User Manual

Gas Detector

ProGas 4

Product code: PW-017-PG4-X

POD-064-ENG R07

Reliable and Innovative Gas Detection & Safety Systems

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Systems for Monitoring, Detection and Reduction of gas hazards

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Remarks and reservations

- Read and understand this manual prior to connection and operation of the device. Keep the User Manual with the device for future reference.
- The manufacturer shall not be held responsible for any errors, damage or defects caused by improper selection of suitable devices or cables, errors in installation of equipment or any misuse due to failure to understand the document content.
- Unauthorised repairs and modifications of the device are not allowed. The manufacturer shall discard any responsibility for consequences of such actions.
- Exposure of the device to the impact of excessive mechanical, electric or environmental factors may lead to damage of the device.
- Operation of damaged or incomplete devices in not allowed.
- Engineering of a gas safety system for any specific facilities to be safeguarded may need consideration of other requirements during the entire lifetime of the product.
- Use of unauthorized spare parts different from the ones listed in Table 13 is strictly forbidden.

How to use this manual?

- The following symbols of optical indicators status are used throughout the document:

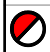
Symbol	Interpretation
	Optical indicator on
	Optical indicator flashing
	Optical indicator off
	Optical indicator status not determined (depends on other factors)

Table 1: Optical indicators status notation

- Important fragments of the text are highlighted in the following way:

> Pay extreme attention to information provided in such framed boxes.

- This User Manual consists of a main text and attached appendices. The appendices are independent documents and can be used separately from this Manual. Page numbering of appendices starts anew with no relationship to pare numbering of the main document and appendices may have their own tables of contents. In the right bottom corner of each page you can find the name (symbol) of any document included into the User Manual package with its revision (issue) number.

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1 Preliminary information

The ProGas 4 Gas Detector is a device designed as a component of the Gas Safety System and is intended for operation under heavy duty industrial conditions with broad variations of environmental factors (high temperatures, corrosive gases or vapours, moisture and dust).

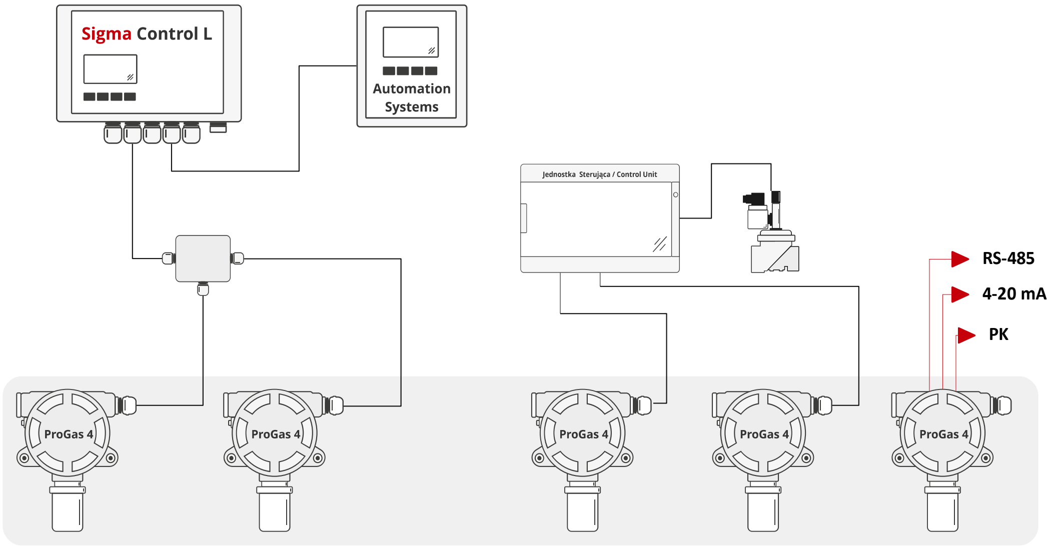


Figure 1: Location and role of the device in Gas Safety System

1.1 Functional properties

Main characteristics

- Variety of detected gases and vapours.
- Wide operating temperature range.
- Wide selection of communication interfaces and HMI panels: Modbus ASCII 4..20 mA, potential -free relay outputs, LCD/FLED displays, wireless interface (Bluetooth).
- Manufacturing option with audible warning.
- Customized accessories dedicated for specific detectors (see Table 13).
- Detectors furnished with a modern measuring head to achieve the topmost metering parameters.
- Upon request, optional upgrade to IP66/IP67 protection class (provided that a suitable membrane is applied).
- Customized configuration of the electric current source (source / sink).

Basic functionalities

- Non-invasive calibration and configuration – the gas detector can be calibrated and parametrized (e.g. the alarm thresholds) in hazardous areas without opening the housing or turning off other parts of the gas safety system (only for RS-485).
- Ability to calibrate gas detectors mounted at inaccessible locations.
- Remote communication with gas detector.
- Electronic compensation of the influence of ambient temperature.
- Self-diagnosis function.

- Storing, in the memory of the gas detector such parameters as: substance CAS number, location name, serial number, the intervals between mandatory calibrations, etc.

1.2 The principle of operation

The gas detectors measures the concentration of a given component, and then turns it – depending on the variety (described below) – to understandable signal for other devices of the gas safety system. In addition to the implementation of the measurement, the detector analyses the value of the measured concentration and may provide information about exceeding the following threshold values:

- warning 1,
- warning 2,
- alarm,
- gas overload (threatening with the sensor damage).

In addition to the above, the gas detector is a self-diagnostic device – in the case of detection of malfunctions, it informs the user about it.

1.3 Gas detector status

Mode	Description
Correct operation	The detector operates properly and makes measurements. The concentration value of the gas being measured does not exceed threshold values and no irregularities in the device operation were detected.
Warning 1	Signalled after exceeding the gas concentration above the specific value.
Warning 2	Signalled after exceeding the gas concentration above the specific value.
Alarm	Signalled after exceeding the gas concentration above the alarm threshold.
Gas overload	Gas concentration has exceeded the overload threshold value. If such is the case, the sensor may be damaged or its sensitivity and shelf-life may be reduced.
Lock[1]	Gas concentration is above the overload value (the default value is 100% LEL). The detector is locked (see Appendix [3]) – the last value of the concentration is shut. The detector does not make measurements. It is possible to unlock the condition by means of sending the applicable command from the control unit or from the superior system. ⚠ Removing the lock on a detector which is in the conditions of concentration above the measuring range can damage the sensor.
Warm up	After turning on the detector's power supply, the sensors's working parameters stabilize for some time. ⚠ Measurements are also taken during preheating of the detector but no information about gas hazards is provided. Be aware that exceeding of gas concentration above its maximum measurable range may led to damage of the gas sensor.

1 The condition is present only for the detectors with a catalytic sensor. Active lock mechanism.

Mode	Description
Calibration	In this state the detector allows to change your settings. In the calibration mode it is also possible to examine the detector without raising an alarm (in fact, the behaviour of the system will be determined by the interpretation of the data by the central system). The detector can be switched to this state using the appropriate software tools.
Non-critical failure	Detector malfunction threatening its accuracy of measurement (e.g. time out for periodic calibration).
Critical failure	Faulty detector.

Table 2: Gas detector status

1.4 Detected gases

Depending on the gas to which the gas detector is intended, the manufacturer configures the device's measurement parameters – selects the type and range sensor used (to avoid confusion, it is assumed that the sensor is an element which converts the gas concentration into an electronic signal, and the gas detector is the entire unit).

Information about detectors measurement parameters configuration can be found in document Measurement parameters configuration document (DOK-6073).

Information about sensors properties can be found in User Manual – Sensors used in gas detectors produced by Atest Gaz (POD-062-ENG).

1.5 Output signal

- RS-485 – this port allows easy integration with data transmission systems, visualization systems in ACP, industrial controllers – details in Section 4.2.
- 4 – 20 mA output – it allows for easy integration of the gas detectors with other automation systems, e.g. with industrial controllers – details in Section 4.3.
- Relays – it allows the direct use of gas detectors to control executive devices – details in Section 4.4.

1.6 Gas detector with an FL.C head

Gas detectors designed for installation at poorly accessible or inaccessible locations (e.g. highly, closely under ceilings) can be equipped with dedicated heads (H=FL.C) that enable supplying a reference gas directly to the detector.

It is the solution that facilitates calibration of a gas detector, where one end of a flexible hose (with the size of 6/4 mm) is connected to the detector and the other end is lowered to a location that is accessible for an operator – see Figure 2.

> The FL.C can be used only for some specific gases – see details in DOK-6073-ENG "Configuration of measurement parameters".

The calibration procedure is described in Section 5.6.2.2. In addition, the calibration procedure for gas detectors furnished with the FL.C head must be carried out with consideration of the following constraints:

- flow rate of a reference gas must be not less than 0.5 ltr./min,
- wind velocity nearby the detector must not exceed 0.5 m/s.

The manufacturer recommends to use a Reference Gas Supply Unit together with a suitable hose – see details in Section 8.

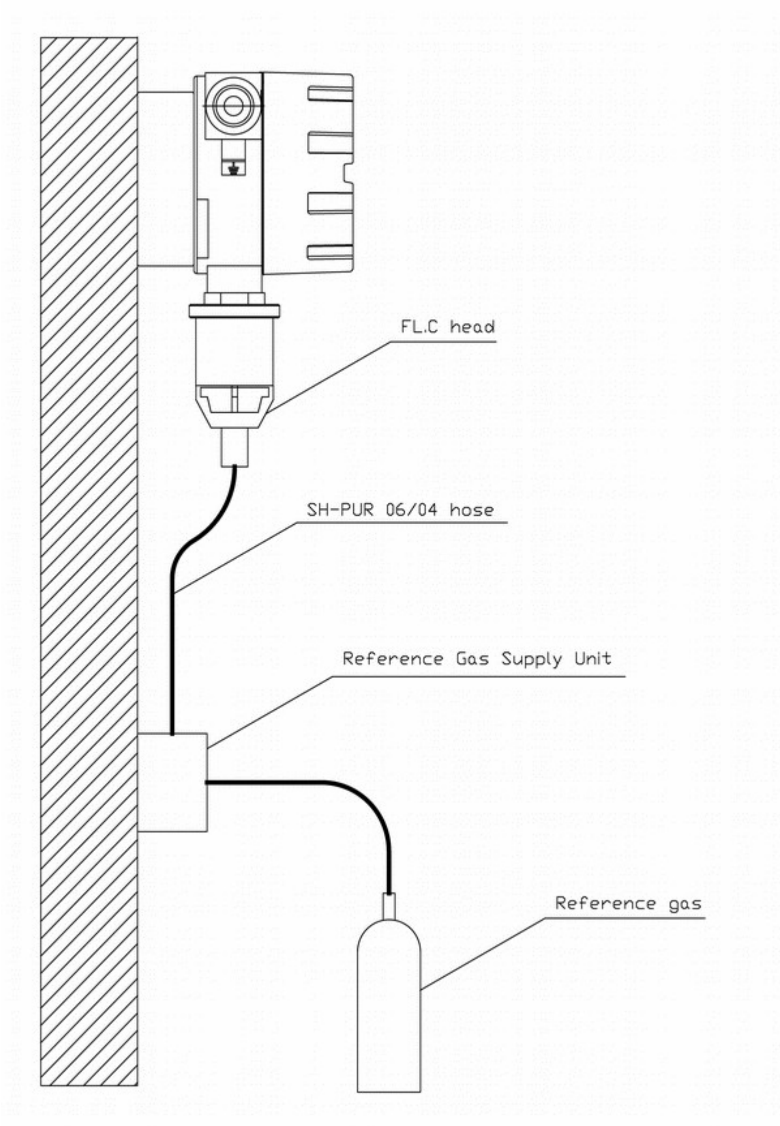


Figure 2: Calibration of a gas detector with the FL.C head

2 Safety

Testing of the detector with a gas of unknown composition or excessive concentration is forbidden since it may lead to irreversible damage of the gas sensor.

