Version 7.3.1

ЭРИС

DGS ERIS-210

Fixed gas detector

Designed for measurement of explosive hydrocarbon gases, toxic gases or oxygen in the ambient atmosphere

Operation manual

Content

Introduction

The present operation manual is intended for study of structure, design and operating principle of the fixed gas detector DGS ERIS-210 (hereinafter referred to as DGS ERIS-210, gas detector, detector). The operation manual contains basic specification data, usage information, maintenance recommendations and other data required for proper operation, repair and storage of the gas detector.

The gas detector is admitted for use in the Russian Federation and has the pattern approval certificate issued by Federal Agency on Technical Regulating and Metrology RU.C.31.005.A № 59201 and is listed in State Register of Measuring Instruments of the Russian Federation under No. 61055-15.

The gas detector meets requirements of Customs Union Technical Regulation TR TS 012/2011 "The safety of equipment for explosive environments", conformity certificate No. TS RU S-RU.GB08.V.01361. Validity period: till 25.10.2020 inclusively.

The gas detector meets requirements of Customs Union Technical Regulation TR TS 020/2011 "Electromagnetic compatibility of technical equipment", registration number of conformity declaration of Eurasian Economic Union No. RU D-RU.AL16.V.64361. Validity period: till 23.01.2022 inclusively.

The gas detector meets requirements of Russian Maritime Register of Shipping, registration No.17.19075.130. Validity period: till 07.04.2022 inclusively.

The gas detector meets requirements of GOST 30546.1-98, GOST 30546.2-98, GOST 30546.3-98 (seismic resistance 9 on MSK-64 scale) conformity certificate No. ROSS RU.AV28.N21437. Validity period: till 02.06.2019 inclusively.

The gas detector meets requirements of 2014/30/EU Electromagnetic compatibility EN 61326-1:2013, conformity certificate No. 171199020. Validity period: till 12.02.2020 inclusively.

1 Safety precautions

The present operation manual shall be carefully studied before installation, operation and maintenance of the equipment. Special attention shall be paid to warning signs:

TTENTION. Reference to the potential hazardous situation that in case of non-observance of the corresponding preventive measures could lead to personnel injury, device damage or environment incidents. Warning on device mishandling.

INFORMATION. Additional information on device handling.

The gas detector shall be operated only by personnel acquainted with the present operation manual and completed the safety training.

Do not operate the gas detector with mechanical damages of the housing or damaged seal.

Do not open the gas detector in an explosion hazard area when power supply is on.

Only trained personnel could have access to the internal parts of the gas detector for any works performance.

Installation and operation procedures shall correspond to rules and guidelines of "Electrical Installations Code" (EIC) and "Safety rules in Gas Industry".

Installation and connection of the gas detector shall be carried out with power off.

Connection of power-supply and interface circuits to the gas detector shall be performed in accordance with Section 12. In this case voltage shall not exceed the following Um values:

for power-supply circuits Um=32 V;

for interface circuits RS-485 MODBUS Um=6 V.

The gas detector housing shall be grounded. Internal and external grounding devices with earth signs according to GOST 21130-75 are available for gas detector ground connection.

Repair of the gas detector shall be carried out by the manufacturer personnel or persons authorised by the manufacturer for repair works performance.

Do not disassemble detectors and interchange detectors parts.

Do not expose the detector to temperatures out of the specified operation range.

Do not expose the detector in storage to organic solvents or highly inflammable liquids.

Upon service life expiration the replaceable electrochemical oxygen and toxic gases sensors shall be environmentally friendly disposed. Disposal shall be carried out in accordance with the local regulations on waste management and legislation on environmental protection.

Do not discharge state standard sample of calibration gas mixture in the atmosphere of working premises during gas detector adjustment and verification.

2 Gas detector application

The gas detector DGS ERIS-210 is designed for measurement and information transfer on content of flammable gases and vapours of inflammable liquids (including petroleum vapours), toxic gases and oxygen in air of working area, process gas environment, industrial premises and open spaces of production facilities, pipelines and air ducts and for warning alarm on excess of the set alarm limit values.

The gas detector meets requirements of GOST 12.2.007.0-75, GOST 13320-81, GOST 27540-87, GOST 26.011-80, GOST R 52931-2008.

The gas detector is designed for fixed installation.

The gas detector is designed in accordance with TU 4215-020-56795556-2009.

Application field - explosion hazard areas according to 1Exd[ia]IICT6 X explosion proof mark where explosive mixture of gases and vapours could be generated.

DGS ERIS-210 is equipped with visual alarm circle, status LED in the center of the front panel.

The sensor used in the gas detector:

- DGS ERIS-210IR – infrared sensor;
- DGS ERIS-210CT – thermocatalytic sensor;
- DGS ERIS-210EC – electrochemical sensor.

Sampling method is diffusion.

Working position of the gas detector is vertical, with the sensor downwards.

Operation mode is continuous.

Controlled medium is air of working area according to GOST12.1.005-88 and gas environment of production processes.

The gas detector shall be verified according to MP 116-221-2014 with amendment No.1. Verification intervals:

- DGS ERIS-210IR – 3 years;
- DGS ERIS-210CT, DGS ERIS-210EC– 1 year.

3 Manufacturer warranty

Warranty period is 36 months from the sale date.

Warranty for the sensor:

- for DGS ERIS-210IR – 36 months;
- for DGS ERIS-210CT, DGS ERIS-210EC– 12 months.

The manufacturer warrants the device against defective parts. Warranty is not provided in case of non-observance of operation and storage conditions. Financial responsibility of the manufacturer shall not exceed under any circumstances the real cost paid by the buyer.

The warranty does not cover:

- fuses, batteries, filters and parts broken down as a result of normal wear during operation;
- any damages or defects resulted from improper installation and commissioning, repair of the device by persons non-authorized for repair and companies non-authorised by the manufacturer as service centres;
- defects resulted from force majeure circumstances (effects of acts of God, fires, floods, high-voltage discharges, lightings), injury, deliberate and incautious acts of the consumer or third parties.

4 Gas detector design

4.1 External view

Depending on housing materials gas detectors are divided into:

- the gas detector in aluminium housing;
- the gas detector in stainless steel housing.

Overall view of the gas detector is presented at Figure 1

Figure 1 – External view of DGS ERIS-210-1, from left to right: in aluminium housing, in stainless steel housing

4.2 Overall dimensions

Overall dimensions of the gas detector are presented at Figures 2 and 3. All dimensions are indicated in mm.

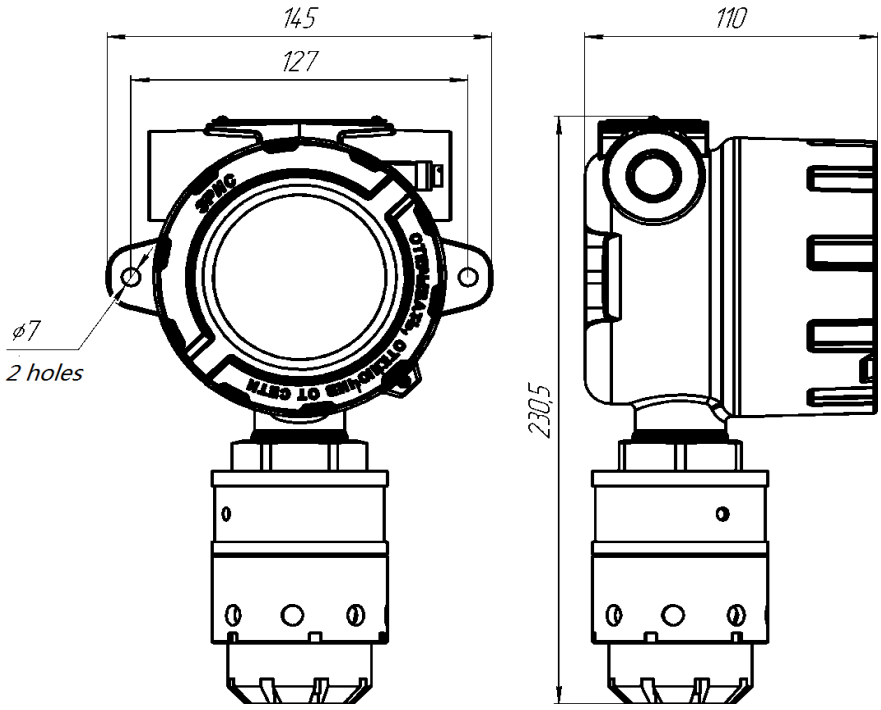


Figure 2 – Overall dimensions of DGS ERIS-210

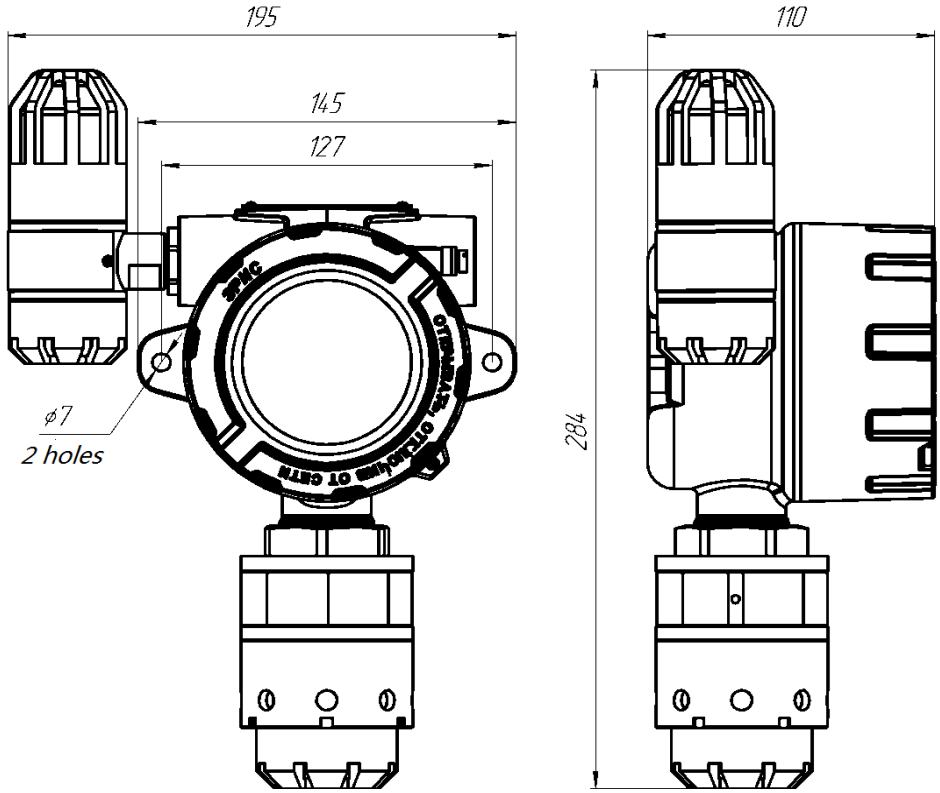


Figure 3 – Overall dimensions of DGS ERIS-210 with audible and visible alarm

4.3 Gas detector design

The gas detector is designed as the metal housing with the cover. The gas detector housing has three threaded entries. Two cable / electric conduits entries located on the both sides of the upper part of the gas detector housing are intended for connection of power supply source, signal output, relay contacts, and HART connector or audible and visible alarm (Figure 4). The bottom entry ensures direct connection of the measurement module. The gas detector housing has the integral mounting plate providing the use of various mounting options. The gas detector cover has a glass window which allows to monitor the device status by means of status LEDs and to use the magnetic wand for activation of three magnetic switches located on the front panel of the electronic module (Figure 5). The magnetic wand also enables a non-intrusive one-man adjustment of the gas detector.
The lock screw is used to prevent the cover unscrewing. To unscrew the lock screw the hexagon wrench supplied along with the gas detector is used.
The gas detector consists of the following functional components (Figure 5):

- measurement module;
- terminal module;
- electronic module;
- housing and cover.

The measurement module is equipped with the sensor (infrared, thermocatalitic or electrochemical). The sensor function is to detect the specific gas, transform the gas concentration into the digital signal and transmit the signal to the electronic module. The sensor of the gas detector DGS ERIS-210IR is protected by the metal ceramic filter integrated into the sensor cover. The measurement module is equipped with the moisture protection cap for protection against moisture.

The terminal module is designed for digital signal transmission from the measurement module to the electronic module for connection of the external power-supply circuits, analog and digital outputs, arrangement and connection of relay outputs.

The electronic module is equipped with the intrinsic safety barrier to ensure intrinsically safe circuits. To intrinsically safe circuits belong series of circuits between measurement and electronic modules. Therefore such circuits do not restrict the external connections and do not require the use of external intrinsic safety barriers to ensure explosion protection of the gas detector. Main functions of this module: generation of analog and digital signals and signals transmission to the terminal module, operation status indication of the gas detector. This module is equipped with magnetic switches for the gas detector calibration.

