



Safeguarding people and progress
for academic and research excellence.

GfG Solutions in the Fields of Education and Research





GfG solutions in the areas of education and research

Many students, technicians and engineers wish to build their career and practice their profession within a safe research laboratory.

Laboratories are spaces specially designed to carry out experiments and put knowledge to good use, whether medical, physical, chemical or even biological.

Typical types of laboratories:

The chemical laboratory is, without any doubt, the most popular type of laboratory. This is from the type of laboratories that can be manipulated by liquid chemical products, solids or gases to conduct research on the interaction of different molecules between the two.

The biology laboratory is where we find the main pharmaceutical laboratories. It is within this type of laboratory that we imagine new formulas that make it possible to bring new drugs to fruition.

The physics laboratory is exclusively focused on research. It is within it that theories on physics are tested, and in particular on electronic research, on physical phenomena at reduced dimensions.

A **LN₂ lab** refers to a laboratory that uses or stores liquid nitrogen (LN₂), which is nitrogen in its cryogenic liquid form for freezing, cooling, or preserving samples for storage of sensitive biological or chemical materials.

An **NMR lab** is a laboratory that uses Nuclear Magnetic Resonance (NMR) spectroscopy to study the structure and properties of molecules.

A **pathology lab** (or clinical pathology laboratory) is a medical facility where samples like blood, urine, tissue, or other body fluids are tested to help diagnose diseases.

Gas Chromatography lab (GC) is an analytical technique used to separate and analyze compounds that can be vaporized without decomposition.

Gas safety in the laboratory

Modern laboratories use a number of gases in their daily operations. The most common methods of supplying laboratory gas are not without risks in terms of the safety of individuals and installations.

Some gases are more dangerous than others. Toxic gases such as carbon monoxide, carbon dioxide and hydrogen sulfide, for example – present an immediate risk to laboratory safety if leaked. Direct exposure to any of these gases is very dangerous and should absolutely be avoided.

But be careful, all gases can cause a safety risk if they escape from a distribution system. Hydrogen, methane and oxygen, for example, can respectively ignite and promote the ignition of combustible materials if they are found in significant quantities in the air of a laboratory. Nitrogen or Helium escaping from a system can vary the concentration of oxygen in the atmosphere and create a potentially dangerous environment in a closed space (anoxia). Gases that are

denser than air such as propane and butane can be deposited in cavities or enclosures where they will accumulate, which can also create a risk of explosion.

Because gases like oxygen, hydrogen, or nitrogen are not always treated with the same degree of precaution as harmful gases, it is possible for small leaks to appear in a laboratory without anyone noticing. These leaks represent, first and foremost, a potential danger.

But gas that escapes is also gas wasted, which can end up having a significant impact on the costs linked to these uncontrolled losses.

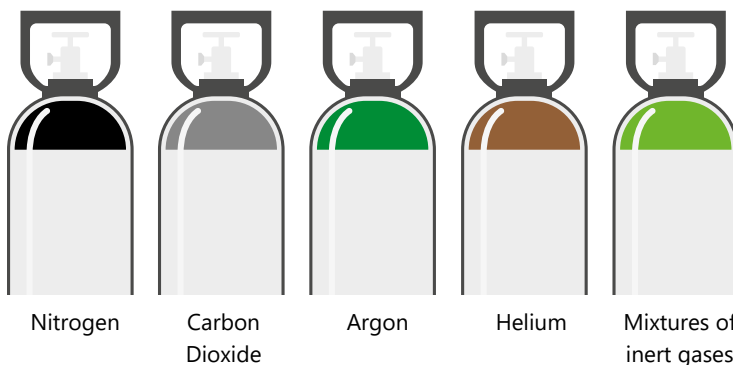
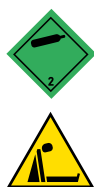
Several gases are used in laboratories for various applications such as: chromatographic spectroscopy and sample preparation, to name just a few examples. Helium, hydrogen and nitrogen are among the gases most commonly used by laboratories for these applications.