All activities related to connecting detectors, signallers and other system components must be carried out while control unit's power supply is off.

⚠ Despite the power supply voltage for the Gas Safety System is off, dangerous voltage may persist across terminals of the Control Unit. Such a voltage may come from another system controlled by the same unit, for instance ventilation, that use one output pin of the control unit.

⚠ The gas detector must be reliably secured during any repair, installation or maintenance works.

⚠ Before painting the facility walls make sure that the device is properly secured against unintentional painting or paint splashing.

⚠ Before use of silicon or silicon-based materials (paints, adhesives, sealant, etc.), make sure that the device is properly secured against unintentional coating.

⚠ The recommended position for the detector operation is the position with its measuring head looking down (see Figure 3). Other mounting positions may compromise IP class of the device.

⚠ When screwing the cover of the detector enclosure pay attention to the thread of the enclosure. Incorrect screwing may damage the enclosure thread.

2.1 Conditions of the working environment

Any design of the gas detection system must take account of the following factors:

- corrosion aggressiveness of ambient atmospheres – the device must be installed and operated in environments that are not corrosive for materials applied,
- in the case of reactive substances – such as HCl, Cl_2 – note the danger of adsorption of a particular substance on the sensor surface, particularly in humid environments,
- the probability of deposition of dust, grease and other "clogging" substances, especially on the sinter of the gas inlet to the measuring chamber, which can lead to blocking gas access to the detector,

- ambient temperature – ambient temperature should be in line with the values declared by the manufacturer (or see Table 10). Especially during the start-up of the technological installation and in the case of technological failures, attention should be paid to whether there is any temporary exceeding of the temperature range, and when it occurs – please contact the manufacturer,
- if the detector operates at an ambient temperature higher than the maximum permissible ambient temperature, the effect may be a thermal detector failure can occur,
- danger of flooding the detector with water or other substance – it may lead to the inh ibit of the detector,
- possible outdoor mounting – for outdoor mounting the device must protected against condensation of moisture inside the housing since it may lead to blocking of the inlet sintering material. Such protection can be achieved e.g. by heating of the detector by several centigrades,
- the oxygen content in the environment:
    - especially in the case of catalytic detector (pellistor type), oxygen content less than 18% significantly reduces the sensitivity of the detector,
- the presence of other gaseous substances which can cause:
    - false alarms – e.g. the presence of aerosols in the case of semiconductor gas detectors – see User Manual – Sensors used in gas detectors produced by Atest Gaz (POD-062-ENG),
    - pollution of the detector – e.g. the presence of silicone can cause damage to catalytic detector – see User Manual – Sensors used in gas detectors produced by Atest Gaz (POD-062-ENG),
    - crossover effect – the sensor also reacts to other gases, e.g. an electrochemical sensor of carbon monoxide can also react with hydrogen – see User Manual – Sensors used in gas detectors produced by Atest Gaz (POD-062-ENG),
    - masking effect – a reaction of the sensor to the working gas can be reduced in the presence of other interfering gases (e.g. in the presence of nitrogen dioxide, the sensor of sulphur dioxide reacts weaker to the working gas).

3 Description of the construction

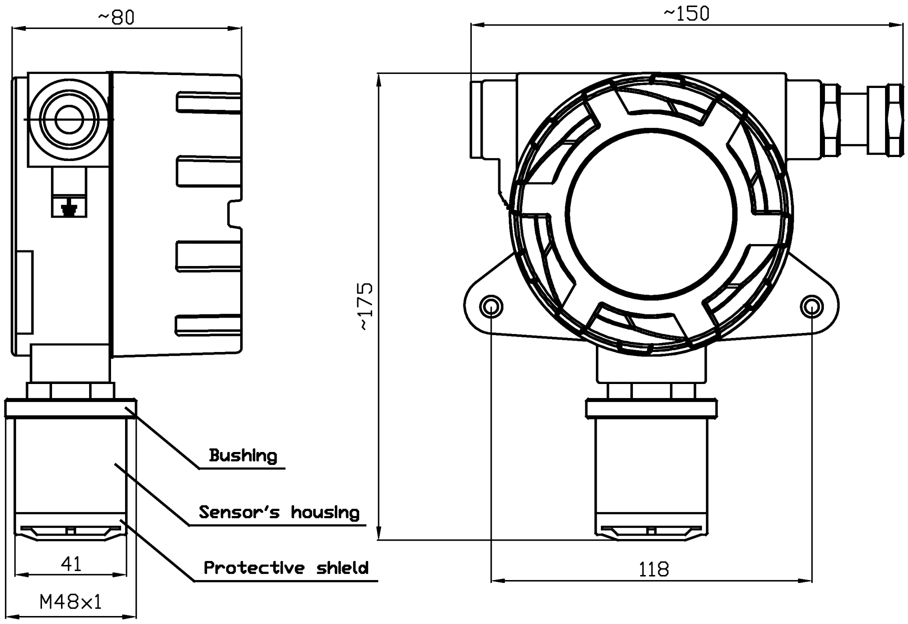


Figure 3: The construction of the device and its dimensions

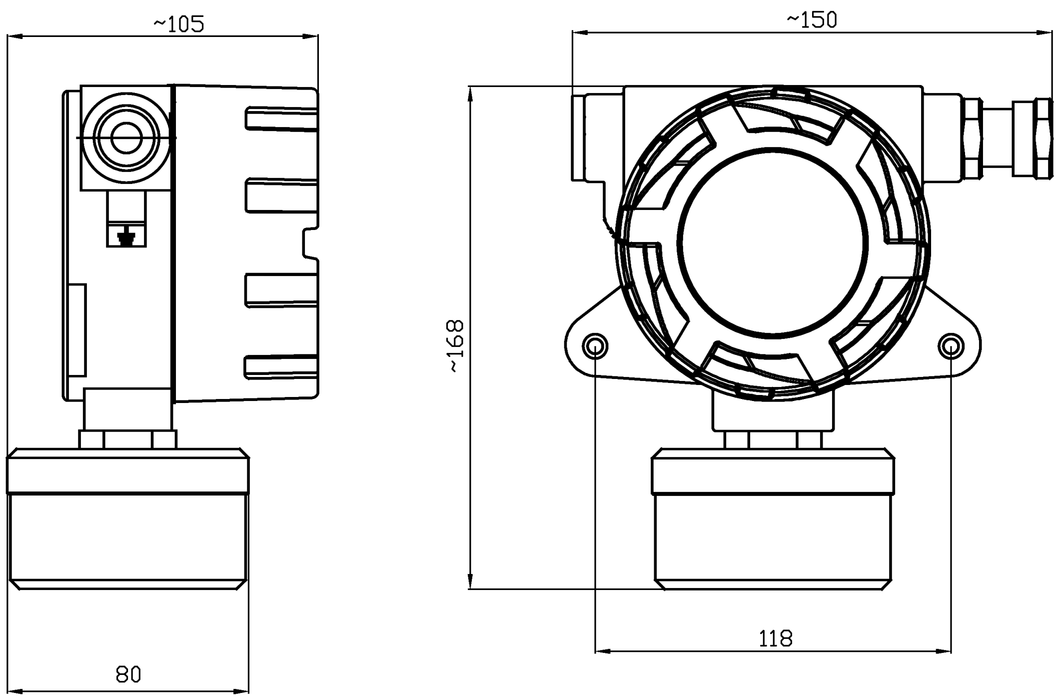


Figure 4: The construction of the gas detector and its dimensions (H=HW)

4 Input-output interfaces

4.1 Electric interface

Assignment of contacts on the terminal block depends on the device configuration (see details is Section 9). All possible options of the terminal block layouts are shown on illustrations below.

4.1.1 RS-485 digital communication port

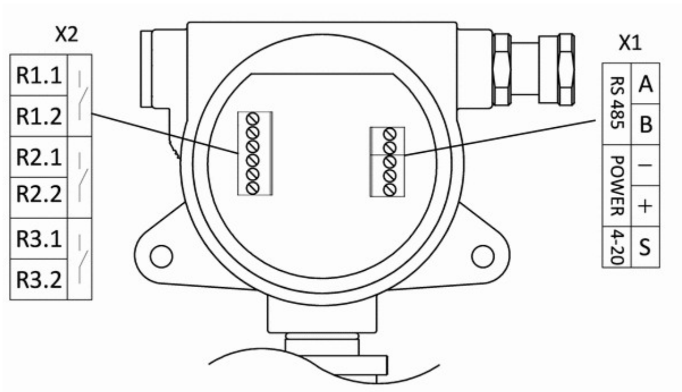


Figure 5: Electric connections for the option with the RS-485 port

Port designation	Name	Pin	Description
X1	RS-485	A, B	Signal lines for the RS-485 port
	POWER	-, +	Power supply
	4-20	S	4 – 20 mA current output
X2	R1.1 – R3.2	—⁄—	Relays terminals

Table 3: Connections diagram for the option with the RS-485 port

4.1.2 Teta Bus digital communication port

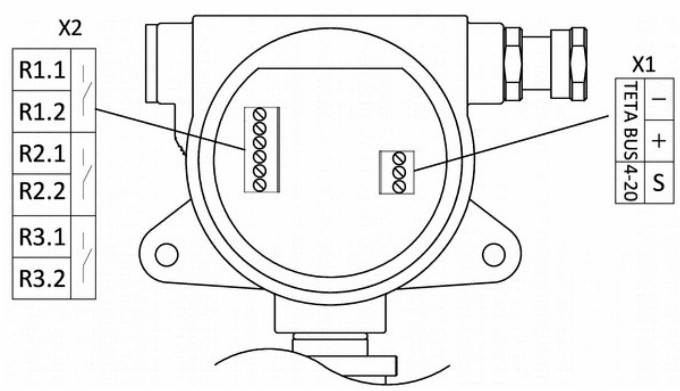


Figure 6: Electric connections for the option with the Teta Bus port

Port designation	Name	Pin	Description
X1	TETA BUS	-, +	Combined transmission and power supply lines
	4-20	S	4 – 20 mA current output
X2	R1.1 – R3.2	—⁄—	Relays terminals

Table 4: Connections diagram for the option with Teta Bus port

4.2 RS-485

Communication via the RS-485 employs either the Modbus ASCII or the Sigma Bus protocol (when the detector communicates with other devices of the Sigma system).

Detectors provided with the RS-485 port transmit output signals in the digital form (see Appendix [4]). Each detector provides information about its status by transmission of the following parameters:

- result for measurements of gas concentration expressed as percentage ratio of the full range,
- information whether warning /alarms thresholds are exceeded or not,
- status details, e.g. possible failures or defect, etc.

4.3 Current output

4.3.1 Operating modes – direction of current flow

The current output can be used in two modes: sink or source. The diagram below explains how to connect the detector for each of the operating mode.

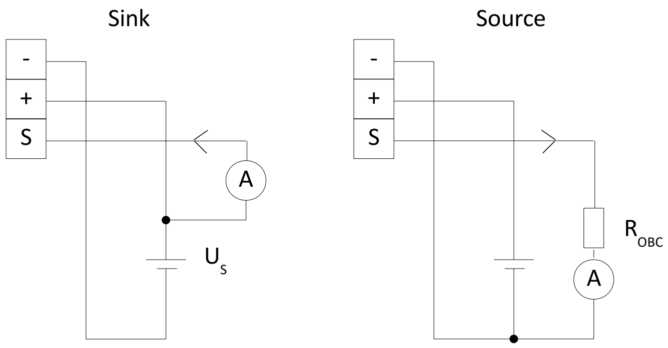


Figure 7: Connection of a gas detector according to the direction of current flow

Maximum limits for U_s and R_{obc} are provided in Table 10.