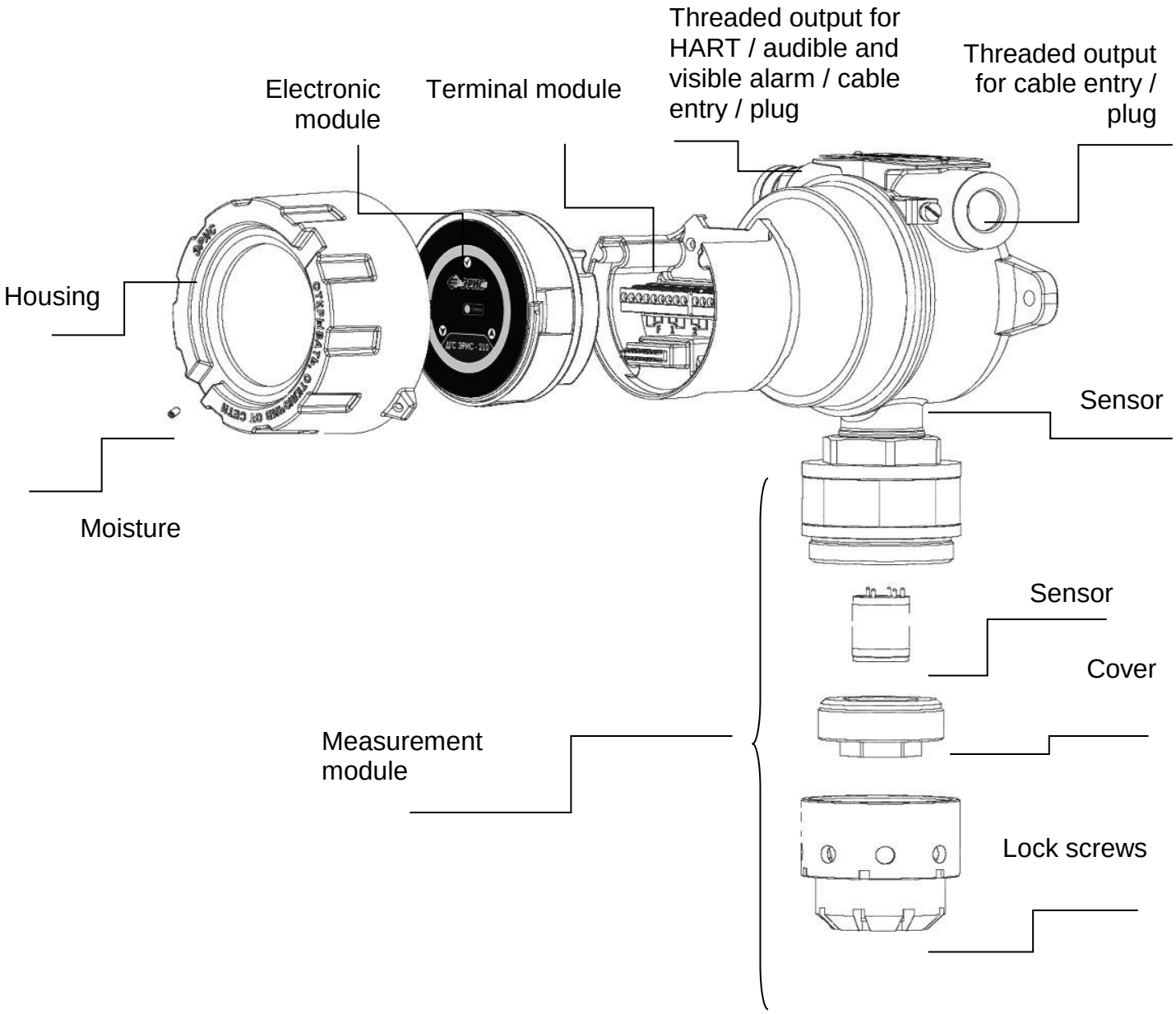


Figure 4 – Functional structure of DGS ERIS-210

4.4 Description of the front panel

The front panel of the gas detector includes (Figure 5):

- Status condition LED,
- magnetic switch areas UP/DOWN/ENTER for local adjustment,
- alarm LED circle.

Status LED glows GREEN during normal operation of the device. LED blinks RED in case gas concentration exceeds upper or lower alarm limits. Operation statuses of the gas detector are described more detailed in clause 14.1, Table 3.

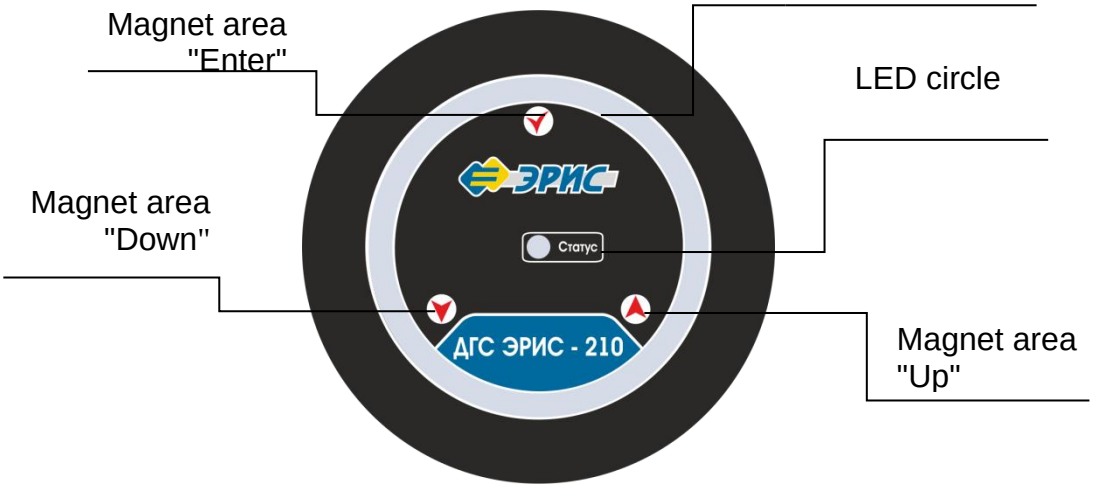


Figure 5 – Location of magnet areas on the front label of DGS ERIS-210

5 Scope of supply

Scope of supply of gas detectors DGS ERIS-210:

Designation	Quantity, pcs.
Gas detector DGS ERIS-210	1
Certificate	1
Operation manual	1*
Verification procedure MP 116-221-2014 with revision No.1	1*
Hexagon wrench	1
Conformity certificate TR TS	1*
Packing	1
Software	1**
Magnetic wand (see below)	1
Moisture protection cap	1

Note:

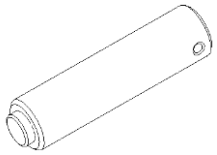
** One copy for 10 gas detectors in lot, but minimum one copy for shipment.*

*** Available on the website free of charge: www.eriskip.com*

Additional accessories for DGS ERIS-210:

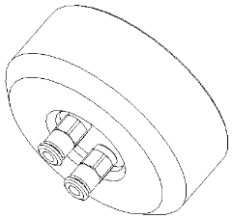
① Magnetic wand.

Magnetic wand is used for the gas detector calibration.

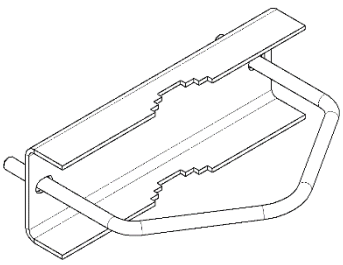


② Calibration cap***.

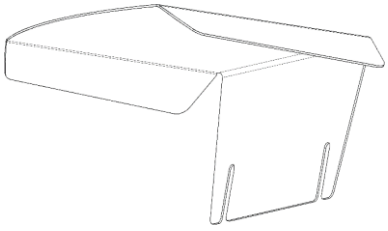
Calibration cap is used for span calibration of the gas detector by gas mixture. It is used for periodic operability check as well .



③ Pipe mounting kit***. The gas detector can be mounted on pipe with diameter 38…68 mm.

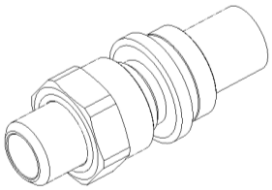


④ Shield for protection against atmosphere precipitation and sun***. The shield is used for protection of the gas detector installed outdoors against overheating in warm season or against heavy atmosphere precipitation in winter time.



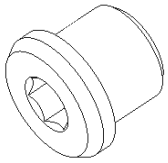
⑤ Cable entry***.

It ensures easy and safe entry of the cable to the housing of the gas detector. Specific type of the cable entry shall be specified at the time of order. Mounting torque is 40Nm.



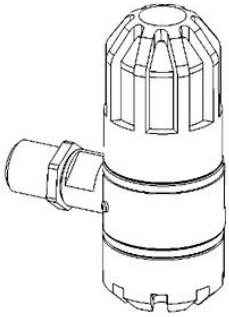
⑥ Plug***.

The plug shall be screwed in the cable entry port. Mounting torque is 40Nm.



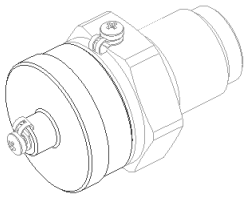
⑦ Audible and visible alarm***.

Audible and visible alarm is used for additional status notification of the gas detector. Mounting torque is 25Nm

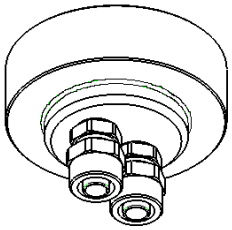


⑧ HART communicator connection device***.

Additional HART connector is used for information output via HART to communicator. Mounting torque is 40Nm.

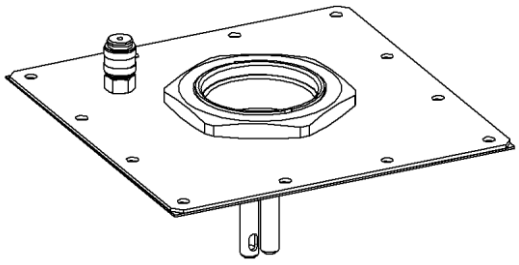


⑨ Flow nozzle for process environment***.



⑩ Air duct mounting kit***.

It is used in case gas monitoring inside air ducts is required. Installation of this kit shall be carried out in accordance with clause 11.4.



*Note - *** Supplied optionally*

Audible and visible alarm and HART communicator connection device could not be used simultaneously..

6 Storage and transportation

6.1 Storage of gas detectors

The gas detector and operational documentation are packed in carton box. Packing method, preparation for packaging, transport package and materials used during packaging, positioning order correspond to the manufacturer drawing.

Gas detectors shall be stored at supplier and consumer stock in original package under conditions No.1 according to GOST 15150-69 (heated warehouses and storehouses with air temperature from plus 5 to plus 40 °C)*. Gas detectors shall be places on racks during storage.

*Gas detectors could be stored at negative temperatures down to 60°C provided that ports of cable entries are plugged. *The gas detector shall stay switched off in normal conditions minimum 12 hours before installation and switch-on.*

Zero calibration and span calibration of the gas detector (Section 16) shall be carried out during commissioning in case the gas detector was stored more than 12 months

After unpacking the gas detector storage conditions shall be equal to the mentioned above.

Storage environment shall not contain harmful impurities causing corrosion.

Distance between heating units of storehouses and gas detectors shall be minimum 0.5 m.

6.2 Transportation of the gas detectors

Transportation conditions are under storage conditions 5(OZh4) according to GOST 15150-69. Temperature range is from minus 60 to plus 65^0C.

Transportation of gas detectors shall be carried out by air, by rail, by water and by road in closed vehicles, heated pressurized compartments of planes in accordance with regulations concerning goods transportation valid for the corresponding means of transport.

Packed gas detectors shall not be subjected to sharp impacts and exposure to atmospheric precipitation during loading and unloading operations and transportation.

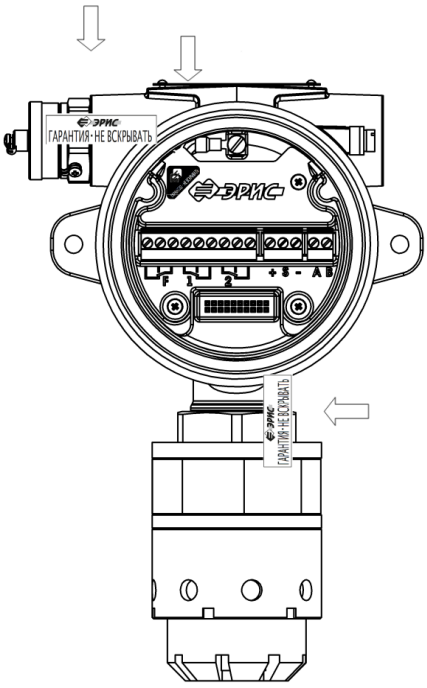
7 Marking and sealing

The gas detector marking includes the following information:

- manufacturer name and trade mark;
- gas detector type;
- molecular formula of the measured gas;
- measurement range;
- year of manufacture;
- serial number of the gas detector under manufacturer numbering system;
- pattern approval mark according to PR 50.2.009;
- explosion protection designation;
- explosion safety sign in accordance with TR TS 012/2011;
- warning notice "Open only after mains disconnection";
- ingress protection rating of IP67;
- operation temperature;
- certificate number;
- grounding sign.

Sealing of units are used for protection against unauthorized access to the internal parts of the gas detector (Picture 8): electronic module, measurement module, terminal module, HART connector or audible and visible alarm. Secure seals are executed as damageable labels.

Gas detector without cover and electronic module.



Back view of the electronic module.

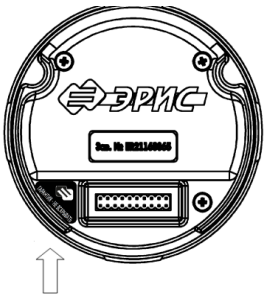


Figure 6 - Sealing allocation

8 Technical specifications

8.1 Operation conditions

The gas detector is designed for operation in the following environmental conditions:

- ambient temperature range - from –60 up to +60°C;
- relative humidity - no more than 98 %;
- atmospheric pressure - from 84 up to 106.7 kPa;
- content of mechanical and aggressive impurities in the controlled medium shall not exceed maximum permissible concentration limits according to GOST 12.1.005-88.

DGS ERIS-210 gas detectors correspond to D3 design according to GOST R 52931-2008 in respect of resistance to influence of ambient air temperature and humidity.

The gas detector is proof against vibration in frequency range from 10 to 30 Hz with total displacement for 1 mm and in frequency range from 31 to 150 Hz with acceleration amplitude 19,6 m/s^2 (2g) according to GOST R 52931-2008.

