13-09:00	2005-06-25-15:44	019
MICRO IV	8947613598	2005-06-17-06:59	2005-04-01-07:10	2005-01-01-07:00	023
MICRO IV	4580546578	2005-09-19-06:00	2005-09-01-07:00	-	115
MICRO IV	8985462145	2005-09-15-17:13	2005-02-13-09:00	2005-06-25-15:44	054
MICRO IV	8947613598	2005-06-17-06:59	2005-04-01-07:10	2005-01-01-07:00	215
MICRO IV	4580546578	2005-09-19-06:00	2005-09-01-07:00	-	026
MICRO IV	8985462145	2005-09-15-17:13	2005-02-13-09:00	2005-06-25-15:44	089
MICRO IV	4580546578	2005-09-19-06:00	2005-09-01-07:00	-	002
MICRO IV	8985462145	2005-09-15-17:13	2005-02-13-09:00	2005-06-25-15:44	079
MICRO IV	8947613598	2005-06-17-06:59	2005-04-01-07:10	2005-01-01-07:00	035
MICRO IV	4580546578	2005-09-19-06:00	2005-09-01-07:00	-	020
MICRO IV	8985462145	2005-09-15-17:13	2005-02-13-09:00	2005-06-25-15:44	111
MICRO IV	8947613598	2005-06-17-06:59	2005-04-01-07:10	2005-01-01-07:00	123

Menu



Docking Station Micro IV DS-220

- **Automatic Teast Station for Micro IV**
- **Auto Bump test**
- **Auto Calibration**
- **Bump or calibrate up to six instruments at the same time**
- **Test results automatically results stored on MMC flash memory card**



DS 220 Docking "Station"

- **Complete device management system:**
 - *Automatic bump test*
 - *Automatic calibration adjustment*
 - *Programming interface*
 - *Data transfer*
- **Easy operation**
 - *Push green button for "Bump Test"*
 - *Push red button for "Auto Calibration" adjustment*
- *Test up to 6 detectors simultaneously*
- *No PC required!*



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Micro IV single sensor gas detector

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DS 220 Docking Station

- **Automatically stores results:**
 - *Battery capacity*
 - *Alarm thresholds*
 - *Visual alarm*
 - *Audible alarm*
 - *Serial number (detector)*
 - *Sensor serial number*
 - *Software version*
 - *Detector identification*
 - *Faults*
 - *Alarm list*
 - *"Event record" with gas concentration and alarm status*
 - *Response time for alarm 1 and alarm 2*



Test Results

- **LED indicators signal test results:**
 - **Green = Detector OK**
 - **Yellow = Test in process**
 - **Red = Test failed**



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Micro IV single sensor gas detector

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Calibration adjustment

- **Press red key to start automatic calibration**
- **Up to 6 instruments can be adjusted simultaneously**
- **No mishandling possible**
- **Shorter waiting time, faster completion!**



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Micro IV single sensor gas detector

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Automatically store test and calibration results

Test result

BUMP test	Adjustment			ZPT-before	SPAN-before	ZPT-akt	SPAN-akt
	Horn Error	T-A1	T-A2 T-50%				
Ok	3,2	4,2	7,2				
Ok	2,7	3,7	5,7				
Ok	2,4	3,4	6,4				
Ok	1,4	3,4	5,4				
				3,9	1820,4	-0,9	1886,8
				1,6	1888,0	-3,1	2050,8
				-4,1	1701,6	-7,6	1761,6
				-5,6	1713,6	-9,3	1772,0



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Micro IV single sensor gas detector

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MICRO IV Single Sensor Gas Detector

- Available for use with a wide range of dependable, substance specific electrochemical sensors
- O₂, CO and H₂S sensors warranted for 3-full years
- Optional range and resolution available for many sensors
- Plug-and-play sensor design makes changing or replacing sensors a snap



