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# DrägerSensor® & Portable Instruments Handbook

2nd Edition

Dräger. Technology for Life®

# DrägerSensor® & Portable Instruments Handbook

2nd Edition

Dräger Safety AG & Co. KGaA
Lübeck, Germany
2011

This handbook is intended to be a reference for the users of portable gas detection. The information has been compiled to the best of our knowledge. However, the Dräger organization is not responsible for any consequence or accident which may occur as the result of misuse or misinterpretation of the information contained in this handbook.

The instructions for use may not always correspond to the data given in this book. For a full understanding of the performance characteristics of the measurement devices and for the use of Dräger products, only the instructions of use enclosed with the product shall apply and any inconsistencies between this handbook and the instructions for use shall be resolved in favour of the instructions for use. The user should carefully read and fully understand the instructions for use prior to the use of the measurement devices.

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## CONTENTS


Gas-Vision
CC-Vision E-Cal
CC-Vision
DrägerService®
E-Cal®
Calibrations and
Test System
Pump X-am® 125
Pac® 3500
Pac® 5500
Pac® 7000
Test Gases
X-am® 1700
X-am® 2000
X-am® 5000
X-am® 5600
Probes
Pump- and
calibration adapter
PAM
personal air monitoring
CSE
confined space entry
Dräger® Sensors
Area Monitoring
X-zone® 5000
(combined with
X-am® 5000 or X-am® 5600)
X-zone® 5000
attenuation ring
Tubes
CMS
accuro®
MultiPID 2
(suitable for leakage
detection)
X-am® 3000
X-am® 7000
(suitable for leakage
detection)
X-am® 7000
X-zone®
Inductive Charger
Mobile
Printer
Bump Test
Station

# 1 Foreword

Dear Readers,

So here it is – first edition of the DrägerSensor® & Portable Instruments Handbook. While creating this new handbook, we had our current customers in mind as well as prospective customers – and also our own staff. We gathered our own expertise together with some general principles and guidelines from the areas in which portable Portable Instrumentsare used. We hope that this will shed some light on the many and varied aspects of our sensors and portable gas detectors, so as to increase the safety in your place of work.

Dräger has been involved for decades in the development and production of gas detection sensors and portable gas detection devices. This is a subject area in motion – "panta rhei," as Heraclitus would have said – and the development is ongoing. Lots of innovative ideas have found their way into patents for sensors and gas detection devices. We have worked through, and continue to work through, lots of learning curves. And that is why it is always of tremendous benefit to gather the experience we have in the field of instrumentation together with our expertize in the development of sensors within one company. The demands placed on gas detection by the numerous standards and regulations are becoming more and more complex.

We are continually having to adjust in order to increase safety levels and protect people's lives. We hope that this handbook will provide you with a tool which will give you a quick, clear overview of the technologies we use – right down to the details.

May this book prove to be a dependable companion!

With best regards,

Ulf Ostermann
Portfolio Manager, Portable Instruments

P.S. A special thank to all the hard-working people who helped to produce this handbook.

# 2 Properties of dangerous gases and vapors

Flammable and toxic gases and vapors occur in many areas. It is important to recognize the danger they pose – and that is the purpose of gas detection and warning devices. This handbook is meant to give a basic introduction to gas detection technology, measuring principles and safety concerns.

## 2.1 Gases – what is a gaseous matter?

Matter at a temperature above its boiling point is referred to as a gas. In terms of the normal human environment, this means that all those substances whose boiling points at normal atmospheric pressure are below 20°C (68° F), are gases. The lightest gas is hydrogen ($H_2$, fourteen times lighter than air), the heaviest gas (around ten times heavier than air) is tungsten hexafluoride ($WF_6$).

Under normal conditions, one cubic centimeter of gas contains thirty trillion molecules, whose average distance from one another is only around 3 nanometers. They move through space at between several hundred and several thousand meters per second but, at the same time, they collide with other molecules many billions of times each second. With the result that they only cover around 50–100 nanometers between impacts, and they continuously change their direction and transfer energy to the other molecules with which they collide.

The result is a completely random molecular motion which in macroscopic terms can be measured as temperature (average kinetic energy of all the molecules) and pressure (the average force exerted on a surface by all the molecules hitting it), as well as volume (spatial extent). Pressure, temperature, and volume are always in a fixed relationship to one another, which is governed by external conditions. In an ideal situation, they obey what is known as the "ideal gas law," namely:

- **At a constant pressure, their volume changes in proportion to their temperature** – their volume increases when heated;
- **If the volume remains the same (for example, in a closed container), then their pressure changes in proportion to their temperature** – for example, the pressure inside a container increases when heated;
- **At a constant temperature, pressure changes inversely proportion to volume** – for instance, the interior pressure rises when gas is compressed.

The extremely fast random movement of gas molecules is also the reason why they mix freely with other gases, never to become seperated again. This molecular behavior also explains the tendency of molecules to become less concentrated (diffusion), something which plays an important role in gas detection technology. Generally speaking, these processes become faster, the more quickly the molecules move (in other words, the hotter the gas is) and the lighter the molecules are (in other words, the lighter the gas is).

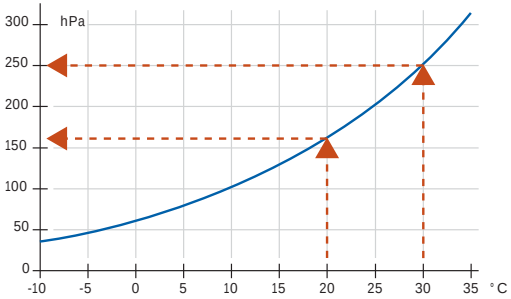
## 2.2 Vapors – aren't they gases, too?

Unlike gas – of which there are only perhaps between 200 to 300 – the word vapor is used to describe the gaseous state of a material below its boiling point. Vapor is always in equilibrium with its fluid (and sometimes solid) phase – it condenses and vaporizes according to the temperature. This is most familiar to us with water; when moist air near the ground cools down at night, ground mist forms (condensation) – but the warmth of the morning sun dissipates the mist (evaporation).

In a closed container, a maximum vapor concentration always exists above the surface of a liquid, and this concentration is dependent on the temperature of the liquid. On a microscopic level, the vapor is a result of the random movement of the liquid's molecules combined with their ability to overcome the surface tension and mix with the air molecules above the surface.

Every liquid has a certain characteristic vapor pressure, which depends on its temperature and reaches atmospheric pressure when the liquid reaches its boiling point. A graphic depiction of this relationship is known as a vapor pressure curve, and it shows the maximum possible vapor concentration at any given temperature.

Vapor pressure curve of liquid n-hexane

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If you divide the maximum possible vapor pressure by the ambient pressure, you are given the saturation concentration in Vol.-% (volume percent). Hexane gas at 20°C or 68° F (vapor pressure 162 hPa or 2.35 psi) and an ambient pressure of 1,000 hPa (14.5 psi) has a maximum possible concentration of 16.2 Vol.-%.

## 2.3 Our atmosphere

Our atmosphere extends far out into space, getting less dense the more it stretches. The blue color of the sky is caused by the scattering of the sun's rays on the air molecules in the atmosphere. The sky is actually already black by the time you reach a height of around 21 km (13 miles). If you were to subject the entire atmosphere to an even pressure of 1013 hPa (14.7 psi), then it would only be 8 km (5 miles) high, and the UV-absorbing stratospheric ozone layer would be a mere 3 mm (0.11 in.) high.

Typical composition of the earth's atmosphere in ppm:

| | Composition | |
|---|---|---|
| Gas | dry | humid |
| **Principal gases** | | |
| $N_2$ – nitrogen | 780,840 | 768,543 |
| $O_2$ – oxygen | 209,450 | 206,152 |
| $H_2O$ – water vapor | 0 | 15,748 |
| Ar – argon | 9,340 | 9,193 |
| $CO_2$ – carbon dioxide | 340 | 335 |
| **Trace gases** | | |
| Ne – neon | 18 | 18 |
| He – helium | 5 | 5 |
| $CH_4$ – methane | 1.8 | 1.8 |
| Kr – krypton | 1.1 | 1.1 |
| $H_2$ – hydrogen | 0.5 | 0.5 |
| $N_2O$ – nitrous oxide | 0.3 | 0.3 |
| CO – carbon monoxide | 0.09 | 0.09 |
| Xe – xenon | 0.09 | 0.09 |
| $O_3$ – ozone | 0.07 | 0.07 |
| Other trace gases | 3.05 | 3.0 |
| **Total** | **1,000,000** | **1,000,000** |

1 Vol.-% = 10,000 ppm; assumption for humid air: 68% r.h. at 20°C (68°F)

The earth's atmosphere has a mass of around 5 quadrillion metric tons ($5.235 \times 10^{18}$ kg), which weighs down on an area on the earth's surface of $0.507 \times 10^{15}$ $m^2$. This creates an atmospheric pressure on the earth's surface of 10,325 $kg/m^2$, which corresponds to normal atmospheric pressure: 1,013 hPa (14.7 psi). Atmospheric pressure decreases with increasing altitude:

| Altitude m/ft. | Atmospheric pressure hPa/psi | Altitude m/ft. | Atmospheric pressure hPa/psi |
|---|---|---|---|
| -1.000 (-3280.8) | 1.148 (16.6) | 2.000 (6.561,7) | 795 (11.5) |
| -500 (-1640.4) | 1.078 (15.6) | 3.000 (9.842,5) | 701 (10.2) |
| 0 (0) | 1.013 (14.7) | 4.000 (13.123,3) | 616 (8.9) |
| 500 (1640.4) | 952 (13.8) | 5.000 (16.404,2) | 540 (7.8) |
| 1.000 (3280.8) | 900 (13.1) | 6.000 (19.685,0) | 472 (6.8) |
| 1.500 (4921.2) | 840 (12.2) | 8.000 (26.246,7) | 356 (5.2) |

The number of molecules in a given volume decreases with decreasing atmospheric pressure, which means that the results produced by partial pressure-measuring sensors are always dependent on the atmospheric pressure.

More than 78 Vol.-% of the earth's atmosphere is nitrogen, which is fully inert, and although available in excess, can not even be used as a much-needed fertilizer for plants. In contrast, highly reactive oxygen is fundamental to our breathing – more than that: it is the foundation of almost all life.

Just under 21 Vol.-% of the atmosphere is oxygen. A lack of oxygen is life-threatening – and cannot be perceived by the human senses.

Oxygen deficiency is generally caused by the release of an inert gas, which then in turn displace oxygen. Since the atmosphere is only around one fifth oxygen, the oxygen concentration is only reduced by around one fifth of the concentration of the inert gas. For example, if 10 Vol.-% of helium is released into the air then oxygen is reduced by 2 Vol.-% and the level of nitrogen by 8 Vol.-%. Because liquid nitrogen (–196°C or –321°F) is frequently used in industry, its evaporation can quickly cause a dangerous oxygen deficiency.

Oxygen enrichment (e.g. more than 25 Vol.-%) cannot be perceived by humans, but have severe consequences with respect to the flammability of materials, and may even cause autoignition. This is why explosion protection relates exclusively to atmospheric oxygen concentration.

At what level does it become dangerous?

| Oxygen concentration in Vol.-% | Oxygen partial pressure in hPa/psi | Symptoms |
|---|---|---|
| Less than 17 | Less than 170/2.5 | Early stage of danger due to oxygen deficiency |
| 11 to 14 | 110 to 140/1.6 to 2.0 | Unnoticed decrease in physical and mental performance |
| 8 to 11 | 80 to 110/1.2 to 2.0 | Possible sudden loss of consciousness without warning after a certain period of exposure |
| 6 to 8 | 60 to 80/0.9 to 1.2 | Loss of consciousness within a few minutes – resuscitation possible if performed instantly |
| Less than 6 | Less than 60/0.9 | Immediate loss of consciousness |

## 2.4 Ex, Ox, Tox – gas hazards!

**Gases and vapors are almost always dangerous. If gases are not present in the atmospheric composition to which we are accustomed and which we can breathe, then safe breathing is threatened. Furthermore, all gases are potentially dangerous in their liquid, compressed, or normal state – the decisive factor is their concentration.**

There are basically three categories of risk:

- **Risk of explosion (ex)** caused by flammable gases
- **Oxygen (ox)**
  Risk of suffocation through oxygen deficiency
  Risk of increased flammability due to oxygen enrichment
- **Risk of poisoning (tox)** by toxic gases

Without equipment to assist, mankind is not in a position to detect these risks early enough to enable preventative steps from being taken. And, with a few exceptions, our nose has proven an extremely unreliable warning instrument.

For example, hydrogen sulfide can be detected in low concentrations because it smells of rotten eggs. However, the nose can no longer perceive the lethal, high concentrations of hydrogen sulfide. Many fatal accidents have occured because people have fled into what they thought was the safe, odour-free area.

Even harmless gases such as argon, helium or nitrogen can also become dangerous if they are suddenly released, displacing the oxygen that is essential to life. Then there is risk of suffocation. An oxygen concentration of less than six Vol.-% is deadly. An excess of oxygen increases the risk of fire, and can even cause flammable materials to self-ignite. By igniting, flammable gases and vapors can not only cause considerable damage to industrial plants and equipment, they can also threaten people's lives.

Therefore, it is essential to be able to detect Ex, Ox and Tox risks reliably, and to protect human life, industrial plants and equipment, as well as the environment by taking the appropriate measures. Whether Dräger-Tubes® or portable gas detectors, Dräger offers you individual solutions that meet your needs and enable you to counter gas risks professionally.

## 2.5 Toxic gases and vapors

**The toxicity of gases and vapors used in industrial processes is defined in laboratory experiments by determining the $LC_{50}$ rate. On that basis, and together with other scientific tests and experiments relating to occupational health at the workplace, authorized commissions in several countries make recommendations of limit values, which are legally binding. In Germany, this is the Federal Institute for Occupational safety and Health (BAuA).**

This maximum allowable concentration in the air means that workers will not suffer any detrimental affects to their health if they spend their entire working lives breathing in gas concentrations, which do not exceed that level. This, however, must be assured.

| Limit value | Selected substances to which this limit value applies |
|---|---|
| 5,000 ppm | carbon dioxide |
| 1,000 ppm | propane, butane |
| 500 ppm | acetone |
| 200 ppm | methyl ethyl ketone (MEK) |
| 100 ppm | butanol |
| 50 ppm | n-hexane, toluene |
| 20 ppm | acetonitrile |
| 10 ppm | chlorobenzene |
| 5 ppm | diethylamine |
| 1 ppm | 1.1.2.2-tetrachloroethane |
| 500 ppb | chlorine |
| 200 ppb | methyl chlorformate |
| 100 ppb | chlorine dioxide |
| 50 ppb | glutaraldehyde |
| 10 ppb | methyl isocyanate |

Status 2010, according to TRGS 900 (Germany)

T+ Very toxic $LC_{50}$ < 0.5 g/m³

Arsine, boron trichloride, boron trifluoride, bromine, diborane, fluorine, hydrogen cyanide, hydrogen fluoride, hydrogen phosphide, hydrogen sulfide, nitrogen dioxide, nitrogen monoxide, ozone, phosgene, sulfur tetrafluoride, tungsten hexafluoride

T Toxic $LC_{50}$ = 0.5 ... 2.0 g/m³

Acetonitrile, ammonia, benzene, carbon disulfide, carbon monoxide, chlorine, cyanogen, hydrogen chloride, methanol, methyl bromide, nitrogen trifluoride, sulfur dioxide

$LC_{50}$ (LC stands for "lethal concentration") is the gas concentration in air, which – when inhaled over a given time period (usually four hours) – kills 50% of experimental animals (normally white laboratory rats).

## 2.6 Flammable gases and vapors

Flammable gases become more dangerous when they have a relatively low LEL (lower explosion limit) or flash point. The flash point is defined by the liquid's temerature-dependent vapor pressure and it's LEL.

| Vapor | LEL Vol.-% | LEL g/m³ | Flash point in °C/°F | Vapor pressure at 20°C (68° F) in mbar | Ignition temp. in °C/°F |
|---|---|---|---|---|---|
| acetone | 2.5 | 60.5 | < –20/–4 | 246 | 535/995 |
| acrylonitrile | 2.8 | 61.9 | –5/23 | 117 | 480/896 |
| benzene | 1.2 | 39.1 | –11/12 | 100 | 555/1031 |
| n-butanol | 1.7 | 52.5 | 35/95 | 7 | 325/617 |
| n-butyl acetate | 1.2 | 58.1 | 27/81 | 11 | 390/734 |
| n-butyl acrylate | 1.2 | 64.1 | 37/99 | 5 | 275/527 |
| chlorobenzene | 1.3 | 61.0 | 28/82 | 12 | 590/1094 |
| cyclohexane | 1.0 | 35.1 | –18/–0,4 | 104 | 260/500 |
| cyclopentane | 1.4 | 40.9 | –51/–60 | 346 | 320/608 |
| 1.2-dichloroethane (EDC) | 6.2 | 255.7 | 13/55 | 87 | 440/824 |
| diethyl ether | 1.7 | 52.5 | –40/–40 | 586 | 175/374 |
| 1.4-dioxane | 1.9 | 69.7 | 11/52 | 38 | 375/707 |
| epichlorhydrin | 2.3 | 88.6 | 28/82 | 16 | 385/725 |
| ethanol | 3.1 | 59.5 | 12/54 | 58 | 400/752 |
| ethyl acetate | 2.0 | 73.4 | –4/25 | 98 | 470/878 |
| ethylbenzene | 1.0 | 44.3 | 23/73 | 10 | 430/806 |
| n-hexane | 1.0 | 35.9 | –22/–8 | 160 | 240/464 |
| methanol | 6.0 | 80.0 | 9/48 | 129 | 440/824 |
| 1-methoxy-2-propanol | 1.8 | 67.6 | 32/90 | 12 | 270/518 |
| methyl ethyl ketone (MEK) | 1.5 | 45.1 | –10/14 | 105 | 475/887 |
| methyl methacrylate | 1.7 | 70.9 | 10/50 | 40 | 430/806 |
| n-nonane | 0.7 | 37.4 | 31/88 | 5 | 205/401 |
| n-octane | 0.8 | 38.1 | 12/54 | 14 | 205/401 |
| n-pentane | 1.4 | 42.1 | –40/–40 | 562 | 260/500 |

| Vapor | LEL Vol.-% | LEL g/m³ | Flash point in °C/°F | Vapor pressure at 20°C in mbar | Ignition temperature in °C/°F |
|---|---|---|---|---|---|
| i-propanol (IPA) | 2.0 | 50.1 | 12/54 | 43 | 425/797 |
| propylene oxide | 1.9 | 46.0 | –37/–35 | 588 | 430/806 |
| styrol | 1.0 | 43.4 | 32/90 | 7 | 490/914 |
| tetrahydrofuran (THF) | 1.5 | 45.1 | –20/–4 | 200 | 230/446 |
| toluene | 1.1 | 42.2 | 6/43 | 29 | 535/995 |
| xylene (isomer mixture) | 1.0 | 44.3 | 25/77 | 7 | 465/869 |

| Gas | LEL Vol.-% | LEL g/m³ | Ignition temperature in °C/°F |
|---|---|---|---|
| acetylene | 2.3 | 24.9 | 305/581 |
| ammonia | 15.4 | 109.1 | 630/1166 |
| 1,3-butadiene | 1.4 | 31.6 | 415/779 |
| dimethyl ether | 2.7 | 51.9 | 240/464 |
| ethene (ethylene) | 2.4 | 28.1 | 440/824 |
| ethylene oxide | 2.6 | 47.8 | 435/815 |
| hydrogen | 4.0 | 3.3 | 560/1040 |
| i-butane | 1.5 | 36.3 | 460/860 |
| methane | 4.4 | 29.3 | 595/1103 |
| methyl chloride | 7.6 | 159.9 | 625/1157 |
| n-butane | 1.4 | 33.9 | 365/689 |
| n-butene (butylene) | 1.2 | 28,1 | 360/680 |
| propane | 1.7 | 31.2 | 470/878 |
| propene (propylene) | 1.8 | 31.6 | 485/905 |

Only flammable liquids have a flash point.

By definition, flammable gases do not have a flash point.

# 2.7 LEL and preventative explosion protection

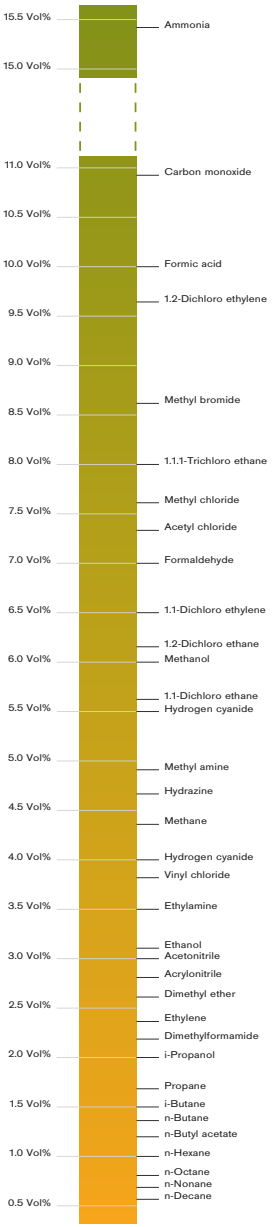
**Flammable gases and vapors can form ignitable mixtures when combined with air, but the ratio of flammable gas to oxygen (or air) must lie within certain limits.**

The lower explosion limit (LEL) is defined as the concentration of combustion gas (stated in Vol.-%) at which, under standardized conditions, the gas-air mixture can be ignited and will continue to burn on its own accord. The LEL of all known flammable gases and vapors lies in a range of approximately 0.5 to 15 Vol.-%. The LEL of hydrogen in air, for instance, is 4 Vol.-%. Accordingly, a gas sample containing 2 Vol.-% of hydrogen in air can definitely not be ignited.

## Concentration limitation

This behavior of gases and vapors has important consequences for practical explosion protection. If a flammable gas cannot be ignited below it's LEL, then we can protect people against
explosions by measuring the gas concentrations continuously and using appropriate measures to ensure that concentrations never exceed a level such as half the LEL (50% LEL).

This method of preventative explosion protection is often referred to as a primary measure. What is prevented is not the ignition of the gas, but the very formation of an atmosphere which can explode. The preferred method of measuring these concentrations is to use infrared or catalytic bead sensors, which, when used for this purpose, must fulfill certain safety requirements.

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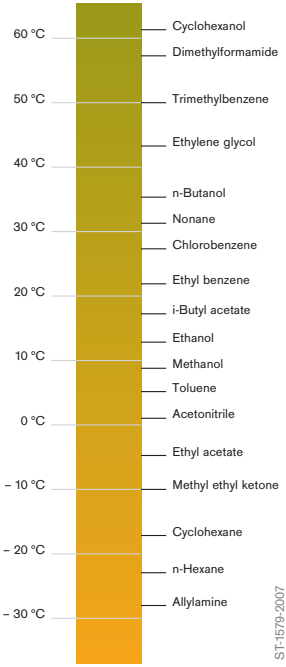
# 2.8 Flash point of flammable liquids

Although we speak of flammable liquids, in fact, the liquid state is not flammable. It is the vapor, which can form a flammable mixture together with the oxygen in the air. Both the volatility of this vapor and its lower explosion limit (LEL) comprise the measure of its potential danger. This is described by what is known as the flash point.

To be able to ignite at all, the concentration of vapor above the surface of the liquid must exceed the LEL. Whether it does so or not depends on how much vapor is produced. This, in turn, depends on what is known as the vapor pressure, which depends upon the temperature of the liquid. In safety terms, this is described by defining a flash point (F).The flash point is the temperature at which sufficient vapor forms to create a vapor-air mixture, which can be ignited in a standardized
apparatus. If a flammable liquid's flash point is above 50°C (122° F), then it definitely cannot be ignited at a temperature of 30°C (86° F).

Therefore, the lower the flash point of a flammable liquid, the more dangerous it is. Because the vapor of a flammable liquid is not ignitable below its flash point, preventative explosion protection can consist of using liquids whose flash points are significantly higher than the ambient temperature. This is often done in practice, but it does have the disadvantage – when using such liquids as solvents – that large amounts of energy are required to evaporate them. Gases by definition do not have a flash point, because under normal conditions they do not exist in liquid form.




You cannot ignite diesel (F > 55°C) using a match, but you can ignite gasoline with one (F < –20°C)!

# 2.9 Concentration and their calculation

Concentration is defined as the content of a substance within a reference substance. When measuring harmful substances in the air, the quantity of that substance is defined in terms of a concentration in relation to the air. The right units must be chosen to produce useful figures for defining the concentration. High concentration is generally given as Vol.-% – in other words, one part of a substance to 100 parts of air. Air, for example, consists of 21% Vol.-% oxygen, which means that 100 parts of air contain 21 parts of oxygen. Lower concentration levels are measured in ppm = parts per million ($mL/m^3$), or ppb = parts per billion ($\mu L/m^3$). A concentration of one ppm means there is one part of a substance in one million parts of air (the rough equivalent to one sugar cube inside a gasoline tanker). A concentration of one ppb refers to one part of a substance in one billion parts of air (equivalent to five people out of the entire population of the earth). Converting these very low concentrations into Vol.-% produces the following simple relationship:

**1 Vol.-% = 10,000 ppm = 10,000,000 ppb**

Alongside gaseous components, the air can also contain 'dissolved' solid or liquid substances, known as aerosols. The size of droplets or particles borne by the air is very small, which means that measuring them in terms of volume is not very useful. Aerosol concentrations are therefore measured in $mg/m^3$.

| | | Vol.-% | ppm | ppb |
|---|---|---|---|---|
| Vol.-% = | 10 $L/m^3$<br>1 cL/L | 1 | $10^4$ | $10^7$ |
| ppm = | $mL/m^3$<br>$\mu L/L$ | $10^{-4}$ | 1 | $10^3$ |
| ppb = | $\mu L/m^3$<br>nL/L | $10^{-7}$ | $10^{-3}$ | 1 |

| | | g/L | mg/L | $mg/m^3$ |
|---|---|---|---|---|
| g/L = | 10 $L/m^3$<br>1 cL/L | 1 | $10^3$ | $10^6$ |
| mg/L = | $mL/m^3$<br>$\mu L/L$ | $10^{-3}$ | 1 | $10^3$ |
| $mg/m^3$ | $\mu L/m^3$<br>nL/L | $10^{-6}$ | $10^{-3}$ | 1 |

### Converting $mg/m^3$ into ppm

$$c_{[ppm]} = \frac{\text{Molar volume}}{\text{Molar mass}} \cdot c$$

$$c_{[mg/m^3]} = \frac{\text{Molar mass}}{\text{Molar volume}} \cdot c$$

The molar volume of any gas is 24.1 L/mol at 20°C (68° F) and 1,013 hPa (14.7 psi); the molar mass of a specific gas should be adapted dependent on that gas.

# 3 Introduction to portable instruments

In the beginning, there was the canary. These little finches would warn miners about dangerous gases underground: if they stopped singing, the miners had to get out quick. Crude and inaccurate methods of determining gas concentrations in the atmosphere like this one have long been consigned to history.

Nowadays, precise measuring instruments monitor the concentration of dangerous gases and flammable vapors. The latest of these are compact, small, robust and flexible single-gas and multi-gas units. Gases and vapors are not always necessarily harmful; after all, the earth's atmosphere is made of them. It is not until their concentration exceeds critical levels (risk of poisoning and explosion) or drops below certain levels (risk of suffocation through oxygen deficiency) that they can become a threat. This is why portable gas detection devices are used in all kinds of ways throughout many branches of industry. Scenarios range from individual employees and small groups of workers – all the way to large-scale operations such as the industrial shutdown of an entire petrochemical plant. Instruments measuring the various dangerous gases have to perform reliably under changing conditions. This can place great demands on reliability, durability, and flexibility, because in the end the detection equipment is directly responsible for the safety and health of workers. Not every unit may be used in every working environment. Before a device is used, you have to determine whether its specifications are sufficient. These requirements are all laid down in various standards and directives.

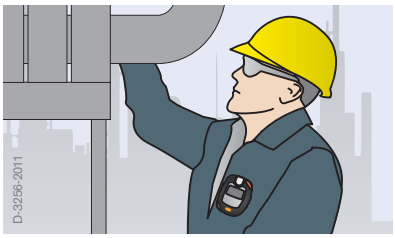
## 3.1 Application areas for portable gas detection

**Portable gas detection instruments are subject to very diverse requirements. Different application areas require solutions tailored to the measurment task, which also take into account the respective ambient conditions.**

It is generally possible to distinguish between the following application areas:

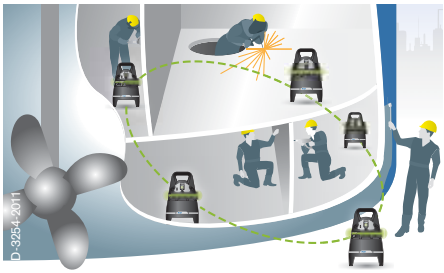
Personal monitoring

– These devices are designed to warn the wearer about gas risks in the immediate vicinity. For this reason, they are usually worn on work clothing. The basic requirements that these units therefore have to fulfill are wearing comfort, durability, and reliability. Continuously measuring single-gas and multi-gas instruments are suitable for this kind of work.



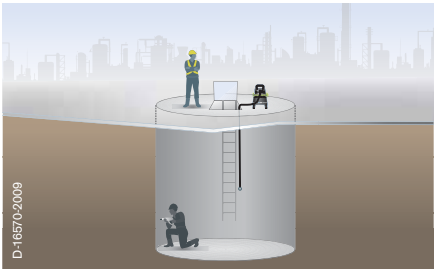
## Area monitoring

– The task here is to monitor an area in which one or more workers are active. The unit is positioned centrally so it can monitor the working area as effectively as possible. The basic requirements in this case are durability, stability, and an alarm, which is extremely easy to perceive (both visually and acoustic). Continuously measuring multi-gas instruments are used in this field.
– When several work areas are simultaneously being monitored and these individual areas are not visible from one central point, a wireless alarm chain with several area monitoring devices can provide maximum safety.

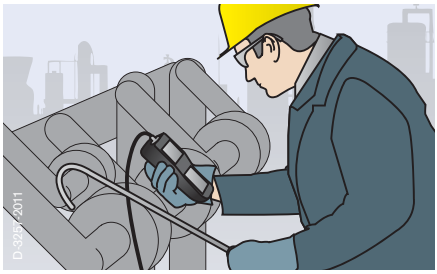

## Confined space entry

– Maintenance and repair work often require people to climb into confined spaces. These areas of work can be especially dangerous because of the lack of space, the lack of ventilation, and the presense or development of hazardous substances. A clearance measurement is required before entry. Multi-gas instruments are used together with corresponding pumps and accessories such as hoses and probes. After a successful measurement where no hazards have been found, the same instruments can be used for continuous personal monitoring while working in the confined space.




Leak detection

– Leakages can occur wherever gases or liquids are stored or transported. It is important to identify leakages quickly so that the appropriate measures can be taken to avert harm to people, the environment, and the facility. Detection devices combined with corresponding pumps must be able to respond quickly so as to detect small changes in concentration. High




## 3.2 Requirements for gas detection instruments

As safety products, gas detection devices for industrial use must fulfill the statutory requirements (explosion protection, electromagnetic compatibility), as well as other requirements, so that their quality and reliability remains assured even under tough conditions.

Explosion protection standards:
Design stipulations ensure that the gas measuring instrument does not become a source of ignition itself. Globally accepted standards include CENELEC (ATEX), CSA, UL, GOST, etc.

Protection ratings as defined by EN 60529 (IP Code)
The IP code provides information about the degree to which a casing provides protection against foreign objects and water.

IP = International Protection/Ingress Protection

Extract based on DIN EN 60529:

| First index number | Protection against solid foreign objects | Second index number | Protection against water |
|---|---|---|---|
|  | **5** Protection against contact. Protection against interior dust deposits |  | **5** Protection against projected water from any angle |
|  | **6** Complete protection against touch. Protection against dust penetration |  | **6** Protection against penetrating water during temporary flooding |
| | |  | **7** Protection against penetrating water during temporary immersion |

D-16408-2009

Protection class IP 67 provides a high degree of robustness, although this can have negative consequences in terms of vapor permeability. The MEWAGG research group ("Mess- und Warngeräte für gefährliche Gase") – part of BG Chemie (Germany's statutory employment accident insurance fund for the chemical industry) – therefore advises users who need to detect not only gases like methane and propane, but also higher hydrocarbons and solvents, to check the suitability of equipment with the manufacturer. This can, for example, involve a detection equipment assessment under ATEX.

### Quality of measurement functions

Maintaining a predefined detection quality, even under extreme ambient conditions (temperature, pressure, wind, moisture, vibration, and so on)

EN 45 544 – for toxic gases and vapors
EN 50 104 – for oxygen
EN 60 079-29-1 – for flammable gases and vapors

### Electromagnetic compatibility as defined by EN 50270

Electrical and electronic devices should not be influenced or interfered with by other electrical, magnetic, or electromagnetic fields – and vice versa. For instance, this means that using a mobile phone or a radio in the immediate vicinity of gas detection devices should not interfere with the instrument's detection signal, nor should the instrument interfere with the phone. EMC guidelines and standards define means of proving and confirming a device's insensitivity to interference and low level of interference output. Simply complying with the requirements of a standard or guideline may not be sufficient depending on the various operating and ambient conditions. Rugged industrial applications require much more robust

devices. Dräger pays special attention to these requirements, for example, with an additional in-house "robustness test."

### RoHS and REACH

The requirements for materials and substances used must also be considered during the development and production of gas detection equipment. The European RoHS (Restriction of Hazardous Substances) Directive requires that six particularly dangerous substances may not be contained in electrical and electronic devices. The REACH Regulation (Registration, Evaluation, Authorization, and Restriction of Chemicals) requires that the presence of particularly hazardous materials in products must be disclosed. Dräger seeks to avoid such substances as far as possible within the scope of technical conditions and meets the relevant directives and regulations in this regard.

## 3.3 Explosion protection

**Industrial processes very often involve flammable substances, including sometimes flammable particles. In these areas, flammable gases and vapors can sometimes be released on a process-related basis (such as relief valves) or by unforeseen incidents (breakdowns). As a means of prevention, areas such as these are designated EX areas ("zones") in which only equipment which is reliably protected against ignition may be used.**

Explosion protection is standardized worldwide; IEC (international), CENELEC (European) and NEC 505 North American standards are similar, and based on the three-zone concept which is rapidly gaining acceptance in the USA.

| Zone in IEC, NEC 505 and CENELEC | Dangerous, explosive atmosphere exists ... |
|---|---|
| Zone 0 | constantly, regularly or long-term |
| Zone 1 | occasionally |
| Zone 2 | rarely and for short periods |

American explosion protection compliant with NEC 500 is still typically based on the dual division concept:

| Division in NEC 500 | Dangerous explosive atmosphere exists ... |
|---|---|
| Division 1 | constantly or occasionally |
| Division 2 | rarely and for short periods |

## 3.4 ATEX 137 – directive 1999/92/EC

**ATEX** stands for **AT**mospheres **EX**plosibles. This directive has been binding on all systems since July 30, 2006, and is addressed to employers. It describes minimum requirements for the protection of employees' health and safety in areas at risk of explosion.

The directive pursues the following targets:
- Prevent the formation of explosive atmospheres; if this is not possible
- Prevent the ignition of explosive atmospheres; if this is not possible
- Reduce the harmful effects of an explosion to a tolerable minimum.

Employers are obliged to assess the risk of explosion in the relevant areas. Zone categories are defined by answering the question: how likely is it that an explosive atmosphere (gas, vapor, dust) will form in the areas concerned?

### ZONE DEFINITIONS IN ATEX 137, ANNEX I, 2

| | |
|---|---|
| | Areas at risk of explosion are divided into the following zones according to the likelihood of an explosive atmosphere forming there: |
| Zone 0 | Area in which explosive atmospheres comprising mixtures of air and flammable gases, vapors, and aerosols are present constantly, frequently, or over long periods of time. |
| Zone 1 | Area in which, under normal operation, an explosive atmosphere can occasionally form as a mixture of air and flammable gases, vapors, or aerosols. |
| Zone 2 | Area in which, under normal operation, an explosive atmosphere consisting of a mixture of air and flammable gases, vapors, or aerosols normally does not form – or, if so, only briefly. |
| Zone 20 | Area in which explosive atmospheres in the form of clouds of combustible dust in the air are present constantly, frequently, or over long periods of time. |
| Zone 21 | Area in which, under normal operation, an explosive atmosphere can occasionally form as clouds of combustible dust in the air. |
| Zone 22 | Area in which, under normal operation, an explosive atmosphere in the form of a cloud of combustible dust in the air normally does not form – or, if so, only briefly. |

Depending on the zone identified, only certain gas measuring instruments may be used there (this table links the categories of ATEX 95 with the zones in ATEX 137):

| Permitted use | Gas, vapor (G) | Dust (D) |
|---|---|---|
| Instruments in category 1 | Zone 0, 1, 2 | Zone 20, 21, 22 |
| Instruments in category 2 | Zone 1, 2 | Zone 21, 22 |
| Instruments in category 3 | Zone 2 | Zone 22 |

(For instrument categories, see section 3.5 ATEX 95)

The instrument group and temperature category requirements are then determined by defining the flammable gases, vapors, aerosols, and dusts used, along with their ignition temperatures.

Extract from section 2.6 “Flammable gases and vapors”

| Gas | LEL Vol.-% | LEL g/m³ | Ignition temperature in °C/°F |
|---|---|---|---|
| acetylene | 2.3 | 24.9 | 305/581 |
| ammonia | 15.4 | 109.1 | 630/1166 |
| 1,3-butadiene | 1.4 | 31.6 | 415/779 |
| dimethyl ether | 2.7 | 51.9 | 240/464 |
| ethene (ethylene) | 2.4 | 28.1 | 440/824 |
| ethylene oxide | 2.6 | 47.8 | 435/815 |
| hydrogen | 4.0 | 3.3 | 560/1040 |
| i-butane | 1.5 | 36.3 | 460/860 |
| methane | 4.4 | 29.3 | 595/1103 |
| methyl chloride | 7.6 | 159.9 | 625/1157 |
| n-butane | 1.4 | 33.9 | 365/689 |
| n-butene (butylene) | 1.2 | 28,1 | 360/680 |
| propane | 1.7 | 31.2 | 470/878 |
| propene (propylene) | 1.8 | 31.6 | 485/905 |

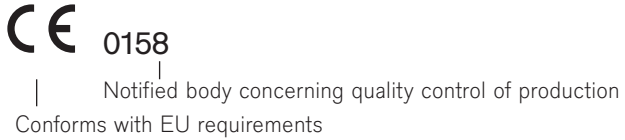
| Vapor | LEL Vol.-% | LEL g/m³ | Flash point in °C/°F | Vapor pressure at 20°C (68°F) in mbar | Ignition temperature in °C/°F |
|---|---|---|---|---|---|
| isopropyl alcohol (IPA) | 2.0 | 50.1 | 12/54 | 43 | 425/797 |
| propylene oxide | 1.9 | 46.0 | –37/–35 | 588 | 430/806 |
| styrol | 1,0 | 43.4 | 32/90 | 7 | 490/914 |
| tetrahydrofuran (THF) | 1.5 | 45.1 | –20/–4 | 200 | 230/446 |
| toluene | 1.1 | 42.2 | 6/43 | 29 | 535/995 |
| xylol (isomer mixture) | 1.0 | 44.3 | 25/77 | 7 | 465/869 |

## 3.5 ATEX 95 – directive 94/9/EC

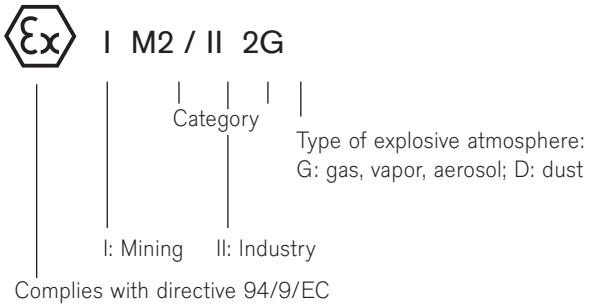
**This directive applies to, among others, the manufacturers of gas detection and warning instruments. It describes the requirements that must be fulfilled by gas detection devices used in areas at risk of explosion, and which incorporate their own potential ignition sources.**

The CE symbol of conformity – coupled with information about the equipment category (described the zones of the area at risk of explosion in which the gas warning instrument may be used as an electrical device) may look like this:

Markings as defined by 94/9/EC (ATEX 95)




Markings (as defined by ATEX):




Equipment groups I and II indicate in which area the device may be used:

I = Mining

II = Industry

Information then follows about which equipment category the gas detection device satisfies:

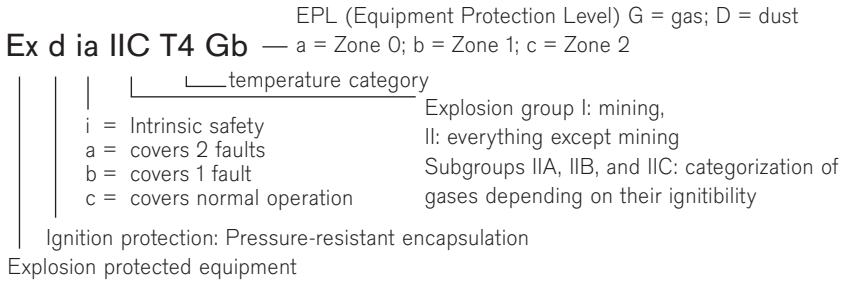
| | |
|---|---|
| **Category 1** | Very high level of safety, sufficient safety provided by two protective measures or in the event of two faults |
| **Category 2** | Sufficient safety in the event of frequent equipment faults or one breakdown |
| **Category 3** | Sufficient safety if operation is fault-free |

Finally, the atmosphere is indicated (G: gas, vapor, aerosol or D: conductive and non-conductive combustible dusts).

The designation indicates the zones in which the instrument may be used (example for industry).

| Ex area: | Zone 0 | Zone 1 | Zone 2 | Zone 20 | Zone 21 | Zone 22 |
|---|---|---|---|---|---|---|
| Ex atmosphere: | constantly, long-term or frequently | occasionally | normally not or only short-term | constantly, long-term or frequently | occasionally | normally not or only short-term |
| II 1 G | yes | yes | yes | no | no | no |
| II 2 G | no | yes | yes | no | no | no |
| II 3 G | no | no | yes | no | no | no |
| II 1 D | no | no | no | yes | yes | yes |
| II 2 D | no | no | no | no | yes | yes |
| II 3 D | no | no | no | no | no | yes |

Explosion protection designation in EN 60079




The requirements for electrical equipment to be used in hazardous areas are outlined in the standard series EN 60079. In addition to the requirements, markings are defined as well. A marking according to ATEX as well as a marking to indicate the equipment protection level (EPL = Equipment Protection Level) is required. With the introduction of the EPL, it is now possible to allocate which device may be used in which explosive atmosphere or area outside of Europe as well.

Ignition protection types provide information about the protective measures incorporated into a device:

Ignition protection types and CENELEC standards

| Abbreviation | CENELEC standard | Ignition protection type |
|---|---|---|
| **Gas** | | |
| | EN 60079-0 | General terms |
| Ex o | EN 60079-6 | Oil immersion |
| Ex p | EN 60079-2 | Pressurized encapsulation |
| Ex m | EN 60079-18 | Encapsulation |
| Ex q | EN 60079-5 | Powder / Sand filling |
| Ex d | EN 60079-1 | Explosion/Flame-proof encapsulation |
| Ex e | EN 60079-7 | Increased safety |
| Ex ia<br>Ex ib<br>Ec ic | EN 60079-11 | Intrinsic safety<br>ia required for Zone 0<br>ib sufficient for Zone 1<br>ic sufficient for Zone 2 |
| Ex n | EN 60079-15 | Ignition protection types for Zone 2 |
| **Dust** | | |
| | EN 61241-0 | General terms |
| Ex tD | EN 61241-1 | Protection by instrument housing |
| Ex pD | EN 61241-2 | Dust – pressurized encapsulation |
| Ex iD | EN 61241-11 | Dust – intrinsic safety |

Comparison: Designation according to IEC (2007) / CENELEC (2009) and EU directive 94/9/EG (ATEX)

| EPL (Equipment Protection Level) | | |
|---|---|---|
| according to IEC / CENELEC | according to EU directive 94/9/EG | Area |
| Ma | M1 | Mining |
| Mb | M2 | |
| Ga | 1G | explosive gas atmosheres |
| Gb | 2G | |
| Gc | 3G | |
| Da | 1D | area with combustible dust |
| Db | 2D | |
| Dc | 3D | |

Explosion group

Explosion group I encompasses equipment used for mining (coal dust and methane atmospheres). Explosion group II applies to all other areas (all other gases). For the ignition types “explosion/flame-proof encapsulation” and “intrinsic safety,” explosion group II is subdivided into IIA, IIB, and IIC. This subdivision relates to the different levels of ignitability in terms of ignition penetration and electrical sparks. Explosion group IIC covers all gases and vapors. In the future, we will also see explosion group III for flammable dusts, and this in turn will be subdivided in three other groups (IIIA: flammable fibers, IIIB: non-conductive dust, IIIC: conductive dust).

## CATEGORIZATION OF GASES AND VAPORS

| Explosion group | Temperature category (max. permissible surface temperature) | | | | | |
|---|---|---|---|---|---|---|
| | T1 (450°C) | T2 (300°C) | T3 (200°C) | T4 (135°C) | T5 (100°C) | T6 (85°C) |
| Ignition temp. | > 450°C | 300–450°C | 200–300°C | 135–300°C | 100–135°C | 85–100°C |
| | > 842°F | 572–842°F | 392–572°F | 275–572°F | 212–275°F | 185–212°F |
| I | methane | | | | | |
| IIA | acetone | isoamyl acetate | amyl alcohol | acetaldehyde | | |
| Ignition energy | ammonia | n-butane | benzine | | | |
| more than | benzene | n-butanol | diesel fuel | | | |
| 0.18 mJ | ethyl acetate | 1-butene | heating oil | | | |
| | methane | propyl acetate | n-hexane | | | |
| | methanol | i-propanol | | | | |
| | propane | vinyl chloride | | | | |
| | toluene | | | | | |
| IIB | hydrogen cyanide | 1.3-butadiene | dimethyl ether | diethyl ether | | |
| Ignition energy | coal gas | 1.4-dioxane | ethylglycol | | | |
| 0.06 to 0.18 mJ | | ethylene | hydrogen sulfide | | | |
| | | ethylene oxide | | | | |
| IIC | hydrogen | acetylene | | | | carbon disulfide |
| Ignition energy less than 0.06 mJ | | | | | | |

### Temperature category

Electrical equipment in group II is categorized according to the maximum surface temperatures that are allowed to come into contact with explosive atmospheres. The ignition temperature of the gas must be greater than the maximum surface temperature. T6 covers all gases and vapors. For dust explosion protection, the maximum surface temperature is specified in °C, e.g. T130 °C (266 °F).

The last part of the designation, the EC construction type certificate, shows among other things which testing station tested the equipment and when the first time.

### EC construction type certification:

BVS 10 ATEX E 080X

- E: X: Special conditions / U: Ex-component
- 080: Number of certificate
- X: Complies with European Directive 94/9/EC
- 10: Year of EC certificate's publication
- BVS: Notified body having type-approved equipment

## 3.6 Laws and regulations in USA, Canada, and Mexico

Laws and regulations in most municipalities, states, and provinces in North America require certain products to be tested to a specific standard or group of standards by a Nationally Recognized Testing Laboratory (NRTL). There are a number of third party approval agencies in the US – UL, FM, ETL and many others. They all provide ratings for Intrinsic Safety and provide some performance testing. They do not have any regulatory or legal status. They are primarily a certification to verify the safety of a product for insurance purposes and to minimize liability.

Underwriters Laboratories Inc. (UL)
is a private third party product safety certification organization. UL develops standards and test procedures for products, materials, components, assemblies, tools and equipment, chiefly dealing with product safety. UL is one of several companies approved for such testing by the U.S. federal agency OSHA. OSHA maintains a list of approved NRTL's.

UL develops standards for safety, often based on American National Standards (ANSI) and evaluates many types of products. A typical standard for electronic products includes not only requirements for electrical safety, but also spread of fire and mechanical hazards. UL evaluates products for compliance with specific safety requirements. UL develops its Standards to correlate with the requirements of model installation codes, such as the National Electrical Code (NEC).

UL evaluates instruments for Intrinsic Safety (IS) for use in hazardous areas. The IS rating means that the instrument will not be the source of ignition in a potentially explosive environment. The areas are defined by the type of hazard that may exist (Class), the possibility of a hazard being present in the area (Division) and the specific hazards that may be encountered (Group). UL 913 is the applicable Standard for Safety for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations.

Hazardous Location:

An area where the possibility of explosion and fire is created by the presence of flammable gases, vapors, dusts, fibers or filings.

| | |
|---|---|
| **Class I** | Those areas in which flammable gases or vapors may be present in the air in sufficient quantities to be explosive or ignitable. |
| **Class II** | Those areas made hazardous by the presence of combustible dust. |
| **Class III** | Those areas in which there are easily ignitable fibers or filings present, due to type of material being handled, stored or processed. |

| | |
|---|---|
| **Division 1** | Division 1 is the normal situation; the hazard would be expected to be present in everyday production operations or during frequent repair and maintenance activity. |
| **Division 2** | Division 2 is the abnormal situation; material is expected to be confined within closed containers or closed systems and will be present only through accidental rupture, breakage or unusual faulty operation. |

Groups

The gases and vapors of Class I locations are broken into four groups by the codes A, B, C and D. These materials are grouped according to the ignition temperature of the substance, its explosion pressure and other flammable characteristics.

Class II – dust locations – groups E, F & G. These groups are classified according to the ignition temperature and the conductivity of the hazardous substance.

| | | |
|---|---|---|
| The gases and vapors of Class I locations are broken into four groups by the codes A, B, C and D. These materials are grouped according to the ignition temperature of the substance, its explosion pressure and other flammable characteristics. | **Group A** | Acetylene |
| | **Group B** | Hydrogen |
| | **Group C** | Ethyl-Ether, Ethylene, Cycle Propane |
| | **Group D** | Gasoline, Hexane, Naptha, Benzene, Butane, Propane, Alcohol, Laquer Solvent Vapors, Natural Gas |
| Class II – dust locations – groups E, F & G. These groups are classified according to the ignition temperature and the conductivity of the hazardous substance. | **Group E** | Metal Dust |
| | **Group F** | Carbon Black, Coal, Coke Dust |
| | **Group G** | Flour, Starch, Grain Dust |

Operating Temperature Codes

| Maximum Temperature | | |
|---|---|---|
| Degrees C | Degrees F | Temperature Codes |
| 450 | 842 | T1 |
| 300 | 572 | T2 |
| 280 | 536 | T2A |
| 260 | 500 | T2B |
| 230 | 446 | T2C |
| 215 | 419 | T2D |
| 200 | 392 | T3 |
| 180 | 356 | T3A |
| 165 | 329 | T3B |
| 160 | 320 | T3C |
| 135 | 275 | T4 |
| 120 | 248 | T4A |
| 100 | 212 | T5 |
| 85 | 185 | T6 |

These are simplified definitions – refer to National Electrical Code (NEC), Article 500 for complete definitions.

Notes

1) T1 through T2D not applicable to Class II location.
2) T2A through T2D, Class I Group D only.

A typical UL classification would look like this:

Only as to intrinsic safety for use in hazardous locations

## Class I&II, Div.1, Grps A,B,C,D,E,F,G

Safe in atmospheres containing the gases listed in the chart above

Use in areas where the hazard could exist at any time

For use in potentially explosive gas or dust atmospheres

UL is currently planning to start using the Zone classification system for North America as part of a global harmonization effort.

| | |
|---|---|
| **Division 1:** Where ignitable concentrations of flammable gases, vapors or liquids can exist all of the time or some of the time under normal operating conditions. | **Zone 0:** Where ignitable concentrations of flammable gases, vapors or liquids are present continuously or for long periods of time under normal operating conditions. |
| | **Zone 1:** Where ignitable concentrations of flammable gases, vapors or liquids are likely to exist under normal operation conditions. |
| **Division 2:** Where ignitable concentrations of flammable gases, vapors or liquids are not likely to exist under normal operation conditions. | **Zone 2:** Where ignitable concentrations of flammable gases, vapors or liquids are not likely to exist under normal operation conditions. |

### US Mine Safety Health Administration (MSHA)

In the United States, equipment for use in mines must be approved by the US Mine Safety Health Administration (MSHA). MSHA maintains its own test facilities and has specific standards for electrical equipment being used in mines. MSHA defines and enforces safety regulations for all types of mining operations as legislated by the US Congress. This includes both underground and above ground coal mines, metal/nonmetal mines and large tunneling operations. The MSHA approval process is a legal requirement for use of equipment in a mine. MSHA considers all underground operations as hazardous locations. An MSHA approval reads a bit differently than a UL approval label, although the same classification codes are used:

### Permissible Gas Monitor

Only as to intrinsic safety for use in hazardous locations, Class I
Div. 1, Group A<B<C<D Temp Code T4, Ta ≤ 55 °C

### The Canadian Standards Association (CSA)

The Canadian Standards Association (CSA) is a not-for-profit association composed of representatives from government, industry, and consumer groups. They are involved with many diverse areas of specialization such as climate change, business management and safety and performance standards, including those for electrical and electronic equipment, industrial equipment, boilers and pressure vessels, compressed gas handling appliances, environmental protection, and construction materials. CSA also provides advisory services, training materials and print and electronic published standard documents. Currently forty percent of all the standards issued by CSA are referenced in Canadian legislation.

CSA developed the CAN/CSA Z299 series of quality assurance standards still in use today. They are an alternative to the ISO 9000 series of quality standards.

They do all of the review and testing for Intrinsic Safety and conduct performance testing. They propose standards which are often codified into law or become de facto standards in Canada. CSA is a recognized NRTL for testing and safety.

### Mexican Safety and Health

Mexican Safety and Health is controlled by the Norma Official Mexicana (NOM) regulations. Nom -005-STPS-1998 is very comparable to 29 CFR 1910.1200, the basic OSHA regulation in the US. While using US OSHA regulations as a basis, the Mexican government has implemented local requirements. They accept the testing and standards of any of the Nationally Recognized Testing Labs.

## HAZARDOUS LOCATIONS CLASSIFICATIONS

| Classification Material Presence | IEC, ATEX NEC 505 Codes | NEC 500 CSA/UL Codes | Max Surface Temp. | IEC, ATEX NEC 505 Codes | NEC 500 CSA/UL Codes |
|---|---|---|---|---|---|
| | | | | | |
| Continuously Present | Zone 0 | Division 1 | 450 °C | T1 | T1 |
| Intermittently Present | Zone 1 | Division 1 | 300 °C | T2 | T2 |
| Abnormally Present | Zone 2 | Division 2 | 280 °C | | T2A |
| Apparatus | | | 260 °C | | T2B |
| Gas & Vapors | | | 230 °C | | T2C |
| Acetylene | Group IIC | Class I/ Group A | 215 °C | | T2D |
| Hydrogen | Group IIB | Class I/ Group B | 200 °C | T3 | T3 |
| Ethylene | Group IIB | Class I/ Group C | 180 °C | | T3A |
| Propane | Group IIA | Class I/ Group D | 165 °C | | T3B |
| Methane | Group I | Class I/ Group D | 160 °C | | T3C |
| Dust | | | 135 °C | T4 | T4 |
| Metal | N/A | Class II/ Group E | 120 °C | | T4A |
| Coal | N/A | Class II/ Group F | 100 °C | T5 | T5 |
| Grain | N/A | Class II/ Group G | 85 °C | T6 | T6 |
| Fibers (All) | N/A | Class III | | | |

## 3.7 Single-gas measuring instruments


If the danger of toxic gases or vapors can be narrowed down to a single gas or condustive component, then single-gas measuring and warning devices are the ideal solution for personal monitoring in the workplace. They are small, robust, and ergonomic. These devices are usually attached to the work clothing near the breathing area, but do not limit the movement of workers. They monitor the ambient air continuously and produce an alarm (visual, acoustic, and by vibration) if the gas concentration exceeds an alarm limit preset in the device. This enables employees to respond immediately to dangers if accidents occur during normal operation, or if unforeseen events occur during maintenance and repair work.


### Dräger Pac 3500–7000

The Pac 3500–7000 family is equipped with XXS sensors. These miniaturized electrochemical sensors enable a small, ergonomic instrument design. The sensor sits right behind a replaceable dust and water filter which protects it from outside influences, and yet has a negligible effect on response times. Like accuracy and reliability, response time is a crucial factor. The $t_{90}$ to $t_{20}$ times provide information about how quickly the sensor responds to changes in gas concentration. Their fast response times and very small diffusion paths enable these sensors to react extremely quickly, immediately indicating any danger that arises. The electrical signal produced by the sensor is converted into a concentration reading on the display by the unit's electronics and software. Alarm thresholds are stored in the unit (A1 = pre-alarm/A2 = main alarm). If gas concentrations exceed these alarm thresholds, then the unit produces an acoustic, visual, and vibration alarm. Durability and explosion protection are two other important factors when choosing the right gas detection device.

### Dräger X-am 5100

The Dräger X-am 5100 is designed for the measurement of the gases / vapors hydrazine, hydrogen peroxide, hydrogen chloride and hydrogen fluoride. These special gas hazards are difficult to detect because they adsorb to different surfaces. The open gas inlet projecting from the device prevents that adsorbing surfaces are between the gas and the gas sensor. A rapid response of the proven XS sensors is thus also ensured for these special gases.

# Dräger Pac 3500/5500/7000

ST-15139-2008

Small and robust, economical and powerful. The compact Dräger Pac family is equipped with the latest sensor technology and a multitude of features, and is tailor-made for the diverse demands of industry.

D-537-2009

ST-1743-2005

## OTHER BENEFITS

| |
|---|
| Robust: water- and dust-protection compliant with IP 66/67 |
| Ideal solution for functional testing and adjustment |
| Flexible alarm and warning features |
| Long sensor and device life time at Dräger Pac 5500 and 7000 |
| Reliable gas entry from both sides |

ST-6066-2004

Personal monitoring

## ESPECIALLY SUITED FOR THE FOLLOWING APPLICATIONS

| | |
|---|---|
| **Personal monitoring** | Robust, IP 66/67 |
| | Reliable gas inlets from both sides |
| | Response time of 10 seconds |

The impact-resistant housing is covered with protective rubber, which makes it resistant to corrosive chemicals. A strong, rotating crocodile clip made from stainless steel allows the unit to be fixed securely to clothing or belt.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Dimensions (W × H × D)** | 84 × 64 × 25 mm; 3.3 x 2.5 x 1.0 in. |
| **Weight** | 120 g; 3.8 oz. |
| **Ambient conditions:** | |
| Temperature | –30 to +50°C; -20 to +120°F |
| Pressure | 700 to 1,300 hPa |
| Humidity | 10 to 90% r.h. |
| Ingress protection | IP 66/67 |
| **Alarms:** | |
| Visual | 360° |
| Acoustic | Multi-tone alarm > 90 dB in 30 cm (1 ft.) |
| Vibration | yes |
| **Power supply** | Replaceable lithium battery |

# Dräger Pac 3500/5500/7000

## FEATURES COMPARISON

| | Dräger Pac 3500 | Dräger Pac 5500 | Dräger Pac 7000 |
|---|---|---|---|
| **Compatible sensors:** | | | |
| XXS EC sensors | $O_2$, CO, $H_2S$-LC | $O_2$, CO, $H_2S$-LC | $O_2$, CO, $H_2S$-LC, $CO_2$, $Cl_2$, HCN, $NH_3$, NO, $NO_2$, $PH_3$, $SO_2$, $H_2S$, OV; OV-A |
| Operation time | 2 years | Unlimited | Unlimited |
| **Data logger:** | Events saved with date and time (up to 60 events) | Events saved with date and time (up to 60 events) | Concentrations and events saved together with date and time (up to 120 hours at 1 data set per minute). |
| Battery life CO, $H_2S$ | 8 hours/day, 2 years (1 minute alarm per day) | 8 hours/day, 2 years (1 minute alarm per day) | 24 hours/day > 5,500 hours (1 minute alarm per day) |
| Battery life $O_2$ | 8 hours/day, 1 year (1 minute alarm per day) | 8 hours/day, 1 year (1 minute alarm per day) | 24 hours/day > 2,700 hours (1 minute alarm per day) |
| Bump test | Pushing the OK-button 3 times | Pushing the OK-button 3 times | Automatic |
| **Approvals:** | | | |
| ATEX | ATEX I M1 / II 1G Ex ia I/IIC T4 | ATEX I M1 / II 1G Ex ia I/IIC T4 | ATEX I M1 / II 1G Ex ia I/IIC T4 |
| Measurement performance certificate | – | – | XXS EC Sensoren: $O_2$, $H_2S$, CO |
| UL | Class I, II Div. 1 Group A, B, C, D, E, F, G Temp. Code T4 | Class I, II Div. 1 Group A, B, C, D, E, F, G Temp. Code T4 | Class I, II Div. 1 Group A, B, C, D, E, F, G Temp. Code T4 |
| CSA | Class I, II Div. 1 Gruppe A, B, C, D, E, F, G Temp.-Code T4 | Class I, II Div. 1 Gruppe A, B, C, D, E, F, G Temp.-Code T4 | Class I, II Div. 1 Gruppe A, B, C, D, E, F, G Temp.-Code T4 |
| IECEx | Ex ia II CT4 | Ex ia II CT4 | Ex ia II CT4 |
| GOST | PO Exial X / 0ExialICT4 X | PO Exial X / 0ExialICT4 X | PO Exial X / 0ExialICT4 X |
| RUS – Pattern Approval Certificate of measuring instruments | XXS EC Sensoren: $O_2$, $H_2S$, CO | XXS EC Sensoren: $O_2$, $H_2S$, CO | XXS EC Sensoren: $O_2$, $H_2S$, CO, $H_2S$ LC, $Cl_2$, $CO_2$, HCN, $PH_3$, $NH_3$, $NO_2$, $SO_2$, OV, OV-A |
| MED | – | – | 96/98/EC |
| CE mark | Electromagnetic compatibility (Directive 2004/108/EC) | Electromagnetic compatibility (Directive 2004/180/EC) | Electromagnetic compatibility (Directive 2004/108/EC) |

## ACCESSORIES

| | |
|---|---|
| **Calibration accessories** | Dräger Bump Test Station |
| | Dräger E-Cal |
| | Communication accessories: |
| | Dräger CC-Vision/Pac-Vision |
| | Printer Set for Dräger Bump Test Station |

ST-4701-2005

Dräger Bump Test Station

D-12277-2009

Dräger E-Cal

ST-1521-2007

Printer Set for Dräger Bump Test Station

ST-14355-2008

Communication cradle & Dräger PacVision

# Dräger X-am 5100

D-11213-2011

The Dräger X-am 5100 is designed for the measurement of the gases / vapors hydrazine, hydrogen peroxide, hydrogen chloride and hydrogen fluoride. These special gas hazards are difficult to detect because they adsorb to different surfaces. The open gas inlet projecting from the device prevents that adsorbing surfaces are between the gas and the gas sensor. A rapid response of the proven XS sensors is thus also ensured for these special gases. Dräger X-am 5100 can only be operated in diffusion mode.