The gas detector is proof against radio-frequency electromagnetic field in the range from 80 to 1000 MHz (emission from common sources) and in the range from 800 to 960 MHz and from 1.4 to 6.0 GHz (emission from digital wireless phones and other radio frequency devices) according to GOST R 51317.4.3-99, electromagnetic field strength is up to 3 V/m.

8.2 Design performance

Explosion protection type and level of the gas detector corresponds to 1Exd[ia]IICT6X.

Level of human protection against electric shock of the gas detector corresponds to III class according to GOST 12.2.007.0-75.

Level of protection against water, dust and other solid particles penetration into the gas detector corresponds to IP67 code according to GOST 14254-96 (MEK 529-89).

Overall dimensions of the gas detector (without audible and visible alarm), maximum: 150×110×235 mm. Overall dimensions of the gas detector (with audible and visible alarm), maximum: 195×110×284 mm.

Gas detector weight:

- maximum 2.0 kg in aluminium housing;
- maximum 3.9 kg in stainless steel housing;
- with audible and visible alarm - additional 0.35 kg.

8.3 Power supply voltage of the gas detector: 13-36 V DC.

Gas detector power consumption depending on the operation mode:

- switch-on – maximum 6.3 W;
- warming-up – maximum 1 W;

- measuring mode – maximum 1.3 W;
- measuring mode when alarm is active (alarm limit is exceeded) - maximum 2.2 W;
- sensor warming-up - additionally 3 W (automatic switch-on at ambient temperature +5°C and below. Only for DGS ERIS-210EC);
- operation of audible and visible alarm, in measuring mode – additionally 2.3 W;
- operation of audible and visible alarm when alarm is active (alarm limit is exceeded) - additionally 6.2 W.

Time limits of the gas detector warming-up:

- DGS ERIS-210IR – maximum 2 minutes;
- DGS ERIS-210CT, DGS ERIS-210EC – maximum 10 minutes.

Cable length from the gas detector to the controller depends on power supply voltage and selected cable. Length calculation is presented in clause 12.3.

Load impedance of current loop circuit is maximum 500 Ohm.

Maximum commutated current of relay - 2 A, 220 V AC (or 250 V DC).

8.4 Metrological performance

Measurements ranges of gases and limits of permissible reference error of DGS ERIS-210 are indicated in annex A. Gases detected by flammable gas sensors are indicated in annex B.

DGS ERIS-210EC gas detectors with electrochemical sensors could ensure measurement of volume and mass concentration of the gas. Recalculation of volume concentration values, ppm (or million^{-1}) to mass concentration, mg/m^3 is carried out by the following formula:

$$C_{mg/m3} = \frac{M \cdot C_{ppm}}{R \cdot T/P},$$

where $C_{mg/m3}$ – gas concentration value, mg/m^3;

C_{ppm} – gas concentration value, ppm;

M – molar mass of gas;

R- absolute gas constant, equal to 8,314472;

P – atmospheric pressure, kPa;

T – temperature, K.

Under normal conditions (T = 293.15 K, P = 101.325 kPa) the formula is written as:

$$C_{mg/m3} = C_{ppm} \cdot K,$$

where K - correction factor under normal conditions.

Correction factors under normal conditions are indicated in the gas detector certificate.
Output signal variation in ratio of the reference error is not more than 0.5.

Permissible additional error associated with ambient temperature change for every 10 °C in ratio of the reference error is ±0.2.

Time of the input signal setting of the gas detector on level 0.9 ($T_{0.9}$):

- DGS ERIS-210IR – 5 seconds;
- DGS ERIS-210CT – 10 seconds;
- DGS ERIS-210EC – 15 seconds.

Time of the input signal setting depends on ambient temperature and measured gas.

Limit of the permissible interval of the gas detector operation period without output signal adjustment - minimum 6 months.

8.5 Reliability performance

Average time between failures of the gas detector:

- DGS ERIS-210IR – minimum 70000 hours;
- DGS ERIS-210CT, DGS ERIS-210EC – minimum 35000 hours.

Failure criterion - tolerance failure of reference error, functionality failure.

Average full service life of the gas detector is minimum 15 years.

8.6 Default configuration

DGS ERIS-210 is supplied calibrated and ready for use in accordance with default configuration described in Table 1.

Table 1- Default settings

Function	Value / Setting	Description
Detector type	Automatic selection depending on the connected sensor type.	DGS ERIS-210 recognizes the sensor in accordance with gas type within its own sensor family: sensors IR,CT,EC
Signal output	less than 1.5 mA	Fault
	from 4.0 mA to 20.0 mA	Normal measuring mode
	22.0 mA	Exceeding of the maximum permitted limit
ALARM Relay 1*	Contact normally opened (NO)	Closing in case alarm limit is exceeded
ALARM Relay 2*	Contact normally opened (NO)	Closing in case alarm limit is exceeded
Fault Relay	Contact normally closed (NC)	Opening in case of alarm.
Timeout period	2 minutes	Time of automatic exit from the service mode
Sensor warming up	Switch-on in case of ambient temperature is +5°C.	Automatic switch-on
ModBus	ID, baud rate and parity bit	ID: 1 Baud rate 9600 Parity bit No
Note - * Relays automatically reset when reading is within the range specified by the alarm thresholds.		

9 Interface

- The gas detector ensures output of information on measured concentration value by the following interfaces:
- Status LED in the center of the front panel;
- 8 LEDs located circle-wise for visual alarm in case of alarm limits achievement or fault detection
- audible and visible alarm (optionally). Audible and visible alarm is described in Section 18;
- digital serial interface RS-485 MODBUS® (communication protocol is described in Section 20);
- current loop 4-20 mA (nominal static conversion function is described in Section 21);
- 3 relays (Alarm 1, Alarm 2, Fault) (optionally);
- 3 relays (Alarm 1, Alarm 2, Alarm 3) (optionally only for gas detectors designed for ammonia concentration measurement);
- HART protocol (local or through the current loop) (optionally). Local HART is provided by the HART communicator connection device. HART protocol menu is described in Section 19.

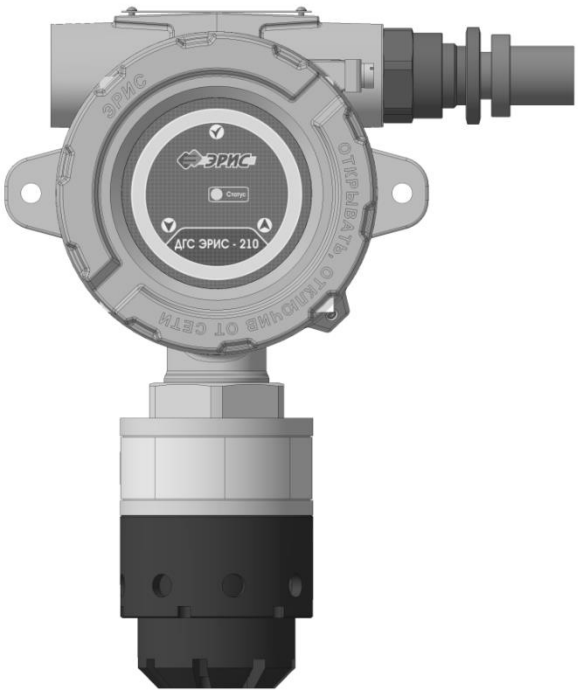
Audible and visible alarm and HART communicator connection device could not be used simultaneously.

10 Pre-starting procedure

The gas detector shall be operated only by personnel acquainted with the present operation manual and completed the safety training.

Do not operate the gas detector with mechanical damages of the housing or damaged seal.

Only trained personnel could have access to the internal parts of the gas detector for any works performance.



After unpacking of the gas detector check scope of supply, seals, explosion proof markings, absence of mechanical damages.

In case the gas detector was kept in transport package at negative temperature, it should be kept switched off under normal conditions not less than 12 hours.

If cable entries are available, they shall be installed in the corresponding ports of the gas detector housing. Mounting torque of the cable entry is 40Nm.

11 Gas detector installation

The gas detector installation on site shall be carried out in accordance with the approved under the established procedure project of allocation of monitoring system with the gas detector.

During installation and operation the guidelines of the following documents shall be followed:

- *clause 7.3 of "Electrical Installations Code" (PUE);*
- *clause 3.4 of "Rules of operation of electric installations of consumers" (PEEP);*
- *"Safety Rules for Operation of Customers' Electrical Installations" (PTB).*

Gas detectors shall be grounded. The ground screw is located on the outside of the housing and marked accordingly ⏚.

11.1 Recommendations on optimal positioning of the gas detector

➢ The gas detector shall be positioned at place specified by the design documentation where gas could possibly be detected.

➢ For measurement of lighter-than-air gases the gas detector shall be positioned above the protected area. For measurement of heavier-than-air gases the gas detector shall be positioned below the protected area.

➢ The gas detector shall be positioned at places with sufficient air circulation. Limitation of the natural air flow could be the reason of the delayed response.

➢ Do not install the gas detector in direct sunlight without shield for protection against atmosphere precipitation and sun.

➢ Do not install the gas detector at places subjected to rain, water, aerosol sprays, fog or strong condensation, dust sources, vapours without shield for protection against atmosphere precipitation and sun.

➢ Do not install the gas detector near heat sources.

➢ The gas detector shall be installed at places providing maintenance access.

The gas detector is equipped with the built-in mounting plate with two mounting holes in the housing. The gas detector could be installed directly on the mounting surface (wall, plate) or at pipe with diameter 38-68 mm (1.5–2.7 inch) in vertical position or at air duct.

11.2 Wall (plate) mounting of the gas detector

Mounting dimensions for fastening shall be observed in accordance with Figure 7 in case of wall (plate) mounting of the gas detector. All dimensions are indicated in mm. Mounting shall be carried out by screws and nuts M6. View of the wall mounted gas detector is shown at Figure 8. Make sure that mounting screws are properly tightened and appropriate lock washers are used. During the mounting process make sure that the gas detector has access to the measured air and there is enough space for further dismounting and operability check.

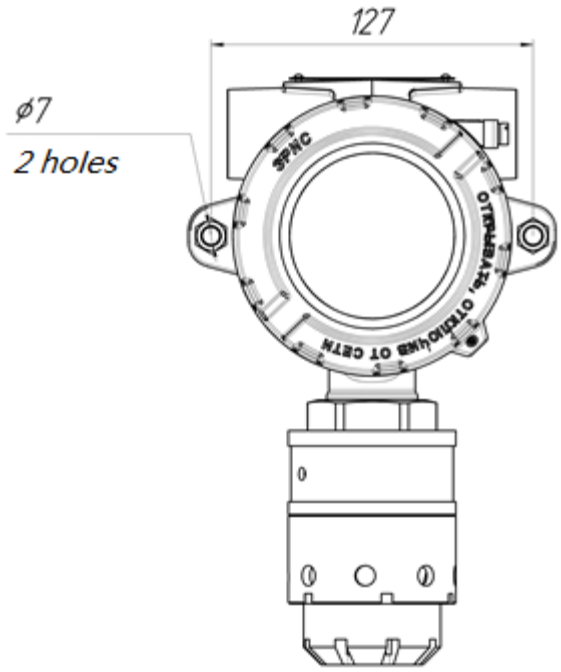


Figure 7 – Mounting dimensions

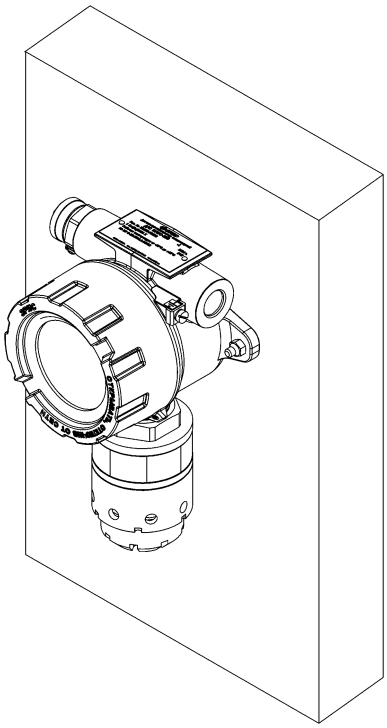


Figure 8 – View of the wall mounted gas detector

11.3 Pipe mounting of the gas detector

Pipe mounting kit (Figure 9) shall be used for pipe mounting of the gas detector (supplied optionally). The external view of the pipe mounted gas detector with installation kit is shown at Figure 10. Maximum diameter of the pipe for installation is 68 mm; minimum diameter is 38 mm. All dimensions are indicated in mm.

