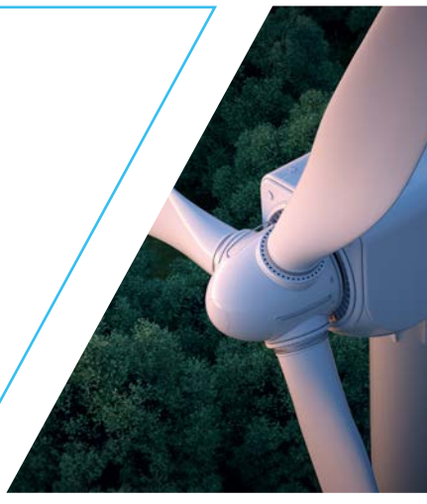
Hydrogen Safety Solutions Brochure

International Gas Detectors

IGD



A Member of
safe monitoring group

Safe Monitoring Group
Building the Future Together

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safe monitoring group

Safe Monitoring Group aims to build the leading group of European Gas Safety Manufacturers.

Sustainability is at the heart of everything we do. From the design and production of our products to the way we manage our operations and interact with our customers, we are committed to building a business that is both environmentally and socially responsible.

We seek to drive our industry forward by setting the standard for sustainability and enacting positive change in the world around us. We believe that by working together and taking bold action, we can create a brighter, more sustainable future for everyone.

IGD International Gas Detectors

Our story began in 1917 when Henry Ringrose founded the world's first gas detection company.

Over 100 years later our goal remains the same: to keep you safe by continuously improving our pioneering technology. From the first flammable gas detector to our groundbreaking, exclusive 2-Wire Addressable gas detection technology, more than a century of innovation has positioned us as the Detectably Better choice and the authority in the gas detection industry. We've cemented our position at the forefront of our industry by establishing enduring relationships with renowned global companies and elevating their safety protocols with a combination of fixed and portable gas detection products.

Today we manufacture detectors for over 700 gases and vapours at our purpose-built facility in Stockport, UK. Total control of the manufacturing process means total control of the delivered product, so you can relax in the knowledge that we have you covered. From our controllers to our detectors, accessories and PCB components, everything is manufactured in-house so that we can guarantee you the level of quality that our customers have come to expect of us, taking care of the entire process from consultation to installation to aftercare.

Getting gas detection isn't a choice.
Who you get it from is.

mems AG

Founded in 2003 Mems AG has accrued over 20 years of expertise in gas measurement technology and electronics.

Our mission is to ensure the technical and commercial success of your products. Mems AG is headquartered on our own property in Birmenstorf, Switzerland. Our team consists of approximately twenty dedicated professionals, predominantly engineers, specialising in electrical engineering, mechanical engineering, information technology, and system technology, alongside several accomplished physicists.

As an independent technology company, Mems AG is proudly owned entirely by our employees. This structure fosters a strong commitment to our values and ensures that our clients receive the highest level of service and innovation. The diverse expertise and extensive experience within our team enable us to tackle complex challenges with a thorough technical and academic approach. We specialise in developing cutting-edge electronics and sensors for clients across the industrial, service, and public sectors, ensuring market readiness as required.

Bieler+Lang

Bieler+Lang has led in safety technology for over 50 years, specialising in gas detection and warning systems.

Our mission is to protect people, the environment, equipment, and property from harmful or explosive gases and vapours. Our systems provide timely, reliable warnings of gas accidents and explosions and are trusted globally by renowned companies.

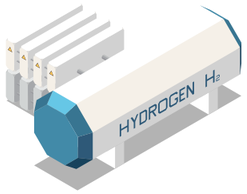
We are committed to innovation and strict quality standards. Our engineers continually enhance our products, which are produced and calibrated in-house for high reliability and ease of operation. Leading companies rely on Bieler+Lang for safety solutions known for their precision and durability. Bieler+Lang devices are user-friendly and reliable, enabling swift and effective safety measures. We prioritise accessibility and dependability, allowing clients to focus on their core operations confidently.

At Bieler+Lang, we set the standard in gas detection and warning systems, advancing safety technology to protect lives and property.

Beyond Hydrogen
Mitigating Diverse Hazards

Risk Assessment

To ensure safety you must understand the steps in the hydrogen fuel process, from generation and transport to storage and end-use, and the hazards and byproducts associated with each step.