## OTHER BENEFITS

| |
|---|
| Usage in industrial area – Ex approved |
| Measurement performance of the sensors are independent of the device |
| Easy solutions for service, calibration and bump testing |

ST-7817-2005

Personal monitoring

## ESPECIALLY SUITED FOR THE FOLLOWING APPLICATIONS

| | |
|---|---|
| **Personal monitoring** | small and light<br>rapid respond time of the Dräger XS Sensors<br>Battery life > 200 hours |

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Dimensions (W × H × D)** | 47 x 129 x 55 mm; 1.85 x 5.08 x 2.17 in. |
| **Weight** | ca. 220 g; 7 oz. |
| **Ambient conditions:** | |
| Temperature | -20 to +50; -4 to +120°F |
| Pressure | 700 to 1300 |
| Humidity | 10 to 95 % r.H. |
| Ingress protection | IP 54 |
| **Alarms:** | |
| Visual | 180° |
| Acoustic | Multi-tone alarm > 90 dB in 30 cm (1 ft.) |
| Vibration | yes |
| **Power supply** | Alkaline, rechargeable NiMH for Alkaline Pack, T4 Akku Pack |
| **Battery life (h)** | > 200 |
| **Charging time (h)** | < 4 |
| **Compatible sensors** | XS Sensors XS $H_2O_2$, XS Hydrazine, XS HF/HCL |
| **Operation time** | unlimited |
| **Data logger** | can be read out via IR > 1000 h at a recording interval of 1 value per minute |
| **Approvals:** | |
| ATEX | pending |
| c CSA us | pending |
| IECEx | pending |
| CE mark | Electromagnetic compatibility (Directive 2004/108/EC) |
| RoHS | Directive 2002/95/EC |

## ACCESSORIES

| | |
|---|---|
| **General accessories** | Charging module<br>Car charging connection cable 12V/24V |
| **Calibration accessories** | Communication accessories: Dräger CC-Vision<br>Calibration adapter |

D-2126-2011

**Dräger CC-Vision**
Communication software

D-12284-2009

Charging accessories

ST-14351-2008

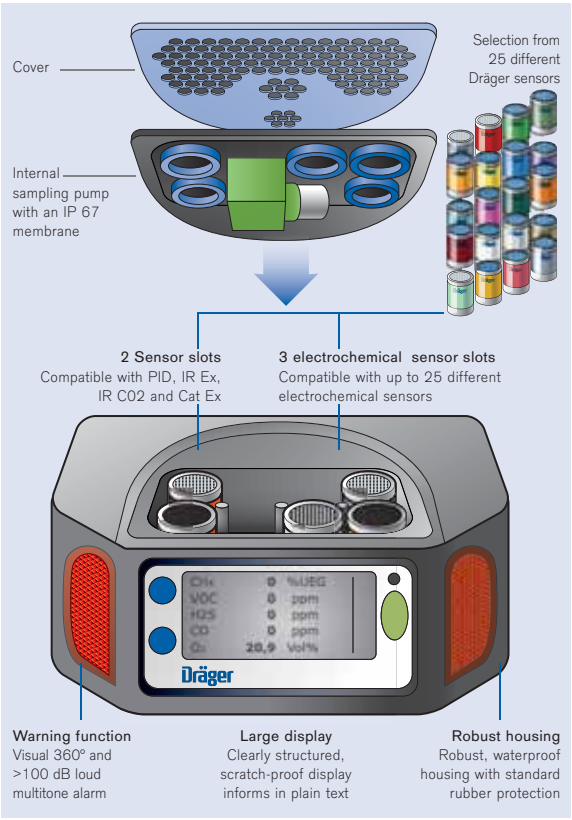
Car charging connecting cable

# 3.8 Multi-gas measuring instruments

If hazardous substances (Ex-Ox-Tox) occur in the work place, then it is advisable to use continuous multi-gas measuring instruments. These enable different measuring approaches be used (infrared, catalytic bead, PID, and electrochemical sensors) in one device, thus drawing on the strengths of the measurement principles.

The constellation of the sensors depends on the application. Up to 6 gases can be detected in real-time and continuously. As well as being used for personal monitoring and area monitoring, multi-gas measuring instruments can also be used for clearance monitorings and leak detection with the help of optional accessories. Multi-gas measuring instruments include the Dräger X-am 1700, X-am 2000, X-am 3000, X-am 5000, X-am 5600, and X-am 7000.

**Gas measurement technology** (example: Dräger X-am 7000)




D-16407-2009

# Dräger X-am 1700/2000/5000/5600


ST-7461-2005


ST-9468-2007


D-27784-2009

Dräger offers a complete product series for the simultaneous measurement of different gases. The Dräger X-am 1700/2000/5000/5600 family is a new generation of gas detection equipment. Its practical design, cell-phone size, low weight, and the long-life of the electrochemical XXS sensors make this family the perfect companion for personal monitoring. Combined with an optional external pump and hose or probe, they are perfect for confined space entry measurements.

## OTHER BENEFITS

Robust: water and dust protection compliant with IP 67

Reliable gas inlets from both sides

Precise, vapor-sensitive Ex monitoring

Ideal solution for functional testing and calibration
(automatic testing and calibration station – Dräger E-Cal & Dräger Bump Test Station)


ST-7317-2005

Personal monitoring


ST-9555-2007

Confined space entry


ST-9618-2007

Leak detection


D-27769-2009

Area Monitoring

## ESPECIALLY SUITED FOR THE FOLLOWING APPLICATIONS

| | |
|---|---|
| **Personal monitoring** | Durable, IP 67 |
| **Confined space entry** | High level of flexibility using external pump (with 20 m or 66 ft. tube), adaptable to various probes |
| **Leak detection** | Catalytic sensors and XXS sensors respond quickly |
| **Area Monitoring** | Wireless fenceline, available for use in Zone 0 |

An optional external pump, which can be operated using a hose of up to 20 meters (66 ft.) long, is an ideal solution for applications involving the confined space entry measurements in tanks, pipelines, etc. When the instrument is placed in the cradle, the pump automatically starts. The Dräger E-Cal automatic test and calibration station and the Dräger Bump Test Station are ideal system accessories for saving time and minimizing your workload.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Dimensions (W × H × D)** | 47 × 129 × 31 mm; 1.8 x 5.1 x 1.2 in. |
| **Weight** | 220 g; 8.8 oz. |
| **Ambient conditions:** | |
| Temperature | –20 to +50°C; -4 to +122°F |
| Pressure | 700 to 1,300 hPa |
| Humidity | 10 to 95% r.h. |
| Ingress protection | IP 67 |
| **Alarms:** | |
| Visual | 180° |
| Acoustic | Multi-tone > 90 dB in 30 cm (1 ft.) |
| Vibration | yes |
| **Power supply** | Alkaline, rechargeable NiMH for alkaline pack, T4 rechargeable battery pack |
| **Operating period (h)** | approx. 10 |
| **Charging time (h)** | < 4 |
| **Pump mode (Dräger X-am 1/2/5000 external pump)** | Maximum hose length 20 m; 66 ft. |

# Dräger X-am 1700/2000/5000/5600

## FEATURES COMPARISON

| | Dräger X-am 1700/2000 | Dräger X-am 5000 | Dräger X-am 5600 |
|---|---|---|---|
| **Compatible sensors** | X-am 1700: Catalytic sensor, $O_2$, CO and $H_2S$ X-am 2000: Flexible 1 - 4 sensors. One catalytic sensor and XXS EC sensors - $O_2$ ,CO, and $H_2S$ | Flexible from 1 to 4 sensors. One catalytic sensor and 3 XXS EC sensors (see XXS EC sensors) | Flexible from 1 to 4 sensors One IR sensor and 3 XXS EC sensors (see XXS EC sensors) |
| **XXS EC sensors** | $O_2$, CO, $H_2S$ | Amine, $O_2$, CO, $COCL_2$, CO HC, $H_2S$, $H_2S$ LC, $H_2S$ HC, $CO_2$, $Cl_2$, HCN, $NH_3$, NO, $NO_2$, $NO_2$ LC, $PH_3$, $PH_3$ HC, $SO_2$, OV, OV-A, $H_2S$/CO, CO $H_2$ (compensated), $H_2$, $H_2$ HC, Odorant, $O_3$ | Amine, $O_2$, CO, $COCL_2$, CO HC, $H_2S$, $H_2S$ LC, $H_2S$ HC, $CO_2$, $Cl_2$, HCN, $NH_3$, NO, $NO_2$, $NO_2$ LC, $PH_3$, $PH_3$ HC, $SO_2$, OV, OV-A, $H_2S$/CO, CO $H_2$ (compensated), $H_2$, $H_2$ HC, Odorant, $O_3$ |
| **Catalytic sensors** | | | |
| Cat Ex 125 PR | 0–100% LEL<br>0–5 Vol.-% $CH_4$ | 0–100% LEL<br>0–100 Vol.-% $CH_4$<br>Special calibration for organic vapors is possible | |
| Cat Ex 125 Mining | | 0–100% LEL<br>0–100 Vol.-% $CH_4$ | |
| **Infrared sensors** | | | 0–100% LEL<br>0–100 Vol.-% $CH_4$ / $C_4H_{10}$ / $C_2H_4$ / LPG |
| IR Ex | | | |
| IR $CO_2$ | | | 0–5 Vol.-% $CO_2$ |
| IR $CO_2$/Ex | | | 0–100% LEL<br>0–100 Vol.-% $CH_4$ / $C_4H_{10}$ / $C_2H_4$ / LPG<br>0–5 Vol.-% $CO_2$ |
| Operation time | 2 years (X-am 1700) unlimited (X-am 2000) | Unlimited | Unlimited |
| Data logger | Can be read out via Infrared > 1000 hours with 4 gases and a recording interval of 1 value per minute | Can be read out via Infrared > 1000 hours with 5 gases and a recording interval of 1 value per minute | Can be read out via Infrared > 1000 hours with 6 gases and a recording interval of 1 value per minute |
| **Approvals:** | | | |
| ATEX | I M1/II 2G Ex ia d IIC T4/T3<br>I M2 EEx ia d I | I M1/II 1G Ex ia I/IIC T3<br>I M2/II 2G Ex d ia I/IIC T4/T3 | I M1/II 1G Ex ia I/IIC T4/T3 |
| Measurement performance certificate | for $O_2$ according to EN 50104/CO and $H_2S$ according to EN 45544/Methane to Nonane according to EN 60079 and EN 50271 | for $O_2$ according to EN 50104/CO and $H_2S$ according to EN 45544/Methane to Nonane according to EN 60079 and EN 50271 | for $O_2$ according to EN 50104/CO and $H_2S$ according to EN 45544/Methane to Nonane according to EN 60079 and EN 50271 |
| UL | Class I & II, Div. 1 Group A, B, C, D, E, F, G, T. Code T4/T3 | Class I & II, Div. 1 Group A, B, C, D, E, F, G, T. Code T4/T3 | |
| CSA | Class I Div. 1 Group A, B, C, D, T. Code T4/T3 | Class I, Div. 1 Group A, B, C, D T. Code T4/T3 | |
| c CSA us | | | Div.1, Class I, Groups A,B,C,D T4/T3<br>A/Ex ia IIC T4/T3 /Ga<br>Canada:<br>Ex ia IIC T4/T3<br>USA:<br>AEx ia IIC T4/T3 Ga |

## FEATURES COMPARISON

| | Dräger X-am 1700/2000 | Dräger X-am 5000 | Dräger X-am 5600 |
|---|---|---|---|
| IECEx | Ex ia d I/IIC T4/T3 | Ex ia I<br>Ex ia IIC T3<br>Ex d ia I<br>Ex d ia IIC T4/T3 | Ex ia I<br>Ex ia IIC T4/T3 |
| CE mark | Electromagnetic compatibility (Directive 2004/108/EC) | Electromagnetic compatibility (Directive 2004/108/EC) | Electromagnetic compatibility (Directive 2004/108/EC) |
| RoHS | Directive 2002/95/EC | Directive 2002/95/EC | Directive 2002/95/EC |
| MED | X-am 2000:<br>MED 96/98/EG | MED 96/98/EG | MED 96/98/EG |
| MSHA | X-am 1700 no /<br>X-am 2000 according the requirement "Title 30 Code of Federal Regulations, Part 22 for use in gassy underground mines" | according the requirement "Title 30 Code of Federal Regulations, Part 22 for use in gassy underground mines" | – |
| GOST | PB Ex d ia I X / 1 Ex d ia IIC T4/T3 X | PO Ex ia I X / 0 Ex ia IIC T3 X oder PB Ex d ia I X/ 1 Ex d ia IIC T4/T3 X | PO Ex ia 1X / 0 Ex ia IIC T4/T3 X |

## ACCESSORIES

| | |
|---|---|
| **General accessories** | Charging module |
| | Car charging connection cable 12V/24V |
| **Calibration accessories** | Dräger Bump Test Station |
| | Dräger E-Cal |
| | Communication accessories: Dräger CC-Vision |
| | Printer Set for Dräger Bump Test Station |
| | Nonane tester (for function tests) |
| **Pump accessories** | Dräger X-am 1/2/5000 external pump |
| | Hoses of various lengths |
| | Probes |
| **Area Monitoring** | Dräger X-zone 5000 |

ST-1526-2007

Printer Set for Dräger Bump Test Station

D-12278-2009

Dräger E-Cal

ST-9476-2007

External pump

ST-15024-2008

Nonane tester

D-23594-2009

Dräger X-zone 5000

# Dräger X-Zone 5000

D-23612-2009

State-of-the-art area monotoring – the Dräger X-zone 5000, in combination with the Dräger X-am 5000/5600 gas detection instruments, can be used for the measuement of one to six gases. This easily transportable, robust and waterproof unit extends mobile gas detection technology to a unique system with many flexible applications.

## OTHER BENEFITS

IP 67 and Zone 0 approval for industrial applications

Wireless communication of X-zone's for frequencie: 868 MHz, 915 MHz, 433 Mhz and 430 MHz

digital radio, robust and interference-free transmission between two X-zone up to 100 m

robust and simple to be used induction wireless charging technology available

PowerOff-function: via the potential-free alarm contact external equipment can be switched off during an alarm occur.

D-27692-2009

D-27691-2009

## ESPECIALLY SUITED FOR THE FOLLOWING APPLICATIONS

| | |
|---|---|
| **Area Monitoring** | up to 25 Dräger X-zone can be automatically interconnected to form a wireless fenceline, this allows a flexible monitoirng of larger areas, e.g. pipelines or industrial tanks continuous operation of up to 120 hours for not only for Dräger X-zone 5000 but for Dräger X-zone 5000 and Dräger X-am 5000/5600. |
| **Confined space entry** | An optional intergrated pump allows the continuous monitoring like confined space entry or locations which are difficult to access, from a distance of up to 45 m. |

The Dräger X-zone 5000 transforms the Dräger personal gas detection instruments Dräger X-am 5000/5600 into innovative area monitoring devices for a wide range of application.This gas measurement system is patented. With the 360°alarm amplifier, the acoustic warning is heard with the same volume from all sides. X-zone 5000 affords a new portable safety concept. Up to 25 Dräger X-zones can be automatically interconnected to form a wireless fenceline. In the event of a gas alarm, the device transmits the alarm signal to all units that are part of the fenceline which then signal a daughter alarm. The daughter alarm is, in contrast to the red master alarm, displayed geen/red by the illuminated LED ring, thus allowing and providing for a fast and easy recognitions of the alarm itself as well as of the alarm-trigging devices. This ensures and easy and clear evacuation alarm and alerting. Via the potential-free alarm contact, the Dräger X-zone 5000 device can also be interconnected and operate external equipment such as alarm horns, lamps or traffic lights. Furthermore, the fenceline signal together with the alarm contact can be forwarded to a control room - overseeing a wide range of applications. Dräger X-zone 5000 as an area monitoring devices often stay located well within an explosion hazard area, even in during a gas alarm. It is therefore all the more important the

devices are approved for use in explosion hazard areas, zone 0. The modern induction charger, is simple to use, comfortable and has no problem with dirty charging contacts, so it is maintenance friendly.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Dimensions (W × H × D)** | 480 x 300 x 300 mm; 19 x 12 x 12 in |
| **Weight** | 7 kg; 247 oz. (12 Ah battery) 10 kg; 353 oz. (24 Ah battery) |
| **Ambient conditions:** | |
| Temperature | -20 to +50; -4 to +122°F |
| Pressure | 700 to 1,300 hPa |
| Humidity | 10 to 95 % r.h. |
| Ingress protection | IP 67 |
| **Alarms:** | |
| Visual | 360° LED (illuminated ring) |
| Acoustic | multi-tone: > 108 in 1m (3.3 ft.)<br>> 120 in 30 cm (1 ft.) |
| Vibration | no |

| | |
|---|---|
| **Alarm output** | Potential-free alarm contact for intrinsically safe circuits (6 pole); < 30 V bis 0,25 A (0,15 A constant current); Resisting load |
| **Radio transmission** | Worldwide licencse-free ISM frequencies<br>Digital radio, robust and interference-free transmission up to 100 m. |
| **RF approval** | 868 MHz (EU, Norway, Switzerland, Turkey, South Africa, Singapore)<br>915 MHz (USA, Canada, India, Australia)<br>433 MHz (Russia)<br>429 MHz (Japan) |
| **Power supply** | Pb-Akku |
| **Operation period** | 60 h (12 Ah)<br>120 h ( 24 Ah)<br>at 15 min alarm per day and fully equipped Dräger x-am 5000 |
| **Charging period** | < 10 h, flexilbe power supply; External 100 - 240V charger (worldwide) or inductive wireless charging |
| **Pump mode** | internal pump / hose length: max 45 m |
| **Approval** | |
| ATEX | I M1 Ex ia I Ma<br>II 1G Ex ia IIC T3 Ga<br>II 2G Ex ia d IIC T4 Gb |
| c CSA us | Class I, Zone 0, AExia IIC T3 Ga<br>Class I, Zone 1, AExia d IIC T4 Gb<br>Ex ia IIC T3<br>Ex ia d IIC T4<br>Ex ia IIC T4 |
| IECEx | Ex ia I Ma, Ex ia IIC T3 Ga, Ex ia d IIC T4 Gb |
| CE-mark | Electromagnetic compatibility (Directive 2004/108/EC) /<br>R&TTE (Directive 99/005/EG) |

## ACCESSORIES

| | |
|---|---|
| **General accessories** | Inductive charger<br>Plug-in charger<br>Pb-battery (12 Ah or 24 Ah)<br>Socket, 30 cm high; for measurement of light gases<br>Alarm damper, for use within bump tests<br>X-zone Switch Off, X-zone Switch On |
| **Calibration accessories** | Bump Test adapter for function tests<br>Cover plate with diffusion adapter<br>Communication accessories:<br>Dräger CC-Vision<br>USB DIRA with USB cable |
| **Pump accessories** | cover plate with pump adapter<br>different measuring probe<br>extension hose, different lenght |

D-23634-2009

**Inductive charger**
Allowing easy charging

D-23631-2009

**Socket**
For measurements of light gases

D-23627-2009

**Cover plate**
With diffusion adapter

ST-5026-2005

**Dräger CC-Vision**
Configuration software

D-27768-2009

**Alarm damper**
For use within bump tests

D-6704-2011

**X-zone Switch Off**
Switching station

D-6741-2011

**X-zone Switch On**
Switching station

# Dräger X-am 3000

ST-129-2004

Rugged construction for industrial use: the robust Dräger X-am 3000 two- to four-gas detection device continuously measures $H_2S$, CO, $O_2$, and flammable gas in the ambient air. Its functional design and microprocessor-controlled digital technology are made especially to fulfill the requirements of personal monitoring. Combined with a hose of up to 20 meters (66 ft.) in length, Dräger X-am 3000 with an internal high-performance pump is excellent for confined space entry measurements in tanks, pipelines, etc. When the pump adapter is attached, the device automatically switches from diffusion to pump operation.

## OTHER BENEFITS

| |
|---|
| Integrated water- and dust-filter compliant with IP 65 |
| Easy to handle, with large display |
| Intelligent sensors |
| Flexible power supply options |

ST-2881-2003

Personal monitoring

ST-2923-2003

Confined space entry

## ESPECIALLY SUITED FOR THE FOLLOWING APPLICATIONS

| | |
|---|---|
| **Personal monitoring** | Durable, IP 65 |
| **Confined space entry** | Internal high-performance pump combined with a hose of up to 20 m (66 ft.) and a pump adapter |
| **Leak detection** | Pump can be used together with various probes |

An integrated water- and dust-filter ensures reliable operation. The optional rubber boot offers additional protection against impact and vibration. Replaceable NiMH and alkaline batteries, and a vehicle charger option, make the unit very flexible in application.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Dimensions (W × H × D)** | 90 × 140 × 55 mm; 3.5 x 5.5 x 2.2 in. |
| **Weight** | approx. 550 g; 20 oz. |
| **Ambient conditions:** | |
| Temperature | –20 to +55 °C, short-term –40 to +55 °C<br>–5 to +130 °F, short-term –40 to +130 °F |
| Pressure | 700 to 1,300 hPa |
| Humidity | 10 to 95% r.h. |
| Ingress protection | IP 65 |
| **Alarms:** | |
| Visual | yes |
| Acoustic | > 90 dB in 30 cm (1 ft.) |
| Vibration | yes |
| **Power supply** | Alkaline, rechargeable NiMH for alkaline pack |
| **Battery life (h)** | Alkaline: > 24 (diffusion mode)<br>> 12 (pump mode)<br>NiMH: > 18 (diffusion mode)<br>> 12 (pump mode) |
| **Charging time (h)** | < 4 |
| Data logger (without bump tests) | 60 h |
| Pump mode | Maximum hose length 20 m (66 ft.) |
| **Approvals:** | |
| ATEX | I M2 / II 2G EEx ia d I/IIC T4<br>-25 °C ≤ Ta ≤ + 55 °C (NiMh)<br>-25 °C ≤ Ta ≤ + 50 °C (alkaline) |
| Measurement performance certificate | for $O_2$ according to EN 50104/ CO and $H_2S$ according to EN 45544/ Methane according to EN 61779 |
| UL | Class I Div. 1 Group A, B, C, D, T. Code T4 |
| CSA | Class I Div. 1 Group A, B, C, D, T. Code T4 |
| IECEx | Ex ia d I/IIC T4; –25 ≤ Ta ≤ +55°C (NiMh)<br>–25 ≤ Ta ≤ +50°C (alkaline) |
| CE mark | Electromagnetic compatibility (Directive 2004/108/EC) |

## ACCESSORIES

| | |
|---|---|
| **General accessories** | Charging module, Power supply for vehicles |
| **Calibration accessories** | Dräger Bump Test Station<br>Dräger E-Cal<br>Communication accessories: Dräger CC-Vision |
| **Pump accessories** | Pump adapter<br>Dräger X-am 3000 pump<br>Probes<br>Hoses |

ST-14368-2008

Dräger Bump Test Station

ST-576-2005

Dräger E-Cal

ST-134-2004

Charging module

ST-4983-2005

Pump adapter and hose

# Dräger X-am 7000

ST-7054-2005

Multi-purpose: the Dräger X-am 7000 is the innovative solution for the simultaneous and continuous measurement of up to five gases. A combination of more than 25 sensors allows flexible solutions to individual monitoring tasks. The X-am 7000 can be equipped with three electrochemical and two infrared, catalytic bead sensors or photo ionization sensors. It is the ideal companion in a variety of applications where the reliable detection of oxygen, toxic and combustible gases and vapors is necessary.

## OTHER BENEFITS

- Integrated water- and dust-filter, and immersion-proof, as defined in IP 67
- Clearly structured, scratch-resistant display
- Very loud acoustic multi-tone alarm and 360° all-round visual alarm
- Intelligent charge management
- Intuitive software functions

ST-7058-2005

Area monitoring

ST-2770-2003

Confined space entry

ST-6109-2004

Leak detection

## ESPECIALLY SUITED FOR THE FOLLOWING APPLICATIONS

| | |
|---|---|
| **Area monitoring** | Durable, IP 67 |
| **Confined space entry** | Built-in high-performance pump makes it possible to sample gas using a hose up to 45 m/150 ft. long. |
| **Leak detection** | Extensive portfolio of over 25 different DrägerSensors enables the detection of more than 100 gases and vapors. |

Smart Cat Ex sensors enable the detection of flammable gases and vapors, and can be calibrated to as many as five different sensitivity levels. The unit can be switched automatically from % LEL to 100 Vol.-% in full-range mode. Leakages are reliably detected, visually in bar-graph mode and audibly in tracking mode.

The PID sensor detects organic vapors in very low concentrations. An integrated library of 20 substances, three user-adaptable channels, and an easy switch to leak detection mode makes the instrument flexible enough to met your specific needs.

With the help of Dräger CC-Vision software, up to 5 different detection applications can be saved within the instrument. By doing so, the use of different instrument configurations can be set for that specific application. During operation, a simple change between these set parameters can be done via the instrument's menu.

In addition to the electrochemical sensors, the catalytic and infrared sensors are automatically recognized by the instrument upon insertion. All sensors are pre-calibrated, and therefore a reconfiguration of the Dräger X-am 7000 can be done by simply changing the sensor. No additional service or maintenance is necessary.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Dimensions (W × H × D)** | 150 × 140 × 75 mm; 5.9 x 5.6 x 3 in. |
| **Weight** | 600 g; 21 oz. (basic unit)<br>490 g; 17 oz. (rechargeable battery 3.0 Ah)<br>730 g; 26 oz. (rechargeable battery 6.0 Ah) |
| **Ambient conditions:** | |
| Temperature | –20 to +55 °C, short-term, –40 to +60 °C,<br>–5 to + 130 °F, short-term –40 to +140 °F |
| Pressure | 700 to 1,300 hPa |
| Humidity | 10 to 95% r.h. |
| Ingress protection | IP 67 |
| **Alarms:** | |
| Visual | 360° |
| Acoustic | Multi-tone > 100 dB in 30 cm (1 ft.) |
| Vibration | no |
| **Power supply** | Alkaline, rechargeable NiMH |
| **Battery life (h)** | Alkaline: > 20<br>NiMH: > 9 (4.8 V/3.0 Ah)<br>> 20 (4.8 V/6.0 Ah)<br>(complete with all sensors and 20 % of the time in pumped mode) |
| **Charging time (h)** | 3.5 to 7, dependent on battery type |
| Data logger | 100 h |
| Pump mode | Maximum hose length of 45 m (150 ft.) |
| **Approvals:** | |
| ATEX | II 2G EEx ia d IIC T4 Gb; -20 ≤ Ta ≤ + 60 °C<br>I M2 EEx ia d I Mb |
| Measurement performance certificate | for Methane, Propane and Nonane according to EN 60079-27-1 |
| UL | Class I Div. 1 Group A, B, C, D, Temp. Code T4<br>–20 ≤ Ta ≤ + 60 °C (NiMH);<br>–20 ≤ Ta ≤ +40 °C (Alkaline) |
| CSA | Class I Div. 1 Gruppe A, B, C, D,<br>T.-Code T4 -20 ≤ Ta ≤ + 60 °C |
| IECEx | Ex ia d I/IIC T4; -20 ≤ Ta ≤ + 60 °C |
| MED | MED 96/98/EC |
| CE mark | Electromagnetic compatibility<br>(Directive 2004/108/EC) |

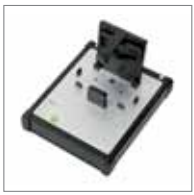
## ACCESSORIES

| | |
|---|---|
| **General accessories** | Charging module |
| | Power supply for charging module |
| | Power supply for vehicles |
| | Car mounting kit |
| **Calibration accessories** | Dräger Bump Test Station |
| | Dräger E-Cal |
| | Communication accessories: |
| | Dräger CC-Vision/Gas-Vision |
| | Printer Set for Dräger Bump Test Station |
| **Pump accessories** | Pump adapter |
| | Pump membrane set |
| | Probes |
| | Hoses |

ST-7491-2005

Dräger Bump Test Station

ST-551-2005



Dräger E-Cal

ST-4990-2005

Pump adapter

ST-14991-2008

Charging module

# Dräger Multi-PID 2

ST-2425-2003

Innovative technology: the Dräger Multi-PID 2 is a highly developed photo-ionization measuring instrument for highly volatile organic compounds. Its innovative PID (photo ionization detector) technology combines great sensitivity and durability with enormous flexibility in all sorts of applications such as screening soil, water and the ambient air in containers, detecting leakages, and taking measurements in confined spaces.

## OTHER BENEFITS

- Large standard measurement range of 0 to 2,000 ppm
- Large 5-language display and assigned calibration button
- Various warning functions
- Prefilter tube for the specific measurement of benzene
- Comprehensive gas library

ST-2729-2003

Leak detection

## ESPECIALLY SUITED FOR THE FOLLOWING APPLICATIONS

- **Leak search**
- **Confined space entry**

- PID sensor responds quickly
- Additional gas dilution probe extends measurement range up to 20,000 ppm

The instrument contains a gas library of up to 50 substances. Many other substances (see list of detectable gases and vapors) are identified and can be entered into the device if required. The Dräger application laboratory can also define customer-specified compounds for the instrument.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Dimensions (W × H × D)** | 230 × 110 × 80 mm, width at handle 67 mm;<br>9 x 4.3 x 3 in., width at handle 2.6 in. |
| **Weight** | 860 g; 1.9 lb. |
| **Ambient conditions:** | |
| Temperature | 0 to +40 °C; +32 to +104 °F |
| Pressure | – |
| Humidity | 0 to 95% r.h., non-condensing |
| **Alarms:** | |
| Visual | Warning lamp |
| Acoustic | > 95 dB at 30 cm (1 ft.) |
| Vibration | No |
| **Power supply** | Nickel-cadmium battery |
| **Operating period (h)** | 8 |
| **Charging time (h)** | < 4 |
| Data logger | Built-in data memory capable of storing up to 15,000 readings |
| Pump operation | Hose length up to 3 m; 9.8 ft. |
| **Approvals:** | |
| CE mark | Electromagnetic compatibility (Directive 89/336/EEC) |

## TECHNICAL SPECIFICATIONS FOR SENSORS

| | |
|---|---|
| **Lamps** | 10.6 eV/11.7 eV |
| **Detection limit** | 0.1 ppm isobutylene |
| **Resolution** | 0.1 ppm to 100 ppm<br>1 ppm from 100 ppm |
| **Measurement accuracy** | ± 10% or ± 2 ppm, whichever is higher |
| **Response time** | ≤ 3 seconds at 20 °C or 68 °F ($T_{90}$) |

## ACCESSORIES

| | |
|---|---|
| **General accessories** | Worldwide charger, 110–230 V<br>Charger USA, 110 V AC<br>Rechargeable battery pack<br>12 V DC car charger adapter |
| **Calibration accessories** | Calibration gas regulator<br>Calibration gas (100 ppm i-butene)<br>Communication accessories: Dräger GasVision |
| **Measurement accessories** | Pre-tube holder<br>Pre-filter tube for benzene<br>Pre-filter tube for humidity<br>10.6 eV/11.7 eV detector lamp |
| **Pump accessories** | Gas sample bag<br>Sampling probe, 17 cm (6.7 in.)<br>Dilution probe<br>Replacement filter for dilution probe<br>Replacement particle filter |

## ACCESSORIES


ST-15025-2008

Dräger Multi-PID 2 Professional Set


ST-8348-2006

Pre-filter tube for the specific measurement of benzene


ST-14343-2008

Single charger


ST-5027-2005

Dräger GasVision

The response factors apply to a measurement range of 5 to 500 ppm and are based on calibration with 100 ppm isobutylene. Response factor for isobutylene = 1.0. The response factors are determined using the following formula:

$$\text{Response factor} = \frac{\text{Actual concentration}}{\text{Displayed concentration}}$$

A response factor below 1 means that the compound is displayed with greater sensitivity than isobutylene. A response factor above 1 means that the compound is displayed with less sensitivity than isobutylene.

## RESPONSE FACTORS

| Substance | CAS No. | 10.6 eV-lamp | 11.7-eV lamp |
|---|---|---|---|
| Acetaldehyde | 75-07-0 | 10.5 | |
| Acetic acid, anhydride | 108-24-7 | 4.9 | |
| Acetone | 67-64-1 | 1.2 | |
| Acetophenone | 98-86-2 | 1.7 | |
| Acrolein | 107-02-8 | 4.0 | |
| Acrylonitrile | 107-13-1 | | 5.8 |
| Allyl chloride | 107-05-1 | 3.9 | |
| (-)-Alpha-pinene | 7785-26-4 | 0.4 | |
| Ammonia | 7664-41-7 | 10.0 | |
| Aniline | 62-53-3 | 0.5 | |
| Benzene | 71-43-2 | 0.5 | |
| Benzonitrile | 100-47-0 | 0.5 | |
| Benzyl alcohol | 100-51-6 | 1.0 | |
| Biphenyl | 92-52-4 | 3.2 | |
| Bromoform | 75-25-2 | 2.0 | |
| 1-Brompropane | 106-94-5 | 1.9 | |
| 1,3-Butadiene | 106-99-0 | 0.7 | |
| 1-Butanol | 71-36-3 | 3.4 | |
| 1-Butanol, 3-methyl, acetate | 123-92-2 | 1.8 | |
| 2-Butenal | 4170-30-3 | 1.2 | |

## RESPONSE FACTORS

| Substance | CAS No. | 10.6-eV lamp | 11.7-eV lamp |
|---|---|---|---|
| 2-Butoxyethyl acetate | 112-07-2 | 2.3 | |
| 1-Butyl acetate | 123-86-4 | 2.3 | |
| 1-Butyl mercaptan | 109-79-5 | 0.6 | |
| Carbon disulfide | 75-15-0 | 1.3 | |
| Carbonyl sulfide | 463-58-1 | | 4.8 |
| Chloroacetone | 78-95-5 | 1.3 | |
| Chlorobenzene | 108-90-7 | 0.4 | |
| Cis-1,2-dichloroethylene | 156-59-2 | 0.8 | |
| Cumene | 98-82-8 | 0.6 | |
| Cyclohexane | 110-82-7 | 1.3 | |
| Cyclohexanone | 108-94-1 | 0.9 | |
| Cyclohexylamine | 108-91-8 | 0.5 | |
| Cyclopentane | 287-92-3 | > 20 | |
| Dibutyl ether | 142-96-1 | 1.0 | |
| Dibutylamine | 111-92-2 | 0.7 | |
| 1,2-Dichlorobenzene | 95-50-1 | 0.5 | |
| 1,1-Dichloroethylene | 75-35-4 | 0.8 | |
| 1,3-Dichloropropene | 542-75-6 | 0.8 | |
| Diethyl ether | 60-29-7 | 1.2 | |
| 1,1-Difluoroethene | 75-38-7 | 12.0 | |
| Diisopropyl ether | 108-20-3 | 0.8 | |
| Dimethyl disulfide | 624-92-0 | 0.2 | |
| Dimethyl ether | 115-10-6 | 2.2 | |
| Dimethyl sulfide | 75-18-3 | 1.0 | |
| 1,4-Dioxane | 123-91-1 | 1.3 | |
| Epichlorohydrin | 106-89-8 | 6.5 | |
| 1,2-Ethanediamine | 107-15-3 | 3.0 | |
| Ethanol | 64-17-5 | | 7.4 |
| 2-Ethoxyethanol | 110-80-5 | 1.3 | |
| 2-Ethoxy-2-methylpropane | 637-92-3 | 0.9 | |
| Ethyl acetate | 141-78-6 | 3.8 | |
| Ethyl acrylate | 140-88-5 | 2.3 | |
| Ethyl bromide | 74-96-4 | 4.8 | |
| Ethyl mercaptan | 75-08-1 | 0.6 | |
| 4-Ethyl toluene | 622-96-8 | 0.5 | |
| Ethylbenzene | 100-41-4 | 0.5 | |
| Ethylene | 74-85-1 | 10.1 | |
| 2-Ethylhexyl acrylate | 103-11-7 | 1.8 | |
| Ethylene oxide | 75-21-8 | approx. 17 | |
| Furfural | 98-01-1 | 1.0 | |
| 2-Heptanone | 110-43-0 | 0.9 | |
| 1-Hexene | 592-41-6 | 1.6 | |
| Hydrazine | 302-01-2 | 1.0 | |
| Hydrogen phosphide | 7803-51-2 | 3.4 | |

## RESPONSE FACTORS

| Substance | CAS No. | 10.6-eV lamp | 11.7-eV lamp |
|---|---|---|---|
| Hydrogen selenide | 7783-07-5 | 0.8 | |
| Hydrogen sulfide | 7783-05-4 | 3.3 | |
| 4-Hydroxy-4-methylpentan-2-one | 123-42-2 | 0.6 | |
| i-Hexane | 107-83-5 | 4.2 | |
| Iodomethane | 74-88-4 | 0.9 | |
| Iron pentacarbonyl | 13463-40-6 | 0.6 | |
| Isobutyl acetate | 110-19-0 | 2.6 | |
| Isobutylene | 115-11-7 | 1.0 | |
| Isobutyraldehyde | 78-84-2 | 1.1 | |
| Iso-octane | 540-84-1 | 1.2 | |
| Isoprene | 78-79-5 | 0.6 | |
| Isopropoxyethanol | 109-59-1 | 1.2 | |
| Isopropyl acetate | 108-21-4 | 2.6 | |
| Methanol | 67-56-1 | | 12.4 |
| 2-Methoxyethanol | 109-86-4 | 3.0 | |
| 2-Methoxy-1-methylethyl acetate | 108-65-6 | 1.2 | |
| Methyl acetate | 79-20-9 | 5.5 | |
| Methyl bromide (bromomethane) | 74-83-9 | 1.6 | |
| 2-Methyl butane | 78-78-4 | 8.2 | |
| Methyl ethyl ketone | 78-93-3 | 0.8 | |
| Methyl isobutyl ketone | 108-10-1 | 1.0 | |
| Methyl mercaptan | 74-93-1 | 0.5 | |
| Methyl methacrylate | 80-62-6 | 1.8 | |
| Methyl tert-butyl ether (MTBE) | 1634-04-4 | 0.8 | |
| Methylamine | 74-89-5 | 1.3 | |
| Methylene chloride | 75-09-2 | | 2.9 |
| m-Xylol | 108-38-3 | 0.5 | |
| N,N-diethylaniline | 91-66-7 | 0.4 | |
| N,N-dimethylacetamide | 127-19-5 | 0.1 | |
| N,N-dimethylformamide | 68-12-2 | 0.8 | |
| Napthalene | 91-20-3 | 0.2 | |
| N-butyl acrylate | 141-32-2 | 1.8 | |
| N-decane | 124-18-5 | 1.1 | |
| N-heptane | 142-82-5 | 2.4 | |
| N-hexane | 110-54-3 | 4.7 | |
| Nitrobenzene | 98-95-3 | 1.7 | |
| 2-Nitrotoluene | 88-72-2 | 1.5 | |
| 3-Nitrotoluene | 99-08-1 | 1.6 | |
| N-Methyl-2-Pyrrolidone | 872-50-4 | 1.4 | |
| N-Nonane | 111-84-2 | 1.4 | |
| N-Octane | 111-65-9 | 1.6 | |
| N-Pentane | 109-66-0 | 10.4 | |
| N-Propanol | 71-23-8 | 5.1 | |
| N-Propyl acetate | 109-60-4 | 3.1 | |

## RESPONSE FACTORS

| Substance | CAS No. | 10.6-eV lamp | 11.7-eV lamp |
|---|---|---|---|
| O-Cresol | 95-48-7 | 0.8 | |
| O-Toluidine | 95-53-4 | 0.5 | |
| O-Xylol | 95-47-6 | 0.5 | |
| P-Chloroaniline | 106-47-8 | 1.3 | |
| P-Cresol | 106-44-5 | 2 .1 | |
| Perchloroethylene | 127-18-4 | 0.5 | |
| Phenol | 108-95-2 | 0.4 | |
| Phenylhydrazine | 100-63-0 | 1. 3 | |
| Propanal | 123-38-6 | 14.8 | |
| 2-Propanol | 67-63-0 | 4.4 | |
| 2-Propen-1-ol | 107-18-6 | 2.7 | |
| Propylene | 115-07-1 | 1.2 | |
| 1,2-Propylene oxide | 75-56-9 | 5.8 | |
| P-Xylol | 106-42-3 | 0.5 | |
| Styrol | 100-42-5 | 0.4 | |
| Tetra-Ethyl lead | 78-00-2 | approx. 0.2 | |
| Tetrahydrofuran | 109-99-9 | 1.5 | |
| Tetrahydrothiophene | 110-01-0 | 0.5 | |
| Thiophene | 110-02-1 | 0.5 | |
| Toluene | 108-88-3 | 0.5 | |
| 2,4-Toluene diisocyanate | 584-84-9 | 0.4 | |
| Trans-1,2-Dichloroethylene | 156-60-5 | 0.4 | |
| Trichloroethylene | 79-01-6 | 0.5 | |
| Trichloromethane (chloroform) | 67-66-3 | | 1.7 |
| Trimethylamine | 75-50-3 | 0.9 | |
| 1,3,5-Trimethylbenzene | 108-67-8 | 0.3 | |
| Vinyl acetate | 108-05-4 | 1.2 | |
| Vinyl bromide | 593-60-2 | 0.4 | |
| Vinyl chloride | 75-01-4 | 1.5 | |

# 4 Introduction to sensor technology

The heart of every measuring instrument is its sensor. The sensor is crucial in determining the quality of measurements, and therefore it has a fundamental influence on the safety of the user. The development and production of sensors is part of Dräger's core competence.

## 4.1 Selecting the proper measurement method

Selecting the correct measuring principle is essential when detecting dangerous gases. Every measuring principle has its own strengths and limits, and each is better for particular groups of gases (flammable/toxic gases and oxygen). For this reason, it is important to ask which gases/vapors occur in the workplace Generally speaking, we differentiate between the following gas risks:

Risk of explosion

– Wherever flammable gases and vapors occur, there is an increased risk of explosion. Typical areas for this include mining, refineries, the chemical industry, and many others. Infrared and catalytic bead sensors are used to detect this type of risk. These sensors usually detect gas concentrations in the LEL (lower explosure level) range, but some of them can also be used for the 100 Vol.-% range.

Lack or excess of oxygen

– A lack of oxygen is life-threatening. An excess of oxygen can affect the flammability of materials and can even cause auto-ignition. Electrochemical sensors are used to measure oxygen. Their measuring range is from between 0 and 25 Vol.-% all the way up to 100 Vol.-%.

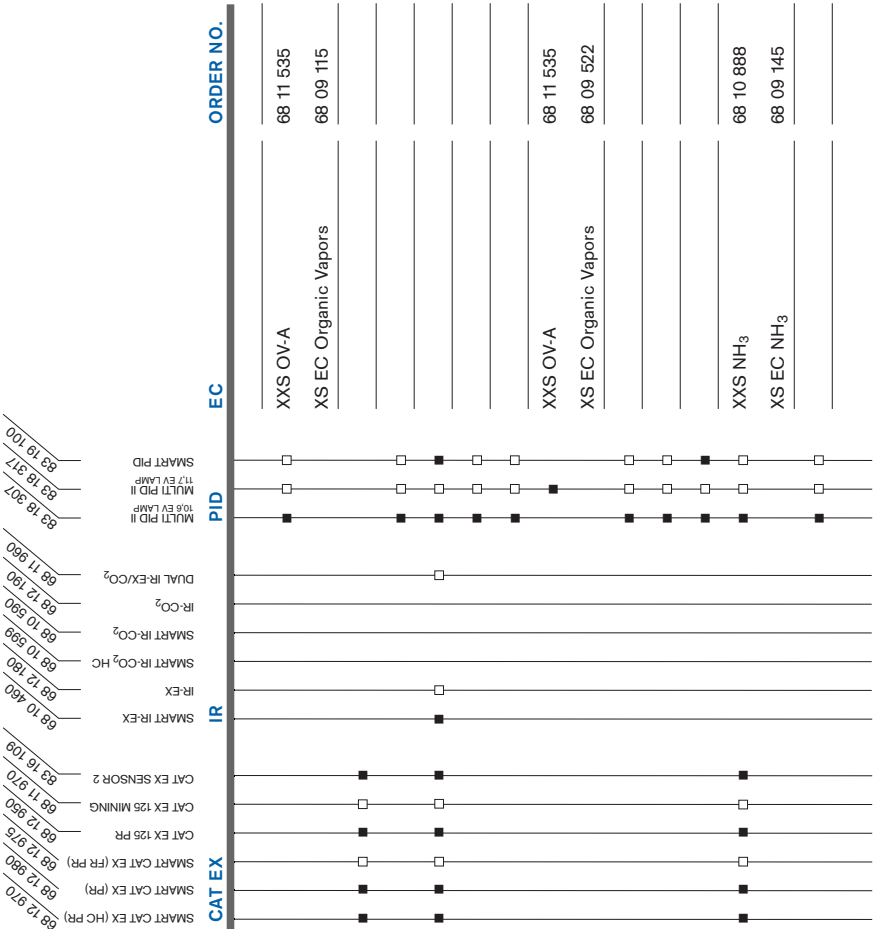
Toxicity

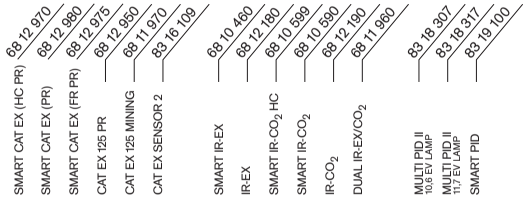
– Poisonous substances can occur anywhere – in industrial production and processing, in transport (rail, road, ship), in the case of incomplete combustion (CO), and also as a result of completely naturally processes such as rotting and decomposition of biomass. Electrochemical and PID sensors are used to detect toxic gases.

The decision about which sensor type is the right one for a particular application also depends on other factors such as:

– What other hazardous material are present (cross-sensitivity)?
– Is it necessary to measure hazardous material selectively, or is it more sensible to measure a complete parameter?

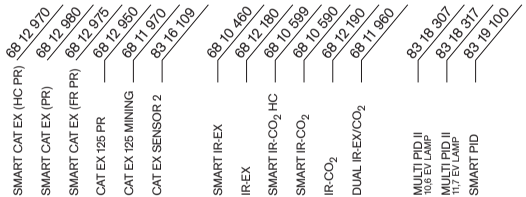
# 4.2 Overview of detectable vapors and gases





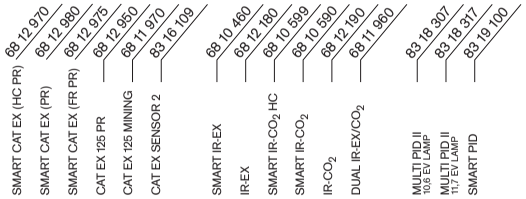

| CHEMICAL DESIGNATION | CAS NO. | CAT EX | IR | PID | EC | ORDER NO. |
|---|---|---|---|---|---|---|
| Arsine | 7784-42-1 | | | | XS EC Hydride | 68 09 135 |
| | | | | | XXS $PH_3$ | 68 10 886 |
| Benzene | 71-43-2 | ■ ■ □ ■ □ ■ | ■ □ | ■ □ ■ | | |
| Benzonitrile | 100-47-0 | | | ■ □ ■ | | |
| Benzylalcohol | 100-51-6 | | | ■ □ ■ | | |
| Biphenyl | 92-52-4 | | | ■ □ ■ | | |
| Bromine | 7726-95-6 | | | | XXS $Cl_2$ | 68 10 890 |
| | | | | | XS EC $Cl_2$ | 68 09 165 |
| 1-Bromopropane | 106-94-5 | | | ■ □ ■ | | |
| Bromoform (Tribromomethane) | 75-25-2 | | | ■ □ ■ | | |
| n-Butane | 106-97-8 | ■ ■ □ ■ □ ■ | ■ □ | ■ | | |
| i-Butane | 75-28-5 | □ □ □ □ □ □ | ■ □ | □ | | |
| i-Butene | 115-11-7 | □ □ □ □ □ □ | ■ □ | □ | | |
| 1,3-Butadiene | 106-99-0 | ■ ■ □ ■ □ ■ | ■ □ | ■ □ ■ | XXS OV | 6811530 |
| | | | | | XS EC Organic Vapors | 6809115 |
| Butanone | 78-93-3 | ■ ■ □ ■ □ ■ | | | | |

■ Sensitivity data known □ Sensitivity not yet determined



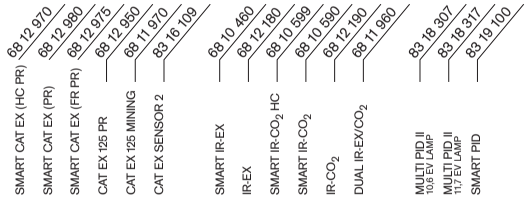

| CHEMICAL DESIGNATION | CAS NO. | CAT EX | | | | | | IR | | | | | | PID | | | EC | ORDER NO. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2-Butoxyethyl acetate | 112-07-2 | | | | | | | | | | | | | ■ | □ | □ | | |
| n-Butyl acetate | 123-86-4 | ■ | ■ | □ | ■ | □ | ■ | | | | | | | ■ | □ | □ | | |
| n-Butyl acrylate | 141-32-2 | | | | | | | | | | | | | ■ | □ | □ | | |
| n-Butylalcohol | 71-36-3 | ■ | ■ | □ | ■ | □ | ■ | | | | | | | ■ | □ | □ | | |
| n-Butyl mercaptan (Butanethiol) | 109-79-5 | | | | | | | | | | | | | ■ | □ | □ | | |
| tert. Butyl mercaptane | 75-66-1 | | | | | | | | | | | | | | | | XS EC Odorant | 68 09 200 |
| | | | | | | | | | | | | | | | | | XXS Odorant | 68 12 535 |
| sec. Butyl mercaptane | 513-53-1 | | | | | | | | | | | | | | | | XS EC Odorant | 68 09 200 |
| | | | | | | | | | | | | | | | | | XXS Odorant | 68 12 535 |
| Carbon dioxide | 124-38-9 | | | | | | | | | ■ | ■ | ■ | | | | | XXS $CO_2$ | 68 10 889 |
| | | | | | | | | | | | | | | | | | XS EC $CO_2$ | 68 09 175 |
| Carbon disulfide | 75-15-0 | | | | | | | | | | | | ■ | ■ | □ | □ | | |
| Carbon monoxide | 630-08-0 | ■ | ■ | □ | ■ | □ | ■ | | | | | | | | | | XXS CO | 68 10 882 |
| | | | | | | | | | | | | | | | | | XXS $H_2S$/CO | 68 11 410 |
| | | | | | | | | | | | | | | | | | XXS CO $H_2$-CP | 68 11 950 |
| | | | | | | | | | | | | | | | | | XXS CO HC | 68 12 010 |

■ Sensitivity data known □ Sensitivity not yet determined



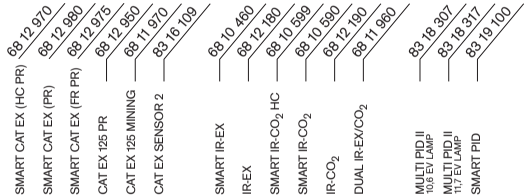

| CHEMICAL DESIGNATION | CAS NO. | CAT EX | IR | PID | EC | ORDER NO. |
|---|---|---|---|---|---|---|
| Carbon monoxide | | | | | XXS E CO | 68 12 212 |
| | | | | | XS EC CO | 68 09 105 |
| | | | | | XS EC CO HC | 68 09 120 |
| | | | | | XS 2 CO | 68 10 365 |
| | | | | | XS R CO | 68 10 258 |
| | | | | | XS CO microPac | 68 10 030 |
| Chlorine | 7782-50-5 | | | | XXS $Cl_2$ | 68 10 890 |
| | | | | | XS EC $Cl_2$ | 68 09 165 |
| 1-Chlorine-2,3 epoxypropane | 106-89-8 | | | | XXS OV | 68 11 530 |
| (Epichlorohydrin) | | | | | XS EC Organic Vapors - A | 68 09 522 |
| 4-Chloroaniline | 106-47-8 | | | ■ □ □ | | |
| Chlorine dioxide | 10049-04-4 | | | □ □ □ | XS EC $Cl_2$ | 68 09 165 |
| | | | | | XXS EC $CL_2$ | 68 10 890 |
| | | | | | XS EC $ClO_2$ | 68 11 360 |
| Chloroacetone | 78-95-5 | | | ■ □ □ | | |
| Chlorobenzene | 108-90-7 | | | ■ □ ■ | | |

■ Sensitivity data known □ Sensitivity not yet determined



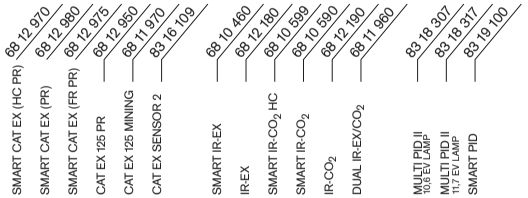

| CHEMICAL DESIGNATION | CAS NO. | CAT EX | | | | | | IR | | | | | | PID | | | EC | ORDER NO. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| p-Cresol | 106-44-5 | | | | | | | | | | | | | ■ | □ | □ | | |
| m-Cresol | 108-39-4 | | | | | | | | | | | | | ■ | □ | □ | | |
| o-Cresol | 95-48-7 | | | | | | | | | | | | | ■ | □ | □ | | |
| Crotonaldehyde (2-Butenal) | 4170-30-3 | | | | | | | | | | | | | ■ | □ | □ | | |
| Cumene (Isopropylbenzene) | 98-82-8 | | | | | | | | | | | | | ■ | □ | □ | | |
| Cyclohexane | 110-82-7 | ■ | ■ | □ | ■ | □ | ■ | ■ | □ | | | | □ | ■ | □ | ■ | | |
| Cyclohexanone | 108-94-1 | | | | | | | | | | | | | ■ | □ | □ | | |
| Cyclohexylamine | 108-91-8 | | | | | | | | | | | | | ■ | □ | □ | | |
| Cyclopentane | 287-92-3 | ■ | ■ | □ | ■ | □ | ■ | ■ | □ | | | | □ | ■ | □ | ■ | | |
| n-Decane | 124-18-5 | | | | | | | | | | | | | ■ | □ | □ | | |
| Diborane | 19287-45-7 | | | | | | | | | | | | | | | | XXS $PH_3$ | 68 10 886 |
| | | | | | | | | | | | | | | | | | XS EC Hydride | 68 09 135 |
| Dibutylamine | 111-92-2 | | | | | | | | | | | | | ■ | □ | □ | | |
| Dibutylether | 142-96-1 | □ | □ | □ | □ | □ | □ | | | | | | | ■ | □ | □ | | |
| 1,2-Dichlorobenzene | 95-50-1 | | | | | | | | | | | | | ■ | □ | □ | | |
| 1,3 Dichloropropene | 542-75-6 | | | | | | | | | | | | | ■ | □ | □ | | |

■ Sensitivity data known □ Sensitivity not yet determined



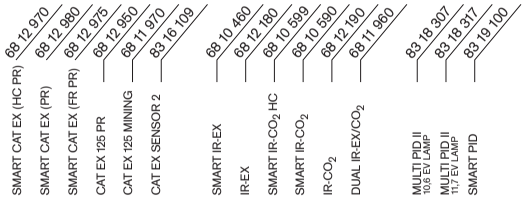

| CHEMICAL DESIGNATION | CAS NO. | CAT EX | IR | PID | EC | ORDER NO. |
|---|---|---|---|---|---|---|
| 1,2-Dichloroethylene (trans) | 156-60-5 | | | ■ ■ ■ | | |
| Diesel fuel | | □ □ □ □ □ □ | | ■ □ ■ | | |
| Diethylamine | 109-89-7 | ■ ■ □ ■ □ □ | | | XS EC Amine | 68 09 545 |
| | | | | | XXS Amine | 68 12 545 |
| Diethylether | 60-29-7 | ■ ■ □ ■ □ ■ | | ■ □ □ | XXS OV-A | 68 11 535 |
| | | | | | XS EC Organic Vapors | 68 09 115 |
| 1,1-Difluorethylene | 75-38-7 | | | ■ □ □ | | |
| Dimethylamine | 124-40-3 | □ □ □ □ □ □ | | □ □ □ | XS EC Amine | 68 09 545 |
| | | | | | XXS Amine | 68 12 545 |
| 1,4-Dioxane | 123-91-1 | | | ■ □ □ | | |
| Dimethyldisulfide | 624-92-0 | | | ■ □ □ | XXS Odorant | 68 12 535 |
| Dimethyl ether | 115-10-6 | □ □ □ □ □ □ | ■ □ □ | ■ □ □ | | |
| Dimethyl hydrazine | 540-73-8 | | | | XS EC Hydrazine | 68 09 190 |
| | | | | | XS EC Hydrazine D | 68 10 295 |
| Dimethylsulfide | 75-18-3 | | | ■ □ □ | XS EC Odorant | 68 09 200 |
| | | | | | XXS Odorant | 68 12 535 |

■ Sensitivity □ Sensitivity not yet determined




| CHEMICAL DESIGNATION | CAS NO. | CAT EX | IR | PID | EC | ORDER NO. |
|---|---|---|---|---|---|---|
| N,N Diethylanilin | 91-66-7 | | | ■ □ □ | | |
| N,N-Dimethylacetamide | 127-19-5 | | | ■ □ □ | | |
| N,N-Dimethylformamide (DMF) | 68-12-2 | | | ■ □ □ | | |
| Epichlorohydrin (1-Chloro-2,3 Epoxypropane) | 106-89-8 | | | ■ □ □ | | |
| Ethane | 74-84-0 | ■ ■ □ ■ □ ■ | ■ □ | ■ | | |
| Ethanol | 64-17-5 | ■ ■ □ ■ □ ■ | ■ ■ | □ ■ | XXS OV-A | 68 11 535 |
| | | | | | XS EC Organic Vapors | 68 09 115 |
| Ethene | 74-85-1 | ■ ■ □ ■ □ ■ | ■ ■ | ■ | XXS OV | 68 11 530 |
| | | | | | XS EC Organic Vapors | 68 09 115 |
| Ethine | 74-86-2 | ■ ■ □ ■ □ ■ | | | XXS OV-A | 68 11 535 |
| | | | | | XS EC Organic Vapors | 68 09 115 |
| Ethylacetate | 141-78-6 | ■ ■ □ ■ □ ■ | ■ □ | ■ □ ■ | | |
| Ethyl acrylate | 140-88-5 | | ■ □ | ■ □ ■ | | |
| Ethyl amine | 75-04-7 | □ □ □ □ □ □ | | □ □ □ | XS EC Amine | 68 09 545 |
| | | | | | XXS Amine | 68 12 545 |
| Ethylbenzene | 100-41-4 | | | ■ □ ■ | | |

■ Sensitivity data known □ Sensitivity not yet determined

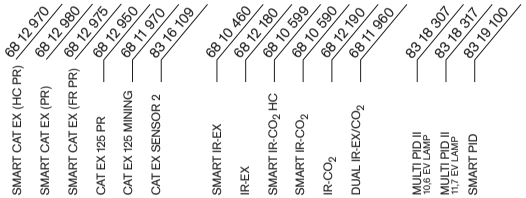



| CHEMICAL DESIGNATION | CAS NO. | CAT EX | IR | PID | EC | ORDER NO. |
|---|---|---|---|---|---|---|
| Ethylbromide | 74-96-4 | | | ■ □ □ | | |
| Ethyl cellosolve (2-Ethoxyethanol) | 110-80-5 | | | ■ □ □ | | |
| Ethylenediamine (1,2-Diaminoethane) | 107-15-3 | | | ■ □ □ | | |
| Ethylene oxide | 75-21-8 | | | ■ □ □ | XXS OV | 68 11 530 |
| | | | | | XXS OV-A | 68 11 535 |
| | | | | | XS EC Organic Vapors | 68 09 115 |
| | | | | | XS EC Organic Vapors A | 68 09 522 |
| 2-Ethylhexylacrylate | 103-11-7 | | | ■ □ □ | | |
| Ethyl mercaptan (Ethanethiol) | 75-08-1 | | | ■ □ □ | XS EC Odorant | 68 09 200 |
| | | | | | XXS Odorant | 68 12 535 |
| Ethyl tert butyl ether (ETBE) | 637-92-3 | | | ■ □ □ | | |
| 4-Ethyltoluene | 622-96-8 | | | ■ □ □ | | |
| Fluorine | 7782-41-4 | | | | XXS $Cl_2$ | 68 10 890 |
| | | | | | XS EC $Cl_2$ | 68 09 165 |
| Formaldehyde | 50-00-0 | | | | XXS OV | 68 11 530 |
| | | | | | XS EC Organic Vapors | 68 09 115 |