More configuration details – see Section 5.4.1.

4.3.2 Operation modes – status details

The level of output current is in proportion to the gas concentration measured by the detector (constant output signal). Possible signal levels are listed in the table below.

Current output	Status
2 mA	Critical failure
4 mA..20 mA	The signal level is in proportion to the gas concentration: 4 mA – 0% of the full range 20 mA – 100% of the full range
22 mA	Detector overloaded

Table 5: Constant output signals

The level of output current may also correspond to warning of alarm thresholds (stepped intervals). Levels of output current for specific degrees of gas hazard are listed in the table below.

Current output	Status
2 mA	Critical failure
4 mA	No alarm
9 mA	Warning 1
11 mA	Warning 2
13 mA	Alarm
22 mA	Detector overloaded

Table 6: Intervals of the output current according to the detector status

The specific operation mode with respect to information provided at the 4..20 mA current output can be set upon configuration detectors by means of dedicated software – for details see Section 5.4.

4.4 Relay outputs

Each gas detector has three relay outputs that can be used for the following purposes:

- tripping control contacts for status indicators
  - Warning 1,
  - Warning 2,
  - Alarm,
  - Failure,
- mode of indication: inverted or not

Assignment and operation mode of each relay output can be independently set by means of dedicated software – see Section 5.4.

Specification of relay parameters is provided in Table 10.

4.5 Bluetooth wireless interface (WI=BT)

Wireless interface enables the operator to control gas detectors from remote locations by means of dedicated software (see details in Section 5.4).

The Bluetooth interface behavior depends on the operation mode selected for the Bluetooth port upon configuration and presence of a permanent magnet. See details in Table 7 below.

Operation of the Bluetooth interface	Permanent magnet in place	The detector is seen on the list of devices with Bluetooth interface	The detector can communicate via the Bluetooth interface
Detector not available for remote control	-	No	No
Detector is always seen but can communicate only with the permanent magnet in place	No	Yes	No
	Yes		Yes
Detector is seen and can communicate only with the permanent magnet in place	No	No	No
	Yes	Yes	Yes
Detector is always seen and can communicate	-	Yes	Yes

Table 7: Operation modes of gas detectors with the Bluetooth interface

The picture below depicts how to mount the permanent magnet on the detector housing (only strong neodymium magnets are suitable).

Be careful to mount the permanent magnet correctly with right orientation of poles.

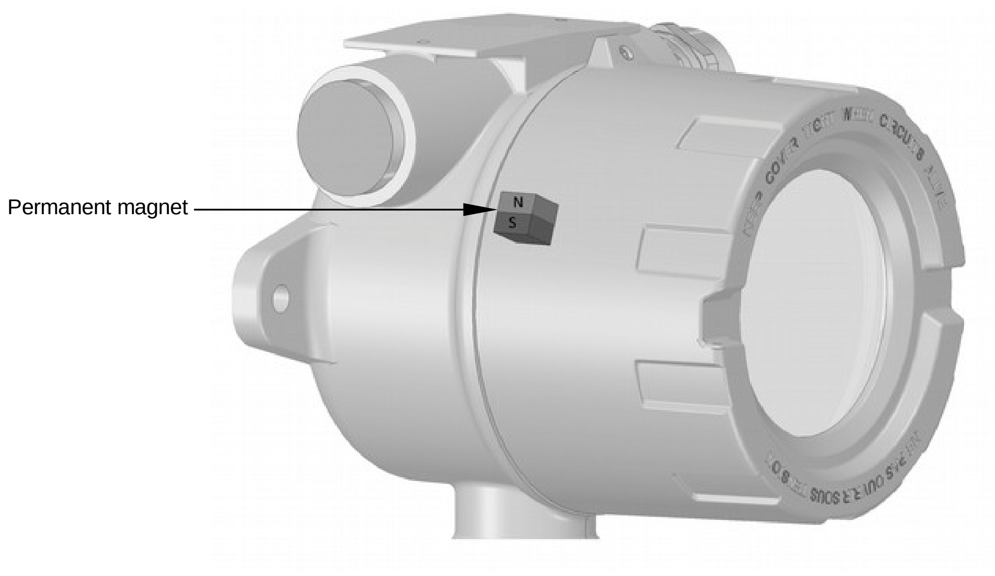


Figure 8: Gas detector with a permanent magnet in place

Upon communication between the gas detector and the control software is established, the permanent magnet can be removed.

5 Life cycle

5.1 Transportation

The device can be shipped in the same way as new equipment of that type. If the original package or another protecting means (e.g. corks) is unavailable the conveyed equipment must be secured against shocks, vibrations or moisture by means of adequate methods and material at the own responsibility of the sender.

The device can be conveyed under environmental conditions as described in Table 10.

5.2 Installation

5.2.1 Deployment of gas detectors

Deployment of gas detectors must be determined by the system designed with consideration to the following rules:

- medium density detected in relation to density of air:
  - detectors of gases with densities less than air density must be mounted nearby the room ceiling with the maximum distance between the face of the measuring head to the room ceiling from about 20 to 30 cm,
  - detectors of gases heavier than air must be mounted nearby the room floor with the maximum distance between the face of the measuring head to the room floor from about 20 to 30 cm,
- detectors should me mounted at locations where gathering (accumulation) of gas is expected due to architectural properties of the facility (e.g. in the facility part that is separated from the entire space by means of walls or other structural components),
- the influence of the gas temperature – a substance heavier than air when heated becomes lighter and migrates upwards, but after cooling, it can flow down toward the floor,
- pressure and the expected nature of outflow (leakage / gush),
- volatility of gas – in the case of substances of low volatility, the detector should be located as close as possible to the expected leak,
- the impact of environmental conditions – see Section 2.1,
- direction of ventilation
  - the detectors should be located in areas in the ventilation path from the place of leakage to the extraction unit,
  - in the event that the route may be variable, four detectors should be provided so as to "circumnavigate" a potential source of emissions,
  - in the case of outdoor installation, it is necessary to take into account the expected direction of the wind,
- likely whereabouts of the people in relation to emission sources – detectors should "fence off" the personnel from the source,
- mechanical shock – the detector is made in high strength aluminium casing, resistant to very high mechanical shocks. However, it is necessary to protect the detector from damaging exposures,
- locations of detectors must enable easy checks and adjustments as well as replacement or disconnection of each detector.

5.2.2 Mechanical mounting of detectors

> Detectors should be wall-mounted within the distance not less than the limit indicated in Figure 9. Should the distance is less the detector calibration may prove infeasible.

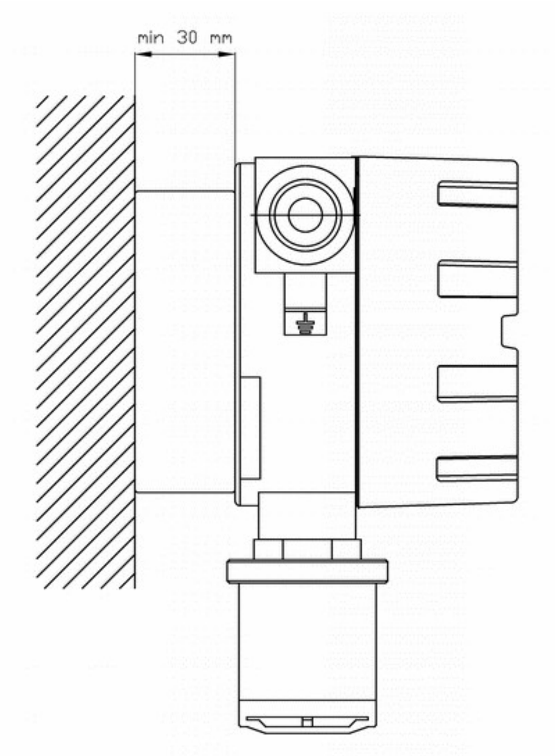


Figure 9: Correct mounting of the gas detector

The manufacturer recommends application of the Mounting Bracket WM8 (see Table 13) – since it enables easy calibration of gas detectors and protects their housings against damage.

First the mounting bracket should be mounted to a support structure (wall) by means of two rawlplugs or M6 bolts.

Then the detector can be fixed to the bracket by means of two M6 bolts included into the device package.

5.2.3 Electric network

The applied flameproof cable glands allows to introduce cables with diameters of a specific range. The suggested cable types are included in the table in Appendices [6],[7], [8] and [9].

When performing electrical connections, it is necessary to observe the following order:

- make sure that the connected cables are disconnected from any electrical circuits and potentials,
- make sure that during installation there is no risk of explosion or fire,
- unscrew and remove the cover of the detector,
- untighten the cable gland,
- after preparation (see Appendix [9]) thread the cable through the gland – For more details please refer to the manual POD-066-ENG „Cable glands used in offered devices".

⚠ Make sure that the cable outer diameter corresponds to the type of cable gland.

- properly lay the cable so that it is not influenced by mechanical stress and the possibility of getting into the water sensor flowing down the wrongly laid duct,
- tighten the cable gland,
- tighten the detector cover, making sure that the seal is in place,

Should the cable gland design allows, connect cable shields to the gland to avoid threading the cable braiding into the device housing. Do never connect cable shields to the earthing potential (ground) of electronic boards.

Cable shields must be insulated and slightly protrude from the cable gland inside the device interior. Do never connect shields to any terminal of the electronic device.

⚠ A detailed description of the preparation of the cable and connecting the cable to the detector is provided in Appendix [9].

On the side of the control unit, screens must be connected to ground.

According to good practice, wiring of the detectors should be carried out as far as possible from the power cables / high-current cables, preferably in separate trays.

⚠ The electric circuits of the Gas Safety System is not intrinsically safe. Damage of any cable can lead to a danger.

If the connection was made with the use of multi-wire cables (commonly known as a "cord"), the ends of these connectors should be ended with clamp sleeves.

If there is a need to connect two conductors in one terminal of the device, the only allowable option is to connect them in a common clamping sleeve (see Table 10).

⚠ It is unacceptable to combine in one connector two wires which are not pinched in one cable lug.

⚠ Do not place the cable reserve in the device. Bare wires or wires surplus may create a danger of electric shock or equipment damage.

⚠ Do not leave disconnected cables inside the device.

⚠ Incorrect cable routing can lead to reducing the device's immunity from electromagnetic interference.

⚠ Unused screw terminals must be tightened home.

5.3 Commissioning

Before power up make sure that all parts are tightly screwed (cable glands, blinding plugs and the detector lid). All fixing bolts (for the detector lid and bushing) must be in place and firmly tightened to prevent any self-loosening during operation of the detector.

New detectors and factory calibrated and checked.

The detector behaviour after power on is described in Table 2.

If a test of the gas detection system is required, supply test gas to the gas detector and make sure that the detector behaviour is in line with the specification.

> ⚠ It is recommended that – if possible – the commissioning of a gasometric installation should take place in conditions where there is no risk of explosion – e.g. during a standstill of the technological installations.

For large systems it is recommended to carry out commissioning of the entire system in several steps with successive connection and commissioning of subsequent detectors. It makes easy to reveal and remedy any possible errors.

5.4 Configuration of gas detectors

Detectors have two jumpers designed for configuration of the device – see Figure 10.