Risk Mitigation

To effectively mitigate gas hazards you must first ascertain whether you're dealing with explosive, toxic or asphyxiant gases. While each type requires a different approach to implementing appropriate gas detection measures, in all cases, early detection saves lives and protects your plant.

Compliance

The laws surrounding air quality, and the mitigation of gas risks can only be managed with the assistance of gas detection. Compliance with standards is not an option.

To avoid legal repercussions, you must be equipped with a gas detection system that adheres to the following standards:

+ 98/24/EC Chemical Agents Directive
+ 99/92/EC Explosive Atmospheres (ATEX)
+ DSEAR
+ COSHH

These regulations are specific to the UK, but all regions will have their own regulations and guidance on air quality.

COSHH
The Control of Substances Hazardous to Health (COSHH) Regulations mandate that employers evaluate the dangers associated with using hazardous substances. This evaluation must cover plans for handling accidents, incidents, or emergencies, including significant spillages.

While specific regulations will vary based on region, each region will observe similar sets of standards.

DSEAR
The Dangerous Substances and Explosive Atmospheres Regulations (DSEAR) mandate the evaluation and management of the potential risk to personnel from fires or explosions caused by hazardous substances in the workplace. You are required to mitigate or minimise these risks to the extent that is feasibly possible.

Gas Detection
Why Wait Until it's too Late?

As the Hydrogen sector continues to grow, so does the demand for hydrogen detection solutions.

The proper utilisation of hydrogen will play an essential role in creating a net zero future, but each stage of the hydrogen process, from production and storage to transportation and end use, comes with its own set of risks and gas hazards. A gas detection specialist must perform a risk assessment at each stage in the process to properly mitigate these hazards through the implementation of effective, accurate, and reliable gas detection.

While hydrogen may be the primary gas hazard in the industry, it's certainly not the only one.

As the Hydrogen sector continues to grow, so does the demand for hydrogen detection solutions.

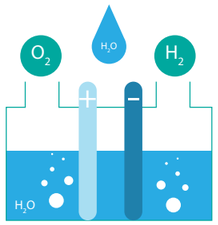
Most safety systems are reactive. They are designed to alert you to an issue that has already arisen, typically so that you can evacuate a premises or limit the amount of damage sustained. A fire alarm system, for example, sits at the reactive end of the safety system spectrum, alerting you to the fact that a fire has already broken out. A gas detection system is a pre-emptive system, not a reactive one.

A gas detector detects a gas leak immediately, alerting you to the issue before there is a high enough gas concentration to present a toxic or flammable threat. The time between a gas leak and the creation of an explosive atmosphere can be a matter of seconds so you must have a safety system that allows you to take immediate action. Our gas detection systems bridge the safety gap by preventing the creation of an explosive atmosphere to protect you and your personnel before a threat arises.

Hydrogen Safety Solutions
Stage 1: Production

Water Electrolysis

There are numerous ways to produce hydrogen, but water electrolysis is currently the most environmentally friendly means.



Containerised electrolysis solutions offer huge growth in the hydrogen production sub-sector of the energy market. Water electrolysis is a process that uses electrical energy to split water molecules (H_2O) into hydrogen (H_2) and, the byproduct oxygen (O_2). If utilising salt water for electrolysis, chlorine (Cl) is produced as an additional byproduct.

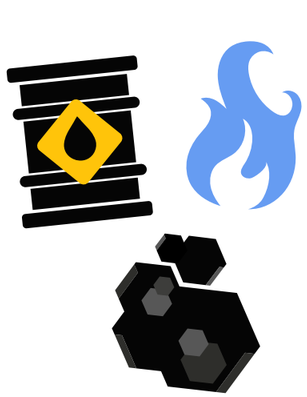
Partial Oxidation

Partial oxidation is a process that utilises heavy hydrocarbons such as oil, coal and natural gases to produce hydrogen.

Hydrocarbons are partially oxidised with a regulated quantity of oxygen, resulting in a mixture of hydrogen, carbon monoxide, carbon dioxide and water.

This reaction takes place at elevated temperatures (+1,200° to +1,500°C).

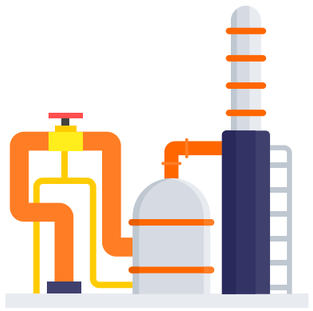
Hydrogen can be produced from fossil fuels through several established methods, each involving different chemical processes.