■ Sensitivity □ Sensitivity not yet determined

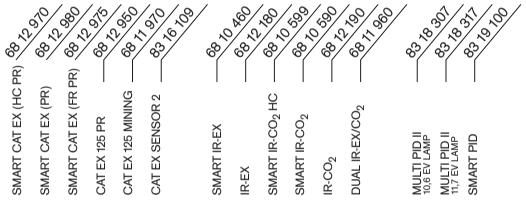
| CHEMICAL DESIGNATION | CAS NO. | 68 12 970 SMART CAT EX (HC PR) | 68 12 980 SMART CAT EX (PR) | 68 12 975 SMART CAT EX (FR PR) | 68 12 950 CAT EX 125 PR | 68 11 970 CAT EX 125 MINING | 83 16 109 CAT EX SENSOR 2 | 68 10 460 SMART IR-EX | 68 12 180 IR-EX | 68 10 599 SMART IR-$CO_2$ HC | 68 10 590 SMART IR-$CO_2$ | 68 12 190 IR-$CO_2$ | 68 11 960 DUAL IR-EX/$CO_2$ | 83 18 307 MULTI PID II 10.6 EV LAMP | 83 18 317 MULTI PID II 11.7 EV LAMP | 83 19 100 SMART PID | EC | ORDER NO. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CAT EX | | | | | | IR | | | | | | PID | | | | |
| Furfural | 98-01-1 | | | | | | | | | | | | | ■ | □ | □ | | |
| Germanium hydride | 7782-65-2 | | | | | | | | | | | | | | | | XS EC Hydride | 68 09 135 |
| Hydrazine | 302-01-2 | | | | | | | | | | | | | ■ | □ | □ | XS EC Hydrazine | 68 09 190 |
| | | | | | | | | | | | | | | | | | XS EC Hydrazine D | 68 10 295 |
| 1-Hexene | 592-41-6 | | | | | | | | | | | | | ■ | □ | □ | | |
| n-Heptane | 142-82-5 | ■ | ■ | □ | ■ | □ | ■ | ■ | □ | | | | □ | ■ | □ | □ | | |
| i-Hexane | 107-83-5 | | | | | | | | | | | | | ■ | □ | □ | | |
| n-Hexane | 110-54-3 | ■ | ■ | □ | ■ | □ | ■ | ■ | □ | | | | □ | ■ | □ | □ | | |
| Hydrogen | 1333-74-0 | ■ | ■ | □ | ■ | □ | ■ | | | | | | | | | | XXS CO $H_2$-CP | 68 11 950 |
| | | | | | | | | | | | | | | | | | XXS $H_2$ HC | 68 12 025 |
| | | | | | | | | | | | | | | | | | XXS $H_2$ | 68 12 370 |
| | | | | | | | | | | | | | | | | | XS EC $H_2$ | 68 09 185 |
| | | | | | | | | | | | | | | | | | XS $H_2$ HC | 68 11 365 |
| Hydrogen bromide | 10035-10-6 | | | | | | | | | | | | | | | | XS EC HF/ HCl | 68 09 140 |
| Hydrogen chloride | 7647-01-0 | | | | | | | | | | | | | | | | XS EC HF/ HCl | 68 09 140 |

■ Sensitivity data known □ Sensitivity not yet determined



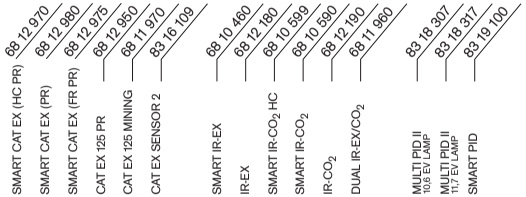

| CHEMICAL DESIGNATION | CAS NO. | CAT EX | IR | PID | EC | ORDER NO. |
|---|---|---|---|---|---|---|
| Hydrogen cyanide | 74-90-8 | | | | XXS HCN | 68 10 887 |
| | | | | | XS EC HCN | 68 09 150 |
| Hydrogen fluoride | 7664-39-3 | | | | XS EC HF/ HCl | 68 09 140 |
| Hydrogen peroxide | 7722-84-1 | | | | XS EC $H_2O_2$ | 68 09 170 |
| Hydrogen sulfide | 7783-06-4 | | | ■ □ □ | XXS $H_2S$ | 68 10 883 |
| | | | | | XXS $H_2S$/CO | 68 11 410 |
| | | | | | XXS $H_2S$ LC | 68 11 525 |
| | | | | | XXS $H_2S$ HC | 68 12 015 |
| | | | | | XXS E $H_2S$ | 68 12 213 |
| | | | | | XS EC $H_2S$ 100 | 68 09 110 |
| | | | | | XS EC $H_2S$ HC | 68 09 180 |
| | | | | | XS 2 $H_2S$ | 68 10 370 |
| | | | | | XS 2 $H_2S$ SR | 68 10 575 |
| | | | | | XS R $H_2S$ 100 | 68 10 260 |
| | | | | | XS $H_2S$ microPac | 68 10 032 |
| Hydrogen selenide | 7783-07-5 | | | ■ □ □ | | |

■ Sensitivity □ Sensitivity not yet determined



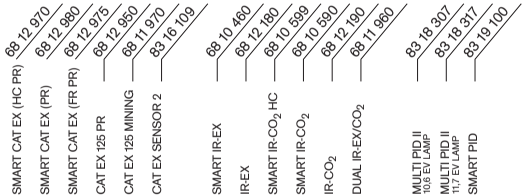

| CHEMICAL DESIGNATION | CAS NO. | CAT EX | IR | PID | EC | ORDER NO. |
|---|---|---|---|---|---|---|
| 4-Hydroxy-4-methyl-2-pentanone (Diaceton alcohol) | 123-42-2 | | | ■ | | |
| Iodomethane | 74-88-4 | | | ■ | | |
| Iron pentacarbonyl | 13463-40-6 | | | ■ | | |
| Isoamyl acetate | 123-92-2 | | | ■ | | |
| Isobutene | 115-11-7 | | | ■ | XXS OV-A | 68 11 535 |
| | | | | | XS EC Organic Vapors | 68 09 522 |
| Isobutyl acetate | 110-19-0 | | | ■ | | |
| Isobutyraldehyde | 78-84-2 | | | ■ | | |
| Isopentane | 78-78-4 | | | ■ | | |
| Isoprene (2-Methyl-1,3-Butadiene) | 78-79-5 | | | ■ | | |
| Isopropyl acetate | 108-21-4 | | | ■ | | |
| Isopropyl cellosolve | 109-59-1 | | | ■ | | |
| Isopropyl ether | 108-20-3 | | | ■ | | |
| Jet Fuel | | □ | ■ | ■ | | |

■ Sensitivity data known □ Sensitivity not yet determined



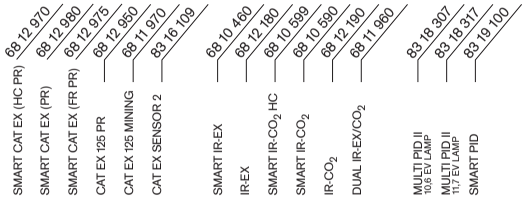

| CHEMICAL DESIGNATION | CAS NO. | CAT EX | | | | | | IR | | | | | | PID | | | EC | ORDER NO. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Liquefied gas (50 % Propane + 50 % n-Butane) | | | | | | | | ■ | | | | | | | | | | |
| Methane | 74-82-8 | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | ■ | | | | | |
| 1-Methoxy-2-propylacetate Propylene glycol monomethyl Ether acetate (PGMEA) | 108-65-6 | | | | | | | | | | | | | ■ | □ | □ | | |
| 1-Methoxy-Propanol-2 | 107-98-2 | ■ | ■ | □ | ■ | □ | □ | | | | | | | | | | | |
| 1-Methyl-2-pyrrolidone | 872-50-4 | | | | | | | | | | | | | ■ | □ | □ | | |
| 2-Methoxy-ethanol | 109-86-4 | | | | | | | | | | | | | ■ | □ | □ | | |
| Methylalcohol (Methanol) | 67-56-1 | ■ | ■ | □ | ■ | □ | □ | ■ | □ | | | | □ | | ■ | | XXS OV<br>XS EC Organic Vapors | 68 11 530<br>68 09 115 |
| Methyl acetate | 79-20-9 | | | | | | | | | | | | | ■ | □ | □ | | |
| Methyl bromide (Bromomethane) | 74-83-9 | | | | | | | | | | | | | ■ | □ | ■ | | |
| Methyl chloride | 74-87-3 | | | | | | | ■ | □ | | | | □ | | | | | |
| Methyl ethyl ketone | 78-93-3 | | | | | | | ■ | □ | | | | □ | ■ | □ | ■ | | |
| Methyl isobutyl ketone | 108-10-1 | | | | | | | | | | | | | ■ | □ | □ | | |

■ Sensitivity data known □ Sensitivity not yet determined



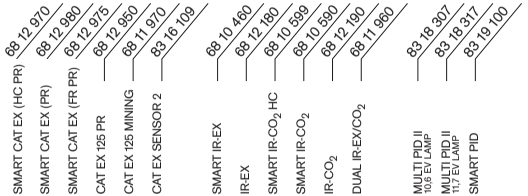

| CHEMICAL DESIGNATION | CAS NO. | CAT EX | | | | | | IR | | | | | | PID | | | EC | ORDER NO. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Methyl mercaptan (Methanethiol) | 74-93-1 | | | | | | | | | | | | | ■ | □ | □ | XS EC Odorant | 68 09 200 |
| | | | | | | | | | | | | | | | | | XXS Odorant | 68 12 535 |
| Methyl n-amyl ketone (2-Heptanone) | 110-43-0 | | | | | | | | | | | | | ■ | □ | □ | | |
| Methyl tert-butyl ether (MTBE) | 1634-04-4 | ■ | ■ | □ | ■ | □ | □ | | | | | | | ■ | □ | ■ | | |
| Methylen chloride | 75-09-2 | | | | | | | ■ | □ | | | | □ | | ■ | | | |
| Methylmethacrylate | 80-62-6 | | | | | | | | | | | | | | | | XXS OV | 68 11 530 |
| | | | | | | | | | | | | | | | | | XS EC Organic Vapors A | 68 09 522 |
| Monomethylamine | 74-89-5 | | | | | | | | | | | | | ■ | □ | □ | XS EC Amine | 68 09 545 |
| | | | | | | | | | | | | | | | | | XXS Amine | 68 12 545 |
| Monomethylhydrazine | 60-34-4 | | | | | | | | | | | | | | | | XS EC Hydrazine | 68 09 190 |
| | | | | | | | | | | | | | | | | | XS EC Hydrazine D | 68 10 295 |
| Napthalene | 91-20-3 | | | | | | | | | | | | | ■ | □ | □ | | |
| Nitric acid | 7697-37-2 | | | | | | | | | | | | | | | | XS EC HF/ HCl | 68 09 140 |
| 2-Nitrotoluene | 88-72-2 | | | | | | | | | | | | | ■ | □ | □ | | |
| 3-Nitrotoluene | 99-08-1 | | | | | | | | | | | | | ■ | □ | □ | | |
| Nitrobenzene | 98-95-3 | | | | | | | | | | | | | ■ | □ | □ | | |

■ Sensitivity data known □ Sensitivity not yet determined



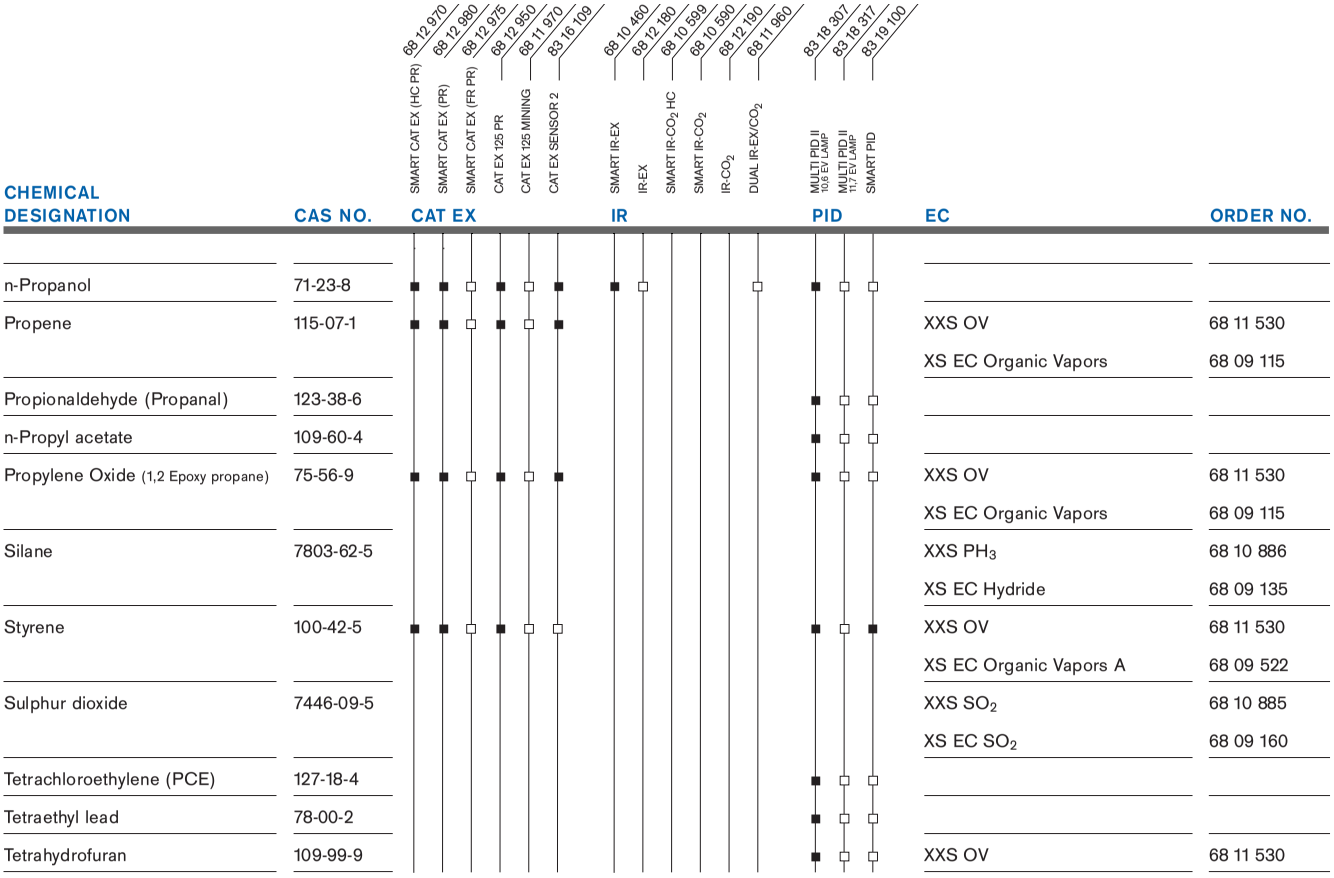

| CHEMICAL DESIGNATION | CAS NO. | CAT EX | | | | | | IR | | | | | | PID | | | EC | ORDER NO. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nitrogen dioxide | 10102-44-0 | | | | | | | | | | | | | | | | XXS $NO_2$ | 68 10 884 |
| | | | | | | | | | | | | | | | | | XS EC $NO_2$ | 68 09 155 |
| | | | | | | | | | | | | | | | | | XXS $NO_2$ LC | 68 12 600 |
| Nitrogen monoxide | 10102-43-9 | | | | | | | | | | | | | | | | XXS NO | 68 11 545 |
| | | | | | | | | | | | | | | | | | XS EC NO | 68 09 125 |
| n-Nonane | 111-84-2 | ■ | ■ | □ | ■ | □ | ■ | ■ | □ | | | | ■ | ■ | □ | ■ | | |
| n-Octane | 111-65-9 | ■ | ■ | □ | ■ | □ | ■ | □ | □ | | | | □ | ■ | □ | ■ | | |
| iso-Octane | 540-84-1 | | | | | | | | | | | | | ■ | □ | □ | | |
| (2,2,4-Trimethylpentane) | | | | | | | | | | | | | | | | | | |
| Oxygen | 7782-44-7 | | | | | | | | | | | | | | | | XXS $O_2$ | 68 10 881 |
| | | | | | | | | | | | | | | | | | XXS E $O_2$ | 68 12 211 |
| | | | | | | | | | | | | | | | | | XS EC $O_2$ LS | 68 09 130 |
| | | | | | | | | | | | | | | | | | XS EC $O_2$ 100 | 68 09 550 |
| | | | | | | | | | | | | | | | | | XS 2 $O_2$ | 68 10 375 |
| | | | | | | | | | | | | | | | | | XS R $O_2$ LS | 68 10 262 |
| | | | | | | | | | | | | | | | | | XS $O_2$ miroPac | 68 10 034 |

■ Sensitivity data known □ Sensitivity not yet determined



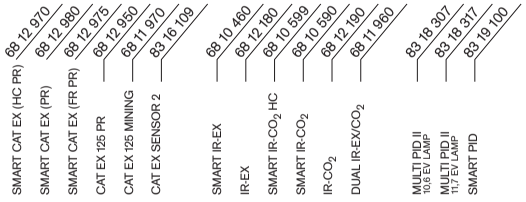

| CHEMICAL DESIGNATION | CAS NO. | CAT EX | | | | | | IR | | | | | | PID | | | EC | ORDER NO. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ozone | 10028-15-6 | | | | | | | | | | | | | | | | XXS Ozone | 68 11 540 |
| n-Pentane | 109-66-0 | ■ | ■ | □ | ■ | □ | ■ | ■ | ■ | | | | ■ | ■ | □ | □ | | |
| Pentylalcohol | 71-41-0 | ■ | ■ | □ | ■ | □ | □ | ■ | □ | | | | □ | | | | | |
| Petrol (Gasoline) | 8030-31-7 | ■ | ■ | □ | ■ | □ | □ | □ | □ | | | | □ | ■ | □ | ■ | | |
| Phenol | 108-95-2 | | | | | | | | | | | | | ■ | □ | □ | | |
| Phenyl hydrazine | 100-63-0 | | | | | | | | | | | | | ■ | □ | □ | | |
| Phosgene | 75-44-5 | | | | | | | | | | | | | | | | XS EC $COCl_2$ | 68 08 582 |
| Phosphine | 7803-51-2 | | | | | | | | | | | | | ■ | □ | □ | XS EC Hydride | 68 09 135 |
| | | | | | | | | | | | | | | | | | XS EC $PH_3$ | 68 09 535 |
| | | | | | | | | | | | | | | | | | XXS $PH_3$ | 68 10 886 |
| | | | | | | | | | | | | | | | | | XXS $PH_3$ HC | 68 12 020 |
| Phosphorous trichloride | 7719-12-2 | | | | | | | | | | | | | | | | XS EC HF/ HCl | 68 09 140 |
| Phosphorous trichlorideoxide | 10025-87-3 | | | | | | | | | | | | | | | | XS EC HF/ HCl | 68 09 140 |
| Propane | 74-98-6 | ■ | ■ | □ | ■ | □ | ■ | ■ | ■ | | | | ■ | | | | | |
| i-Propanol (Isopropanol) | 67-63-0 | □ | □ | □ | □ | □ | ■ | | | | | | | ■ | □ | □ | XXS OV | 68 11 530 |
| | | | | | | | | | | | | | | | | | XS EC Organic Vapors | 68 09 115 |

■ Sensitivity data known □ Sensitivity not yet determined



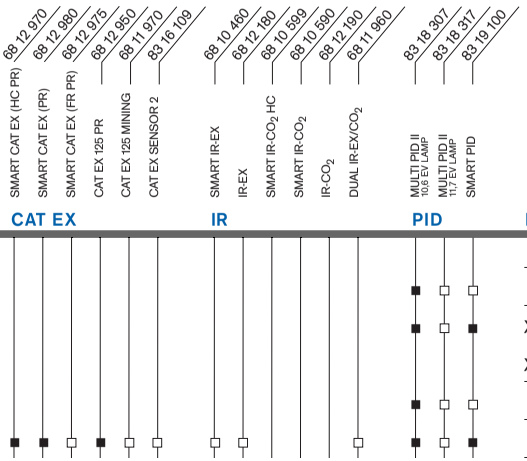

| CHEMICAL DESIGNATION | CAS NO. | CAT EX | IR | PID | EC | ORDER NO. |
|---|---|---|---|---|---|---|
| n-Propanol | 71-23-8 | ■ ■ □ ■ □ ■ | ■ □ □ | ■ □ □ | | |
| Propene | 115-07-1 | ■ ■ □ ■ □ ■ | | | XXS OV | 68 11 530 |
| | | | | | XS EC Organic Vapors | 68 09 115 |
| Propionaldehyde (Propanal) | 123-38-6 | | | ■ □ □ | | |
| n-Propyl acetate | 109-60-4 | | | ■ □ □ | | |
| Propylene Oxide (1,2 Epoxy propane) | 75-56-9 | ■ ■ □ ■ □ ■ | | ■ □ □ | XXS OV | 68 11 530 |
| | | | | | XS EC Organic Vapors | 68 09 115 |
| Silane | 7803-62-5 | | | | XXS $PH_3$ | 68 10 886 |
| | | | | | XS EC Hydride | 68 09 135 |
| Styrene | 100-42-5 | ■ ■ □ ■ □ □ | | ■ □ ■ | XXS OV | 68 11 530 |
| | | | | | XS EC Organic Vapors A | 68 09 522 |
| Sulphur dioxide | 7446-09-5 | | | | XXS $SO_2$ | 68 10 885 |
| | | | | | XS EC $SO_2$ | 68 09 160 |
| Tetrachloroethylene (PCE) | 127-18-4 | | | ■ □ □ | | |
| Tetraethyl lead | 78-00-2 | | | ■ □ □ | | |
| Tetrahydrofuran | 109-99-9 | | | ■ □ □ | XXS OV | 68 11 530 |

■ Sensitivity data known □ Sensitivity not yet determined




| CHEMICAL DESIGNATION | CAS NO. | EC | ORDER NO. |
|---|---|---|---|
| Tetrahydrothiophene | 110-01-0 | XS EC THT | 68 09 195 |
| | | XS EC Odorant | 68 09 200 |
| | | XXS Odorant | 68 12 535 |
| Thiophene | 110-02-1 | | |
| Toluene | 108-88-3 | | |
| o-Toluidine | 95-53-4 | | |
| 2,4-Toluene diisocyanate | 584-84-9 | | |
| Trichlormethane (Chloroform) | 67-66-3 | | |
| Trichloroethylene | 79-01-6 | | |
| Triethylamine | 121-44-8 | XS EC Amine | 68 09 545 |
| | | XXS Amine | 68 12 545 |
| Trimethylamine | 75-50-3 | XS EC Amine | 68 09 545 |
| | | XXS Amine | 68 12 545 |
| 1,3,5-Trimethylbenzene | 108-67-8 | | |
| Vinyl acetate | 108-05-4 | XXS OV-A | 68 11 535 |
| | | XS EC Organic Vapors | 68 09 115 |

■ Sensitivity data known  □ Sensitivity not yet determined



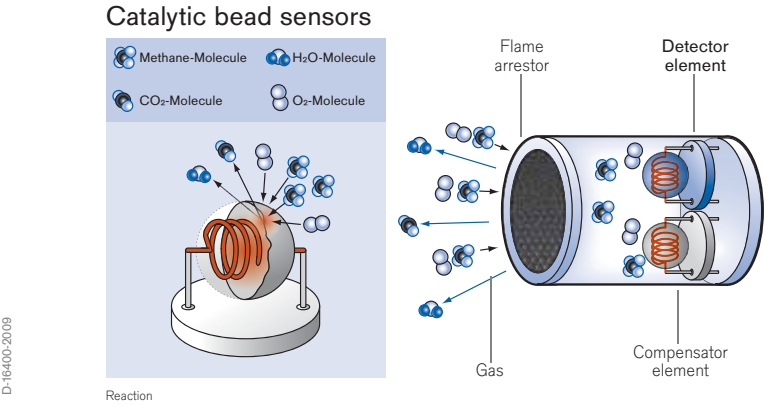

| CHEMICAL DESIGNATION | CAS NO. | CAT EX | IR | PID | EC | ORDER NO. |
|---|---|---|---|---|---|---|
| Vinyl bromide | 593-60-2 | | | ■ □ □ | | |
| Vinyl chloride (Chloroethylene) | 75-01-4 | | | ■ □ ■ | XXS OV | 68 11 530 |
| | | | | | XS EC Organic Vapors | 68 09 115 |
| Vinylidene chloride (1,1-DCE) | 75-35-4 | | | ■ □ □ | | |
| Xylene | 1330-20-7 | ■ ■ □ ■ □ □ | □ □ | ■ □ ■ | | |

■ Sensitivity data known □ Sensitivity not yet determined

## 4.3 Dräger CatEx sensors


Under certain circumstances, flammable gases and vapors can be oxidized using the oxygen in the ambient air, causing heat of the reaction to be released. Typically, this is achieved through the use of special and suitably heated catalyst material, which slightly increases its temperature through the resulting heat of reaction. This slight increase in temperature is a measure of the gas concentration.

A small platinum coil is embedded in a porous ceramic bead with a diameter of less than 1 mm (0.04 in.). A current flows through the platinum coil, heating the pellistor to several hundred degrees. If the pellistor contains a suitable catalytic material, then its temperature will increase in the presence of flammable gases, which in turn causes the resistance of the platinum coil to increase. This change in resistance can then be evaluated electronically. The oxygen required for the combustion comes from the ambient air. This sensor works on the basis of the catalytic bead principle.




In order to eliminate changes in the ambient temperature, a second pellistor is used with almost the same structure, but which does not react to gas (it may, for example, contain no catalytic material). Coupled by a Wheatstone bridge, the two pellistors then form a sensor circuit, which is largely independent of the ambient temperature, and which can detect the presence of flammable gases and vapors. Because a catalytic bead sensor contains hot pellistors, it can – if the lower exposure level (LEL) is exceeded – become a source of ignition in its own right. This is prevented using a metal sinter disk. If an ignition occurs in the interior of the catalytic bead sensor, then the sensor's housing withstands the explosion pressure and the flame is cooled to below the ignition temperature of the gas by the sinter disk. This ensures that the flame does not penetrate through to the outside of the sensor. If gas concentrations are far above the LEL (above the stoichiometric mixture ratio), then the detector's sensitivity drops, because the ambient oxygen required for combustion is displaced. This can lead to ambient measurement results. That is why, in Dräger Cat Ex sensors, a compensatory element measures the thermal conduction of the ambient air being monitored, and this differs from the thermal conduction of normal air if a series of gases are present. The variable thus obtained then allows the device to provide a clear reading for the LEL range. If the device is adjusted and calibrated accordingly, then the thermal conduction signal can be used to determine the gas concentration of methane between 0 and 100 Vol.-%.

# DrägerSensor® Smart CatEx (HC PR)

**Order no. 68 12 970**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 2 years | – |

## MARKET SEGMENTS

Telecommunications, shipping, sewage, gas supply companies, refineries, chemical industry, mining, landfills, biogas plants, tunneling.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 2% LEL / 0.1 Vol.-% |
| **Resolution:** | 1.0% LEL for the measuring range 0 to 100% LEL<br>0.02 Vol.-% for the measuring range 0 to 5 Vol.-% $CH_4$ (methane)<br>1 Vol.-% for the measuring range 5 to 100 Vol.-% $CH_4$ (methane) |
| **Measurement range:** | 0 to 100% LEL or<br>0 to 100 Vol.-% $CH_4$ (methane) |
| **General technical specifications** | |
| **Ambient conditions** | |
| Temperature: | (–20 to 55)°C (–4 to 131)°F |
| Humidity: | (10 to 95)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Warm-up time:** | ≤ 5 minutes |

## FOR THE MEASUREMENT RANGE 0 TO 100% LEL WHEN CALIBRATED WITH METHANE IN AIR:

| | |
|---|---|
| **Response time:** | ≤ 15 seconds at 25 °C (77 °F) ($T_{50}$)<br>≤ 25 seconds at 25 °C (77 °F) ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 1% LEL |
| Sensitivity: | ≤ ± 2.5% of measured value |
| **Linearity error** | ≤ ± 2% LEL (0–40% LEL)<br>≤ ± 5% of measured value (40–100% LEL) |
| **Long-term drift** | |
| Zero point: | ≤ ± 1% LEL/month |
| Sensitivity: | ≤ ± 2% LEL/month |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.1% LEL/K at (–20 to 40)°C (–4 to 104)°F |
| Sensitivity: | ≤ ± 0.3% of measured value/K at (–20 to 40)°C (–4 to 104)°F |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.03% LEL/% RH |
| Sensitivity: | ≤ ± 0.1% of measured value/% RH |
| **Effect of sensor poisons:** | Hydrogen sulphide $H_2S$ 1000 ppmh ≤ ± 5 % of measured value<br>Hexamethyldisiloxane HMDS 10 ppmh ≤ ± 5 % of measured value<br>Hexamethyldisiloxane HMDS 30 ppmh ≤ ± 20 % of measured value<br>After an exposure of 10 ppm HDMS for 5 hours, the sensivity loss is less than 50 %. Halogenated hydrocarbons, heavy metals, substances containing silicone or sulfur, or substances that can polymerize → potential poisoning. 4.5 Vol.-% $CO_2$ ≤ ± 4% of measured value |
| **Test gas:** | approx. 2 Vol.-% or 50 Vol.-% $CH_4$ test gas |

## FOR THE MEASUREMENT RANGE 0 TO 100% LEL WHEN CALIBRATED WITH PROPANE IN AIR:

| | |
|---|---|
| **Response time:** | ≤ 20 seconds at 25°C (77° F) ($T_{50}$) |
| | ≤ 40 seconds at 25°C (77° F) ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 1% LEL |
| Sensitivity: | ≤ ± 2.5% of measured value |
| **Linearity error:** | ≤ ± 4% LEL (0–40% LEL) |
| | ≤ ± 10% of measured value (40–100% LEL) |
| **Long-term drift** | |
| Zero point: | ≤ ± 4% LEL/month |
| Sensitivity: | ≤ ± 1% LEL/month |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.1% LEL/K at (–20 to 40)°C (–4 to 104)°F |
| Sensitivity: | ≤ ± 0.3% of measured value/K at (–20 to 40)°C (–4 to 104)°F |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.04% LEL/% RH |
| Sensitivity: | ≤ ± 0.1% of measured value/% RH |

## FOR THE MEASUREMENT RANGE 0 TO 100 VOL.-% $CH_4$:

| | |
|---|---|
| **Response time:** | ≤ 30 seconds at 25°C (77° F) at 0 to 5 Vol.-% |
| | ≤ 45 seconds at 25°C (77° F) at 5 to 100 Vol.-% |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.05 Vol.-% |
| Sensitivity: | ≤ ± 2.5% of measured value |
| **Linearity error:** | |
| 0 to 2 Vol.-% | ≤ ± 0.1 Vol.-% |
| 2 to 5 Vol.-% | ≤ ± 10% of measured value |
| 5 to 50 Vol.-% | ≤ ± 5 Vol.-% |
| 50 to 100 Vol.-% | ≤ ± 10% of measured value |
| **Long-term drift** | |
| Zero point: | ≤ ± 0.15 Vol.-%/month |
| Sensitivity 0 to 5 Vol.-% | ≤ ± 5% of measured value/month |
| Sensitivity 5 to 50 Vol.-% | ≤ ± 3 Vol.-%/month |
| Sensitivity 50 to 100 Vol.-% | ≤ ± 5% of measured value/month |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.005 Vol.-%/K at (–20 to 40)°C (–4 to 104)°F |
| Sensitivity 0 to 5 Vol.-% | ≤ ± 0.5% of measured value/K at (–20 to 40)°C (–4 to 104)°F |
| Sensitivity 5 to 50 Vol.-% | ≤ ± 0.15 Vol.-%/K at (–20 to 40)°C (–4 to 104)°F |
| Sensitivity 50 to 100 Vol.-% | ≤ ± 0.3% of measured value/K at (–20 to 40)°C (–4 to 104)°F |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.0025 Vol.-%/RH |
| Sensitivity 0 to 5 Vol.-% | ≤ ± 0.2% of measured value/% RH |
| Sensitivity 5 to 50 Vol.-% | ≤ ± 0.1 Vol.-%/% RH |
| Sensitivity 50 to 100 Vol.-% | ≤ ± 0.2% of measured value/% RH |

## TECHNICAL SPECIFICATIONS

### FOR THE MEASUREMENT RANGE 0 TO 100% LEL WHEN CALIBRATED WITH NONANE IN AIR:

| | |
|---|---|
| **Response time, rising:** | ≤ 60 seconds ($T_{50}$) at 25 °C (77 °F) |
| | ≤ 320 seconds ($T_{90}$) at 25 °C (77 °F) |
| **Response time, declining:** | ≤ 130 seconds ($T_{50}$) at 25 °C (77 °F) |
| | ≤ 1000 seconds ($T_{90}$) at 25 °C (77 °F) |

## SPECIAL CHARACTERISTICS

The DrägerSensor® Smart CatEx (HC PR) is used to detect flammable gases and vapors in the ambient air: LEL monitoring or, in the case of methane, also Vol.-% monitoring. It has an excellent poison resistance against hydrogen sulphide, siloxiane and other sensor poisons. These sensors have been tested according to EN 61779-1 and EN 61779-4 for methane, propane, and nonane for 0–100% LEL, and for 0–100 Vol.-% for methane in accordance with EN 61779-1 and EN 61779-5. Substance-specific data is stored in the data memory for 35 different gases and vapors.

## DETECTING OTHER GASES AND VAPORS

**Through the use of cross sensitivities for the measurement range of 0 to 100% LEL.** The figures given are typical readings when calibrated with methane ($CH_4$) and apply to new sensors without additional diffusion barriers. A LEL of 4.4 Vol.-% was used for methane. If an LEL of 5.0 Vol.-% is used, then the figures in the table must be multiplied by a factor of 0.88. The table does not claim to be complete. The sensor may also be sensitive to other gases and vapors.

| Gas/vapor | Chem. symbol | Test gas concentration in Vol.-% | Displayed reading in % LEL |
|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1.25 | 31 |
| 1,3-butadiene | $CH_2CHCHCH_2$ | 0.70 | 26 |
| Acetic acid | $CH_3COOH$ | 3.00 | 23 |
| Ammonia | $NH_3$ | 7.70 | 58 |
| Benzene | $C_6H_6$ | 0.60 | 22 |
| Butane | $C_4H_{10}$ | 0.70 | 27 |
| Butanone | $CH_3COC_2H_5$ | 0.75 | 22 |
| Carbon monoxide | CO | 5.45 | 41 |
| Cyclohexane | $C_6H_{12}$ | 0.50 | 21 |
| Cyclopentane | $C_5H_{10}$ | 0.70 | 27 |

| Gas/vapor | Chem. symbol | Test gas concentration in Vol.-% | Displayed reading in % LEL |
|---|---|---|---|
| Diethyl ether | $(C_2H_5)_2O$ | 0.85 | 24 |
| Diethylamine | $(C_2H_5)_2NH$ | 0.85 | 26 |
| Ethane | $C_2H_6$ | 1.20 | 34 |
| Ethanol | $C_2H_5OH$ | 1.55 | 31 |
| Ethene | $C_2H_4$ | 1.20 | 36 |
| Ethyl acetate | $CH_3COOC_2H_5$ | 1.00 | 24 |
| Ethine | $C_2H_2$ | 1.15 | 34 |
| Heptane | $C_7H_{16}$ | 0.40 | 18 |
| Hexane | $C_6H_{14}$ | 0.50 | 21 |
| Hydrogen | $H_2$ | 2.00 | 48 |
| 1-Methoxy-Propanol-2 | $C_4H_{10}O_2$ | 0.90 | 22 |
| Methane | $CH_4$ | 2.20 | 50 |
| Methanol | $CH_3OH$ | 3.00 | 39 |
| Methyl tert-butyl ether (MTBE) | $CH_3OC(CH_3)_3$ | 0.80 | 27 |
| n-butanol | $C4H_9OH$ | 0.70 | 19 |
| n-butyl acetate | $CH_3COOC_4H_9$ | 0.60 | 17 |
| Nonane | $C_9H_{20}$ | 0.35 | 13 |
| Octane | $C_8H_{18}$ | 0.40 | 17 |
| Pentane | $C_5H_{12}$ | 0.55 | 21 |
| Pentanol | $C_5H_{11}OH$ | 0.60 | 19 |
| Propane | $C_3H_8$ | 0.85 | 28 |
| Propanol | $C_3H_7OH$ | 0.60 | 19 |
| Propene | $C_3H_6$ | 1.00 | 32 |
| Propylene oxide | $C_3H_6O$ | 0.95 | 23 |
| Styrol | $C_6H_5CHCH_2$ | 0.50 | 15 |
| Toluene | $C_6H_5CH_3$ | 0.50 | 19 |
| Xylene | $C_6H4(CH_3)_2$ | 0.55 | 19 |

# DrägerSensor® Smart CatEx (PR)

**Order no. 68 12 980**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 2 years | – |

## MARKET SEGMENTS

Telecommunications, shipping, sewage, gas supply companies, refineries, chemical industry, mining, landfills, biogas plants, tunneling.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 2% LEL / 0.1 Vol.-% |
| **Resolution:** | 1.0% LEL for the measuring range 0 to 100% LEL,<br>0.02 Vol.-% for the measuring range 0 to 5 Vol.-% $CH_4$ (methane) |
| **Measurement range:** | 0 to 100% LEL |
| **General technical specifications** | |
| **Ambient conditions** | |
| Temperature: | (–20 to 55)°C (–4 to 131)°F |
| Humidity: | (10 to 95)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Warm-up time:** | ≤ 5 minutes |

## FOR THE MEASUREMENT RANGE 0 TO 100% LEL WHEN CALIBRATED WITH METHANE IN AIR:

| | |
|---|---|
| **Response time:** | ≤ 15 seconds at 25 °C (77 °F) ($T_{50}$)<br>≤ 25 seconds at 25 °C (77 °F) ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 1% LEL |
| Sensitivity: | ≤ ± 2.5% of measured value |
| **Linearity error:** | ≤ ± 2% LEL (0–40% LEL)<br>≤ ± 5% of measured value (40–100% LEL) |
| **Long-term drift** | |
| Zero point: | ≤ ± 1% LEL/month |
| Sensitivity: | ≤ ± 2% LEL/month |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.1% LEL/K at (–20 to 40)°C (–4 to 104)°F |
| Sensitivity: | ≤ ± 0.3% of measured value/K at (–20 to 40)°C (–4 to 104)°F |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.03% LEL/% RH |
| Sensitivity: | ≤ ± 0.1% of measured value/% RH |
| **Effect of sensor poisons:** | Hydrogen sulphide $H_2S$ 1000 ppmh ≤ ± 5 % of measured value<br>Hexamethyldisiloxane HMDS 10 ppmh ≤ ± 5 % of measured value<br>Hexamethyldisiloxane HMDS 30 ppmh ≤ ± 20 % of measured value<br>After an exposure of 10 ppm HDMS for 5 hours, the sensivity loss is less than 50 %. Halogenated hydrocarbons, heavy metals, substances containing silicone or sulfur, or substances that can polymerize → potential poisoning. 4.5 Vol.-% $CO_2$ ≤ ± 4% of measured value |
| **Test gas:** | approx. 2 Vol.-% $CH_4$ test gas |

## FOR THE MEASUREMENT RANGE 0 TO 100% LEL WHEN CALIBRATED WITH PROPANE IN AIR:

| | |
|---|---|
| **Response time:** | ≤ 20 seconds at 25°C (77° F) ($T_{50}$) |
| | ≤ 40 seconds at 25°C (77° F) ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 1% LEL |
| Sensitivity: | ≤ ± 2.5% of measured value |
| **Linearity error:** | ≤ ± 4% LEL (0–40% LEL) |
| | ≤ ± 10% of measured value (40–100% LEL) |
| **Long-term drift** | |
| Zero point: | ≤ ± 4% LEL/month |
| Sensitivity: | ≤ ± 1% LEL/month |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.1% LEL/K at (–20 to 40)°C (–4 to 104)°F |
| Sensitivity: | ≤ ± 0.3% of measured value/K at (–20 to 40)°C (–4 to 104)°F |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.04% LEL/% RH |
| Sensitivity: | ≤ ± 0.1% of measured value/% RH |

## FOR THE MEASUREMENT RANGE 0 TO 100% LEL WHEN CALIBRATED WITH NONANE IN AIR:

| | |
|---|---|
| **Response time, rising:** | ≤ 60 seconds ($T_{50}$) at 25°C (77° F) |
| | ≤ 320 seconds ($T_{90}$) at 25°C (77° F) |
| **Response time, declining:** | ≤ 130 seconds ($T_{50}$) at 25°C (77° F) |
| | ≤ 1000 seconds ($T_{90}$) at 25°C (77° F) |

## SPECIAL CHARACTERISTICS

The DrägerSensor® Smart CatEx (PR) is used to detect flammable gases and vapors around the LEL in the ambient air. It has an excellent poison resistance against hydrogen sulphide, siloxiane and other sensor poisons. These sensors have been tested according to EN 61779-1 and EN 61779-4 for methane, propane, and nonane for a range of 0–100% LEL. Substance-specific data is stored in the data memory for 35 different gases and vapors.

## DETECTING OTHER GASES AND VAPORS

**Through the use of cross sensitivities for the measurement range of 0 to 100% LEL.** The figures given are typical readings when calibrated with methane ($CH_4$) and apply to new sensors without additional diffusion barriers. A LEL of 4.4 Vol.-% was used for methane. If a LEL of 5.0 Vol.-% is used, then the figures in the table must be multiplied by a factor of 0.88. The table does not claim to be complete. The sensor may also be sensitive to other gases and vapors.

| Gas/vapor | Chem. symbol | Test gas concentration in Vol.-% | Displayed reading in % LEL |
|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1.25 | 31 |
| 1,3-butadiene | $CH_2CHCHCH_2$ | 0.70 | 26 |
| Acetic acid | $CH_3COOH$ | 3.00 | 23 |
| Ammonia | $NH_3$ | 7.70 | 58 |
| Benzene | $C_6H_6$ | 0.60 | 22 |
| Butane | $C_4H_{10}$ | 0.70 | 27 |
| Butanone | $CH_3COC_2H_5$ | 0.75 | 22 |
| Carbon monoxide | CO | 5.45 | 41 |
| Cyclohexane | $C_6H_{12}$ | 0.50 | 21 |
| Cyclopentane | $C_5H_{10}$ | 0.70 | 27 |
| Diethyl ether | $(C_2H_5)_2O$ | 0.85 | 24 |
| Diethylamine | $(C_2H_5)_2NH$ | 0.85 | 26 |
| Ethane | $C_2H_6$ | 1.20 | 34 |
| Ethanol | $C_2H_5OH$ | 1.55 | 31 |
| Ethene | $C_2H_4$ | 1.20 | 36 |
| Ethyl acetate | $CH_3COOC_2H_5$ | 1.00 | 24 |
| Ethine | $C_2H_2$ | 1.15 | 34 |
| Heptane | $C_7H_{16}$ | 0.40 | 18 |
| Hexane | $C_6H_{14}$ | 0.50 | 21 |
| Hydrogen | $H_2$ | 2.00 | 48 |
| 1-Methoxy-Propanol-2 | $C_4H_{10}O_2$ | 0.90 | 22 |
| Methane | $CH_4$ | 2.20 | 50 |
| Methanol | $CH_3OH$ | 3.00 | 39 |
| Methyl tert-butyl ether (MTBE) | $CH_3OC(CH_3)_3$ | 0.80 | 27 |
| n-butanol | $C4H_9OH$ | 0.70 | 19 |

| Gas/vapor | Chem. symbol | Test gas concentration in Vol.-% | Displayed reading in % LEL |
|---|---|---|---|
| n-butyl acetate | $CH_3COOC_4H_9$ | 0.60 | 17 |
| Nonane | $C_9H_{20}$ | 0.35 | 13 |
| Octane | $C_8H_{18}$ | 0.40 | 17 |
| Pentane | $C_5H_{12}$ | 0.55 | 21 |
| Pentanol | $C_5H_{11}OH$ | 0.60 | 19 |
| Propane | $C_3H_8$ | 0.85 | 28 |
| Propanol | $C_3H_7OH$ | 0.60 | 19 |
| Propene | $C_3H_6$ | 1.00 | 32 |
| Propylene oxide | $C_3H_6O$ | 0.95 | 23 |
| Styrol | $C_6H_5CHCH_2$ | 0.50 | 15 |
| Toluene | $C_6H_5CH_3$ | 0.50 | 19 |
| Xylene | $C_6H4(CH_3)_2$ | 0.55 | 19 |

# DrägerSensor® Smart CatEx (FR PR)

**Order no. 68 12 975**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 2 years | – |

## MARKET SEGMENTS

Gas supply companies (methane leak detection), telecommunications, shipping, sewage, refineries, chemical industry, mining, landfills, biogas plants, tunneling.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 2% LEL/0.1 Vol.-% |
| **Resolution:** | 1.0% LEL for the measuring range 0 to 100% LEL<br>0.02 Vol.-% for the measuring range 0 to 5 Vol.-% $CH_4$ (methane)<br>1 Vol.-% for the measuring range 5 to 100 Vol.-% $CH_4$ (methane) |
| **Measurement range:** | 0 to 100% LEL or<br>0 to 100 Vol.-% $CH_4$ (methane) |
| **General technical specifications** | |
| **Ambient conditions** | |
| Temperature: | (–20 to 55)°C (–4 to 131)°F |
| Humidity: | (10 to 95)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Warm-up time:** | ≤ 5 minutes |

## FOR THE MEASUREMENT RANGE 0 TO 100% LEL WHEN CALIBRATED WITH METHANE IN AIR:

| | |
|---|---|
| **Response time:** | ≤ 7 seconds at 25 °C (77 °F) ($T_{50}$)<br>≤ 9 seconds at 25 °C (77 °F) ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 1% LEL |
| Sensitivity: | ≤ ± 2.5% of measured value |
| **Linearity error:** | ≤ ± 4% LEL (0–40% LEL)<br>≤ ± 10% of measured value (40–100% LEL) |
| **Long-term drift** | |
| Zero point: | ≤ ± 1% LEL/month |
| Sensitivity: | ≤ ± 1% LEL/month |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.1% LEL/K at (–20 to 40)°C (–4 to 104)°F |
| Sensitivity: | ≤ ± 0.2% of measured value/K at (–20 to 40)°C (–4 to 104)°F |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.05% LEL/% RH |
| Sensitivity: | ≤ ± 0.3% of measured value/% RH |
| **Effect of sensor poisons:** | Hydrogen sulphide $H_2S$ 1000 ppmh ≤ ± 5 % of measured value<br>Hexamethyldisiloxane HMDS 10 ppmh ≤ ± 5 % of measured value<br>Hexamethyldisiloxane HMDS 30 ppmh ≤ ± 20 % of measured value<br>After an exposure of 10 ppm HDMS for 5 hours, the sensivity loss is less than 50 %. Halogenated hydrocarbons, heavy metals, substances containing silicone or sulfur, or substances that can polymerize → potential poisoning. 4.5 Vol.-% $CO_2$ ≤ ± 4% of measured value |

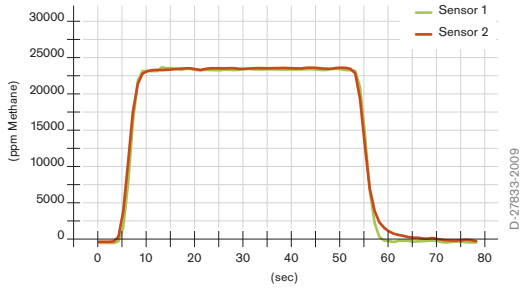
## FOR THE MEASUREMENT RANGE 0 TO 100 VOL.-% $CH_4$:

| | |
|---|---|
| **Response time:** | ≤ 14 seconds at 25°C (77° F) ($T_{90}$) at 0 to 5 Vol.-% |
| | ≤ 18 seconds at 25°C (77° F) ($T_{90}$) at 5 to 100 Vol.-% |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.05 Vol.-% |
| Sensitivity: | ≤ ± 2.5% of measured value |
| **Linearity error:** | |
| 0 to 2 Vol.-% | ≤ ± 0.1 Vol.-% |
| 2 to 5 Vol.-% | ≤ ± 10% of measured value |
| 5 to 50 Vol.-% | ≤ ± 5 Vol.-% |
| 50 to 100 Vol.-% | ≤ ± 10% of measured value |
| **Long-term drift** | |
| Zero point: | ≤ ± 0.15 Vol.-%/month |
| Sensitivity 0 to 5 Vol.-% | ≤ ± 5% of measured value/month |
| Sensitivity 5 to 50 Vol.-% | ≤ ± 3 Vol.-%/month |
| Sensitivity 50 to 100 Vol.-% | ≤ ± 5% of measured value/month |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.005 Vol.-%/K at (–20 to 40)°C (–4 to 104)°F |
| Sensitivity 0 to 5 Vol.-% | ≤ ± 0.5% of measured value/K at (–20 to 40)°C (–4 to 104)°F |
| Sensitivity 5 to 50 Vol.-% | ≤ ± 0.15 Vol.-%/K at (–20 to 40)°C (–4 to 104)°F |
| Sensitivity 50 to 100 Vol.-% | ≤ ± 0.3% of measured value/K at (–20 to 40)°C (–4 to 104)°F |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.0025 Vol.-%/% RH |
| Sensitivity 0 to 5 Vol.-% | ≤ ± 0.2% of measured value/% RH |
| Sensitivity 5 to 50 Vol.-% | ≤ ± 0.1 Vol.-%/% RH |
| Sensitivity 50 to 100 Vol.-% | ≤ ± 0.2% of measured value/% RH |
| **Test gas:** | approx. 2 Vol.-% or 50 Vol.-% $CH_4$ test gas |

## SPECIAL CHARACTERISTICS

The DrägerSensor® Smart CatEx (FR PR) is especially suitable for detecting leaks on account of its fast response time ($T_{90}$) of less than 9 seconds for methane. Like all other Smart CatEx sensors, it is also suitable for detecting flammable gases and vapors around the LEL in the ambient air. It has an excellent poison resistance against hydrogen sulphide, siloxiane and other sensor poisons.

Response time of DrägerSensor CatEx FR
in X-am 7000



# DrägerSensor® CatEx 125 PR

**Order no. 68 12 950**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 1/2/5000 | – | yes | 2 years | – |

## MARKET SEGMENTS

Telecommunications, shipping, sewage, gas supply companies, refineries, chemical industry, mining, landfills, biogas plants, sewage treatment plants, tunneling.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 1% LEL/0.05 Vol.-% |
| **Resolution:** | 1.0% LEL for measuring range 0 to 100% LEL,<br>0.1 Vol.-% for measuring range 0 to 5 Vol.-% $CH_4$ (methane) |
| **Measurement range:** | 0 to 100% LEL in Dräger X-am 1700/2000/500<br>0 to 100 Vol.% $CH_4$ (methane) in Dräger X-am 5000 |
| **General technical specifications** | |
| **Ambient conditions** | |
| Temperature: | (–20 to 55)°C (–4 to 131)°F |
| Humidity: | (10 to 95)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Warm-up time:** | ≤ 3 minutes |

## FOR THE MEASUREMENT RANGE 0 TO 100% LEL WHEN CALIBRATED WITH METHANE IN AIR:

| | |
|---|---|
| **Response time:** | ≤ 17 seconds at 25 °C (77 °F) ($T_{90}$)<br>≤ 7 seconds at 25 °C (77 °F) ($T_{50}$)<br>typical values for X-am 2000 $T_{90}$ at 25 °C (77 °F) ≤ 12 seconds<br>typical values for X-am 5000 $T_{90}$ at 25 °C (77 °F) ≤ 10 seconds |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 1% LEL |
| Sensitivity: | ≤ ± 1.5% LEL (0–50 % LEL) |
| **Linearity error:** | ≤ ± 2% LEL (0–90% LEL) |
| **Long-term drift** | |
| Zero point: | ≤ ± 2% LEL/month typical value in X-am 2000/5000 ≤ 1 % LEL/month |
| Sensitivity: | ≤ ± 2% LEL/month typical value in X-am 2000/5000 ≤ 1 % LEL/month |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.1% LEL/K at (–20 to 40)°C (–4 to 104)°F |
| Sensitivity: | ≤ ± 0.2% of measured value/K at (–20 to 40)°C (–4 to 104)°F |
| **Influence of humidity** | |
| Zero point: | ≤ ± 1% LEL |
| Sensitivity: | ≤ ± 2% LEL, effect of humidity when calibrating at 0% relative humidity in the range of 10–90 % at 40°C) |
| **Effect of sensor poisons:** | Hydrogen sulphide $H_2S$, 1000 ppmh ≤ ±2% of the measured value<br>Hexamethyldisiloxane HMDS 10 ppmh ≤ ±5 % of the measured value<br>Hexamethyldisiloxane HMDS 30 ppmh ≤ ±20 % of the measured value. After an exposure to HMDS of 10 ppm for 5 hours, the loss of sensitivity is less than 50%. Halogenated hydrocarbons, volatile substances containing sulphur, heavy metals and silicon, or substances capable of polymerisation poisoning possible. |

## FOR THE MEASUREMENT RANGE 0 TO 100% LEL WHEN CALIBRATED WITH PROPANE IN AIR:

| | |
|---|---|
| **Response time:** | ≤ 10 seconds at 25°C (77° F) ($T_{50}$)<br>≤ 32 seconds at 25°C (77° F) ($T_{90}$)<br>typical values for X-am 2000 $T_{90}$ at 25 °C (77 °F) ≤ 24 seconds<br>typical values for X-am 5000 $T_{90}$ at 25 °C (77 °F) ≤ 14 seconds |
| **Measurement accuracy** | |
| Zero point: | 1 % LEL |
| Sensitivity: | 1 % LEL (0–50 % LEL) |
| **Long-term drift** | |
| Zero point: | ≤ ± 2% LEL/month |
| Sensitivity: | ≤ ± 2% LEL/month |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.1% LEL/K at (–20 to 40)°C (–4 to 104)°F |
| Sensitivity: | ≤ ± 0.1% of measured value/K at (–20 to 40)°C (–4 to 104)°F |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.01% LEL/% RH |
| Sensitivity: | ≤ ± 0.02% LEL (at 50% LEL and 0–90 % r.H. at 40 °C/104 °F) |

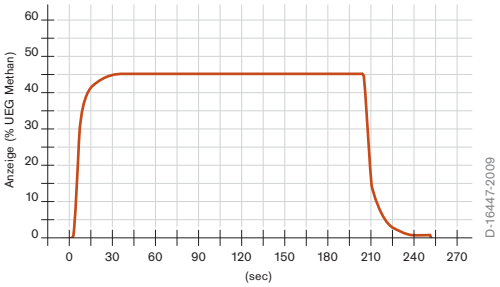
## FOR THE MEASUREMENT RANGE 0 TO 100 VOL.-% $CH_4$:

| | |
|---|---|
| **Response time:** | ≤ 30 seconds at 25°C (77° F) ($T_{90}$) at 5 to 100 Vol.-% |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.05 Vol.-% |
| Sensitivity: | ≤ ± 2.5% of measured value |
| **Linearity error:** | |
| 0 to 2 Vol.-% | ≤ ± 0.1 Vol.-% |
| 2 to 5 Vol.-% | ≤ ± 10% of measured value |
| 5 to 50 Vol.-% | ≤ ± 5 Vol.-% |
| 50 to 100 Vol.-% | ≤ ± 10% of measured value |
| **Long-term drift** | |
| Zero point: | ≤ ± 0.15 Vol.-%/month |
| Sensitivity 0 to 5 Vol.-% | ≤ ± 5% of measured value/month |
| Sensitivity 5 to 50 Vol.-% | ≤ ± 3 Vol.-%/month |
| Sensitivity 50 to 100 Vol.-% | ≤ ± 5% of measured value/month |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.005 Vol.-%/K at (–20 to 40)°C (–4 to 104)°F |
| Sensitivity 0 to 5 Vol.-% | ≤ ± 0.5% of measured value/K at (–20 to 40)°C (–4 to 104)°F |
| Sensitivity 5 to 50 Vol.-% | ≤ ± 0.15 Vol.-%/K at (–20 to 40)°C (–4 to 104)°F |
| Sensitivity 50 to 100 Vol.-% | ≤ ± 0.3% of measured value/K at (–20 to 40)°C (–4 to 104)°F |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.0025 Vol.-%/RH |
| Sensitivity 0 to 5 Vol.-% | ≤ ± 0.2% of measured value/% RH |
| Sensitivity 5 to 50 Vol.-% | ≤ ± 0.1 Vol.-% RH |
| Sensitivity 50 to 100 Vol.-% | ≤ ± 0.2% of measured value/% RH |
| **Test gas:** | approx. 2 Vol.-% or 50 Vol.-% $CH_4$ test gas |

## SPECIAL CHARACTERISTICS

The DrägerSensor® CatEx 125 PR (Poison Resistant) is used to detect flammable gases and vapors. The detection of hydrocarbons from methane to nonane is certified by a measurement performance certificates for use in the Dräger X-am 1/2/5000 series in accordance with EN 60079-29-1 and EN 50271. It also has a small long-term drift, few influence of humidity and excellent poison resistance against hydrogen sulphide, siloxiane and other sensor poisons.

Ansprechzeit des DrägerSensor CatEx 125 PR
im X-am 5000 bei 45% UEG Methan




## DETECTING OTHER GASES AND VAPORS

**Through the use of cross sensitivities for the measurement range of 0 to 100% LEL.** The figures given are typical readings when calibrated with methane ($CH_4$) and apply to new sensors without additional diffusion barriers. A LEL of 4.4 Vol.-% was used for methane. If a LEL of 5.0 Vol.-% is used, then the figures in the table must be multiplied by a factor of 0.88. The table does not claim to be complete. The sensor may also be sensitive to other gases and vapors.

| Gas/vapor | Chem. symbol | Test gas concentration in Vol.-% | Displayed reading in % LEL |
|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1.25 | 31 |
| Acetic acid | $CH_3COOH$ | 7.7 | 57 |
| Ammonia | $NH_3$ | 6.16 | 48 |
| Benzene | $C_6H_6$ | 0.6 | 25 |
| Butadiene -1,3 | $CH_2CHCHCH_2$ | 0.7 | 27 |
| Butane | $C_4H_{10}$ | 0.7 | 26 |
| n-butanol | $C_4H_9OH$ | 0.7 | 20 |
| Butanone | $CH_3COC_2H_5$ | 0.75 | 22 |
| n-butyl acetate | $CH_3COOC_4H_9$ | 0.6 | 18 |
| Carbon monoxide | CO | 5.45 | 32 |
| Cyclohexane | $C_6H_{12}$ | 0.5 | 21 |
| Cyclopentane | $C_5H_{10}$ | 0.7 | 27 |
| Diethylamine | $(C_2H_5)_2NH$ | 0.85 | 28 |

| Gas/vapor | Chem. symbol | Test gas concentration in Vol.-% | Displayed reading in % LEL |
|---|---|---|---|
| Diethyl ether | $(C_2H_5)_2O$ | 0.85 | 27 |
| Ethane | $C_2H_6$ | 1.2 | 35 |
| Ethanol | $C_2H_5OH$ | 1.55 | 33 |
| Ethene | $C_2H_4$ | 1.2 | 36 |
| Ethine | $C_2H_2$ | 1.15 | 36 |
| Ethyl acetate | $CH_3COOC_2H_5$ | 1.0 | 25 |
| Heptane | $C_7H_{16}$ | 0.4 | 17 |
| Hexane | $C_6H_{14}$ | 0.5 | 21 |
| Hydrogen | $H_2$ | 2.0 | 49 |
| Methane | $CH_4$ | 2.2 | 50 |
| Methanol | $CH_3OH$ | 3.0 | 42 |
| Methyl tert-butyl ether (MTBE) | $CH_3OC(CH_3)_3$ | 0.8 | 27 |
| Nonane | $C_9H_{20}$ | 0.35 | 15 |
| 1-Methoxy-Propanol-2- | $C_4H_{10}O_2$ | 0.9 | 23 |
| Octane | $C_8H_{18}$ | 0.4 | 18 |
| Pentane | $C_5H_{12}$ | 0.55 | 22 |
| Pentanol | $C_5H11OH$ | 0.6 | 19 |
| Propane | $C_3H_8$ | 0.85 | 29 |
| Propanol | $C_3H_7OH$ | 1.00 | 27 |
| Propene | $C_3H_6$ | 1.00 | 35 |
| Propylene oxide | $C_3H_6O$ | 0.95 | 25 |
| Styrene | $C_6H_5CHCH_2$ | 0.5 | 11 |
| Toluene | $C_6H_5CH_3$ | 0.5 | 21 |
| Xylene | $C_6H_4(CH_3)_2$ | 0.55 | 22 |

# DrägerSensor® CatEx 125 Mining

**Order no. 68 11 970**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 5000 | – | yes | 2 years | – |

## MARKET SEGMENTS

Mining, telecommunications, shipping, sewage, gas supply companies, refineries, chemical industry, landfills, biogas plants, sewage treatment plants, tunneling.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 2% LEL/0.1 Vol.-% |
| **Resolution:** | 1.0% LEL for measuring range 0 to 100% LEL,<br>0.1 Vol.-% for measuring range 0 to 5 Vol.-% $CH_4$ (methane) |
| **Measurement range:** | 0 to 100% LEL or 0 to 100 Vol.-% $CH_4$ (methane) |
| **General technical specifications** | |
| **Ambient conditions** | |
| Temperature: | (–20 to 55)°C (–4 to 131)°F |
| Humidity: | (10 to 95)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Warm-up time:** | ≤ 5 minutes |

## FOR THE MEASUREMENT RANGE 0 TO 100% LEL WHEN CALIBRATED WITH METHANE IN AIR:

| | |
|---|---|
| **Response time:** | ≤ 7 seconds at 25 °C (77 °F) ($T_{50}$)<br>≤ 10 seconds at 25 °C (77 °F) ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 1% LEL |
| Sensitivity: | ≤ ± 2.5% of measured value |
| **Long-term drift** | |
| Zero point: | ≤ ± 3% LEL/month |
| Sensitivity: | ≤ ± 3% LEL/month |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.1% LEL/K |
| Sensitivity: | ≤ ± 0.2% of measured value/K |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.05% LEL/% RH |
| Sensitivity: | ≤ ± 0.3% of measured value/% RH |

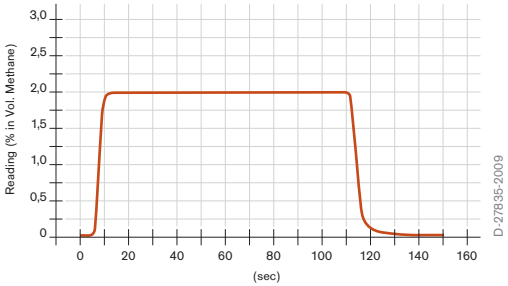
## FOR THE MEASUREMENT RANGE 0 TO 100 VOL.-% $CH_4$:

| | |
|---|---|
| **Response time:** | ≤ 30 seconds at 25°C (77° F) ($T_{90}$) at 0 to 5 Vol.-% |
| | ≤ 45 seconds at 25°C (77° F) ($T_{90}$) at 5 to 100 Vol.-% |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.05 Vol.-% |
| Sensitivity: | ≤ ± 2.5% of measured value |
| **Linearity error:** | |
| 0 to 2 Vol.-% | ≤ ± 0.1 Vol.-% |
| 2 to 5 Vol.-% | ≤ ± 10% of measured value |
| 5 to 50 Vol.-% | ≤ ± 5 Vol.-% |
| 50 to 100 Vol.-% | ≤ ± 10% of measured value |
| **Long-term drift** | |
| Zero point: | ≤ ± 0.15 Vol.-%/month |
| Sensitivity 0 to 5 Vol.-% | ≤ ± 5% of measured value/month |
| Sensitivity 5 to 50 Vol.-% | ≤ ± 3 Vol.-%/month |
| Sensitivity 50 to 100 Vol.-% | ≤ ± 5% of measured value/month |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.005 Vol.-%/K at (–20 to 40)°C (–4 to 104)°F |
| Sensitivity 0 to 5 Vol.-% | ≤ ± 0.5% of measured value/K at (–20 to 40)°C (–4 to 104)°F |
| Sensitivity 5 to 50 Vol.-% | ≤ ± 0.15 Vol.-%/K at (–20 to 40)°C (–4 to 104)°F |
| Sensitivity 50 to 100 Vol.-% | ≤ ± 0.3% of measured value/K at (–20 to 40)°C (–4 to 104)°F |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.0025 Vol.-%/% RH |
| Sensitivity 0 to 5 Vol.-% | ≤ ± 0.2% of measured value/% RH |
| Sensitivity 5 to 50 Vol.-% | ≤ ± 0.1 Vol.-%/RH. |
| Sensitivity 50 to 100 Vol.-% | ≤ ± 0.2% of measured value/% RH |
| **Test gas:** | approx. 2 Vol.-% or 50 Vol.-% $CH_4$ test gas |
| **Effect of sensor contaminants:** | 10 ppm Hydrogen sulfide ($H_2S$) → ≤ ± 10% of measured value/8 h<br>Halogenated hydrocarbons, heavy metals, substances containing silicone or sulfur, or substances that can polymerize → potential poisoning. |

## SPECIAL CHARACTERISTICS

This sensor is optimized for the detection of methane. It has a response time ($T_{90}$) of less than 10 seconds. The pellistors are impact-protected, which makes the sensor especially shock-proof. In conjunction with this sensor, the Dräger X-am 5000 is approved for Zone 0/T4 worldwide. The LEL and the Vol.-% measuring range can be used in the Dräger X-am 5000.

