POLON-ALFA

# ADDRESSABLE
# GAS DETECTORS
## TYPE PSG-6000

Installation and Maintenance Guide
IK-E363-001-GB

EDITION 4

The PSG-6000 addressable gas detectors that are the subject of this CI meet the essential requirements of the following regulations of the European Parliament and of the Council (EU) and European Union directives:

**EMC** Directive (EU) 2014/30/EU on electromagnetic compatibility.

An EU declaration of conformity has been issued for the PSG-6000 addressable gas detectors, available on the www.polon-alfa.com.

Before starting installation and operation, read the contents of this manual.

Failure to follow the recommendations in this manual may prove dangerous or result in a violation of applicable regulations.

The manufacturer POLON-ALFA is not responsible for damage caused as a result of use inconsistent with these instructions.

| | |
|---|---|
| A worn-out product, unfit for further use, should be handed over to one of the points dealing with the collection of waste electrical and electronic equipment. |  |

**Note** - The right to make changes is reserved.

# 1. PURPOSE.

PSG-6000 detectors are designed to detect flammable and toxic gases in public buildings, especially in underground garages and boiler rooms. It has a replaceable sensor module with 3 alarm thresholds. Addressable gas detectors of the PSG-6000 type operate on the detection lines of the CDG 6000 control panel.

**!!! NOTICE**
The PSG-6000 detectors are not intended for use in hazardous (EX) areas.

Thanks to the built-in temperature compensation, the detectors can operate in changing environmental conditions.
Information about the installed sensor module along with the values of alarm thresholds can be found on the detector housing.
PSG-6000 detectors are equipped with short-circuit isolators.

*Table 1: Selection of PSG-6000 type detectors.*

| Gas Detected | **CNG (Natural Gas) (selective methane)** | **LPG (propane – butane)** | **CO (carbon monoxide)** | |
|---|---|---|---|---|
| Model | **PSG-6001** | **PSG-6002** | **PSG-6003** | **PSG-6103** |
| Sensor module | MSG-6001 | MSG-6002 | MSG-6003 | MSG-6003 |
| Sensor type | Solid state | Solid state | electrochemical | electrochemical |
| Sensor supply | external 9÷30 V | external 9÷30 V | external 9÷30 V | from the detection line |

# 2. GAS HAZARDS.

**CO - carbon monoxide (colloquially: carbon monoxide)** - a colourless and odourless gas, undetectable by the senses. Slightly lighter than air, it mixes very well with it. Carbon monoxide as a product of incomplete combustion is practically always present in the exhaust fumes of motor vehicles and in boiler rooms. It is perfectly absorbed into the body (better than oxygen) by permanently binding to hemoglobin, which can result in serious hypoxia.

*Table 2: Effect of carbon monoxide on humans according to CIOP-PIB1.*

| CO concentration in the air | TIME OF ABSORPTION and observed SYMPTOMS of POISONING |
|---|---|
| ~200 ppm | slight headache after a few hours |
| ~400 ppm | headache, nausea, vomiting, muscle weakness, apathy after 1 to 2 hours |
| ~800 ppm | collapse, loss of consciousness after 2 hours |
| ~1600 ppm | collapse within 20 minutes, risk of DEATH after 2 hours |
| ~3400 ppm | collapse after 5-10 minutes, risk of DEATH after 30 minutes |
| ~7000 ppm | collapse after 1-2 minutes, risk of DEATH after 10-15 minutes |
| ~13000 ppm | DEATH after 1 to 3 minutes! |

[1] NOTE: for CO 1 % vol. = 10.000 ppm = 8600 mg/m$^3$

**LPG (auto gas) –** the most popular gas fuel in vehicles with an internal combustion engine. A mixture of flammable hydrocarbons, mainly propane and butane. The lower explosive limit for butane is 1.4 % and for propane is 1.7 %. It is much heavier than air, which means that it will lie well in all depressions, basements, workshop sewers, etc. The danger associated with LPG lies primarily in its explosiveness.
**CNG (compressed natural gas)** - an increasingly popular and cheap fuel for delivery vehicles and public transport. The main ingredient is methane – a gas much lighter than air, which means that it can linger under the ceiling of the room. The lower explosion limit for methane is 4.4 %.