Gases commonly found in laboratories :

Inert gases

They are invisible and have no odor

Inert/asphyxiating gases are non-oxidizing, non-flammable, non-toxic and non-corrosive gases, but which dilute or replace the oxygen normally present in the air, hence their asphyxiating nature.



Nitrogen

Carbon
Dioxide

Argon

Helium

Mixtures of
inert gases

Mixtures composed of these gases are all asphyxiating.

All gases containing less than 20% oxygen are asphyxiating.

Flammable gases (hydrogen, acetylene, benzene, propane, methane and pyrophoric (arsine)) Also known as combustible gases. They burn when mixed with an oxidant and in contact with an ignition source.

Toxic and/or corrosive (chlorine, carbon monoxide)

Special case of carbon dioxide: A concentration of 2% carbon dioxide gas causes a reduction in alertness, and at 7%, breathing difficulties appear, with risk of respiratory arrest. The risk may particularly arise in premises where there are laboratory freezers operating with this gas or solid forms of this gas (dry ice).

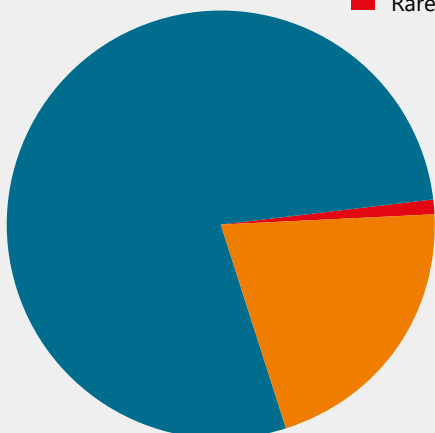
Oxidizer (oxygen, ozone, nitric acid)

(hydrogen, acetylene, benzene, propane, methane) and pyrophoric (arsine)
A gas in the liquid state evaporates quickly and leads to a considerable volume expansion which can generate an atmosphere saturated with asphyxiating gas.



The composition of the air:

- Nitrogen (78%)
- Oxygen (21%)
- Rare gases (1%)

**How do gases behave?**

- » A gas that is heavier than air will tend to sink and remain on the ground, and in the absence of ventilation, to accumulate without being diluted in the air.

Nitrous oxide, carbon dioxide, and argon are responsible for the risk of asphyxiation in basements.

Gaseous vapors coming from the evaporation of cryogenic gases by leaks or accidental spills (oxygen and liquid nitrogen for example) are very dense, because at very low temperatures, they form by condensation of atmospheric humidity, a white fog located above ground level, spreading rapidly and can penetrate any low point.

- » Gases lighter than air, for example hydrogen, helium, natural gas, will tend to concentrate at ceiling level.

Should we protect ourselves against gas risks?

Presence of one or more gases in a closed and/or confined environment = Automatic protection by fixed detection. Regardless of the nature of the gas (gaseous, liquid), it represents a risk.

Handling in chemical laboratories

For a long time, cylinders have been the most common method of supplying gas. They are still widely used in laboratories around the world.

Gas detection and monitoring

The installation of a gas detection solution in the premises of concern will ensure the protection of people and property.

- » A central monitoring station installed outside the premises to be protected.
- » Sensors in the affected areas.
- » A light alarm (1st threshold) and an audible alarm (2nd threshold) per room.
- » Audible and light alarms (or only light alarms) can be installed outside the premises, above the access door to the at-risk areas to prevent access.



1 Hydrogen transmitter CH₄

2 D-ReX (PoS)

3 Warning panel

4 Oxygen transmitter

5 CO₂ transmitter

6 Visual alarm

Example of laboratory detection:

GfG gas detection units can control other types of systems in order to increase the level of security of your installations:

- » Air extractor / Vents: will allow the gases present to be evacuated by controlling the air extractors.
- » Electromagnet: cut-off of the solenoid valve in the event of a gas leak.
- » Power cut-off: strongly recommended in the presence of explosive gases (Methane, Hydrogen, etc.).