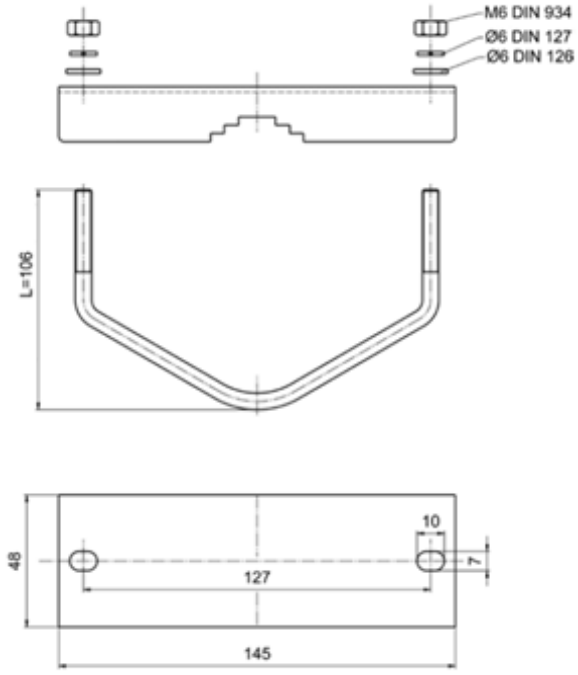


Figure 9 – View of the pipe mounting kit

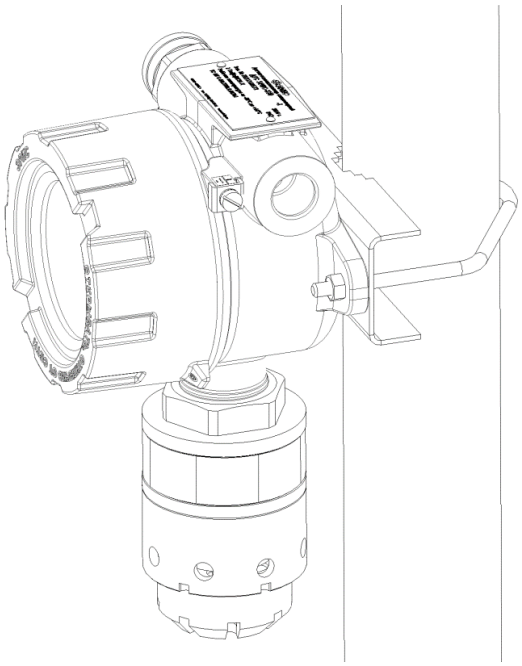


Figure 10 – View of the pipe mounted gas detector

11.4 Air duct mounting of the gas detector

Area on the upper wall of the air duct shall be prepared for installation of the air duct mounting kit (hereinafter referred to as the kit) (Figure 11.). Other mounting methods could be used providing tightness and resistance (for example, by self-driving screws). All dimensions are indicated in mm.

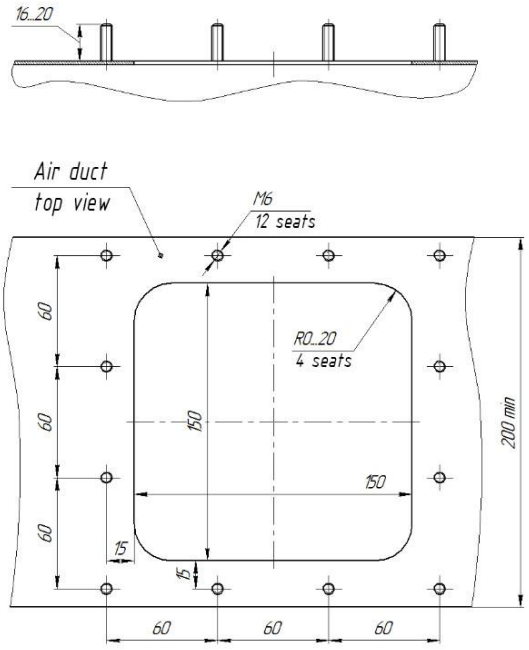


Figure 11 – Kit installation area

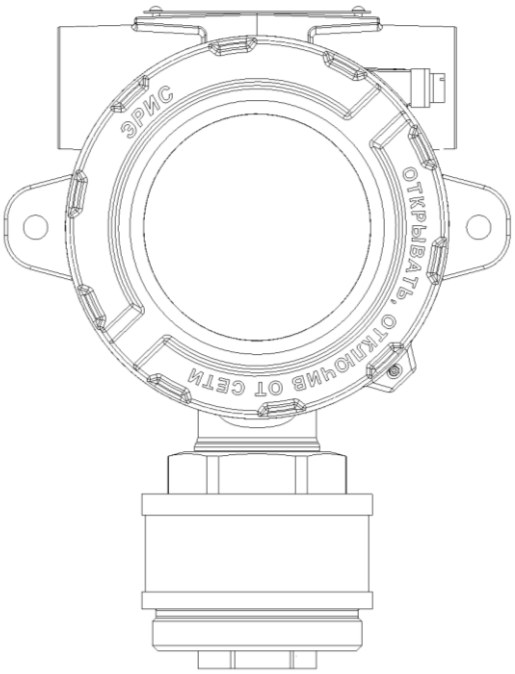


Figure 12 – Gas detector without moisture protection cap

Installation order of the air duct mounting kit and the gas detector:

a) Position the kit on the prepared area at the air duct. Fix by nuts M6. Rubber seal shall be pressed between plate and air duct wall;

b) Remove the moisture protection cap from the gas detector (Figure 12);

c) Screw the gas detector into the cover of the kit (Figure 13);

d) Further connection of the gas detector shall be carried out in accordance with clause 12.1.

External view of the mounted gas detector is shown at Figure 13.

The corresponding gas mixture shall be supplied to the gas feeding point by means of the quick release connector (supplied complete with) in order to check operability of the gas detector. Gas mixture flow rate is 0.5-0.6 l/min.

Disconnect the quick release connector after completion of operability check in order to avoid gas discharge outside from the air duct.

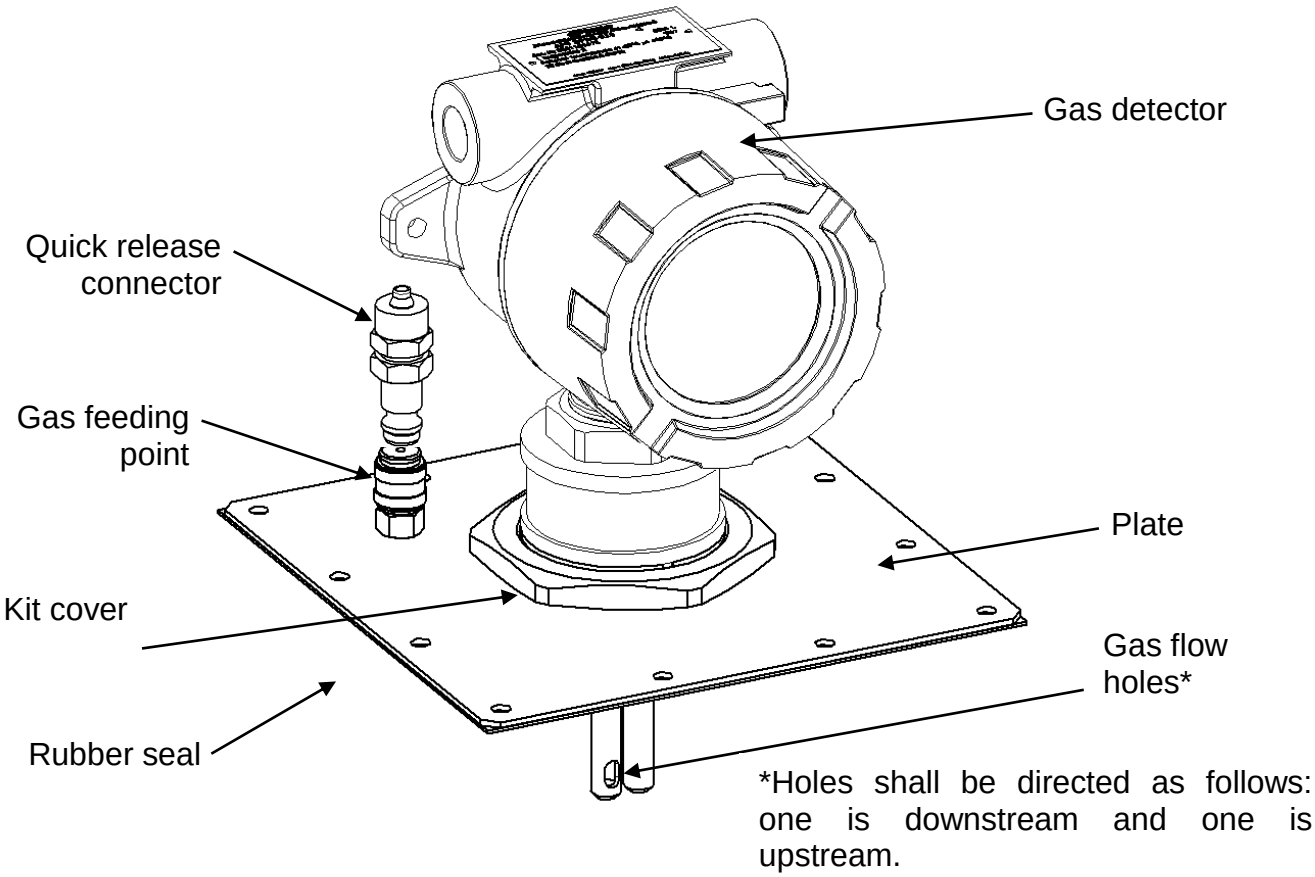


Figure 13 – External view of the gas detector and air duct mounting kit.

11.5 Installation of the protective shield of the gas detector

The external view of the gas detector with installed protective shield in case of pipe mounting is shown at Figure 14.

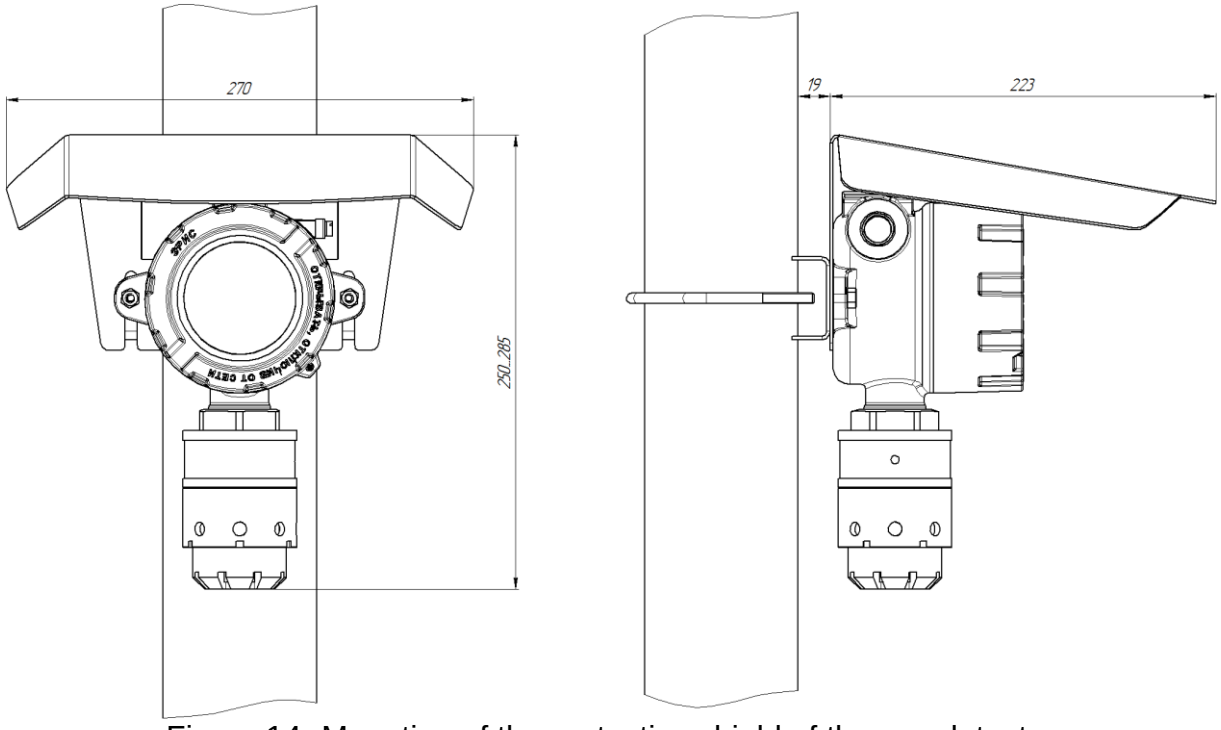


Figure 14- Mounting of the protective shield of the gas detector

12 Gas detector connection

The gas detector shall be operated only by personnel acquainted with the present operation manual and completed the safety training.

Only trained personnel could have access to the internal parts of the gas detector for any works performance.

Installation and operation procedures shall correspond to rules and guidelines of "Electrical Installations Code" (PUE) and "Safety rules in Gas Industry".

Installation and connection of the gas detector shall be carried out with power off.

Connection of power-supply and interface circuits to the gas detector shall be performed in accordance with Section 12. In this case voltage shall not exceed the following Um values:

for power-supply circuits Um=32 V;
for interface circuits RS-485 MODBUS Um=6 V.

The gas detector housing shall be grounded. Internal and external grounding devices and earth signs according to GOST 21130-75 are available for gas detector ground connection.

Do not expose the detector to temperatures out of the specified operation range

12.1 Cables connection

Cables connection inside the gas detector shall be carried out in the following order:

a. Screw off lock screws in the gas detector cover (Figure 15).
b. Screw off the cover.
c. Remove the electronic module from connectors by pulling the semicircular handle.