## 3. TECHNICAL DATA.

*Table 3: Technical parameters.*

| Parameter | PSG-600x | PSG-610x |
|---|---|---|
| Supply voltage. | external 9 ÷ 30 V DC<br>from the 16.5 V ÷ 24.6 V detection line | from the 16.5 V ÷ 24.6 V detection line |
| Power consumption | max 30 mA @ 12 V<br>max 15 mA @ 24 V | n.d. |
| Current consumption from the detection line | < 150 µA | < 250 µA |
| Alarm thresholds | **PSG-6001:** A1 = 10 % A2 = 20 % A3 = 30 % LEL of methane (selective)<br>**PSG-6002:** A1 = 10 % A2 = 20 % A3 = 30 % LEL of propane-butane (50/50)<br>**PSG-6x03**: A1 = 30 ppm CO (TWA 15 min) A2 = 60 ppm CO (TWA 15 min) A3 = 150 ppm (exceeded by at least 60 s) according to PN-EN 50545-1 | |
| Interferying gases | **PSG-6001:** hydrogen, ethanol, oxygen deficiency<br>**PSG-6002**: methane, hydrogen, ethanol, oxygen deficiency<br>**PSG-6x03**: hydrogen, slightly ethanol | |
| Working conditions | -20 ÷ 50 °C RH. 10-90 % | |
| Storage conditions | 0 ÷ 40 °C 10-80 % | |
| Protection | IP54 (in recommended mounting position) | |
| Housing Material | ABS/PC | |
| Cable Inlets (Cable Diameter) | stuffing box M12 (3÷6.5 mm) | |
| Dimensions (with glands) | 160x124x68 mm | 120x124x68 mm |
| Mass | < 0.3 kg | < 0.25 kg |
| Service intervals | 3 months recommended (maximum 12 months) | |
| Sensor lifetime. | Up to 10 years in clean air | |

## 4. DESCRIPTION OF THE BUILD.

Figures 4.1 and 4.2 show the interior of the PSG-6000 and PSG-6100 detectors, respectively. The PSG-6000 detectors work with interchangeable MSG-6000 sensor modules. The detector has spring connectors allowing the use of wire and stranded wires with a diameter of 0.25 to 1.5 $mm^2$ (up to 1 $mm^2$ in the case of crimping sleeves). In the PSG-6000 detectors, the detection line system is isolated, which allows to connect the power supply to the detectors from any source, and it is also possible to power the detectors on the detection line from various sources. In the PSG-6001 and PSG-6002 detectors, there is a cover with a dust filter on the sensor module that protects not only against dust but also against small insects. With the PSG6x03, the sensor is sealed directly to the ventilation element.