Other parameters of gas detectors are configured using dedicated software:

- Sigma Toolbox package for PCs with the Windows system,
- Detector Toolbox for Android devices.

This software can be downloaded from the manufacturer's website https://www.atestgaz.pl/en/software.

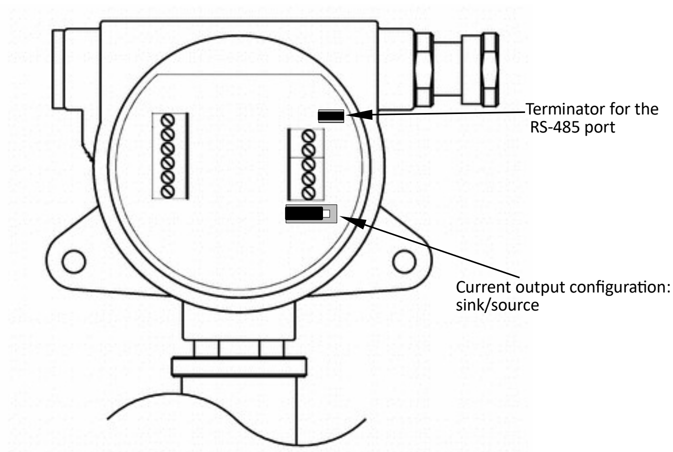


Figure 10: Front view of the detector – configuration jumpers

5.4.1 Configuration of the current source

The detector is furnished with a source of electric current. Depending on needs the source can be configured as a SOURCE or a SINK – see Section 4.3.1.

Configuration by installing a jumper – see table below.

Setting of jumpers	Operation mode
	SOURCE of electric current (default setting)
	SINK for electric current

Table 8: Configuration of the embedded source of electric current

5.4.2 End-line terminals

The communication port is furnished with end-line terminals. Configuration of these terminals needs opening of the device housing to insert a jumper into the terminal connector (TERM.).

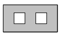
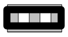
Setting of jumpers	Operation mode
	Terminal for the serial port is off (default setting)
	Terminal for the serial port is on

Table 9: Configuration of the serial port terminal

5.5 Troubleshooting

Details for detects and failures reported by the detector are provided in Appendix [5].

5.6 Periodical operations

The detector, similarly to all gas sensors, are components that subject to ageing and wear due to environmental influences. Thus, a variety of maintenance operation must be carried out within a regular schedule.

Periodical operations include:

- zero point adjustment,
- calibrations,
- replacement of fast wearing parts,
- periodical inspections.

5.6.1 Resetting

Gas sensors are characterized by a certain drift of zero over time. It's mean that during operation, the detector may indicate minor gas concentration despite the fact that in reality there is no gas in the building.

In such a situation, the reset function should be used (available in devices cooperating with the detector, e.g. in the control unit).

In some detectors configurations, the mechanism for automatic deletion of this drift is active. In this case, you do not need to use the above-mentioned zeroing function, and its use in this case can only speed up the automatic zeroing.

The reset function is available only for a narrow range of detector's indications (there is not hazard of resetting high concentrations).

It is recommended to apply clean air to the detector before performing the zeroing function.

5.6.2 Calibration

5.6.2.1 General rules

The gas sensor applied for the device is a components that is subject to ageing and other environmental impacts with decrease of its sensitivity as a natural effect.

Therefore regular calibration must be carried out to compensate the foregoing phenomenon. The calibration must be performed only by authorized maintenance staff of the manufacturer with the frequency is specified in the Calibration Certificate – see Table 10).

Please remember that the calibration should be carried out each time under the following circumstances:

- when the deadline for a subsequent calibration is exceeded (the deadline is specified in the Calibration Certificate or is indicated by the detector itself),
- when the detector fails the functionality test or,
- when the maximum limits for environmental impacts are exceeded.

Gas detectors manufactured by Atest Gaz are classified to the A category of instruments (see Appendix [10]) with respect to environments conditions for calibration.

When local conditions for calibration of gas detectors on site are not suitable the device must be taken out from the plant and sent to the Atest Gaz office for calibration.

The detector calibration occurs digitally. It involves connecting a service device

- a PC computer with appropriate software:
  - to the control unit – a common data bus transfers data between detectors and the control unit,
  - directly to the detector – when you open the cover,
- or an Android device:
  - directly to the detector – for devices with a Bluetooth radio interface (WI=BT) – see Section 4.5.

> Execution of the calibration procedure needs a calibration kit and a specific reference gas – see Table 13.

5.6.2.2 Calibration procedure

To calibrate gas detectors follow the procedure below:

- to avoid undesired alarms when the detector responds to excessive concentration of reference gas, switch the detector to be calibrated to the calibration mode – the calibration mode is recognized by the control unit,
- supply the calibration gas
  - baseline (zero-air) gas (e.g. synthetic air or nitrogen),
  - calibration (reference) gas (composition of reference gas depends on the gas to be detected and the detector range)

  to individual detectors one after another. Indications of the detectors are automatically recorded by the supervising computer,
- check and analyse the data acquired, apply a correction factor to each detector,
- switch the calibration mode off.

During calibration the following is determined:

- the degree of characteristics drift,
- the degree of sinter contamination (measuring the response time T90),
- the degree of sensor wear,

The calibration also includes checks of the following explosion proof properties:

- tightness of cables in cable glands, retighten glands when necessary,
- symptoms of a flameproof housing damage.

5.6.3 Replacement of fast wearing parts

Please refer to Table 12 for the recommended lifetime and replacement schedule of fast wearing parts.

> It is highly recommended to entrust all jobs related to the measuring head to the service staff of the manufacturer or to properly trained personnel.

> All jobs must be performed with the power voltage for the detector switched off.

5.6.3.1 Replacement of the shield with sintered material {1}, {2}, {3}

When contamination of the piece of sintered material is found out its shield must be replaced in the following way:

- loosen the locking screws in the bushing with a 1.5 mm Allen wrench (see Figure 3),
- replace the shield with the attention paid to make sure that the shield is correctly installed, i.e. screws must be tightened until a clear resistance is sensed),
- retighten the securing screws (if the screw fails to fully sink into the hole it means that components of the head do not match).

5.6.3.2 Membrane replacement {4}

To replace the membrane follow the procedure below:

- loosen the securing screws in the bushing (see Figure 3) with a 1.5 mm Allen wrench,
- remove the cover,
- replace the membrane,

> The membrane should be put with the hydrophobic side outwards (see Figure 11 and 12).

- reinstall the protective cover and retighten the securing bolts.

> Before assembly, make sure that the O-ring is in the groove of the cover with sinter (see Figure 11).

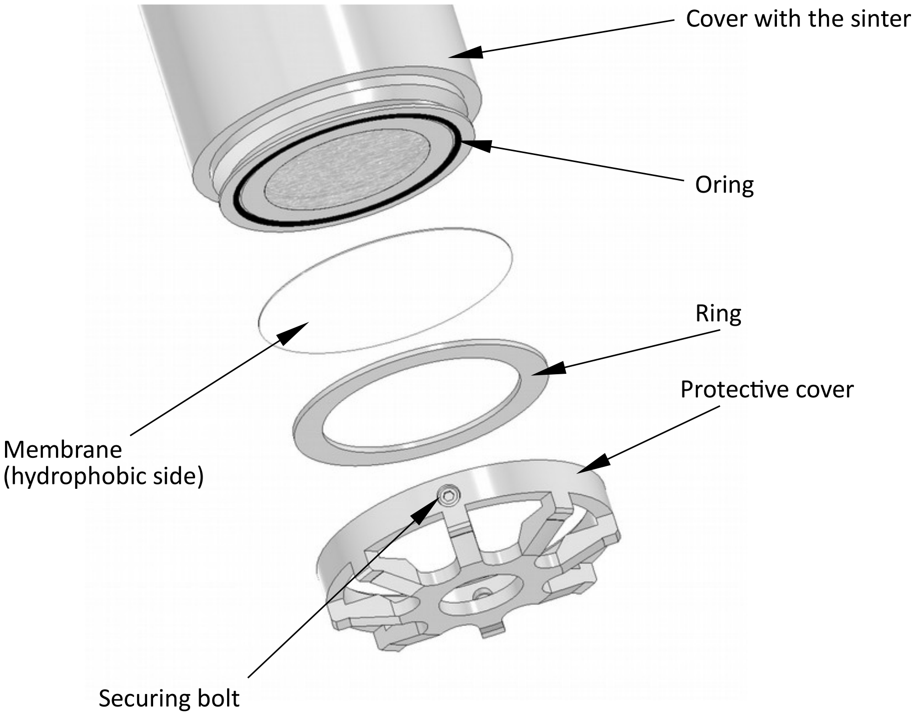
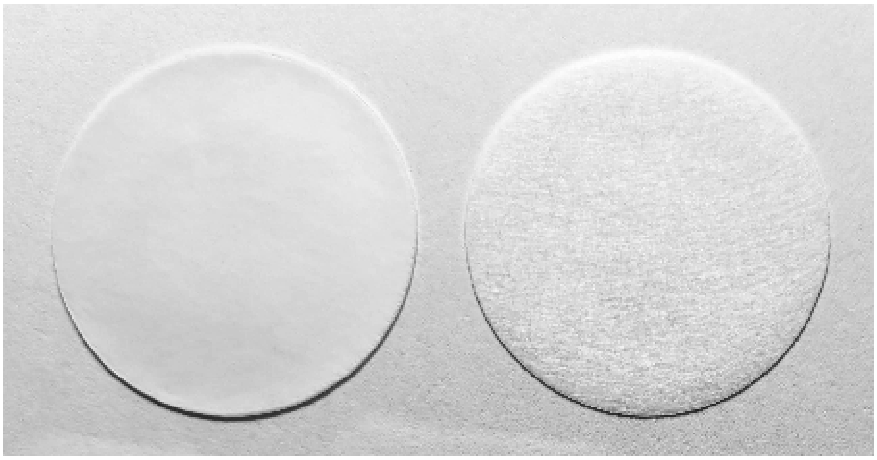


Figure 11: Design of the gas sensing head



Outer side, hydrophobic.
Matte surface, smoother than printer paper.

Inner side, not hydrophobic.
Clearly visible, shiny fibers.
The surface is more porous than the surface of the paper.

The photo shows the membrane visible against the background of white paper

Figure 12: Identification of the hydrophobic side of the membrane

5.6.3.3 Sensor replacement {5}

During operation there is a natural loss of metrological parameters of the sensors. Compensation of this phenomenon occurs through periodic, systematic adjustment of the display (see Section 5.6.2.2) – until the moment when it is necessary to exchange the sensor. It is assumed that the exchange should be carried out after the loss of sensitivity below 50% of the initial sensitivity.

> Sensor replacement must be always combined with subsequent calibration of the detector.

To assembly and disassembly the sensor, it is necessary to:

- loosen the locking screws in the bushing with 1.5 mm Allen wrench (see Figure 3),
- unscrew the sensor housing (do not allow bushing to rotate due to the possibility of damage to the connector inside the enclosure),
- remove the filling stuff (unscrew the bolts in the case of the HW head),
- take out the old sensor (or a sensor module) from the head (unscrew the bolts in the case of the HW head) and replace it with a new one, make sure that the new sensor is positioned correctly,
- insert (and screw if necessary) the filling stuff,
- follow instruction in Section 5.6.3.1,
- carry out calibration of the detector.

> Not all errors resulting from improper assembly are detected by the diagnostics system of the detector. Each disassembly and assembly of the measurement head must be verified by supplying gas and checking the detector's reaction to gas.