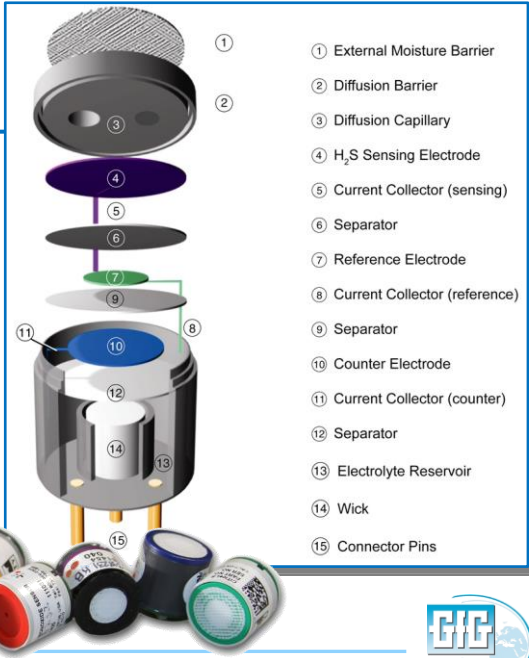
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Substance-specific electrochemical sensors

- Gas diffusing into sensor reacts at surface of the sensing electrode
- Sensing electrode made to catalyze a specific reaction
- Use of selective external filters further limits cross sensitivity



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Micro IV single sensor gas detector

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Available electrochemical sensors, standard ranges and resolution

- More types of EC sensors available every year, both for individual toxic gases as well as sensors designed to detect a range of toxic or combustible gases



Gas	Formula	Sensor model	Resolution	Range(s)
Ammonia	NH ₃	NH3 3E 5000 SE	1.0 ppm 5.0 ppm 10.0 ppm	0 - 200 ppm 0 - 500 ppm 0 - 1,000 ppm
Arsine	AsH ₃	Ash3 3E 1 F LT	0.03 ppm	0 - 1.0 ppm
Carbon monoxide	CO	4CM	0.1 ppm 1.0 ppm 1.0 ppm	0 - 300 ppm 0 - 500 ppm 0 - 1,000 ppm
Carbon monoxide (CO-H)	CO	2CF	1.0 ppm 1.0 ppm 1.0 ppm	0 - 500 ppm 0 - 1,000 ppm 0 - 2,000 ppm
CO / H ₂ S	CO H ₂ S	4COSH	CO: 1.0 ppm H ₂ S: 0.2 ppm	0 to 500 ppm 0 to 100 ppm
Chlorine	Cl ₂	O2 3E 50	0.1 ppm	0 - 10.0 ppm
Chlorine dioxide	ClO ₂	ClO2 3E 10	0.1 ppm	0 - 2.0 ppm
Diborane	B ₂ H ₆	B2H6 3E 1 LT	0.03 ppm	0 - 1.0 ppm
Ethylene oxide (EtO)	C ₂ H ₄ O	ETO-A1	0.1 ppm	0 - 20 ppm
Fluorine	F ₂	F2 3E 1	0.02 ppm	0 - 1.0 ppm
Hydrazine	N ₂ H ₄	N2H4 2E 1	0.01 ppm	0 - 1.0 ppm
Hydrogen	H ₂	4HYT	1.0 ppm	0 - 2,000 ppm
Hydrogen	H ₂	H2 3E 4%	0.01 % vol.	0 - 4.0% vol.
Hydrogen bromide	HBr	HCl/HBr 3E 30	0.1 ppm	0 - 30 ppm
Hydrogen chloride	HCl	HCl/HBr 3E 30	0.1 ppm	0 - 30 ppm
Hydrogen cyanide	HCN	HCN 3E 30 F	0.2 ppm	0 - 50 ppm
Hydrogen fluoride	HF	HF 3E 10 SE	0.1 ppm	0 - 10.0 ppm
Hydrogen sulfide	H ₂ S	4HS-LM	0.1 ppm 0.2 ppm	0 - 100 ppm 0 - 500 ppm
Methyl mercaptan	CH ₃ SH	TBM 2E	0.3 ppm	0 - 25 ppm
Nitric oxide	NO	4NT	1.0 ppm	0 - 100 ppm
Nitrogen dioxide	NO ₂	NO2 A1	0.02 ppm 0.04 ppm	0 - 30 ppm 0 - 50 ppm
Oxygen	O ₂	O2-A3	0.1% vol.	0 - 25.0% vol.
Oxygen	O ₂	4OX-V	0.1% vol.	0 - 25.0% vol.
Ozone	O ₃	O3 3E 1	0.02 ppm	0 - 1.0 ppm
Phosgene	COCl ₂	COCl2 3E 1	0.02 ppm	0 - 2.0 ppm
Phosphine	PH ₃	4PH - Fast	0.1 ppm 0.01 ppm	0 - 10.0 ppm 0 - 10.0 ppm
Silane	SiH ₄	SiH4 3E 50 LT	1.0 ppm	0 - 40 ppm
Sulfur dioxide	SO ₂	4S	0.04 ppm 0.1 ppm	0 - 10.0 ppm 0 - 50 ppm
Tetrahydrothiophene (THT)	C ₄ H ₈ S	THT 3E	1.5 mg/m ³ (0.3 ppm)	0 - 100 mg/m ³ (0 - 50 ppm)