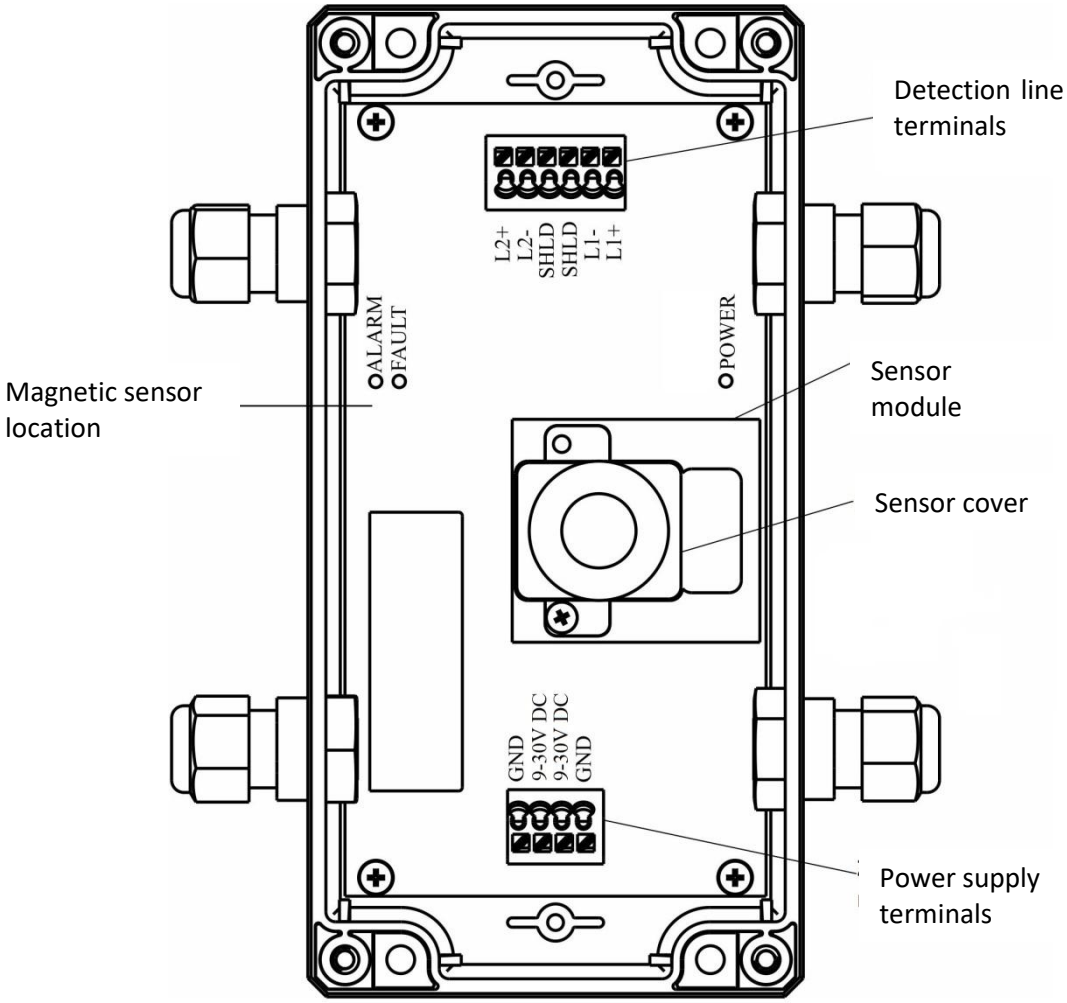


*Figure 4.1 Inside the PSG-6000.*

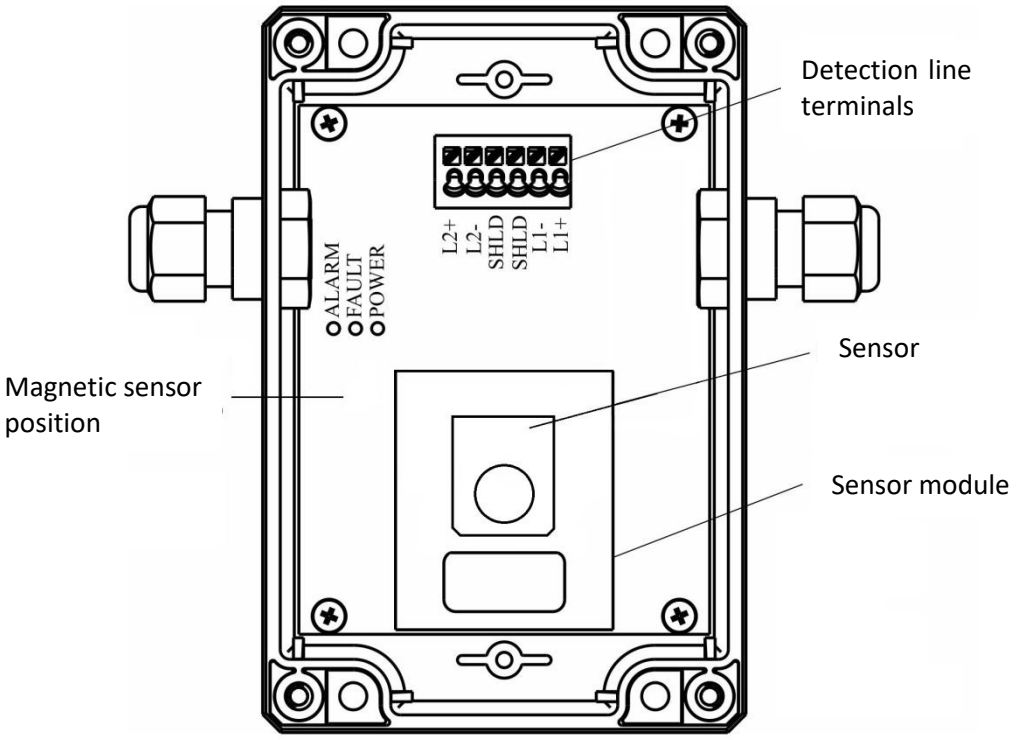


*Figure 4.2 Inside the PSG-6100 detector.*

## 5. DESCRIPTION OF THE OPERATION.

In their principle of operation, detectors use the phenomenon of gas diffusion in the environment. The ventilation element allows gas to enter the detector and reach the sensor. The microprocessor measuring system continuously analyzes the concentration of the measured gas and compares it with the value of the corresponding alarm threshold. For alarm thresholds expressed in instantaneous values, a false alarm filter (shorter than 15 s) has been added. The measurement circuit also provides temperature compensation, giving the possibility of using detectors in a wider range of temperatures. After connecting the power supply, the detector is in the sensor warm-up state for 60 seconds, during which the initial conditioning of the sensor operation takes place. Semiconductor sensors achieve full measurement efficiency after at least 48 hours of uninterrupted power supply.
The built-in short-circuit isolator allows for the detection of errors and damage to the installation. In the case of using a loop line, the damage of the line in one place does not disconnect the detectors from the control panel.