Risks inherent to compressed gases

Compressed gases stored in cylinders or frames have certain characteristics that carry risks, mainly because they are stored under high pressure.

When a leak occurs, visual or by scent detection is often not possible. Compressed gases can be stored in gaseous form, or as liquid gas under pressure (e.g. carbon dioxide).

The rules and safety instructions relating to the use of compressed gases mainly concern the prevention of gas leaks, as well as good control of pressure and flow. It is absolutely essential that the user is aware of the hazardous properties (such as flammability, toxicity, chemical activities and corrosive effects) of the gas they wish to use.

Gas detection systems help ensure a safe workplace by alerting staff to the presence of flammable or toxic substances or a lack of oxygen.

To ensure reliable operation, gas detection systems must be periodically tested and calibrated against reference gas mixtures. Thanks to our portable detectors you will be able to check the values indicated and remove any doubts regarding potential leaks.

The user must first read the safety data sheets (SDS). Depending on the method and purpose of using the gas, one risk may outweigh another. Thus, the flammability of carbon monoxide constitutes the main risk near an open flame. But when carbon monoxide is used as a reagent, the major risk is the toxicity of the gas, especially in the event of a leak.





EC22 D



IR22 D



ZD22 D



EC22 O

Risk Overview

Inert Gases

Inert gases are colorless and odorless, and are not flammable or toxic. However, they are not without danger because, in confined spaces, the inert gases released can displace the oxygen present, which can lead to potentially fatal situations. Their presence in large quantities may go unnoticed until the increased concentrations are recognized by the body. Neutral gases, such as nitrogen, helium and argon, are the most used inert gases in laboratories. They are generally used for sample inerting or as a carrier gas for gas chromatography.

Oxidizing gases

These gases do not ignite but support combustion. Since these gases can react particularly quickly and violently, it is essential to eliminate any possible ignition sources when using oxygen and other oxidizing gases. Oxygen is used in various laboratory applications, often as a combustion gas.

Toxic gases

When used incorrectly, toxic gases can cause serious health problems. The level of toxicity and the resulting effects depend on the gas in question. Additionally, toxic gases can also be reactive, flammable and/or oxidizing. In laboratories, toxic and corrosive gases are often used for chemical reactions, or as a component in calibration mixtures.

Use of flammable gases

The illustration to the right indicates the flammability range – upper explosive limit (UEL) and lower explosive limit (LEL) – of different gases.

Although the flammability range of liquefied petroleum gases – like butane and propane – is relatively limited, only small concentrations are needed to form a flammable mixture.

Positioning of gas detectors

The most common sensor positions are:

- » 1 ft from the ground (CO₂, Cl₂, Propane, etc.).
- » 4 ft from the ground (Nitrogen, Argon, etc.).
- » 5 ft 3 in to 6 ft (NH₃, CO, No...).
- » Ceiling (Explosive gases, Helium).

Flammable Gases

These gases form a flammable mixture if mixed with air at atmospheric temperature and pressure. The flammability range may vary significantly due to changes in temperature, pressure or oxygen concentration. All possible sources of ignition must be eliminated.

Cryogenic gases

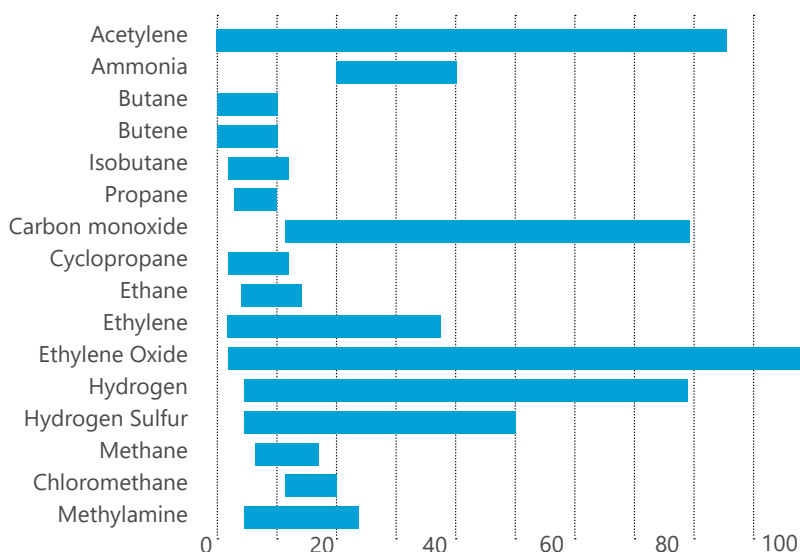
Cryogenic gases are extremely cold and can cause serious injury. Although they are generally neutral (like liquid nitrogen), they can also be flammable and/or oxidizing. Liquid nitrogen is often used in laboratories due to its extremely low temperature or to preserve biological samples.