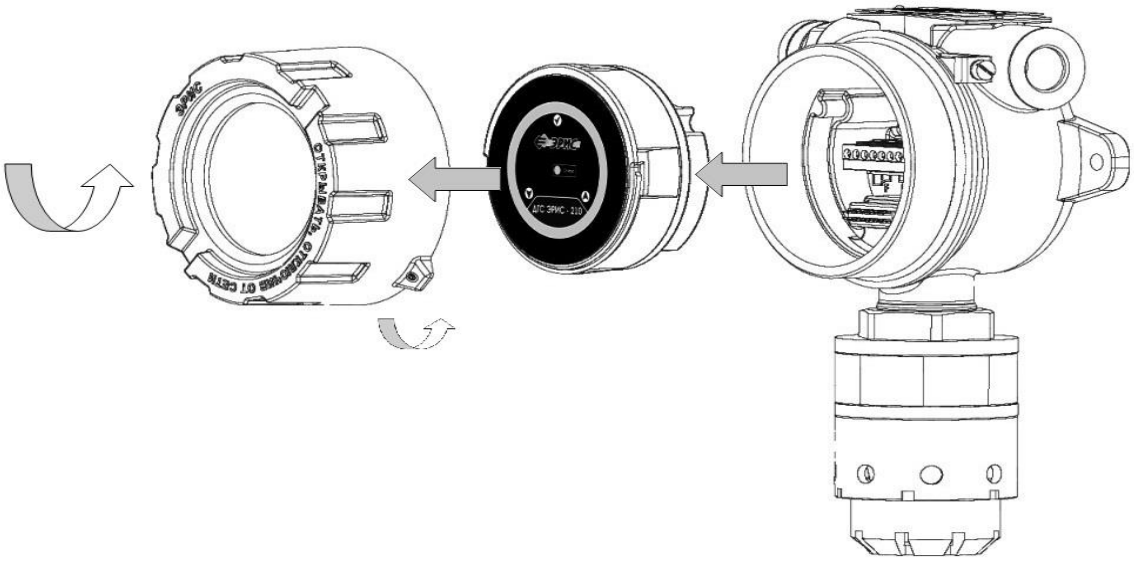


Figure 15– DGS ERIS-210 disassembling diagram

d. Cables connection shall be carried out in accordance with application and marking on the terminal module (connection diagrams according to Figures 16-19).
e. After connection the device shall be assembled in the in reverse order.

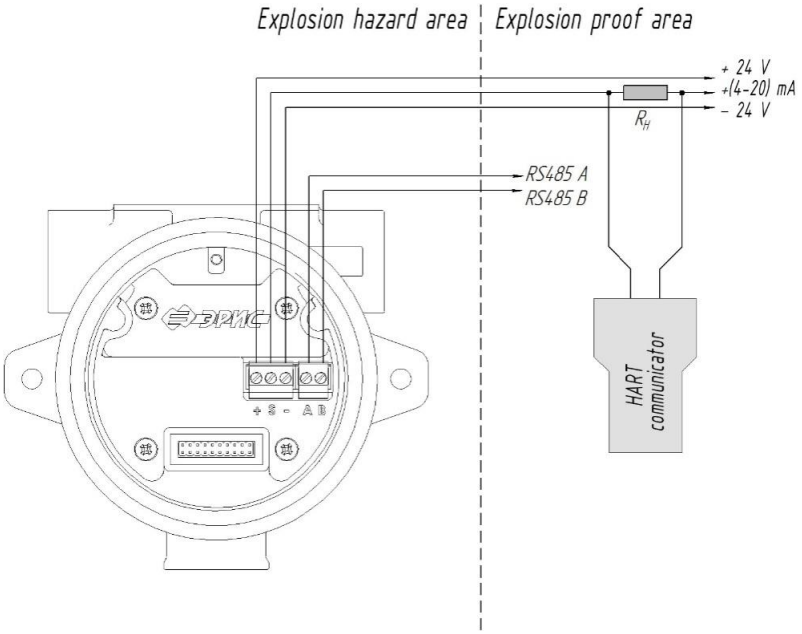


Figure 16 – 3-wire connection diagram of the gas detector DGS ERIS-210 without relay with HART connection using the current loop

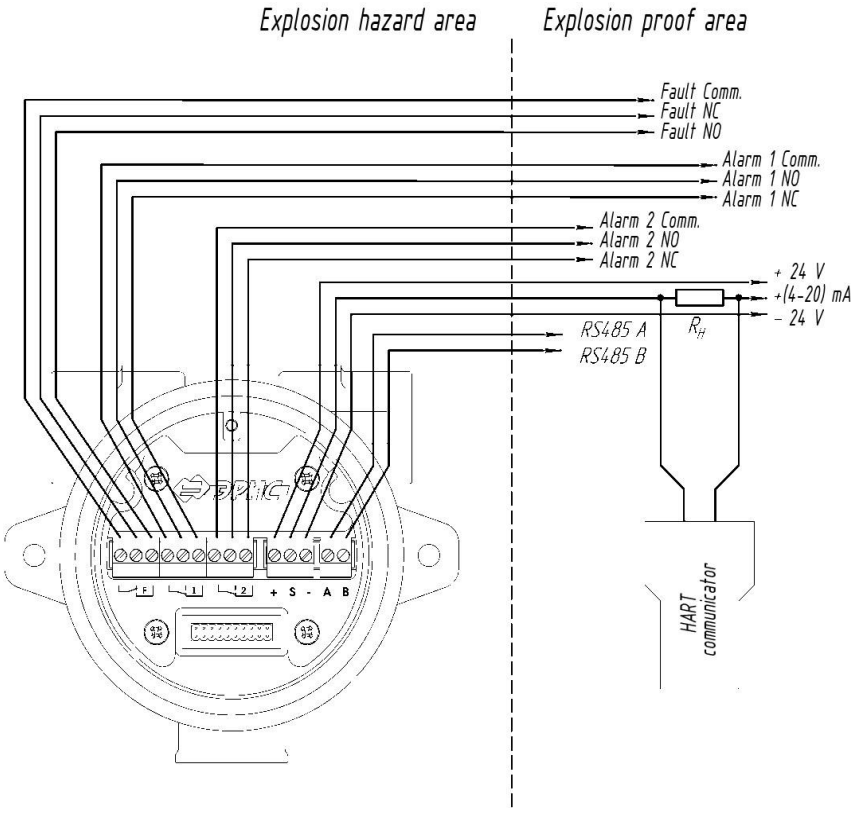


Figure 17 – 3-wire connection diagram of the gas detector DGS ERIS-210 with relay with HART connection using the current loop. NO - contact normally opened; NC - contact normally closed.

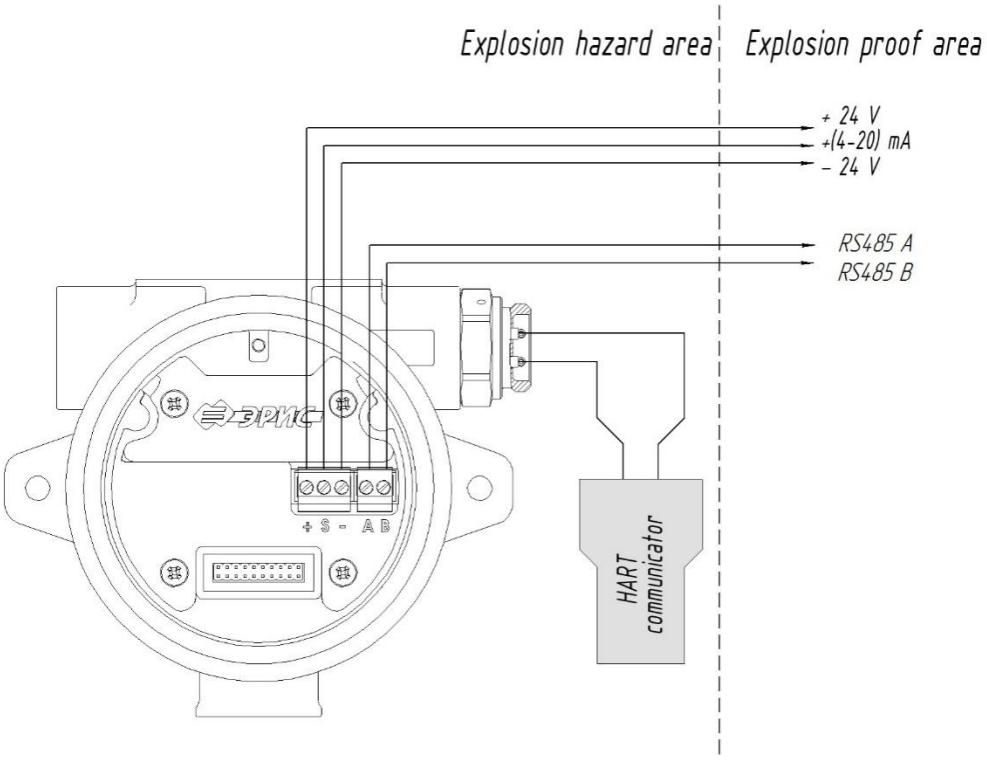


Figure 18 – 3-wire connection diagram of the gas detector DGS ERIS-210 without relay and with local HART connection

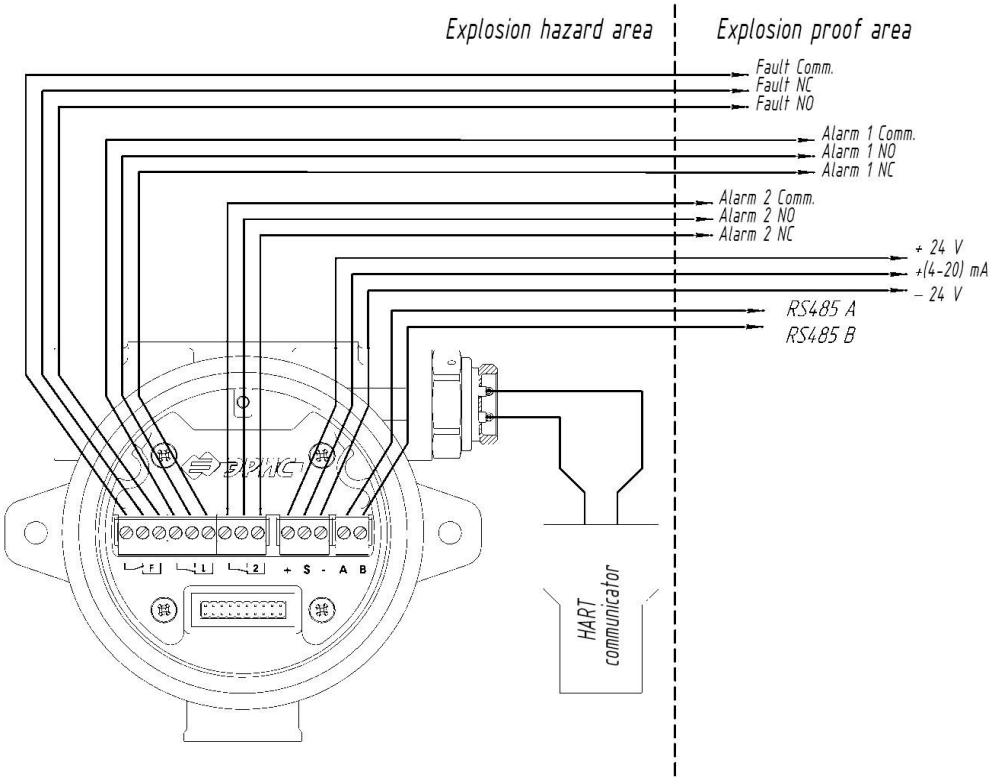


Figure 19 – 3-wire connection diagram of the gas detector DGS ERIS-210 with relay and with local HART connection. NO - contact normally opened; NC - contact normally closed.

12.2 Calculation of cable line length

To calculate maximum power cable line length of the detector the following needs to be defined:

$R_{cable\ line_{max}}$ maximum total resistance,

- r_{core} maximum electrical DC resistance of power core with length 1 km.

The maximum allowed cable length shall be calculated by formula:

$$L_{cable\ line_{max}} = \frac{R_{cable\ line_{max}}}{2 \cdot r_{core}}, (km),$$

Where $L_{cable\ line_{max}}$ – maximum power cable length, km,

$R_{cable\ line_{max}}$ – maximum total resistance of the cable, Ohm,

r_{core} – maximum electrical DC resistance of power core with length 1 km (at + 20°C), Ohm/km. These data are indicated in the cable quality certificate or according to GOST 22483-2012. Power is supplied over two cable cores, therefore both cores resistance shall be taken into account by adding value 2 to the denominator.

Maximum total resistance shall be calculated by formula:

$$R_{cable\ line_{max}} = \frac{U_{power\ supply} - U_{min}}{I_{consumption}} (\text{Ohm}),$$

where $U_{power\ supply}$ – power supply voltage (for example, power unit, controller etc.), V,

U_{min} – minimum power supply voltage of the gas detector, V. For DGS ERIS-210 the minimum voltage is 13 V.

$I_{consumption}$ – consumption current of the gas detector at minimum power supply voltage, A. For DGS ERIS-210 this value is 0.525 A.

***Example*:** For power supply of the gas detector DGS ERIS-210 one-core and multi-core cables and cables with circle stranded wires from flexible copper without coating of 3rd class produced in accordance with GOST 22483-2012 are used. Gas detector DGS ERIS-210 is powered from the controller SGM ERIS-130 by voltage 24V, i. e.:

$U_{power\ supply} = 24$ V, $U_{min} = 13\ V,\ I_{consumption} = 0{,}525$ A, $r_{core} = 39{,}6$ Ohm$/km$

Calculate maximum length of two-core cable:

$$R_{cable\ line_{max}} = \frac{24 - 13}{0{,}525} = 20{,}95\ \text{Ohm}$$

$$L_{cable\ line_{max}} = \frac{20{,}95}{39{,}6 \cdot 2} = 0{,}26\ km$$

Table 2 shows the maximum power cable length between the controller and detector.

Temperature corrections and actual cable quality are not considered in these calculations.

Table 2 – Maximum length of two-core power cable

Core section, mm²	$R_{cable\ line_{max}}$, Ohm	r_{core} (at + 20°C), Ohm/km	$L_{cable\ line_{max}}$, km
0,50	20,95	39,6	0,26
0,75		25,5	0,41
1,0		21,8	0,48
1,5		14,0	0,74

2,5		7,49	1,39
4		4,79	2,18
6		3,11	3,36
10		1,99	5,26
16		1,21	8,65
25		0,809	12,94
35		0,551	19
Note: temperature corrections and actual cable quality are not taken into account in these calculations.			

12.3 Grounding procedure

Effective grounding is required to restrict influence of radio frequency interference and ensure electromagnetic compatibility.