Steam Methane Reforming

SMR is the most common method for industrial hydrogen production and while it is relatively efficient it also produces significant carbon dioxide emissions, contributing to greenhouse gases. Methane (CH_4) reacts with steam (H_2O) at high temperatures in the presence of a nickel catalyst to produce syngas (a mixture of hydrogen, carbon monoxide, and carbon dioxide).

The carbon monoxide (CO) produced reacts with more steam to produce additional hydrogen and carbon dioxide CO_2.



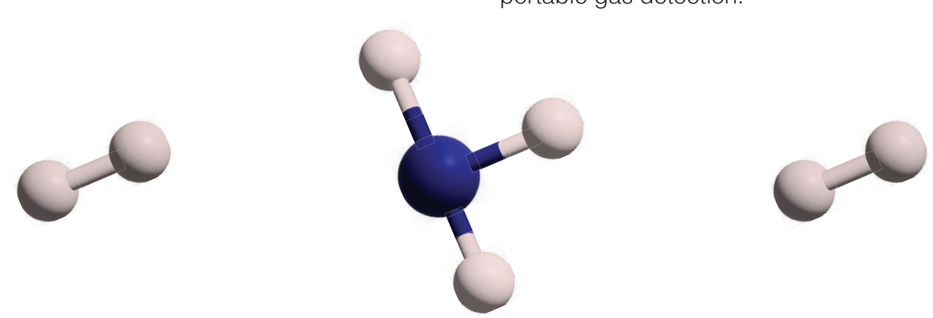
Hydrogen Safety Solutions
Stage 2: Storage & Transport

Storage and transport is a critical part of the hydrogen economy. Hydrogen and the various gases produced as a byproduct of production can present serious health risks.

This necessitates the implementation of methods to safely store and transport hydrogen for use in energy, transportation, and industrial applications. As hydrogen is prone to leaking, storage often involves the conversion of gaseous hydrogen into liquid hydrogen or ammonia.

Effective gas detection is required in both the storage and transportation process and requires a combined solution of fixed and portable detectors.

Fixed detectors should be strategically placed throughout storage applications, and portable gas detectors should be worn by personnel to provide an added layer of protection. When in transit drivers should always be wearing personal portable gas detection.



Liquid Hydrogen

Creating liquid hydrogen involves compressing and cooling gaseous hydrogen to extremely low temperatures (below -253°C) to turn it into a liquid state. Liquid hydrogen is not only less likely to leak, but it's also less volatile and takes up far less space than its gas state.

Ammonia Conversion

Ammonia can be created via the synthesis of hydrogen and nitrogen (N_2). This is achieved by reacting the two elements under high pressures and temperatures in the presence of an iron-based catalyst. Liquid ammonia can then be stored and transported under moderate pressure or low temperatures in pressurised tanks or insulated tanks respectively. Liquid ammonia takes up far less space than gaseous hydrogen.

Pressurised Hydrogen

Gaseous hydrogen can be stored in high-pressure tanks, but it is more prone to leakage and rapid dispersion if containment is breached due to its high volatility.

This makes it better suited to applications in which easy transport and handling at ambient conditions are more common.

Hydrogen Safety Solutions
Stage 3: End Use

While fossil fuels currently account for around ¾ of global hydrogen production, with the costs for renewable electricity continuing to decline, the interest in electrolysis-sourced hydrogen grows.

As a growing number of countries continue to introduce policies that directly support investment in the hydrogen industry, opportunities within the sector are increasing.

The development of new technologies in turn prompts the establishment and viability of new end-use cases. These end-use cases broadly fall into one of four categories:

1. Industry
2. Transport
3. Buildings
4. Power generation

Each end-use case comes with a unique set of risks, requiring careful consideration, professional risk assessments and bespoke safety solutions on a case-by-case basis.

Buildings

Natural Gas Networks
Hydrogen can be blended into natural gas networks to provide a cleaner energy source for commercial and residential properties reducing CO_2 emissions.

Multi-gas detection would be needed to mitigate the diverse gas risks presented by the combination of hydrogen and methane.

Scalable solutions are a necessity when it comes to providing accurate, and reliable coverage across entire applications.

Power Generation

Renewable Energy Storage
Hydrogen can be used as a medium for excess renewable energy storage through electrolysis.