The alarming status of the detector is indicated by a pulsed red LED light. The indicator allows you to quickly locate the alarming detector and helps you periodically check the detector's operation. The detector fault condition is indicated by a pulsed yellow LED light. The green POWER LED indicates the detector is operating. In the PSG-6100 detectors, it flashes signaling the correct operation of the detector. In the PSG-6000 detectors, the POWER diode is connected to the sensor module, signaling the correct supply voltage of the sensor module, in addition, short flashes of this diode signal the sensor burn-in status. Short blanks indicate the detection of a small amount of gas detected, which can be helpful during periodic inspection.

# 6. INSTALLING DETECTORS.

## 6.1. Installation location.

The installation location has a significant impact on the operation of the detector. The detector should be mounted:

- as close as possible to the potential source of gas – no further than 9 m,
- away from ventilation air vents, doors or windows,
- in a place with free flow of ambient air,
- in a place not exposed to the sun, away from heat sources,
- in a place not threatened by mechanical damage, vibrations and strong electromagnetic fields,
- in a place not threatened by the direct influence of outside air, water vapour, car fluids and exhaust fumes, exhaust gases from furnaces and dust.

CO detectors should be mounted at a height of **1.5 to 2 m** (i.e. at the height of the head of a person of average height).
LPG detectors should be mounted at a height of **15 to 40 cm** away from depressions in the ground.
CNG detectors should be mounted at a height **not lower than 30 cm** below the ceiling or on the ceiling.