Using the screened cable the screen covering circuit conductors protects them against parasitic capacitive couplings and external magnetic fields. This screen shall be connected to the ground screw only at one end point, usually from controller side (Figure 20). The screen at the other end from the detector side shall be terminated or connected to a blank terminal.

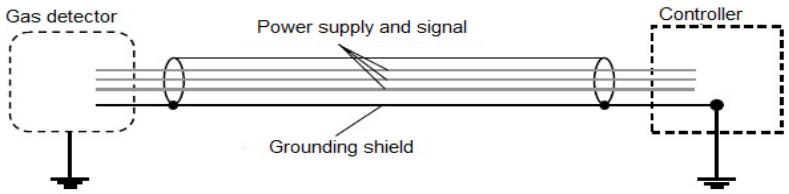
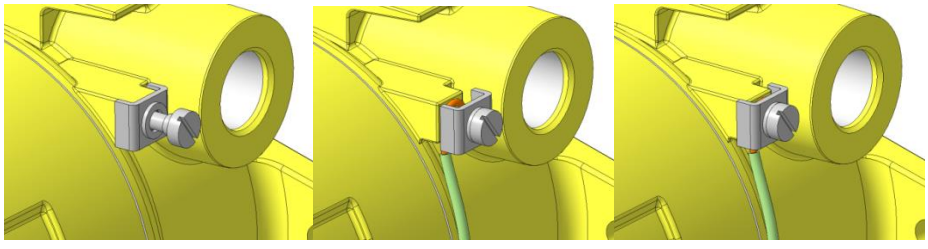


Figure 20 – Screened cable grounding

Do not ground the screen from both sides: currents inducing incorrect readings or false alarms could occur due to difference of potentials.

In accordance with clause 7.3 of Electrical Installations Code the housing of the gas detector shall be grounded in order to ensure protective grounding. The external ground screw and grounding sign are provided for this purpose according to GOST 21130-75. Specially indented for this purpose grounding conductors shall be used.

In order to connect the grounding conductor loosen the ground screw sufficiently to enable wrapping the wire around the screw in a “U” shape (Figure 21). Raise the clamp and place the wire between the clamp and the detector housing. Lower the clamp and tighten the ground screw.



a) loosen the screw b) place the wire c) tighten the screw

Figure 21 – Grounding of the gas detector housing

13 First time switch-on (commissioning)

Do not open the gas detector in an explosion hazard area when power supply is on.

Only trained personnel could have access to the internal parts of the gas detector for any works performance.

The gas detector housing shall be grounded. Internal and external grounding devices and earth signs according to GOST 21130-75 are available for gas detector ground connection.

Do not disassemble detectors and interchange detectors parts.

Do not expose the detector to temperatures out of the specified operation range.

Do not connect the gas detector to main supply line with 220 V. The manufacturer shall have no warranty obligation in case of such improper operation of the gas detector.

13.1 Check of power supply connection

Zero calibration is mandatory before the use of the gas detector for gas detection. Refer to Section 16 for description of the corresponding procedure.

1) Screw off the lock screw on the upper cover of the gas detector cover (Figure 22). Screw off the cover. Remove the electronic module from connectors by pulling horizontally the semicircular handle "acr" (do not rotate).

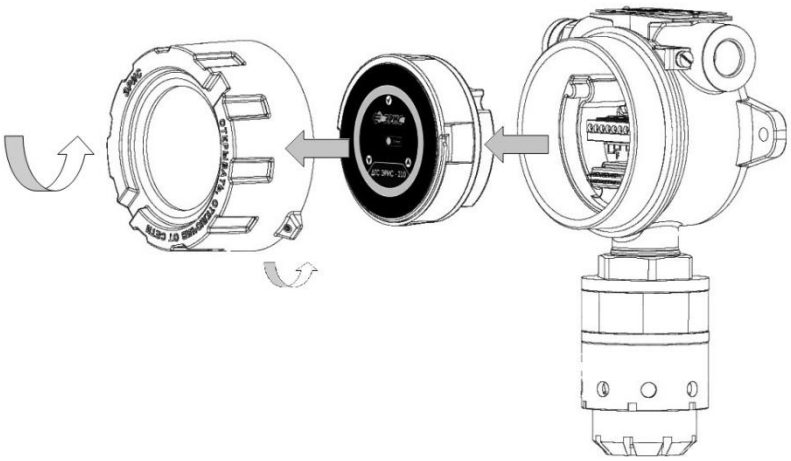


Figure 22 - Gas detector disassembling diagram

2) Make sure that all electrical connections are correctly joined according to Section 12.

3) After inspection the device shall be assembled in the in reverse order.

Ensure that none of terminal module wires cause an obstruction when refitting the electronic module. The socket of the electronic module shall be fully engaged in the connector of the terminal module.

4) Switch on external power supply of the gas detector.

5) Then start up procedure, initialization and warming up of the gas detector will be initiated. Then the gas detector will turn to the measuring mode

Process	Visible alarm type
Start up	LEDs blink red around a circle, Status LED glows white.
Initialization	Red LED blinks around a circle. Status LED alternatively

	blinks red, green, and blue.
Warming up	Status LED blinks white once per second.
The gas detector functions properly*. Low value of volume concentration of detected gas (to value ALARM 1).	Status LED blinks green once per second.

* If the gas detector was not calibrated after installation, red glow after warming up mode does not mean the alarm limit exceeding. Perform zero calibration of the gas detector (Section 16).

Full description of each process and visible alarm type is given in Table 3

13.2 Installation inspection

Before the gas detector commissioning check the following:

1) Make sure that mounting bolts / nuts of the gas detector are securely tightened. Make sure that the gas detector could not be moved manually.

2) Make sure that cable entry / plug / audible and visible alarm are firmly tightened.

Torque:

- Cable entry - 40 Nm;
- Plug - 40 Nm;
- Lock nut of the audible and visible alarm - 25 Nm.

Make sure that cable entry and/or plug and/or audible and visible alarm could not be moved manually.

3) Make sure that the housing cover is firmly tightened, the lock screw is locked. Make sure that the gas detector cover could not be moved manually.

14 Indication and operability check

14.1 Indication check

The indication shall be checked after the first switch-on to ensure correct operation of device. Zero calibration is mandatory before the first switch-on of the gas detector.

When the gas detector is switched on in the area not containing flammable and toxic gases, the audible and visible alarm signals shall correspond to Table 3. When the measured gases concentration exceeds the set alarm values or in case the failures occur, the audible and visible alarm of the gas detector shall correspond to Table.

All indication signals and interface statuses are described in Table 3. The audible and visible alarm operation statuses are described in Section 18.

Table 3. DGS ERIS-210 interface statuses

Process		Visible alarm type	Current loop 4-20 mA	RS-485MODBUS	Fault Relay*	Alarm 1 Relay*	Alarm 2 Relay*
The gas detector is switched off.		-	-	-	✓		
Preparation for measurement	Start up	LEDs glow red around a circle, Status LED glows white.	–	–			
	Initialization	Red LED blinks around a circle. Status LED alternatively blinks red, green, blue.	–	–			
	Warming up	Status LED blinks white once per second.	2	–			
Measurement	The gas detector functions properly. Low value of volume concentration of detected gas (to value ALARM 1).	Status LED blinks green once per second.	4-20	Concentration value and status code			
	Maximum volume concentration of detected gas exceeds set limit of ALARM 1	Status LED glows red. LEDs around a circle blink one time, once per second.	4-20	Concentration value and status code		✓	
	Maximum volume concentration of detected gas exceeds set limit of ALARM 2	Status LED glows red. LEDs around a circle blink two times, once per second.	4-20	Concentration value and status code		✓	✓

14.2 Relay activation test

The relay activation could be tested only if the gas detector supports such option. Maximum relay output shall not exceed 2 A.

To perform field calibration using the state standard sample of the calibration gas mixture, proceed as follows:

1) Fault relay test. To test the relay, switch on the gas detector. The fault signal shall be displayed on the control panel.

2) Alarm 1 relay test. To test the relay, supply the calibration gas mixture through the calibration cap of the gas detector, the measured gas concentration shall exceed the set value of Alarm 1. If the fault signal is displayed on the control panel, the repay operates correctly. Visual alarm signals of the gas detector shall correspond to Table 3.

3) Alarm 2 relay test. To test the relay, supply the calibration gas mixture through the calibration cap of the gas detector, the measured gas concentration shall exceed the set value of Alarm 2. If the fault signal is displayed on the control panel, the repay operates correctly. Visual alarm signals of the gas detector shall correspond to Table 3. Check of the gas detector relays operation is complete.

15 Gas detector operation

Gas detector DGS ERIS-210 is supplied configured and ready for use according to the default settings specified in clause 9.6.

Zero calibration (see Section 16) shall be performed after the gas detector installation, when zero calibration is complete the gas detector is ready for operation.

The Status LED glows GREEN during the normal operation or measuring mode.

LEDs blink RED if the gas concentration falls outside the low or high limits of alarm response (ALARM 1, ALARM 2).

The full list of gas detector indications is shown in Section 14, Table 3.

Operation indications of the gas detector equipped with the audible and visible alarm is described in Section 18.

15.1 Operation mode structure

The gas detector has three operations modes.

1) Measuring mode is a normal device state, when the gas detector measures the gas concentration. In this mode the fault and warning statuses are regularly checked, and corresponding relay contacts are activated according to the set configuration.

2) Calibration mode is used to perform zero and span calibration of the sensor.

3) Configuration mode is used to change configuration parameters of the gas detector in accordance with the specific requirements.

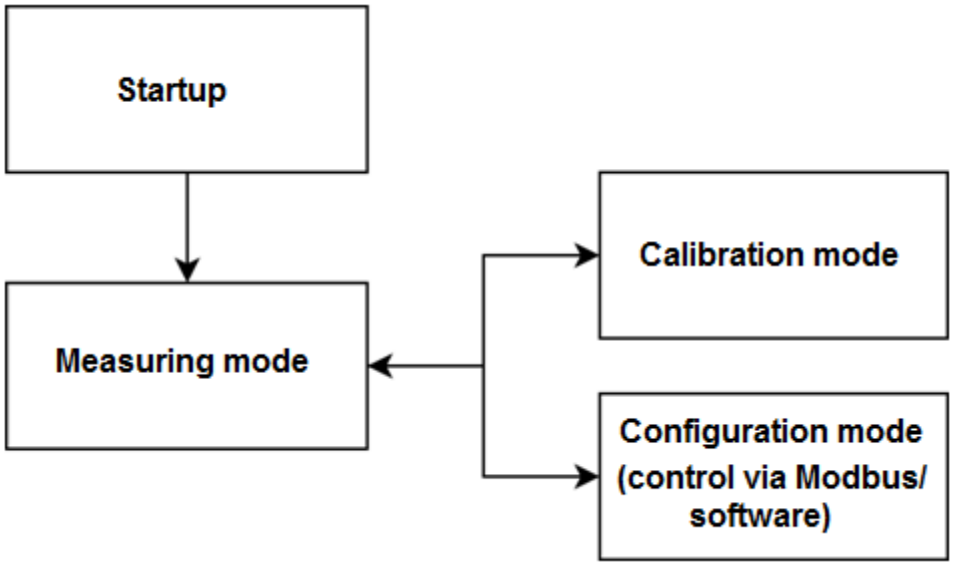


Figure 23 - Operation mode structure

16 Zero calibration and span calibration

Do not operate the gas detector with mechanical damages of the housing or damaged seal.

Do not open the gas detector in the explosion hazard area when power supply is on. Only trained personnel could have access to the internal parts of the gas detector for any kind of works.

The gas detector housing shall be grounded. Internal and externaI grounding devices and earth signs according to GOST 21130-75 are envisaged for gas detector ground connection.

Do not disassemble gas detectors and interchange detectors' parts.

Do not discharge state standard sample of the calibration gas mixture in the atmosphere of working premises during the gas detector adjustment and verification.

When the power supply is on, the gas detector shall be held switched on within the following periods of time before the calibration is performed:

DGS ERIS-210EC – 1 hour;

DGS ERIS-210CT – 1 hour;

DGS ERIS-210IR – 10 min;

DGS ERIS-210EC(O_2) – 24 hours.

In zeroing and span calibration mode the current output from the gas detector is inhibited (default 2.6 mA and 3.4 mA correspondingly) to avoid false alams.

If the area, where the gas detector is installed, contains any residual amount of measured gas, then zero gas cylinder shall be applied for zero calibration. If there is no measured gas, then ambient air could be used for zero calibration. Zero grade air or nitrogen of high purity is recommended to use as a zero gas (nitrogen must not be used for DGS ERIS-210CT).

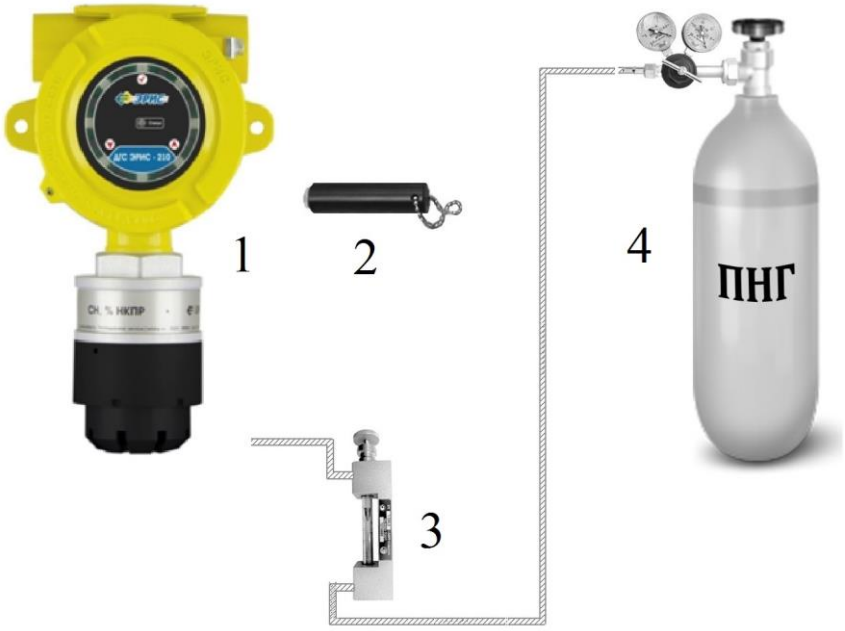
Zero calibration is not required for an oxygen gas detector. The oxygen gas detector could be calibrated using ambient air (20.9% vol. oxygen). Zero calibration shall be performed using nitrogen (N_2).