Response time of DrägerSensor CatEx 125 Mining
in X-am 5000



# DrägerSensor® CatEx 2

**Order no. 83 16 109**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 3000 | – | yes | 2 years | – |

## MARKET SEGMENTS

Telecommunications, shipping, sewage, gas supply companies, refineries, chemical industry, mining, landfills, biogas plants, tunneling.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 2% LEL/0.1 Vol.-% |
| **Resolution:** | 1.0% LEL for the measuring range 0 to 100% LEL $CH_4$ (methane), |
| | 0.1 Vol.-% for the measuring range 0 to 5 Vol.-% $CH_4$ (methane), |
| | 1 Vol.-% for the measuring range 5 to 100 Vol.-% $CH_4$ (methane) |
| **Measurement range:** | 0 to 100% LEL or 0 to 100 Vol.-% $CH_4$ (methane) |
| **General technical specifications** | |
| **Ambient conditions** | |
| Temperature: | (–20 to 55)°C (–4 to 131)°F |
| Humidity: | (10 to 95)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Warm-up time:** | approx. 30 seconds |

## FOR THE MEASUREMENT RANGE 0 TO 100% LEL WHEN CALIBRATED WITH METHANE IN AIR:

| | |
|---|---|
| **Response time:** | ≤ 8 seconds at 20 °C (68 °F) ($T_{50}$) |
| | ≤ 15 seconds at 20 °C (68 °F) ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.4% LEL |
| Sensitivity: | ≤ ± 5% of measured value |
| **Linearity filter** | ≤ ± 3% of measured value (0–50% LEL) |
| | ≤ ± 5% of measured value (50–100% LEL) |
| **Long-term drift** | |
| Zero point: | ≤ ± 0.75% LEL/month |
| Sensitivity: | ≤ ± 2.5% of measured value/month[1)] |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.2% LEL/K |
| Sensitivity: | ≤ ± 0.3% of measured value/K |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.025% LEL/% RH |

[1)] Measured over a period of 600 days.

## FOR THE MEASUREMENT RANGE 0 TO 100 VOL.-% $CH_4$:

| | |
|---|---|
| **Response time:** | ≤ 8 seconds at 20°C ($T_{50}$)<br>≤ 15 seconds at 20°C ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.8 Vol.-% |
| Sensitivity: | ≤ ± 7% of measured value |
| **Linearity error:** | |
| 5 to 50 Vol.-% | ≤ ± 5 Vol.-% of measured value |
| 50 to 100 Vol.-% | ≤ ± 10% of measured value |
| **Long-term drift** | |
| Zero point: | ≤ ± 1.2 Vol.-%/month |
| Sensitivity | ≤ ± 3% of measured value/month<br>(applies to entire measuring range) |
| **Influence of temperature** | |
| Zero point: | ≤ ± 2.5 Vol.-%/K at (–25 to 55)°C (–13 to 131)°F |
| Sensitivity | ≤ ± 0.35% of measured value/K at (–25 to 55)°C (–13 to 131)°F<br>(applies to entire measuring range) |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.025 Vol.-%/% RH |
| **Test gas:** | approx. 2 Vol.-% $CH_4$ test gas |
| **Effect of sensor contaminants:** | 10 ppm Hydrogen sulfide ($H_2S$) → ≤ ±10% of measured value/8 h<br>Halogenated hydrocarbons, heavy metals, substances containing silicone or sulfur, or substances that can polymerize → potential poisoning. |

## SPECIAL CHARACTERISTICS

The DrägerSensor® CatEx 2 is used to detect flammable gases and vapors in the ambient air: LEL monitoring or, in the case of methane, also Vol.-% monitoring.

## DETECTING OTHER GASES AND VAPORS

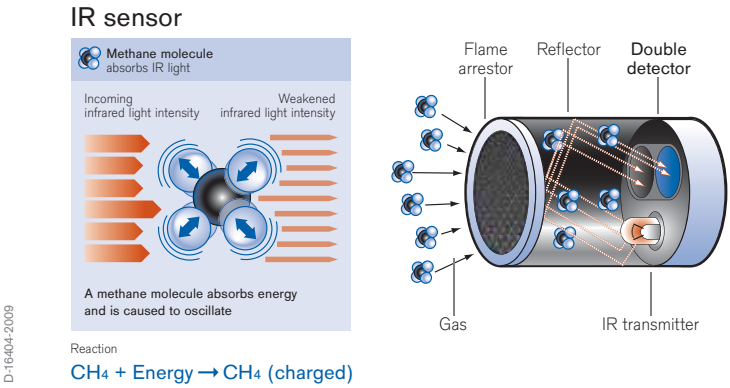
**Through the use of cross sensitivities for the measurement range of 0 to 100% LEL.** The correction factors given are typical readings when calibrated with methane ($CH_4$) and apply to new sensors without sensor filters. A LEL of 5.0 Vol.-% was used for methane. If a LEL of 4.4 Vol.-% is used, then the figures in the table must be multiplied by a factor of 1.14. The correction factors listed were determined for 25 °C (77 °F) and may fluctuate by ± 30% (source: NIOSH, Pocket guide to chemical hazards, 1997). The table does not claim to be complete. Calibrating the sensor using the actual gas that is to be measured is always preferable. The sensor may also be sensitive to other gases and vapors. Toxicity caused by catalyzer poisons can alter the relative sensitivities for various gases and vapors.

| Gas/vapor | Chem. symbol | Correction factor |
|---|---|---|
| Acetic acid | $CH_3COOH$ | 2.5 |
| Acetone | $CH_3COCH_3$ | 2.2 |
| Ammonia | $NH_3$ | 0.6 |
| Benzene | $C_6H_6$ | 2.5 |
| 1,3-butadiene | $CH_2CHCHCH_2$ | 2 |
| n-butane | $C_4H10$ | 2 |
| n-butanol | $C_4H9OH$ | 4.5 |
| 2-butanone | $CH_3COC_2H_5$ | 2.6 |
| n-butyl acetate | $CH_3COOC_4H_9$ | 3.9 |
| Carbon monoxide | CO | 1.2 |
| Cyclohexane | $C_6H_{12}$ | 2.5 |
| Cyclopentane | $C5H_{10}$ | 2.5 |
| Diethyl ether | $(C_2H5)_2O$ | 2.3 |
| Ethane | $C_2H_6$ | 1.4 |
| Ethanol | $C_2H_5OH$ | 1.7 |
| Ethene | $C_2H_4$ | 1.5 |
| Ethine | $C_2H_2$ | 1.2 |
| Ethyl acetate | $CH_3COOC_2H_5$ | 2.6 |
| n-heptane | $C_7H_{16}$ | 3 |
| n-hexane | $C_6H_{14}$ | 2.3 |
| Hydrogen | $H_2$ | 1.2 |

| Gas/vapor | Chem. symbol | Correction factor |
|---|---|---|
| Methane | $CH_4$ | 1 |
| Methanol | $CH_3OH$ | 1.5 |
| n-nonane | $C_9H20$ | 4 |
| n-octane | $C_8H_{18}$ | 2.9 |
| n-pentane | $C_5H_{12}$ | 2.2 |
| Propane | $C_3H_8$ | 1.9 |
| i-propanol | $C_3H_7OH$ | 2.7 |
| n-propanol | $C_3H_7OH$ | 2.7 |
| Propene | $C_3H_6$ | 1.8 |
| 1,2-propylene oxide | $C_3H_6O$ | 2.1 |
| Toluene | $C_6H_5CH_3$ | 2.5 |
| o-xylene | $C_6H_4(CH_3)_2$ | 3.5 |
| m-xylene | $C_6H_4(CH_3)_2$ | 3.5 |
| p-xylene | $C_6H_4(CH_3)_2$ | 4 |

## 4.4 Dräger infrared sensors


Every gas absorbs light in a particular way; some even absorb visible light (wavelength of 0.4 to 0.8 micrometers), which is why chlorine is yellowish green, bromine and nitrogen dioxide are brown, iodine vapor is violet, and so on – but unfortunately they are only visible in high (deadly) concentrations.




Hydrocarbons, on the other hand, absorb light in a certain wavelength range, from between about 3.3 and 3.5 micrometers – and that can be utilized for detection purposes, since the main components of air (oxygen, nitrogen, and argon) do not absorb radiation in that range. In a container containing gaseous hydrocarbons such as methane or propane, the intensity of an incoming infrared light will be weakened, and the degree of this weakening is dependent on the concentration of gas.

**Air:** infrared light passes through without weakening – intensity remains the same
**Gas (e.g. methane)**: infrared light becomes weaker as it passes through – intensity drops in relation to the concentration of methane. This is the principle of an infrared measuring instrument that utilizes Dräger IR sensors. Flammable gases and vapors are mostly hydrocarbons, and hydrocarbons are almost always detectable by means of their typical IR absorption levels.

**Functional principle:** the ambient air to be monitored passes into the measuring cuvette by means of diffusion or through the use of a pump. The infrared transmitter produces broad-band radiation that passes through a window into the cuvette, where it is reflected off the mirrored walls and passes through another window, falling onto the double detector. This double detector consists of a measurement and a reference detector. If the gas mixture contains a percentage of hydrocarbons, then some of the radiation is absorbed and the measurement detector produces a reduced electrical signal. The signal from the reference detector remains unchanged. Fluctuations in the performance of the infrared transmitter, dirt on the mirror and windows, and interference from dust or aerosols in the ambient air have the same effect on both sensors, and are fully compensated.

# DrägerSensor® Smart IR Ex

**Order no. 68 10 460**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 5 years | – |

## MARKET SEGMENTS

Telecommunications, shipping, sewage, gas supply companies, refineries, chemical industry, mining, landfills, biogas plants, tunneling.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 3% LEL/0.1 Vol.-% |
| **Resolution:** | 0.5% LEL |
| **Measurement range:** | 0 to 100% LEL/0 to 100 Vol.-%<br>depending on the gas being measured |
| **Ambient conditions** | |
| Temperature: | (–20 to 60)°C (–4 to 140)°F |
| Humidity: | (10 to 95)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Warm-up time:** | ≤ 4 minutes |

## FOR THE MEASUREMENT RANGE 0 TO 100% LEL OR 0 TO 4.4 VOL.-% $CH_4$ WHEN CALIBRATED WITH METHANE IN AIR:

| | |
|---|---|
| **Response time:** | Diffusion mode ≤ 20 seconds ($T_{50}$)<br>Diffusion mode ≤ 50 seconds ($T_{90}$)<br>Pump mode ≤ 20 seconds ($T_{50}$)<br>Pump mode ≤ 41 seconds ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 1.0% LEL methane |
| Sensitivity: | ≤ ± 2.0% LEL methane at 50% LEL |
| **Linearity error, typical:** | ≤ ± 5% of measured value |
| **Long-term drift** | |
| Zero point: | ≤ ± 2.5% LEL methane/month |
| Sensitivity: | ≤ ± 2.5% LEL methane/month at 50% LEL |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.05% LEL methane/K at (–20 to 60)°C (–4 to 140)°F |
| Sensitivity: | ≤ ± 0.15% LEL methane/K at 50% LEL and (–20 to 60)°C (–4 to 140)°F |
| **Effect of humidity, at 40°C (104 °F) (0 to 95% RH, non-condensing)** | |
| Zero point: | ≤ ± 0.05% LEL methane/% RH |

## FOR THE MEASUREMENT RANGE 0 TO 100% LEL OR 0 TO 1.7 VOL.-% $C_3H_8$ WHEN CALIBRATED WITH PROPANE IN AIR:

| | |
|---|---|
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.75% LEL propane |
| Sensitivity | ≤ ± 1.0% LEL propane at 50% LEL |
| **Linearity error, typical:** | ≤ ± 4.0% of measured value |
| **Long-term drift** | |
| Zero point: | ≤ ± 1.0% LEL propane/month |
| Sensitivity | ≤ ± 2.0% LEL propane/month at 50% LEL |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.03% LEL propane/K |
| Sensitivity | ≤ ± 0.08% LEL propane/K |
| **Effect of humidity, at 40°C (104 °F) (0 to 95% RH, non-condensing)** | |
| Zero point: | ≤ ± 0.03% LEL propane/% RH |
| **Test gas:** | 2 Vol.-% $CH_4$<br>0.9 Vol.-% $C_3H_8$ |

## SPECIAL CHARACTERISTICS

This sensor can be used for LEL monitoring and Vol.-% monitoring for some gases. The sensor's database can contain up to 50 different gases. It is also the ideal sensor for measuring hydrocarbons in an inert atmosphere, since its measuring method does not depend on the presence of oxygen. This sensor also has a very long life time, and there is no risk of poisoning from sulfurous or silicone compounds.

LEL figures depend on country-specific standards.

## COMPATIBLE GASES AND MEASUREMENT RANGES:

### Sensor precalibration

The sensor can be delivered with all the necessary calibration data available. The sensor's database can contain up to 50 different gases. The zero point and sensitivity are precalibrated in the sensor for methane (0 to 100% LEL) and propane (0 to 100% LEL). The Vol.-% and % LEL readings are differentiated by displaying the measured gas in upper- and lower-case letters (e.g. $ch_4$ for 0 to 100% LEL and $CH_4$ for 0 to 100 Vol.-%).

| Gas | Data set name | Measurement range |
|---|---|---|
| n-butane | buta | 0 to 100% LEL [2] |
| n-butane | BUTA | 0 to 100 Vol.-% |
| Ethene | $c_2h_4$ | 0 to 100% LEL [2] |
| Ethene | $C_2H_4$ | 0 to 100 Vol.-% |
| Ethanol | EtOH | 0 to 100% LEL [2] |
| Ex | Ex | 0 to 100% LEL |
| Liquid petroleum gas | LPG<br>(50% propane + 50% butane)[3] | 0 to 100% LEL [2] /<br>0 to 100 Vol.-% |
| JetFuel | JetF | 0 to 100% LEL [2] |
| Methane | $ch_4$ | 0 to 100% LEL [2] |
| Methane | $CH_4$ | 0 to 100 Vol.-% |
| n-nonane | Nona | 0 to 100% LEL [2] |
| n-pentane | Pent | 0 to 100% LEL [2] |
| Propane | $c_3h_8$ | 0 to 100% LEL [2] |
| Propane | $C_3H_8$ | 0 to 100 Vol.-% |
| Toluene | Tolu | 0 to 100% LEL [2] |

[2] LEL figures depend on country-specific standards.

[3] The figures in the table assume a composition of 50% propane and 50% butane.
In practice, the composition of LPG fluctuates, which can lead to increased measurement errors.

## DETECTION OF OTHER GASES AND VAPORS FOR THE MEASUREMENT RANGE 0 TO 100% LEL:

**Through the use of cross sensitivities when calibrated with propane ($C_3H_8$, 100% LEL = 1.7 Vol.-%).** The sensor can be used to detect the gases and vapors listed in the following table. The sensor must be configured to "Ex" measurement gas in the instrument. For example: if the instrument is subjected to 1.25 Vol.-% acetone (50% LEL), the instrument will show a reading of 19% LEL if configured to "Ex" measurement gas (calibration using 50% LEL / = 0.85 Vol.-% propane). Calibration using the target gas is preferable to calibration using a replacement gas.

| Gas/vapor gas | Chemical symbol | Test gas concentration in Vol.-% | Reading displayed in % LEL (if calibrated to 0.85 Vol.-% propane) | Cross-sensitivity factor |
|---|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1.25 | 19 | 2.63 |
| Acetylene | $C_2H_2$ | – | not possible | – |
| Benzene | $C_6H_6$ | 0.6 | 11 | 4.44 |
| Butadiene -1,3 | $CH_2CHCHCH_2$ | 0.7 | 13 | 3.85 |
| Cyclohexane | $C_6H_{12}$ | – | on request | – |
| Cyclopentane | $C_5H_{10}$ | 0.7 | 52 | 0.96 |
| Dimethyl ether | $(C_2H_5)_2O$ | 1.35 | 62 | 0.81 |
| Ethane | $C_2H_6$ | 1.35 | 76 | 0.66 |
| Ethanol | $C_2H_5OH$ | 1.75 | 64 | 0.78 |
| Ethene | $C_2H_4$ | 1.15 | 9 | 5.56 |
| Ethyl acetate | $CH_3COOC_2H_5$ | 1.05 | 35 | 1.43 |
| Ethyl acrylate | $C_5H_8O_2$ | 0.85 | 23 | 2.17 |
| i-butane | $C_4H_{10}$ | 0.9 | 49 | 1.02 |
| i-butene | $C_4H_8$ | 0.8 | 32 | 1.56 |
| Methanol | $CH_4O$ | 2.75 | 93 | 0.54 |
| Methyl chloride | $CH_3Cl$ | 3.8 | 42 | 1.19 |
| Methylene chloride | $CH_2Cl_2$ | 6.5 | 13 | 3.85 |
| Methyl ethyl ketone | $C_4H_8O$ | 0.9 | 28 | 1.79 |
| n-heptane | $C_7H_{16}$ | 0.55 | 45 | 1.11 |
| n-hexane | $C_6H_{14}$ | 0.5 | 42 | 1.19 |
| n-nonane | $C_9H_{20}$ | – | on request | – |
| n-octane | $C_8H_{18}$ | 0.4 | 32 | 1.56 |
| n-pentane | $C_5H_{12}$ | 0.7 | 54 | 0.93 |
| Propane | $C_3H_8$ | 0.85 | 50 | 1.00 |
| n-propanol | $C_3H_7OH$ | 0.6 | 40 | 1.25 |
| o-xylene | $C_6H_4(CH_3)_2$ | 0.5 | 13 | 3.85 |
| Toluene | $C_6H_5CH_3$ | 0.6 | 19 | 2.63 |

# DrägerSensor® IR EX

**Order no. 68 12 180**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 5600 | – | yes | 5 years | – |

## MARKET SEGMENTS

Telecommunications, shipping, sewage, gas supply companies, refineries, chemical industry, mining, landfills, biogas plants, tunneling.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 1% LEL/0.2 Vol.-% |
| **Resolution:** | 1% LEL/0.1 Vol.-% (dependent on measuring range) |
| **Measurement range:** | 0 to 100% LEL/0 to 100 Vol.-%<br>depending on the gas being measured |
| **Ambient conditions** | |
| Temperature: | (–20 to 50)°C (–4 to 120)°F |
| Humidity: | (10 to 95)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Warm-up time:** | ≤ 5 minutes |

## FOR THE MEASUREMENT RANGE 0 TO 100% LEL OR 0 TO 4.4 VOL.-% $CH_4$ WHEN CALIBRATED WITH METHANE IN AIR:

| | |
|---|---|
| **Response time:** | Diffusion mode ≤ 10 seconds ($T_{50}$)<br>Diffusion mode ≤ 20 seconds ($T_{90}$)<br>Pump mode ≤ 10 seconds ($T_{50}$)<br>Pump mode ≤ 15 seconds ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 1.0% LEL methane |
| Sensitivity: | ≤ ± 1.5% LEL methane at 50% LEL |
| **Linearity error, typical:** | ≤ ± 3.5% of measured value or ≤ ± 1.5% of the highest figure in the set measuring (whichever is higher) |
| **Long-term drift** | |
| Zero point: | ≤ ± 0.2% LEL methane/month |
| Sensitivity: | ≤ ± 4.5% LEL methane/6 months at 50% LEL |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.015% LEL methane/K at (–20 to 50)°C (–4 to 120)°F |
| Sensitivity: | ≤ ± 0.03% LEL methane/K at 50% LEL and (–20 to 50)°C (–4 to 120)°F |
| **Effect of humidity, at 40°C (104 °F) (0 to 95% RH, non-condensing)** | |
| Zero point: | ≤ ± 0.005% LEL methane/% RH |

## FOR THE MEASUREMENT RANGE 0 TO 100% LEL OR 0 TO 1.7 VOL.-% $C_3H_8$ WHEN CALIBRATED WITH PROPANE IN AIR:

| | |
|---|---|
| **Response time:** | Diffusion mode ≤ 15 seconds ($T_{50}$)<br>Diffusion mode ≤ 25 seconds ($T_{90}$)<br>Pump mode ≤ 15 seconds ($T_{50}$)<br>Pump mode ≤ 20 seconds ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 1.0% LEL propane |
| Sensitivity | ≤ ± 1.25% LEL propane |
| **Linearity error, typical:** | ≤ ± 3.0% of measured value or ≤ ± 1.0% of the highest figure in the set measuring (whichever is higher) |
| **Long-term drift** | |
| Zero point: | ≤ ± 0.3% LEL propane/month |
| Sensitivity | ≤ ± 3.0% LEL propane/6 months |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.02% LEL propane/K |
| Sensitivity | ≤ ± 0.025% LEL propane/K |
| **Effect of humidity, at 40°C (104 °F) (0 to 95% RH, non-condensing)** | |
| Zero point: | ≤ ± 0.008% LEL propane/% RH |
| **Test gas:** | 2 Vol.-% $CH_4$ or 50 Vol.-% $CH_4$<br>0.9 Vol.-% $C_3H_8$ |

## SPECIAL CHARACTERISTICS

This sensor can be used for LEL monitoring, and Vol.-% monitoring for some gases. It is also the ideal sensor for measuring hydrocarbons in an inert atmosphere, since its measuring method does not depend on the presence of oxygen. This sensor also has a very long life time, and there is no risk of poisoning from sulfurous or silicone compounds.

## COMPATIBLE GASES AND MEASURING RANGES:

| Gas | Data set name | Measurement range |
|---|---|---|
| n-butane | buta | 0 to 100% LEL [2)] |
| n-butane | BUTA | 0 to 100 Vol.-% |
| Ethene | $c_2h_4$ | 0 to 100% LEL [2)] |
| Ethene | $C_2H_4$ | 0 to 100 Vol.-% |
| Ethanol | EtOH | 0 to 100% LEL [2)] |
| Ex | Ex | 0 to 100% LEL |
| JetFuel | JetF | 0 to 100% LEL [2)] |
| Methane | $ch_40$ to 100% LEL [2)] | |
| Methane | $CH_4$ | 0 to 100 Vol.-% |
| n-nonane | Nona | 0 to 100% LEL [2)] |
| n-pentane | Pent | 0 to 100% LEL [2)] |
| Propane | $c_3h_4$ | 0 to 100% LEL [2)] |
| Propane | $C_3H_8$ | 0 to 100 Vol.-% |
| Toluene | Tolu | 0 to 100% LEL [2)] |

[2)] LEL figures depend on country-specific tandards.

## DETECTION OF OTHER GASES AND VAPORS FOR THE MEASURING RANGE 0 TO 100% LEL

| Gas/vapor gas | Chemical symbol | Test gas concentration in Vol.-% | Reading displayed in % LEL (if calibrated to 0.85 Vol.-% propane) | Cross-sensitivity factor |
|---|---|---|---|---|
| Acetone | $C_3H_6O$ | 1.25 | 18 | 2.78 |
| Acetylene | $C_2H_2$ | – | out of range | – |
| Benzene | $C_6H_6$ | 0.6 | 20 | 2.50 |
| Butadiene -1,3 | $C_4H_6$ | 0.7 | 20 | 2.50 |
| i-Butane | $(CH_3)_3CH$ | 0.75 | 41 | 1.22 |
| n-Butane | $C_4H_{10}$ | 0.7 | 42 | 1.19 |
| i-Butene | $(CH_3)_2C=CH_2$ | 0.8 | 31 | 1.61 |
| n-Butanol | $C_4H_{10}O$ | 0.85 | 25 | 2.0 |
| 2-Butanone (MEK) | $C_4H_8O$ | 0.75 | 22 | 2.27 |
| Butyl Acetate | $C_6H_{12}O_2$ | 0.60 | 20 | 2.5 |
| Cyclohexane | $C_6H_{12}$ | 0.50 | 15 | 3.33 |
| Cyclopentane | $C5H_{10}$ | 0.7 | 47 | 1.06 |
| Dimethyl Aether | $C_2H_6O$ | 1.35 | 51 | 0.98 |
| Diethylamine | $C_4H_{11}N$ | 0.85 | 44 | 1.14 |
| Diethyl Aether | $(C_2H_5)_2O$ | 0.85 | 46 | 1.09 |
| Ethane | $C_2H_6$ | 1.2 | 65 | 0.77 |
| Ethylalcohol | $C_2H_6O$ | 1.55 | 41 | 1.22 |
| Ethene | $C_2H_4$ | 1.2 | 15 | 3.33 |
| Ethylacetate | $C_4H_8O_2$ | 1.0 | 35 | 1.43 |
| Ethyl acetate | $C_5H_8O_2$ | 0.85 | 26 | 1.92 |
| n-Heptane | $C_7H_{16}$ | 0.55 | 36 | 1.39 |
| n-Hexane | $C_6H_{14}$ | 0.5 | 34 | 1.47 |
| Methane | $CH_4$ | 2.2 | 37 | 1.35 |
| Methanol | $CH_4O$ | 3,0 | 92 | 0,54 |
| n-Methoxy-2-Propanol | $C_4H_{10}O_2$ | 0.9 | 26 | 1.92 |
| Methyl-tert-butyl aether | $C_5H_{12}O$ | 0.80 | 59 | 0.85 |
| Methyl chloride | $CH_3Cl$ | 3.8 | 47 | 1.06 |
| Methylen chlorid | $CH_2Cl_2$ | 6.5 | on request | – |
| Methyl ethyl ketone | $C_4H_8O$ | 0.75 | on request | – |
| n-Nonane | $C9H_{20}$ | 0.35 | on request | – |
| n-Octane | $C8H_{18}$ | 0.40 | 20 | 2.50 |
| n-Pentane | $C5H_{12}$ | 0.55 | 36 | 1.39 |
| Propane | $C_3H_8$ | 0.85 | 50 | 1.00 |
| n-Propylalcohol | $C_3H_7OH$ | 1.05 | 40 | 1.25 |
| Propene | $C_3H_6$ | 0.90 | 31 | 1.61 |
| Propylene oxide | $C_3H_6O$ | 0.95 | 49 | 1.02 |
| Toluene | $C_6H_5CH_3$ | 0.50 | 19 | 2.63 |
| o-Xylene | $C_6H_4(CH_3)_2$ | 0.5 | 11 | 4.55 |

D-10118-2009

**DrägerSensor® Smart IR Ex**

# DrägerSensor® Smart IR $CO_2$

**Order no. 68 10 590**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 5 years | – |

## MARKET SEGMENTS

Telecommunications, shipping, sewage, gas supply companies, refineries, chemical industry, mining, landfills, biogas plants, tunneling.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.01 Vol.-% |
| **Resolution:** | 0.01 Vol.-% $CO_2$ |
| **Measurement range:** | 0 to 5 Vol.-% $CO_2$ |
| **Ambient conditions** | |
| Temperature: | (–20 to 60)°C (–4 to 140)°F |
| Humidity: | (10 to 95)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Warm-up time:** | ≤ 4 minutes |

## FOR THE MEASUREMENT RANGE 0 TO 5 VOL.-% $CO_2$

| | |
|---|---|
| **Response time** | Diffusion mode ≤ 20 seconds ($T_{50}$)<br>Diffusion mode ≤ 45 seconds ($T_{90}$)<br>Pump mode ≤ 15 seconds ($T_{50}$)<br>Pump mode ≤ 30 seconds ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.01 Vol.-% $CO_2$ |
| Sensitivity: | ≤ ± 0.06 Vol.-% $CO_2$ at 2.5 Vol.-% |
| **Linearity error, typical:** | ≤ ± 5% of measured value |
| **Long-term drift** | |
| Zero point: | ≤ ± 0.004 Vol.-% $CO_2$/month |
| Sensitivity: | ≤ ± 3% of measured value/month at 2.5 Vol.-% |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.002 Vol.-% $CO_2$/K at (–20 to 60)°C (–4 to 140)°F |
| Sensitivity: | ≤ ± 0.4% of measured value/K at 2.5 Vol.-% and (–20 to 60)°C (–4 to 140)°F |
| **Effect of humidity, at 40°C (104 °F) (0 to 95% RH, non-condensing)** | |
| Zero point: | ≤ ± 0.02 Vol.-% $CO_2$ |
| **Test gas:** | 2.5 Vol.-% $CO_2$ |

## SPECIAL CHARACTERISTICS

With its extremely low drift and low detection limit, this sensor is ideal for measuring carbon dioxide inside closed spaces, and for monitoring $CO_2$ in the workplace. As with all other IR sensors, it requires little maintenance and has a high level of long-term stability.

# DrägerSensor® Smart IR $CO_2$ HC

**Order no. 68 10 599**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 5 years | – |

## MARKET SEGMENTS

Biogas, process gas

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.4 Vol.-% |
| **Resolution:** | 0.2 Vol.-% $CO_2$ |
| **Measurement range:** | 0 to 100 Vol.-% $CO_2$ |
| **Ambient conditions** | |
| Temperature: | (–20 to 60)°C (–4 to 140)°F |
| Humidity: | (10 to 95)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Warm-up time:** | ≤ 4 minutes |

## FOR THE MEASUREMENT RANGE 0 TO 100 VOL.-% $CO_2$

| | |
|---|---|
| **Response time:** | Diffusion mode ≤ 20 seconds ($T_{50}$)<br>Diffusion mode ≤ 65 seconds ($T_{90}$)<br>Pump mode ≤ 20 seconds ($T_{50}$)<br>Pump mode ≤ 65 seconds ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.2 Vol.-% $CO_2$ |
| Sensitivity: | ≤ ± 2.0 Vol.-% $CO_2$ at 50 Vol.-% |
| **Linearity error, typical:** | ≤ ± 1 Vol.-% $CO_2$ or ≤ ± 5% of measured value (whichever is higher) |
| **Long-term drift** | |
| Zero point: | ≤ ± 0.2 Vol.-% $CO_2$/month |
| Sensitivity: | ≤ ± 3% of measured value/month at 50 Vol.-% |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.004 Vol.-% $CO_2$/K at (–20 to 60)°C (–4 to 140)°F |
| Sensitivity: | ≤ ± 0.4% of measured value/K at 50 Vol.-% and (–20 to 60)°C (–4 to 140)°F |
| **Effect of humidity, at 40°C (104 °F) (0 to 95% RH, non-condensing)** | |
| Zero point: | ≤ ± 0.5 Vol.-% $CO_2$ |
| **Test gas:** | 50 Vol.-% $CO_2$ |

## SPECIAL CHARACTERISTICS

This sensor is especially suitable if you need to measure high concentrations of $CO_2$ in process gas, for example. $CO_2$ concentrations of up to 100 Vol.-% can be detected reliably with this sensor. Other qualities that distinguish this sensor are low cross-sensitivities, long-term stability, and minimal maintenance.

# DrägerSensor® IR $CO_2$

**Order no. 68 12 190**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 5600 | – | yes | 5 years | – |

## MARKET SEGMENTS

Telecommunications, shipping, sewage, gas supply companies, refineries, chemical industry, mining, landfills, biogas plants, tunneling.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.01 Vol.-% $CO_2$ |
| **Resolution:** | 0.01 Vol.-% $CO_2$ or 50 ppm $CO_2$ (dependent on measuring range) |
| **Measurement range:** | 0 to 5 Vol.-% $CO_2$ |
| **Ambient conditions** | |
| Temperature: | (–20 to 50)°C (–4 to 120)°F |
| Humidity: | (10 to 95)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Warm-up time:** | ≤ 5 minutes |

## FOR THE MEASUREMENT RANGE 0 TO 5 VOL.-% $CO_2$

| | |
|---|---|
| **Response time:** | Diffusion mode ≤ 15 seconds ($T_{50}$)<br>Diffusion mode ≤ 20 seconds ($T_{90}$)<br>Pump mode ≤ 10 seconds ($T_{50}$)<br>Pump mode ≤ 15 seconds ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.01 Vol.-% $CO_2$ |
| Sensitivity: | ≤ ± 0.08 Vol.-% $CO_2$ at 2.5 Vol.-% |
| **Linearity error, typical:** | ≤ ± 3.5% of measured value or ≤ ± 1.5% of the highest figure in the set measuring range (whichever is higher) |
| **Long-term drift** | |
| Zero point: | ≤ ± 0.005 Vol.-% $CO_2$/month |
| Sensitivity: | ≤ ± 0.1 Vol.-% $CO_2$ /6 months |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.0002 Vol.-% $CO_2$/K at (–20 to 50)°C (–4 to 120)°F |
| Sensitivity: | ≤ ± 0.0015 Vol.-% $CO_2$/K at 2.5 Vol.-% and (–20 to 50)°C (–4 to 120)°F |
| **Effect of humidity, at 40°C (104 °F) (0 to 95% RH, non-condensing)** | |
| Zero point: | ≤ ± 0.0001 Vol.-% $CO_2$/% RH |
| **Test gas:** | 2.5 Vol.-% $CO_2$ |

## SPECIAL CHARACTERISTICS

With its extremely low drift and low detection limit, this sensor is ideal for measuring carbon dioxide inside closed spaces, and for monitoring $CO_2$ in the workplace. As with all other IR sensors, it requires little maintenance and has a high level of long-term stability.

# DrägerSensor® DUAL IR Ex/$CO_2$

**Order no. 68 11 960**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 5600 | – | yes | 5 years | – |

## MARKET SEGMENTS

Telecommunications, shipping, sewage, gas supply companies, refineries, chemical industry, mining, landfills, biogas plants, tunneling.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 1% LEL/0.2 Vol.-% for IR Ex<br>0.01 Vol.-% $CO_2$ for IR $CO_2$ |
| **Resolution:** | 1% LEL/0.1 Vol.-% for IR Ex (dependent on measuring range)<br>0.01 Vol.-% $CO_2$ or 50 ppm $CO_2$ for IR $CO_2$<br>(dependent on measuring range) |
| **Measurement range:** | 0 to 100% LEL/0–100 Vol.-% $CH_4$<br>0 to 5 Vol.-% $CO_2$ |
| **Ambient conditions** | |
| Temperature: | (–20 to 50)°C (–4 to 120)°F |
| Humidity: | (10 to 95)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Warm-up time:** | ≤ 5 minutes |

## FOR THE MEASUREMENT RANGE 0 TO 100% LEL OR 0 TO 4.4 VOL.-% $CH_4$ WHEN CALIBRATED WITH METHANE IN AIR:

| | |
|---|---|
| **Response time:** | Diffusion mode ≤ 10 seconds ($T_{50}$)<br>Diffusion mode ≤ 20 seconds ($T_{90}$)<br>Pump mode ≤ 10 seconds ($T_{50}$)<br>Pump mode ≤ 15 seconds ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 1.0% LEL methane |
| Sensitivity: | ≤ ± 1.5% LEL methane at 50% LEL |
| **Linearity error, typical:** | ≤ ± 3.5% of measured value or ≤ ± 1.5% of the highest figure in the set measuring range (whichever is higher) |
| **Long-term drift** | |
| Zero point: | ≤ ± 0.2% LEL methane/month |
| Sensitivity: | ≤ ± 4.5% LEL methane/6 months at 50% LEL |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.015% LEL methane/K at (–20 to 50)°C (–4 to 120)°F |
| Sensitivity: | ≤ ± 0.03% LEL methane/K at 50% LEL and (–20 to 50)°C (–4 to 120)°F |
| **Effect of humidity, at 40°C (104 °F) (0 to 95% RH, non-condensing)** | |
| Zero point: | ≤ ± 0.005% LEL methane/% RH |

## FOR THE MEASUREMENT RANGE 0 TO 100% LEL OR 0 TO 1.7 VOL.-% $C_3H_8$ WHEN CALIBRATED WITH PROPANE IN AIR

| | |
|---|---|
| **Response time:** | Diffusion mode ≤ 15 seconds ($T_{50}$)<br>Diffusion mode ≤ 25 seconds ($T_{90}$)<br>Pump mode ≤ 15 seconds ($T_{50}$)<br>Pump mode ≤ 20 seconds ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 1.0% LEL propane |
| Sensitivity: | ≤ ± 1.25% LEL propane |
| **Linearity error, typical:** | ≤ ± 3.0% of measured value or ≤ ± 1.0% of highest measuring range figure (whichever is higher) |
| **Long-term drift** | |
| Zero point: | ≤ ± 0.3% LEL propane/month |
| Sensitivity: | ≤ ± 3.0% LEL propane/6 months |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.02% LEL propane/K |
| Sensitivity: | ≤ ± 0.025% LEL propane/K |
| **Effect of humidity, at 40°C (104 °F) (0 to 95% RH, non-condensing)** | |
| Zero point: | ≤ ± 0.008% LEL propane/% RH |

## FOR THE MEASUREMENT RANGE 0 TO 5 VOL.-% $CO_2$

| | |
|---|---|
| **Response time:** | Diffusion mode ≤ 15 seconds ($T_{50}$)<br>Diffusion mode ≤ 20 seconds ($T_{90}$)<br>Pump mode ≤ 10 seconds ($T_{50}$)<br>Pump mode ≤ 15 seconds ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.01 Vol.-% $CO_2$ |
| Sensitivity: | ≤ ± 0.08 Vol.-% $CO_2$ at 2.5 Vol.-% |
| **Linearity error, typical:** | ≤ ± 3.5% of measured value or ≤ ± 1.5% of highest measuring range figure (whichever is higher) |
| **Long-term drift** | |
| Zero point: | ≤ ± 0.005 Vol.-% $CO_2$/month |
| Sensitivity: | ≤ ± 0.1 Vol.-% $CO_2$/6 months |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.0002 Vol.-% $CO_2$/K at (–20 to 50)°C (–4 to 120)°F |
| Sensitivity: | ≤ ± 0.0015% Vol.-% $CO_2$/K at 2.5 Vol.-% and (–20 to 50)°C (–4 to 120)°F |
| **Effect of humidity, at 40°C (104 °F) (0 to 95% RH, non-condensing)** | |
| Zero point: | ≤ ± 0.0001 Vol.-% $CO_2$/% RH |
| **Test gas:** | 2 Vol.-% $CH_4$ or 50 Vol.-% $CH_4$<br>2.5 Vol.-% $CO_2$ |

## SPECIAL CHARACTERISTICS

This sensor enables flammable gases and carbon dioxide to be measured simultaneously with just one sensor. As with all other IR sensors, it requires little maintenance, has a high level of long-term stability, and is highly resistant to poisoning.

## COMPATIBLE GASES AND MEASURING RANGES:

| Gas | Data set name | Measurement range |
|---|---|---|
| Ethene | $c_2h_4$ | 0 to 100% LEL [2)] |
| Ethene | $C_2H_4$ | 0 to 100 Vol.-% |
| Ethanol | EtOH | 0 to 100% LEL [2)] |
| Ex | Ex | 0 to 100% LEL |
| JetFuel | JetF | 0 to 100% LEL [2)] |
| Methane | $ch_4$ | 0 to 100% LEL [2)] |
| Methane | $CH_4$ | 0 to 100 Vol.-% |
| n-butane | buta | 0 to 100% LEL [2)] |
| n-butane | BUTA | 0 to 100 Vol.-% |
| n-nonane | Nona | 0 to 100% LEL [2)] |
| n-pentane | Pent | 0 to 100% LEL [2)] |
| Propane | $c_3h_4$ | 0 to 100% LEL [2)] |
| Propane | $C_3H_8$ | 0 to 100 Vol.-% |
| Toluene | Tolu | 0 to 100% LEL [2)] |

## DETECTION OF OTHER GASES AND VAPORS FOR THE MEASURING RANGE 0 TO 100% LEL

| Gas/vapor gas | Chemical symbol | Test gas concentration in Vol.-% | Reading displayed in % LEL (if calibrated to 0.85 Vol.-% propane) | Cross-sensitivity factor |
|---|---|---|---|---|
| Acetone | $C_3H_6O$ | 1.25 | 18 | 2.78 |
| Acetylene | $C_2H_2$ | – | out of range | – |
| Benzene | $C_6H_6$ | 0.6 | 20 | 2.50 |
| Butadiene -1,3 | $C_4H_6$ | 0.7 | 20 | 2.50 |
| i-Butane | $(CH_3)_3CH$ | 0.75 | 41 | 1.22 |
| n-Butane | $C_4H_{10}$ | 0.7 | 42 | 1.19 |
| i-Butene | $(CH_3)_2C=CH_2$ | 0.8 | 31 | 1.61 |
| n-Butanol | $C_4H_{10}O$ | 0.85 | 25 | 2.0 |
| 2-Butanone (MEK) | $C_4H_8O$ | 0.75 | 22 | 2.27 |
| Butyl Acetate | $C_6H_{12}O_2$ | 0.60 | 20 | 2.5 |
| Cyclohexane | $C_6H_{12}$ | 0.50 | 15 | 3.33 |
| Cyclopentane | $C5H_{10}$ | 0.7 | 47 | 1.06 |
| Dimethyl Aether | $C_2H_6O$ | 1.35 | 51 | 0.98 |
| Diethylamine | $C_4H_{11}N$ | 0.85 | 44 | 1.14 |
| Diethyl Aether | $(C_2H_5)_2O$ | 0.85 | 46 | 1.09 |

[2)] LEL figures depend on country-specific standards.

## DETECTION OF OTHER GASES AND VAPORS FOR THE MEASURING RANGE 0 TO 100% LEL

| Gas/vapor gas | Chemical symbol | Test gas concentration in Vol.-% | Reading displayed in % LEL (if calibrated to 0.85 Vol.-% propane) | Cross-sensitivity factor |
|---|---|---|---|---|
| Ethane | $C_2H_6$ | 1.2 | 65 | 0.77 |
| Ethylalcohol | $C_2H_6O$ | 1.55 | 41 | 1.22 |
| Ethene | $C_2H_4$ | 1.2 | 15 | 3.33 |
| Ethylacetate | $C_4H_8O_2$ | 1.0 | 35 | 1.43 |
| Ethyl acetate | $C_5H_8O_2$ | 0.85 | 26 | 1.92 |
| n-Heptane | $C_7H_{16}$ | 0.55 | 36 | 1.39 |
| n-Hexane | $C_6H_{14}$ | 0.5 | 34 | 1.47 |
| Methane | $CH_4$ | 2.2 | 37 | 1.35 |
| Methanol | $CH_4O$ | 3,0 | 92 | 0,54 |
| n-Methoxy-2-Propanol | $C_4H_{10}O_2$ | 0.9 | 26 | 1.92 |
| Methyl-tert-butyl aether | $C_5H_{12}O$ | 0.80 | 59 | 0.85 |
| Methyl chloride | $CH_3Cl$ | 3.8 | 47 | 1.06 |
| Methylen chlorid | $CH_2Cl_2$ | 6.5 | on request | – |
| Methyl ethyl ketone | $C_4H_8O$ | 0.75 | on request | – |
| n-Nonane | $C9H_{20}$ | 0.35 | on request | – |
| n-Octane | $C8H_{18}$ | 0.40 | 20 | 2.50 |
| n-Pentane | $C5H_{12}$ | 0.55 | 36 | 1.39 |
| Propane | $C_3H_8$ | 0.85 | 50 | 1.00 |
| n-Propylalcohol | $C_3H_7OH$ | 1.05 | 40 | 1.25 |
| Propene | $C_3H_6$ | 0.90 | 31 | 1.61 |
| Propylene oxide | $C_3H_6O$ | 0.95 | 49 | 1.02 |
| Toluene | $C_6H_5CH_3$ | 0.50 | 19 | 2.63 |
| o-Xylene | $C_6H_4(CH_3)_2$ | 0.5 | 11 | 4.55 |


D-10120-2009

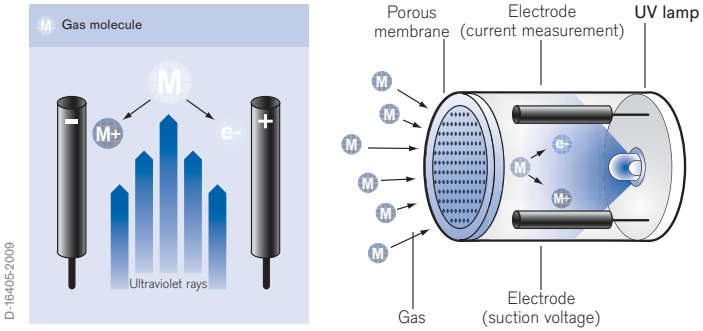
**DrägerSensor® Smart IR $CO_2$**

## 4.5 Dräger PID sensors


Many flammable gases and vapors are toxic to humans long before they reach the lower explosion limit (LEL). For this reason, personal protection in the workplace ideally includes the additional measurement of ppm levels of volatile organic substances using a PID sensor.

The air is drawn into the measuring chamber through the gas inlet. In the chamber, a UV lamp produces photons, which ionize certain molecules within the flow of gas. A relatively high amount of energy is required to ionize the air's permanent gases such as noble gases, nitrogen, oxygen, carbon dioxide, and water vapor. For this reason, these gases do not interfere with the measurement of the harmful substances. Most of the organic substances recognized as dangerous (such as hydrocarbons) are ionized and subjected to the electrical field between the electrodes in the measuring chamber. The strength of the resulting current is directly proportional to the concentration of ionized molecules inside the chamber. This makes it possible to determine the concentration of harmful substance in the air.

PID sensor




## Ionization energy and UV lamps

Ionization energy is measured in electron volts (eV) and defines the amount of energy required to bring a molecule into the ionized (charged) state. Ionization energy is something specific to each material, like the boiling point and vapor pressure. For a substance to be ionized, its ionization energy must be lower than the photon energy from the lamp used in the PID. Two types of lamps are commonly used – the 10.6-eV lamp and the 11.7-eV lamp. This enables a PID to detect whole groups of harmful substances, while it can also be used to measure single substances if calibrated accordingly.

## Calibration and response factors

Isobutylene is used to calibrate a PID, unless the actual substance being measured can be used. The relative sensitivity to other substances is then expressed in terms of response factors. If a substance is detected with greater sensitivity than isobutylene, then its response factor is less than one. Substances that are detected with less sensitivity than isobutylene have a response factor greater than one.

**FOR EXAMPLE:**

| Substance | Ionization energy | Response factor |
|---|---|---|
| Benzene | 9.25 eV | 0.5 |
| Cyclohexane | 9.98 eV | 1.3 |

# DrägerSensor® Smart PID

**Order no. 83 19 100**

| Used in | Plug & Play | Replaceable | Guaranty | UV lamp |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 1 year | 10.6 eV |

## MARKET SEGMENTS

Chemical industry, painters, storage and use of fuels (e.g. gas stations)

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 2 ppm isobutylene |
| **Resolution:** | 1 ppm up to 100 ppm<br>2 ppm from 100 to 250 ppm<br>5 ppm from 250 ppm upwards |
| **Measurement range:** | 0 to 2,000 ppm isobutylene |
| **General technical specifications** | |
| **Ambient conditions** | |
| Temperature: | (–20 to 60)°C (–4 to 140)°F |
| Humidity: | (10 to 95)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Warm-up time:** | 4 minutes |

## FOR THE MEASUREMENT RANGE 1 TO 2,000 PPM WHEN CALIBRATED WITH ISOBUTYLENE IN AIR:

| | |
|---|---|
| **Response time:** | Diffusion mode ≤ 15 seconds ($T_{20}$)<br>Diffusion mode ≤ 50 seconds ($T_{90}$)<br>Pump mode ≤ 10 seconds ($T_{20}$)<br>Pump mode ≤ 25 seconds ($T_{90}$) |
| **Repeatability** | |
| Zero point: | ≤ ± 1 ppm isobutylene |
| at 100 ppm isobutylene: | ≤ ± 2 ppm isobutylene |
| **Linearity error, typical:** | ≤ ± 5% of measured value |
| **Pressure effect** | ≤ ± 0.1% of measured value/hPa |
| **Effect of humidity, at 40°C (104 °F) (0 to 90% RH, non-condensing)** | |
| Zero point: | ≤ ± 0.06 ppm isobutylene/% RH |
| at 100 ppm isobutylene: | ≤ ± 0.15 ppm isobutylene/% RH |
| **Test gas:** | approx. 100 ppm i-$C_4H_8$ (isobutylene) |

## SPECIAL CHARACTERISTICS

The PID can be used to detect numerous volatile organic compounds (VOCs). More than 20 of the VOCs most commonly used in industry are stored in its data memory. Other gases can be added to the memory on the customer's request.

## GASES STORED IN THE MEMORY

| Gas/vapor | CAS no. | Data set name | Measurement range |
|---|---|---|---|
| Acetone | 67-64-1 | ACTO | 0–2,000 ppm |
| (-)-alpha-pinene | 7785-26-4 | aPIN | 0–1,000 ppm |
| Benzene | 71-43-2 | BENZ | 0–1,000 ppm |
| Chlorobenzene | 108-90-7 | CLBZ | 0–3,000 ppm |
| Cyclohexane | 110-82-7 | CYHE | 0–3,000 ppm |
| Diesel | | DESL | 0–2,000 ppm |
| Ethyl acetate | 141-78-6 | ETAC | 0–5,000 ppm |
| Ethylbenzene | 100-41-4 | ETBZ | 0–1,500 ppm |
| Gasoline | | GASO | 0–2,000 ppm |
| Isobutylene | 115-11-7 | IBUT | 0–2,000 ppm |
| Jet fuel | | JP8 | 0–1,000 ppm |
| Methyl bromide | 74-83-9 | MEBR | 0–4,000 ppm |
| Methyl ethyl ketone | 78-93-3 | MEK | 0–1,000 ppm |
| Methyl tert-butyl ether (MTBE) | 1634-04-4 | MTBE | 0–2,000 ppm |
| n-nonane | 111-84-2 | NONA | 0–3,000 ppm |
| n-octane | 111-65-9 | OCTA | 0–5,000 ppm |
| Styrene | 100-42-5 | STYR | 0–1,500 ppm |
| Toluene | 108-88-3 | TOLU | 0–1,500 ppm |
| Trichloroethylene | 79-01-6 | TCE | 0–1,500 ppm |
| Vinyl chloride | 75-01-4 | VC | 0–3,000 ppm |
| Xylene | 1330-20-7 | XYLE | 0–1,500 ppm |

The standard gas is: Isobutylene – 0 to 2,000 ppm.

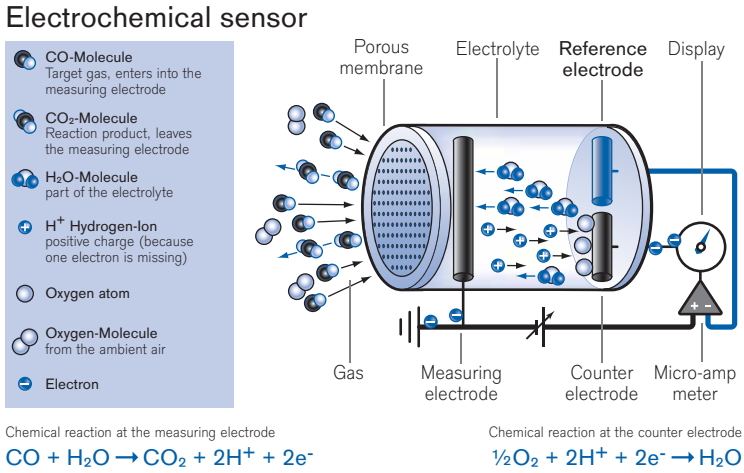
Other gases can be added to the memory on the customer's request.

# 4.6 Electrochemical sensors


Many toxic gases are highly reactive and can change their chemical composition under certain conditions. An electrochemical sensor is a micro-reactor, which produces a very small but measurable current when reactive gases are present. As in a normal household battery, this involves an electrochemical process, since the chemical transformation produces electrons.

The basic principle behind an electrochemical sensor involves at least two electrodes (a measuring electrode and a counter-electrode), which have contact with each other in two ways: first, through an electrically conductive medium (electrolyte, meaning a fluid that conducts ions) and, second, through an external electrical circuit (electron conductor). The electrodes are made of a special material that also has catalytic characteristics so that certain chemical reactions take place at what is known as the three-phase zone where gas, solid catalyzer, and liquid electrolyte meet. A dual-electrode sensor (measuring and counter-electrode) does, however, have many drawbacks. For instance, if high concentrations of gas occur, this leads to higher currents in the sensor and, therefore, to a drop in voltage. The drop in voltage, in turn, changes the preset sensor voltage. This can lead to unusable readings or, in the worst case, it can cause the chemical reaction inside the sensor to come to a halt during the measurement process.

For this reason, the Dräger XS and XXS sensors contain a third electrode known as the reference electrode, which does not have a current passing through it, and whose potential therefore remains constant. It continuously measures the sensor voltage at the measuring electrode, which can be corrected using the sensor's control enhancement. This produces a considerably improved measuring quality (e.g. in terms of linearity and selectivity) and a longer life time.




The Dräger XS sensors are known as "smart" sensors and contain their own EEPROM. This memory module contains all of the sensor's relevant data, which, when plugged into Dräger X-am 7000 is retrieved. The device then automatically adjusts itself to these figures (e.g. calibration figures, alarm level). This "plug & play" function enables sensors to be swapped between devices without performing operations such as a re-calibration. XXS sensors are used in the following devices: Dräger Pac 3500 to 7000 and Dräger X-am 1700/2000/5000 and to 5600. In this case, the sensor-relevant data is stored in the device. When a sensor is changed, this information is transferred using a software application.

## CONTENTS XS SENSORS

## CONTENTS XS SENSORS

# DrägerSensor® XS EC Amine

**Order no. 68 09 545**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 1 year | – |

## MARKET SEGMENTS

Foundries, refineries, power plants

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 2 ppm |
| **Resolution:** | 1 ppm |
| **Measurement range:** | 0 to 100 ppm $CH_3NH_2$ (methylamine) |
| | 0 to 100 ppm $(CH_3)_2NH$ (dimethylamine) |
| | 0 to 100 ppm $(CH_3)_3N$ (trimethylamine) |
| | 0 to 100 ppm $C_2H_5NH_2$ (ethylamine) |
| | 0 to 100 ppm $(C_2H_5)_2NH$ (diethylamine) |
| | 0 to 100 ppm $(C_2H_5)_3N$ (triethylamine) |
| **Response time:** | ≤ 30 seconds at 20 °C or 68 °F ($T_{50}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 2 ppm |
| Sensitivity: | ≤ ± 3% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 2 ppm/month |
| Sensitivity: | ≤ ± 3% of measured value/month |
| **Warm-up time:** | ≤ 12 hours |
| **Ambient conditions** | |
| Temperature: | (–40 to 50)°C (–40 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 5 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.1 ppm/% RH |
| Sensitivity: | ≤ ± 0.2% of measured value/% RH |
| **Test gas:** | approx. 50 to 100 ppm $NH_3$ or one of the other target gases (MA, DMA, TMA, EA, DEA, TEA) |

## SPECIAL CHARACTERISTICS

Six different amines can be detected using this sensor. It is sufficient to calibrate it using an ammonia test gas. By doing so, all of the other amines are then automatically calibrated.

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of amine. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $NH_3$ |
|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1,000 ppm | No effect |
| Carbon dioxide | $CO_2$ | 1.5 Vol. % | ≤ 5(–) |
| Carbon monoxide | CO | 200 ppm | No effect |
| Chlorine | $Cl_2$ | 10 ppm | ≤ 20(–) |
| Ethene | $C_2H_4$ | 1,000 ppm | ≤ 3 |
| Ethine | $C_2H_2$ | 200 ppm | No effect |
| Hydrogen | $H_2$ | 1,000 ppm | ≤ 3 |
| Hydrogen cyanide | HCN | 25 ppm | ≤ 3 |
| Hydrogen sulfide | $H_2S$ | 20 ppm | ≤ 50 |
| Methane | $CH_4$ | 10 Vol. % | No effect |
| Methanol | $CH_3OH$ | 200 ppm | ≤ 3 |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 10(–) |
| Nitrogen monoxide | NO | 20 ppm | ≤ 10 |
| Phosphine | $PH_3$ | 5 ppm | ≤ 8 |
| Sulfur dioxide | $SO_2$ | 20 ppm | No effect |
| Tetrahydrothiophene | $C_4H_8S$ | 10 ppm | ≤ 10 |

(–) Indicates negative deviation

# DrägerSensor® XS EC $Cl_2$

**Order no. 68 09 165**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 1 year | – |

## MARKET SEGMENTS

Food and beverage, inorganic chemicals, manufacture of plastics, measuring hazardous material, pulp and paper, power generation, sewage plants water treatment.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.1 ppm |
| **Resolution:** | 0.05 ppm |
| **Measurement range:** | 0 to 20 ppm $Cl_2$ (chlorine) |
| | 0 to 20 ppm $F_2$ (fluorine) |
| | 0 to 20 ppm $Br_2$ (bromine) |
| | 0 to 20 ppm $ClO_2$ (chlorine dioxide) |
| **Response time:** | ≤ 30 seconds at 20 °C or 68 °F ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.05 ppm |
| Sensitivity: | ≤ ± 2% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 0.2 ppm/year |
| Sensitivity: | ≤ ± 2% of measured value/month |
| **Warm-up time:** | ≤ 1 hour |
| **Ambient conditions** | |
| Temperature: | (–40 to 50)°C (–40 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.1 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.4% of measured value/% RH |
| **Test gas:** | approx. 5 to 10 ppm $Cl_2$ or one of the other target gases: $F_2$, $Br_2$, $ClO_2$ |

## SPECIAL CHARACTERISTICS

This sensor is suitable for monitoring concentrations of chlorine, bromine, fluorine, and chlorine dioxide in the ambient air. It is sufficient to calibrate the sensor using a chlorine test gas; by doing so, all of the other target gases are then automatically calibrated.

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of chlorine. To be sure, please check if gas mixtures are present. .

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $Cl_2$ |
|---|---|---|---|
| Ammonia | $NH_3$ | 50 ppm | ≤ 0.5(–) |
| Carbon dioxide | $CO_2$ | 1.5 Vol. % | No effect |
| Carbon monoxide | CO | 100 ppm | No effect |
| Ethene | $C_2H_4$ | 1,000 ppm | No effect |
| Ethine | $C_2H_2$ | 200 ppm | No effect |
| Hydrogen | $H_2$ | 1,000 ppm | No effect |
| Hydrogen cyanide | HCN | 20 ppm | ≤ 0.1 |
| Hydrogen sulfide | $H_2S$ | 20 ppm | ≤ 0.1(–) |
| i-propanol | $(CH_3)_2CHOH$ | 1 Vol. % | No effect |
| Methane | $CH_4$ | 4 Vol. % | No effect |
| Methanol | $CH_3OH$ | 500 ppm | ≤ 0.3(–) |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 0.2 |
| Nitrogen monoxide | NO | 25 ppm | No effect |
| Phosphine | $PH_3$ | 10 ppm | No effect |
| Sulfur dioxide | $SO_2$ | 10 ppm | ≤ 0.2 |
| Tetrahydrothiophene | $C_4H_8S$ | 1,000 ppm | No effect |

(–) Indicates negative deviation

# DrägerSensor® XS EC $ClO_2$

**Order no. 68 11 360**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 1 year | – |

## MARKET SEGMENTS

Food and beverage, breweries, waste water treatment, swimming pools, industrial gases, pulp and paper.