## 6.2. Mounting position.

The PSG-6000 series detectors are recommended to be mounted in a vertical position with the gas inlet downwards, this position guarantees the best protection against dust and splashes. In the case of methane detectors, due to the installation height, a horizontal position is possible, although not recommended, (increased susceptibility to dust accumulation in the gas inlet element) or ceiling mounting. Installation with the gas inlet facing upwards is not permitted, in this position the detector is exposed to splashing water and excessive dust accumulation in the gas inlet element. The mounting positions are shown in Figure 6.3.1.
For propane-butane detectors, due to the low installation height in places exposed to mechanical damage, it is recommended to use an appropriate cover.

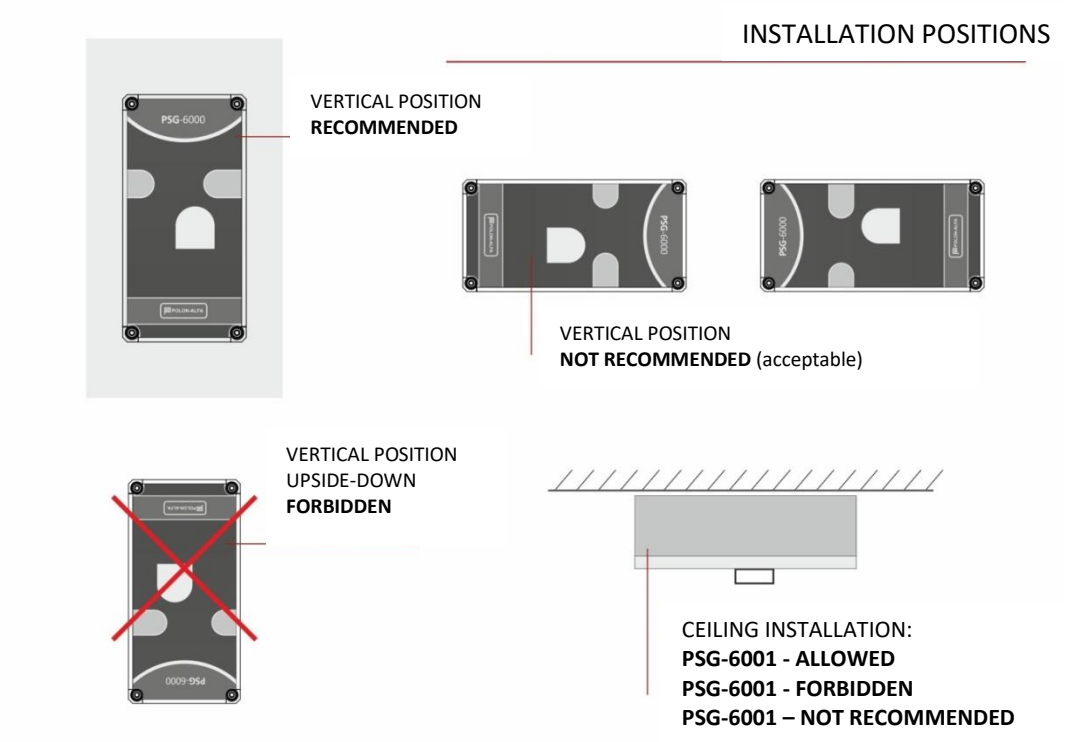


*Figure 6.2.1 Mounting positions of PSG-6000 detectors.*

## 6.3. Installation of detectors.

| | |
|---|---|
|  | **!!! NOTICE**<br>All works related to the installation of detectors should be carried out with the power supply voltage disconnected. |

Before installation, check the validity of the calibration certificate.
Remove the detector cover and remove the sensor module to protect against dust. Attach the detector to the ground with 4 wall plugs.
The self-locking connectors used allow the use of multi-core wires and strands with a cross-section of 0.25 to 1.5 $mm^2$ (up to 1$mm^2$ in the case of crimping sleeves). The diameter of the wire is limited by the cable glands used and is 3 ÷ 6.5 mm. The ends of the wires should be stripped over a length of 8 mm.
After connecting the power supply and all sensors are burned in, the installation test can be performed according to procedure 8.1. After a positive pass, the detector covers can be installed, making sure that the sensor covers are mounted and in the correct position. The lack of sensor covers reduces the protection of the housing to IP43 and the operation of the detector without the sensor cover is prohibited.
The diagram of the detector connection is shown in Figure 6.3.1.