> When the bushing of the detector head is damaged or removed the detector must be sent back to the manufacturer for repair.

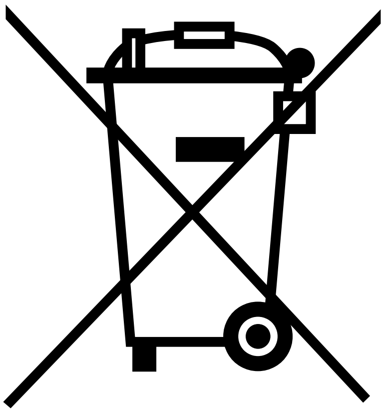
5.6.4 Maintenance

The regular maintenance of the detector is limited to wiping its housing with a damp soft cloth. cleaning agents that contain solvents, white spirit or alcohol are not allowed.

You should also:

- checking and cleaning inserts made of sintered material (dry cleaning with a brush or a cloth),
- checking of the cable gland with verification of its sound installation and lack of damage.

5.7 Utilization



This symbol on a product or on its packaging indicates that the product must not be disposed of with other household waste. Instead, it is the user's responsibility to ensure disposal of waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The proper recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. Information about relevant designated collection points can be obtained from the Local Authority, waste disposal companies and in the place of purchase. The equipment can also be returned to the manufacturer.

6 Technical specification

Power supply • Voltage V_{cc} • Power	 15 – 50 V ⎓ 0.1 – 4 W(depends on the configuration, see Table 11)	
Environment	In operation	Storage
• Ambient temperatures Ta • Humitidy • Pressure	Specified depending on device configuration, including the sensor used (see Section 9) 10 – 90% long term, 0 – 99% short term Without condensation 1013 ± 10% hPa	0 – 40^{o}C 30 – 90% long term
Time parameters	For catalytic sensor: • Hydrogen $T_{90} \leq 9$ s $T_{Alarm}(T_{20}) \leq 3$ s • Methane $T_{90} \leq 13$ s $T_{Alarm}(T_{20}) \leq 4$ s • Propane $T_{90} \leq 17$ s $T_{Alarm}(T_{20}) \leq 4$ s • Ethanol $T_{90} \leq 18$ s $T_{Alarm}(T_{20}) \leq 5$ s	
IP	• IP66/IP67 (measuring head with membrane FL.M, FH.M) • IP63 (other)	
Analog output 4 – 20 mA • Output type • R_{load_MAX} (source mode) • U_{S_MAX} (sink mode)	 Sink / source 300 Ω 30 V (max. voltage between pins „S" and „-")	
Digital output parameters • Relays	 3 x Floating contacts, 24 V / 0.3 A, Not protected against overloading	
Digital communication parameters • RS-485 • Teta	 • RS-485, Modbus ASCII/RTU, Sigma Bus, 19200 Bd 7E1 • Teta Bus	
Protection class	III	
Dimension	See Figure 3	
Cable glands • Cable diameter range • External thread	 See Section 9 M20 x 1.5	
Acceptable cables	0.5 – 2.5 mm^2 (cable lugs 2 x 1 mm^2 or 2 x 0.75 mm^2 should be used for double wires)	
Parameters of the hose coupling to the FL.C head	6 / 4 mm	
Enclosure material	Aluminium spray epoxy	
Measuring head material	SS316L / SS316L + PTFE	
Weight	1.3 kg	
Mandatory periodic inspection	Every 12 months (Calibration Certificate validity) – time can be shortened due to difficult working conditions	
Lifetime of consumables	See Table 12	
Mounting	• To the supporting structure, 2 screw holes M6, hole spacing 118 mm with a minimum distance from the wall – see Section 5.2.2 • We recommend using mounting brackets WM8 – see Section 8	

Table 10: Technical specification

> The technical parameters of the standard version of the detector you can find in Table 10 Some of the above-mentioned parameters may be different in the case of customized design. Details can be found in the Appendix [2].

In the table below shows the gas detector current consumption depending on the device configuration.

Product code					**Current consumption [mA]**	
					15 V	**24 V**
PW-017	PG4	EC	0	FL, FL.M, FL.C, HL, HR	20	20
		PEL			100	70
		IR		FL, FL.M, FL.C, HL, HW	80	55
				FH, FH.M, HH	155	95
		PID		FH, FH.M, HH	120	75

Table 11: Power consumption

7 List of consumables

No.	Consumables	Lifetime	Manufacturer	Product code
{1}	Breathing flameproof housing	Depends on ambient conditions	Atest Gaz	PWS-046-A
{2}	Flameproof housing with an insert made of sintered material, size 2.5 mm	Depends on ambient conditions	Atest Gaz	PWS-055-A
{3}	HW Housing	-	Atest Gaz	PWS-060-B
{4}	Membrane with sealings	Depends on ambient conditions	Atest Gaz	-
{5}	Sensor with gasket	Depends on the sensor type	-	-

Table 12: List of consumables

8 List of accessories

Product code	Description
PW-063-A	Ventilation Adapter AW1
PW-064-WM8	Mounting Bracket (for wall mounting, ProGas 4)
PW-064-WM10	Mounting Bracket (for ceiling mounting, ProGas 4)
PW-082-X	Calibration kit
PW-049-CB6	Service cable CB6
PW-126-A	Reference Gas Supply Unit
TUBES_INTERNATIONAL_SH-PURE-06_04	Hose SH-PURE-06/04, transparent, material: PUR polyurethane (PUR)
-	Standardized reference gas

Table 13: List of accessories

9 Product marking

ProGas 4 Gas Detector

PW-017-PG4- M - D - H - E - T - DI - AI - WI - MC - G

M **Converter module**	**X**	Selected by the manufacturer depending on the chosen MC – field value does not matter when ordering the product (when ordering, please specify X, available EC, PEL, IR, PID options show the used sensor type – see DOK-6073-ENG)
D **Display**	**0**	Without
	LCD	LCD display and LED controls **(Ta: -20 – 50°C)** – *under development*
	FLED	Bright, multi-colour display **(Ta: - 40 – 60°C)** – *under development*
	FLED.A	Bright, multi-colour display equipped with an acoustic signaller **(Ta: -40 – 60°C)** – *under development*
H **Measuring Head**	Type of the measuring head installed in the detector is associated with the MC – the head specification is determined by gas to be detected and its parameters	
	FL	With sinter (fast – reduced T90), made of stainless steel
	FL.C	With sinter (fast – reduced T90), made of stainless steel, with remote test gas supply and calibration
	FL.M	With sinter (fast – reduced T90) and membrane, made of stainless steel
	FH	With sinter (fast – reduced T90), made of stainless steel, warmed
	FH.M	With sinter (fast – reduced T90) and membrane, made of stainless steel, warmed
	HL	With sinter, made of stainless steel
	HH	With sinter, made of stainless steel, warmed
	HR	Without sinter, made of stainless steel and PTFE plastic (for reactive gases e.g. Cl_2, HCl, NO_x)
	HW	Without sinter, made of stainless steel (for SF_6/R_X gases)
E **Enclosure**	**AL**	Aluminium, spray epoxy
T **Temperature**	**0**	Standard **(Ta: -30 – 50°C)**
	T	Extended temperature range for gas detector **(Ta: -40 – 85°C)**
DI **Digital interface**	**485**	RS-485
	Teta	Teta Bus – *under development*
AI **Analog interface**	**0-0**	Without
	420-PK	4 – 20 mA (sink/source) + 3 x relay
WI **Wireless interface**	**0**	Without
	BT	Wireless interface allowing remote sensor calibration
MC **Measurement parameters configuration**	**-**	See details and **Ta** in DOK-6073-ENG „Measurement parameters configuration”
G **Cable gland**	**-**	See details in POD-066-ENG „Cable glands used in offered devices”

Table 14: Method of product's marking

⚠ The configuration for the standard version of the detector you can find in Table 14. Some configurations may be different in the case of customized design. Details can be found in the Appendix [2].

10 Appendices

[1] DEZG138-ENG – EC Declaration of Conformity – ProGas 4

[2] PU-Z-114-ENG– SmArtGas 4, ProGas 4 – customized (non-standard) design

[3] PU-Z-093-ENG – Instructions for removing the lock of a detector with a catalytic sensor

[4] PU-Z-113-ENG – Register map of gas detectors of PW-017, PW-044 and PW-093 type

[5] PU-Z-073-ENG – The user interface and failure codes of Gas Detectors of PW-017, PW-044 and PW-093 type

[6] PU-Z-074-ENG – Example of connection cables for gas detector PW-017 and PW-044 with 4 – 20 mA output

[7] PU-Z-076-ENG – Example of connection cables for gas detector PW-017 and PW-044 with relay output

[8] PU-Z-003-ENG – Guidelines to the cabling of the system with an RS-485 interface

[9] PU-Z-015-ENG – Shielded cables applied for connecting detectors – preparation and installation

[10] PU-Z-039-ENG – Classification of chemicals used at Atest Gaz

EU Declaration of Conformity

Atest Gaz A. M. Pachole sp. j. declares with full responsibility, that the product:

(Product description)	(Trade name)	(Type identifier or Product code)
Gas Detector	**ProGas 4**	**PW-017**

complies with the following Directives and Standards:

- in relation to Directive 2014/30/EU – on the harmonisation of the laws of the Member States relating to electromagnetic compatibility:
  - EN 50270:2015
- In relation to directive 2011/65/EU – on the restriction of the use of certain hazardous substances in electrical and electronic equipment
  - EN IEC 63000:2018
- other:
  - EN 60529:1991

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Purpose and scope of use: product is intended for use in gas detection systems for residential, commercial and industrial environment.

This EU Declaration of Conformity becomes not valid in case of product change or rebuild without manufacturer's permission.

Gliwice, 01.02.2022

(Name and Signature)

Managing Director
Aleksander Pachole

SmArtGas 4, ProGas 4 – customized (non-standard) design

1 Gas detectors with a broad range of power voltages

1.1 Description

These design options of gas detectors are dedicated for operation in systems with the power voltage of 12 V DC.

1.2 Technical specification

The table below summarizes those parameters of gas detectors that are different from the ones for devices of standard design and listed in the section Technical Parameters of User Manuals for specific detectors.

Power supply • Voltage • Power	 10,5 – 50 V ⎓ 0,1 – 4 W (depends on the configuration, see Table “Power consumption” in User Manual for the individual gas detector)

1.3 Product code

- Detector dedicated to areas with potentially explosive atmospheres (Ex)

  SmArtGas 4 PW-044-SG4.LV-X Gas Detector

- Detectors dedicated to areas without potentially explosive atmospheres (non-Ex)

  ProGas 4 PW-017-PG4.LV-X Gas Detector

X – optional components of the product code – see details in user manuals for specific gas detectors, sections “Product code”.

All possible design options available for gas detectors are summarized in the table below.

<table>
<tr><th colspan="5">Product code</th></tr>
<tr><td rowspan="9">PW-044</td><td rowspan="9">SG4.LV</td><td rowspan="3">EC</td><td>0</td><td rowspan="5">FL, FL.C, FL.M, HL</td></tr>
<tr><td>LCD</td></tr>
<tr><td>FLED, FLED.A</td></tr>
<tr><td rowspan="2">PEL</td><td>0</td></tr>
<tr><td>LCD</td></tr>
<tr><td rowspan="2">IR</td><td>0</td><td>FL, FL.C, FL.M, FH, FH.M, HL, HH</td></tr>
<tr><td>LCD</td><td>FL, FL.C, FL.M, HL</td></tr>
<tr><td rowspan="2">PID</td><td>0</td><td rowspan="2">FH, FH.M, HH</td></tr>
<tr><td>LCD</td></tr>
<tr><td rowspan="4">PW-017</td><td rowspan="4">PG4.LV</td><td>EC</td><td rowspan="4">0</td><td rowspan="2">FL, FL.M, FL.C, HL, HR</td></tr>
<tr><td>PEL</td></tr>
<tr><td>IR</td><td>FL, FL.C, FL.M, FH, FH.M, HL, HH, HW</td></tr>
<tr><td>PID</td><td>FH, FH.M, HH</td></tr>
</table>

2 Gas detector dedicated to specific applications (details to be consulted with the manufacturer)

2.1 Technical specification

Detailed parameters of specific gas detector are outlined in sections "Technical specification" in user manual for specific detector.