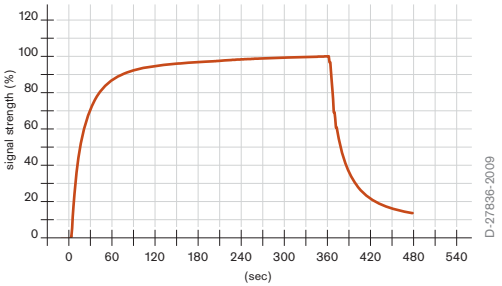
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.02 ppm |
| **Resolution:** | 0.01 ppm |
| **Measurement range:** | 0 to 20 ppm $ClO_2$ (chlorine dioxide) |
| **Response time:** | ≤ 20 seconds at 20 °C or 68 °F ($T_{50}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.02 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 0.03 ppm/year |
| Sensitivity: | ≤ ± 2% of measured value/month |
| **Warm-up time:** | ≤ 12 hours |
| **Ambient conditions** | |
| Temperature: | (–20 to 50)°C (–4 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.02 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.1% of measured value/% RH |
| **Test gas:** | $ClO_2$ test gas between 40% and 100% of highest figure in the set measuring range. Every time this sensor is used, a function test should be done beforehand, for which the $ClO_2$ generator (68 11 497) can be used. |

## SPECIAL CHARACTERISTICS

The chlorine dioxide sensor is especially selective (see cross sensitivity table) and has a particularly low cross sensitivity to chlorine.

Sensor reaction to $ClO_2$ at 20 °C / 68 °F
Flow = 0.5 l/min, with 0.1 ppm $ClO_2$




The values given in the table are standard an apply to new sensors, The values maybe fluctuate be ± 30%. The sensor may also be sensitive to other gases (for information contact Dräger).
Gas mixtures can be displayed as the sum of all components. Gases with negative sensitivity may displace a positive display of chlorine dioxide. A check should be carried out to see if mixtures of gases are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $ClO_2$ |
|---|---|---|---|
| Ammonia | $NH_3$ | 50 ppm | No effect |
| Carbon dioxide | $CO_2$ | 10 Vol. % | No effect |
| Carbon monoxide | CO | 200 ppm | No effect |
| Chlorine | $Cl_2$ | 1 ppm | ≤ 0.1 |
| Hydrogen | $H_2$ | 1,000 ppm | ≤ 0.02 |
| Hydrogen cyanide | HCN | 10 ppm | No effect |
| Hydrogen sulfide | $H_2S$ | 20 ppm | ≤ 0.5(–) |
| Methane | $CH_4$ | 1 Vol. % | No effect |
| Methanol | $CH_3OH$ | 500 ppm | No effect |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 1 |
| Nitrogen monoxide | NO | 20 ppm | ≤ 0.05 |
| Ozone | $O_3$ | 0.5 ppm | ≤ 0.05 |
| Sulfur dioxide | $SO_2$ | 20 ppm | No effect |

(–) Indicates negative deviation

# DrägerSensor® XS EC CO — Order no. 68 09 105
# DrägerSensor® XS 2 CO — 68 10 365
# DrägerSensor® XS R CO — 68 10 258
# DrägerSensor® XS CO microPac (Dräger X-am 3000 only) — 68 10 030

| Used in | Plug & Play | Replaceable | Guaranty* | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 3/2/5 years | D3T, 68 09 022 – replaceable for XS EC + XS R |
| | | | | A2T, 68 10 378 – replaceable for XS-2 |
| | | | | Cross sensitivity of alcohols and acid gases ($H_2S$, $SO_2$) are eleminated |

## MARKET SEGMENTS

Waste disposal, metal processing, petrochemicals, fertilizer production, mining and tunneling, shipping, inorganic chemicals, steel, organic chemicals, oil and gas, hazmat, biogas.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 2 ppm for XS EC / XS 2 / XS R, 6 ppm for XS microPac |
| **Resolution:** | 1 ppm |
| **Measurement range:** | 0 to 2,000 ppm CO (carbon monoxide) |
| | 0 to 1,000 ppm CO (carbon monoxide) for XS microPac |
| **Response time:** | ≤ 35 seconds at 20 °C or 68 °F ($T_{90}$) – XS EC |
| | ≤ 20 seconds at 20 °C or 68 °F ($T_{90}$) – XS 2 |
| | ≤ 30 seconds at 20 °C or 68 °F ($T_{90}$) – XS R |
| | ≤ 28 seconds at 20 °C or 68 °F ($T_{90}$) – XS microPac |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 2 ppm – XS EC / XS 2 / XS R, ≤ ± 4 ppm – XS microPac |
| Sensitivity: | ≤ ± 1% of measured value – XS EC / XS 2 / XS R |
| | ≤ 2% of measured value – XS microPac |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 1 ppm/month – XS EC / XS 2 |
| | ≤ ± 6 ppm/year – XS R / XS microPac |
| Sensitivity: | ≤ ± 1% of measured value/month |
| **Warm-up time:** | ≤ 12 hours – XS EC / XS 2 / XS R, ≤ 10 minutes – XS microPac |
| **Ambient conditions** | |
| Temperature: | (–20 to 50) °C (–4 to 122) °F – XS EC |
| | (–40 to 50) °C (–40 to 122) °F – XS 2 / XS R / XS microPac |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 5 ppm |
| Sensitivity: | ≤ ± 0.4% of measured value/K |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.02 ppm/% RH – XS EC / XS microPac |
| | No effect – XS 2 / XS R |
| Sensitivity: | ≤ ± 0.1% of measured value/% RH – XS EC / XS 2 / XS microPac |
| | ≤ ± 0.05% of measured value/% RH – XS R |
| **Test gas:** | approx. 50–300 ppm CO test gas |

## SPECIAL CHARACTERISTICS

In addition to an outstanding linearity and a quick response time, these CO sensors are highly selective. Internal selective filters, some of which are replaceable, filter out the majority of accompanying gases such as alcohol and acidic gases like $H_2S$, $SO_2$.

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of carbon monoxide. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES DrägerSensor® XS EC CO – 68 09 105

| Gas/vapor | Chem. symbol | Concentration | Display in ppm CO without selective filter | Display in ppm CO with selective filter |
|---|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1,000 ppm | ≤ 20 | ≤ 1 |
| Ammonia | $NH_3$ | 200 ppm | ≤ 1 | ≤ 1 |
| Carbon dioxide | $CO_2$ | 30 Vol. % | ≤ 35 | ≤ 35 |
| Chlorine | Cl2 | 20 ppm | ≤ 1(–) | ≤ 1 |
| Dichloromethane | $CH_2CL_2$ | 1,000 ppm | ≤ 1 | ≤ 1 |
| Ethane | $C_2H_6$ | 0.2 Vol. % | ≤ 1 | ≤ 1 |
| Ethanol | $C_2H_5OH$ | 200 ppm | ≤ 400 | ≤ 1 |
| Ethene | $C_2H_4$ | 10 ppm | ≤ 25 | ≤ 25 |
| Ethyl acetate | $CH_2COOC_2H_4$ | 1,000 ppm | ≤ 150 | ≤ 1 |
| Ethine | $C_2H2$ | 200 ppm | ≤ 500 | ≤ 300 |
| Formaldehyde | HCHO | 20 ppm | ≤ 30 | ≤ 1 |
| Hydrogen | $H_2$ | 0.1 Vol. % | ≤ 90 | ≤ 90 |
| Hydrogen chloride | HCl | 40 ppm | ≤ 6 | ≤ 1 |
| Hydrogen cyanide | HCN | 50 ppm | ≤ 10 | ≤ 1(–) |
| Hydrogen sulfide | $H_2S$ | 30 ppm | ≤ 120 | ≤ 1 |
| Methane | $CH_4$ | 5 Vol. % | ≤ 1 | ≤ 1 |
| Methanol | $CH_3OH$ | 175 ppm | ≤ 150 | ≤ 2 |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 1 | ≤ 1 |
| Nitrogen monoxide | NO | 25 ppm | ≤ 50 | ≤ 6 |
| Phosgene | $COCL_2$ | 50 ppm | ≤ 1 | ≤ 1 |
| Phosphine | $PH_3$ | 5 ppm | ≤ 20 | ≤ 3 |
| Propane | $C_3H_8$ | 1 Vol. % | ≤ 1 | ≤ 1 |
| Sulfur dioxide | $SO_2$ | 25 ppm | ≤ 25 | ≤ 1 |
| Tetrachloroethylene | $CCl_2$ $CCl_2$ | 1,000 ppm | ≤ 1 | ≤ 1 |
| Toluene | $C_6H_5CH_3$ | 1,000 ppm | ≤ 1 | ≤ 1 |
| Trichloroethylene | $CHClCCl_2$ | 1,000 ppm | ≤ 1 | ≤ 1 |

* DrägerSensor XS EC CO = three-year guaranty
DrägerSensor XS 2 CO = two-year guaranty
DrägerSensor XS R CO = five-year guaranty
DrägerSensor XS microPac CO = two-year guaranty
(–) Indicates negative deviation

## RELEVANT CROSS-SENSITIVITIES DrägerSensor® XS R CO – 68 10 258

| Gas/vapor | Chem. symbol | Concentration | Display in ppm CO without selective filter | Display in ppm CO with selective filter |
|---|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1,000 ppm | ≤ 20 | No effect |
| Ammonia | $NH_3$ | 200 ppm | No effect | No effect |
| Carbon dioxide | $CO_2$ | 30 Vol. % | No effect | No effect |
| Chlorine | $Cl_2$ | 20 ppm | No effect | No effect |
| Dichloromethane | $CH_2CL_2$ | 1,000 ppm | No effect | No effect |
| Ethane | $C_2H_6$ | 0.2 Vol. % | No effect | No effect |
| Ethanol | $C_2H_6OH$ | 200 ppm | ≤ 400 | No effect |
| Ethene | $C_2H_4$ | 10 ppm | ≤ 25 | ≤ 25 |
| Ethyl acetate | $CH_2COOC_2H_4$ | 1,000 ppm | ≤ 150 | No effect |
| Ethyne | $C_2H_2$ | 200 ppm | ≤ 500 | ≤ 300 |
| Formaldehyde | HCHO | 20 ppm | ≤ 30 | No effect |
| Hydrogen | $H_2$ | 0.1 Vol. % | ≤ 90 | ≤ 90 |
| Hydrogen chloride | HCl | 40 ppm | ≤ 6 | No effect |
| Hydrogen cyanide | HCN | 50 ppm | ≤ 10 | No effect |
| Hydrogen sulfide | $H_2S$ | 30 ppm | ≤ 120 | No effect |
| Methane | $CH_4$ | 5 Vol. % | No effect | No effect |
| Methanol | $CH_3OH$ | 175 ppm | ≤ 150 | ≤ 2 |
| Nitrogen dioxide | $NO_2$ | 20 ppm | No effect | No effect |
| Nitrogen monoxide | NO | 25 ppm | ≤ 50 | ≤ 6 |
| Phosgene | $COCL_2$ | 50 ppm | No effect | No effect |
| Phosphine | $PH_3$ | 5 ppm | ≤ 20 | ≤ 3 |
| Propane | $C_3H_8$ | 1 Vol. % | No effect | No effect |
| Sulfur dioxide | $SO_2$ | 25 ppm | ≤ 25 | No effect |
| Tetrachloroethylene | $CCl_2$ $CCl_2$ | 1,000 ppm | No effect | No effect |
| Toluene | $C_2H_5CH_3$ | 1,000 ppm | No effect | No effect |
| Trichloroethylene | $CHClCCl_2$ | 1,000 ppm | No effect | No effect |

## RELEVANT CROSS-SENSITIVITIES DrägerSensor® XS 2 CO – 68 10 365

| Gas/vapor | Chem. symbol | Concentration | Display in ppm CO without selective filter | Display in ppm CO with selective filter |
|---|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1,000 ppm | ≤ 20 | No effect |
| Ammonia | $NH_3$ | 200 ppm | No effect | No effect |
| Carbon dioxide | $CO_2$ | 30 Vol. % | No effect | No effect |
| Chlorine | $Cl_2$ | 20 ppm | No effect | No effect |
| Dichloromethane | $CH_2CL_2$ | 1,000 ppm | No effect | No effect |
| Ethane | $C_2H6$ | 0.2 Vol. % | No effect | No effect |
| Ethanol | $C_2H_5OH$ | 200 ppm | ≤ 400 | No effect |
| Ethene | $C_2H_4$ | 50 ppm | ≤ 25 | ≤ 10 |
| Ethyl acetate | $CH_2COOC_2H_4$ | 1,000 ppm | ≤ 150 | No effect |
| Ethine | $C_2H_2$ | 200 ppm | ≤ 500 | ≤ 50 |
| Formaldehyde | HCHO | 20 ppm | ≤ 30 | No effect |
| Hydrogen | $H_2$ | 0.1 Vol. % | ≤ 20 | ≤ 20 |
| Hydrogen chloride | HCl | 40 ppm | ≤ 6 | No effect |
| Hydrogen cyanide | HCN | 50 ppm | ≤10 | No effect |
| Hydrogen sulfide | $H_2S$ | 30 ppm | ≤ 120 | No effect |
| Methane | $CH_4$ | 5 Vol. % | No effect | No effect |
| Methanol | $CH_3OH$ | 175 ppm | ≤ 150 | ≤ 2 |
| Nitrogen dioxide | $NO_2$ | 20 ppm | No effect | No effect |
| Nitrogen monoxide | NO | 25 ppm | ≤ 50 | No effect |
| Phosgene | $COCL_2$ | 50 ppm | No effect | No effect |
| Phosphine | $PH_3$ | 5 ppm | ≤ 20 | No effect |
| Propane | $C_3H_8$ | 1 Vol. % | No effect | No effect |
| Sulfur dioxide | $SO_2$ | 25 ppm | ≤ 25 | No effect |
| Tetrachloroethylene | $CCl_2$ $CCl_2$ | 1,000 ppm | No effect | No effect |
| Tetrahydrothiophene | $C_4H_8S$ | 5 ppm | No effect | No effect |
| Toluene | $C_2H_5CH_3$ | 1,000 ppm | No effect | No effect |
| Trichloroethylene | $CHClCCl_2$ | 1,000 ppm | No effect | No effect |

## RELEVANT CROSS-SENSITIVITIES DrägerSensor® XS CO MICROPAC – 68 10 030

| Gas/vapor | Chem. symbol | Concentration | Display in ppm CO |
|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1,000 ppm | ≤ 1 |
| Ammonia | $NH_3$ | 200 ppm | ≤ 1 |
| Carbon dioxide | $CO_2$ | 30 Vol. % | ≤ 1 |
| Chlorine | $Cl_2$ | 20 ppm | ≤ 1 |
| Dichloromethane | $CH_2Cl_2$ | 1,000 ppm | ≤ 1 |
| Ethane | $C_2H_6$ | 0.2 Vol. % | ≤ 1 |
| Ethanol | $C_2H_5OH$ | 200 ppm | ≤ 1 |
| Ethene | $C_2H_4$ | 10 ppm | ≤ 25 |
| Ethyl acetate | $CH_3COOC_2H_5$ | 1,000 ppm | ≤ 1 |
| Ethine | $C_2H_2$ | 200 ppm | ≤ 300 |
| Formaldehyde | HCHO | 20 ppm | ≤ 1 |
| Hydrogen | $H_2$ | 0.1 Vol. % | ≤ 200 |
| Hydrogen chloride | HCl | 40 ppm | ≤ 1 |
| Hydrogen cyanide | HCN | 50 ppm | ≤ 1 |
| Hydrogen phosphide | $PH_3$ | 5 ppm | ≤ 3 |
| Hydrogen sulfide | $H_2S$ | 30 ppm | ≤ 1 |
| Methane | $CH_4$ | 5 Vol. % | ≤ 1 |
| Methanol | $CH_3OH$ | 175 ppm | ≤ 2 |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 1 |
| Nitrogen monoxide | NO | 25 ppm | ≤ 6 |
| Phosgene | $COCl_2$ | 50 ppm | ≤ 1 |
| Propane | $C_3H_8$ | 1 Vol. % | ≤ 1 |
| Sulfur dioxide | $SO_2$ | 25 ppm | ≤ 1 |
| Tetrachloroethylene | $CCl_2$ $CCl_2$ | 1,000 ppm | ≤ 1 |
| Toluene | $C_6H_5CH_3$ | 1,000 ppm | ≤ 1 |
| Trichloroethylene | $CHClCCl_2$ | 1,000 ppm | ≤ 1 |


ST-14960-2008

DrägerSensor® XS CO

# DrägerSensor® XS EC CO HC

**Order no. 68 09 120**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 1 year | – |

## MARKET SEGMENTS

Waste disposal, metal processing, petrochemicals, fertilizer production, mining and tunneling, shipping, inorganic chemicals, steel, organic chemicals, oil and gas, hazmat, biogas.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 10 ppm |
| **Resolution:** | 5 ppm |
| **Measurement range:** | 0 to 10,000 ppm CO (carbon monoxide) |
| **Response time:** | ≤ 10 seconds at 20 °C or 68 °F ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 5 ppm |
| Sensitivity: | ≤ ± 1% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 2 ppm/month |
| Sensitivity: | ≤ ± 2% of measured value/month |
| **Warm-up time:** | ≤ 12 hours |
| **Ambient conditions** | |
| Temperature: | (–40 to 50)°C (–40 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 10 ppm |
| Sensitivity: | ≤ ± 0.3% of measured value/K |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.05% of measured value/% RH |
| **Test gas:** | approx. 300 ppm CO test gas |

## SPECIAL CHARACTERISTICS

Because of its excellent linearity, this sensor (measurement range 10,000 ppm) can be calibrated at the lower levels of its measurement range. It also offers very stable measurements, even at high concentrations and over long periods of time.

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of carbon monoxide. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm CO |
|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1,000 ppm | ≤ 30 |
| Ammonia | $NH_3$ | 200 ppm | No effect |
| Benzene | $C_6H_6$ | 0.6 Vol. % | No effect |
| Carbon dioxide | $CO_2$ | 10 Vol. % | No effect |
| Chlorine | $Cl_2$ | 20 ppm | ≤ 8(–) |
| Ethanol | $C_2H_5OH$ | 200 ppm | ≤ 400 |
| Ethene | $C_2H_4$ | 20 ppm | ≤ 50 |
| Hydrogen | $H_2$ | 0.1 Vol. % | ≤ 400 |
| Hydrogen chloride | HCl | 40 ppm | No effect |
| Hydrogen cyanide | HCN | 50 ppm | ≤ 10 |
| Hydrogen sulfide | $H_2S$ | 20 ppm | ≤ 80 |
| Methane | $CH_4$ | 5 Vol. % | No effect |
| Nitrogen dioxide | $NO_2$ | 20 ppm | No effect |
| Nitrogen monoxide | NO | 20 ppm | ≤ 40 |
| Phosgene | $COCl_2$ | 50 ppm | No effect |
| Phosphine | $PH_3$ | 5 ppm | ≤ 20 |
| Sulfur dioxide | $SO_2$ | 20 ppm | ≤ 20 |
| Tetrahydrothiophene | $C_4H_8S$ | 10 ppm | ≤ 4 |

(–) Indicates negative deviation

# DrägerSensor® XS EC $CO_2$

**Order no. 68 09 175**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 1 year | – |

## MARKET SEGMENTS

Waste disposal, Food and beverage, breweries, metal processing, petrochemicals, fertilizer production, sewage, police, customs and rescue services, mining and tunneling, shipping and transport, power generation.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.2 Vol. % |
| **Resolution:** | 0.1 Vol. % |
| **Measurement range:** | 0 to 5 Vol. % $CO_2$ (carbon dioxide) |
| **Response time:** | ≤ 45 seconds at 20 °C or 68 °F ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.2 Vol. % |
| Sensitivity: | ≤ ± 20% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 0.1 Vol. %/month |
| Sensitivity: | ≤ ± 15% of measured value/month |
| **Warm-up time:** | ≤ 12 hours |
| **Ambient conditions** | |
| Temperature: | (–20 to 40)°C (–4 to 104)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.01 Vol. %/K |
| Sensitivity: | ≤ ± 2% of measured value/K |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.005 Vol. %/% RH |
| Sensitivity: | ≤ ± 0.1% of measured value/% RH |
| **Test gas:** | approx. 1 to 3 Vol. % $CO_2$ test gas |

## SPECIAL CHARACTERISTICS

This sensor is highly sensitive (see cross-sensitivity list) and offers an economical alternative to infrared
sensors, if you need to warn against $CO_2$ concentrations in the ambient air.

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of dioxide. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display |
|---|---|---|---|
| Ammonia | $NH_3$ | 50 ppm | ≤ 0.1(–) |
| Boron trichloride | $BCl_3$ | 15 ppm | ≤ 0.1 |
| Carbon monoxide | CO | 100 ppm | ≤ 0.1 |
| Chlorine | $Cl_2$ | 5 ppm | ≤ 0.1(–) |
| Ethanol | $C_2H_5OH$ | 130 ppm | ≤ 0.1(–) |
| Ethene | $C_2H_4$ | 50 ppm | ≤ 0.1(–) |
| Hydrogen | $H_2$ | 1,000 ppm | ≤ 0.1(–) |
| Hydrogen chloride | HCl | 20 ppm | ≤ 0.1(–) |
| Hydrogen phosphide | $PH_3$ | 5 ppm | ≤ 0.1(–) |
| Hydrogen sulfide | $H_2S$ | 20 ppm | ≤ 0.1(–) |
| Methane | $CH_4$ | 30 Vol. % | ≤ 0.1 |
| Methanol | $CH_3OH$ | 200 ppm | ≤ 0.1(–) |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 0.1(–) |
| Nitrogen monoxide | NO | 20 ppm | ≤ 0.1(–) |
| Sulfur dioxide | $SO_2$ | 20 ppm | ≤ 0.1(–) |

(–) Indicates negative deviation

# DrägerSensor® XS EC $COCl_2$

**Order no. 68 08 582**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 6 months | – |

## MARKET SEGMENTS

Production of plastics, insecticides production, dyes.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.01 ppm |
| **Resolution:** | 0.01 ppm |
| **Measurement range:** | 0 to 10 ppm $COCl_2$ (phosgene) |
| **Response time:** | ≤ 20 seconds at 20 °C or 68 °F ($T_{20}$)<br>≤ 40 seconds at 20 °C or 68 °F ($T_{50}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.01 ppm |
| Sensitivity: | ≤ ± 10% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 0.01 ppm/month |
| Sensitivity: | ≤ ± 2% of measured value/month |
| **Warm-up time:** | ≤ 1 hour |
| **Ambient conditions** | |
| Temperature: | (–20 to 40)°C (–4 to 104)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.001 ppm/K |
| Sensitivity: | ≤ ± 1% of measured value/K |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.05% of measured value/% RH |
| **Test gas:** | $COCl_2$ test gas between 40% and 100% of highest figure in the set measurement range. |

## SPECIAL CHARACTERISTICS

The XS Phosgene sensor is highly selective, especially against hydrogen chloride (HCl).

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of phosgene. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $COCl_2$ |
|---|---|---|---|
| Ammonia | $NH_3$ | 20 ppm | No effect |
| Carbon dioxide | $CO_2$ | 1.5 Vol. % | No effect |
| Carbon monoxide | CO | 1,000 ppm | No effect |
| Chlorine | $Cl_2$ | 0.5 ppm | ≤ 0.2 |
| Ethanol | $C_2H_5OH$ | 260 ppm | No effect |
| Ethine | $C_2H_2$ | 20 ppm | No effect |
| Hydrogen | $H_2$ | 8,000 ppm | No effect |
| Hydrogen chloride | HCl | 0.5 ppm | ≤ 0.7 |
| Hydrogen peroxide | $H_2O_2$ | 1 ppm | No effect |
| Hydrogen sulfide | $H_2S$ | 1 ppm | ≤ 1 |
| Nitrogen dioxide | $NO_2$ | 1 ppm | ≤ 0.1(–) |
| Nitrogen monoxide | NO | 30 ppm | No effect |
| Ozone | $O_3$ | 0.3 ppm | ≤ 0.05(–) |
| Propanol | $C_3H_7OH$ | 500 ppm | No effect |
| Sulfur dioxide | $SO_2$ | 2 ppm | No effect |

(–) Indicates negative deviation

# DrägerSensor® XS EC $H_2$

**Order no. 68 09 185**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 1 year | – |

## MARKET SEGMENTS

Chemical, petrochemical, rocket fuel, leakages, production of plastics, metal processing, industrial gases, fertilizer production

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 10 ppm |
| **Resolution:** | 5 ppm |
| **Measurement range:** | 0 to 2,000 ppm $H_2$ (hydrogen) |
| **Response time:** | ≤ 20 seconds at 20 °C or 68 °F ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 10 ppm |
| Sensitivity: | ≤ ± 1% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 4 ppm/month |
| Sensitivity: | ≤ ± 4% of measured value/month |
| **Warm-up time:** | ≤ 1 hour |
| **Ambient conditions** | |
| Temperature: | (–20 to 50)°C (–4 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 10 ppm |
| Sensitivity: | ≤ ± 1 ppm/K |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.15% of measured value/% RH |
| **Test gas:** | approx. 1,000 ppm $H_2$ test gas |

## SPECIAL CHARACTERISTICS

This sensor enables ppm concentrations of $H_2$ (hydrogen) to be measured in the ambient air. It has a very fast response time and is therefore especially suited to detect leakages.

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $H_2$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $H_2$ |
|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1,000 ppm | ≤ 10 |
| Ammonia | $NH_3$ | 100 ppm | No effect |
| Carbon dioxide | $CO_2$ | 1.5 Vol. % | No effect |
| Carbon monoxide | CO | 100 ppm | ≤ 130 |
| Chlorine | $Cl_2$ | 5 ppm | ≤ 5(–) |
| Ethene | $C_2H_4$ | 1,000 ppm | ≤ 1800 |
| Ethine | $C_2H_2$ | 200 ppm | ≤ 700 |
| Hydrogen chloride | HCl | 40 ppm | No effect |
| Hydrogen cyanide | HCN | 20 ppm | ≤ 20 |
| Methane | $CH_4$ | 50 Vol. % | No effect |
| Methanol | $CH_3OH$ | 500 ppm | ≤ 750 |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 15(–) |
| Nitrogen monoxide | NO | 20 ppm | ≤ 10 |
| Phosgene | $COCl_2$ | 50 ppm | No effect |
| Phosphine | $PH_3$ | 10 ppm | ≤ 40 |
| Sulfur dioxide | $SO_2$ | 20 ppm | ≤ 15 |
| Tetrahydrothiophene | $C_4H_8S$ | 20 ppm | ≤ 10 |

(–) Indicates negative deviation

# DrägerSensor® XS EC $H_2$ HC

**Order no. 68 11 365**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 1 year | – |

## MARKET SEGMENTS

Ammonia synthesis, fuel refinement (hydrocracking), sulfur elimination, chemical, rocket fuel, leakage inspection, metal processing, industrial gases, fertilizer production, battery chargers, fuel cells.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.02 Vol. % |
| **Resolution:** | 0.01 Vol. % |
| **Measurement range:** | 0 to 4 Vol. % $H_2$ (hydrogen) |
| **Response time:** | ≤ 20 seconds at 20 °C or 68 °F ($T_{50}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.05 Vol. % |
| Sensitivity: | ≤ ± 2% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 0.05 Vol. %/year |
| Sensitivity: | ≤ ± 3% of measured value/month |
| **Warm-up time:** | ≤ 1 hour |
| **Ambient conditions** | |
| Temperature: | (–20 to 50)°C (–4 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.05 Vol. % |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.1% of measured value/% RH |
| **Test gas:** | approx. 2 Vol. % $H_2$ test gas |

## SPECIAL CHARACTERISTICS

This sensor covers the entire range of LELs up to 4 Vol. % $H_2$, and is therefore the ideal addition when using IR technology in the Dräger X-am 7000 to measure for explosion risks. The sensor also offers high selectivity (see cross-sensitivity specifications) and linearity.

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $H_2$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in Vol. % $H_2$ |
|---|---|---|---|
| Ammonia | $NH_3$ | 500 ppm | No effect |
| Carbon dioxide | $CO_2$ | 1.5 Vol. % | No effect |
| Carbon monoxide | CO | 1,000 ppm | ≤ 0.1 |
| Chlorine | $Cl_2$ | 50 ppm | No effect |
| Ethanol | $C_2H_5OH$ | 250 ppm | No effect |
| Ethylene | $C_2H_4$ | 1,000 ppm | ≤ 0.1 |
| Ethine | $C_2H_2$ | 200 ppm | ≤ 0.02 |
| Hydrogen cyanide | HCN | 50 ppm | No effect |
| Hydrogen sulfide | $H_2S$ | 20 ppm | ≤ 0.1 |
| Methane | $CH_4$ | 1 Vol. % | No effect |
| Nitrogen dioxide | $NO_2$ | 20 ppm | No effect |
| Nitrogen monoxide | NO | 20 ppm | ≤ 0.05 |
| Phosphine | $PH_3$ | 5 ppm | ≤ 0.02 |
| Sulfur dioxide | $SO_2$ | 20 ppm | No effect |

# DrägerSensor® XS EC HCN

**Order no. 68 09 150**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 1 year | – |

## MARKET SEGMENTS

Metal processing, mining, fumigation and pest control, chemical war agent (blood agents).

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.5 ppm |
| **Resolution:** | 0.1 ppm |
| **Measurement range:** | 0 to 50 ppm HCN (hydrogen cyanide) |
| **Response time:** | ≤ 10 seconds at 20 °C or 68 °F ($T_{50}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.5 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 1 ppm/month |
| Sensitivity: | ≤ ± 5% of measured value/month |
| **Warm-up time:** | ≤ 15 minutes |
| **Ambient conditions** | |
| Temperature: | (–20 to 50)°C (–4 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 1 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.1% of measured value/% RH |
| **Test gas:** | approx. 10 ppm HCN<br>After long periods of exposure > 10 ppm HCN/hour, the sensor should be recalibrated. |

## SPECIAL CHARACTERISTICS

The extremely quick response time of this sensor provides a fast and reliable warning against prussic acid (hydrogen cyanide).

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of hydrogen cyanide. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm HCN |
|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1,000 ppm | No effect |
| Ammonia | $NH_3$ | 200 ppm | No effect |
| Carbon dioxide | $CO_2$ | 1.5 Vol. % | No effect |
| Carbon monoxide | CO | 1,000 ppm | ≤ 0.5 |
| Chlorine | $Cl_2$ | 10 ppm | ≤ 10(–) |
| Ethene | $C_2H_4$ | 1,000 ppm | No effect |
| Ethylene oxide | $C_2H_4O$ | 30 ppm | No effect |
| Ethine | $C_2H_2$ | 200 ppm | ≤ 20 |
| Formaldehyde | HCHO | 50 ppm | ≤ 2 |
| Hydrogen | $H_2$ | 1.6 Vol. % | ≤ 10 |
| Hydrogen sulfide | $H_2S$ | 20 ppm | ≤ 5 |
| i-propanol | $(CH_3)_2CHOH$ | 500 ppm | No effect |
| Methane | $CH_4$ | 20 Vol. % | No effect |
| Methanol | $CH_3OH$ | 175 ppm | No effect |
| Nitrogen dioxide | $NO_2$ | 10 ppm | ≤ 10(–) |
| Nitrogen monoxide | NO | 20 ppm | ≤ 0.5 |
| Phosphine | $PH_3$ | 5 ppm | ≤ 25 |
| Propane | $C_3H_8$ | 1 Vol. % | No effect |
| Sulfur dioxide | $SO_2$ | 20 ppm | ≤ 10 |
| Tetrahydrothiophene | $C_4H_8S$ | 10 ppm | ≤ 0.5 |

(–) Indicates negative deviation

# DrägerSensor® XS EC HF/HCl

**Order no. 68 09 140**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 5100 | no | yes | 1 year | – |

## MARKET SEGMENTS

Semiconductor, chemical

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 1 ppm |
| **Resolution:** | 0.1 ppm |
| **Measurement range:** | 0 to 30 ppm HCl (hydrogen chloride) |
| | 0 to 30 ppm $HNO_3$ (nitric acid) |
| | 0 to 30 ppm HBr (hydrogen bromide) |
| | 0 to 30 ppm $POCl_3$ (phosphoryl trichloride) |
| | 0 to 30 ppm $PCl_3$ (phosphorous trichloride) |
| | 0 to 30 ppm HF (hydrogen fluoride) |
| **Response time:** | ≤ 60 seconds at 20 °C or 68 °F ($T_{50}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 1 ppm |
| Sensitivity: | ≤ ± 15% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 0.5 ppm/month |
| Sensitivity: | ≤ ± 5% of measured value/month |
| **Warm-up time:** | ≤ 1 hour |
| **Ambient conditions** | |
| Temperature: | (–20 to 40)°C (–4 to 104)°F |
| Humidity: | (30 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.5 ppm |
| Sensitivity: | ≤ ± 10% of measured value |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 2% of measured value/% RH |
| **Test gas:** | HCl test gas between 40% and 100% of the highest figure within the set measurement ranget; or one of the other target gases HCl, $HNO_3$, HBr, $POCl_3$,$PCl_3$, HF. Every time the sensor is used, the following function test should be performed beforehand. Procedure: hold the unit over a container containing a (9 ± 0.5) mol of acetic acid, at room temperature. Evaluation: after 30 seconds, the figure displayed should be greater than 0.5 ppm HCl. If the figure is less than 0.5 ppm, then the sensitivity must be calibrated. A function test can also be performed using the test gas. |

## SPECIAL CHARACTERISTICS

This sensor is used exclusively in the Dräger X-am 5100. This sensor can be used to monitor concentrations of hydrogen chloride (HCl), nitric acid ($HNO_3$), hydrogen bromide (HBr), phosphoryl trichloride ($POCl_3$), phosphorous trichloride ($PCl_3$) and HF (hydrogen fluoride) in the ambient air.

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of HCl/HF. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm HCl |
|---|---|---|---|
| Ammonia* | $NH_3$ | 500 ppm | No effect |
| Carbon dioxide | $CO_2$ | 10 Vol. % | No effect |
| Carbon monoxide | CO | 150 ppm | No effect |
| Chlorine | $Cl_2$ | 5 ppm | ≤ 22 |
| Hydrogen | $H_2$ | 1.5 Vol. % | No effect |
| Hydrogen cyanide | HCN | 20 ppm | ≤ 9 |
| Hydrogen peroxide | $H_2O_2$ | 20 ppm | No effect |
| Hydrogen sulfide | $H_2S$ | 30 ppm | ≤ 2 |
| i-propanol | $(CH_3)_2CHOH$ | 500 ppm | No effect |
| Methane | $CH_4$ | 2 Vol. % | No effect |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 0.8 |
| Nitrogen monoxide | NO | 20 ppm | ≤ 5 |
| Sulfur dioxide | $SO_2$ | 20 ppm | ≤ 20 |

* Volatile alkaline substances (such as $NH_3$, amines) can impair the function of the sensor. If in doubt, perform a function test.

# DrägerSensor® XS EC $H_2S$ 100 — Order no. 68 09 110
# DrägerSensor® XS 2 $H_2S$ — 68 10 370
# DrägerSensor® XS R $H_2S$ — 68 10 260
# DrägerSensor® XS $H_2S$ microPac (Dräger X-am 3000 only) — 68 10 032

| Used in | Plug & Play | Replaceable | Guaranty* | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 3/2/5 years | – |

## MARKET SEGMENTS

Waste disposal, petrochemical, fertilizer production, sewage, mining and tunneling, shipping, inorganic chemicals, steel industry, pulp and paper, organic chemicals, oil and gas, hazmat, biogas.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 1 ppm for XS EC / XS 2 / XS R, 2 ppm for XS microPac |
| **Resolution:** | 0.1 ppm for XS EC / XS 2 / XS R, 1 ppm for XS microPac |
| **Measurement range:** | 0 to 100 ppm $H_2S$ (hydrogen sulfide) |
| **Response time:** | ≤ 20 seconds at 20 °C or 68 °F ($T_{90}$) - XS R |
| | ≤ 25 seconds at 20 °C or 68 °F ($T_{90}$) - XS EC |
| | ≤ 30 seconds at 20 °C or 68 °F ($T_{90}$) - XS 2 |
| | ≤ 39 seconds at 20 °C or 68 °F ($T_{90}$) - XS microPac |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 1 ppm - XS EC / XS 2 / XS R, ≤ ± 2 ppm - XS microPac |
| Sensitivity: | ≤ ± 2% of measured value - XS EC / XS R / XS microPac |
| | ≤ ± 1% of measured value - XS 2 |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 1 ppm/year - XS EC / XS R / XS microPac |
| | ≤ ± 1 ppm/month - XS 2 |
| Sensitivity: | ≤ ± 1% of measured value/month |
| **Warm-up time:** | ≤ 12 hours - XS EC / XS 2 / XS R, ≤ 10 minutes - XS microPac |
| **Ambient conditions** | |
| Temperature: | (–20 to 50)°C (–4 to 122)°F - XS EC |
| | (–40 to 50)°C (–40 to 122)°F - XS 2 / XS R / XS microPac |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 5 ppm - XS EC / XS microPac, ≤ ± 2 ppm - XS 2 / XS R |
| Sensitivity: | ≤ ± 5% of measured value - XS EC / XS 2 / XS R |
| | ≤ ± 20% of measured value - XS microPac |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.02 ppm/% RH - XS EC / XS 2 / XS microPac, no effect - XS R |
| Sensitivity: | ≤ ± 0.05% of measured value/% RH - XS EC / XS 2 / XS R |
| | ≤ ± 0.75% of measured value/% RH - XS microPac |
| **Test gas:** | approx. 20 to 100 ppm $H_2S$ test gas |

* DrägerSensor XS EC $H_2S$ = three-year guaranty
DrägerSensor XS 2 $H_2S$ = two-year guaranty
DrägerSensor XS R $H_2S$ = five-year guaranty
DrägerSensor XS $H_2S$ microPac = two-year guaranty

## SPECIAL CHARACTERISTICS

These sensor's advantages include fast response times and excellent linearity. At concentrations up to 20 ppm, sulfur dioxide only has a minor effect on hydrogen sulfide readings. This, therefore, enables the selective measurement of hydrogen sulfide alongside sulfur dioxide.

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $H_2S$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES DrägerSensor® XS EC $H_2S$ 100

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $H_2S$ |
|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1,000 ppm | ≤ 4 |
| Ammonia | $NH_3$ | 500 ppm | ≤ 1 |
| Benzene | $C_6H_6$ | 0.6 Vol. % | ≤ 1 |
| Carbon dioxide | $CO_2$ | 1.5 Vol. % | ≤ 1(–) |
| Carbon disulfide | $CS_2$ | 15 ppm | ≤ 1 |
| Carbon monoxide | CO | 125 ppm | ≤ 3 |
| Chlorine | $Cl_2$ | 20 ppm | ≤ 2(–) |
| Dimethyldisulfide | $CH_3SSCH_3$ | 20 ppm | ≤ 13 |
| Dimethylsulfide | $(CH_3)_2S$ | 20 ppm | ≤ 6 |
| Ethanol | $C_2H_5OH$ | 200 ppm | ≤ 2 |
| Ethanethiol | $C_2H_5SH$ | 20 ppm | ≤ 5 |
| Ethene | $C_2H_4$ | 1,000 ppm | ≤ 10 |
| Ethine | $C_2H_2$ | 0.6 Vol. % | ≤ 10 |
| FAM regular gasoline (DIN 51635, DIN 51557) | – | 0.55 Vol. % | ≤ 1 |
| Hexane | $C_6H_{14}$ | 0.6 Vol. % | ≤ 1 |
| Hydrogen | $H_2$ | 1 Vol. % | ≤ 10 |
| Hydrogen chloride | HCl | 40 ppm | ≤ 1 |
| Hydrogen cyanide | HCN | 50 ppm | ≤ 1 |
| Methane | $CH_4$ | 5 Vol. % | ≤ 1 |
| Methanol | $CH_3OH$ | 200 ppm | ≤ 10 |
| Methylmercaptane | $CH_3SH$ | 20 ppm | ≤ 15 |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 1 |
| Nitrogen monoxide | NO | 20 ppm | ≤ 10 |
| Octane | $C_8H_{18}$ | 0.4 Vol. % | ≤ 1 |
| Phosphine | $PH_3$ | 5 ppm | ≤ 5 |
| Propane | $C_3H_8$ | 1 Vol. % | ≤ 1 |
| Propene | $C_3H_6$ | 0.5 Vol. % | ≤ 1 |
| Sulfur dioxide | $SO_2$ | 20 ppm | ≤ 4 |
| sec-Butylmercaptan | $C_4H_{10}SH$ | 20 ppm | ≤ 7 ppm |
| Tetrahydrothiophene | $C_4H_5S$ | 20 ppm | ≤ 4 |
| Toluene | $C_2H_5CH_3$ | 0.6 Vol. % | ≤ 1 |
| tert-Butylmercaptane | $(CH_3)_3CSH$ | 20 ppm | ≤ 10 ppm |
| Trichloroethylene | $CHClCCl_2$ | 1,000 ppm | ≤ 1 |
| Xylol | $C_6H_4(CH_3)_2$ | 0.5 Vol. % | ≤ 4 |

(–) Indicates negative deviation

## RELEVANT CROSS-SENSITIVITIES DrägerSensor® XS 2 $H_2S$

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $H_2S$ |
|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1,000 ppm | ≤4 |
| Ammonia | $NH_3$ | 500 ppm | No effect |
| Carbon dioxide | $CO_2$ | 1.5 Vol. % | No effect |
| Carbon disulfide | $CS_2$ | 15 ppm | No effect |
| Carbon monoxide | CO | 125 ppm | ≤3 |
| Chlorine | $Cl_2$ | 20 ppm | ≤2(–) |
| Ethane | $C_2H_6$ | 0.2 Vol. % | No effect |
| Ethanol | $C_2H_5OH$ | 200 ppm | ≤2 |
| Ethanethiol | $C_2H_5SH$ | 10 ppm | ≤5 |
| Ethene | $C_2H_4$ | 1,000 ppm | ≤10 |
| Ethine | $C_2H_2$ | 0.6 Vol. % | ≤10 |
| Hexane | $C_6H_{14}$ | 0.6 Vol. % | No effect |
| Hydrogen | $H_2$ | 1 Vol. % | ≤10 |
| Hydrogen chloride | HCl | 40 ppm | No effect |
| Hydrogen cyanide | HCN | 50 ppm | No effect |
| Methane | $CH_4$ | 5 Vol. % | No effect |
| Methanol | $CH_3OH$ | 200 ppm | ≤10 |
| Nitrogen dioxide | $NO_2$ | 20 ppm | No effect |
| Nitrogen monoxide | NO | 20 ppm | ≤10 |
| Phosgene | $COCL_2$ | 50 ppm | No effect |
| Phosphine | $PH_3$ | 5 ppm | ≤5 |
| Propane | $C_3H_8$ | 1 Vol. % | No effect |
| Sulfur dioxide | $SO_2$ | 20 ppm | ≤4 |
| Tetrahydrothiophene | $C_4H_5S$ | 10 ppm | ≤4 |
| Toluene | $C_2H_5CH_3$ | 0.6 Vol. % | No effect |
| Xylene | $C_6H_4(CH_3)_2$ | 0.5 Vol. % | ≤4 |

(–) Indicates negative deviation

## RELEVANT CROSS-SENSITIVITIES DrägerSensor® XS R $H_2S$ 100

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $H_2S$ |
|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1,000 ppm | ≤ 4 |
| Ammonia | $NH_3$ | 500 ppm | No effect |
| Benzene | $C_6H_6$ | 0.6 Vol. % | No effect |
| Carbon dioxide | $CO_2$ | 1.5 Vol. % | No effect |
| Carbon disulfide | $CS_2$ | 15 ppm | No effect |
| Carbon monoxide | CO | 125 ppm | No effect |
| Chlorine | $Cl_2$ | 8 ppm | ≤ 2(–) |
| Ethanol | $C_2H_5OH$ | 200 ppm | ≤ 2 |
| Ethanethiol | $C_2H_5SH$ | 10 ppm | ≤ 5 |
| Ethene | $C_2H_4$ | 1,000 ppm | ≤ 10 |
| Ethine | $C_2H_2$ | 0.6 Vol. % | ≤ 10 |
| FAM regular gasoline (DIN 51635, DIN 51557) | – | 0.55 Vol. % | No effect |
| Hexane | $C_6H_{14}$ | 0.6 Vol. % | No effect |
| Hydrogen | $H_2$ | 1 Vol. % | ≤ 10 |
| Hydrogen chloride | HCl | 40 ppm | No effect |
| Hydrogen cyanide | HCN | 50 ppm | No effect |
| Methane | $CH_4$ | 5 Vol. % | No effect |
| Methanol | $CH_3OH$ | 200 ppm | ≤ 10 |
| Nitrogen dioxide | $NO_2$ | 20 ppm | No effect |
| Nitrogen monoxide | NO | 20 ppm | ≤ 10 |
| Octane | $C_8H_{18}$ | 0.4 Vol. % | No effect |
| Phosgene | $COCl_2$ | 50 ppm | No effect |
| Phosphine | $PH_3$ | 5 ppm | ≤ 5 |
| Propane | $C_3H_8$ | 1 Vol. % | No effect |
| Propene | $C_3H_6$ | 0.5 Vol. % | No effect |
| Sulfur dioxide | $SO_2$ | 20 ppm | ≤ 4 |
| Tetrahydrothiophene | $C_4H_5S$ | 10 ppm | ≤ 4 |
| Toluene | $C_2H_5CH_3$ | 0.6 Vol. % | No effect |
| Xylene | $C_6H_4(CH_3)_2$ | 0.5 Vol. % | ≤ 4 |

(–) Indicates negative deviation

## RELEVANT CROSS-SENSITIVITIES DrägerSensor® XS $H_2S$ MICROPAC

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $H_2S$ |
|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1,000 ppm | ≤ 4 |
| Ammonia | $NH_3$ | 500 ppm | ≤ 1 |
| Benzene | $C_6H_6$ | 0.6 Vol. % | ≤ 1 |
| Carbon dioxide | $CO_2$ | 1.5 Vol. % | ≤ 1(–) |
| Carbon disulfide | $CS_2$ | 15 ppm | ≤ 1 |
| Carbon monoxide | CO | 125 ppm | ≤ 3 |
| Chlorine | $Cl_2$ | 8 ppm | ≤ 2(–) |
| Ethanol | $C_2H_5OH$ | 200 ppm | ≤ 1 |
| Ethanethiol | $C_2H_5SH$ | 10 ppm | ≤ 5 |
| Ethene | $C_2H_4$ | 1,000 ppm | ≤ 10 |
| Ethine | $C_2H_2$ | 0.6 Vol. % | ≤ 10 |
| FAM regular gasoline | – | 0.55 Vol. % | ≤ 1 |
| Hexane | $C_6H_{14}$ | 0.6 Vol. % | ≤ 1 |
| Hydrogen | $H_2$ | 1 Vol. % | ≤ 10 |
| Hydrogen chloride | HCl | 40 ppm | ≤ 1 |
| Hydrogen cyanide | HCN | 50 ppm | ≤ 1 |
| Hydrogen phosphide | $PH_3$ | 5 ppm | ≤ 5 |
| Methane | $CH_4$ | 5 Vol. % | ≤ 1 |
| Methanol | $CH_3OH$ | 200 ppm | ≤ 1 |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 1 |
| Nitrogen monoxide | NO | 20 ppm | ≤ 10 |
| Octane | $C_8H_{18}$ | 0.4 Vol. % | ≤ 1 |
| Phosgene | $COCl_2$ | 50 ppm | ≤ 1 |
| Propane | $C_3H_8$ | 1 Vol. % | ≤ 1 |
| Propene | $C_3H_6$ | 0.5 Vol. % | ≤ 1 |
| Sulfur dioxide | $SO_2$ | 20 ppm | ≤ 4 |
| Tetrahydrothiophene | $C_4H_8S$ | 10 ppm | ≤ 4 |
| Toluene | $C_6H_5CH_3$ | 0.6 Vol. % | ≤ 1 |
| Xylene | $C_6H_4(CH_3)_2$ | 0.5 Vol. % | ≤ 4 |


DrägerSensor® XS $H_2S$

# DrägerSensor® XS EC $H_2S$ HC

**Order no. 68 09 180**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 1 year | – |

## MARKET SEGMENTS

Waste disposal, petrochemical, fertilizer production, sewage, mining and tunneling, shipping, inorganic chemicals, steel industry, pulp and paper, organic chemicals, oil and gas, hazmat, biogas.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 5 ppm |
| **Resolution:** | 1 ppm |
| **Measurement range:** | 0 to 1,000 ppm $H_2S$ (hydrogen sulfide) |
| **Response time:** | ≤ 20 seconds at 20 °C or 68 °F ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 5 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 3 ppm/month |
| Sensitivity: | ≤ ± 3% of measured value/month |
| **Warm-up time:** | ≤ 12 hours |
| **Ambient conditions** | |
| Temperature: | (–40 to 50)°C (–40 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 5 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.1 ppm/% RH |
| Sensitivity: | ≤ ± 0.1% of measured value/% RH |
| **Test gas:** | approx. 100 ppm $H_2S$ test gas |

## SPECIAL CHARACTERISTICS

Because of its excellent linearity, this sensor can be calibrated in its lower measurement range using a hydrogen sulfide test gas without compromising on accuracy in its upper measurement range. It also offers a fast response time and good selectivity.

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $H_2S$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $H_2S$ |
|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1,000 ppm | ≤ 4 |
| Ammonia | $NH_3$ | 500 ppm | No effect |
| Benzene | $C_6H_6$ | 0.6 Vol. % | No effect |
| Carbon dioxide | $CO_2$ | 1.5 Vol. % | No effect |
| Carbon disulfide | $CS_2$ | 15 ppm | No effect |
| Carbon monoxide | CO | 125 ppm | ≤ 3 |
| Chlorine | $Cl_2$ | 8 ppm | ≤ 2(–) |
| Ethanol | $C_2H_5OH$ | 200 ppm | ≤ 2 |
| Ethanethiol | $C_2H_5SH$ | 10 ppm | ≤ 5 |
| Ethene | $C_2H_4$ | 1,000 ppm | ≤ 10 |
| Ethine | $C_2H_2$ | 0.6 Vol. % | ≤ 10 |
| FAM regular gasoline (DIN 51635, DIN 51557) | – | 0.55 Vol. % | No effect |
| Hexane | $C_6H_{14}$ | 0.6 Vol. % | No effect |
| Hydrogen | $H_2$ | 0.1 Vol. % | ≤ 10 |
| Hydrogen chloride | HCl | 40 ppm | No effect |
| Hydrogen cyanide | HCN | 50 ppm | No effect |
| Methane | $CH_4$ | 5 Vol. % | No effect |
| Methanol | $CH_3OH$ | 500 ppm | ≤ 20 |
| Nitrogen dioxide | $NO_2$ | 20 ppm | No effect |
| Nitrogen monoxide | NO | 20 ppm | ≤ 10 |
| Octane | $C_8H_{18}$ | 0.4 Vol. % | No effect |
| Phosgene | $COCl_2$ | 50 ppm | No effect |
| Phosphine | $PH_3$ | 5 ppm | ≤ 5 |
| Propane | $C_3H_8$ | 1 Vol. % | No effect |
| Propene | $C_3H_6$ | 0.5 Vol. % | No effect |
| Sulfur dioxide | $SO_2$ | 20 ppm | ≤ 4 |
| Tetrahydrothiophene | $C_4H_8S$ | 10 ppm | ≤ 2 |
| Toluene | $C_6H_5CH_3$ | 0.6 Vol. % | No effect |
| Xylol | $C_6H_4(CH_3)_2$ | 0.5 Vol. % | ≤ 4 |

(–) Indicates negative deviation

# DrägerSensor® XS 2 $H_2S$ SR

**Order no. 68 10 575**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 2 years | – |

## MARKET SEGMENTS

Shipping

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 1 ppm |
| **Resolution:** | 0.1 ppm |
| **Measurement range:** | 0 to 100 ppm $H_2S$ (hydrogen sulfide) |
| **Response time:** | ≤ 30 seconds at 20 °C or 68 °F ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 1 ppm |
| Sensitivity: | ≤ ± 1% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 1 ppm/month |
| Sensitivity: | ≤ ± 2% of measured value/month |
| **Warm-up time:** | ≤ 15 minutes |
| **Ambient conditions** | |
| Temperature: | (–40 to 50)°C (–40 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 2 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.02 ppm/% RH |
| Sensitivity: | ≤ ± 0.05% of measured value/% RH |
| **Test gas:** | approx. 20 to 100 ppm $H_2S$ test gas |

## SPECIAL CHARACTERISTICS

This sensor offers a high level of electromagnetic compatibility, as is required in industries such as shipping.

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $H_2S$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $H_2S$ |
|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1,000 ppm | ≤ 4 |
| Ammonia | $NH_3$ | 200 ppm | No effect |
| Carbon dioxide | $CO_2$ | 1.5 Vol. % | No effect |
| Carbon disulfide | $CS_2$ | 15 ppm | No effect |
| Carbon monoxide | CO | 1,000 ppm | ≤ 7 |
| Chlorine | $Cl_2$ | 20 ppm | ≤ 6(–) |
| Ethane | $C_2H_6$ | 0.2 Vol. % | No effect |
| Ethanol | $C_2H_5OH$ | 200 ppm | No effect |
| Ethanthiol | $C_2H_5SH$ | 10 ppm | ≤ 5 |
| Ethene | $C_2H_4$ | 1,000 ppm | No effect |
| Ethine | $C_2H_2$ | 200 ppm | No effect |
| Hexane | $C_6H_{14}$ | 0.6 Vol. % | No effect |
| Hydrogen | $H_2$ | 1 Vol. % | ≤ 10 |
| Hydrogen chloride | HCl | 40 ppm | No effect |
| Hydrogen cyanide | HCN | 50 ppm | No effect |
| Methane | $CH_4$ | 5 Vol. % | No effect |
| Methanol | $CH_3OH$ | 500 ppm | No effect |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 5(–) |
| Nitrogen monoxide | NO | 20 ppm | ≤ 2 |
| Phosgene | $COCl_2$ | 50 ppm | No effect |
| Phosphine | $PH_3$ | 5 ppm | ≤ 5 |
| Propane | $C_3H_8$ | 1 Vol. % | No effect |
| Sulfur dioxide | $SO_2$ | 20 ppm | ≤ 4 |
| Tetrahydrothiophene | $C_4H_8S$ | 10 ppm | ≤ 4 |
| Toluene | $C_6H_5CH_3$ | 0.6 Vol. % | No effect |
| Xylol | $C_6H_4(CH_3)_2$ | 0.5 Vol. % | ≤ 4 |

(–) Indicates negative deviation

# DrägerSensor® XS EC $H_2O_2$

**Order no. 68 09 170**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 5100 | no | yes | 1 year | – |

## MARKET SEGMENTS

Disinfection and sterilization, bleaching, decontaminating interior spaces.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.5 ppm |
| **Resolution:** | 0.1 ppm |
| **Measurement range:** | 0 to 20 ppm $H_2O_2$ (hydrogen peroxide) |
| **Response time:** | ≤ 60 seconds at 20 °C or 68 °F ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.5 ppm |
| Sensitivity: | ≤ ± 10% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 1 ppm/year |
| Sensitivity: | ≤ ± 2% of measured value/month |
| **Warm-up time:** | ≤ 12 hours |
| **Ambient conditions** | |
| Temperature: | (0 to 50)°C (32 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 1 ppm |
| Sensitivity: | ≤ ± 0.5% of measured value/K |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.01 ppm/% RH |
| Sensitivity: | ≤ ± 0.1% of measured value/% RH |
| **Test gas:** | $H_2O_2$ test gas between 40% and 100% of the highest figure within the set measurement range. The Dräger Sensor XS EC $H2O_2$ has a defined cross sensitivity to sulphur dioxide ($SO_2$). Alternatively, the sensor can be calibrated using $SO_2$. Such surrogate calibration with $SO_2$ can lead to an additional measuring error of up to 20%. We recommend calibrating devices using the gas that is to be detected during actual operation. This method of target gas calibration is more accurate than calibrating with a surrogate gas. |

## SPECIAL CHARACTERISTICS

This sensor is used in the Dräger X-am 5100 to monitor the $H_2O_2$ (hydrogen peroxide) concentration in the ambient air. It offers high sensitivity (see cross-sensitivity table).

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $H_2O_2$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $H_2O_2$ |
|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1,000 ppm | No effect |
| Ammonia | $NH_3$ | 100 ppm | No effect |
| Carbon dioxide | $CO_2$ | 1.5 Vol. % | No effect |
| Carbon monoxide | CO | 125 ppm | No effect |
| Chlorine | $Cl_2$ | 5 ppm | ≤ 1(–) |
| Ethene | $C_2H_4$ | 50 ppm | No effect |
| Ethine | $C_2H_2$ | 200 ppm | ≤ 35 |
| Hydrogen | $H_2$ | 1.5 Vol. % | ≤ 5 |
| Hydrogen chloride | HCl | 15 ppm | ≤ 3 |
| Hydrogen cyanide | HCN | 25 ppm | ≤ 7 |
| Hydrogen sulfide | $H_2S$ | 20 ppm | ≤ 80 |
| i-propanol | $(CH_3)CHOH$ | 500 ppm | No effect |
| Methane | $CH_4$ | 5 Vol. % | No effect |
| Methanol | $CH_3OH$ | 200 ppm | No effect |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 15(–) |
| Nitrogen monoxide | NO | 20 ppm | No effect |
| Phosphine | $PH_3$ | 5 ppm | ≤ 15 |
| Sulfur dioxide | $SO_2$ | 20 ppm | ≤ 10 |
| Tetrahydrothiophene | $C_4H_8S$ | 10 ppm | ≤ 5 |

(–) Indicates negative deviation

# DrägerSensor® XS EC Hydrazine

**Order no. 68 09 190**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 5100 | no | yes | 1 year | – |

## MARKET SEGMENTS

Rocket fuel, aircraft fuel (e.g. F-16), fuel for emergency power generators, for electrochemical power generation in secondary cells or in alkaline fuel cells, especially in space travel, submarines, and other military equipment.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.02 ppm |
| **Resolution:** | 0.01 ppm |
| **Measurement range:** | 0 to 3 ppm $N_2H_4$ (hydrazine) |
| | 0 to 3 ppm $CH_3NH\text{-}NH_2$ (methyl hydrazine) |
| | 0 to 3 ppm $(CH_3)_2N\text{-}NH_2$ (dimethylhydrazine) |
| **Response time:** | ≤ 180 seconds at 20 °C or 68 °F ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.01 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 0.01 ppm/month |
| Sensitivity: | ≤ ± 5% of measured value/month |
| **Warm-up time:** | ≤ 1 hour |
| **Ambient conditions** | |
| Temperature: | (–20 to 50)°C (–4 to 122)°F |
| Humidity: | (15 to 95)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.1% of measured value/% RH |
| **Test gas:** | $N_2H_4$, MMH or UDMH |

## SPECIAL CHARACTERISTICS

This sensor is used exclusively in the Dräger X-am 5100 for monitoring concentrations of hydrazine ($N_2H_4$), methyl hydrazine ($CH_3NH\text{-}NH_2$), and dimethylhydrazine ($(CH_3)_2N\text{-}NH_2$).

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of hydrazine. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $N_2H_4$ |
|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1,000 ppm | No effect |
| Ammonia | $NH_3$ | 250 ppm | ≤ 2.5 |
| Carbon dioxide | $CO_2$ | 100 Vol. % | No effect |
| Carbon monoxide | CO | 1,000 ppm | No effect |
| Chlorine | $Cl_2$ | 10 ppm | ≤ 0.1(–) |
| Ethanol | $C_2H_5OH$ | 130 ppm | No effect |
| Ethene | $C_2H_4$ | 20 ppm | No effect |
| Hydrogen | $H_2$ | 1,000 ppm | No effect |
| Hydrogen sulfide | $H_2S$ | 20 ppm | ≤ 0.25 |
| i-propanol | $(CH_3)_2CHOH$ | 1,000 ppm | No effect |
| Methane | $CH_4$ | 3 Vol. % | No effect |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 0,05 |
| Nitrogen monoxide | NO | 25 ppm | ≤ 0.05 |
| Propane | $C_3H_8$ | 1.5 Vol. % | No effect |
| Sulfur dioxide | $SO_2$ | 10 ppm | No effect |

(–) Indicates negative deviation

# DrägerSensor® XS EC Hydrazine D

**Order no. 68 10 295**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger Pac III S / E* | yes | yes | 6 months | – |

## MARKET SEGMENTS

Rocket fuel, aircraft fuel (e.g. F-16), fuel for emergency power generators, for electrochemical power generation in secondary cells or in alkaline fuel cells, especially in space travel, submarines, and other military equipment.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.02 ppm |
| **Resolution:** | 0.01 ppm |
| **Measurement range:** | 0 to 3 ppm $N_2H_4$ (hydrazine) |
| | 0 to 3 ppm $CH_3NH\text{-}NH_2$ (methyl hydrazine) |
| | 0 to 3 ppm $(CH_3)_2N\text{-}NH_2$ (dimethylhydrazine) |
| **Response time:** | ≤ 180 seconds at 20 °C or 68 °F ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.01 ppm |
| Sensitivity: | ≤ ± 10% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 0.01 ppm/month |
| Sensitivity: | ≤ ± 20% of measured value/6 months |
| **Warm-up time:** | ≤ 1 hour |
| **Ambient conditions** | |
| Temperature: | (–20 to 50)°C (–4 to 122)°F |
| Humidity: | (15 to 95)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.1% of measured value/% RH |
| **Test gas:** | $N_2H_4$ test gas between 40% and 100% of the highest figure in the set measurement range; or of one of the other target gases: MMH or UDMH |

*The DrägerSensor XS EC Hydrazine D can be ordered as a replacement sensor for the Dräger Pac III S/E. The Dräger Pac III will no longer be sold at the end of 2011. The DrägerSensor XS EC Hydrazine used in combination with the Dräger X-am 5100 can then be used to monitor hydrazine concentrations.

## SPECIAL CHARACTERISTICS

This sensor is used exclusively in the Dräger Pac III for monitoring concentrations of hydrazine ($N_2H_4$), methyl hydrazine ($CH_3NH\text{-}NH_2$), and dimethylhydrazine ($(CH_3)_2N\text{-}NH_2$). Hydrazines tend to be adsorbed by surfaces, which means a special sensor cap should be used (order no. 68 09 541). This sensor does not have to be recalibrated during its limited life span.