To achieve required accuracy of the span calibration the concentration of applied span gas shall lay within 25–75% of measurement range.

The gas detector calibration requires the corresponding gas cylinder, constant flow regulator and calibration cap (see Section 5). The flow rate used for different calibration gases is shown below:

Gas type	Flow rate (l/min)
Air or N_2 for zero calibration	from 0.5 to 1.0
Flammable gases (thermocatalitic sensor)	from 1 to 1.5
O_2	from 0.5 to 1.0
H_2S	from 0.5 to 1.0
CO	from 0.5 to 1.0
H_2	from 0.5 to 1.0
Toxic gases	from 0.5 to 1.0
Flammable gases (infrared sensor)	from 0.4 to 0.6
CO_2	from 0.4 to 0.6

16.1 Zero calibration using the magnetic wand



①Zero calibration using the magnet requires the following equipment:
1 – DGS ERIS-210;
2 – magnetic wand;
3 – variable area flow meter;
4 – zero gas or pure air without any residual amount of the measured gas.

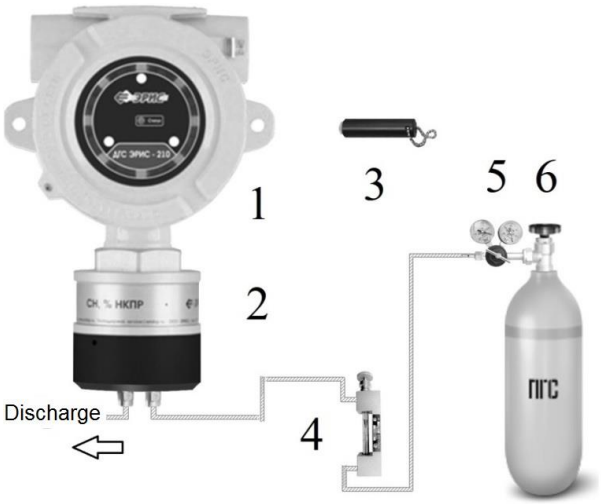
If the ambient air is NOT POSSIBLE to use as the reliable calibration gas to set ZERO, then remove the moisture protection cap, install the calibration cap (see Section 5) onto the gas detector and connect the zero gas cylinder.

Zero calibration of an oxygen gas detector shall be performed using nitrogen (N_2).

② For access to the Calibration menu, attach the magnet to area ▼, hold for two seconds and remove. Status LED will start blinking green (ten times per second), then turns to zero calibration mode and blinks pink one time per second.	
③ If zero gas is used to set zero, turn on zero gas supply through the calibration cap. Gas flow rate shall be from 0.5 to 1.0 l/min.	
④ After 3 minutes put the magnet over the area ▼ for a short time. Data saving process will start. Status LED blinks blue during 5 seconds.	

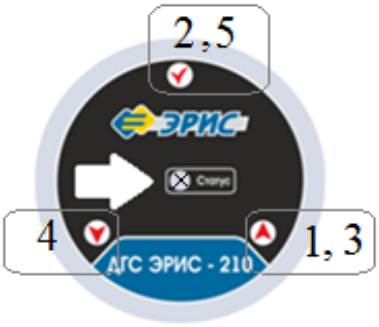
⑤ If zero gas is used to set zero, turn off zero gas supply. Zero calibration is complete and saved.	
⑥Then menu turns to the zero calibration mode. Status LED blinks pink one time per second.	
⑦ If the span calibration is required, use the magnetic wand to move to the next step (see clause 16.2). If span calibration is not required, put the magnet over the "Enter" area ✓ for a short period of time, the gas detector turns to the measuring mode (Status LED blinks green one time per second), or in 2 minutes the gas detector will turn to the measuring mode automatically.	

16.2 Калибровка чувствительности при помощи магнитного ключа



❶ Span calibration using the magnet requires the following equipment:
1 – DGS ERIS-210;
2 – calibration cap;
3 – magnetic wand;
4 – variable area flow meter;
5 – pressure regulator;
6 – state standard sample of the calibration gas mixture.

Span calibration of an oxygen gas detector could be performed using ambient air (20.9% vol. oxygen).

❷ Attach the magnet to the magnet areas in the following sequence: ▲,▼,▲,▼,▼. The gas detector will turns to the span calibration mode. Status LED blinks pink twice, one time per second.	
❸ Supply state standard sample of the calibration gas mixture through the calibration cap (the concentration shall be 25–75% of measurement range).	
❹ After 3 minutes put the magnet over the area ▼ for a short time. Data saving process will start. Status LED blinks blue during 5 seconds.	
❺ Turn off the calibration mixture supply. Span calibration is complete and saved.	
❻ Then menu turns to the span calibration mode (if required, data saving could be repeated). Status LED blinks pink one time per second.	
❼ Leave calibration menu by attaching the magnet to the "Enter" area▼. If the magnet is not attached, the gas detector stays in the span calibration mode for 5 minutes, then turns to the measuring mode. (Status LED will start blinking green one time per second).	
❽ *It is essential to change the calibration cap with the moisture protection cap after each span calibration.*	

16.3 Zero calibration using HART communicator

Detailed description of supported commands, HART communication protocol, as well as HART menu is stipulated in Section 20.

Your gas detector shall support this option. Check that HART connector is available in the left threaded port. If there is no HART connector, HART communication is possible using the current loop according to Figures 16 u 17.

①Zero calibration requires the following equipment:

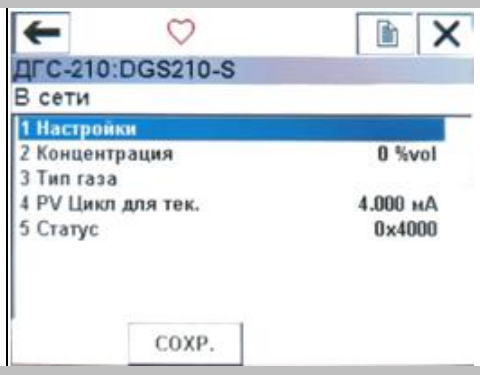
1 – DGS ERIS-210 with HART connector;
2 – HART communicator;
3 – zero gas or pure air without any residual amount of the measured gas.

If the ambient air is NOT POSSIBLE to use as the reliable calibration gas to set ZERO, then remove the moisture protection cap, install the calibration cap (see Section 5) onto the gas detector and connect the zero gas cylinder.

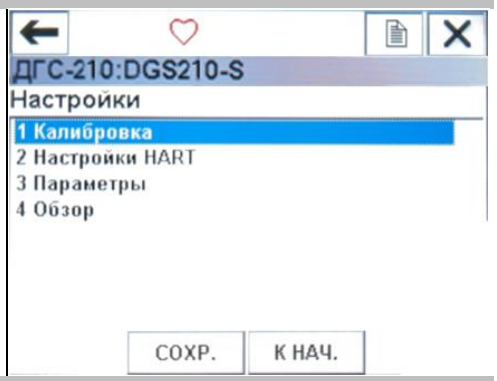
② Switch on HART communicator (if required, move from the main menu to communication setting submenu) and wait for connection with the gas detector.

When connection is successful, the main menu will appear.

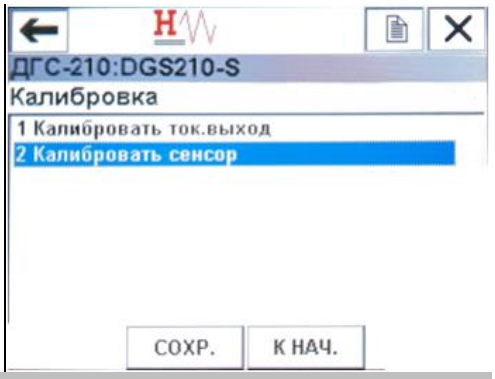
Select SETTINGS menu



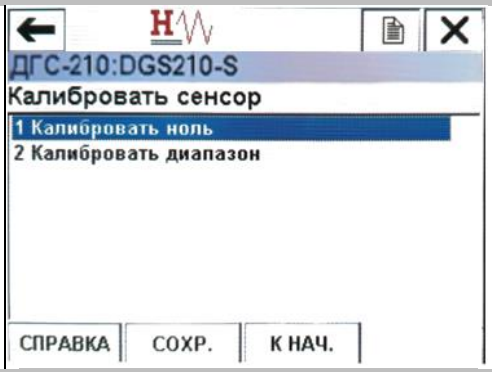
③ Select CALIBRATION



④ Select CALIBRATE SENSOR



⑤ For zero calibration select ZERO CALIBRATION

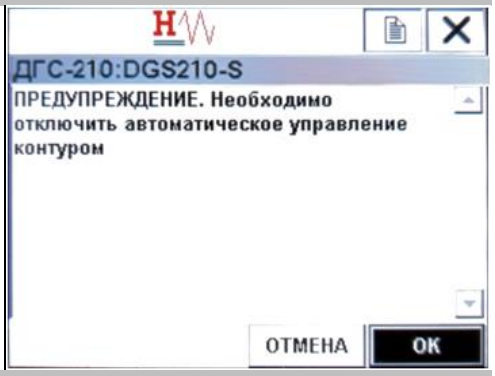


⑥The following warning will appear:

"Switch off circuit automatic operation".

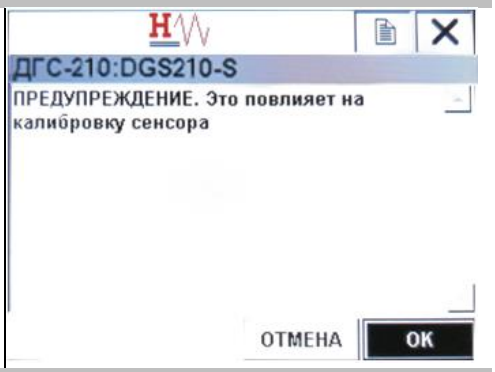
It means that current output value is fixed and does not correspond to the sensor reading (only for this operation).

Press "OK"

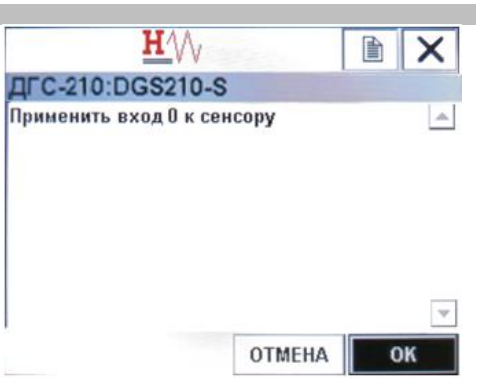


⑦ Then the following warning will appear:

"It will affect sensor calibration".



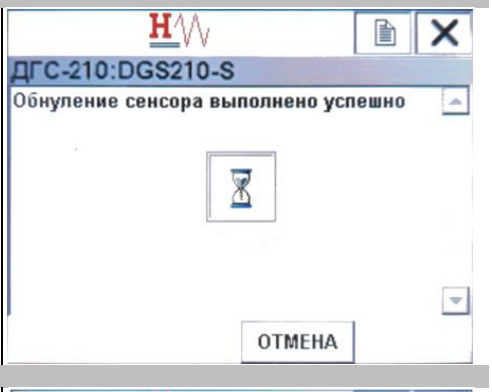
⑧ The following message will be displayed "Apply input 0 to sensor". Ensure that the gas detector is calibrated in the area without any residual amounts of the measured gas, otherwise supply zero gas to gas detector DGS ERIS-210.



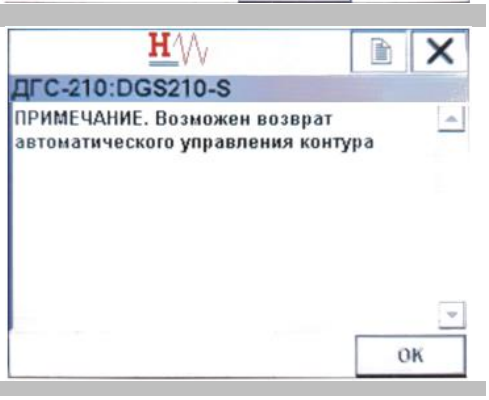
⑨ Press "OK" and allow the sensor to stabilize.

⑩ The notification window will appear stating that zero calibration is completed.

If zero gas is used to set zero, turn off zero gas supply.



⑪ Zero calibration is complete. The following note will appear: "It is possible to return to circuit automatic operation".



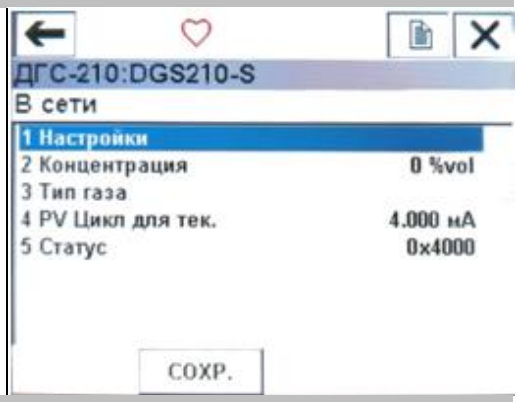
16.4 Span calibration using HART communicator

Detailed description of supported commands, HART communication protocol, as well as HART menu is stipulated in Section 19.