Mitigate against leaks in storage with fixed hydrogen detection systems, area monitoring and emergency shutdown systems for an added layer of protection.

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Hydrogen Safety Solutions
Stage 3: End Use

Industries

Fuel Cell Cars & Trucks

Hydrogen can be employed in vehicles with fuel cells to generate electricity for propulsion as a means of reducing CO_2 emissions.

Leaks in fuel storage or delivery systems can quickly lead to the creation of an explosive atmosphere so on-board hydrogen detection systems, robust safety protocols and regular maintenance with portable gas detectors are essential.

Shipping & Aviation

The potential to use hydrogen in fuel cells in shipping and aviation is currently being explored. The high flammability, propensity to leak and low ignition energy would make the use of hydrogen in such small spaces particularly dangerous.

Oil Refineries

Hydrogen is extensively used in oil refineries for hydrocracking and desulphurisation processes.

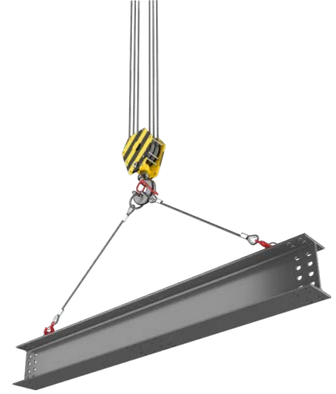
Hydrogen can quickly contribute to an explosive atmosphere in these enclosed spaces, and the explosive risk is multiplied by the other combustible materials present.

Fixed detectors should be installed near areas with hydrogen pipelines and storage, and portable detectors should be utilised for maintenance checks.

Steel Production

Hydrogen is used as a reducing agent in steel production, replacing carbon-based agents to reduce CO2 emissions.

Steel production usually takes place in enclosed spaces and requires careful monitoring and multi-gas detection systems (both fixed and portable) to mitigate the dangers of hydrogen and carbon monoxide



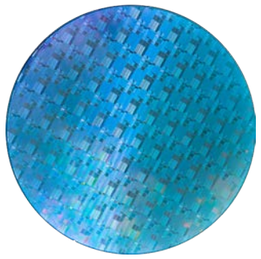
Transport

Vehicles with hydrogen fuel cells will need to refuel, offload fuel or undergo maintenance in maintenance bays and garage forecourts. While there is less risk of dangerous gas build-ups in forecourts, the enclosed spaces of maintenance bays provide a perfect environment for the build-up of hydrogen, and ammonia in the event of a gas leak, quickly creating a risk of explosion. In maintenance bays, fixed and personal gas detection must be combined with an effective ventilation system.

Other Industrial Uses

Other industrial uses include (but are not limited to) glass manufacturing, semiconductor production and food processing, and while appropriate gas detection solutions vary based on the application, it will typically be intended to mitigate flammability and explosion risks.

Fixed gas detection, portable gas detection, and continuous monitoring with sampler solutions should be implemented to provide comprehensive coverage and ultimate protection for personnel and plants.



Hydrogen Safety Solutions
Understanding the Hazards

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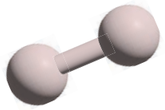
As the Hydrogen sector continues to grow, so does the demand for hydrogen detection solutions.

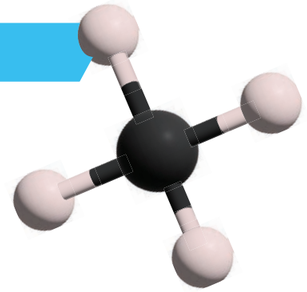
Gases

Hydrogen (H_2)



- Flammable in air at concentrations between 4 to 75%
- A huge explosive hazard requiring only 0.017mj to ignite
- Colourless, odourless and non-toxic
- The smallest known molecule in the universe wand prone to leaking
- In high concentrations, it can displace oxygen in the air, leading to an asphyxiation hazard.
- Lighter than air, requiring fixed gas detection at ceiling level

Methane (CH_4)



- The feedstock for Steam methane reforming
- Colourless, odourless, non-toxic and flammable
- Flammable over a range of concentrations 5.4% to 17%
- The most abundant hydrocarbon pollutant on earth
- Natural processes account for 40% of global methane emissions.
- Lighter than air, requiring fixed gas detection at a high level

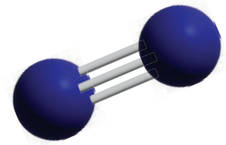
Oxygen (O_2)