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of hydrazine. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $N_2H_4$ |
|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1,000 ppm | No effect |
| Ammonia | $NH_3$ | 250 ppm | ≤ 2.5 |
| Carbon dioxide | $CO_2$ | 100 Vol. % | No effect |
| Carbon monoxide | CO | 1,000 ppm | No effect |
| Chlorine | $Cl_2$ | 10 ppm | ≤ 0.1(–) |
| Ethanol | $C_2H_5OH$ | 130 ppm | No effect |
| Ethene | $C_2H_4$ | 20 ppm | No effect |
| Hydrogen | $H_2$ | 1,000 ppm | No effect |
| Hydrogen sulfide | $H_2S$ | 20 ppm | ≤ 0.25 |
| i-propanol | $(CH_3)_2CHOH$ | 1,000 ppm | No effect |
| Methane | $CH_4$ | 3 Vol. % | No effect |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 0.05 |
| Nitrogen monoxide | NO | 25 ppm | ≤ 0.05 |
| Propane | $C_3H_8$ | 1.5 Vol. % | No effect |
| Sulfur dioxide | $SO_2$ | 10 ppm | No effect |

(–) Indicates negative deviation

# DrägerSensor® XS EC Hydride

**Order no. 68 09 135**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 1 year | – |

## MARKET SEGMENTS

Inorganic chemicals, industry, fumigation, pre entry measurement.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.02 ppm |
| **Resolution:** | 0.01 ppm |
| **Measurement range:** | 0 to 20 ppm $PH_3$ (hydrogen phosphide) |
| | 0 to 20 ppm $AsH_3$ (arsine) |
| | 0 to 1 ppm $B_2H_6$ (diborane) |
| | 0 to 20 ppm $GeH_4$ (germanium tetrahydride) |
| | 0 to 50 ppm $SiH_4$ (silane) |
| **Response time:** | ≤ 10 seconds at 20 °C or 68 °F ($T_{90}$) for $PH_3$, $B_2H_6$, $SiH_4$ |
| | ≤ 20 seconds at 20 °C or 68 °F ($T_{90}$) for $AsH_3$, $GeH_4$ |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.02 ppm for $PH_3$, $B_2H_6$, $SiH_4$, $GeH_4$ |
| | ≤ ± 0.05 ppm for $AsH_3$ |
| Sensitivity: | ≤ ± 2% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 0.02 ppm/month |
| Sensitivity: | ≤ ± 2% of measured value/month for $PH_3$, $AsH_3$ |
| | ≤ ± 3% of measured value/month for $SiH_4$ |
| | ≤ ± 5% of measured value/month for $B_2H_6$, $GeH_4$ |
| **Warm-up time:** | ≤ 15 minutes |
| **Ambient conditions** | |
| Temperature: | (–20 to 50)°C (–4 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.02 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.02 ppm |
| Sensitivity: | ≤ ± 0.05% of measured value/% RH |
| **Test gas:** | approx. 0.5 ppm $PH_3$ test gas or one of the other target gases: |
| | $AsH_3$, $B_2H_6$, $GeH_4$, $SiH_4$ |

## SPECIAL CHARACTERISTICS

This sensor can be used to monitor the concentration of $PH_3$ (hydrogen phosphide), $AsH_3$ (arsine), $B_2H_6$ (diborane), $GeH_4$ (germanium tetrahydride) or $SiH_4$ (silane) in the ambient air. It is sufficient to calibrate the sensor using a $PH_3$ test gas; by doing so all of the other target gases are then automatically calibrated.

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of hydride. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $PH_3$ |
|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1,000 ppm | No effect |
| Ammonia | $NH_3$ | 250 ppm | No effect |
| Carbon dioxide | $CO_2$ | 1.5 Vol. % | No effect |
| Carbon monoxide | CO | 150 ppm | ≤ 0.1 |
| Chlorine | $Cl_2$ | 10 ppm | ≤ 2(–) |
| Ethene | $C_2H_4$ | 1,000 ppm | ≤ 0,2 |
| Ethine | $C_2H_2$ | 200 ppm | ≤ 12 |
| Formaldehyde | HCHO | 50 ppm | ≤ 0.15 |
| Hydrogen | $H_2$ | 1,000 ppm | ≤ 0.25 |
| Hydrogen cyanide | HCN | 50 ppm | ≤ 2 |
| Hydrogen sulfide | $H_2S$ | 20 ppm | ≤ 20 |
| i-propanol | $(CH_3)_2CHOH$ | 1 Vol. % | No effect |
| Methane | $CH_4$ | 4 Vol. % | No effect |
| Methanol | $CH_3OH$ | 200 ppm | No effect |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 5(–) |
| Nitrogen monoxide | NO | 20 ppm | No effect |
| Sulfur dioxide | $SO_2$ | 10 ppm | ≤ 2 |

(–) Indicates negative deviation

# DrägerSensor® XS EC $NH_3$

**Order no. 68 09 145**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 1 year | – |

## MARKET SEGMENTS

Food and beverage, poultry farming, power generation, inorganic chemicals, fertilizer production, analysis of chemical war agents, hazmat, fumigation, metal processing, petrochemicals, pulp and paper.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 3 ppm |
| **Resolution:** | 1 ppm |
| **Measurement range:** | 0 to 300 ppm $NH_3$ (ammonia) |
| **Response time:** | ≤ 20 seconds at 20 °C or 68 °F ($T_{50}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 3 ppm |
| Sensitivity: | ≤ ± 3% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 2 ppm/month |
| Sensitivity: | ≤ ± 2% of measured value/month |
| **Warm-up time:** | ≤ 12 hours |
| **Ambient conditions** | |
| Temperature: | (–40 to 50)°C (–40 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 5 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.1 ppm/% RH |
| Sensitivity: | ≤ ± 0.2% of measured value/% RH |
| **Test gas:** | approx. 50 to 100 ppm $NH_3$ |

## SPECIAL CHARACTERISTICS

The quick response time of this sensor provides a fast and reliable warning against ammonia.

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $NH_3$. To be sure, please check if gas mixtures are present. .

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $NH_3$ |
|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1,000 ppm | No effect |
| Carbon dioxide | $CO_2$ | 1.5 Vol. % | ≤ 5(–) |
| Carbon monoxide | CO | 200 ppm | No effect |
| Chlorine | $Cl_2$ | 10 ppm | ≤ 20(–) |
| Ethene | $C_2H_4$ | 1,000 ppm | ≤ 3 |
| Ethine | $C_2H_2$ | 200 ppm | No effect |
| Hydrogen | $H_2$ | 1,000 ppm | ≤ 3 |
| Hydrogen cyanide | HCN | 25 ppm | ≤ 3 |
| Hydrogen sulfide | $H_2S$ | 20 ppm | ≤ 50 |
| Methane | $CH_4$ | 10 Vol. % | No effect |
| Methanol | $CH_3OH$ | 200 ppm | ≤ 3 |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 10(–) |
| Nitrogen monoxide | NO | 20 ppm | ≤ 10 |
| Phosphine | $PH_3$ | 5 ppm | ≤ 8 |
| Sulfur dioxide | $SO_2$ | 20 ppm | No effect |
| Tetrahydrothiophene | $C_4H_8S$ | 10 ppm | ≤ 10 |

(–) Indicates negative deviation

# DrägerSensor® XS EC NO

**Order no. 68 09 125**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 1 year | – |

## MARKET SEGMENTS

Power plants, district heating plants

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 1 ppm |
| **Resolution:** | 0.5 ppm |
| **Measurement range:** | 0 to 200 ppm NO (nitrogen monoxide) |
| **Response time:** | ≤ 30 seconds at 20 °C or 68 °F ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 1 ppm |
| Sensitivity: | ≤ ± 3% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 1 ppm/month |
| Sensitivity: | ≤ ± 3% of measured value/month |
| **Warm-up time:** | ≤ 18 hours |
| **Ambient conditions** | |
| Temperature: | (–40 to 50)°C (–40 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.01 ppm/K |
| Sensitivity: | ≤ ± 0.2% of measured value/K |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.01 ppm/% RH |
| Sensitivity: | ≤ ± 0.05% of measured value/% RH |
| **Test gas:** | approx. 10 to 25 ppm NO test gas |

## SPECIAL CHARACTERISTICS

This sensor enables a selective measurement of NO. It also offers a very fast response time and excellent linearity across its entire measurement range.

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of NO. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm NO |
|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1,000 ppm | No effect |
| Ammonia | $NH_3$ | 500 ppm | No effect |
| Benzene | $C_6H_6$ | 0.6 Vol. % | No effect |
| Carbon dioxide | $CO_2$ | 5 Vol. % | No effect |
| Carbon monoxide | CO | 2,000 ppm | No effect |
| Chlorine | $Cl_2$ | 5 ppm | No effect |
| Ethanol | $C_2H_5OH$ | 250 ppm | No effect |
| Ethene | $C_2H_4$ | 0.1 Vol. % | No effect |
| Ethine | $C_2H_2$ | 0.8 Vol. % | ≤ 2 |
| Hydrogen | $H_2$ | 5 Vol. % | ≤ 2 |
| Hydrogen chloride | HCl | 40 ppm | No effect |
| Hydrogen cyanide | HCN | 50 ppm | No effect |
| Hydrogen sulfide | $H_2S$ | 5 ppm | ≤ 5 |
| Methane | $CH_4$ | 2 Vol. % | No effect |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 1 |
| Phosphine | $PH_3$ | 2 ppm | ≤ 2 |
| Propane | $C_3H_8$ | 1 Vol. % | No effect |
| Sulfur dioxide | $SO_2$ | 10 ppm | ≤ 2 |
| Tetrachloroethylene | $CCl_2$ $CCl_2$ | 1,000 ppm | No effect |
| Toluene | $C_6H_5CH_3$ | 0.6 Vol. % | No effect |
| Trichloroethylene | $CHClCCl_2$ | 1,000 ppm | No effect |

# DrägerSensor® XS EC $NO_2$

**Order no. 68 09 155**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 1 year | – |

## MARKET SEGMENTS

Inorganic chemicals, metal processing, oil and gas, petrochemicals, steel, shipping, rocket engineering, mining and tunneling.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.5 ppm |
| **Resolution:** | 0.1 ppm |
| **Measurement range:** | 0 to 50 ppm $NO_2$ (nitrogen dioxide) |
| **Response time:** | ≤ 15 seconds at 20 °C or 68 °F ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.5 ppm |
| Sensitivity: | ≤ ± 2% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 1 ppm/month |
| Sensitivity: | ≤ ± 2% of measured value/month |
| **Warm-up time:** | ≤ 15 minutes |
| **Ambient conditions** | |
| Temperature: | (–40 to 50)°C (–40 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 1 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.2% of measured value/% RH |
| **Test gas:** | approx. 5 to 50 ppm $NO_2$ test gas |

## SPECIAL CHARACTERISTICS

This sensor offers a fast response time and stable readings, even after experiencing high concentrations of nitrogen dioxide.

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $NO_2$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $NO_2$ |
|---|---|---|---|
| Acetaldehyde | $CH_3CHO$ | 500 ppm | No effect |
| Acetone | $CH_3COCH_3$ | 1,000 ppm | No effect |
| Ammonia | $NH_3$ | 200 ppm | No effect |
| Carbon dioxide | $CO_2$ | 2.5 Vol. % | No effect |
| Carbon monoxide | CO | 125 ppm | No effect |
| Chlorine | $Cl_2$ | 10 ppm | ≤ 10 |
| Ethene | $C_2H_4$ | 1,000 ppm | ≤ 1(–) |
| Ethine | $C_2H_2$ | 200 ppm | ≤ 60(–) |
| Formaldehyde | HCHO | 50 ppm | No effect |
| Hydrogen | $H_2$ | 1,000 ppm | ≤ 2(–) |
| Hydrogen cyanide | HCN | 50 ppm | ≤ 10(–) |
| Hydrogen sulfide | $H_2S$ | 20 ppm | ≤ 100(–) |
| Methane | $CH_4$ | 5 Vol. % | No effect |
| Methanol | $CH_3OH$ | 175 ppm | No effect |
| Nitrogen monoxide | NO | 20 ppm | No effect |
| Phosphine | $PH_3$ | 5 ppm | ≤ 25(–) |
| Sulfur dioxide | $SO_2$ | 50 ppm | ≤ 50(–) |
| Tetrahydrothiophene | $C_4H_8S$ | 10 ppm | ≤ 5(–) |

(–) Indicates negative deviation

# DrägerSensor® XS EC Odorant

**Order no. 68 09 200**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 1 year | B2T, 68 09 198 – replaceable<br>Cross sensitivities from acidic gases ($H_2S$, $SO_2$) are largely eliminated |

## MARKET SEGMENTS

Gas supply companies

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 1 ppm |
| **Resolution:** | 0.5 ppm |
| **Measurement range:** | 0 to 40 ppm $C_4H_8S$ (tetrahydrothiophene) |
| | 0 to 40 ppm $(CH_3)_3CSH$ (t-butyl mercaptan) |
| | 0 to 40 ppm $C_2H_5CH(CH_3)SH$ (sec-butyl mercaptan) |
| | 0 to 40 ppm $CH_3SH$ (methyl mercaptan) |
| | 0 to 40 ppm $C_2H_5SH$ (ethyl mercaptan) |
| | 0 to 100 ppm $(CH_3)_2S$ (dimethyl sulfide) |
| | 0 to 40 ppm $CH_3SSCH_3$ (dimethyl disulfide) |
| **Response time:** | ≤ 90 seconds at 20 °C or 68 °F ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 1 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 1 ppm/month |
| Sensitivity: | ≤ ± 3% of measured value/month |
| **Warm-up time:** | ≤ 12 hours |
| **Ambient conditions** | |
| Temperature: | (–20 to 50)°C (–4 to 122)°F for THT, TBM, SBM |
| | (5 to 40)°C (32 to 104)°F for MeM, EtM, DMS, DMDS |
| Humidity: | (0 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 1 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.01 ppm/% RH |
| Sensitivity: | ≤ ± 0.1% of measured value/% RH |
| **Test gas:** | THT test gas between 40% and 100% of the highest figure in the set measurement range; or of one of the other target gases: TBM, SBM, MeM, EtM, DMS, DMDS |

## SPECIAL CHARACTERISTICS

This sensor can be used to monitor seven different odorants in the ambient air or (for short periods) in natural gas. It is sufficient to calibrate the sensor using a THT test gas. By doing so, all of the other target gases are then automatically calibrated.

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of THT. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm THT without selective filter | Display in ppm THT with selective filter |
|---|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1,000 ppm | ≤ 3 | ≤ 3 |
| Ammonia | $NH_3$ | 200 ppm | No effect | No effect |
| Carbon dioxide | $CO_2$ | 1.5 Vol. % | No effect | No effect |
| Carbon monoxide | CO | 125 ppm | ≤ 3 | ≤ 3 |
| Chlorine | $Cl_2$ | 8 ppm | ≤ 3(–) | No effect |
| Ethene | $C_2H_4$ | 50 ppm | No effect | No effect |
| Hydrogen | $H_2$ | 1,000 ppm | ≤ 2 | ≤ 2 |
| Hydrogen cyanide | HCN | 50 ppm | No effect | No effect |
| Hydrogen sulfide | $H_2S$ | 10 ppm | ≤ 30 | No effect |
| Methane | $CH_4$ | 100 Vol. % | No effect | No effect |
| Methanol | $CH_3OH$ | 175 ppm | ≤ 8 | ≤ 8 |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 2 | ≤ 2 |
| Nitrogen monoxide | NO | 20 ppm | ≤ 30 | ≤ 30 |
| n-propyl mercaptan | $C_3H_7SH$ | 6 ppm | ≤ 4 | ≤ 4 |
| Phosphine | $PH_3$ | 5 ppm | ≤ 15 | ≤ 15 |
| Sulfur dioxide | $SO_2$ | 20 ppm | ≤ 15 | No effect |

(–) Indicates negative deviation

# DrägerSensor® XS EC OV

**Order no. 68 09 115**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 1 year | – |

## MARKET SEGMENTS

Production of plastics, painter, chemical industry, disinfection, pest control.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 1 ppm |
| **Resolution:** | 0.5 ppm |
| **Measurement range:** | 0 to 200 ppm $C_2H_4O$ (ethylene oxide) |
| | 0 to 200 ppm $C_3H_6O$ (propylene oxide) |
| | 0 to 100 ppm $C_2H_4$ (ethene) |
| | 0 to 100 ppm $C_3H_6$ (propene) |
| | 0 to 100 ppm $C_2H_3Cl$ (vinyl chloride) |
| | 0 to 100 ppm $CH_3OH$ (methanol) |
| | 0 to 300 ppm $C_2H_5OH$ (ethanol) |
| | 0 to 200 ppm $CH_3CHO$ (acetaldehyde) |
| | 0 to 100 ppm $CH_2CHCHCH_2$ (butadiene) |
| | 0 to 100 ppm HCHO (formaldehyde) |
| | 0 to 100 ppm $CH_3COOC_2H_3$ (vinyl acetate) |
| | 0 to 300 ppm $(H_3C)_2CHOH$ (isopropanol) |
| **Response time:** | ≤ 90 seconds at 20 °C or 68 °F ($T_{50}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 3 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 2 ppm/month |
| Sensitivity: | ≤ ± 5% of measured value/month |
| **Warm-up time:** | ≤ 18 hours |
| **Ambient conditions** | |
| Temperature: | (–20 to 50)°C (–4 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.1 ppm/K at (–20 to 40)°C (–4 to 104)°F |
| Zero point: | ≤ ± 1 ppm/K at (40 to 50)°C (104 to 122)°F |
| Sensitivity: | ≤ ± 1% of measured value/K |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.2% of measured value/% RH |
| **Test gas:** | approx. 10 ppm $C_2H_4O$ test gas or one of the other target gases |

## SPECIAL CHARACTERISTICS

This sensor is especially suited to detect leakages of numerous organic gases and vapors. Although it does not detect as broad a spectrum of gases as a PID, it has the key advantage of being almost completely insensitive to moisture. It also does not need to be calibrated every day, having instead a six-month calibration interval typical of electrochemical sensors. Furthermore, for the majority of gases it is enough to calibrate it using ethylene oxide, whereby all other gases are automatically calibrated as well. The exceptions are ethyne, tetrahydrofuran, and diethyl ether, which have to be calibrated using the target gas.

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of ethylene oxide. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $C_2H_4O$ |
|---|---|---|---|
| Acetic acid | $CH_3COOH$ | 100 ppm | No effect |
| Acetone | $CH_3COCH_3$ | 1,000 ppm | ≤ 15 |
| Ammonia | $NH_3$ | 100 ppm | No effect |
| Benzene | $C_6H_6$ | 2,000 ppm | No effect |
| Carbon dioxide | $CO_2$ | 30 Vol. % | No effect |
| Carbon monoxide | CO | 100 ppm | ≤ 56 |
| Chlorine | $Cl_2$ | 10 ppm | No effect |
| Chlorobenzene | $C_6H_5Cl$ | 200 ppm | No effect |
| Dichloromethane | $CH_2Cl_2$ | 1,000 ppm | No effect |
| Dimethyl disulfide | $(CH_3)_2S_2$ | 50 ppm | ≤ 65 |
| Dimethyl sulfide | $(CH_3)_2S$ | 50 ppm | ≤ 40 |
| Dimethylformamide | $HCON(CH_3)_2$ | 100 ppm | No effect |
| Ethane | $C_2H_6$ | 0.2 Vol. % | No effect |
| Ethyl acetate | $CH_3COOC_2H_5$ | 100 ppm | No effect |
| Gasoline, F 50 | – | 700 ppm | ≤ 20 |
| Gasoline, FAM regular gasoline | – | 0.5 Vol. % | ≤ 3 |
| Gasoline, premium unleaded | – | 700 ppm | ≤ 70 |
| Hydrogen | $H_2$ | 5,000 ppm | ≤ 50 |
| Hydrogen chloride | HCl | 40 ppm | ≤ 10 |
| Hydrogen cyanide | HCN | 20 ppm | ≤ 20 |
| Hydrogen sulfide | $H_2S$ | 10 ppm | ≤ 20 |
| Methane | $CH_4$ | 2 Vol. % | No effect |
| Methanethiol | $CH_3SH$ | 50 ppm | ≤ 75 |
| Methyl isobutyl ketone | $(CH_3)_2CHCH_2COCH_3$ | 500 ppm | No effect |
| Nitrogen dioxide | $NO_2$ | 50 ppm | ≤ 5 |
| Nitrogen monoxide | NO | 25 ppm | ≤ 25 |
| Phenol | $C_6H_5OH$ | 30 ppm | ≤ 6 |
| Phosgene | $COCl_2$ | 50 ppm | No effect |
| Propane | $C_3H_8$ | 1 Vol. % | ≤ 3 |
| Sulfur dioxide | $SO_2$ | 10 ppm | ≤ 4 |
| Tetrachloroethylene | $CCl_2$ $CCl_2$ | 100 ppm | No effect |
| Toluene | $C_6H_5CH_3$ | 1,000 ppm | No effect |
| Trichloroethylene | $CHClCCl_2$ | 1,000 ppm | No effect |
| Xylol | $C_6H_4(CH_3)_2$ | 0.2 Vol. % | No effect |

This sensor is not suitable for monitoring the limit values of ethylene oxide, propylene oxide, butadiene, formaldehyde, vinyl acetate or vinyl chloride.

# DrägerSensor® XS EC OV-A

**Order no. 68 09 522**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 1 year | – |

## MARKET SEGMENTS

Production of plastics, disinfection, painter, chemical industry.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 5 ppm |
| **Resolution:** | 0.5 ppm |
| **Measurement range:** | 0 to 100 ppm $C_2H_4O$ (ethylene oxide) |
| | 0 to 100 ppm $H_2CCHCN$ (acrylonitrile) |
| | 0 to 100 ppm $C_6H_5CHCH_2$ (styrol) |
| | 0 to 100 ppm $H_2CC(CH_3)COOCH_3$ (methyl methacrylate) |
| | 0 to 300 ppm $(CH_3)_2CCH_2$ (isobutylene) |
| | 0 to 100 ppm $C_2H_3OCH_2Cl$ (epichlorohydrin) |
| **Response time:** | ≤ 90 seconds at 20 °C or 68 °F ($T_{50}$) for EO, But, ClPO |
| | ≤ 300 seconds at 20 °C or 68 °F ($T_{50}$) for ACN, MMA, Styr |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 2 ppm |
| Sensitivity: | ≤ ± 20% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 2 ppm/month |
| Sensitivity: | ≤ ± 10% of measured value/month |
| **Warm-up time:** | ≤ 18 hours |
| **Ambient conditions** | |
| Temperature: | (–20 to 55)°C (–4 to 131)°F for EO, But, Styr, ClPO |
| | (5 to 40)°C (41 to 104)°F for ACN, MMA |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.2 ppm/K |
| Sensitivity: | ≤ ± 1% of measured value/K |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.1 ppm/% RH |
| Sensitivity: | ≤ ± 0.2% of measured value/% RH |
| **Test gas:** | approx. 10 ppm $C_2H_4O$ test gas or one of the other target gases ClPO, ACN, Styr, MMA, But |

## SPECIAL CHARACTERISTICS

The DrägerSensor® XS OV-A has the same excellent insensitivity to moisture that the other DrägerSensor® XS OVs have, but it has also been optimized for other organic gases and vapors. Target gas calibration is required for all gases. Because of the absorption effects of the gases it measures, dust filters cannot be used.

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of ethylene oxide. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $C_2H_4O$ |
|---|---|---|---|
| Acetic acid | $CH_3COOH$ | 100 ppm | No effect |
| Acetone | $CH_3COCH_3$ | 1,000 ppm | ≤ 15 |
| Ammonia | $NH_3$ | 100 ppm | No effect |
| Benzene | $C_6H_6$ | 2,000 ppm | No effect |
| Carbon dioxide | $CO_2$ | 30 Vol. % | No effect |
| Carbon monoxide | CO | 30 ppm | ≤ 15 |
| Chlorine | $Cl_2$ | 10 ppm | No effect |
| Chlorobenzene | $C_6H_5Cl$ | 200 ppm | No effect |
| Dichloromethane | $CH_2Cl_2$ | 1,000 ppm | No effect |
| Dimethyl disulfide | $(CH_3)_2S_2$ | 50 ppm | ≤ 65 |
| Dimethyl sulfide | $(CH_3)_2S$ | 50 ppm | ≤ 40 |
| Dimethylformamide | $HCON(CH_3)_2$ | 100 ppm | No effect |
| Ethyl acetate | $CH_3COOC_2H_5$ | 100 ppm | No effect |
| Gasoline, F 50 | – | 700 ppm | ≤ 20 |
| Hydrogen | $H_2$ | 5,000 ppm | ≤ 50 |
| Hydrogen chloride | HCl | 40 ppm | ≤ 10 |
| Hydrogen cyanide | HCN | 20 ppm | ≤ 20 |
| Hydrogen sulfide | $H_2S$ | 10 ppm | ≤ 20 |
| Methane | $CH_4$ | 2 Vol. % | No effect |
| Methanethiol | $CH_3SH$ | 50 ppm | ≤ 75 |
| Methyl isobutyl ketone | $(CH_3)_2CHCH_2COCH_3$ | 500 ppm | No effect |
| Nitrogen dioxide | $NO_2$ | 50 ppm | ≤ 5 |
| Nitrogen monoxide | NO | 25 ppm | ≤ 25 |
| Phenol | $C_6H_5OH$ | 30 ppm | ≤ 6 |
| Phosgene | $COCl_2$ | 50 ppm | No effect |
| Sulfur dioxide | $SO_2$ | 10 ppm | ≤ 4 |
| Trichloroethylene | $CHClCCl_2$ | 1,000 ppm | No effect |

# DrägerSensor® XS EC $O_2$-LS — Order no. 68 09 130
# DrägerSensor® XS 2 $O_2$ — 68 10 375
# DrägerSensor® XS R $O_2$ — 68 10 262
# DrägerSensor® XS $O_2$ microPac (Dräger X-am 3000 only) — 68 10 034

| Used in | Plug & Play | Replaceable | Guaranty* | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 3/2/5 years | – |

## MARKET SEGMENTS

Sewage, mining and tunneling, fumigation, biogas, measuring hazmat, industrial gases.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.1 Vol. % |
| **Resolution:** | 0.1 Vol. % |
| **Measurement range:** | 0 to 25 Vol. % $O_2$ (oxygen) |
| **Response time:** | ≤ 25 seconds at 20 °C or 68 °F ($T_{90}$) – XS EC |
| | ≤ 20 seconds at 20 °C or 68 °F ($T_{90}$) – XS 2 / XS R |
| | ≤ 32 seconds at 20 °C or 68 °F ($T_{90}$) – XS microPac |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.2 Vol. % |
| Sensitivity: | ≤ ± 1% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 0.5 Vol. %/year |
| Sensitivity: | ≤ ± 1% of measured value/month |
| **Warm-up time:** | ≤ 1 hour |
| **Ambient conditions** | |
| Temperature: | (–40 to 50)°C (–40 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.4 Vol. % XS EC / XS microPac |
| | ≤ ± 0.2 Vol. % XS 2 / XS R |
| Sensitivity: | ≤ ± 2% of measured value XS EC |
| | ≤ ± 1% of measured value XS R / XS 2 |
| | ≤ ± 4.5% of measured value XS microPac |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.002 Vol. %/% RH – XS EC / XS microPac |
| | No effect – XS 2 / XS R |
| Sensitivity: | ≤ ± 0.1% of measured value/% RH |
| **Test gas:** | $N_2$ (zero gas) |
| | approx. 18 Vol. % $O_2$ |

* DrägerSensor XS EC $O_2$ = three-year guaranty
DrägerSensor XS 2 $O_2$ = two-year guaranty
DrägerSensor XS R $O_2$ = five-year guaranty
DrägerSensor XS $O_2$ microPac = two-year guaranty

## SPECIAL CHARACTERISTICS

DrägerSensor® XS oxygen sensors are lead-free, thus complying with Directive 2002/95/EC (RoHS). Because they are non-consuming sensors, they have a much longer life spans than sensors that are consuming.

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $O_2$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES DrägerSensor® XS EC $O_2$ LS

| Gas/vapor | Chem. symbol | Concentration | Display in Vol. % $O_2$ |
|---|---|---|---|
| Chlorine | $Cl_2$ | 20 ppm | ≤ 0.1 |
| Carbon dioxide | $CO_2$ | 5 Vol. % | ≤ 0.1 |
| Carbon monoxide | CO | 0.5 Vol. % | ≤ 0.3(–) |
| Ethane | $C_2H_6$ | 5 Vol. % | ≤ 0.1 |
| Ethanol | $C_2H_5OH$ | 1 Vol. % | ≤ 0.2(–) |
| Ethene | $C_2H_4$ | 2 Vol. % | ≤ 0.5(–) |
| Ethine | $C_2H_2$ | 0.5 Vol. % | ≤ 0.2(–) |
| Hydrogen | $H_2$ | 1 Vol. % | ≤ 1.6(–) |
| Hydrogen chloride | HCl | 40 ppm | ≤ 0.1 |
| Hydrogen sulfide | $H_2S$ | 100 ppm | ≤ 0.1 |
| Methane | $CH_4$ | 10 Vol. % | ≤ 0.1 |
| Nitrogen dioxide | $NO_2$ | 50 ppm | ≤ 0.1 |
| Nitrogen monoxide | NO | 100 ppm | ≤ 0.1 |
| Propane | $C_3H_8$ | 2 Vol. % | ≤ 0.1 |
| Sulfur dioxide | $SO_2$ | 50 ppm | ≤ 0.1 |

(–) Indicates negative deviation

## RELEVANT CROSS-SENSITIVITIES DrägerSensor® XS 2 $O_2$

| Gas/vapor | Chem. symbol | Concentration | Display in Vol. % $O_2$ |
|---|---|---|---|
| Chlorine | $Cl_2$ | 20 ppm | No effect |
| Carbon dioxide | $CO_2$ | 5 Vol. % | No effect |
| Carbon monoxide | CO | 0.5 Vol. % | ≤ 0.3(–) |
| Ethane | $C_2H_6$ | 5 Vol. % | No effect |
| Ethanol | $C_2H_5OH$ | 1 Vol. % | ≤ 0.2(–) |
| Ethene | $C_2H_4$ | 2 Vol. % | ≤ 0.5(–) |
| Ethyne | $C_2H_2$ | 0.5 Vol. % | ≤ 0.2(–) |
| Hydrogen | $H_2$ | 1 Vol. % | ≤ 1.6(–) |
| Hydrogen chloride | HCl | 40 ppm | No effect |
| Hydrogen sulfide | $H_2S$ | 100 ppm | No effect |
| Methane | $CH_4$ | 10 Vol. % | No effect |
| Nitrogen dioxide | $NO_2$ | 50 ppm | No effect |
| Nitrogen monoxide | NO | 100 ppm | No effect |
| Propane | $C_3H_8$ | 2 Vol. % | No effect |
| Sulfur dioxide | $SO_2$ | 50 ppm | No effect |

## RELEVANT CROSS-SENSITIVITIES DrägerSensor® XS R $O_2$ LS

| Gas/vapor | Chem. symbol | Concentration | Display in Vol. % $O_2$ |
|---|---|---|---|
| Chlorine | $Cl_2$ | 20 ppm | No effect |
| Carbon dioxide | $CO_2$ | 5 Vol. % | No effect |
| Carbon monoxide | CO | 0.5 Vol. % | ≤ 0.3(–) |
| Ethane | $C_2H_6$ | 5 Vol. % | No effect |
| Ethanol | $C_2H_5OH$ | 1 Vol. % | ≤ 0.2(–) |
| Ethene | $C_2H_4$ | 2 Vol. % | ≤ 0.5(–) |
| Ethyne | $C_2H_2$ | 0.5 Vol. % | ≤ 0.2(–) |
| Hydrogen chloride | HCl | 40 ppm | No effect |
| Hydrogen sulfide | $H_2S$ | 100 ppm | No effect |
| Methane | $CH_4$ | 10 Vol. % | No effect |
| Nitrogen dioxide | $NO_2$ | 50 ppm | No effect |
| Nitrogen monoxide | NO | 100 ppm | No effect |
| Propane | $C_3H_8$ | 2 Vol. % | No effect |
| Sulfur dioxide | $SO_2$ | 50 ppm | No effect |

(–) Indicates negative deviation

## RELEVANT CROSS-SENSITIVITIES DrägerSensor® XS $O_2$ MICROPAC

| Gas/vapor | Chem. symbol | Concentration | Display in Vol. % $O_2$ |
|---|---|---|---|
| Chlorine | $Cl_2$ | 20 ppm | ≤ 0.1 |
| Carbon dioxide | $CO_2$ | 5 Vol. % | ≤ 0.1 |
| Carbon monoxide | CO | 0.5 Vol. % | ≤ 0.3(–) |
| Ethane | $C_2H_6$ | 5 Vol. % | ≤ 0.1 |
| Ethanol | $C_2H_5OH$ | 1 Vol. % | ≤ 0.2(–) |
| Ethene | $C_2H_4$ | 2 Vol. % | ≤ 0.5(–) |
| Ethine | $C_2H_2$ | 0.5 Vol. % | ≤ 0.2(–) |
| Hydrogen | $H_2$ | 1 Vol. % | ≤ 1.6(–) |
| Hydrogen chloride | HCl | 40 ppm | ≤ 0.1 |
| Hydrogen sulfide | $H_2S$ | 100 ppm | ≤ 0.1 |
| Methane | $CH_4$ | 10 Vol. % | ≤ 0.1 |
| Nitrogen dioxide | $NO_2$ | 50 ppm | ≤ 0.1 |
| Nitrogen monoxide | NO | 100 ppm | ≤ 0.1 |
| Propane | $C_3H_8$ | 2 Vol. % | ≤ 0.1 |
| Sulfur dioxide | $SO_2$ | 50 ppm | ≤ 0.1 |

(–) Indicates negative deviation

# DrägerSensor® XS EC $O_2$ 100

**Order no. 68 09 550**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 1 year | – |

## MARKET SEGMENTS

Sewage, mining and tunneling, fumigation, biogas, hazmat, industrial gases.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.5 Vol. % |
| **Resolution:** | 0.5 Vol. % |
| **Measurement range:** | 0 to 100 Vol. % $O_2$ (oxygen) |
| **Response time:** | ≤ 5 seconds at 20 °C or 68 °F ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.5 Vol. % |
| Sensitivity: | ≤ ± 1% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 0.5 Vol. %/year |
| Sensitivity: | ≤ ± 3% of measured value/month |
| **Warm-up time:** | ≤ 1 hour |
| **Ambient conditions** | |
| Temperature: | (0 to 45)°C (32 to 133)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,100) hPa |
| **Influence of temperature** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.01% of measured value/% RH |
| **Test gas:** | $N_2$ (zero gas) |
| | approx. 18 Vol. % $O_2$ |

## SPECIAL CHARACTERISTICS

This sensor can be used for measuring oxygen concentrations of up to 100 Vol. % $O_2$ in the ambient air. The principle upon which the sensor is based is the measurement of the partial oxygen pressure, which means it can also measure oxygen in inert gases like nitrogen, argon, and helium.

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $O_2$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in Vol. %$O_2$ |
|---|---|---|---|
| Carbon dioxide | $CO_2$ | 5 Vol. % | ≤ 1(–) |
| Chlorine | $Cl_2$ | 20 ppm | No effect |
| Helium | He | 50 Vol. % | ≤ 1(–) |
| Hydrogen chloride | HCl | 40 ppm | No effect |
| Hydrogen sulfide | $H_2S$ | 100 ppm | No effect |
| Methane | $CH_4$ | 10 Vol. % | No effect |
| Nitrogen dioxide | $NO_2$ | 50 ppm | No effect |
| Nitrogen monoxide | NO | 0.05 Vol. % | ≤ 1(–) |
| Propane | $C_3H_8$ | 2 Vol. % | No effect |
| Sulfur dioxide | $SO_2$ | 50 ppm | No effect |

(–) Indicates negative deviation

# DrägerSensor® XS EC $PH_3$ HC

**Order no. 68 09 535**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 1 year | – |

## MARKET SEGMENTS

Inorganic chemicals, industry, fumigation, pre entry measurements.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 2 ppm |
| **Resolution:** | 1 ppm |
| **Measurement range:** | 0 to 1,000 ppm $PH_3$ (phosphine) |
| **Response time:** | ≤ 10 seconds at 20 °C or 68 °F ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 1 ppm |
| Sensitivity: | ≤ ± 3% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 1 ppm/month |
| Sensitivity: | ≤ ± 3% of measured value/month |
| **Warm-up time:** | ≤ 15 minutes |
| **Ambient conditions** | |
| Temperature: | (–40 to 50)°C (–40 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.05% of measured value/% RH |
| **Test gas:** | approx. 20 to 50 ppm $PH_3$ |

## SPECIAL CHARACTERISTICS

This sensor demonstrates excellent linearity across the whole measurement range even if calibrated in the lower levels of that range, and it also provides a stable reading even at high concentrations over long periods of time.

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of phosphine. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $PH_3$ |
|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1.25 Vol. % | No effect |
| Ammonia | $NH_3$ | 50 ppm | No effect |
| Arsine | $AsH_3$ | 5 ppm | ≤ 4 |
| Carbon dioxide | $CO_2$ | 10 Vol. % | No effect |
| Carbon monoxide | CO | 300 ppm | No effect |
| Chlorine | $Cl_2$ | 5 ppm | No effect |
| Diborane | $B_2H_6$ | 5 ppm | ≤ 3 |
| Ethanol | $C_2H_5OH$ | 250 ppm | No effect |
| Ethene | $C_2H_4$ | 200 ppm | No effect |
| Germanium tetrahydride | $GeH_4$ | 5 ppm | ≤ 5 |
| Hydrogen | $H_2$ | 1,000 ppm | No effect |
| Hydrogen chloride | HCl | 20 ppm | No effect |
| Hydrogen cyanide | HCN | 25 ppm | ≤ 2 |
| Hydrogen selenide | $H_2Se$ | 5 ppm | ≤ 2 |
| Hydrogen sulfide | $H_2S$ | 20 ppm | ≤ 20 |
| i-propanol | $(CH_3)CHOH$ | 1 Vol. % | No effect |
| Methane | $CH_4$ | 4 Vol. % | No effect |
| Methanol | $CH_3OH$ | 200 ppm | No effect |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 5(–) |
| Nitrogen monoxide | NO | 20 ppm | No effect |
| Silane | $SiH_4$ | 5 ppm | ≤ 5 |
| Sulfur dioxide | $SO_2$ | 10 ppm | ≤ 2 |
| Toluene | $C_6H_5CH_3$ | 1 Vol. % | No effect |
| Trimethylboron | $B(CH_3)_3$ | 1 ppm | No effect |

(–) Indicates negative deviation

# DrägerSensor® XS EC $SO_2$

**Order no. 68 09 160**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 7000 | yes | yes | 1 year | K1T, 68 09 163 – replaceable<br>Eliminates cross-sensitivity to hydrogen sulfide ($H_2S$). |

## MARKET SEGMENTS

Food industry, pest control, mining, oil and gas, petrochemicals, pulp and paper, shipping, steel

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.5 ppm |
| **Resolution:** | 0.1 ppm |
| **Measurement range:** | 0 to 100 ppm $SO_2$ (sulfur dioxide) |
| **Response time:** | ≤ 20 seconds at 20 °C or 68 °F ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.2 ppm |
| Sensitivity: | ≤ ± 2% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 1 ppm/month |
| Sensitivity: | ≤ ± 2% of measured value/month |
| **Warm-up time:** | ≤ 15 minutes |
| **Ambient conditions** | |
| Temperature: | (–40 to 50)°C (–40 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 1 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.002 ppm/% RH |
| Sensitivity: | ≤ ± 0.2% of measured value/% RH |
| **Test gas:** | approx. 10 ppm $SO_2$ test gas |

## SPECIAL CHARACTERISTICS

In addition to a fast response time and excellent linearity, this sensor is highly selective if the selective filter is used. The K1T selective filter (order no. 68 09 163) is an accessory for the DrägerSensor® XS EC $SO_2$ and eliminates the sensor's cross-sensitivity to hydrogen sulfide. The filter has a lifetime of 2,000 ppm × hours, which means that at a hydrogen sulfide concentration of 1 ppm it can be used for 2,000 hours.

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $SO_2$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $SO_2$ without selective filter |
|---|---|---|---|
| Acetaldehyde | $CH_3CHO$ | 500 ppm | ≤ 0.5 |
| Acetone | $CH_3COCH_3$ | 1,000 ppm | ≤ 0.5 |
| Ammonia | $NH_3$ | 200 ppm | ≤ 0.5 |
| Carbon dioxide | $CO_2$ | 30 Vol. % | ≤ 0.5 |
| Carbon monoxide | CO | 125 ppm | ≤ 0.5 |
| Chlorine | $Cl_2$ | 5 ppm | ≤ 5(–) |
| Ethene | $C_2H_4$ | 50 ppm | ≤ 0.5 |
| Ethine | $C_2H_2$ | 200 ppm | ≤ 60 |
| Formaldehyde | HCHO | 50 ppm | ≤ 1 |
| Hydrogen cyanide | HCN | 20 ppm | ≤ 10 |
| Hydrogen | $H_2$ | 1,000 ppm | ≤ 2 |
| Hydrogen sulfide | $H_2S$ | 20 ppm | ≤ 100 |
| Methane | $CH_4$ | 2 Vol. % | ≤ 0.5 |
| Methanol | $CH_3OH$ | 175 ppm | ≤ 0.5 |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 20(–) |
| Nitrogen monoxide | NO | 20 ppm | ≤ 0.5 |
| Phosphine | $PH_3$ | 5 ppm | ≤ 50 |
| Tetrahydrothiophene | $C_4H_8S$ | 10 ppm | ≤ 5 |

(–) Indicates negative deviation

# DrägerSensor® XS EC THT

**Order no. 68 09 195**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger Pac III S / E* | yes | yes | 1 year | B2T, 68 09 198 – replaceable<br>Cross sensitivities from acidic gases ($H_2S$, $SO_2$) are largely eliminated |

## MARKET SEGMENTS

Gas supply companies

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 3 mg/m³ |
| **Resolution:** | 1 mg/m³ |
| **Measurement range:** | 0 to 100 mg/m³ THT (tetrahydrothiophene) |
| **Response time:** | ≤ 90 seconds at 20 °C or 68 °F ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 3 mg/m³ |
| Sensitivity: | ≤ ± 5% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 3 mg/m³/month |
| Sensitivity: | ≤ ± 3% of measured value/month |
| **Warm-up time:** | ≤ 12 hours |
| **Ambient conditions** | |
| Temperature: | (–20 to 50)°C (–4 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 3 mg/m³ |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.04 mg/m³/% RH |
| Sensitivity: | ≤ ± 0.01% of measured value/% RH |
| **Test gas:** | THT test gas between 40% and 100% of the highest figure within the set measurement range. |

The DrägerSensor XS EC THT can be ordered as a replacement sensor for the Dräger Pac III S/E. The Dräger Pac III will no longer be sold at the end of 2011. The DrägerSensor XS EC Odorant used in combination with the Dräger X-am 5000/5600 can then be used to monitor THT concentrations.

## SPECIAL CHARACTERISTICS

THT (tetrahydrothiophene) is one of the most common odorants. This sensor is suitable for measuring THT concentrations in the ambient air. Using an internal, replaceable selective filter, the sensor is able to distinguish THT effectively from $SO_2$ and $H_2S$.

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of THT. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in mg/m³ THT without selective filter | Display in mg/m³ THT with selective filter |
|---|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1,000 ppm | ≤ 10 | ≤ 10 |
| Ammonia | $NH_3$ | 200 ppm | No effect | No effect |
| Carbon dioxide | $CO_2$ | 1.5 Vol. % | No effect | No effect |
| Carbon monoxide | CO | 125 ppm | ≤ 10 | ≤ 10 |
| Chlorine | $Cl_2$ | 8 ppm | ≤ 10(–) | ≤ 3(–) |
| Ethene | $C_2H_4$ | 50 ppm | No effect | No effect |
| Hydrogen | $H_2$ | 1,000 ppm | ≤ 5 | ≤ 5 |
| Hydrogen cyanide | HCN | 50 ppm | No effect | No effect |
| Hydrogen sulfide | $H_2S$ | 10 ppm | ≤ 100 | No effect |
| Methane | $CH_4$ | 100 Vol. % | No effect | No effect |
| Methanol | $CH_3OH$ | 175 ppm | ≤ 25 | ≤ 25 |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 7 | ≤ 7 |
| Nitrogen monoxide | NO | 20 ppm | ≤ 90 | ≤ 90 |
| Phosphine | $PH_3$ | 5 ppm | ≤ 50 | ≤ 50 |
| Sulfur dioxide | $SO_2$ | 20 ppm | ≤ 45 | No effect |

(–) Indicates negative deviation

## CONTENTS XXS SENSORS

# DrägerSensor® XXS Amine

**Order no. 68 12 545**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 5000 | no | yes | 1 year | no |
| Dräger X-am 5600 | no | yes | 1 year | |

## MARKET SEGMENTS

Foundries, refineries, power plants

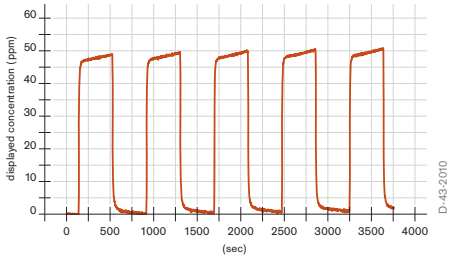
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 2 ppm |
| **Resolution:** | 1 ppm |
| **Measurement range:** | 0 - 100 ppm $CH_3NH_2$ (methylamine) |
| | 0 - 100 ppm $(CH_3)_2NH$ (dimethylamine) |
| | 0 - 100 ppm $(CH_3)_3N$ (trimethylamine) |
| | 0 - 100 ppm $C_2H_5NH_2$ (ethylamine) |
| | 0 - 100 ppm $(C_2H_5)_2NH$ (diethylamine) |
| | 0 - 100 ppm $(C_2H_5)_3N$ (triethylamine) |
| **Response time:** | ≤ 30 seconds at 20 °C or 68 °F ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 2 ppm |
| Sensitivity: | ≤ ± 5 % of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 2 ppm/month |
| Sensitivity: | ≤ ± 3 % of measured value/month |
| **Warm-up time:** | ≤ 12 hours |
| **Ambient conditions** | |
| Temperature: | (-40 to 50)°C (-40 to 122)°F |
| Humidity: | (10 to 90) % RH. |
| Pressure: | (700 to 1300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 5 ppm |
| Sensitivity: | ≤ ± 5 % of measured value |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.1 ppm / % RH |
| Sensitivity: | ≤ ± 0.2 % of measured value/% RH |
| **Test gas:** | approx. 50 to 100 ppm $NH_3$ |

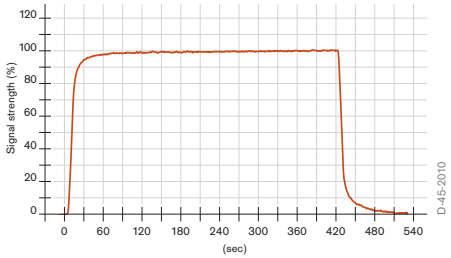
## SPECIAL CHARACTERISTICS

This sensor is suitable for monitoring concentration of six different amines in ambient air. A fast response time and excellent repeatability are just two examples of this sensor's special characteristics.

Reproducibility of Amine sensors
purged with 48 ppm methyl amine average of five sensors




Typical gas response of Amine at 20 °C
flow = 0,5 l/min, purged with 48 ppm methyl amine




The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $NH_3$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $NH_3$ |
|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1000 ppm | No effect |
| Carbon dioxide | $CO_2$ | 1.5 Vol.-% | ≤5 ppm (–) |
| Carbon monoxide | CO | 200 ppm | No effect |
| Chlorine | $Cl_2$ | 10 ppm | ≤20 ppm (–) |
| Ethene | $C_2H_4$ | 1000 ppm | ≤3 ppm |
| Ethine | $C_2H_2$ | 200 ppm | No effect |
| Hydrogen | $H_2$ | 1000 ppm | ≤3 ppm |
| Hydrogen cyanide | HCN | 25 ppm | ≤3 ppm |
| Hydrogen sulfide | $H_2S$ | 20 ppm | ≤50 ppm |
| Methane | $CH_4$ | 10 Vol.-% | No effect |
| Methanol | $CH_3OH$ | 200 ppm | ≤10 ppm |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤10 ppm (–) |
| Nitrogen monoxide | NO | 20 ppm | ≤10 ppm |
| Phosphine | $PH_3$ | 5 ppm | ≤8 ppm |
| Sulfur dioxide | $SO_2$ | 20 ppm | No effect |
| Tetrahydrothiophene | $C_4H_8S$ | 10 ppm | ≤10 ppm |

(–) Indicates negative deviation

# DrägerSensor® XXS $Cl_2$

**Order no. 68 10 890**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger Pac 7000 | no | yes | 1 year | no |
| Dräger X-am 5000 | no | yes | 1 year | no |
| Dräger X-am 5600 | no | yes | 1 year | no |

## MARKET SEGMENTS

Food and beverage, inorganic chemicals, manufacture of plastics, measuring dangerous substances, pulp and paper, power generation, sewage plants, water treatment.

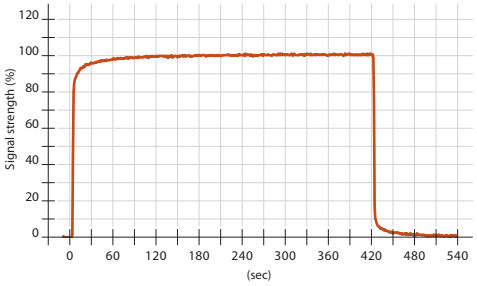
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.05 ppm |
| **Resolution:** | 0.05 ppm |
| **Measurement range:** | 0 to 20 ppm $Cl_2$ (chlorine) |
| | 0 to 20 ppm $F_2$ (fluorine) |
| | 0 to 20 ppm $Br_2$ (bromine) |
| | 0 to 20 ppm $ClO_2$ (chlorine dioxide) |
| **Response time:** | ≤ 30 seconds at 20°C ($T_{90}$) or 68 °F |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.05 ppm |
| Sensitivity: | ≤ ± 2% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 0.2 ppm/year |
| Sensitivity: | ≤ ± 2% of measured value/month |
| **Warm-up time:** | ≤ 30 minutes |
| **Ambient conditions** | |
| Temperature: | (–40 to 50)°C (–40 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.05 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.4% of measured value/% RH |
| **Test gas:** | approx. 5 to 10 ppm $Cl_2$ |

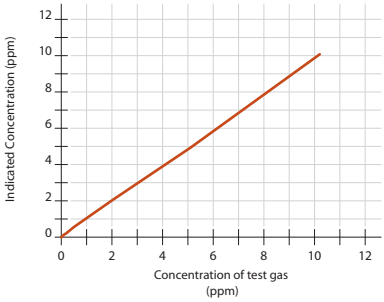
## SPECIAL CHARACTERISTICS

This sensor is suitable for monitoring concentrations of chlorine, bromine, fluorine, and chlorine dioxide in the ambient air. These sensors' advantages include excellent linearity and fast response times.

Sensor reaction $Cl_2$ at 20 °C/68°F
Flow = 0.5 l/min, with 0,5 ppm $Cl_2$




Linearity of $Cl_2$ Sensors
calibrated with 10.2 ppm $Cl_2$




D-27838-2009

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of chlorine. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $Cl_2$ |
|---|---|---|---|
| Ammonia | $NH_3$ | 50 ppm | No effect |
| Carbon dioxide | $CO_2$ | 10 Vol.-% | No effect |
| Carbon monoxide | CO | 1,000 ppm | No effect |
| Ethanol | $C_2H_5OH$ | 250 ppm | No effect |
| Ethine | $C_2H_2$ | 100 ppm | No effect |
| Hydrogen | $H_2$ | 1,000 ppm | No effect |
| Hydrogen chloride | HCl | 20 ppm | ≤ 0.6 |
| Hydrogen cyanide | HCN | 60 ppm | No effect |
| Hydrogen sulfide | $H_2S$ | 10 ppm | ≤ 0.6 (–) |
| Methane | $CH_4$ | 0.9 Vol.-% | No effect |
| Nitrogen dioxide | $NO_2$ | 10 ppm | No effect |
| Nitrogen monoxide | NO | 20 ppm | No effect |
| Ozone | $O_3$ | 1 ppm | No effect |
| Phosphine | $PH_3$ | 1 ppm | No effect |
| Sulfur dioxide | $SO_2$ | 10 ppm | ≤ 1 (–) |

(–) Indicates negative deviation

# DrägerSensor® XXS CO
# DrägerSensor® XXS E CO

**Order no. 68 10 882**
**68 12 212**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger Pac 3500 | no | yes | 2 years | Internal selective filter |
| Dräger Pac 5500 | no | yes | 2 years | Cross sensitivities to alcohol |
| Dräger Pac 7000 | no | yes | 2 years | and acid gases ($H_2S$, $SO_2$) |
| Dräger Pac 7000 5Y | no | yes | 5 years | are eliminated |
| Dräger X-am 1700 | no | yes | 2 years | |
| Dräger X-am 2000 | no | yes | 2 years | |
| Dräger X-am 5000 | no | yes | 2/5 years | |
| Dräger X-am 5600 | no | yes | 2/5 years | |

## MARKET SEGMENTS

Waste disposal industry, metal processing, petrochemical, fertilizer production, mining and tunneling, shipping, inorganic chemicals, steel, organic chemicals, oil and gas, measuring dangerous substances, biogas.

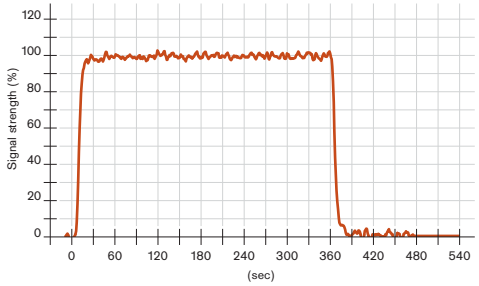
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 2 ppm |
| **Resolution:** | 2 ppm |
| **Measurement range:** | 0 to 2,000 ppm CO (carbon monoxide) |
| **Response time:** | ≤ 15 seconds at 20°C ($T_{90}$) or 68 °F |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 2 ppm |
| Sensitivity: | ≤ ± 2% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 2 ppm/year |
| Sensitivity: | ≤ ± 3% of measured value/year |
| **Warm-up time:** | ≤ 5 minutes |
| **Ambient conditions** | |
| Temperature: | (–40 to 50)°C (–40 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 5 ppm |
| Sensitivity: | ≤ ± 0.3% of measured value/K |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.02% of measured value/% RH |
| **Test gas:** | approx. 50 to 250 ppm CO |

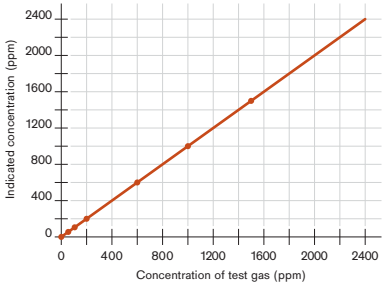
## SPECIAL CHARACTERISTICS

In addition to an outstanding linearity and a quick response time, these CO sensors are highly selective. An internal selective filter, which is fitted to the sensor as standard, filters out most associated gases such as alcohol and acid gases $H_2S$, $SO_2$.

Sensor reaction to CO at 20 °C/68 °F
Flow = 0.5 l/min, with 30 ppm CO




Linearity of CO sensor
calibrated with 50 ppm CO




D-27841-2009

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of CO. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES DRÄGERSENSOR® XXS CO

| Gas/vapor | Chem. symbol | Concentration | Display in ppm CO |
|---|---|---|---|
| Ammonia | $NH_3$ | 100 ppm | ≤ 1 |
| Carbon dioxide | $CO_2$ | 30 Vol.-% | ≤ 2 |
| Chlorine | $Cl_2$ | 20 ppm | ≤ 1 |
| Ethanol | $C_2H_5OH$ | 250 ppm | ≤ 1 |
| Ethine | $C_2H_2$ | 100 ppm | ≤ 200 |
| Hydrogen | $H_2$ | 0.1 Vol.-% | ≤ 350 |
| Hydrogen chloride | HCl | 40 ppm | ≤ 1 |
| Hydrogen cyanide | HCN | 50 ppm | ≤ 1 |
| Hydrogen sulfide | $H_2S$ | 30 ppm | ≤ 1 |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 1 |
| Nitrogen monoxide | NO | 30 ppm | ≤ 5 |
| Methane | $CH_4$ | 5 Vol.-% | ≤ 1 |
| Propane | $C_3H_8$ | 1 Vol.-% | ≤ 1 |
| Sulfur dioxide | $SO_2$ | 25 ppm | ≤ 1 |

## RELEVANT CROSS-SENSITIVITIES DRÄGERSENSOR® XXS E CO

| Gas/vapor | Chem. symbol | Concentration | Display in ppm CO |
|---|---|---|---|
| Ammonia | $NH_3$ | 100 ppm | No effect |
| Carbon dioxide | $CO_2$ | 30 Vol.-% | ≤ 2 |
| Chlorine | $Cl_2$ | 20 ppm | No effect |
| Ethanol | $C_2H_5OH$ | 250 ppm | No effect |
| Ethine | $C_2H_2$ | 100 ppm | ≤ 200 |
| Hydrogen | $H_2$ | 0.1 Vol.-% | ≤ 350 |
| Hydrogen chloride | HCl | 40 ppm | No effect |
| Hydrogen cyanide | HCN | 50 ppm | No effect |
| Hydrogen sulfide | $H_2S$ | 30 ppm | No effect |
| Nitrogen dioxide | $NO_2$ | 20 ppm | No effect |
| Nitrogen monoxide | NO | 30 ppm | ≤ 5 |
| Methane | $CH_4$ | 5 Vol.-% | No effect |
| Propane | $C_3H_8$ | 1 Vol.-% | No effect |
| Sulfur dioxide | $SO_2$ | 25 ppm | No effect |


**DrägerSensor® XXS CO**

# DrägerSensor® XXS CO HC

**Order no. 68 12 010**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 5000 | no | yes | 1 year | Internal selective filter Cross sensitivities to alcohol and acid gases ($H_2S$, $SO_2$) are eliminated. |
| Dräger X-am 5600 | no | yes | 1 year | |

## MARKET SEGMENTS

Waste disposal industry, metal processing, petrochemical, fertilizer production, mining and tunneling (in particular monitoring high CO concentrations during rescue operations), shipping, inorganic chemicals, biogas, hazmat, steel industry, oil and gas, organic chemicals.

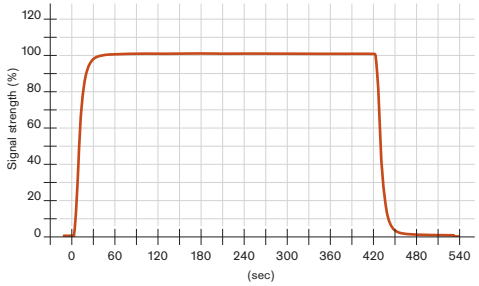
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 10 ppm |
| **Resolution:** | 5 ppm |
| **Measurement range:** | 0 to 10,000 ppm CO (carbon monoxide) |
| **Response time:** | ≤ 25 seconds at 20°C ($T_{90}$) or 68 °F |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 20 ppm |
| Sensitivity: | ≤ ± 2% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 5 ppm/year |
| Sensitivity: | ≤ ± 1% of measured value/month |
| **Warm-up time:** | ≤ 5 minutes |
| **Ambient conditions** | |
| Temperature: | (–40 to 50)°C (–40 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.3% of measured value/K |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.02% of measured value/% RH |
| **Test gas:** | approx. 250 ppm CO |

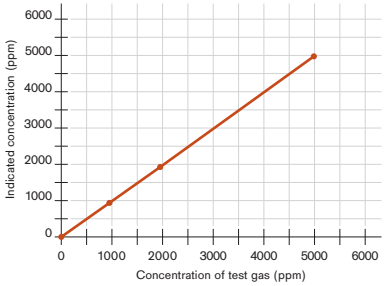
## SPECIAL CHARACTERISTICS

This sensor demonstrates excellent linearity across the whole measurement range even if calibrated in the lower reaches of that range, and it also provides a stable reading even at high concentrations over long periods of time.

Typical Sensor reaction to CO HC at 20 °C/68 °F
Flow = 0.5 l/min, with 5.000 ppm CO




Linearity of CO HC sensor
calibrated with 100 ppm CO




D-27842-2009

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of CO. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm CO |
|---|---|---|---|
| Ammonia | $NH_3$ | 100 ppm | No effect |
| Carbon dioxide | $CO_2$ | 30 Vol.-% | No effect |
| Chlorine | $Cl_2$ | 20 ppm | No effect |
| Hydrogen | $H_2$ | 0.1 Vol.-% | ≤ 350 |
| Hydrogen chloride | HCl | 40 ppm | No effect |
| Hydrogen cyanide | HCN | 50 ppm | No effect |
| Hydrogen sulfide | $H_2S$ | 30 ppm | No effect |
| Ethanol | $C_2H_5OH$ | 250 ppm | No effect |
| Ethine | $C_2H_2$ | 100 ppm | ≤ 200 |
| Nitrogen dioxide | $NO_2$ | 20 ppm | No effect |
| Nitrogen monoxide | NO | 30 ppm | ≤ 5 |
| Methane | $CH_4$ | 5 Vol.-% | No effect |
| Propane | $C_3H_8$ | 1 Vol.-% | No effect |
| Sulfur dioxide | $SO_2$ | 25 ppm | No effect |

# DrägerSensor® XXS CO $H_2$-CP

**Order no. 68 11 950**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 5000 | no | yes | 1 years | Internal selective filterCross sensitivities to alcohol and acid gases ($H_2S$, $SO_2$) are eliminated. |
| Dräger X-am 5600 | no | yes | 1 year | |

## MARKET SEGMENTS

Steel industry, refineries, sewage treatment plants

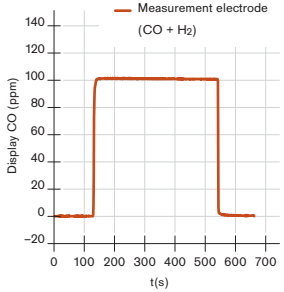
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 6 ppm |
| **Resolution:** | 2 ppm |
| **Measurement range:** | 0 to 2,000 ppm CO (carbon monoxide) |
| **Response time:** | ≤ 25 seconds at 20°C ($T_{90}$) or 68 °F |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 2 ppm |
| Sensitivity: | ≤ ± 2% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 2 ppm/year |
| Sensitivity: | ≤ ± 1% of measured value/month |
| **Warm-up time:** | ≤ 12 hours |
| **Ambient conditions** | |
| Temperature: | (–40 to 50) °C (–40 to 122) °F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 5 ppm |
| Sensitivity: | ≤ ± 0.3% of measured value/K |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.02% of measured value/% RH |
| **Test gas:** | approx. 250 ppm CO and 1,000 ppm $H_2$ |

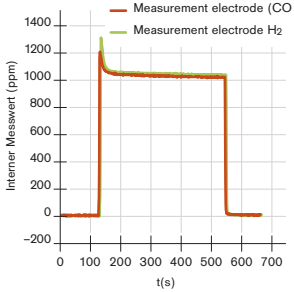
## SPECIAL CHARACTERISTICS

Carbon monoxide and hydrogen can occur simultaneously in many areas of work such as in the steel industry, refineries, and sewage treatment plants. Hydrogen affects the CO signal in conventional sensors, which leads to many false alarms. The DrägerSensor® XXS CO $H_2$-CP uses two measuring electrodes – one of which measures CO and $H_2$, the other only $H_2$. The CO level is calculated and displayed on the basis of the difference between the two signals. A hydrogen concentration of 1,000 ppm (2.5% LEL) causes a maximum displayed concentration of only 15 ppm CO, which does not activate the CO alarm.