Corrosive gases

Corrosive gases attack materials or (human) tissue upon contact. These gases are reactive and can also be toxic and flammable. Most are dangerous if used for prolonged periods, even in low concentrations. The threshold values for these gases must be scrupulously respected, due to the risk of irritation and damage to the lungs, mucous membranes and ocular tissue.

Flammable Gases

Flammability range limits in air.



Special cases

- » Argon and Nitrogen will be detected by the same sensor: O₂ (Oxygen) sensor installed at a height of 4 ft.
- » Helium: it is detected with a specific Helium O₂ cell, and the sensor will be installed 8 inches below the ceiling.
- » NH₃: in laboratories, it is generally advisable to install NH₃ detectors at eye level, in order to monitor the toxicity of the gas present in the air.

In a laboratory < 431 sq ft, we will offer only 1 detector per type of gas (Toxic, Oxidizing, Helium). Beyond 431 sq ft it will be necessary to install a second detector. For light explosive gases, we will put 1 sensor per 646 sq ft. This surface area is larger for light gases because there are very rarely any cluttered areas on the ceiling.

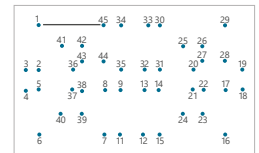
In order to ensure the relevance of the positioning of the detectors, it is necessary to take into account the following parameters:

- » The density relative to air of the gases to be detected, the volatility of the gas.
- » The appearance of gases, in the form of hot and volatile smoke which is confined upwards.
- » The positioning of the extractions.
- » Existence of natural ventilation, dead volumes, etc.
- » A uniform distribution.
- » Detectors should be placed in accessible locations for maintenance.