2.2 Product code

SmArtGas 4 Gas Detector PW-044-SG4- M - D - H - E - T - DI - AI - WI - MC - G

M	**Converter module**	**PELm**	Catalytic, 40% LEL
D	**Display**	**0**	Without
H	**Measuring head**	**HL**	With sinter, made of stainless steel
E	**Enclosure**	**ALB**	Aluminium, spray epoxy – white
T	**Temperature**	**0**	Standard
DI	**Digital interface**	**485**	RS-485
AI	**Analog interface**	**0-0**	Without
WI	**Wireless interface**	**0**	Without
MC	**Measurement parameters configuration**	**C.CH4.40L.B** **C.C3H8.40L.B** **C.H2.40L.A**	Catalytic sensor, methane, 40% LEL **(Ta: -20 – 50°C)** Catalytic sensor, propane, 40% LEL **(Ta: -20 – 50°C)** Catalytic sensor, hydrogen, 40% LEL **(Ta: -20 – 50°C)**
G	**Cable gland**	**EX.NB01** **EX.NB02**	Nickel plated brass, regulated clamping range 4 – 12 mm Nickel plated brass, regulated clamping range 10 – 16 mm See details in POD-066-ENG „Cable glands used in gas detectors produced by Atest Gaz"

ProGas 4 Gas Detector PW-017-PG4- M - D - H - E - T - DI - AI - WI - MC - G

M	**Converter module**	**PELm**	Catalytic, 40% LEL
D	**Display**	**0**	Without
H	**Measuring head**	**HL**	With sinter, made of stainless steel
E	**Enclosure**	**AL**	Aluminium with paint
T	**Temperature**	**0**	Standard
DI	**Digital interface**	**485**	RS-485
AI	**Analog interface**	**0-0**	Without
WI	**Wireless interface**	**0**	Without
MC	**Measurement parameters configuration**	**C.CH4.40L.B** **C.C3H8.40L.B** **C.H2.40L.A**	Catalytic sensor, methane, 40% LEL **(Ta: -20 – 50°C)** Catalytic sensor, propane, 40% LEL **(Ta: -20 – 50°C)** Catalytic sensor, hydrogen, 40% LEL **(Ta: -20 – 50°C)**
G	**Cable gland**	**STD.NB03**	Nickel plated brass, clamping range 7 – 13 mm See details in POD-066-ENG „Cable glands used in gas detectors produced by Atest Gaz"

Instructions for removing the lock of a detector with a catalytic sensor

Detectors using a catalytic sensor (more details concerning the sensor – see Appendix PU-Z-054-ENG) are equipped with a system protecting against its damage caused by a gas concentration exceeding the measuring range of the sensor and before entering non-monotonic part of the catalytic sensor characteristics. In the case of occurrence of such a situation, the detector is switched into the lock state. In this state, the detector saves the last value of gas concentration and switches it off to protect the sensor and prevent false indications.

The lock state is signalled on the detector's display and on all devices showing the detector status (e. g. control units). When the lock detector status occurs, the level of gas concentration in the place of the detector operation must be measured with the use of another measuring device. In a situation when the concentration level drops to the value within the measuring range of the sensor, the operator may proceed to removing the lock – see illustration 1. If the lock is turned off, when the gas concentration in the place of the detector operation is beyond the measuring range of the sensor, a permanent sensor damage or a false reading of the concentration can occur, as a result of the non-monotonic characteristics of the sensor.

When the detector is in the inhibit state and the gas overload condition occurs, the detector will also enter the lock mode and it will be visible after the inhibit mode is deactivated.

The method of executing the **"Remove the lock"** command can be found in the documentation of the control unit that controls the detector. Turning off the power of the detector automatically disables the lock.

Removing the lock on a detector which is in the conditions of concentration above the measuring range can damage the sensor.

Removing the lock on a detector which is in the conditions of concentration over the measuring range can cause its false indication (due to the non-monotonic characteristics of the sensor).

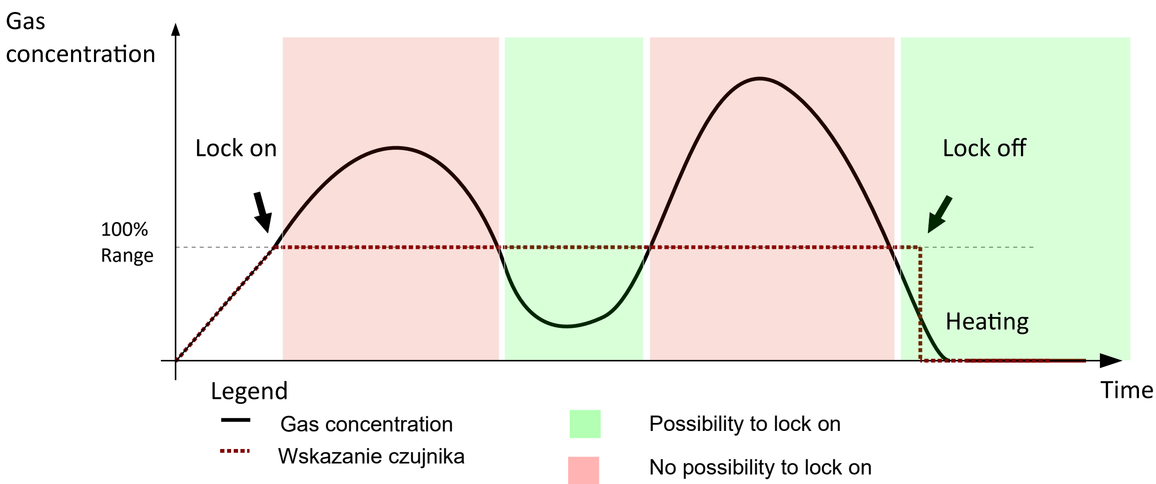


Figure 1: Operation of lock on /off detector

Register map of gas detectors of PW-017, PW-044 and PW-093 type

All the data are available in the 'holding registers' (function code 3).

Register	Name	Description	Type
40001	State_A	Detector status – the definition of bits below	flags
40002	-	Inessential data, can take any value	-
40003	N	Gas concentration A value of 0 corresponds to the 0 concentration, the value of 1000 corresponds to a concentration of the range of the detector	16 bit integer
40004	-	Inessential data, can take any value	-
40005	Sample_Cnt	Sample counter. The value is increased by 1 after each measurement. It takes values from 0 to 65 353	Total number 16 bit

State_A - detector status. The meaning of the bits is described in the table below.

Bit	Name	Description
0	Collective_W1	Gas concentration is above first warning threshold
1	Collective_W2	Crossing the second warning threshold
2	Collective_AL	Crossing the alarm threshold
3	Collective_CrFail	Collective information about a critical failure
4	Collective_NonCrFail	Collective information about a non-critical failure
5	Gas_Hi_Range	Operation on a coarse measuring channel (for type 2 and 3).
6	Gas_HiHi_Range	Gas overload
7	Sensor_Lock	Lock of the sensor (the last measurement was locked)
8	Calibration	Calibration mode
9	Test	Test mode
10	Warm_Up	Sensor warm-up
11..15	-	Inessential data, can take any value

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The user interface and failure codes of Gas Detectors of PW-017, PW-044 and PW-093 type

1 Indicator marking symbols

Symbol	Description
● (red)	Optical indicator on
⊘ (red)	Optical indicator flashing
○	Optical indicator off
⊙	Optical indicator status not determined (depends on other factors)

2 Gas detector with FLED display (D=FLED) / FLED.A (D=FLED.A)

In case of use of a detector with FLED four – colour detector status display, information regarding the state of the detector are indicated via colours.

Colour	Description	Acoustic signalling (only for version D=FLED.A)
– green	The detector works properly	-
/ – red alternating with green	The first warning threshold is exceeded	-
/ – green LED alternating with two yellow blinking 30 seconds apart	Non-critical failure	-
– red	Alarm	Modulated sound signal
– yellow	Detector's critical failure	-
– white	Test, calibration	-

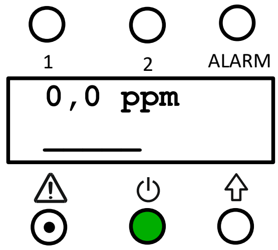
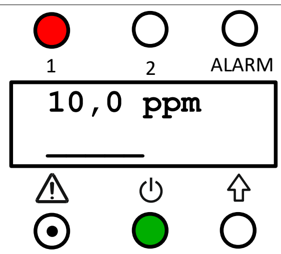
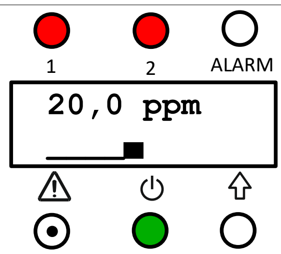
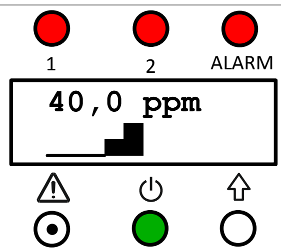
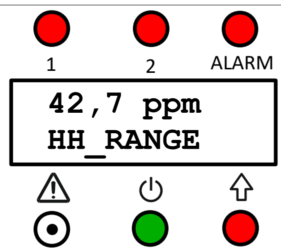
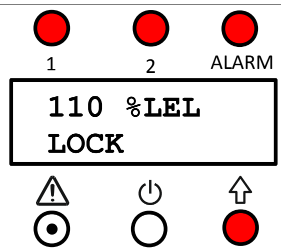
3 Gas detector with LCD display (D=LCD)

3.1 Description of detector state indicators

Indicator	Colour	Description
1	– red	The first warning threshold is exceeded
2	– red	The second warning threshold is exceeded
ALARM	– red	The alarm threshold is exceeded
⚠	– yellow	Detector's failure
⏻	– green	The detector works properly (detector's operation status)
⇧	– red	Gas overload

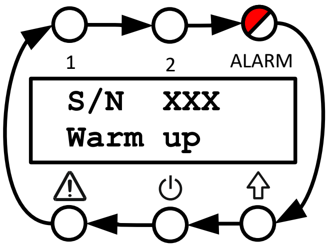
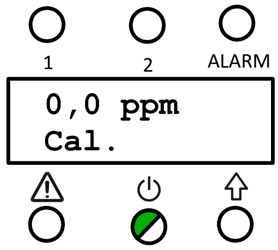
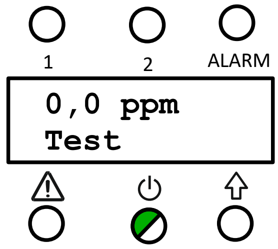
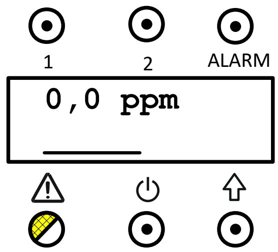
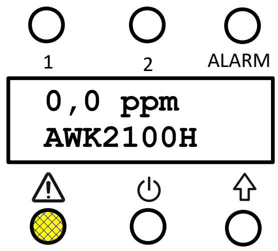
The display has light-sensitive area, which ensures appropriate backlit of the display during operation in an unlit room.