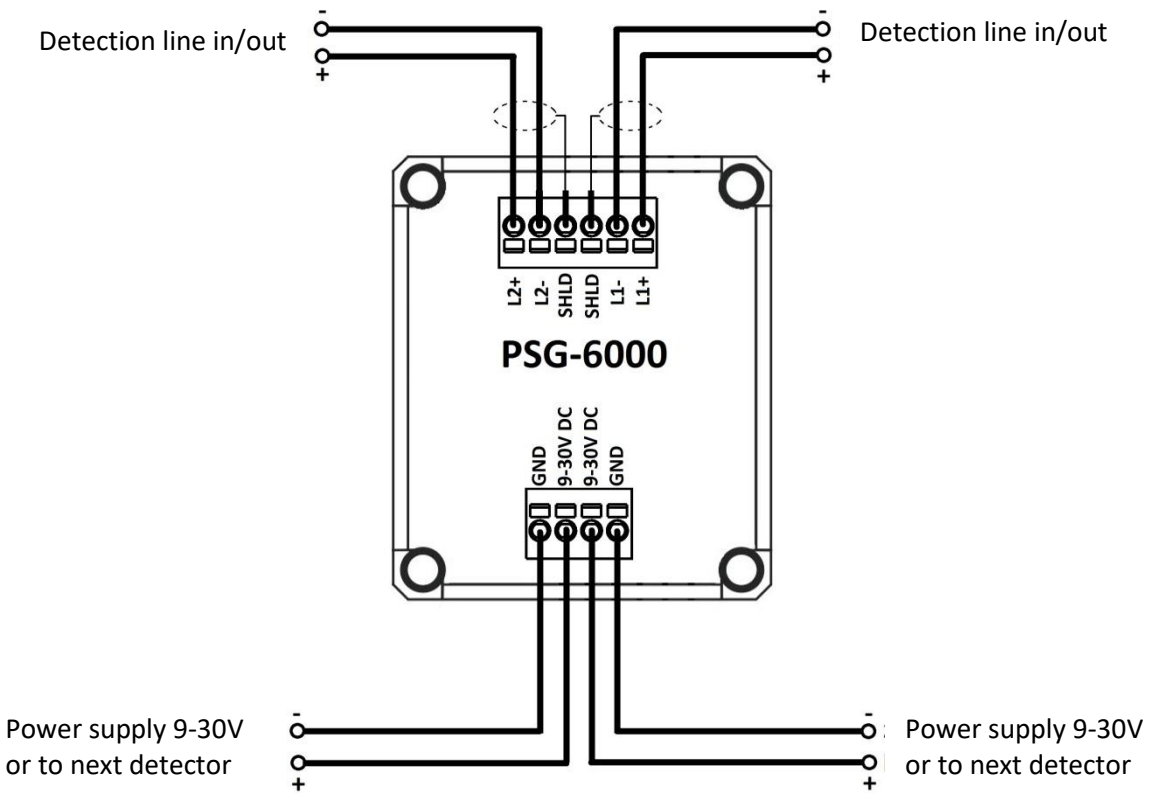


*Figure 6.3.1 Detector wiring diagram.*

# 7. OPERATING AND SERVICING CONDITIONS.

Periodic check-ups are recommended to be carried out once every 3 months and after the occurrence of:

- extreme operating conditions, i.e. high dustiness, occurrence of temperatures outside the permissible range, high concentration of the detected gas,
- a long-term state of alarm,
- after a long-term power outage,
- after renovation works.

Periodic inspection consists of:

- checking the conductivity of the gas sensor cover and the condition of the seals,
- periodic test of detection functions see point 8.2.