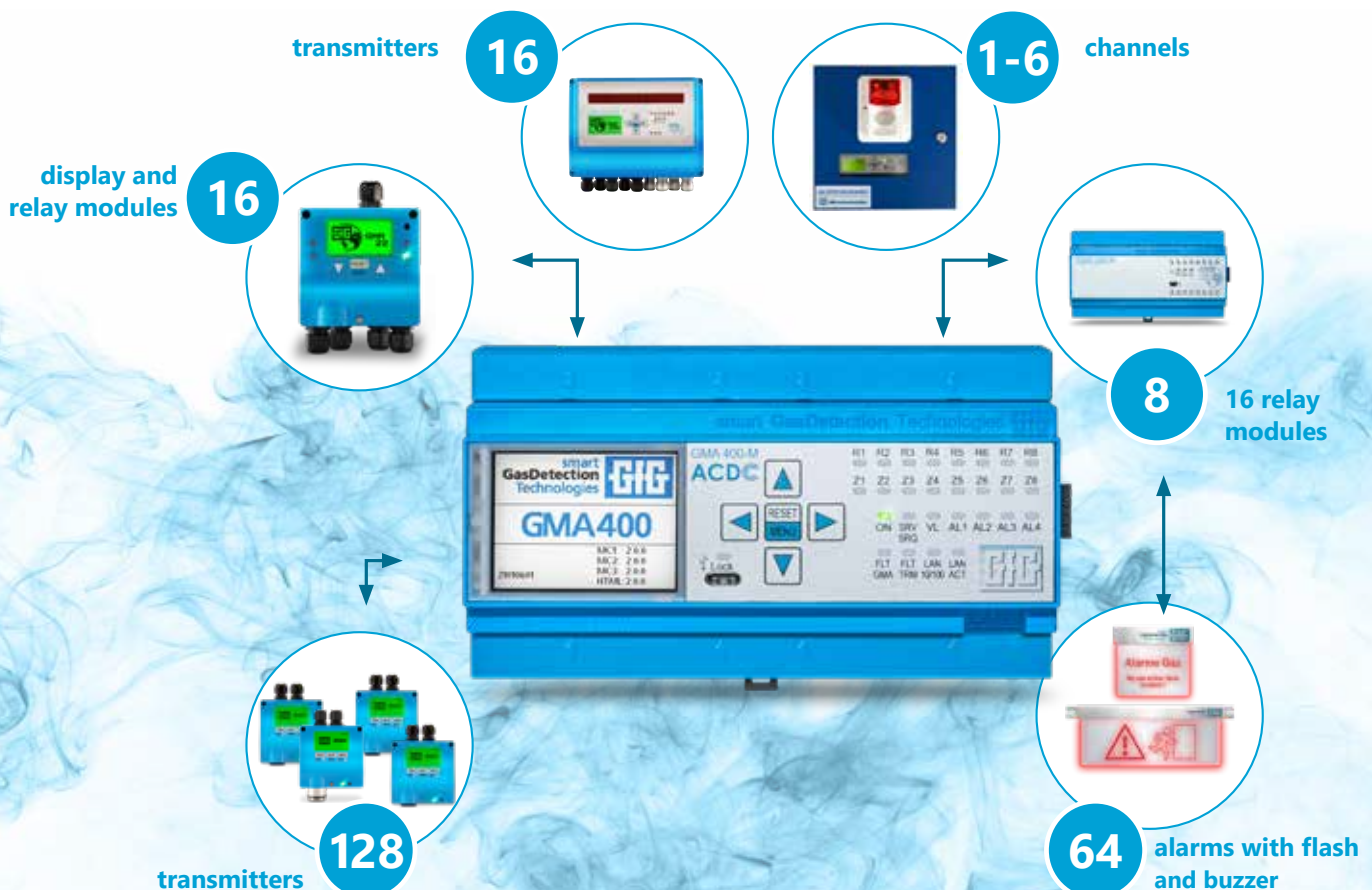
New gas detection controller by GfG GMA400

Protecting your laboratories often requires a significant number of:

- » Gas detectors at different points and heights.
- » Remote display modules at the entrance to each laboratory.
- » Sound and light alarms inside and outside each laboratory.
- » Controls for safety actions such as gas cut-off, electrical cut-off and high speed ventilation.



Thanks to the GMA400 and all the addressable GfG accessories, forming an interconnected complete set - going from the first point and continuing by a 4 conductor cable to the last. Everything else will be programmed using the GfG GMAconfig software and an almost limitless integrated cause and effect matrix!



Maintenance and service

The GfG Technical Service team is your proactive partner, from installation to commissioning and support during operation. Our primary concern is that our controllers, transmitters, and detectors contribute to the safety of people in your business. That's why our service is as reliable as our equipment.

What GfG has to offer:

As a global company, GfG offers a comprehensive service. GfG devices are synonymous with safety and quality. If repairs are necessary, they are carried out quickly and reliably. GfG Service consists of trained service technicians who provide you with individual support.

That's why we always advise you directly on-site, whenever possible. This allows GfG specialists to gain a clear understanding of the application and offer you tailor-made solutions. Simply describe your task to us, and we'll find the right solution for you. Each technology is individually tailored to your needs. This ensures the greatest possible safety for both people and systems.

Our services include:

- » Regular maintenance
- » A reliable supply of wear and spare parts
- » Fast repair in case of defect

If you have any further questions or would you like to receive a quote, please contact us directly and we will be happy to assist you.