- It can operate as an oxidising agent to accelerate the combustion of other materials and increase the risk of fires and explosions
- The measurement of O2 as a percentage can be misleading, as it can be affected by differences in atmospheric pressure
- Colourless, odourless and toxic at concentrations above 25%

Chlorine (Cl_2)

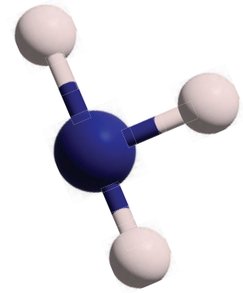
- A byproduct of saltwater electrolysis
- A highly toxic greenish-yellow gas with a characteristic odour
- It can cause severe respiratory irritation, lung damage, and other health effects if inhaled
- Heavier than air, requiring fixed detection at floor level

Nitrogen (N_2)



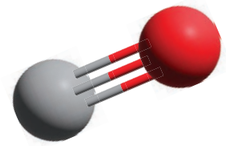
- Used to create ammonia via synthesis with hydrogen for the purposes of storage and transportation
- The most plentiful element in Earth's atmosphere
- A colourless, odourless, tasteless gas
- Neither flammable nor toxic
- It is an asphyxiant
- Slightly lighter than air, requiring fixed gas detection at the Life Safety Zone

Ammonia (NH_3)



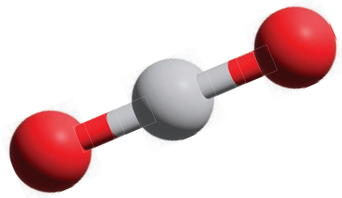
- Liquid ammonia is far less reactive than hydrogen providing a safer means of storing and transporting the compound
- A toxic, colourless lighter-than-air gas with a strong odour
- Its weight depends on the moisture level in a space, so fixed gas detection should be placed at both the floor and ceiling level, and at the Life Safety Zone depending on the application

Carbon Monoxide (CO)



- A byproduct of Steam Methane Reforming
- Colourless and odourless
- Highly toxic and even low-level exposure can present serious health risks
- It's flammable and can contribute to an explosive atmosphere at % levels above IDLH limit
- Slightly lighter than air, requiring fixed gas detection at the Life Safety Zone

Carbon Dioxide (CO_2)



- A common byproduct when using fossil fuels to produce hydrogen
- Colourless, odourless, toxic
- An abundant greenhouse gas
- Heavier than air, requiring fixed gas detection at floor level or at the life safety zone

Safe Area
Gas Detectors

ATEX Area
Gas Detectors

TOC-635 Control Panel

Features & Benefits

State-of-the-art addressable gas detection in one compact package. The TOC-635 Control Panel is the central hub of your addressable gas detection system and the interface through which you can control your entire setup. Equipped with Sentinel+™ digital communication software and 2-Wire Addressable technology, IGD's advanced gas detection system is designed to provide fast, efficient, accurate performance to protect personnel and plant against gas hazards.

- Full event monitoring and optional SMS and email alerts.
- Built-in Wi-Fi and cloud-based data acquisition.
- RGB display, 1-Click auto-setup and Jog-wheel controls.
- Available in both Micro and Plus models
- Connect with up to 8 or 99 external devices.
- Designed and manufactured in the UK and backed up by more than a century of innovation and our 10-year guarantee.

TOC-750 Control Panel

Features & Benefits

Introducing the cutting edge of addressable gas detection: the TOC-650 and 750 Series Control Panels. Equipped with Sentinel+™ 2-Wire Addressable technology, this is IGD's most advanced digitally communicating gas detection system. Designed to provide fast, efficient, accurate performance to protect personnel and plant against gas hazards.
Full event monitoring and optional SMS alerts.

- Full event monitoring and optional SMS and email alerts.
- Built-in Wi-Fi and cloud-based data acquisition.
- RGB display, 1-Click auto-setup and Jog-wheel controls.
- Available in both Micro and Plus models.
- Connect with up to 8 or 99 external devices.
- Designed and manufactured in the UK and backed up by more than a century of innovation and our 10-year guarantee.

TOC-750 Safe Area

Features & Benefits

The gold standard for gas detection. IGD's landmark TOC-750 Safe Area Detector comes pre-calibrated to monitor for any one of over 700 gases and vapours. Our long-life sensors provide fast, accurate, and reliable gas detection and our 2-Wire Addressable system further reduces costs and enables advanced digital communication. As simple as it gets, without compromising on safety.