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Micro IV single sensor gas

Additional gases detectable by means of relative response

- **Electrochemical sensors are designed with specific usage requirements in mind**
- **The same manufacturer may offer multiple models of sensor for the detection of the same gas, but that are optimized for different sets of interferents and operating conditions**
- **Thus, cross sensitivities may vary widely between different models and brands of sensors!**
- **In addition, response values may differ at concentrations other than the ones listed in product documentation**
- **Discuss with manufacturer BEFORE attempting to use relative response values to measure additional gases**

Gas	Formula	Sensor (ppm)
Acetaldehyde	CH ₃ CHO	CO
Arsenic trichloride	AsCl ₃	HCl
Arsenic Trifluoride	AsF ₃	HF
Arsenic pentafluoride	AsF ₅	HF
Boron trichloride	BCl ₃	HCl
Boron tribromine	BBr ₃	HCl
Boron trifluoride	BF ₃	HF
Bromine	Br ₂	Cl ₂
Butanethiol	C ₄ H ₉ SH	TBM
Carbonyl fluoride	COF ₂	HF
Chlorine dioxide	ClO ₂	ClO ₂ or O ₃
Chlorine trifluoride	ClF ₃	ClO ₂ or HF
Dichlorosilane	SiH ₂ Cl ₂	HCl
Diethylether	C ₂ H ₅ O	EtO
Disilane	Si ₂ H ₆	SiH ₄
Disulfur decafluoride	S ₂ F ₁₀	HF
Disulfur dichloride	S ₂ Cl ₂	HCl
Formic Acid	HCOOH	CO
Germane	GeH ₄	PH ₃
Germanium chloride	GeCl ₄	HCl
Hydrogen bromide	HBr	HCl
Iodine	I ₂	Cl ₂ or O ₂
Isopropanol	(CH ₃) ₂ CHOH	CO w/o filter
Methanol	CH ₃ OH	CO w/o filter
Phosphorous trichloride	PCl ₃	HCl
Phosphorous pentachloride	PCL ₅	HCl
Phosphoryl chloride	POCl ₃	HCl
Silicon tetrachloride	SiCl ₄	HCl
Stibine	SbH ₃	Ash3
Thiophene	C ₄ H ₄ S	THT
Tin tetrabromide	SnBr ₄	HBr
Tin tetrachloride	SnCl ₄	HCl
Tin tetrafluoride	SnF ₄	HF
Titanium tetrachloride	TiCl ₄	HCl
Trichlorosilane	SiHCl ₃	HCl
Trichlortriazine	C ₂ Cl ₃ N ₃	HCl
Trifluoro-triazine	C ₂ F ₃ N ₃	HF

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Micro IV single sensor gas detector

Typical Electrochemical Detection Mechanism

H₂S Sensor:

Hydrogen sulfide is oxidized at the sensing electrode:



The counter electrode acts to balance out the reaction at the sensing electrode by reducing oxygen present in the air to water:



And the overall reaction is: $H_2S + 2O_2 \longrightarrow H_2SO_4$

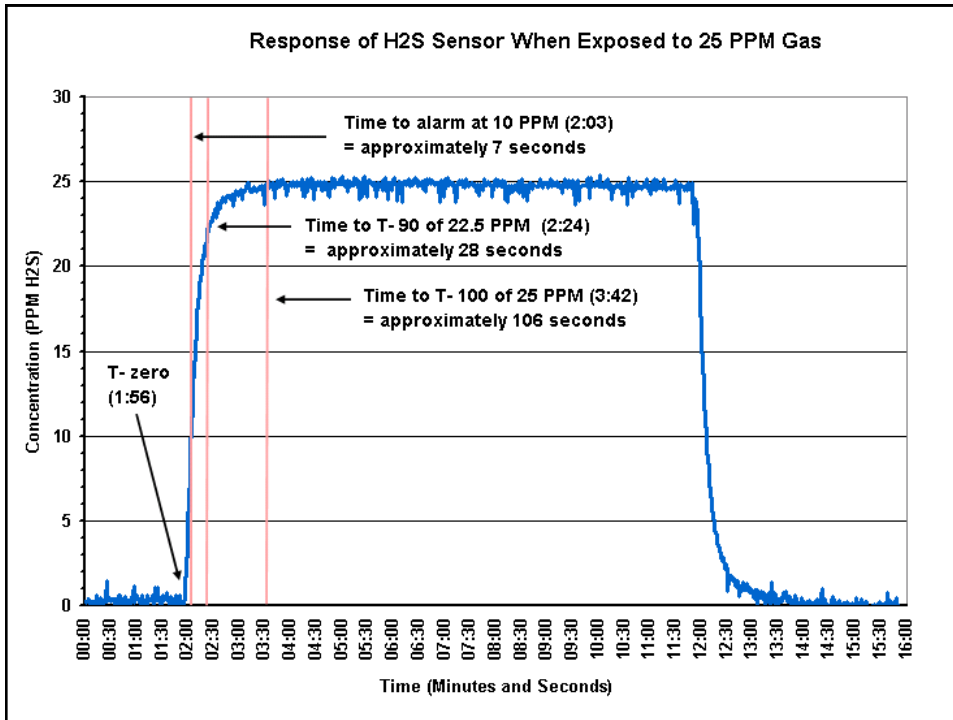
4HS Signal Output: 0.7 μA / ppm H₂S

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Micro IV single sensor gas detector

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Notable recent gas and vapor TLV[®] updates

- *Hydrogen sulfide (2010)*
- *Sulfur dioxide (2009)*
- *Nitrogen dioxide (2012)*

2017

TLVs[®] and BEIs[®]

Based on the Documentation of the

Threshold Limit Values for Chemical Substances and Physical Agents

&

Biological Exposure Indices

Signature Publications

2017

Guide to Occupational Exposure Values

Compiled by
ACGIH[®]

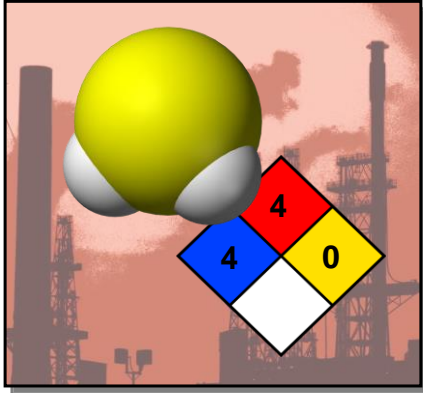
Signature Publications

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Exposure limits for H₂S



- **Old TLV:**
 - TWA = 10 ppm
 - STEL = 15 ppm
- **New (2010) TLV:**
 - TWA = 1.0 ppm
 - STEL = 5.0 ppm



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Micro IV single sensor gas detector

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Are H₂S sensors capable of measuring at the new TLV limits?

- **The answer is "Yes" BUT with qualifications.....**
 - **Depends on the manufacturer!**
 - **Sensor must be capable of providing 0.1 or 0.2 ppm resolution**
 - **Instrument design must permit setting the alarms at the desired concentration**
 - **Micro IV designed for measurement at TLV concentration limits!**



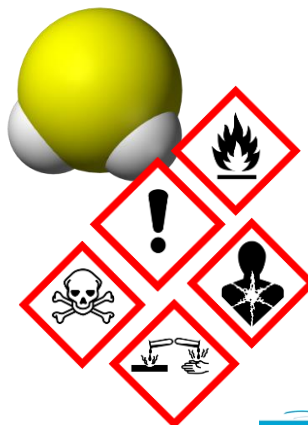
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Where should you set the H₂S alarms?