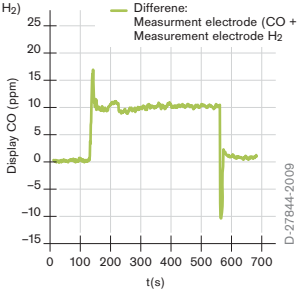
Sensor reaction 100 ppm CO




Internal $H_2$ signal
Sensor reaction 1022 ppm $H_2$




Calculated signal
Sensor reaction 1022 ppm $H_2$




D-27844-2009

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of CO. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm CO |
|---|---|---|---|
| Ammonia | $NH_3$ | 100 ppm | ≤ 1 |
| Carbon dioxide | $CO_2$ | 30 Vol.-% | ≤ 1 |
| Chlorine | $Cl_2$ | 20 ppm | ≤ 1 |
| Hydrogen | $H_2$ | 0.1 Vol.-% | < = ±15 [1] |
| Hydrogen chloride | HCl | 40 ppm | ≤ 1 |
| Hydrogen cyanide | HCN | 50 ppm | ≤ 1 |
| Hydrogen sulfide | $H_2S$ | 30 ppm | ≤ 1 |
| Ethanol | $C_2H_5OH$ | 250 ppm | ≤ 1 |
| Ethine | $C_2H_2$ | 100 ppm | ≤ 200 |
| Methane | $CH_4$ | 5 Vol.-% | ≤ 1 |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 1 |
| Nitrogen monoxide | NO | 30 ppm | ≤ 5 |
| Propane | $C_3H_8$ | 1 Vol.-% | ≤ 1 |
| Sulfur dioxide | $SO_2$ | 25 ppm | ≤ 1 |

[1] after compensation

# DrägerSensor® XXS $CO_2$

**Order no. 68 10 889**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger Pac 7000 | no | yes | 1 year | no |
| Dräger X-am 5000 | no | yes | 1 year | no |
| Dräger X-am 5600 | no | yes | 1 year | no |

## MARKET SEGMENTS

Waste disposal, Food and beverage (breweries), metal processing, petrochemical, fertilizer production, sewage, police, customs and rescue services, mining and tunneling, shipping and transport, power generation.

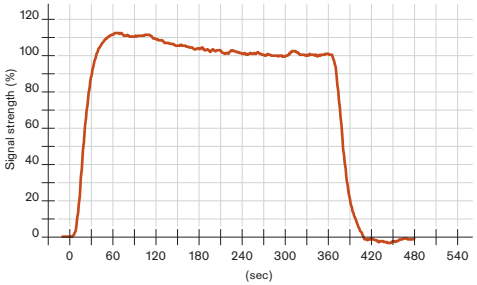
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.3 Vol.-% |
| **Resolution:** | 0.1 Vol.-% |
| **Measurement range:** | 0 to 5 Vol.-% $CO_2$ (carbon dioxide) |
| **Response time:** | ≤ 30 seconds at 20°C ($T_{50}$) or 68 °F |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.3 Vol.-% |
| Sensitivity: | ≤ ± 20% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 0.2 Vol.-%/year |
| Sensitivity: | ≤ ± 15% of measured value/month |
| **Warm-up time:** | ≤ 12 hours |
| **Ambient conditions** | |
| Temperature: | (–20 to 40)°C (–4 to 104)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.01 Vol.-%/K |
| Sensitivity: | ≤ ± 2% of measured value |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.1% of measured value/% RH |
| **Test gas:** | 2.5 Vol.-% $CO_2$ |

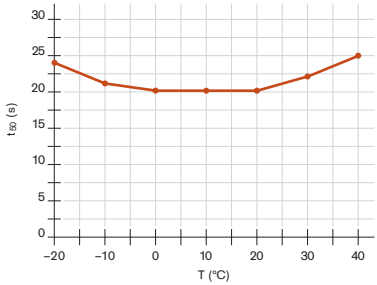
## SPECIAL CHARACTERISTICS

This sensor is highly sensitive (see cross-sensitivity list) and offers an economical alternative to infrared sensors if you need to warn against $CO_2$ concentrations in the ambient air.

Sensor reaction to $CO_2$ at 20 °C/68 °F
Flow = 0.5 l/min, with 5000 ppm $CO_2$




Response time ($t_{50}$) vs. temperature
with 5000 ppm $CO_2$




D-27840-2009

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $CO_2$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $CO_2$ |
|---|---|---|---|
| Ammonia | $NH_3$ | 50 ppm | No effect |
| Carbon monoxide | CO | 1,000 ppm | No effect |
| Chlorine | $Cl_2$ | 10 ppm | No effect |
| Ethanol | $C_2H_5OH$ | 250 ppm | No effect |
| Ethine | $C_2H_2$ | 100 ppm | No effect |
| Hydrogen | $H_2$ | 1.6 Vol.-% | No effect |
| Hydrogen chloride | HCl | 20 ppm | No effect |
| Hydrogen cyanide | HCN | 60 ppm | No effect |
| Hydrogen sulfide | $H_2S$ | 20 ppm | No effect |
| Nitrogen dioxide | $NO_2$ | 20 ppm | No effect |
| Nitrogen monoxide | NO | 20 ppm | No effect |
| Methane | $CH_4$ | 0.9 Vol.-% | No effect |
| Ozone | $O_3$ | 1.5 ppm | No effect |
| Phosphine | $PH_3$ | 5 ppm | No effect |
| Sulfur dioxide | $SO_2$ | 20 ppm | No effectt |

(–) Indicates negative deviation

# DrägerSensor® XXS $COCl_2$

**Order no. 68 12 005**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 5000 | no | yes | 0,5 years | – |
| Dräger X-am 5600 | no | yes | 0,5 years | – |

## MARKTSEGMENTE

Manufacture of plastics, chemical industry, insecticides production, dyes, military

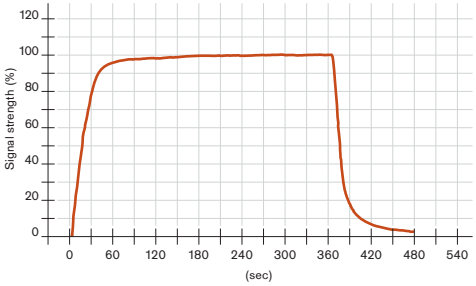
## TECHNISCHE DATEN

| | |
|---|---|
| **Detection limit:** | 0,01 ppm |
| **Resolution:** | 0,01 ppm |
| **Measurement range:** | 0 bis 10 ppm $COCl_2$ (Phosgene) |
| **Response time:** | ≤ 20 seconds at 20 °C ($T_{20}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0,01 ppm |
| Sensitivity: | ≤ ± 5 % of measured value |
| **Long-term drift**, at 20°C (68°F) | |
| Zero point: | ≤ ± 0,01 ppm/year |
| Sensitivity: | ≤ ± 1 % of measured value/month |
| **Warm-up time:** | ≤ 1 hour |
| **Ambient conditions** | |
| Temperature: | (-20 to 35) °C (-4 to 99) °F |
| Humidity: | (10 to 90) % RH |
| Pressure: | (700 to 1300) hPa |
| **Influence of temperature** | |
| Zero point: | no effect |
| Sensitivity: | ≤ ± 0,2 % of measured value/K |
| **Influence of humidity** | |
| Zero point: | no effect |
| Sensitivity: | ≤ ± 0,05 % of measured value/RH |
| **Test gas:** | $COCl_2$ test gas between 4 to 8 ppm |

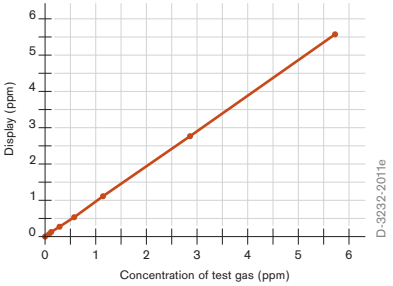
## SPECIAL CHARACTERISTICS

This sensor's advantages include a very low detection limit, excellent linearity and high signal stability.

Sensor reaction at 20 °C
Flow = 0.5 l/min, 0.115 ppm $COCl_2$




Linearity of $COCl_2$ Sensors
calibrated with 0.28 ppm $COCl_2$




The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $COCl_2$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. Symbol | Concentration | Reading in ppm $COCl_2$ |
|---|---|---|---|
| Ammonia | $NH_3$ | 20 ppm | no effect |
| Carbon dioxide | $CO_2$ | 1,5 Vol.-% | no effect |
| Carbon monoxide | CO | 1000 ppm | no effect |
| Chlorine | $Cl_2$ | 0,5 ppm | ≤ 0,2 |
| Ethanol | $C_2H_5OH$ | 260 ppm | no effect |
| Ethine | $C_2H_2$ | 20 ppm | no effect |
| Hydrogen | $H_2$ | 8000 ppm | no effect |
| Hydrogen chloride | HCl | 0,5 ppm | ≤ 0,7 |
| Hydrogen fluoride | HF | 0,4 ppm | ≤ 0,1 ppm |
| Hydrogen peroxide | $H_2O_2$ | 1 ppm | no effect |
| Hydrogen sulfide | $H_2S$ | 1 ppm | ≤ 1[1)] |
| Nitrogen dioxide | $NO_2$ | 1 ppm | ≤ 0,1(–) |
| Nitrogen monoxide | NO | 30 ppm | no effect |
| Ozone | $O_3$ | 0,3 ppm | ≤ 0,05(–) |
| Phosphine | $PH_3$ | 0,5 ppm | ≤ 0,1 ppm |
| Propanol | $C_3H_7OH$ | 500 ppm | no effect |
| Sulfur dioxide | $SO_2$ | 2 ppm | no effect |

(-) negatives Vorzeichen der Abweichung

[1)] dauerhafte Begasung mit $H_2S$ kann zum Empfindlichkeitsverlust führen

(–) negatives Vorzeichen der Abweichung

# DrägerSensor® XXS $H_2$

**Order no. 68 12 370**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 5000 | no | yes | 1 year | Internal selective filter Cross sensitivities to alcohol and acid gases ($H_2S$, $SO_2$) are eliminated |
| Dräger X-am 5600 | no | yes | 1 year | |

## MARKET SEGMENTS

Leak detection, chemical, petrochemical, rocket fuel, production of plastics, steel production, industrial gases, fertilizer, battery charging stations, fuel cells.

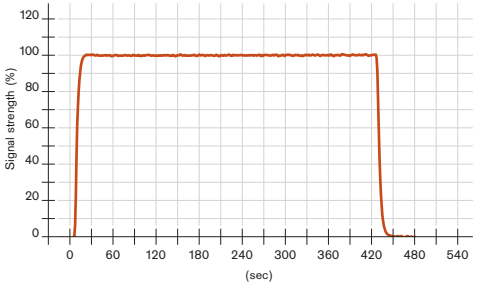
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 10 ppm |
| **Resolution:** | 5 ppm |
| **Measurement range:** | 0 to 2,000 ppm $H_2$ (hydrogen) |
| **Response time:** | ≤ 10 seconds at 20°C ($T_{90}$) or 68 °F |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 10 ppm |
| Sensitivity: | ≤ ± 1% of measured value |
| **Long-term drift**, at 20°C (68°F) | |
| Zero point: | ≤ ± 4 ppm/year |
| Sensitivity: | ≤ ± 4% of measured value/month |
| **Warm-up time:** | ≤ 1 hour |
| **Ambient conditions** | |
| Temperature: | (–20 to 50)°C (–4 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 10 ppm |
| Sensitivity: | ≤ ± 1 ppm/K |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.15% of measured value/% RH |
| **Test gas:** | approx. 1,000 ppm $H_2$ |

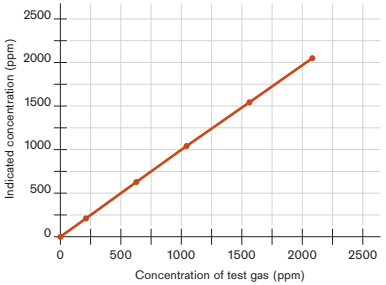
## SPECIAL CHARACTERISTICS

This sensor enables the detection of hydrogen concentrations in ppm. Its very fast response time makes it especially suitable for detecting leaks.

Sensor reaction to $H_2$ at 20 °C/68 °F
Flow = 0.5 l/min, 1000 ppm $H_2$




Linearity of $H_2$ sensors
calibrated with 1045 ppm $H_2$




D-27856-2009

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $H_2$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $H_2$ |
|---|---|---|---|
| Ammonia | $NH_3$ | 100 ppm | ≤ 1 |
| Carbon dioxide | $CO_2$ | 30 Vol.-% | ≤ 2 |
| Carbon monoxide | CO | 1,000 ppm | ≤ 200 |
| Chlorine | $Cl_2$ | 20 ppm | ≤ 1 |
| Ethanol | $C_2H_5OH$ | 250 ppm | ≤ 1 |
| Ethine | $C_2H_2$ | 100 ppm | ≤ 200 |
| Hydrogen chloride | HCl | 40 ppm | ≤ 1 |
| Hydrogen cyanide | HCN | 50 ppm | ≤ 1 |
| Hydrogen sulfide | $H_2S$ | 30 ppm | ≤ 1 |
| Methane | CH4 | 5 Vol.-% | ≤ 1 |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 1 |
| Nitrogen monoxide | NO | 20 ppm | ≤ 51 |
| Propane | $C_3H8$ | 1 Vol.-% | ≤ 1 |
| Sulfur dioxide | $SO_2$ | 25 ppm | ≤ 1 |

# DrägerSensor® XXS $H_2$ HC

**Order no. 68 12 025**

| Used in | Plug & Play | Replaceable | Guaranty | **Selective filter** |
|---|---|---|---|---|
| Dräger X-am 5000 | no | yes | 1 year | Internal selective filter Cross sensitivities to hydrogen sulfide ($H_2S$) and sulfur dioxide ($SO_2$) are eliminated |
| Dräger X-am 5600 | no | yes | 1 year | |

## MARKET SEGMENTS

Chemical industry, petrochemical industry, rocket fuel, leak detection, production of plastics, metal processing, industrial gases, fertilizer manufacturing, battery charging stations, fuel cells.

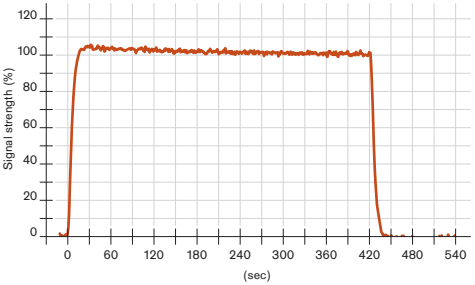
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.02 Vol.-% |
| **Resolution:** | 0.01 Vol.-% |
| **Measurement range:** | 0 to 4 Vol.-% $H_2$ (hydrogen) |
| **Response time:** | ≤ 20 seconds at 20°C ($T_{90}$) or 68 °F |
| **Measurement accuracy** | |
| Zero point: | ± 0.02 Vol.-% |
| Sensitivity: | ≤ ± 2% of measured value |
| **Long-term drift**, at 20°C (68°F) | |
| Zero point: | ≤ ± 0.05 Vol.-%/year |
| Sensitivity: | ≤ ± 3% of measured value/month |
| **Warm-up time:** | ≤ 1 hour |
| **Ambient conditions** | |
| Temperature: | (–20 to 50)°C (–4 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.05 Vol.-% |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.01% of measured value/% RH |
| **Test gas:** | approx. 2 Vol.-% $H_2$ |

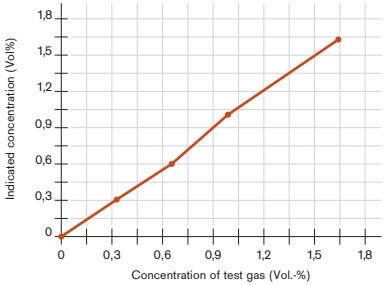
## SPECIAL CHARACTERISTICS

This sensor is suitable for measuring hydrogen across the entire LEL range. If a Dräger X-am 5600 is fitted with an IR-Ex sensor, then this sensor is the ideal addition for detecting any risk of explosion caused by hydrogen. Like all Dräger sensors, this one offers very fast response times and excellent linearity.

Sensor reaction to XXS $H_2$ HC at 20 °C/68 °F
Flow = 0.5 l/min, with 1,63 Vol% $H_2$




Linearity of XXS $H_2$ HC sensors
calibrated with 1.63 Vol% $H_2$




D-27857-2009

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $H_2$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in Vol.-% $H_2$ |
|---|---|---|---|
| Ammonia | $NH_3$ | 100 ppm | No effect |
| Carbon monoxide | CO | 1,000 ppm | ≤ 0.1 |
| Carbon dioxide | $CO_2$ | 30 Vol.-% | No effect |
| Chlorine | $Cl_2$ | 20 ppm | No effect |
| Ethanol | $C_2H_5OH$ | 250 ppm | No effect |
| Ethine | $C_2H_2$ | 100 ppm | ≤ 0.02 |
| Hydrogen chloride | HCl | 40 ppm | No effect |
| Hydrogen cyanide | HCN | 50 ppm | No effect |
| Hydrogen sulfide | $H_2S$ | 30 ppm | No effect |
| Methane | CH4 | 5 Vol.-% | No effect |
| Nitrogen dioxide | $NO_2$ | 20 ppm | No effect |
| Nitrogen monoxide | NO | 20 ppm | ≤ 0.05 |
| Propane | $C_3H_8$ | 1 Vol.-% | No effect |
| Sulfur dioxide | $SO_2$ | 25 ppm | No effect |

# DrägerSensor® XXS HCN

**Order no. 68 10 887**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger Pac 7000 | no | yes | 1 year | no |
| Dräger X-am 5000 | no | yes | 1 year | no |
| Dräger X-am 5600 | no | yes | 1 year | no |

## MARKET SEGMENTS

Metal processing, mining, fumigation and pest control, chemical warfare agent (blood agents).

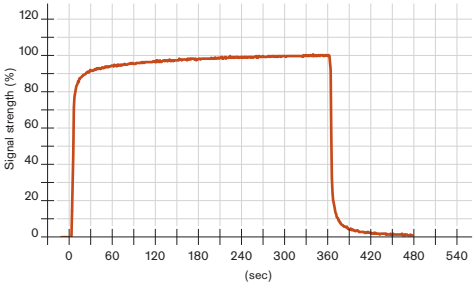
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.5 ppm |
| **Resolution:** | 0.1 ppm |
| **Measurement range:** | 0 to 50 ppm HCN (hydrogen cyanide) |
| **Response time:** | ≤ 10 seconds at 20°C ($T_{50}$) or 68 °F |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.5 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 2 ppm/year |
| Sensitivity: | ≤ ± 5% of measured value/month |
| **Warm-up time:** | ≤ 15 minutes |
| **Ambient conditions** | |
| Temperature: | (–20 to 50)°C (–4 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 1 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.1% of measured value/% RH |
| **Test gas:** | approx. 10 ppm HCN |

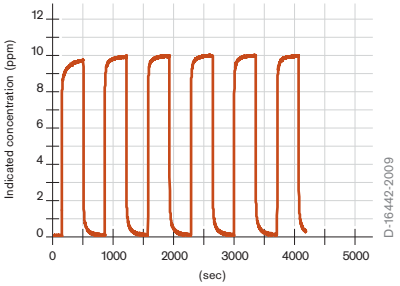
## SPECIAL CHARACTERISTICS

This sensor's extremely quick response time and excellent repeatability provides a fast and reliable warning against Prussic acid (hydrogen cyanide).

Sensor reaction to HCN at 20 °C/68 °F
Flow = 0.5 l/min, 20 ppm HCN




Repeatability of HCN sensors with mit 10 ppm HCN




The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of HCN To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm HCN |
|---|---|---|---|
| Ammonia | $NH_3$ | 50 ppm | No effect |
| Carbon dioxide | $CO_2$ | 10 Vol.-% | No effect |
| Carbon monoxide | CO | 200 ppm | No effect |
| Chlorine | $Cl_2$ | 10 ppm | ≤ 20 (–) |
| Ethanol | $C_2H_5OH$ | 250 ppm | No effect |
| Ethine | $C_2H_2$ | 100 ppm | ≤ 10 |
| Hydrogen | $H_2$ | 1.5 Vol.-% | ≤ 10 |
| Hydrogen chloride | HCl | 20 ppm | ≤ 1 |
| Hydrogen sulfide | $H_2S$ | 20 ppm | ≤ 50 |
| Methane | $CH_4$ | 1 Vol.-% | No effect |
| Nitrogen dioxide | $NO_2$ | 10 ppm | ≤ 20 (–) |
| Nitrogen monoxide | NO | 20 ppm | No effect |
| Ozone | $O_3$ | 0.5 ppm | No effect |
| Phosphine | $PH_3$ | 1 ppm | ≤ 8 |
| Sulfur dioxide | $SO_2$ | 20 ppm | ≤ 10 |

(–) Indicates negative deviation

# DrägerSensor® XXS $H_2S$
# DrägerSensor® XXS E $H_2S$

**Order no. 68 10 883**
**68 12 213**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger Pac 7000 | no | yes | 2 years | no |
| Dräger Pac 7000 5Y | no | yes | 5 years | no |
| Dräger X-am 5000 | no | yes | 2/5 years | no |
| Dräger X-am 5600 | no | yes | 2/5 years | no |

## MARKET SEGMENTS

Waste disposal, petrochemical, fertilizer production, sewage, mining and tunneling, shipping, inorganic chemicals, steel, pulp and paper, organic chemicals, oil and gas, hazmat, biogas.

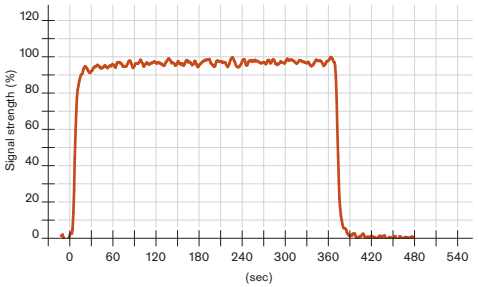
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 2 ppm |
| **Resolution:** | 1 ppm |
| **Measurement range:** | 0 to 200 ppm $H_2S$ (hydrogen sulfide) |
| **Response time:** | ≤ 15 seconds at 20°C (T90) or 68 °F |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.5 ppm |
| Sensitivity: | ≤ ± 2% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 1 ppm/year |
| Sensitivity: | ≤ ± 3% of measured value/year |
| **Warm-up time:** | ≤ 5 minutes |
| **Ambient conditions** | |
| Temperature: | (–40 to 50)°C (–40 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.03% of measured value/% RH |
| **Test gas:** | approx. 100 ppm $H_2S$ |

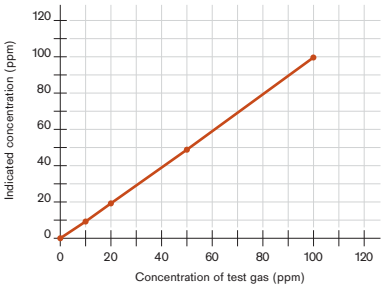
## SPECIAL CHARACTERISTICS

This sensor's advantages include fast response times and excellent linearity. At concentrations up to 20 ppm, sulfur dioxide has hardly any effect on hydrogen sulfide readings. This enables the selective measurement of the gas concentration using the DrägerSensor® XXS $SO_2$ (with integrated selective filter) together with the DrägerSensor® XXS $H_2S$ in a device such as a Dräger X-am 5000 or X-am 5600

Sensor reaction to $H_2S$ at 20 °C/68 °F
Flow = 0.5 l/min, with 10 ppm $H_2S$




Linearity of $H_2S$ sensor
calibrated with 20 ppm $H_2S$




D-27851-2009

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $H_2S$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES DRÄGERSENSOR® XXS $H_2S$

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $H_2S$ |
|---|---|---|---|
| Ammonia | $NH_3$ | 200 ppm | ≤ 1 |
| Carbon dioxide | $CO_2$ | 5 Vol.-% | ≤ 1(–) |
| Carbon monoxide | CO | 500 ppm | ≤ 1 |
| Chlorine | $Cl_2$ | 10 ppm | ≤ 2(–) |
| Ethanol | $C_2H_5OH$ | 250 ppm | ≤ 1 |
| Ethine | $C2H_2$ | 100 ppm | ≤ 1 |
| Hydrogen | $H_2$ | 0.1 Vol.-% | ≤ 1 |
| Hydrogen chloride | HCl | 40 ppm | ≤ 1 |
| Hydrogen cyanide | HCN | 50 ppm | ≤ 1 |
| Methane | $CH_4$ | 5 Vol.-% | ≤ 1 |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 5(–) |
| Nitrogen monoxide | NO | 30 ppm | ≤ 1 |
| Propane | $C_3H_8$ | 1 Vol.-% | ≤ 1 |
| Sulfur dioxide | $SO_2$ | 20 ppm | ≤ 2 |

(–) Indicates negative deviation

## RELEVANT CROSS-SENSITIVITIES DRÄGERSENSOR® XXS E $H_2S$

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $H_2S$ |
|---|---|---|---|
| Ammonia | $NH_3$ | 200 ppm | No effect |
| Carbon dioxide | $CO_2$ | 5 Vol.-% | ≤ 1(–) |
| Carbon monoxide | CO | 500 ppm | No effect |
| Chlorine | $Cl_2$ | 10 ppm | ≤ 2(–) |
| Ethanol | $C_2H_5OH$ | 250 ppm | No effect |
| Ethine | $C2H_2$ | 100 ppm | No effect |
| Hydrogen | $H_2$ | 0.1 Vol.-% | No effect |
| Hydrogen chloride | HCl | 40 ppm | No effect |
| Hydrogen cyanide | HCN | 50 ppm | No effect |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 5(–) |
| Nitrogen monoxide | NO | 30 ppm | No effect |
| Methane | $CH_4$ | 5 Vol.-% | No effect |
| Propane | $C_3H_8$ | 1 Vol.-% | No effect |
| Sulfur dioxide | $SO_2$ | 20 ppm | ≤ 2 |

(–) Indicates negative deviation

ST-1973-2005


D-10162-2009

**DrägerSensor® XXS $H_2S$**

# DrägerSensor® XXS $H_2S$ HC

**Order no. 68 12 015**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 5000 | no | yes | 1 year | no |
| Dräger X-am 5600 | no | yes | 1 year | no |

## MARKET SEGMENTS

Waste disposal industry, petrochemical, fertilizer production, sewage, mining and tunneling, shipping, inorganic chemicals, steel industry, pulp and paper, organic chemicals, oil and gas, measuring hazardous material, biogas.

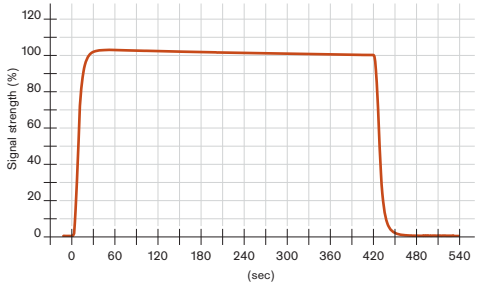
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 4 ppm |
| **Resolution:** | 2 ppm |
| **Measurement range:** | 0 to 1,000 ppm $H_2S$ (hydrogen sulfide) |
| **Response time:** | ≤ 15 seconds at 20°C ($T_{90}$) or 68 °F |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 4 ppm |
| Sensitivity: | ≤ ± 2% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 2 ppm/year |
| Sensitivity: | ≤ ± 1% of measured value/month |
| **Warm-up time:** | ≤ 5 minutes |
| **Ambient conditions** | |
| Temperature: | (–40 to 50)°C (–40 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.03% of measured value/% RH |
| **Test gas:** | approx. 100 ppm $H_2S$ |

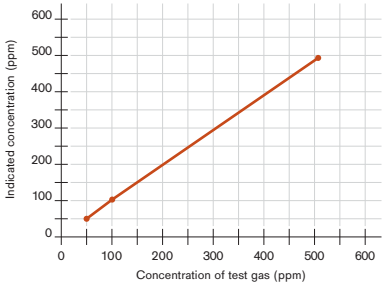
## SPECIAL CHARACTERISTICS

Because of its excellent linearity, this sensor can be calibrated in its lower measurement range using a hydrogen sulfide test gas without compromising on accuracy in its upper measurement range. It also offers a fast response time and good selectivity.

Sensor reaction to $H_2S$ HC at 20 °C/68 °F
Flow = 0.5 l/min, with 505 ppm $H_2S$




Linearity of $H_2S$ HC sensor
calibrated with 50 ppm $H_2S$




D-27853-2009

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $H_2S$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $H_2S$ |
|---|---|---|---|
| Ammonia | $NH_3$ | 200 ppm | No effect |
| Carbon dioxide | $CO_2$ | 5 Vol.-% | No effect |
| Carbon monoxide | CO | 500 ppm | No effect |
| Chlorine | $Cl_2$ | 10 ppm | No effect |
| Ethanol | $C_2H_5OH$ | 250 ppm | No effect |
| Ethine | $C2H_2$ | 100 ppm | No effect |
| Hydrogen | $H_2$ | 0.1 Vol.-% | No effect |
| Hydrogen chloride | HCl | 40 ppm | No effect |
| Hydrogen cyanide | HCN | 50 ppm | No effect |
| Hydrogen phosphide | $PH_3$ | 5 ppm | ≤ 4 |
| Methane | $CH_4$ | 5 Vol.-% | No effect |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ $5^{(-)}$ |
| Nitrogen monoxide | NO | 30 ppm | No effect |
| Propane | $C_3H_8$ | 1 Vol.-% | No effect |
| Sulfur dioxide | $SO_2$ | 20 ppm | ≤ 2 |

(–) Indicates negative deviation

# DrägerSensor® XXS $H_2S$ LC

**Order no. 68 11 525**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger Pac 3500 | no | yes | 2 years | no |
| Dräger Pac 5500 | no | yes | 2 years | no |
| Dräger Pac 7000 | no | yes | 2 years | no |
| Dräger X-am 1700 | no | yes | 2 years | no |
| Dräger X-am 2000 | no | yes | 2 years | no |
| Dräger X-am 5000 | no | yes | 2 years | no |
| Dräger X-am 5600 | no | yes | 2 years | no |

## MARKET SEGMENTS

Waste disposal, petrochemical, fertilizer production, sewage, mining and tunneling, shipping, inorganic chemicals, steel industry, pulp and paper, organic chemicals, oil and gas, hazmat, biogas.

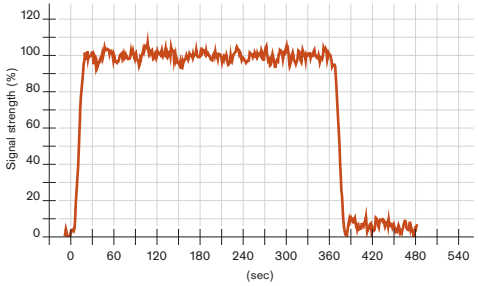
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.4 ppm |
| **Resolution:** | 0.1 ppm |
| **Measurement range:** | 0 to 100 ppm $H_2S$ (hydrogen sulfide) |
| **Response time:** | ≤ 15 seconds at 20°C ($T_{90}$) or 68 °F |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.4 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 0.2 ppm/year |
| Sensitivity: | ≤ ± 5% of measured value/year |
| **Warm-up time:** | ≤ 5 minutes |
| **Ambient conditions** | |
| Temperature: | (–40 to 50)°C (–40 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.1% of measured value/% RH |
| **Test gas:** | approx. 25 ppm $H_2S$ |

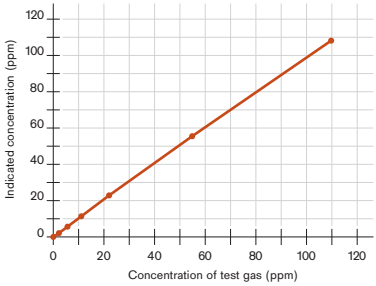
## SPECIAL CHARACTERISTICS

Combined with an excellent linearity and a fast response time, this sensor enables the selective measurement of hydrogen sulfide at below 1 ppm.

Sensor reaction to $H_2S$ at 20 °C/68 °F
Flow = 0.5 l/min, with 0,55 ppm $H_2S$




Linearity of $H_2S$ LC sensor
calibrated with 22 ppm $H_2S$




D-27852-2009

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $H_2S$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $H_2S$ |
|---|---|---|---|
| Ammonia | $NH_3$ | 200 ppm | No effect |
| Carbon dioxide | $CO_2$ | 5 Vol.-% | No effect |
| Carbon monoxide | CO | 500 ppm | ≤ 1 |
| Chlorine | $Cl_2$ | 10 ppm | ≤ 1(–) |
| Ethanol | $C_2H_5OH$ | 250 ppm | No effect |
| Ethine | $C_2H_2$ | 100 ppm | No effect |
| Hydrogen | $H_2$ | 0.1 Vol.-% | ≤ 0.5 |
| Hydrogen chloride | HCl | 40 ppm | No effect |
| Hydrogen cyanide | HCN | 50 ppm | No effect |
| Methane | $CH_4$ | 5 Vol.-% | No effect |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 4(–) |
| Nitrogen monoxide | NO | 30 ppm | No effect |
| Propane | $C_3H_8$ | 1 Vol.-% | No effect |
| Sulfur dioxide | $SO_2$ | 20 ppm | ≤ 1,5 |

(–) Indicates negative deviation

# DrägerSensor® XXS $H_2S$/CO

**Order no. 68 11 410**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 5000 | no | yes | 2 years | Internal selective filter for CO: Cross sensitivities to alcohol and acid gases ($H_2S$, $SO_2$) are eliminated |
| Dräger X-am 5600 | no | yes | 2 years | |

## MARKET SEGMENTS

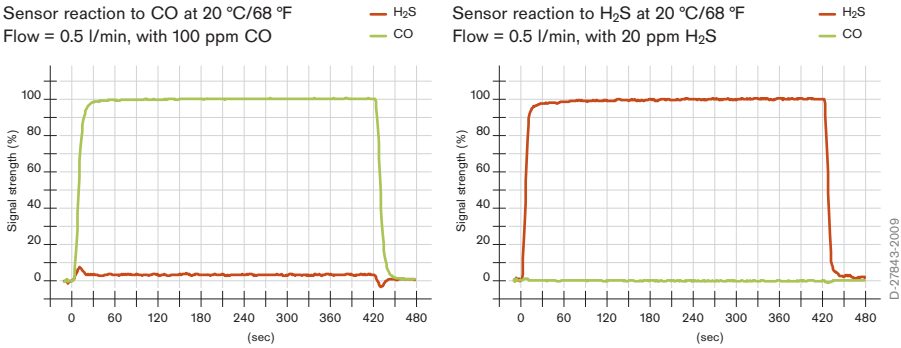
Waste disposal, metal processing, biogas, petrochemical, fertilizer production, sewage, mining and tunneling, shipping, inorganic chemicals, paper industry, hazmat, steel industry, oil and gas, organic chemicals.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 2 ppm ($H_2S$)/6 ppm (CO) |
| **Resolution:** | 1 ppm ($H_2S$)/2 ppm (CO) |
| **Measurement range:** | 0 to 200 ppm $H_2S$ (hydrogen sulfide) |
| | 0 to 2,000 ppm CO (carbon monoxide) |
| **Response time:** | ≤ 20 seconds at 20°C ($T_{90}$) or 68 °F |
| **Measurement accuracy** | |
| Zero point: | ≤± 2 ppm ($H_2S$)/≤ ± 6 ppm (CO) |
| Sensitivity: | ≤ ± 2% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 2 ppm/year |
| Sensitivity: | ≤ ± 1% of measured value/month |
| **Warm-up time:** | ≤ 5 minutes |
| **Ambient conditions** | |
| Temperature: | (–40 to 50)°C (–40 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 2 ppm ($H_2S$) ≤ ± 5 ppm (CO) |
| Sensitivity: | ≤ ± 5% of measured value ($H_2S$) ≤ ± 0.3% of measured value/K (CO) |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.05% of measured value/% RH |
| **Test gas:** | Gas mixture (CO, $H_2S$, $CH_4$,$O_2$) |

## SPECIAL CHARACTERISTICS

Carbon monoxide and hydrogen sulfide occur together in many areas of work. This sensor can monitor both gases simultaneously.




The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of CO or $H_2S$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $H_2S$ | Display in ppm CO |
|---|---|---|---|---|
| Ammonia | $NH_3$ | 100 ppm | ≤ 1 | ≤ 1 |
| Carbon dioxide | $CO_2$ | 30 Vol.-% | ≤ 1 (-) | ≤ 2 |
| Carbon monoxide | CO | 100 ppm | ≤ 1 | ≤ 100 |
| Chlorine | $Cl_2$ | 20 ppm | ≤ 2 (-) | ≤ 1 |
| Hydrogen | $H_2$ | 0.1 Vol.-% | ≤ 1 | ≤ 350 |
| Hydrogen chloride | HCl | 40 ppm | ≤ 1 | ≤ 1 |
| Hydrogen cyanide | HCN | 50 ppm | ≤ 1 | ≤ 1 |
| Hydrogen sulfide | $H_2S$ | 20 ppm | = 20 | ≤ 1 |
| Ethanol | $C_2H_5OH$ | 250 ppm | ≤ 1 | ≤ 1 |
| Ethine | $C_2H_2$ | 100 ppm | ≤ 1 | ≤ 200 |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 5 (-) | ≤ 1 |
| Nitrogen monoxide | NO | 30 ppm | ≤ 1 | ≤ 5 |
| Methane | $CH_4$ | 5 Vol.-% | ≤ 1 | ≤ 1 |
| Propane | $C_3H_8$ | 1 Vol.-% | ≤ 1 | ≤ 1 |
| Sulfur dioxide | $SO_2$ | 25 ppm | ≤ 2 | ≤ 1 |

# DrägerSensor® XXS $NH_3$

**Order no. 68 10 888**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger Pac 7000 | no | yes | 1 year | B2X (68 12 424) – replaceable |
| Dräger X-am 5000 | no | yes | 1 year | Cross sensitivities to hydrogen sulfide ($H_2S$) and sulfur dioxide ($SO_2$) are eliminated |
| Dräger X-am 5600 | no | yes | 1 year | |

## MARKET SEGMENTS

Food and beverage, poultry farming, power generation, inorganic chemicals, fertilizer production, hazmat, fumigation, metal processing, petrochemical, pulp and paper.

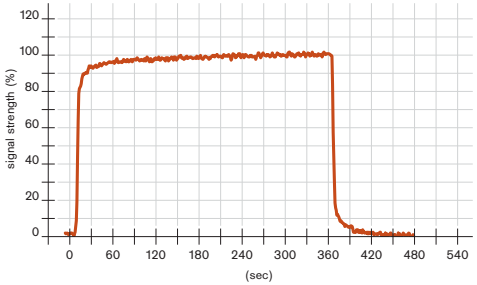
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 4 ppm |
| **Resolution:** | 1 ppm |
| **Measurement range:** | 0–300 ppm $NH_3$ (ammonia) |
| **Response time:** | ≤ 10 seconds at 20°C ($T_{50}$) or 68 °F |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 4 ppm |
| Sensitivity: | ≤ ± 3% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 5 ppm/year |
| Sensitivity: | ≤ ± 2% of measured value/month |
| **Warm-up time:** | ≤ 12 hours |
| **Ambient conditions** | |
| Temperature: | (–40 to 50)°C (–40 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 5 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0.1 ppm/% RH |
| Sensitivity: | ≤ ± 0.2% of measured value/% RH |
| **Test gas:** | approx. 50–300 ppm $NH_3$ |

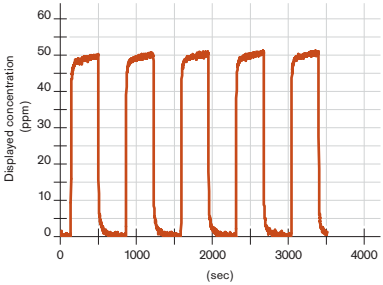
## SPECIAL CHARACTERISTICS

A fast response time and excellent repeatability are just two examples of this sensor's special characteristics.

Sensor reaction to $NH_3$ at 20 °C/68 °F
Flow = 0.5 l/min, 50 ppm $NH_3$




Repeatability of $NH_3$ Sensor with 50 ppm $NH_3$, average from five sensors




D-27837-2009

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $NH_3$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $NH_3$ without selective filter |
|---|---|---|---|
| Carbon dioxide | $CO_2$ | 10 Vol.-% | No effect |
| Carbon monoxide | CO | 1,000 ppm | No effect |
| Chlorine | $Cl_2$ | 10 ppm | ≤ 30 (–) |
| Ethanol | $C_2H_5OH$ | 250 ppm | ≤ 40 |
| Ethine | $C_2H_2$ | 100 ppm | No effect |
| Hydrogen | $H_2$ | 1,000 ppm | ≤ 4 |
| Hydrogen chloride | HCl | 20 ppm | ≤ 15 (–) |
| Hydrogen sulfide | $H_2S$ | 20 ppm | ≤ 70 |
| Methane | $CH_4$ | 0.9 Vol.-% | No effect |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 10 (–) |
| Nitrogen monoxide | NO | 20 ppm | ≤ 10 |
| Ozone | $O_3$ | 0.5 ppm | No effect |
| Phosphine | $PH_3$ | 1 ppm | ≤ 2 |
| Sulfur dioxide | $SO_2$ | 20 ppm | No effect |

(–) Indicates negative deviation

# DrägerSensor® XXS NO

**Order no. 68 11 545**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger Pac 7000 | no | yes | 1 year | no |
| Dräger X-am 5000 | no | yes | 1 year | no |
| Dräger X-am 5600 | no | yes | 1 year | no |

## MARKET SEGMENTS

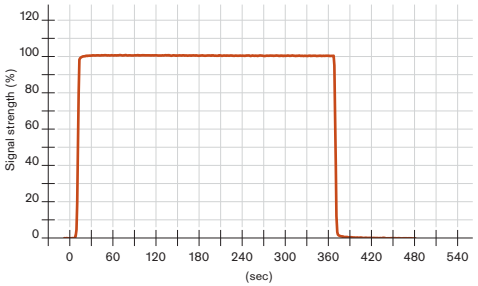
Power and district heating plants, chemical industry.

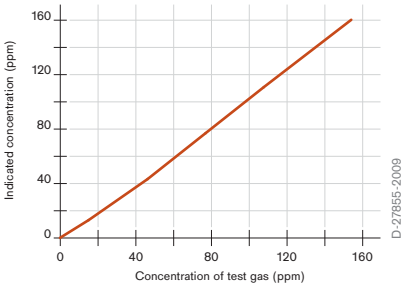
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.3 ppm |
| **Resolution:** | 0.1 ppm |
| **Measurement range:** | 0 to 200 ppm NO (nitrogen monoxide) |
| **Response time:** | ≤ 10 seconds at 20°C ($T_{90}$) or 68 °F |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.3 ppm |
| Sensitivity: | ≤ ± 3% of measured value |
| **Long-term drift**, at 20°C (68°F) | |
| Zero point: | ≤ ± 0.3 ppm/year |
| Sensitivity: | ≤ ± 2% of measured value/month |
| **Warm-up time:** | ≤ 20 hours |
| **Ambient conditions** | |
| Temperature: | (–40 to 50)°C (–40 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.02 ppm/K |
| Sensitivity: | ≤ ± 0.3% of measured value/K |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.05% of measured value/% RH |
| **Test gas:** | approx. 50 ppm NO |

## SPECIAL CHARACTERISTICS

This sensor enables a selective measurement of NO. $NO_2$ concentrations < 20 ppm have not effects. It also offers a very fast response time and excellent linearity across its entire measurement range.




D-27855-2009

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of NO. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm NO |
|---|---|---|---|
| Acetone | $CH_3COCH_3$ | 1,000 ppm | No effect |
| Ammonia | $NH_3$ | 500 ppm | No effect |
| Benzene | $C_6H_6$ | 0.6 Vol.-% | No effect |
| Carbon dioxide | $CO_2$ | 5 Vol.-% | No effect |
| Carbon monoxide | CO | 2,000 ppm | No effect |
| Chlorine | $Cl_2$ | 5 ppm | No effect |
| Ethanol | $C_2H_5OH$ | 250 ppm | No effect |
| Ethene | $C_2H_4$ | 0.1 Vol.-% | No effect |
| Ethine | $C_2H_2$ | 0.8 Vol.-% | No effect |
| Hydrogen | $H_2$ | 1.5 Vol.-% | No effect |
| Hydrogen chloride | HCl | 40 ppm | No effect |
| Hydrogen cyanide | HCN | 50 ppm | No effect |
| Hydrogen sulfide | $H_2S$ | 5 ppm | 100 |
| Methane | $CH_4$ | 2 Vol.-% | No effect |
| Nitrogen dioxide | $NO_2$ | 20 ppm | No effect |
| Phosphine | $PH_3$ | 2 ppm | No effect |
| Propane | $C_3H_8$ | 1 Vol.-% | No effect |
| Sulphur dioxide | $SO_2$ | 10 ppm | No effect |
| Tetrachloroethylene | $CCl_2$ $CCl_2$ | 1,000 ppm | No effect |
| Toluene | $C_6H_5CH_3$ | 0.6 Vol.-% | No effect |
| Trichloroethylene | $CHClCCl_2$ | 1,000 ppm | No effect |

# DrägerSensor® XXS $NO_2$

**Order no. 68 10 884**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger Pac 7000 | no | yes | 1 year | no |
| Dräger X-am 5000 | no | yes | 1 year | no |
| Dräger X-am 5600 | no | yes | 1 year | no |

## MARKET SEGMENTS

Inorganic chemicals, metal processing, oil and gas, petrochemical, steel industry, shipping, rocket engineering, mining and tunneling.

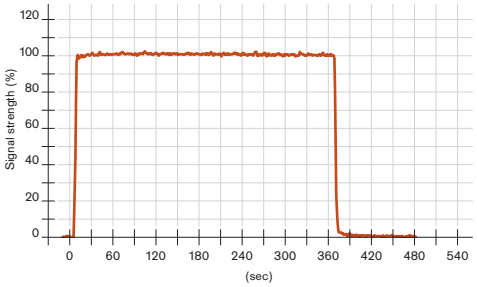
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.2 ppm |
| **Resolution:** | 0.1 ppm |
| **Measurement range:** | 0 to 50 ppm $NO_2$ (nitrogen dioxide) |
| **Response time:** | ≤ 15 seconds at 20°C ($T_{90}$) or 68 °F |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.2 ppm |
| Sensitivity: | ≤ ± 2% of measured value |
| **Long-term drift**, at 20°C (68°F) | |
| Zero point: | ≤ ± 1 ppm/year |
| Sensitivity: | ≤ ± 2% of measured value/month |
| **Warm-up time:** | ≤ 15 minutes |
| **Ambient conditions** | |
| Temperature: | (–30 to 50)°C (–22 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 1 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.2% of measured value/% RH |
| **Test gas:** | approx. 5 to 10 ppm $NO_2$ |

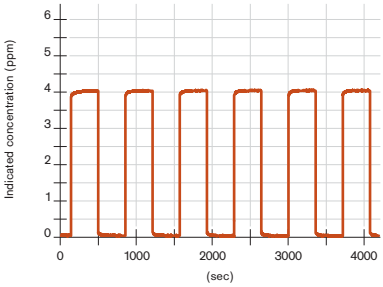
## SPECIAL CHARACTERISTICS

This sensor's advantages include a fast response time and excellent repeatability. This sensor enables a selective measurement of $NO_2$. NO concentrations < 20 ppm do not influence the measurement results, thus a selective $NO_2$ measurement is possilbe.

Sensor reaction to $NO_2$ at 20 °C/68 °F
Flow = 0.5 l/min, 4 ppm $NO_2$




Repeatability of $NO_2$ sensors
with 4 ppm $NO_2$




D-27854-2009

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $NO_2$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $NO_2$ |
|---|---|---|---|
| Ammonia | $NH_3$ | 50 ppm | No effect |
| Carbon dioxide | $CO_2$ | 1.5 Vol.-% | No effect |
| Carbon monoxide | CO | 200 ppm | No effect |
| Chlorine | $Cl_2$ | 10 ppm | ≤ 5 |
| Ethanol | $C_2H_5OH$ | 250 ppm | No effect |
| Ethine | $C_2H_2$ | 100 ppm | ≤ $10^{(-)}$ |
| Hydrogen | $H_2$ | 1,000 ppm | No effect |
| Hydrogen chloride | HCl | 20 ppm | ≤ $10^{(-)}$ |
| Hydrogen cyanide | HCN | 60 ppm | ≤ $10^{(-)}$ |
| Hydrogen sulfide | $H_2S$ | 20 ppm | ≤ $100^{(-)}$ |
| Methane | CH4 | 1 Vol.-% | No effect |
| Sulphur dioxide | $SO_2$ | 20 ppm | ≤ $20^{(-)}$ |
| Nitrogen monoxide | NO | 20 ppm | No effect |
| Ozone | $O_3$ | 0.5 ppm | No effect |
| Phosphine | $PH_3$ | 1 ppm | ≤ $4^{(-)}$ |

(–) Indicates negative deviation

# DrägerSensor® XXS $NO_2$ LC

**Order no. 68 12 600**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 5000 | no | yes | 1 year | no |
| Dräger X-am 5600 | no | yes | 1 year | no |

## MARKET SEGMENTS

Mining and tunnelling (emissions from diesel-engined vehicles), inorganic chemistry, metal processing, oil & gas, petrochemical industry, shipping, rocket technology

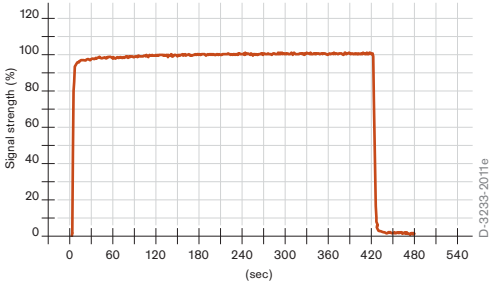
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.04 ppm |
| **Resolution:** | 0.02 ppm |
| **Measurement range:** | 0 to 50 ppm $NO_2$ (nitrogen dioxide) |
| **Response time:** | ≤ 15 seconds at 20°C ($T_{90}$) or 68 °F |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.02 ppm |
| Sensitivity: | ≤ ± 3% of measured value |
| **Long-term drift**, at 20°C (68°F) | |
| Zero point: | ≤ ± 0.04 ppm/year |
| Sensitivity: | ≤ ± 2% of measured value/month |
| **Warm-up time:** | ≤ 120 minutes |
| **Ambient conditions** | |
| Temperature: | (–30 to 50)°C (–22 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.5% of measured value |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.1% of measured value/% RH |
| **Test gas:** | approx. 5 to 10 ppm $NO_2$ |

## SPECIAL CHARACTERISTICS

Low cross sensitivities (e.g against $SO_2$, $H_2S$, NO and CO), which allows a selective measurement of $NO_2$. With a detection limit of 0.04 ppm and a quick response time this sensor is excellent to measure around the limit values.

Typical gas response of XXS $NO_2$ LC at 20 °C
Flow = 0.5 l/min, 1 ppm $NO_2$




The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $NO_2$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $NO_2$LC |
|---|---|---|---|
| Acetylene | $C_2H_2$ | 100 ppm | no effect |
| Ammonia | $NH_3$ | 30 ppm | no effect |
| Arsine | $AsH_3$ | 0.5 ppm | no effect |
| Carbon dioxide | $CO_2$ | 5 Vol.-% | no effect |
| Carbon monoxide | CO | 2,000 ppm | no effect |
| Chlorine | $Cl_2$ | 1 ppm | ≤ 1.5 |
| Chlorine dioxide | $ClO_2$ | 1 ppm | ≤ 1.5 |
| Ethane | $C_2H_6$ | 0.1 Vol.-% | no effect |
| Ethanol | $C_2H_5OH$ | 250 ppm | no effect |
| Hydrazine | $N_2H_4$ | 1 ppm | no effect |
| Hydrogen | $H_2$ | 0.1 Vol.-% | no effect |
| Hydrogen chloride | HCl | 40 ppm | no effect |
| Hydrogen cyanide | HCN | 50 ppm | no effect |
| Hydrogen sulfide | $H_2S$ | 1 ppm | ≤ 0.03(–) |
| Methane | $CH_4$ | 5 Vol.-% | no effect |
| Nitrogen monoxide | NO | 30 ppm | no effect |
| Ozone | $O_3$ | 0,5 ppm | ≤ 1 |
| Phosphine | $PH_3$ | 0,5 ppm | no effect |
| Propane | $C_3H_8$ | 1 Vol.-% | no effect |
| Sulfur dioxide | $SO_2$ | 1 ppm | ≤ 0.12(–) |

(–) Indicates negative deviation

# DrägerSensor® XXS OV

**Order no. 68 11 530**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger Pac 7000 | no | yes | 1 year | no |
| Dräger X-am 5000 | no | yes | 1 year | no |
| Dräger X-am 5600 | no | yes | 1 year | no |

## MARKET SEGMENTS

Production of plastics, disinfection, painter, chemical industry, pest control.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 1 ppm |
| **Resolution:** | 0.5 ppm |
| **Measurement range:** | 0 to 200 ppm $C_2H_4O$ (ethylene oxide) |
| | 0 to 200 ppm $C_3H_6O$ (propylene oxide) |
| | 0 to 100 ppm $C_2H_4$ (ethene) |
| | 0 to 100 ppm $C_3H_6$ (propene) |
| | 0 to 100 ppm $C_2H_3Cl$ (vinyl chloride) |
| | 0 to 200 ppm $CH_3OH$ (methanol) |
| | 0 to 100 ppm $CH_2CHCHCH_2$ (butadiene) |
| | 0 to 100 ppm HCHO (formaldehyde) |
| | 0 to 300 ppm $(H_3C)_2CHOH$ (isopropanol) |
| | 0 to 200 ppm $C_4H_8O$ (tetrahydrofuran) |
| | 0 to 100 ppm $C_2H_3OCH_2Cl$ (1-chloro-2,3 epoxypropane) |
| | 0 to 100 ppm $C_6H_5CHCH_2$ (styrol) |
| | 0 to 100 ppm $H_2CC(CH_3)COOCH_3$ (methyl methacrylate) |
| **Response time:** | ≤ 20 seconds at 20°C ($T_{50}$) or 68 °F |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 3 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 5 ppm/year |
| Sensitivity: | ≤ ± 2% of measured value/month |
| **Warm-up time:** | ≤ 18 hours |
| **Ambient conditions** | |
| Temperature: | (–20 to 50)°C (–4 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ± 2 ppm at (–20 to 40)°C (–4 to 104)°F |
| Zero point: | ± 0.5 ppm/K at (40 to 50)°C (104 to 122)°F |
| Sensitivity: | ≤ ± 1% of measured value/K |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.2% of measured value/% RH |

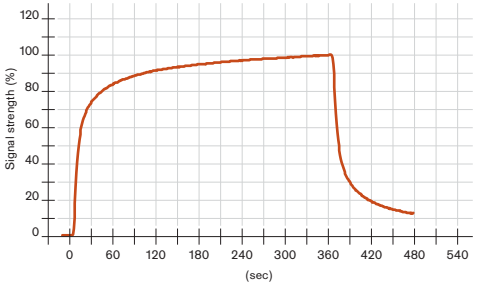
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Test gas:** | approx. 10 ppm $C_2H_4O$<br>The Dräger Sensor XXS OV has a defined cross-sensitivity to carbon monoxide (CO). It can be calibrated with CO as a replacement for all of its target gases. This replacement calibration using CO can produce an additional measuring error of up to 20%. We recommend that devices are calibrated with the gas you intend to detect in actual operation. Calibration using the target gas is more accurate than replacement gas calibration. |

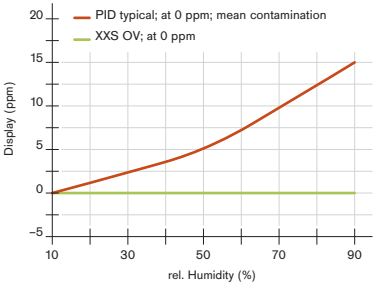
## SPECIAL CHARACTERISTICS

This sensor is especially suited for detecting leakages of numerous organic gases and vapors. Although it does not detect as broad a spectrum of gases as a PID sensor, it has the key advantage of being almost completely insensitive to moisture. It also does not need to be calibrated every day, having instead a six-month calibration interval typical of electrochemical sensors.

Sensor reaction to $C_2H_4O$ at 20 °C/68 °F
Flow = 0.5 l/min, with 20 ppm $C_2H_4O$




Influence of humidity on XXS OV sensors and PID sensors




D-27845-2009

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of ethylene oxide. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $C_2H_4O$ |
|---|---|---|---|
| Acetaldehyde | $CH_3CHO$ | 55 ppm | ≤ 15 |
| Acetic acid | $CH_3COOH$ | 100 ppm | No effect |
| Acrylonitrile | $H_2CCHCN$ | 80 ppm | ≤ 15 |
| Ammonia | $NH_3$ | 100 ppm | No effect |
| Benzene | $C_6H_6$ | 2,000 ppm | No effect |
| Carbon dioxide | $CO_2$ | 30 Vol.-% | No effect |
| Carbon monoxide | CO | 100 ppm | ≤ 44 |
| Chlorine | $Cl_2$ | 10 ppm | No effect |
| Chlorobenzene | $C_6H_5Cl$ | 200 ppm | No effect |
| Dichloromethane | $CH_2Cl_2$ | 1,000 ppm | No effect |
| Diethyl ether | $(C_2H_5)_2O$ | 100 ppm | ≤ 60 |
| Dimethylformamide | $HCON(CH3_3)_2$ | 100 ppm | No effect |
| Ethane | $C_2H_6$ | 0.2 Vol.-% | No effect |
| Ethanol | $C_2H_5OH$ | 250 ppm | ≤ 150 |
| Ethine | $C_2H_2$ | 100 ppm | ≤ 150 |
| Ethyl acetate | $CH_3COOC_2H_5$ | 100 ppm | No effect |
| Hydrogen | $H_2$ | 1,000 ppm | ≤ 5 |
| Hydrogen chloride | HCl | 20 ppm | ≤ 5 |
| Hydrogen cyanide | HCN | 20 ppm | ≤ 10 |
| Hydrogen sulfide | $H_2S$ | 20 ppm | ≤ 40 |
| Isobutylene | $(CH_3)_2CCH_2$ | 50 ppm | ≤ 45 |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 2 |
| Nitrogen monoxide | NO | 20 ppm | ≤ 20 |
| Methane | $CH_4$ | 2 Vol.-% | No effect |
| Methyl isobutyl ketone | $(CH_3)_2CHCH_2COCH_3$ | 500 ppm | No effect |
| Phosgene | $COCl_2$ | 50 ppm | No effect |
| Sulfur dioxide | $SO_2$ | 20 ppm | ≤ 10 |
| Tetrachloroethylene | $CCl_2$ $CCl_2$ | 100 ppm | No effect |
| Toluene | $C_6H_5CH_3$ | 1,000 ppm | No effect |
| Trichloroethylene | $CHClCCl_2$ | 1,000 ppm | No effect |
| Vinyl acetate | $CH_3COOC_2H_3$ | 30 ppm | ≤ 30 |
| Xylol | $C_6H_4(CH_3)_2$ | 0.2 Vol.-% | No effect |

ST-1979-2005


D-10155-2009

**DrägerSensor® XXS OV**

# DrägerSensor® XXS OV-A

**Order no. 68 11 535**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger Pac 7000 | no | yes | 1 year | no |
| Dräger X-am 5000 | no | yes | 1 year | no |
| Dräger X-am 5600 | no | yes | 1 year | no |

## MARKET SEGMENTS

Production of plastics, disinfection, paintshops, chemical industry.

## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 1 ppm |
| **Resolution:** | 1 ppm |
| **Measurement range:** | 0 to 200 ppm $C_2H_4O$ (ethylene oxide) |
| | 0 to 100 ppm $H_2CCHCN$ (acrylonitrile) |
| | 0 to 300 ppm $(CH_3)_2CCH_2$ (isobutylene) |
| | 0 to 100 ppm $CH_3COOC_2H_3$ (vinyl acetate) |
| | 0 to 300 ppm $C_2H_5OH$ (ethanol) |
| | 0 to 200 ppm $CH_3CHO$ (acetaldehyde) |
| | 0 to 200 ppm $(C_2H_5)_2O$ (diethyl ether) |
| | 0 to 100 ppm $C_2H_2$ (ethine) |
| **Response time:** | ≤ 40 seconds at 20°C ($T_{50}$) or 68 °F |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 5 ppm |
| Sensitivity: | ≤ ± 20% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 5 ppm/year |
| Sensitivity: | ≤ ± 3% of measured value/month |
| **Warm-up time:** | ≤ 18 hours |
| **Ambient conditions** | |
| Temperature: | (–20 to 50)°C (–4 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | (–20 to 40)°C (–4 to 104)°F = ± 2 ppm |
| Zero point: | (40 to 60)°C (104 to 140)°F = ± 0.5 ppm/K |
| Sensitivity: | ≤ ± 1% of measured value/K |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.2% of measured value/% RH |

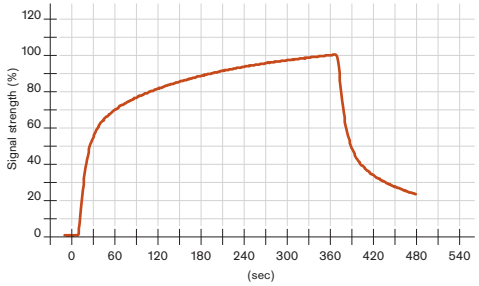
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Test gas:** | approx. 10 ppm $C_2H_4O$<br>The Dräger Sensor XXS OV-A has a defined cross-sensitivity to carbon monoxide (CO). It can be calibrated with CO as a replacement for all of its target gases. This replacement calibration using CO can produce an additional measuring error of up to 20%. We recommend that devices are calibrated with the gas you intend to detect in actual operation. Calibration using the target gas is more accurate than replacement gas calibration. |

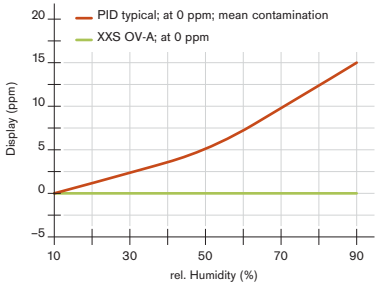
## SPECIAL CHARACTERISTICS

The DrägerSensor® XXS OV-A has the same excellent characteristics as the DrägerSensor® XXS OV, but it has also been optimized for other organic gases and vapors. Just like the DrägerSensor® XXS OV, the DrägerSensor® XXS OV-A can be calibrated with CO as a replacement, although this may produce an additional measuring error of 20%. For more accurate measurements, we recommend calibrating using the target gas – i.e. the gas that you intend to detect in actual operation.

Sensor reaction to $C_2H_4O$ at 20 °C/68 °F
Flow = 0.5 l/min, with 20 ppm $C_2H_4O$




Influence of humidity on XXS OV-A sensors and PID sensors



The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of ethylene oxide. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $C_2H_4O$ |
|---|---|---|---|
| 1-chloro-2, 3 epoxypropane | $C_2H_3OCH_2Cl$ | 25 ppm | ≤ 10 |
| Acetic acid | $CH_3COOH$ | 100 ppm | No effect |
| Ammonia | $NH_3$ | 100 ppm | No effect |
| Benzene | $C_6H_6$ | 2,000 ppm | No effect |
| Butadiene | $CH_2CHCHCH_2$ | 50 ppm | ≤ 75 |
| Carbon dioxide | $CO_2$ | 30 Vol.-% | No effect |
| Carbon monoxide | CO | 100 ppm | ≤ 45 |
| Chlorine | $Cl_2$ | 10 ppm | No effect |
| Chlorobenzene | $C_6H_5Cl$ | 200 ppm | No effect |
| Dichloromethane | $CH_2Cl_2$ | 1,000 ppm | No effect |
| Dimethylformamide | $HCON(CH_3)_2$ | 100 ppm | No effect |
| Ethene | $C_2H_4$ | 50 ppm | ≤ 45 |
| Ethyl acetate | $CH_3COOC_2H_5$ | 100 ppm | No effect |
| Formaldehyde | HCOH | 40 ppm | ≤ 25 |
| Hydrogen | $H_2$ | 1,000 ppm | ≤ 5 |
| Hydrogen chloride | HCl | 20 ppm | ≤ 3 |
| Hydrogen cyanide | HCN | 20 ppm | ≤ 8 |
| Hydrogen sulfide | $H_2S$ | 20 ppm | ≤ 40 |
| Isopropanol | $(H_3C)_2CHOH$ | 250 ppm | ≤ 110 |
| Methane | $CH_4$ | 2 Vol.-% | No effect |
| Methanol | $CH_3OH$ | 100 ppm | ≤ 160 |
| Methyl methacrylate | $H_2CC(CH_3)COOCH_3$ | 60 ppm | ≤ 25 |
| Methyl isobutyl ketone | $(CH_3)_2CHCH_2COCH_3$ | 500 ppm | No effect |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 1 |
| Nitrogen monoxide | NO | 20 ppm | ≤ 15 |
| Phosgene | $COCl_2$ | 50 ppm | No effect |
| Propene | $C_3H_6$ | 50 ppm | ≤ 35 |
| Propylene oxide | $C_3H_6O$ | 50 ppm | ≤ 45 |
| Sulfur dioxide | $SO_2$ | 20 ppm | ≤ 9 |
| Styrene | $C_6H_5CHCH_2$ | 35 ppm | ≤ 35 |
| Tetrahydrofuran | $C_4H8O$ | 60 ppm | ≤ 55 |
| Trichloroethylene | $CHClCCl_2$ | 1,000 ppm | No effect |
| Vinyl chloride | $C_2H_3Cl$ | 50 ppm | ≤ 40 |


ST-1713-2005

D-10157-2009

**DrägerSensor® XXS OV-A**

# DrägerSensor® XXS $O_2$
# DrägerSensor® XXS E $O_2$

**Order no. 68 10 881**
**68 12 211**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger Pac 3500 | no | yes | 2 years | no |
| Dräger Pac 5500 | no | yes | 2 years | no |
| Dräger Pac 7000 | no | yes | 2 years | no |
| Dräger Pac 7000 5Y | no | yes | 5 years | no |
| Dräger X-am 1700 | no | yes | 2 years | no |
| Dräger X-am 2000 | no | yes | 2 years | no |
| Dräger X-am 5000 | no | yes | 2/5 years | no |
| Dräger X-am 5600 | no | yes | 2/5 years | no |

## MARKET SEGMENTS

Sewage, mining and tunneling, fumigation, biogas, hazmat, industrial gases.

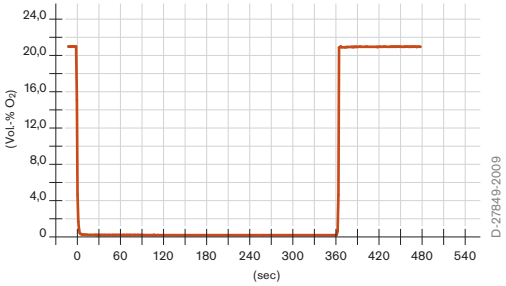
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.1 Vol.-% |
| **Resolution:** | 0.1 Vol.-% |
| **Measurement range:** | 0 to 25 Vol.-% $O_2$ (oxygen) |
| **Response time:** | ≤ 10 seconds at 20°C ($T_{90}$) or 68 °F |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.2 Vol.-% |
| Sensitivity: | ≤ ± 1% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 0.5 Vol.-%/year |
| Sensitivity: | ≤ ± 1% of measured value/year |
| **Warm-up time:** | ≤ 15 minutes |
| **Ambient conditions** | |
| Temperature: | (–40 to 50)°C (–40 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.2 Vol.-% |
| Sensitivity: | ≤ ± 2% of measured value |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.1% of measured value/% RH |
| **Test gas:** | approx. 18 Vol.-% $O_2$ in $N_2$ |

## SPECIAL CHARACTERISTICS

DrägerSensor® XXS oxygen sensors are lead-free, thus complying with Directive 2002/95/EC (RoHS). Because they are non-consuming sensors, they have much longer life times than sensors that are consuming. An extremely fast response time of less than ten seconds produces a reliable warning of any lack or excess of oxygen.

Sensor reaction to $O_2$ at 20 °C/68 °F
Flow = 0.5 l/min, with 100% $N_2$




The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $O_2$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES DRÄGERSENSOR® XXS $O_2$

| Gas/vapor | Chem. symbol | Concentration | Display in Vol.-% $O_2$ |
|---|---|---|---|
| Ammonia | $NH_3$ | 500 ppm | ≤ 0.1 |
| Carbon dioxide | $CO_2$ | 10 Vol.-% | ≤ 0.4(–) |
| Carbon monoxide | CO | 0.5 Vol.-% | ≤ 0.1 |
| Chlorine | $Cl_2$ | 10 ppm | ≤ 0.1 |
| Ethane | $C_2H_6$ | 1.0 Vol.-% | ≤ 0.2(–) |
| Ethanol | $C_2H_5OH$ | 250 ppm | ≤ 0.1 |
| Ethene | $C_2H_4$ | 2 Vol.-% | ≤ 2(–) |
| Ethine | $C_2H_2$ | 1 Vol.-% | ≤ 0.5(–) |
| Hydrogen | $H_2$ | 1.6 Vol.-% | ≤ 2.5(–) |
| Hydrogen chloride | HCl | 40 ppm | ≤ 0.1 |
| Hydrogen cyanide | HCN | 50 ppm | ≤ 0.1 |
| Hydrogen sulfide | $H_2S$ | 100 ppm | ≤ 0.1 |
| Methane | $CH_4$ | 10 Vol.-% | ≤ 0.1 |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 0.1 |
| Nitrogen monoxide | NO | 30 ppm | ≤ 0.1 |
| Propane | $C_3H_8$ | 2 Vol.-% | ≤ 0.1 |
| Sulfur dioxide | $SO_2$ | 20 ppm | ≤ 0.1 |

(–) Indicates negative deviation

## RELEVANT CROSS-SENSITIVITIES DRÄGERSENSOR® XXS E $O_2$

| Gas/vapor | Chem. symbol | Concentration | Display in Vol.-% $O_2$ |
|---|---|---|---|
| Ammonia | $NH_3$ | 500 ppm | No effect |
| Carbon dioxide | $CO_2$ | 10 Vol.-% | ≤ 0.4(–) |
| Carbon monoxide | CO | 0.5 Vol.-% | No effect |
| Chlorine | $Cl_2$ | 10 ppm | No effect |
| Ethane | $C_2H_6$ | 1.0 Vol.-% | ≤ 0.2(–) |
| Ethanol | $C_2H_5OH$ | 250 ppm | No effect |
| Ethene | $C_2H_4$ | 2 Vol.-% | ≤ 2(–) |
| Ethine | $C_2H_2$ | 1 Vol.-% | ≤ 0.5(–) |
| Hydrogen | $H_2$ | 1.6 Vol.-% | ≤ 2.5(–) |
| Hydrogen chloride | HCl | 40 ppm | No effect |
| Hydrogen cyanide | HCN | 50 ppm | No effect |
| Hydrogen sulfide | $H_2S$ | 100 ppm | No effect |
| Methane | $CH_4$ | 10 Vol.-% | No effect |
| Nitrogen dioxide | $NO_2$ | 20 ppm | No effect |
| Nitrogen monoxide | NO | 30 ppm | No effect |
| Propane | $C_3H_8$ | 2 Vol.-% | No effect |
| Sulfur dioxide | $SO_2$ | 20 ppm | No effect |

(–) negative reading


**DrägerSensor® XXS O2**

# DrägerSensor® XXS Odorant

**Order no. 68 12 535**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 5000 | no | yes | 1 year | B2X (68 12 424) – replaceable<br>Cross sensitivities to hydrogen sulfide ($H_2S$) and sulfur dioxide ($SO_2$) are eliminated |
| Dräger X-am 5600 | no | yes | 1 year | |

## MARKET SEGMENTS

Gas supply companies

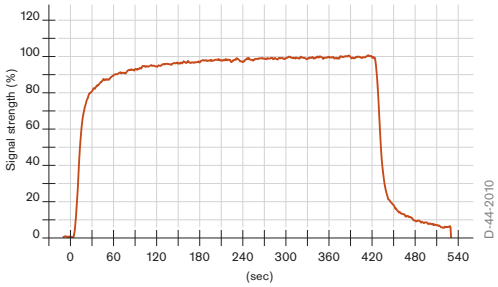
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 1 ppm |
| **Resolution:** | 0.5 ppm |
| **Measurement range:** | 0 - 40 ppm THT (tetrahydrothiophene) |
| | 0 - 40 ppm $(CH_3)_3CSH$ (tert.-butyl mercaptane) |
| | 0 - 40 ppm $C_2H_5CH(CH_3)SH$ (sec.-butyl mercaptane) |
| | 0 - 40 ppm $CH_3SH$ (methyl mercaptane) |
| | 0 - 40 ppm $C_2H_5SH$ (ethyl mercaptane) |
| | 0 - 100 ppm $(CH_3)_2S$ (dimethyl sulfide) |
| | 0 - 40 ppm $CH_3SSCH_3$ (dimethyl disulfide) |
| **Response time:** | ≤ 90 seconds at 20 °C or 68 °F ($T_{90}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 1 ppm |
| Sensitivity: | ≤ ± 3 % measured value/month |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 2 ppm/year |
| Sensitivity: | ≤ ± 2% measured value/month |
| **Warm-up time:** | ≤ 12 hours |
| **Ambient conditions** | |
| Temperature: | (-20 to 50)°C (-4 to 122) °F for THT, TBM, SBM<br>(5 to 40)°C (32 to 104) °F for MeM, EtM, DMS, DMDS |
| Humidity: | (10 to 90) % RH |
| Pressure: | (700 to 1300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 2 ppm |
| Sensitivity: | ≤ ± 10 % of measured value |
| **Influence of humidity** | |
| Zero point: | ≤ ± 0,1 ppm / % RH |
| Sensitivity: | ≤ ± 0,2 % of measured value/ RH |
| **Test gas:** | THT test gas of approx. 10 ppm or an other of the target gases:<br>TBM, SBM, MeM, EtM, DMS, DMDS |

## SPECIAL CHARACTERISTICS

This sensor can be used to monitor seven different odorants in the ambient air or (for short periods) in natural gas. It is sufficient to calibrate the sensor using a THT test gas. By doing so, all of the other target gases are then automatically calibrated. In addition to a quick response time this Odorant sensor are highly selective. An internal, replaceable selective filter filters out most associated gases in natural gases like $H_2S$ and $SO_2$.

Typical gas response of Odorant at 20 °C
flow = 0,5 l/min, purged with 10 ppm THT




The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $NH_3$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm THT without selective filter | Display in ppm THT with selective filter |
|---|---|---|---|---|
| Ammonia | $NH_3$ | 200 ppm | No effect | No effect |
| Carbon dioxide $CO_2$ | 1.5 Vol.-% | No effect | No effect | |
| Carbon monoxide | CO | 125 ppm | No effect | No effect |
| Chlorine | $Cl_2$ | 8 ppm | ≤3 ppm (–) | No effect |
| Ethine | $C_2H_2$ | 50 ppm | No effect | No effect |
| Hydrogen | $H_2$ | 1000 ppm | No effect | No effect |
| Hydrogen cyanide | HCN | 50 ppm | No effect | No effect |
| Hydrogen sulfide | $H_2S$ | 10 ppm | ≤30ppm | No effect |
| Methane CH4 | $CH_4$ | 100 Vol.-% | No effect | No effect |
| Methanol | $CH_3OH$ | 200 ppm | ≤5 ppm | ≤5 ppm |
| Nitrogen dioxide | $NO_2$ | 10 ppm | No effect | No effect |
| Nitrogen monoxide | NO | 20 ppm | ≤30 ppm | ≤30 ppm |
| n-propyl mercaptan | $C_3H_7SH$ | 6 ppm | ≤4 ppm | ≤4 ppm |
| Phosphine PH3 | $PH_3$ | 5 ppm | ≤15 ppm | ≤15 ppm |
| Sulfur dioxide | $SO_2$ | 20 ppm | ≤15 ppm | No effect |

(–) Indicates negative deviation

# DrägerSensor® XXS Ozone

**Order no. 68 11 540**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 5000 | no | yes | 1 year | no |
| Dräger X-am 5600 | no | yes | 1 year | no |

## MARKET SEGMENTS

Ozone generator manufacturer, coal-fired power plants, water treatment (drinking and industrial water), food and beverage industry, swimming pools, pulp and paper industry, pharmaceutical and cosmetics industry

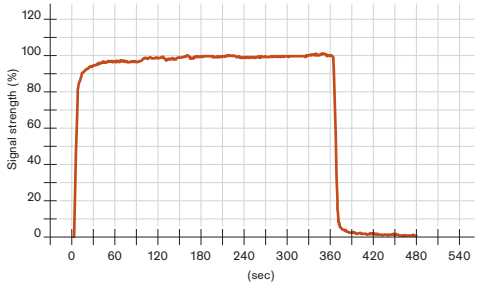
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0,02 ppm |
| **Resolution:** | 0,01 ppm |
| **Measurement range:** | 0 to 50 ppm $O_3$ (Ozon) |
| **Response time:** | ≤ 10 seconds at 20 °C ($T_{50}$) |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0,01 ppm |
| Sensitivity: | ≤ ± 3 % of measured value |
| **Long-term drift**, at 20°C (68°F) | |
| Zero point: | ≤ ± 0,02 ppm/year |
| Sensitivity: | ≤ ± 2 % of measured value/month |
| **Warm-up time:** | ≤ 120 minutes |
| **Ambient conditions** | |
| Temperature: | (-20 to 50) °C (-4 to 122) °F |
| Humidity: | (10 to 90) % RH |
| Pressure: | (700 to 1300) hPa |
| **Influence of temperature** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0,5 % of measured value/K |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0,1 % of measured value/% RH |
| **Test gas:** | Ozone, replacement gas for bump test and calibration $NO_2$ (5 ppm) |

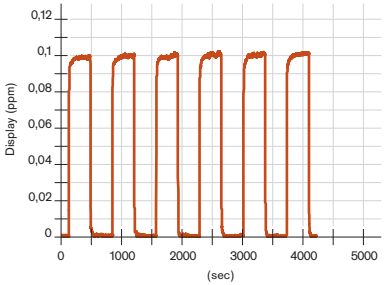
## SPECIAL CHARACTERISTICS

A fast response time and excellent repeatability are just two examples of this sensor's special characteristics. With a detection limit of 0.02 ppm and a resolution of 0.01 ppm, it is also optimally suited for limit value monitoring.

Sensor reaction to $O_3$ at 20 °C
Flow = 0.5 l/min, 0.1 ppm $O_3$




Reproducibility of $O_3$ sensors
purged with 0.1 ppm $O_3$
average of five sensors




D-3235-2011e

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of Ozone. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm Ozone |
|---|---|---|---|
| Ammonia | $NH_3$ | 30 ppm | no effect |
| Arsine | $AsH_3$ | 0,5 ppm | no effect |
| Carbon dioxide | $CO_2$ | 5 Vol.-% | no effect |
| Carbon monoxide | CO | 2000 ppm | no effect |
| Chlorine | $Cl_2$ | 1 ppm | ≤ 0,8 |
| Chlorine dioxide | $ClO_2$ | 1 ppm | ≤ 0,8 |
| Ethane | $C_3H_6$ | 0,1 Vol.-% | no effect |
| Ethanol | $C_2H_5OH$ | 250 ppm | no effect |
| Ethine | $C_2H_2$ | 100 ppm | no effect |
| Hydrazine | $N_2H_4$ | 1 ppm | no effect |
| Hydrogen | $H_2$ | 0,1 Vol.-% | no effect |
| Hydrogen chloride | HCl | 40 ppm | no effect |
| Hydrogen cyanide | HCN | 50 ppm | no effect |
| Hydrogen sulfide | $H_2S$ | 1 ppm | ≤ 0,02 (–) |
| Methane | $CH_4$ | 5 Vol.-% | no effect |
| Nitrogen dioxide | $NO_2$ | 1 ppm | ≤ 0,5 |
| Nitrogen monoxide | NO | 30 ppm | no effect |
| Phosphine | $PH_3$ | 0,5 ppm | no effect |
| Propane | $C_3H_8$ | 1 Vol.-% | no effect |
| Sulfur dioxide | $SO_2$ | 1 ppm | ≤ 0,06 (–) |

(–) Indicates negative deviation

# DrägerSensor® XXS $PH_3$

**Order no. 68 10 886**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger Pac 7000 | no | yes | 1 year | no |
| Dräger X-am 5000 | no | yes | 1 year | no |
| Dräger X-am 5600 | no | yes | 1 year | no |

## MARKET SEGMENTS

Inorganic chemicals, fumigation, clearance measurements.

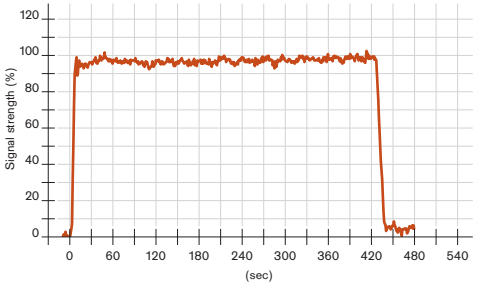
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.02 ppm |
| **Resolution:** | 0.01 ppm |
| **Measurement range:** | 0 to 20 ppm $PH_3$ (phosphine) |
| | 0 to 20 ppm $AsH_3$ (arsine) |
| | 0 to 20 ppm $B_2H_6$ (diborane) |
| | 0 to 20 ppm $SiH_4$ (silane) |
| **Response time:** | ≤ 10 seconds at 20°C ($T_{90}$) or 68 °F |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.02 ppm |
| Sensitivity: | ≤ ± 2% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 0.05 ppm/year |
| Sensitivity: | ≤ ± 2% of measured value/month |
| **Warm-up time:** | ≤ 15 minutes |
| **Ambient conditions** | |
| Temperature: | $PH_3$, $AsH_3$, $SiH_4$: (–20 to 50)°C (–4 to 122)°F |
| | $B_2H_6$: (0 to 50)°C (32 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 0.02 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.05% of measured value/% RH |
| **Test gas:** | approx. 0.5 ppm $PH_3$ |

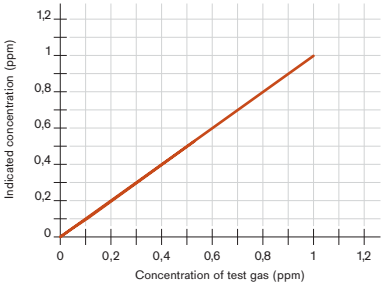
## SPECIAL CHARACTERISTICS

This sensor's advantages include an extreme fast response time of less than 10 seconds for 90% of the measured signal, and its excellent linearity. It is suitable for monitoring concentrations of common hydrides such as phosphine, arsine, diborane, and silane in the ambient air.

Sensor reaction to $PH_3$ at 20 °C/68 °F
Flow = 0.5 l/min, with 0,1 ppm $PH_3$




Linearity of $PH_3$ sensor
calibrated with 1 ppm $PH_3$




D-27847-2009

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $PH_3$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $PH_3$ |
|---|---|---|---|
| Ammonia | $NH_3$ | 50 ppm | No effect |
| Carbon dioxide | $CO_2$ | 10 Vol.-% | No effect |
| Carbon monoxide | CO | 200 ppm | No effect |
| Chlorine | $Cl_2$ | 10 ppm | ≤ 2 (-) |
| Hydrogen | $H_2$ | 1,000 ppm | ≤ 0.3 |
| Hydrogen chloride | HCl | 20 ppm | ≤ 1 |
| Hydrogen cyanide | HCN | 60 ppm | ≤ 5 |
| Hydrogen sulfide | $H_2S$ | 20 ppm | ≤ 20 |
| Ethanol | $C_2H_5OH$ | 250 ppm | No effect |
| Ethine | $C_2H_2$ | 100 ppm | No effect |
| Methane | $CH_4$ | 0.9 Vol.-% | No effect |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 5 (-) |
| Nitrogen monoxide | NO | 20 ppm | No effect |
| Ozone | $O_3$ | 0.5 ppm | No effect |
| Sulfur dioxide | $SO_2$ | 10 ppm | ≤ 1 |

(–) Indicates negative deviation

# DrägerSensor® XXS $PH_3$ HC

**Order no. 68 12 020**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger X-am 5000 | no | yes | 1 year | no |
| Dräger X-am 5600 | no | yes | 1 year | no |

## MARKET SEGMENTS

Inorganic chemicals, industry, fumigation.

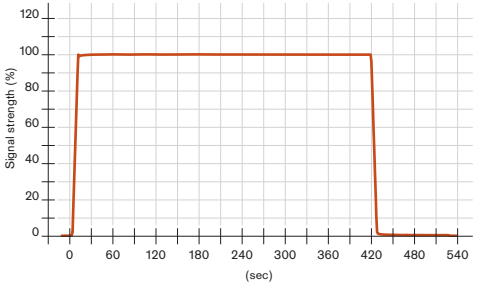
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 2 ppm |
| **Resolution:** | 1 ppm |
| **Measurement range:** | 0 to 2,000 ppm $PH_3$ (phosphine) |
| **Response time:** | ≤ 10 seconds at 20°C ($T_{90}$) or 68 °F |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 3 ppm |
| Sensitivity: | ≤ ± 2% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 2 ppm/year |
| Sensitivity: | ≤ ± 2% of measured value/month |
| **Warm-up time:** | ≤ 15 minutes |
| **Ambient conditions** | |
| Temperature: | (–20 to 50)°C (–4 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.05% of measured value/% RH |
| **Test gas:** | approx. 20 ppm $PH_3$ |

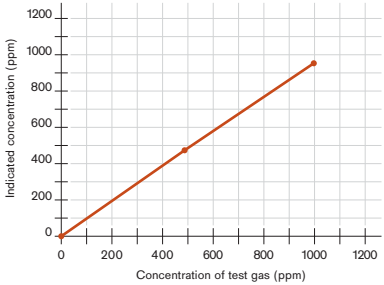
## SPECIAL CHARACTERISTICS

This sensor demonstrates excellent linearity across the whole measurement range even if calibrated in the lower reaches of that range, and it also provides a stable reading even at high concentrations over long periods of time.

Sensor reaction to $PH_3$ HC at 20 °C/68 °F
Flow = 0.5 l/min, with 1.050 ppm $PH_3$




Linearity of $PH_3$ HC sensor
calibrated with 15 ppm $PH_3$




D-27848-2009

The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $PH_3$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $PH_3$ |
|---|---|---|---|
| Ammonia | $NH_3$ | 50 ppm | No effect |
| Arsine | $AsH_3$ | 5 ppm | ≤ 5 |
| Carbon dioxide | $CO_2$ | 10 Vol.-% | No effect |
| Carbon monoxide | CO | 200 ppm | No effect |
| Chlorine | $Cl_2$ | 10 ppm | No effect |
| Diborane | $B_2H_6$ | 5 ppm | ≤ 3 |
| Ethanol | $C_2H_5OH$ | 250 ppm | No effect |
| Ethine | $C_2H_2$ | 100 ppm | No effect |
| Hydrogen | $H_2$ | 1,000 ppm | No effect |
| Hydrogen chloride | HCl | 20 ppm | No effect |
| Hydrogen cyanide | HCN | 60 ppm | ≤ 5 |
| Hydrogen sulfide | $H_2S$ | 20 ppm | ≤ 20 |
| Methane | $CH_4$ | 0.9 Vol.-% | No effect |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 5 (–) |
| Nitrogen monoxide | NO | 20 ppm | No effect |
| Ozone | $O_3$ | 0.5 ppm | No effect |
| Sulfur dioxide | $SO_2$ | 10 ppm | No effect |
| Silane | $SiH_4$ | 5 ppm | ≤ 5 |

(–) Indicates negative deviation

# DrägerSensor® XXS $SO_2$

**Order no. 68 10 885**

| Used in | Plug & Play | Replaceable | Guaranty | Selective filter |
|---|---|---|---|---|
| Dräger Pac 7000 | no | yes | 1 year | KX (68 11 344) replaceable |
| Dräger X-am 5000 | no | yes | 1 year | Cross sensitivities to hydrogen |
| Dräger X-am 5600 | no | yes | 1 year | sulfide ($H_2S$) are eliminated |

## MARKET SEGMENTS

Food industry, pest control, mining, oil and gas, petrochemical, paper manufacture, shipping, steel industry.

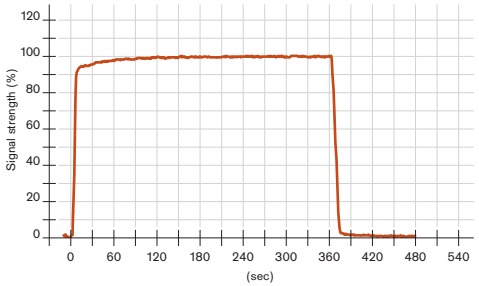
## TECHNICAL SPECIFICATIONS

| | |
|---|---|
| **Detection limit:** | 0.1 ppm |
| **Resolution:** | 0.1 ppm |
| **Measurement range:** | 0 to 100 ppm $SO_2$ (sulfur dioxide) |
| **Response time:** | ≤ 15 seconds at 20°C ($T_{90}$) or 68 °F |
| **Measurement accuracy** | |
| Zero point: | ≤ ± 0.1 ppm |
| Sensitivity: | ≤ ± 2% of measured value |
| **Long-term drift, at 20°C (68°F)** | |
| Zero point: | ≤ ± 1 ppm/year |
| Sensitivity: | ≤ ± 2% of measured value/month |
| **Warm-up time:** | ≤ 15 minutes |
| **Ambient conditions** | |
| Temperature: | (–30 to 50)°C (–22 to 122)°F |
| Humidity: | (10 to 90)% RH |
| Pressure: | (700 to 1,300) hPa |
| **Influence of temperature** | |
| Zero point: | ≤ ± 1 ppm |
| Sensitivity: | ≤ ± 5% of measured value |
| **Influence of humidity** | |
| Zero point: | No effect |
| Sensitivity: | ≤ ± 0.1% of measured value/% RH |
| **Test gas:** | approx. 10 ppm $SO_2$ |

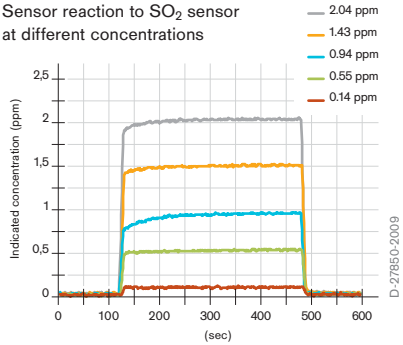
## SPECIAL CHARACTERISTICS

As well as a fast response time and excellent linearity, this sensor is highly selective if the selective filter is used. The KX selective filter (order no. 68 11 344) is an accessory for the DrägerSensor® XXS EC $SO_2$ and eliminates the sensor's cross-sensitivity to hydrogen sulfide. The filter has a lifetime of 1,000 ppm × hours, which means that at a hydrogen sulfide concentration of 1 ppm, it can be used for 1,000 hours.

Sensor reaction to $SO_2$ at 20 °C/68 °F
Flow = 0.5 l/min, with 2 ppm $SO_2$




Sensor reaction to $SO_2$ sensor
at different concentrations




The values shown in the following table are standard and apply to new sensors. The values maybe fluctuate by ± 30%. The sensor may also be sensitive to additional gases (for more information, please contact Dräger). Gas mixtures may be displayed as the sum of all components. Gases with a negative cross sensitivity may displace an existing concentration of $SO_3$. To be sure, please check if gas mixtures are present.

## RELEVANT CROSS-SENSITIVITIES

| Gas/vapor | Chem. symbol | Concentration | Display in ppm $SO_2$ without selective filter |
|---|---|---|---|
| Ammonia | $NH_3$ | 50 ppm | No effect |
| Carbon dioxide | $CO_2$ | 1.5 Vol.-% | No effect |
| Carbon monoxide | CO | 200 ppm | No effect |
| Chlorine | $Cl_2$ | 10 ppm | ≤ 5 (–) |
| Ethanol | $C_2H_5OH$ | 250 ppm | No effect |
| Ethine | $C_2H_2$ | 100 ppm | ≤ 140 |
| Hydrogen | $H_2$ | 1,000 ppm | No effect |
| Hydrogen chloride | HCl | 20 ppm | ≤ 5 |
| Hydrogen cyanide | HCN | 20 ppm | ≤ 10 |
| Hydrogen sulfide | $H_2S$ | 20 ppm | ≤ 60 |
| Methane | CH4 | 1 Vol.-% | No effect |
| Nitrogen dioxide | $NO_2$ | 20 ppm | ≤ 30 (–) |
| Nitrogen monoxide | NO | 20 ppm | No effect |
| Ozone | $O_3$ | 0.5 ppm | No effect |
| Phosphine | $PH_3$ | 1 ppm | ≤ 6 |

(–) Indicates negative deviation

# 4.7 Explanatory notes – sensor data

## DRÄGERSENSOR

Name and type of the sensor as well as the order number

| | |
|---|---|
| **Used as follows:** | Indicates the devices suitable for use with this sensor |
| **Plug & Play:** | Indicates whether this sensor has plug & play functionality |
| **Replaceable:** | Indicates whether the sensor in the device can be replaced |
| **Warranty:** | Indicates the warranty period for the sensor |
| **Selective filter:** | Indicates whether this sensor has a selective filter and which gases are filtered out |

## MARKET SEGMENTS

A list of typical market segments in which this sensor is used. This list does not claim to be complete.

## TECHNICAL DATA

Indicates the technical data for this sensor based on the sensor user manual.

## SPECIAL FEATURES

Description of the features that characterize this sensor and thus make it particularly interesting for various applications.

## RELEVANT INTERFERENCE

Selection of gases, which may affect the sensor in typical applications. The effect of the filter is depicted in a separate column for sensors with selective filter. (Data is based on the sensor user manual)

## TECHNICAL DATA

| | |
|---|---|
| **Detection limit:** | Indicates the smallest concentration other than zero depicted in the display. Example: At a detection limit of 2 ppm, the value 2 ppm is depicted in the display as the first concentration. Concentrations lower than 2 ppm are depicted as 0 ppm. |
| **Resolution:** | Indicates the concentration increments of the display. For example: With a detection limit of 2 ppm and a resolution of 1 ppm, the concentrations are depicted in the following increments: 2 ppm / 3 ppm / 4 ppm ... |
| **Measurement Range:** | Indicates the maximum measuring ranges of the sensors. All gases/ vapors with their ranges are indicated if a sensor can be used for different gases and vapors. |
| **Response time:** | Typically, the times listed here are $T_{50}$ or $T_{90}$ at 20°C (68°F). These times indicate when 50 % or 90 % of the final signal has been reached. |
| **Measurement accuracy:** | The data presented here relate to the zero point and the sensitivity: A zero point measuring accuracy of ≤ ± 2 ppm means the zero point may fluctuate between - 2 ppm and + 2 ppm. For example, if a measuring accuracy of ≤ ± 3 ppm of the measured value is indicated for the sensitivity, then the following can be said about the measuring accuracy: The concentration is between 97 and 103 ppm if 100 ppm is displayed. |
| **Long-term drift:** | This information indicates the typical drift of the sensor in the zero point and in the sensitivity across a longer period. This data may refer to a month or a year. The long-term drift data of ≤ ± 0.2 ppm/year at 20° C (68°F) states that this sensor drifts max. ≤ ±2 ppm per year. A value for the long-term drift of the sensitivity of ≤ ± 2 ppm/month, indicates that after two months with a display of 100 ppm, the maximum gas concentration may be between 96 and 104 ppm. |
| **Warm-up time:** | The warm-up time indicates the amount of time needed before a newly installed sensor or a sensor, which was without electricity for a period of time and then is powered up again, can be calibrated. However, the sensor may be ready for use after only a few minutes. In this case, there may be a higher rate of measurement errors. |
| **Ambient conditions:** | Indicates the temperature, humidity, and pressure range in which the sensor may be used. The indicated corrections do not apply with measurements outside of the permissible ambient conditions. Dräger is pleased to offer you additional advice on how to meet your specific requirements. Please contact the respective branch office if you require assistance. The addresses are listed on the rear cover page of this manual. |

| | |
|---|---|
| **Influence of temperature:** | The effect temperature may have must be considered when the measurement temperature deviates from the temperature during the calibration.<br>Example 1: Temperature effect on the sensitivity amounts to ≤ ± 5 % of the measured value. This means that the max. deviation across the entire temperature range of the sensor (typically - 40 to 50°C or - 40 to 122°F) is expected to be ≤ ± 5 %. At an ambient temperature of, for example, - 10° C (14°F) and a displayed value of 100 ppm, the max. gas concentration may be between 95 and 105 ppm. The temperature difference between the temperature of the measurement and the temperature of the calibration must be taken into account with some sensors.<br>Example 2: The effect of temperature on the sensitivity is ≤ ± 0.5 % of the measured value / K. The sensor was calibrated at 25°C (77°F), the measurement is taken at an ambient temperature of 35°C (95°F). The temperature difference is then 10°C (14°F) or 10 K. This yields the following calculation: 10 x 0.5% = 5%<br>With an ambient temperature of 35°C (95°F) and a displayed value of 100 ppm, the max. gas concentration is between 95 and 105 ppm. |
| **Influence of humidity:** | The effects of humidity must be considered if the humidity during measurement deviates from the calibration humidity.<br>Example 1: The effect of humidity on the sensitivity is ≤ ± 0.5 % of the measured value. This means that the max. deviation to be expected amounts to ≤ ± 5% with the deviation applying to the entire humidity range of the sensor (typically 10 to 90 % rel. humidity). With an ambient humidity of 50 %, for example, and a displayed value of 100 ppm, the max. gas concentration may be between 95 and 105 ppm. The humidity difference between the humidity of the measurement and the humidity of the calibration must be taken into account with some sensors.<br>Example 2: The effects of humidity on the sensitivity is ≤ ± 0.02 % of the measured value / % rel. humidity. The sensor was calibrated at 0% rel. humidity, the measurement is taken at an ambient rel. humidity of 50 %. The difference of the rel. humidity is then 50 %. This yields the following calculation: 50 x 0.02 % = 1 %<br>With an ambient humidity of 50 % and a displayed value of 100 ppm, the max. gas concentration is between 99 and 101 ppm. |
| **Test gas:** | Recommended test gas concentration for calibrating the sensor. |

# 5 Accessories

# 5.1 Introduction

The following chapter provides information about how to choose the right accessories and how to use them properly.

### Safety

Detection devices that do not work correctly can provide no protection and can lead to accidents. The only way to guaranty a reliable and correct measurement and warning of gas risks is to test your detection device using a known gas concentration. This is commonly referred to as a  function or bump test. The device may need to be calibrated.

### Additional features

You can extend the functionality of gas detection devices by using the right accessories. For instance, a device for personal monitoring can be turned into a device for detecting leaks and for performing clearance measurements when entering confined spaces, simply by using a pump, probe, and extension hose. The right materials are important – for example, when using extension hoses.

### Configuration/documentation/archiving

Gas detection devices can be adapted to a variety of applications by adjusting them to different evaluation parameters using an additional software program. This software runs on a separate computer. In many places of work, the exposure to hazardous material must be evaluated and documented. This process should be quick and intuitive.

# 5.2 Equipment for calibration and function tests

Gas detection devices are used for continuous measurements. Environmental influences or other gases can change the calibration, with which the sensor is delivered to the customer. Testing an instrument using a known gas concentration (also known as a function or bump test) is the only way to guarantee reliable and correct measurement of and warning against gas hazards. This test is important to verify whether the gas to be measured can flow through the dust and water filter to the sensor, to check that the sensor is properly calibrated, and to test that alarms are working and are set correctly. If the gas detector has been in contact with very high concentrations of toxic gases or vapours, it must immediately undergo a function (bump) test and the necessary adjustments, regardless of the required function test interval.

The various institutions stipulate regular sensitivity checks and functional tests (bump tests) for gas detection devices; In Germany, BG Chemie therefore recommends regular checks / calibrations in its data sheets T021 (gas warning equipment for toxic gases/vapors) / T023 (gas warning equipment for explosion protection). The EN 60079-29-2 standard (Gas detection devices – selection, installation, application, and maintenance of equipment for

the measurement of flammable gases and oxygen), which applies to all the member states of the European Union also stipulates a sensitivity test immediately before use (international: IEC 60079-29-2).

## 5.3 Basic test with gas

ST-5002-2005

The easiest and least expensive way to test the function of your portable gas detection instrument is to conduct a basic test with gas. All you need is a test gas bottle containing the respective test gas, a trigger regulator and aninstrument-specific calibration adapter. The instrument's alarm is triggered by briefly exposing the sensors to the test gas. To adjust the instrument via a PC, you need additionally the Dräger CC-Vision software, which allows individual configuration and calibration of your gas detection instruments.

## 5.4 Dräger Bump Test Station

The Dräger Bump Test Station was designed to allow a function (bump) test to be performed with a test gas in order to check the warning functions of gas detection instruments. An integrated instrument-specific adapter is provided to test the Dräger Pac 3500 to 7000, and of Dräger X-am 1/2/5500 5600/, 3000 and 7000. When the concentration shown on the instrument's display is within an acceptable tolerance to the concentration of the test gas and the alarms were trigged, the function (bump) test was successful and verifies the instrument calibration. If the function (bump) test was not successful, the instrument needs to be calibrated. With some devices, this is done automatically following an unsuccessful function test in the Dräger Bump Test Station. Instruments with an event or data logger will store the results (pass or fail) of the function (bump) test, as well as the subsequent automatic calibration when applicable. The Dräger Bump Test Station functions independently, without any external power supply, making it ideal for use anywhere in the field. The data from the Dräger Bump Test Station can be sent to a Dräger mobile printer

ST-4700-2005

using an optical port. This printer stores the results of the function test and prints them out. The results can also be exported using the Dräger CC-Vision software.
The tests are very short – sometimes only ten seconds, because the sensors respond so quickly – which makes for very low gas consumption and reduced operating costs.

## 5.5 Dräger E-Cal – the workshop solution

The Dräger E-Cal automatic testing and calibrating station incorporates as many as ten different instrument modules. Because Dräger detection devices can be calibrated and adjusted simultaneously, they are quick and therefore economic to maintain. The Dräger E-Cal is modular in design and, when fully equipped, can consist of a computer, a master station, and as many as ten different device modules.

### Master station

The Master Station allows you to use either two, six or twelve different gases, and supports up to ten instrument modules.

### Device module

When a Dräger portable gas detection instrument is inserted into its module, the sensors contained within are automatically detected. Once calibration has been successfully completed, the results are shown on both the module and the PC. Additionally, you can use the instrument module, with the respective plug, to charge your equipment. With the help of an optional adapter and a computer, each device module can also be operated independently of the master station, and used as an economic alternative for simple testing of a device's functionality.

### Dräger CC-Vision software

The Dräger CC-Vision E-Cal software features intuitive operation and the configurable GO button makes the instrument even easier to use. Specific workshop processes i.e. function (bump) test, calibration, download of data logger or battery test are carried out automatically and simultaneously for up to 10 instruments. Combined with a search function, the software also offers equipment management. The Dräger CC-Vision E-Cal software provides a wide range of different analysis and tracking functions, e.g. who a particular instrument belongs to,

ST-591-2005

which instruments require calibration and when, and what the calibration history is for individual instruments. The software additionally prints out a record to facilitate your data documentation. The workshop solution also simplifies configuration of several Dräger portable gas detection instruments. The Dräger CC-Vision E-Cal software is compatible with any PC.

### Purge module

An optional Purge Module is also available. When there is no ventialation systeminstalled this special option ensures the active and defined suction of waste gases – some of which are toxic and explosive – out of the Dräger E-Cal Station.

| Device | Dräger Bump Test Station with printer | Dräger Bump Test Station | Dräger E-Cal Station | Basic test with gas | Software Dräger CC-Vision |
|---|---|---|---|---|---|
| Dräger Pac 3500 – 7000 | ■ | ■ | ■ | ■ | ■ |
| Dräger X-am 1700/2000/5000/5600 | ■ | ■ | ■ | ■ | ■ |
| Dräger X-am 3000 | | ■ | ■ | ■ | ■ |
| Dräger X-am 5100 | | | | ■ | ■ |
| Dräger X-am 7000 | ■ | ■ | ■ | ■ | ■ |
| Dräger Multi-PID 2 | | | | ■ | |

## 5.6 Calibration gases

St-5080-2005

High-quality test and calibration gases are required in order to test the function of gas detection devices effectively and, if needed, to calibrate them. Dräger test and calibration gases are produced in accordance with ISO 9002, which guarantys a high standard of quality worldwide. They are available as single gases as well as gas mixtures.

The gases are packaged in small, convenient disposable cylinders, which can be taken anywhere, thus enabling on-site function testing with the Dräger Bump Test Station.

Another advantage of the disposable cylinders is the fact that they do not need to be returned – once empty, you can simply dispose of them in an environmentally-friendly manner such as with metal waste. This means no rental or transport costs to return the cylinders.

# 5.7 Regulator valves

All of the regulator valves we supply are suitable for our test and calibration gas cylinders, and permit flow rates of 0.5 l/min.

ST-4806-2005

Model 715

## USE

**For devices without internal pumps**

This valve has a thumb wheel for manually opening and closing the gas outlet.

ST-4804-2005

On-demand regulator valve

**For devices with internal pumps**

This valve opens automatically when the pump draws in gas.

**For the Dräger E-Cal station**

This regulator valve can be used in conjunction with devices that have internal pumps. If large, refillable cylinders with DIN 14 connectors are being used for the E-Cal station, then this valve can also be used in conjunction with a DIN 14 adaptor, which is also available from Dräger.

ST-4809-2005

Trigger-regulator valve

**For quick function tests prior to using a device**

Pulling the trigger manually applies calibration gas briefly to the gas detection device's sensor. Tipping the trigger upwards fixes the regulating valve in the open position, providing a continuous flow of gas.

## 5.8 Pumps

ST-4983-2005

Dräger X-am 3000
with pump adapter

ST-4990-2005

Dräger X-am 7000
with pump adapter

ST-9477-2007

Dräger X-am 1/2/5000
pump

Dräger X-am 3000 and Dräger X-am 7000 are optionally available with an integrated high-performance pump. When you attach the pump adaptor, the device automatically switches from diffusion to pump mode. This accessory enables the device to draw gas from remote measuring sites through a 20-meter-long (66 ft.) hose or, with a Dräger X-am 7000, a 45-meter-long (or 148 ft.) hose, thus enabling clearance measurements in shafts, tanks, and so on. The pump in the device is continuously monitored electronically. If the pump flow becomes too low – if, for example, the extension hose becomes kinked or blocked – then a pump alarm is activated on the device.

The Dräger X-am 1700/2000/5000/5600 devices can be also have this pump function through the use of the external X-am 1/2/5000 pump. When the detection device is put in to place, the pump function starts automatically and a flow test is initiated. Once the flow test is complete, the pump is ready for use and can be used in conjunction with a hose with a length of 20 meters (66 ft.).
The flow test prior to every use ensures safe and reliable pump operation. If the pump flow becomes too low, then a flow alarm is displayed on the pump. An easily replaceable dust and water filter protects the pump and the sensors in the device against dirt and contamination.

## 5.9 Probes

Probes, sometimes combined with extension hoses, are needed whenever leakages must be measured in inaccessible places, or when people are about to enter confined spaces.

| ORDER NUMBER | NAME | | LENGTH | MATERIAL | FOR USE WITH GAS DETECTION DEVICES | USES |
|---|---|---|---|---|---|---|
| 83 17 188 | Bar probe 400 |  D-25398-2009 | 40 cm<br>1.3 ft. | Stainless-steel probe with an external diameter of 10 mm (0.4 in.). | X-am 3000<br>X-am 7000<br>X-am 1700/2000<br>X-am 5000/5600<br>Multi PID II | This probe is particularly durable. It is used for applications such as pre entry measurements in gas-filled containers, where it is necessary to obtain air samples through closed seals. |
| 64 08 160 | GL probe (German Lloyd probe) |  D-25393-2009 | 50 cm<br>1.6 ft. | Stainless-steel probe with an external diameter of 6 mm (0.24 in.). | X-am 3000<br>X-am 7000<br>X-am 1700/2000<br>X-am 5000/5600<br>Multi PID II | Measurements in hatchways on ships. |
| 83 16 531 | Leakage probe 70 |  ST-14995-2008 | 70 cm<br>2.3 ft. | Flexible metal tube with an integrated Viton hose.<br>External diameter of 10 mm (0.4 in.)<br>Approved for Category 2G (Zone 1)<br>Testing report BVS PP 03.2148 EG (exam) | X-am 3000<br>X-am 7000<br>X-am 1700/2000<br>X-am 5000/5600<br>Multi PID II | This flexible probe can measure “round corners,” making it especially useful for difficult to reach places where there is a risk of explosion. |
| 83 16 532 | Bar probe 90 |  D-25396-2009 | 90 cm<br>3.0 ft. | Probe made from carbon-fiber reinforced plastic with an external diameter of 8 mm (0.3 in.). | X-am 3000<br>X-am 7000<br>X-am 1700/2000<br>X-am 5000/5600<br>Multi PID II | With its fixed length, this probe can be used for any applications involving distances of 90 cm (2.9 ft.) such as confined space entry. |
| 83 16 530 | Telescopic probe 100 |  ST-14992-2008 | 1 m<br>3.3 ft. | Metal probe with an integrated Viton hose.<br>External diameter of 12 mm (0.47 in.).<br>Approved for Category 2G (Zone 1)<br>Testing report BVS PP 03.2148 EG (exam) | X-am 3000<br>X-am 7000<br>X-am 1700/2000<br>X-am 5000/5600<br>Multi PID II | Extendable to lengths of up to 1 m (3.3 ft.). Suitable for areas where there is a risk of explosion. |

| ORDER NUMBER | NAME | | LENGTH | MATERIAL | FOR USE WITH GAS DETECTION DEVICES | USES |
|---|---|---|---|---|---|---|
| 83 16 533 | Telescopic probe ES 150 |  ST-14997-2008 | 1.5 m 4.9 ft. | Stainless-steel probe with an integrated Viton hose. External diameter of 12 mm (0.5 in.). Approved for Category 2G (Zone 1) Testing report BVS PP 03.2148 EG (Exam) | X-am 3000 X-am 7000 X-am 1700/2000 X-am 5000/5600 Multi PID II | Extendable to lengths of up to 1.5 m (4.9 ft.). Suitable for areas where there is a risk of explosion; solvent-resistant. |
| 64 08 239 | Measurement probe |  D-25392-2009 | 1.5 m 4.9 ft. | Aluminum probe with with an integrated PVC hose. External diameter of 10 mm (0.4 in.). | X-am 3000 X-am 7000 X-am 1700/2000 X-am 5000/5600 Multi PID II | With its fixed length, this probe can be used for any applications involving distances of 1.5 m (4.9 ft.). The tip of the probe is perforated for the last 15 cm (0.5 ft), enabling sampling in media such as grain sacks and dry bulk solids. |
| 68 01 954 | Plugable telescopic probe |  ST-14958-2008 | 2 m 6.6 ft. | Plastic probe with an integrated rubber hose. External diameter of 13 mm (0.5 in.). | X-am 3000 X-am 7000 X-am 1700/2000 X-am 5000/5600 Multi PID II | A probe 2 m (6.6 ft.) in length whose plug-in system makes it compact and easy to carry. Universal usage. |
| 83 18 371 | Float probe incl. hose |  D-10391-2009 | 5 m 16.4 ft. | Probe: Polycarbonate. Viton hose with external diameter of 8 mm (0.3 in.) + water and dust filter. | X-am 3000 X-am 7000 X-am 1700/2000 X-am 5000/5600 Multi PID II | For measurements in drainage and sewage systems. Solvent-resistant. |
| 68 07 097 | Float probe incl. hose |  D-10391-2009 | 10 m 32.8 ft. | Probe: Polycarbonate. Tube: CR-NR [polychloroprene (CR) with natural rubber (NR)] with an external diameter of 9 mm (0.35 in.). | X-am 3000 X-am 7000 X-am 1700/2000 X-am 5000/5600 Multi PID II | Electrically conductive. |

# 5.10 Extension hoses

Whenever the air quality has to be assessed at a distance, such as on the floor of a silo, at the bottom of a loading chamber on a ship, or in a sewage system, then extension hoses and pumps are needed. There are two important factors – the length of the hose and the material it is made of.

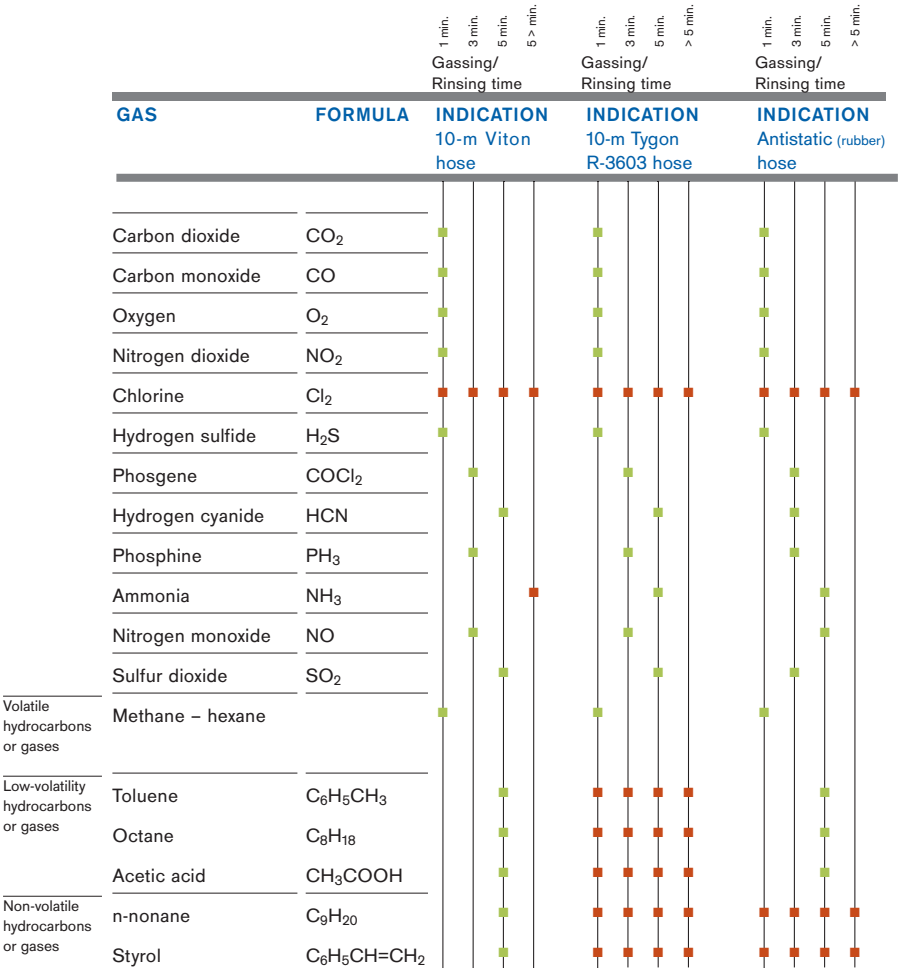
The power of the pump is crucial when deciding on the length of the hose. The Dräger X-am 1/2/5000 external pump and the pump intregrated in the Dräger X-am 3000 are designed for hoses with a length of up to 20 m (66 ft.). The Dräger X-am 7000 integrated pump is suitable for hose up to a length of 45 m (148 ft.).
When choosing the hose material, you must be aware of the way the gases you are measuring are absorbed into the surface of the hose.

Three different types of hose material have proven practical, each being suitable for particular groups of gases. The following table should help you to decide which type of hose to use.

## CHARACTERISTICS

| | **Viton 1203150** | **Tygon 8320395** | **Rubber 1180681** |
|---|---|---|---|
| Material | Viton | PVC | CR-NR DWN 2715 |
| **Chemical name** | FKM | Polyvinyl chloride | Polychloroprene (CR) with natural rubber (NR) |
| **Internal diameter** | 3.5 mm | 5 mm | 5 mm |
| **External diameter** | 5 mm | 8 mm | 7 mm |
| **Hardness** | 70 Shore A | 55 Shore A | 60 Shore A |
| **Color** | Black | Clear | Black |
| **Benefits** | Suitable for vapors | Transparent | Electrically conductive |
| **Temperature range** | –25°C to +200°C | –50°C to +75°C | –30°C to +135°C |
| **Use in Ex areas** | Suitable | Suitable | Suitable |

## TEST RESULTS AND MEASUREMENT RECOMMENDATIONS




| | GAS | FORMULA | INDICATION 10-m Viton hose | INDICATION 10-m Tygon R-3603 hose | INDICATION Antistatic (rubber) hose |
|---|---|---|---|---|---|
| | Carbon dioxide | $CO_2$ | ■ | ■ | ■ |
| | Carbon monoxide | CO | ■ | ■ | ■ |
| | Oxygen | $O_2$ | ■ | ■ | ■ |
| | Nitrogen dioxide | $NO_2$ | ■ | ■ | ■ |
| | Chlorine | $Cl_2$ | ■ ■ ■ ■ | ■ ■ ■ ■ | ■ ■ ■ ■ |
| | Hydrogen sulfide | $H_2S$ | ■ | ■ | ■ |
| | Phosgene | $COCl_2$ | ■ | ■ | ■ |
| | Hydrogen cyanide | HCN | ■ | ■ | ■ |
| | Phosphine | $PH_3$ | ■ | ■ | ■ |
| | Ammonia | $NH_3$ | ■ | ■ | ■ |
| | Nitrogen monoxide | NO | ■ | ■ | ■ |
| | Sulfur dioxide | $SO_2$ | ■ | ■ | ■ |
| Volatile hydrocarbons or gases | Methane – hexane | | ■ | ■ | ■ |
| Low-volatility hydrocarbons or gases | Toluene | $C_6H_5CH_3$ | ■ ■ | ■ ■ ■ ■ | ■ ■ |
| | Octane | $C_8H_{18}$ | ■ ■ | ■ ■ ■ ■ | ■ ■ |
| | Acetic acid | $CH_3COOH$ | ■ ■ | ■ ■ ■ ■ | ■ ■ |
| Non-volatile hydrocarbons or gases | n-nonane | $C_9H_{20}$ | ■ ■ | ■ ■ ■ ■ | ■ ■ ■ ■ |
| | Styrol | $C_6H_5CH=CH_2$ | ■ ■ | ■ ■ ■ ■ | ■ ■ ■ ■ |

■ suitable $t_{90}$ time

■ conditionally suitable, longer rinsing time, $t_{90 > 5 \text{ min.}}$

■ not suitable

## 5.11 Dräger CC-Vision

The “CC“ in Dräger CC-Vision stands for calibration and configuration, and that describes the two principal functions of this software. This software application enables Dräger gas detection devices to be configured and adjusted professionally. For instance, it enables some of the device’s settings to be adjusted to the application on hand, and the sensors to be calibrated. The functions of the device are shown clearly on the screen in a tree structure, allowing quick, customized adjustment of the device’s parameters, and calibration of the sensors as well. The software also helps to manage measurment data, thus enabling quick access to any reports you might need to locate.

## 5.12 Dräger GasVision

This software allows you to depict the measurement data stored in a device in table or graphic form. It shows an exposure curve for each sensor as an overview, from which segments can be extracted. This visualization enables hazardous situations to be recognized, and action to be taken accordingly. Comments about the place of measurement, the personnel, and other relevant data can be added to the records, allowing you to create complete documentation of the situation in a workplace.

### Closing comments

This chapter only covers a part of our comprehensive range of accessories. As well as pumps, calibration, and communication accessories, we also offer a large range of bags and cases (equipped and empty), and a range of power supply units – meaning that you can adapt your accessories to any application. Our gas detection equipment is also complimented by our services such as maintenance contracts, full service agreements, and complete worry-free packages, as well as training courses such as device maintenance courses. Our staff at our branch offices will gladly advise you further about these products and services.

lorem isum

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**HEADQUARTERS**
Dräger Safety AG & Co. KGaA
Revalstrasse 1
23560 Lübeck, Germany

www.draeger.com

**SUBSIDIARIES**

**AUSTRALIA**
Draeger Safety
Pacific Pty. Ltd.
Axxess Corporate Park
Unit 99, 45 Gilby Road
Mt. Waverley. Vic 3149
Tel +61 3 92 65 50 00
Fax +61 3 92 65 50 95

**CANADA**
Draeger Canada Ltd.
7555 Danbro Crescent
Mississauga,
Ontario L5N 6P9
Tel +1 905 821 89 88
Fax +1 905 821 25 65

**P. R. CHINA**
Beijing Fortune
Draeger Safety
Equipment Co., Ltd.
A22 Yu An Rd, B Area,
Tianzhu Airport Industrial Zone,
Shunyi District, Beijing 101300
Tel +86 10 80 49 80 00
Fax +86 10 80 49 80 05

**FRANCE**
Dräger Safety France SAS
3c route de la Fédération,
BP 80141
67025 Strasbourg Cedex 1
Tel +33 3 88 40 59 29
Fax +33 3 88 40 76 67

**MEXICO**
Draeger Safety S.A. de C.V.
Av. Peñuelas No. 5
Bodega No. 37
Fraccionamiento Industrial
San Pedrito
Querétaro, Qro México
Tel +52 442 246-1113
Fax +52 442 246-1114

**NETHERLANDS**
Dräger Safety
Nederland B.V.
Edisonstraat 53
2700 AH Zoetermeer
Tel +31 79 344 46 66
Fax +31 79 344 47 90

**REP. OF SOUTH AFRICA**
Dräger South Africa
(Pty) Ltd.
P.O.Box 68601
Bryanston 2021
Tel +27 11 465 99 59
Fax +27 11 465 69 53

**SINGAPORE**
Draeger Safety
Asia Pte Ltd
67 Ayer Rajah Crescent
#06-03
Singapore 139950
Tel +65 68 72 92 88
Fax +65 65 12 19 08

**SPAIN**
Draeger Safety Hispania S.A.
Calle Xaudaró 5
28034 Madrid
Tel +34 91 728 34 00
Fax +34 91 729 48 99

**UNITED KINGDOM**
Draeger Safety UK Ltd.
Blyth Riverside Business Park
Blyth, Northumberland
NE24 4RG
Tel +44 1670 352-891
Fax +44 1670 356-266

**USA**
Draeger Safety, Inc.
101 Technology Drive
Pittsburgh, PA 15275
Tel +1 412 787 83 83
Fax +1 412 787 22 07

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