- Ready to use with 1-click auto setup and self-check.
- Intuitive plug-and-play pre-calibrated detectors.
- Modular functionality.
- Auto-detect sensor change for automatic updates on ranges, gases, and alarms.
- I/O points put you in control of valves, beacon sounders and other external devices.
- Accommodates 4-20mA signal inputs for system integration.
- Sensor options for over 700 gases and vapours
- Designed and manufactured in the UK and backed up by more than a century of innovation and our 10-year guarantee.

TOC-750X

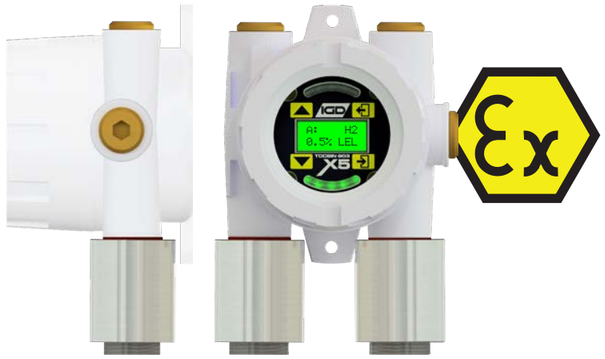
Features & Benefits

TOC-750X Series gas detectors are both ATEX and IECEx approved for use in potentially flammable atmospheres. The TOC-750X uses IGD's Sentinel+™ addressable technology, specifically designed to provide fast, reliable gas detection, and advanced digital communication. TOC-750X is a versatile addressable detector with sensor options for over 400 gases including toxics, flammables, VOCs and oxygen.

- Blind detector reduces overall CAPEX cost.
- Smart plug and play sensor technology.
- 2-Wire Addressable technology for simple installation.
- Certified and performance tested to the internationally recognised 60079-29-1 standard.
- ATEX and IECEx Zone 1 & 2 (Gas), 21 & 22 (Dust).
- Connect wiht other devices via a single cable.
- 1-Click auto-setup and self-check.
- Robust build and custom housing.

Hydrogen Safety Solutions by IGD
ATEX Area Detectors

TOC-903-X5



Features & Benefits

The world's most versatile gas detector. This is the TOC-903-X5 – a dual gas detector transmitter approved for ATEX Zone 1&2 (flammable) and Zone 21&22 (dust) environments, that can be easily integrated into our 2-Wire Addressable system or used as a standalone 4-20mA transmitter.

- Sensor options for over 400 gases.
- 5 port housing.
- Non-intrusive one-man calibration via magnetic wand.
- 2 independent 4-20mA outputs.
- 3-relay outputs.
- 2-Wire Sentinel+™ digital communication.
- 1 fault and 2 alarm relays.
- UKCA, ATEX and IECEX certified.
- At-a-Glance LED digital colour-change display indicating concentration, alarms and fault status.
- Monitor 2 gases and auto-calibrate with plug-and-play sensors.
- Simple operation and easy maintenance.
- Designed and manufactured in the UK and backed up by more than a century of innovation and our 10-year guarantee.

POLI Multi-Gas Portable Monitor

Features & Benefits

Portable gas detectors are your first line of personal defence, and the Poli Multi-Gas Monitor equips you with accurate monitoring to mitigate the diverse gas risks presented by the hydrogen sector. It's an advanced model with a built-in pump and a huge selection of sensors available for a wide range of applications.

- Gases: CO, H_2S, NH_3, HCN, HCl, HF, Cl_2, ClO_2, NO, NO_2, SO_2, C_2H_4O, CH_4S and more.
- Carry Calibration data.
- Battery: 16-Hour Rechargeable Li-ion.
- Monitor up to 5 gases at once.
- USB Micro Charger & Communications cable.
- Pump-Off Switch and Low-Power Sensor Options.
- Automatic Flow Fault on Pump.
- 360° LED Alarm Bar and Man-Down Alarm.
- 6 Month Continuous Datalogging.
- Durable Double Shot Outer Case.
- Wireless Remote Team Communication Available.
- Mobile App for POLI Simulation and Training.

Hydrogen Safety Solutions by B&L
ATEX Area Detectors

ExDetector HC100

Features & Benefits

The ExDetector HC 100 is used to detect combustible gases and vapours in the measuring range from 0 to 100%LEL, and uses a pellistor.