- H₂S TLV® only includes STEL and TWA limits; does not include a Ceiling or “Peak” limit
- Instruments typically have four user settable alarms for each toxic sensor (Low, High, STEL and TWA)
- Suggested alarms:
 - NIOSH:
 - Low: 10.0 ppm
 - High: 15.0 ppm
 - STEL: 15.0 ppm
 - TWA: 10.0 ppm
 - TLV®:
 - Low: 3.0 ppm
 - High: 5.0 ppm
 - STEL: 5.0 ppm
 - TWA: 1.0 ppm



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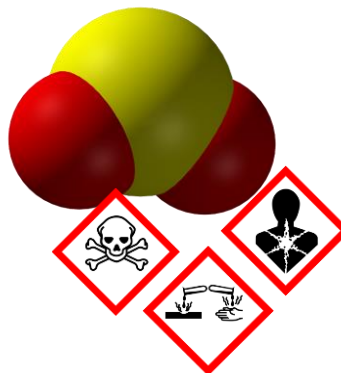
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Exposure limits for SO₂

- OSHA PEL:
 - TWA = 5.0 ppm
- NIOSH REL:
 - TWA = 2.0 ppm
 - STEL = 5.0 ppm
- Old TLV :
 - TWA = 2 ppm
 - STEL = 5 ppm
- New (2009) TLV:
 - STEL = 0.25 ppm



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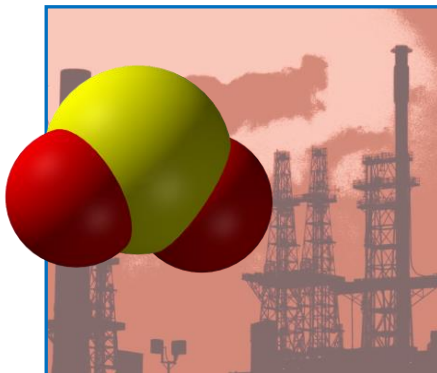
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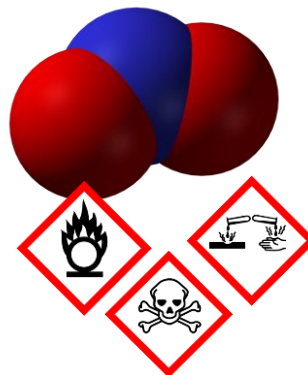
Suggested alarm settings for SO₂

- **Suggested alarms:**
 - **NIOSH:**
 - **Low: 2.0 ppm**
 - **High: 5.0 ppm**
 - **STEL: 5.0 ppm**
 - **TWA: 2.0 ppm**
 - **TLV®:**
 - **Low: 0.75 ppm**
 - **High: 1.25 ppm**
 - **STEL: 0.25 ppm**
 - **TWA: 0.25 ppm**



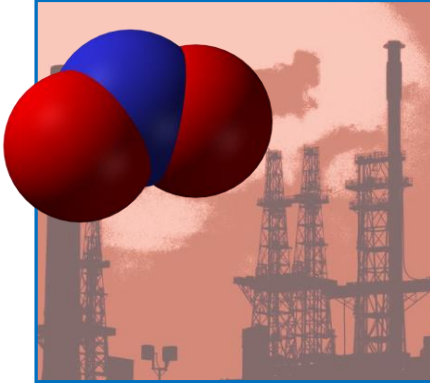
Exposure limits for NO₂

- **US OSHA PEL:**
 - Ceiling = 5 ppm**
- **US NIOSH REL:**
 - 15 min. STEL = 1 ppm**
- **Old TLV:**
 - 8 hr. TWA = 3 ppm**
 - 5 min. STEL = 5 ppm**
- **New 2012 TLV**
 - 8 hr. TWA = 0.2 ppm**



Suggested alarm settings for NO₂

- **Suggested alarms:**
 - **NIOSH:**
 - **Low: 3.0 ppm**
 - **High: 5.0 ppm**
 - **STEL: 1.0 ppm**
 - **TWA: 1.0 ppm**
 - **TLV®:**
 - **Low: 0.6 ppm**
 - **High: 1.0 ppm**
 - **STEL: 0.2 ppm**
 - **TWA: 0.2 ppm**



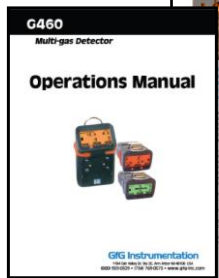
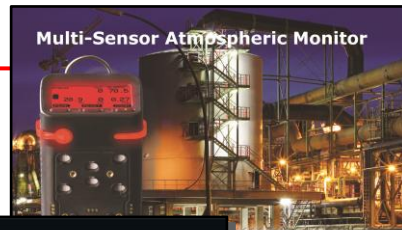
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Sales Support: www.Goodforgas.com

- **Data sheets**
- **Price lists**
- **Manuals**
- **Application Notes**
- **Product images**
- **Print ads**
- **...and more!**



November 2015

GfG Instrumentation company overview

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Questions?