3.2 Detector's state signalling – gas alarms

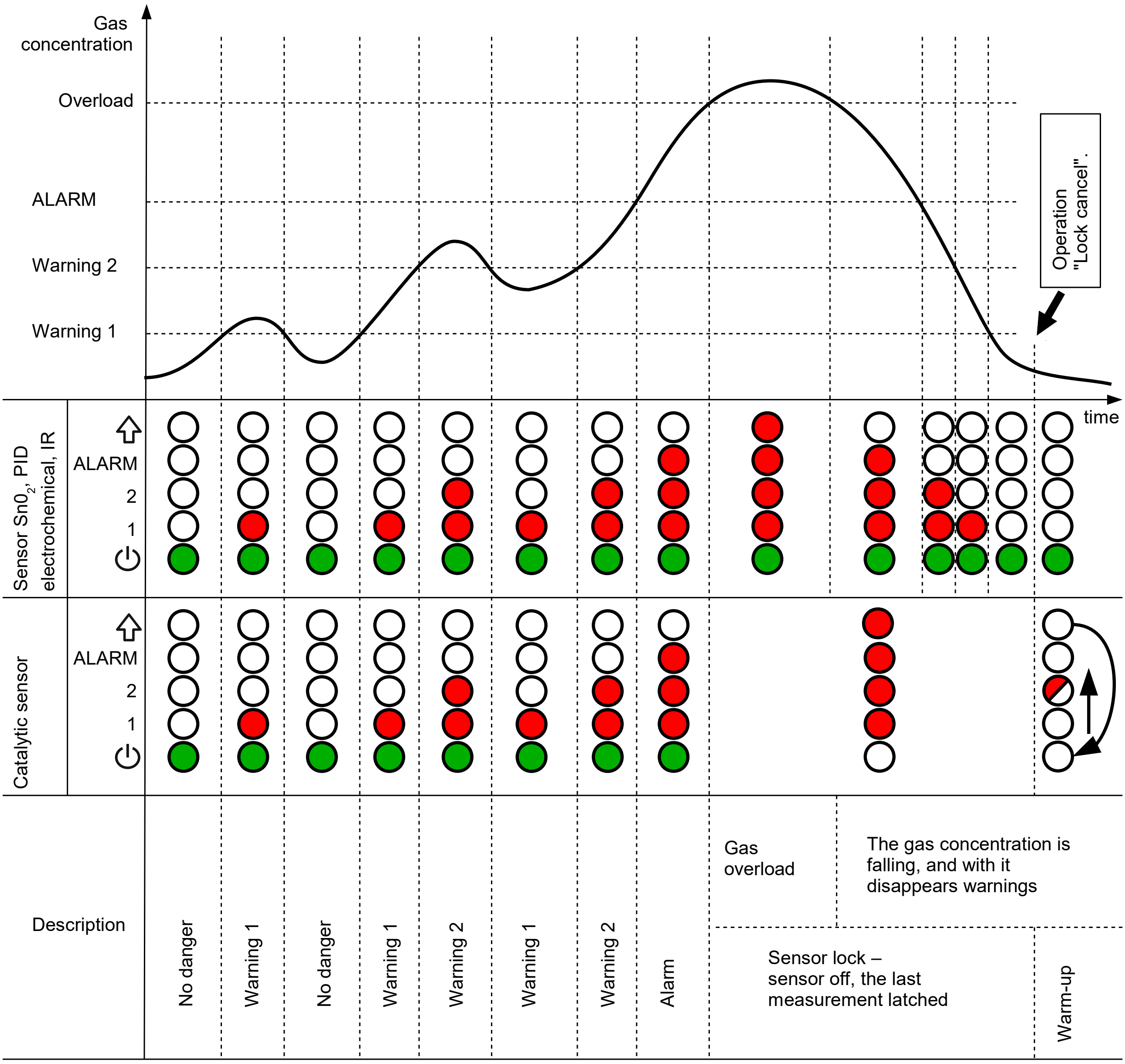
Situation	Description	Indicators/display[1]
No danger	The detector works properly, measures the concentration, which is indicated by continuously lit ⏻ indicator.	
Warning 1	The gas concentration exceeds the first warning threshold. Indicator 1 in the panel is continuously lit. The detector performs measurement, which is indicated by continuously lit ⏻ indicator	
Warning 2	The gas concentration exceeds the second warning threshold. Indicator 1 and 2 in the panel are continuously lit. The detector performs measurement, which is indicated by continuously lit ⏻ indicator	
Alarm	The gas concentration exceeds the alarm threshold. Indicators 1, 2 and ALARM in the panel are continuously lit. The detector performs measurement, which is indicated by continuously lit ⏻ indicator	
Overload	The gas concentration exceeds the overload value. Indicators 1, 2 and ALARM and ⇧ in the panel are continuously lit. The detector still performs measurement, which is indicated by continuously lit ⏻ indicator The display shows HH_RANGE information.	
Lock[2]	The gas concentration exceeds the overload value. Indicators 1, 2 and ALARM and ⇧ in the panel are continuously lit. The detector is in a locked state – the last value of concentration has been latched. The detector does not measure – ⏻ indicator is turned off. The display shows LOCK information.	

1 Display description contains sample content.
2 The state occurs only in case of detectors with a catalytic sensor. The lock mechanism is active.

3.3 Detector's state signalling – special states

Situation	Description	Indicators/display
Heating	Preparation of the detector to work. Its indications are ignored. The indicators are lit one after another in the clockwise direction. The display shows message Warm up.	
Calibration	The detector is in calibration state – its indications are ignored. ⏻ indicator flashes evenly. The remaining indicators are turned off. The display shows message Cal.	
Test	The detector is in test state – its indications are simulated and all signals are treated as real. Gas alarms and failures are possible. ⏻ indicator – two flashes per 2s (_⎍_⎍_____). The display shows TEST message.	
Non-critical failure	Detector malfunction that may negatively impact its measurement accuracy (e.g. exceeding of time until periodic calibration or small zero drift). The detector still performs measurement. ⚠ indicator flashes evenly.	
Critical failure	The detector is damaged and does not perform measurement. ⚠ indicator is lit continuously, the remaining ones are turned off. The display shows AWK2100H message.	

3.4 Signalling depending on the concentration of gas measured by the detector



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3.5 Failure codes

Message	Description	
AWK<failure code>	Critical failure – the detector is damaged – does not perform measurements. The failure code is a hexadecimal number, the meaning of particular bits is as follows:	
	bit 0	non-volatile memory error
	bit 1	incorrect values in the data block
	bit 2	damage of electronics
	bit 3	damage of electronics
	bit 4	negative zero drift
	bit 5	damage of the measurement path
	bit 6	damage of electronics
	bit 7	incorrect hardware configuration
	bit 8	collective critical failure – active when any AWK bit is active
	bit 9	damage of the measurement path
	bit 10	damage of the measurement path
	bit 11	sensor signal is too high
	bit 12	sensor signal is too low
	bit 13	damage of the temperature detector
	bit 14	damage of the program block
	bit 15	damage of the data block
AWN<failure code>	Non-critical failure – malfunction of the defector that may negatively impact its measurement accuracy (e.g. exceeding of time until periodic calibration) or failure of a hardware module not affecting the measurement function of the detector. The failure code is a hexadecimal number, the meaning of particular bits is as follows:	
	bit 8	collective non-critical failure – active when any AWN bit is active
	bit 9	incorrect detector supply voltage
	bit 10	minor negative zero drift
	bit 11	temperature overload
	bit 12	Bluetooth module is failure
	bit 13	calibration time is exceeded
	bit 14	digital amplifier operation monitor warning

Example of connection cables for gas detector PW-017 and PW-044 with 4-20 mA output

1 Introduction

It is recommended that all system components are made according to the design created by person with the necessary skills and competence.

2 Connection cable

In case where project does not specify this, you can use the following types of shielded cables for connecting gas detectors:

An example of a cable symbol		Approximate external diameter [mm]	Maximum cable length [m]
Outdoor installations	**Indoor installations**		
LiYCYv 300/500 V 3x1,0	LiYCY 300/500 V 3x1,0	9,1	155
LiYCYv-Nr 300/500 V 3x1,0	LiYCY-Nr 300/500 V 3x1,0	9,1	155
LiYCYv 300/500 V 3x1,5	LiYCY 300/500 V 3x1,5	9,8	230
LiYCYv-Nr 300/500 V 3x1,5	LiYCY-Nr 300/500 V 3x1,5	9,8	230

It is recommended to use cables with a more accurate, round cross-section, made with the use of pressure (better sealing in the Ex glands).

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Example of connection cables for gas detector PW-017 and PW-044 with relay output

1 Introduction

> It is recommended that all system components are made according to the design created by person with the necessary skills and competence.

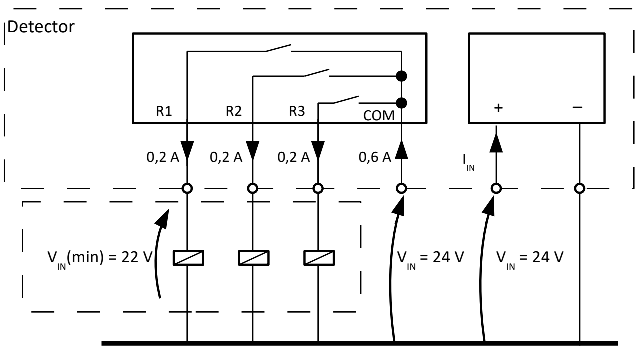
2 Connection cable

In case where project does not specify this, you can use the following types of shielded cables for connecting gas detectors:

An example of a cable symbol		Approximate external diameter [mm]	Maximum cable length [m]
Outdoor installations	Indoor installations		
LiYCYv-Nr 300/500 V 6x0,5	LiYCY-Nr 300/500 V 6x0,5	10,5	50
LiYCYv 300/500 V 6x0,5	LiYCY 300/500 V 6x0,5	10,5	50
LiYCYv-Nr 300/500 V 6x0,75	LiYCY-Nr 300/500 V 6x0,75	11,3	75
LiYCYv 300/500 V 6x0,75	LiYCY 300/500 V 6x0,75	11,3	75
LiYCYv-Nr 300/500 V 8x0,5	LiYCY-Nr 300/500 V 8x0,5	11,9	100
LiYCYv 300/500 V 8x0,5	LiYCY 300/500 V 8x0,5	11,9	100
LiYCYv-Nr 300/500 V 6x1,0	LiYCY-Nr 300/500 V 6x1,0	11,6	100
LiYCYv 300/500 V 6x1,0	LiYCY 300/500 V 6x1,0	11,6	100
LiYCYv-Nr 300/500 V 8x0,75	LiYCY-Nr 300/500 V 8x0,75	13,0	150
LiYCYv 300/500 V 8x0,75	LiYCY 300/500 V 8x0,75	13,0	150

It is recommended to use cables with a more accurate, round cross-section, made with the use of pressure (better sealing in the Ex glands).

3 Connection relay output



Guidelines to the cabling of the system with an RS-485 interface

1 Introductory

⚠ It is recommended that all system components are made according to the design created by person with the necessary skills and competence.

2 Connection cable

⚠ The data transmission line for the gas detectors working in the RS-485 standard should be performed only with the use of a shielded twisted pair cable.