A large number of gases can be monitored, e.g. hydrogen and hydrocarbons (other gases available on request). The ExDetector HC 100 is a versatile sensor and is designed for use in ATEX zones 1 and in overall safety systems classified according to SIL-1.

- EU type examination according to RL 2014/34/EU
- Electrical Safety: II 2G Ex de [ib] IIC T6 Gb, PTB 00 ATEX 1075.
- Measuring Function: BAM 03 ATEX 0003 X.
- Gases: Explosive.
- Measuring Range: 0–100 % LEL.
- Sensor: Pellistor.
- Linear Measuring Signal: 4–20 mA.
- One-person calibration at the detector with optional CalibrationBox.
- 3-Wire technology.

ExMonitor

Features & Benefits

The ExMonitor detector uses an electrochemical sensor to measure and display live readings of toxic gases or, oxygen.

The devices in the ExMonitor series are designed for use in ATEX Zones. A-type examination certificate for the electrical safety of the operating equipment is available.

- EU type-examination according to RL 2014/34/EU
- Electrical Safety: II 2G Ex ia IIC T4 Gb, BVS 03 ATEX E 384
- Gases: CO, H_2S, NO, NO_2, SO_2, Cl_2, HCN, H_2, HCl, NH_3, O_3, C_2H_4O, O_2
- Measuring Range: dependent on gas.
- Sensor: Electrochemical measuring cell.
- Linear Measuring Signal: 4–20 mA.
- Displays live concentration reading.
- One-person calibration directly at the detector.
- 2-Wire technology.

Hydrogen Safety Solutions by MEMS[AG]
Gas Specification

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GasQS™ Flonic Z1

Features & Benefits

Based on a microthermal CMOS sensor, in combination with a critical nozzle and two valves, heat conductivity, heat capacity and relative density of natural gas can be measured. From these quantities, the device correlates various measurements. Requiring no carrier gases, The Z1 is robust, compact, and inexpensive.

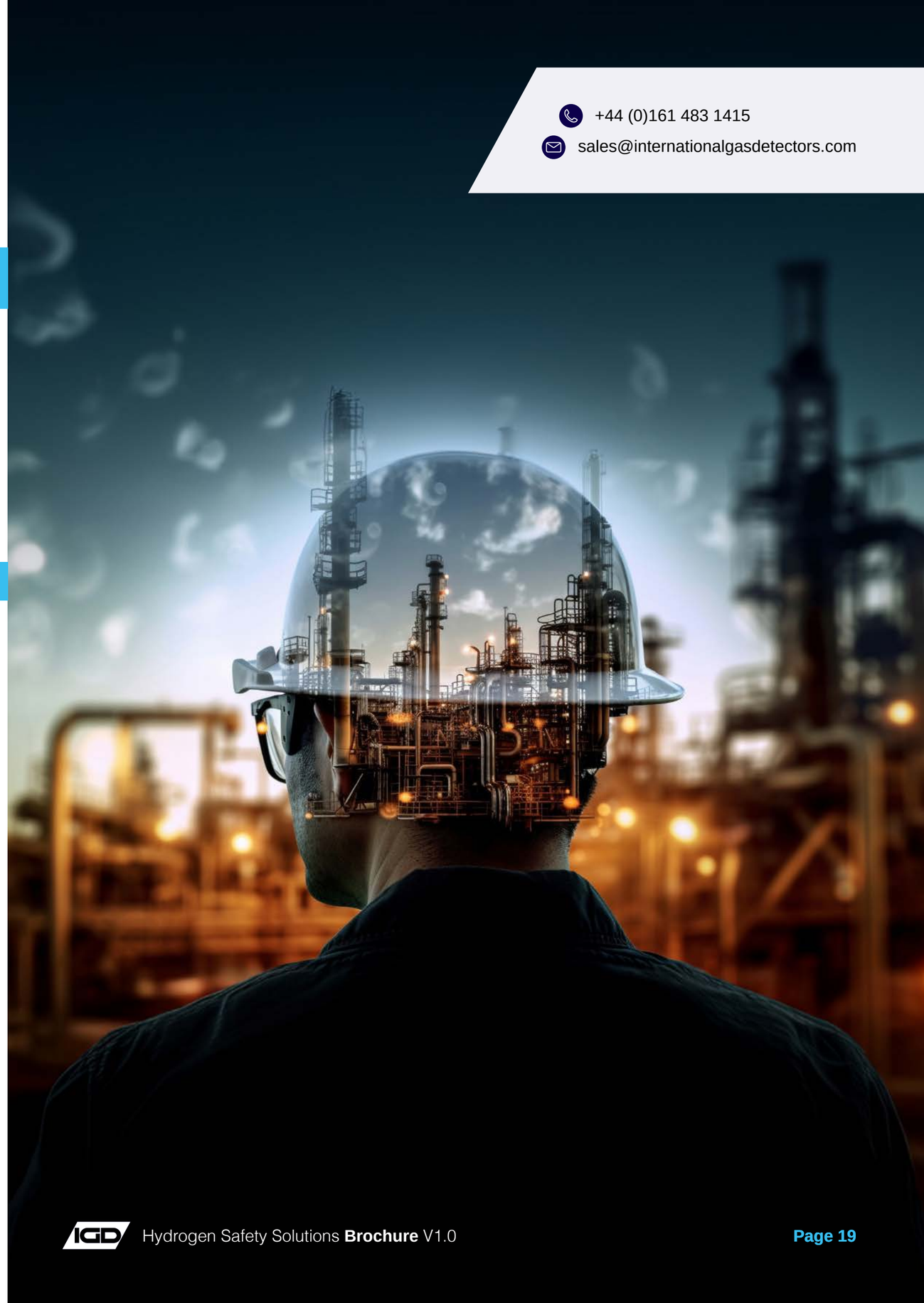
- Measuring Time: ≤30 seconds.
- Measuring Interval: continuous, programmable in seconds.
- Response Time:
  T90 within 3 measurement intervals.
- Operating Temperature: -10–+55°C.
- Ex device Protection: Ex II 2G Ex ib IIC T4 Gb IECEx SEV 22.0007X SEV 18 ATEX 0111 X.
- Gases: dry, neutral (10 µm filtering).
- Load Limit Supply Line: +8.0 bar relative.
- Supply line pressure range:
  +2.5 to +5.0 bar relative.
- Outlet Line Pressure Range:
  -50 to +200 mbar relative.
- Gas Consumption:
  Approx. 0.03 ln/measurement interval, unchanged gas quality.

