

## Application-oriented and cost-optimized concepts for the use and handling of portable gas detection instruments

Portable gas detectors can be used in many very different ways. Checking safety before starting work in confined spaces, for example, can be done using various measurement concepts. The Dräger Pac (single-gas detectors) and X-am (multi-gas detectors)

families are built to meet the requirements of such applications and to maximize workplace safety. The "family design" and wide range of accessories on offer optimize work processes and therefore ensure economical use of the detectors.



Figure 1: Gas detector Dräger Pac 5000 carried by personnel

Table: Typical gas hazards and their detection

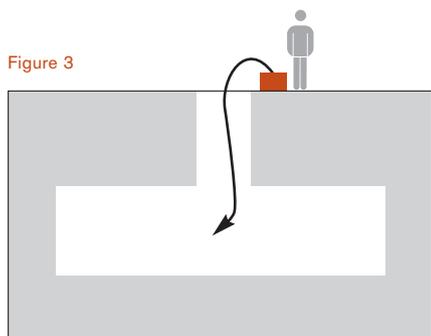
GAS	HAZARD	EXAMPLE	DETECTABLE USING
Explosive gases and vapours (e.g. methane, toluene....)	Risk of explosion	Natural gases, oil & gas (e.g. refineries, chemical industry, construction, transport, sewers...)	Catalytic sensor – X-am series Infrared sensor – X-am 7000
Explosive vapours (e.g. toluene)	Risk of explosion (see above) and toxicity	Refineries, chemical industry, transport, sewage	PID sensor – X-am 7000 OV sensor – X-am 7000
Hydrogen sulphide	Toxicity	Rotting or organic material, oil	Electrochemical H <sub>2</sub> S sensor – X-am and Pac series
Carbon monoxide	Toxicity	Incomplete combustion (e.g. cable fires, fumes...)	Electrochemical CO sensor – X-am and Pac series
Oxygen	Oxygen deficit	Natural anaerobic processes or inert atmospheres	Electrochemical O <sub>2</sub> sensor – X-am and Pac series
Carbon dioxide	Toxicity	Natural gas from rotting processes (e.g. sewage)	Electrochemical CO <sub>2</sub> sensor – X-am 7000 or Pac 7000
Nitrogen dioxide	Toxicity	Welding, combustion of diesel	Electrochemical NO <sub>x</sub> sensor – X-am 7000 or Pac 7000
Sulphur dioxide	Toxicity	Leakage or combustion of fossil fuels (e.g. refineries)	Electrochemical SO <sub>2</sub> sensor – X-am 7000 or Pac 7000
Chlorine	Toxicity	Chlorination processes (e.g. sewage plants)	Electrochemical Cl <sub>2</sub> sensor – X-am 7000 or Pac 7000
Other hazards posed by gases and vapours	Normally toxic hazards	Chemical industry, shipping etc.	Special electrochemical sensors => X-am 7000 Chip Measurement System CMS Dräger Tubes

**Figure 2:** Confined space entry measurement with Dräger X-am 2000



**Confined space entry measurements**

Before personnel can enter a confined space in which gas hazards might be present, an all-clear measurement must be performed by those responsible for safety. Multi-gas detectors with an inbuilt internal pump – e.g. the X-am 3000 and X-am 7000 – are ideally suited to this purpose.



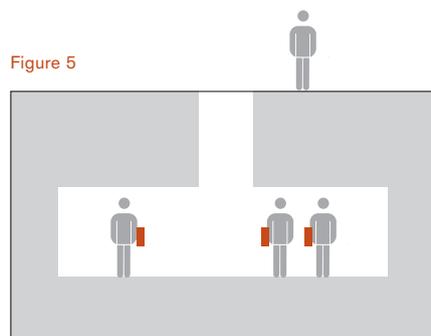
**Figure 3**

**Figure 4:** Personnel protection with Dräger X-am 2000



**Gas detector carried as personnel air monitor**

Once an all-clear measurement has been performed, each member of staff is given their own "personal gas detector". The small, lightweight Dräger X-am 2000 multi-gas detectors and the single-gas detectors of the Pac series are perfect for this application.



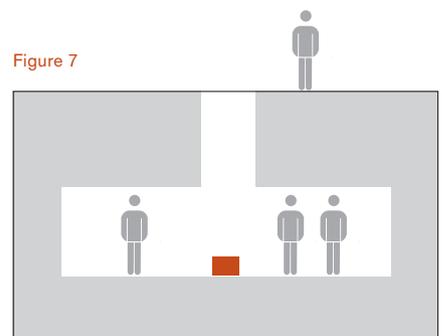
**Figure 5**

**Figure 6:** Area monitoring with Dräger X-am 3000



**Gas detector for area monitoring**

In a confined space, a gas detector can be set up and surrounded by a group of people. Confined spaces with a floor area of 50 to 75 square metres or a radius of five to seven metres around detectors like the Dräger X-am 3000 or 7000 can be classified as safe.



**Figure 7**

**Monitoring carried out by safety attendants**

Safety attendants can use pump-based gas detectors like the Dräger X-am 3000 or 7000 to detect gas hazards in confined spaces. Floor areas of 50 to 75 square metres, or a radius of five to seven metres around the sampling point, can be classified as safe. In many cases, this application is combined with personal gas detectors or area monitoring devices in a confined space.