In the case where project does not specify this, you can use the following types of shielded cables[1] for connecting gas detectors:

An example of a cable symbol		Approximate outer diameter [mm]
Outdoor installations	Indoor installations	
YvKSLYekw-P 300 / 300 V 2x2x1	YKSLYekw-P 300/300 V 2x2x1	8.9
-	LiYCY-P 300 / 500 V 2x2x1	9.5
YvKSLYekw-P 300 / 300 V 2x2x1,5	YKSLYekw-P 300/300 V 2x2x1,5	10.8
-	LiYCY-P 300 / 500 V 2x2x1,5	11.7

It is recommended to:

- use cables with a more accurate, round cross-section, made with the use of pressure (better sealing in the Ex glands).

3 Power source

⚠ The power supply line should be designed in such a way that, at the lowest expected supply voltage the measured voltage at the gas detector terminals does not drop below the permissible value.

On the side of the power source, the least favourable conditions should be considered. It must be assumed that in failure situation – at the time of power failure – the supply voltage from the battery terminals falls below the nominal value. Please refer to the documentation concerning the uninterrupted power supply (typical minimum supply voltage during operation on an emergency power supply battery is 21 V; below this value the system disconnects).

1 Different types of insulation may be needed for different locations – e.g. oils, solvents, high temperatures, etc.

4 Power supply of the gas detector

As a standard, in gas detectors with digital data transmission, it is assumed that the voltage cannot drop below 12 V (see the documentation of the detector). The power consumption of the detector is constant within the range of acceptable voltages. With the decrease of supply voltage, the current consumption from the power supply increases.

For example, if the sensor consumes 1 W:

- when powered by 24 V, the supply current will be 1 W / 24 V = 40 mA
- when powered by 15 V, the supply current will be 1 W / 15 V = 67 mA
- when powered by 10 V, the supply current will be 1 W / 10 V = 100 mA

5 Example – a system with a single sensor

Task: Select the sensor power cable under the following conditions:

Data:

- power consumption of the sensor: 2 W
- min. power supply voltage: 24 V
- min. UPS supply voltage 21V
- min. permissible sensor supply voltage: 12 V
- distance between the control unit and the sensor: 800 m

Calculations:

- max. current consumption of the sensor: 2 W / 12 V = 0.167 A
- permissible voltage drop on the line: 21 V – 12 V = 9 V
- maximum allowable line resistance: 9 V / 0.167 A = 54 Ω

Cable selection:

- cable with the cross-section of 0.5 mm^2: R(2x800 m) = 36 / 1000 * 1600 = 57.6 Ω > 54 Ω
  The cable has a resistance greater than the maximum permissible line resistance, so it does not meet the requirements and cannot be used in the system.

- cable with the cross-section of 1.0 mm^2: R(2x800 m) = 18 / 1000 * 1600 = 28.8 Ω < 54 Ω
  The resistance of the cable is less than the maximum acceptable line resistance – the requirements are satisfied so the cable can be applied to the above system.

⚠ The design line can not be longer than 1200 m.

Shielded cables applied for connecting detectors – preparation and installation

The cable shall be prepared in accordance with the following guidelines (see also 1):

- the cable external sheath shall be removed at the applicable length (see 1),
- the cable shield shall be cut right by the end of the external sheath,
- the cable shield shall be protected with isolation,
- at the ends of the cables, isolated clamp sleeve shall be placed,
- he conductive part of the clamp sleeve shall have applicable length (see 1).

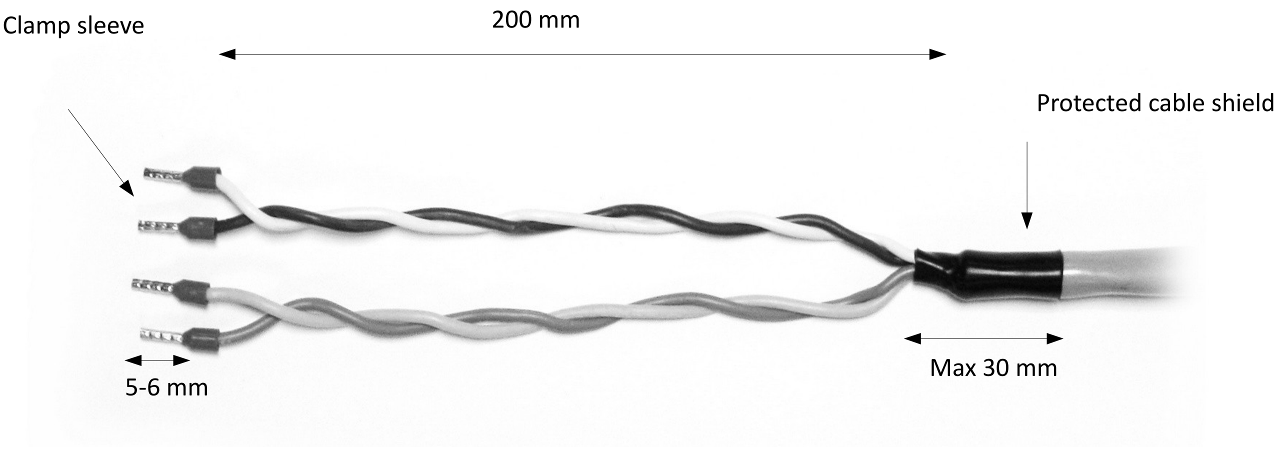


Figure 1: Cable preparation

> For the systems with RS-485 interface, it is necessary to make sure that A and B transmission signals as well as + and – power supply were led with the use of the cables which belong to one pair.

The cable shall be placed in the detector as shown on figure 2. It is necessary to make sure that the shield protection is not located in the rubber element of the cable entry and that the smallest part of the cable external sheath was located inside the detector.

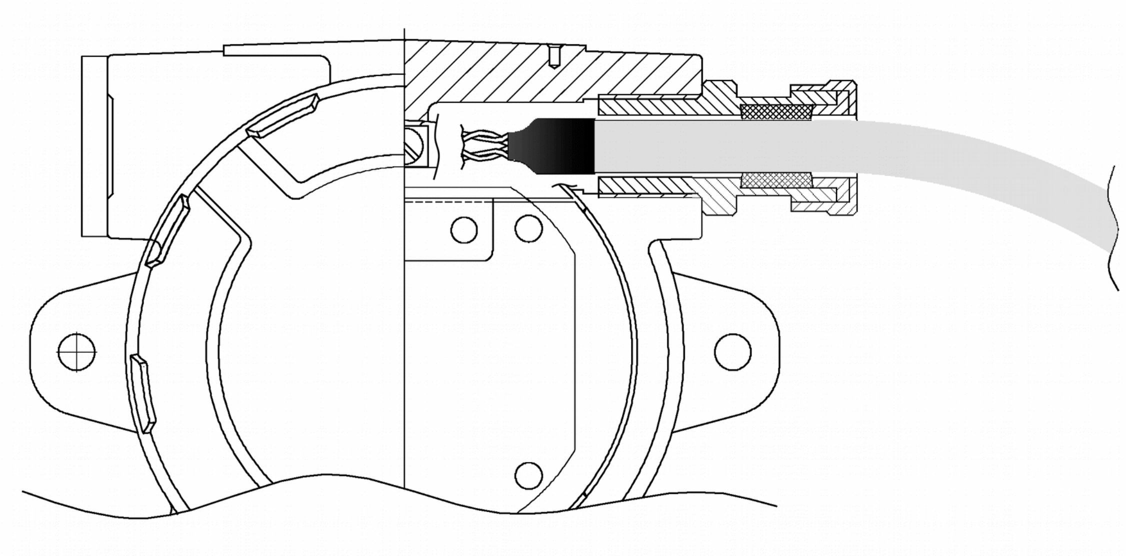


Figure 2: Placing cables in the detector

When laying the cable inside the detector enclosure, it must be remembered that:

- cables should be ordered,
- connecting cables should be kept as far away from the detector electronics as possible and routed as directly as possible to the crimp connection,
- it is necessary to minimize the amount of unnecessary conductor on the detector electronics. It is unacceptable to leave a reserve inside the detector.

Classification of chemicals used at Atest-Gaz

Because of the need to present a **consistent and high level of maintenance services**, to ensure **the safety of the calibration process** and to **create a basis for a rational calculation of the costs** of this process, Atest-Gaz developed the "Classification of Chemical Substances" described below.

The classification determines the complexity of the calibration process of a particular detector type, consider two criteria:

- stability of the calibration mixture (criterion **A**):
  - ease of generate and its stability,
  - ergonomic complexity of operations,
  - required experience and knowledge of the employee performing the calibration,
  - required equipment,
  - environmental requirements for the process (e.g. weather conditions).
- safety / potential hazard generated by the mixture (criterion **B**).

These both criteria have an impact on the final cost of the calibration services and level of competence required from the employee conducting the calibration.

This classification is applied both by Atest-Gaz and the entities cooperating with it – distributors, authorized service providers and users of the systems.

In the case of calibration with the "crossover" substances, the classification is made in accordance with the substance category that is applied (e.g. for the detector with a PID sensor this substance is isobutylene, i.e. B0 A0).
The detector are classified on the stage of offer.

On the next page we present tables showing the above relationships.

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Appendix: PU-Z-039-ENG R01

Category	Description	Terms of facility calibration
A0	Cylinder gases, stable environment	No precipitations, and no strong winds, and temperature over **– 10°C**[1]. In other cases, calibration at a location that meets the above conditions (necessary to remove the detectors).
A1	Cylinder gases, unstable environment or absorption by the moisture	No precipitations, and no strong winds, and temperature over **+ 10°C**[1], and relative humidity under 70%. In other cases, calibration at a location that meets the above conditions (necessary to remove the detectors).
A2	Gases not available in cylinders can be generated at the relevant facilities	like **A1** In other cases, calibration at a location that meets the above conditions (necessary to remove the detectors).
A3	Laboratory calibration	Facility calibration impossible, laboratory calibration only, probably at the manufacturer's. This group also includes conditions resulting from other reasons, e.g. the need for temperature compensation, non-linearity of the sensor, the need for calculation, the use of special tools, etc.

Table 1. Classification of chemicals used at Atest-Gaz. Criterion A: mixture stability

Category	Description	Classification criteria
B0	Safe substances	concentration of flammable components **< 60% LEL**, and concentration of toxic components ≤ **NDSCh**[2], and oxygen concentration **< 25% vol**, and tank **< 3 dm^3** (water capacity) and **p ≤ 70 atm**, or specified liquid chemical compounds, e.g.: glycerol, 1,2-propanediol.
B1	Low-risk substances	concentration of flammable components **< 60% LEL**, and concentration of toxic components ≤ **NDSCh**[2], and oxygen concentration **< 25% vol**, and tank **> 3 dm^3** (water capacity) or **p > 70 atm**, or toxic gases with the concentration of **STEL ÷ 15 x NDSCh**, or specified liquid chemical compounds, e.g.: petrol, acetone, 1-methoxy-2-propanol.
B2	High-risk substances	inert gases having an oxygen concentration **> 25% vol**, or flammable gases with a concentration **> 60% LEL**, or specified liquid chemical compounds, e.g.: styrene, methanol, xylene, toluene, methyl methacrylate.
B3	Extremely dangerous or extremely flammable substances	toxic gases with the concentration of **> 15 x NDSCh**[2], or specified liquid chemical compounds, e.g.: benzene, formaldehyde, formic acid, epichlorohydrin.

Table 2. Classification of chemicals used at Atest-Gaz. Criterion B: OHS

1 Is allowed to perform calibrations at lower temperatures, if they meet the conditions of operation of the detector, e.g. ammonia refrigeration units.
2 In the absence of determined NDSCh it is necessary to adopt 2 x NDS as a criterion.

Notes

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