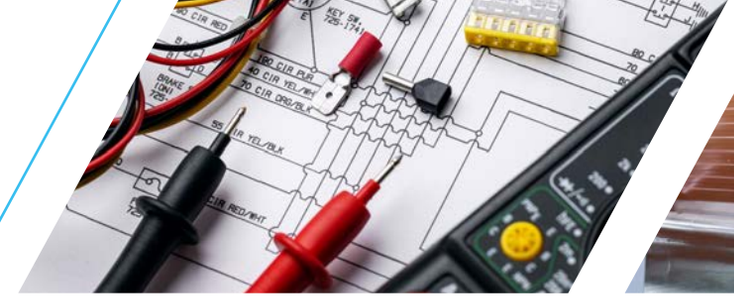
GasQS™ Static

Features & Benefits

Thermal conductivity is precisely determined with the help of a microthermal sensor. For hydrogen in methane applications, it can derive the percentage of both gases. Unlike the market standard, this robust, compact and inexpensive device requires neither readjustment nor reference gases. The two-wire connection allows easy integration into the control system without further knowledge of bus topology. The simple screw-in connection requires only minimal intervention in the pipe system and does not require an exhaust line.

- Measuring Time: 0.1 seconds.
- Measuring Interval: 1 second.
- Response Time: T90, typically 2 seconds.
- Meas. Range Temp. Compen.: -20 to +80 °C.
- Operating Temperature: -25 to +85 °C.
- Ex protection: Ex II 1G Ex ia IIC T4 Ga IECEx SEV 22.0008X SEV 15 ATEX 0191 X.
- Gases: dry, neutral (10 µm filtering).
- Load Limit Supply Line: +30 bar gauge.
- Supply Line Pressure Range:
  Standard: -0.5 to +9.0 bar gauge
  Extended: -0.5 to +15.0 bar gauge (on request).





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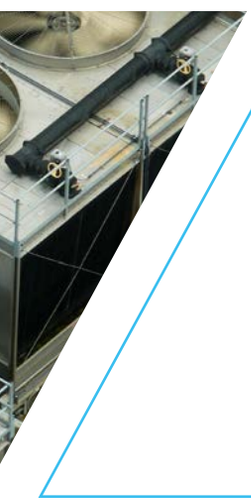




A Member of
safe monitoring group