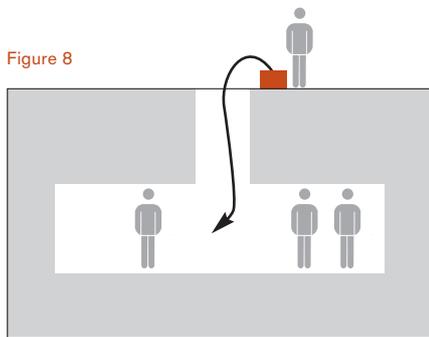


Figure 8

**Leak detection**

Portable gas detectors are also used to actively search for gas hazards. For instance, they can be used during the course of maintenance work to check that industrial valves are leak tight. Gas detectors with an internal pump, like the Multi PID II, X-am 3000 or X-am 7000, are well-suited to this purpose.

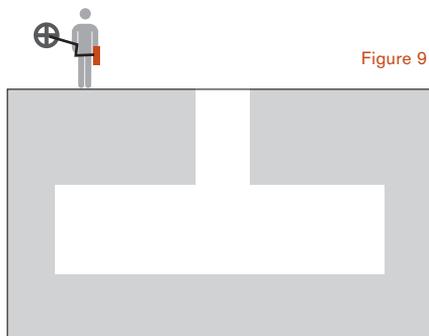


Figure 9



Figure 10: Bump Test

**Solutions to optimize work processes**

**In the morning: function tests and calibrations**

It is possible to distinguish between the use of a gas detector as a test station for function tests in the field, and a workshop solution used by service personnel. By law, gas detection instruments have to be subjected to a function test using test gas before being used in safety-related applications. These function tests, known as bump tests, are performed in some companies by personnel on site. In such cases, a straightforward and fast solution with a low gas consumption is needed – like the Dräger Bump Test Station. Workshop solutions like the Dräger E-Cal Station are professional full service stations. At the push of a button, processes such as function tests, calibration, adjustment, readout of stored data and checks of battery status can be carried out automatically. Instrument configurations can be performed easily, and in addition the PC-based station is ideal for use in data and instrument management.

**During the day: the detector in use**

The optimum design of a gas detector varies in accordance with which of the aforementioned applications is required.

- Personal gas detectors tend to be selected mainly on the basis of wearing comfort. They need to be small and light enough not to disturb the user during their work. What is more, such detectors

have to be extremely easy to operate since they are used by all employees.

- Area monitoring instruments are stable and sturdy, and feature a loud alarm which is visible from all angles.

**The trustworthy core at the heart of the gas detector – the sensor technology**

Because the life of each worker depends on the proper functioning of the gas detector when the instrument is being used in gas-hazard areas, sensor technology which will provide a dependable warning is essential. DrägerSensors are famous for their reliability. For example: catalytic Ex sensors should be sensitive not only to explosive gases like methane, as organic vapours (e.g. petrol fumes) can in many cases pose an explosion hazard. Dräger's catalytic Ex sensor is highly sensitive to organic vapours such as nonane, and therefore offers a particularly high



Figure 11



Figure 12

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Figure 13

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level of reliability in every application. To prevent electrolyte leaks in electrochemical sensors, the electrochemical DrägerSensors of the XS and XXS series feature a patented system of pressure compensation in the 700 to 1300 mbar range. Dräger's patented electrochemical oxygen sensor is designed on the basis of three-electrode technology, with no consumable parts. This gives the sensor a life span of more than five years, which considerably reduces the costs of ownership.

### Withstanding the tough demands of routine industrial use

Portable gas detection instruments must be tough enough to withstand the demands of everyday industrial use. Fully dust- and water-proof instruments with IP 67 approval are best suited to meeting this requirement. What is more, gas detectors are often used in the vicinity of electromagnetic fields (e.g. radio devices). An instrument is considered to be highly resistant to electromagnetic influence if it remains unaffected by antennae situated at a distance of 10 centimetres from the instrument. Shock-absorbing protective rubber sleeves or rubber-coated housings are the industrial standard, and protect the detectors in the event of a fall or impact. Catalytic sensors are, generally speaking, shock-resistant, though the sensors will only withstand being dropped, kicked or hit if the instrument or sensor is intelligently designed.

### Distribution and return of detectors: registration and data management

When the serviceman has to distribute a huge pile of detectors first thing in the morning, speed is of the essence to avoid long queues of people waiting. To accelerate this process and to simplify the return of the equipment at the end of the day, Dräger provides a registration tool in the form of its CC Vision workshop software. One modern way of transmitting the detector's data or event logger to a PC is

via an infrared interface. Software solutions like GasVision offer professional help with data visualization and analysis.

### After work: cleaning of equipment

At the end of a hard and dirty day's work, the detectors are handed back in, often in desperate need of a shower. Water-proof detectors featuring protection class IP 67 can in fact be cleaned using a wet sponge. (Figure 13).

### During the night: recharging

Because different companies have different strategies when it comes to recharging of equipment, different solutions are needed. For individual instruments, individual charging is possible, with cascading multiple charging stations for larger numbers of instruments. Of course, charging can also take place in a vehicle. Vehicle installation kits have to be tough enough to pass the so-called 10 G test which simulates vehicle acceleration (Figure 14).

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Figure 14

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### Conclusion

A number of different aspects have to be taken into account in order to ensure economic and cost effective operation of portable gas detection equipment. Selecting the detector best suited to the task in hand is a key factor, while on the other hand intelligent workshop solutions can help optimize work processes and, therefore, reduce the costs of ownership. Dräger developed the X-am family of multi-gas detectors and the Pac family of single-gas detectors with the needs of users in mind. In combination with the accessory solutions available for these product series, operating costs and work processes are optimized.