Because semiconductor sensors increase their sensitivity over time, it is recommended to calibrate the sensor at least once every 3 years and after too frequent reactions to too low gas concentrations. Electrochemical sensors reduce their sensitivity over time, and long-term very low or high humidity has an additional impact on the change in sensitivity. It is recommended to calibrate at least every 3 years. The expiry of the calibration validity period is indicated by a fault.

In order to calibrate the sensors, the sensor module must be removed and sent back to the manufacturer. Sending the module back is the fastest and most economically justified way to ensure full correct operation of the sensor. The calibrated sensor module will be sent back with a new calibration certificate and a sticker informing about the sensor type and calibration expiration date, which should be placed on the detector housing in place of the previous one.

In the case of renovation works, PSG-6000 detectors must be turned off and tightly secured with foil. Any solvent or silicone fumes are very harmful to the sensors.

## 7.1. Sensor module replacement.

Sensor module removal:

- disconnect the external power supply (in the case of PSG-6100 detectors, disconnect the detection line),
- remove the detector cover,
- take sensor plate with your fingers and gently pull it out,
- Install the detector cover.

**!!! NOTICE**
The absence of the sensor module will reduce the enclosure protection to IP43.

Sensor module installation:

- disconnect the external power supply (in the case of PSG-6100 detectors, disconnect the detection line),
- insert the sensor module, making sure that it is properly mounted (all pins are in the sockets),
- attach the detector cover so that the inlet surface of the sensor is under the foam seal of the ventilation element,
- switch on the power supply.

When the power is turned on, the POWER LED should blink for 60 seconds and then turn on continuously.

# 8. DETECTOR TESTING.

## 8.1. Testing the installation.

Before powering the sensors, make sure that there are no short circuits or interruptions in the system. Lack of external power supply will result in a failure report, which will be signaled in the control panel. The detector is equipped with a magnetic field sensor that allows you to test communication with the control panel and determine its location in the facility. Place the magnet against the housing near the location marked with the magnet symbol.

## 8.2. Detection function test.

With the help of a suitable test cap at a flow rate of 0.5 l/min, put the test gas:

- for PSG-6x03 containing 100 ÷ 200 ppm CO for a time appropriate to trigger alarm 1 or 3,
- for PSG-6001 and PSG-6002 containing > 20 % LEL of gas detected until the alarm is triggered.

When a small amount of gas is detected, the POWER LED lights up continuously with short blanks every 2.5 seconds, which allows the test to be performed in a shorter time and the sensors are not exposed to a significant gas concentration for too long.

# 9. SAFETY CONDITIONS.

## 9.1. Repairs and maintenance.

Maintenance works and periodic inspections must be carried out by authorized personnel of companies authorized or trained by POLON-ALFA.
All repairs must be carried out by the manufacturer.
POLON-ALFA is not responsible for the operation of equipment maintained and repaired by unauthorized personnel.

## 9.2. Work at height.

Work at height related to the installation of detectors should be carried out with special caution with the use of functional equipment and tools.
Particular attention should be paid to the stability of ladders, lifts, etc.
Power tools must be used in accordance with the conditions of their safe operation specified in the relevant manufacturer's instructions.

## 9.3. Protecting your eyes from dust.

When working with a lot of dust, especially when drilling holes in ceilings to attach detectors, use safety goggles and dust masks.

# 10. STORAGE AND TRANSPORT.

## 10.1. Storage.

The detectors shall be stored in enclosed spaces where there are no caustic vapours and gases, where the temperature is between 0 °C and +40 °C and the relative humidity does not exceed 80 % at +35 °C. During storage, the detector should not be exposed to direct sunlight or heat from heating devices. The shelf life of the detector in the transport packaging should not exceed 6 months.

## 10.2. Transport.

The detectors must be transported in confined spaces of means of transport, in packaging that meets the requirements of the applicable transport regulations. The temperature during transport should not

be lower than -20 °C and above +50 °C, and the relative humidity should not exceed 95 % at +45 °C or 80 % at +50 °C.

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