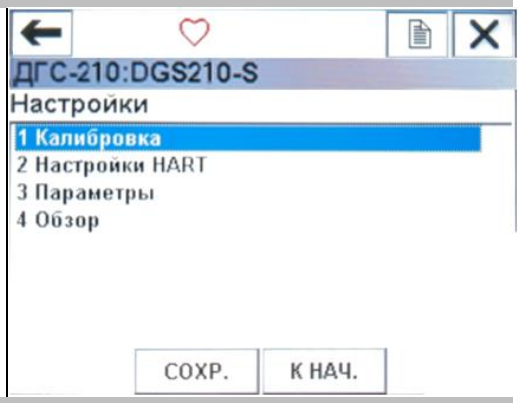
Your gas detector shall support this option. Check that HART connector is available in the left threaded port. If there is no HART connector, HART communication is possible using the current loop according to Figures 16 and 17.

❶ Span calibration requires the following:
1 – DGS ERIS-210 with HART connector;
2 – HART communicator;
3 – zero gas or pure air without any residual amount of the measured gas.
4 – state standard sample of calibration gas mixture. If the ambient air is NOT POSSIBLE to use as the reliable calibration gas to set ZERO, then remove the moisture protection cap, install the calibration cap (see Section 5) onto the gas detector and connect the zero gas cylinder.

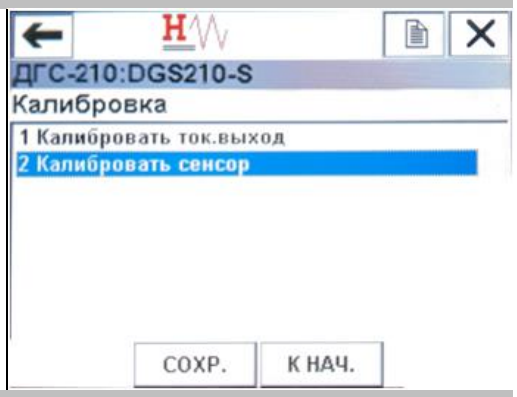
❷ Switch on HART communicator (if required, move from the main menu to communication setting submenu) and wait for connection with the gas detector. When connection is successful, the main menu will appear.
Select SETTINGS menu



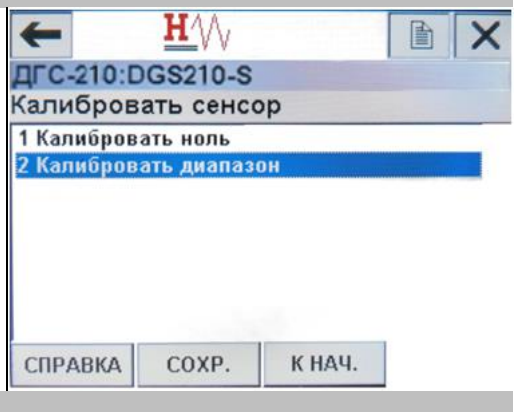
❸ Select CALIBRATION



❹ Select CALIBRATE SENSOR



❺ For span calibration of the sensor, select SPAN CALIBRATION.

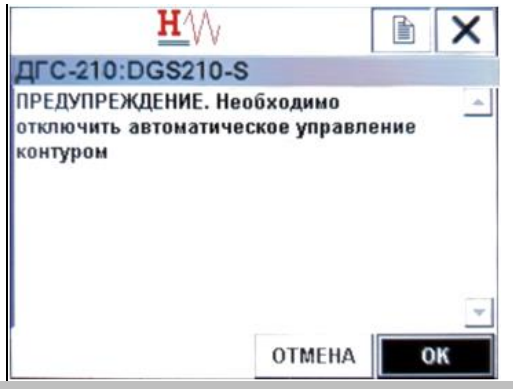


❻ The following warning will appear:

"Switch off circuit automatic operation".

It means that current output value is fixed and does not correspond to the sensor reading (only for this operation).

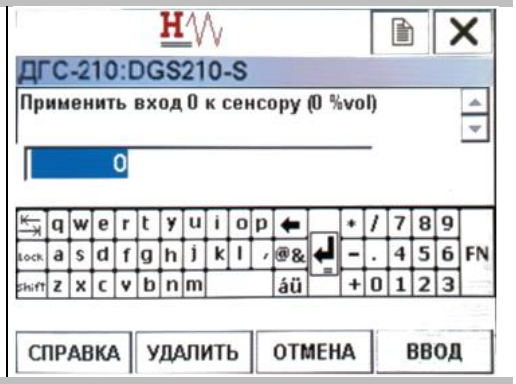
Press "OK"



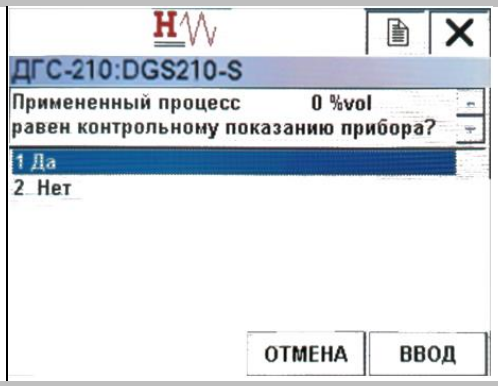
❼ The following message will be displayed "Apply input 0 to sensor". (0% vol.)".

Ensure that the gas detector is calibrated in the area without any residual amounts of the measured gas, otherwise supply zero gas to gas detector DGS ERIS-210.

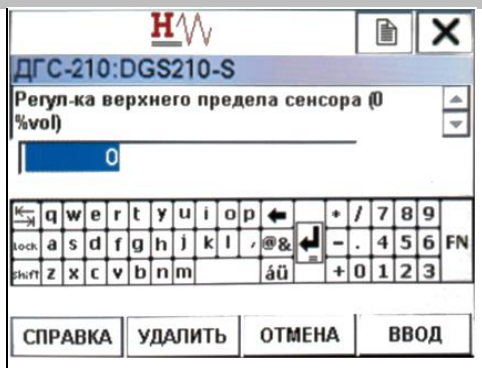
Enter "0" value.



❽ The readings of "Applied process" line shall be equal to "0% vol.", then press "Yes".



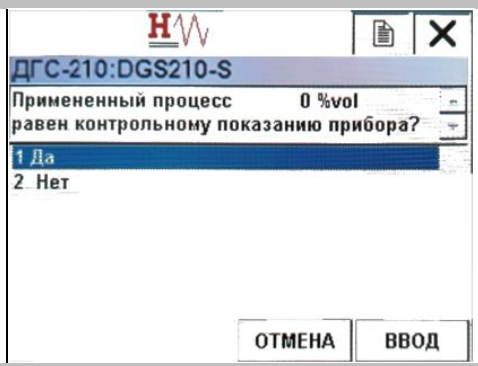
❾ Supply the state standard sample of the calibration gas mixture for span calibration.
After 3 minutes enter the applied concentration value in the input box.



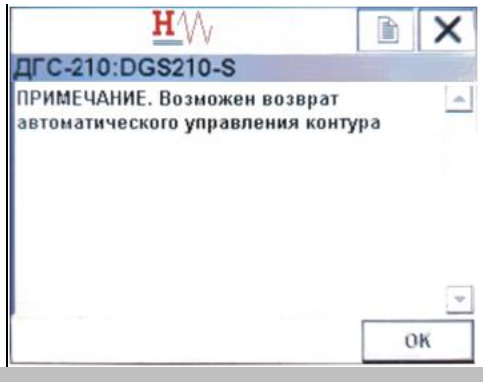
❿ The readings of "Applied process" line shall be equal to "*X% vol*.".

X – value entered in item ❾ for span calibration.

If the values coincide with the entered concentration, press "Yes".

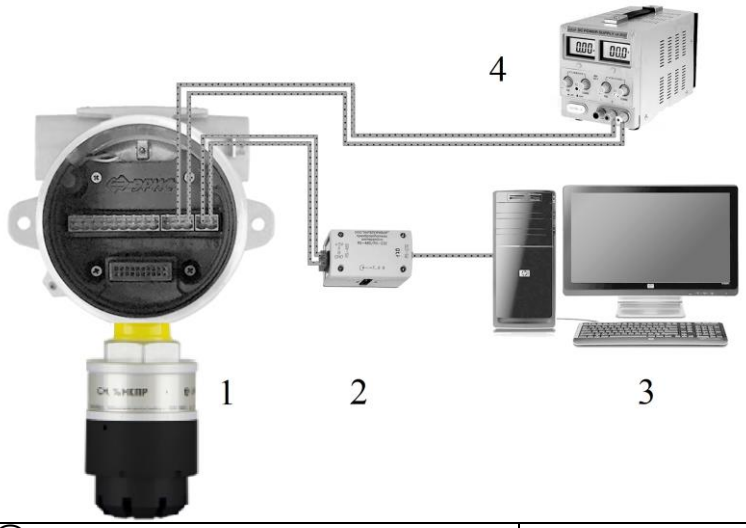


⓫ The span calibration is complete. The following note will appear: "It is possible to return to circuit automatic operation".



16.5 Zero calibration using PC with installed software*

**Please refer to www.eriskip.com. for free software and software manual.*
The full list of RS485 registers of the gas detector is specified in Section 20.



① Zero calibration requires the following equipment:
1 – gas detector DGS ERIS-210;
2 – RS485/USB transmitter;
3 – PC with installed software*;
4 – power supply source.

② Open the program, set the connection:

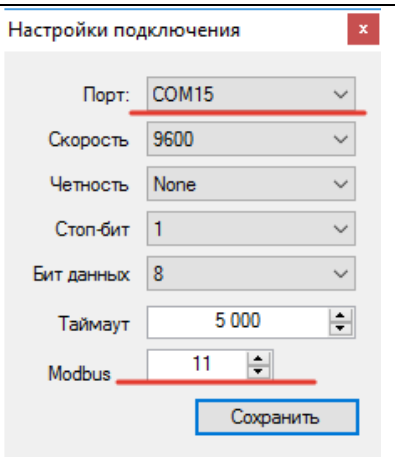
Select the gas detector connection port

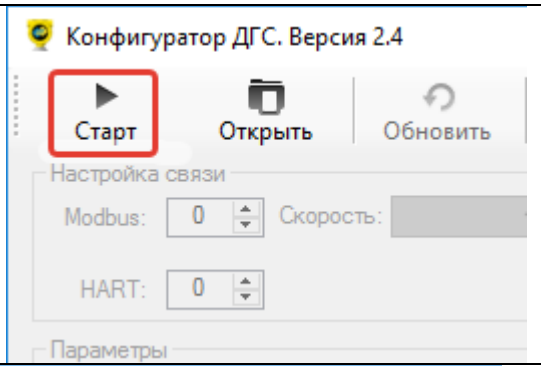
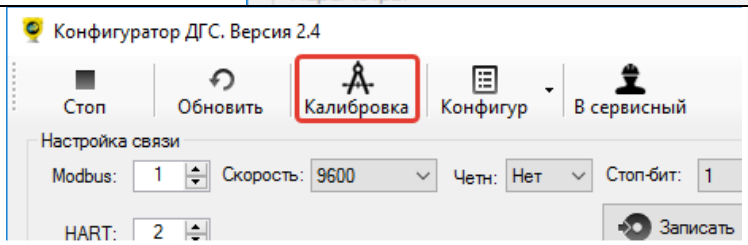
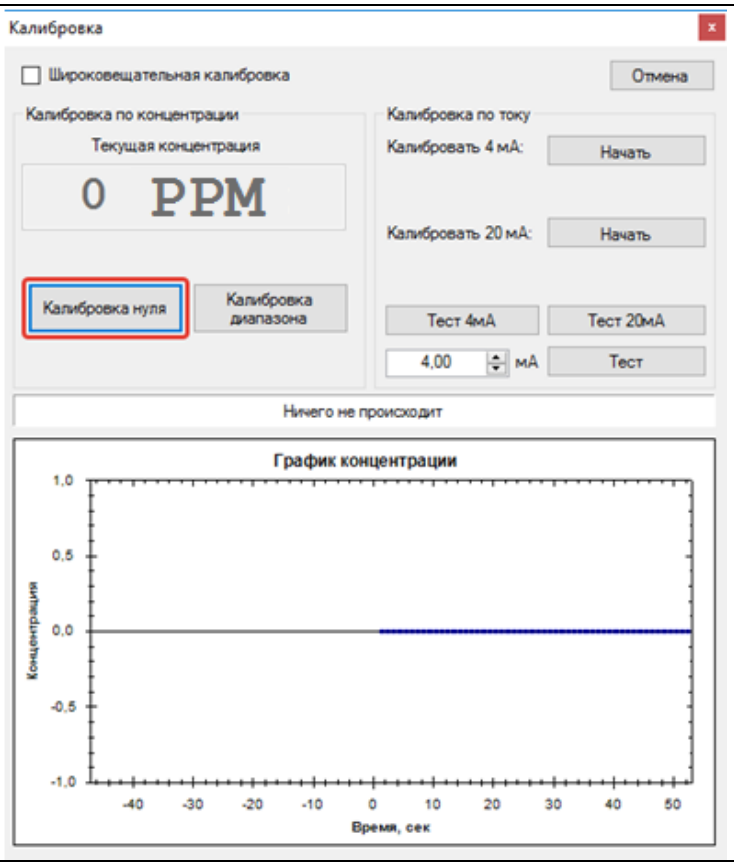
Enter the device address in MODBUS line. The device address is two last digits of the serial number.

Example: Port: COM15.

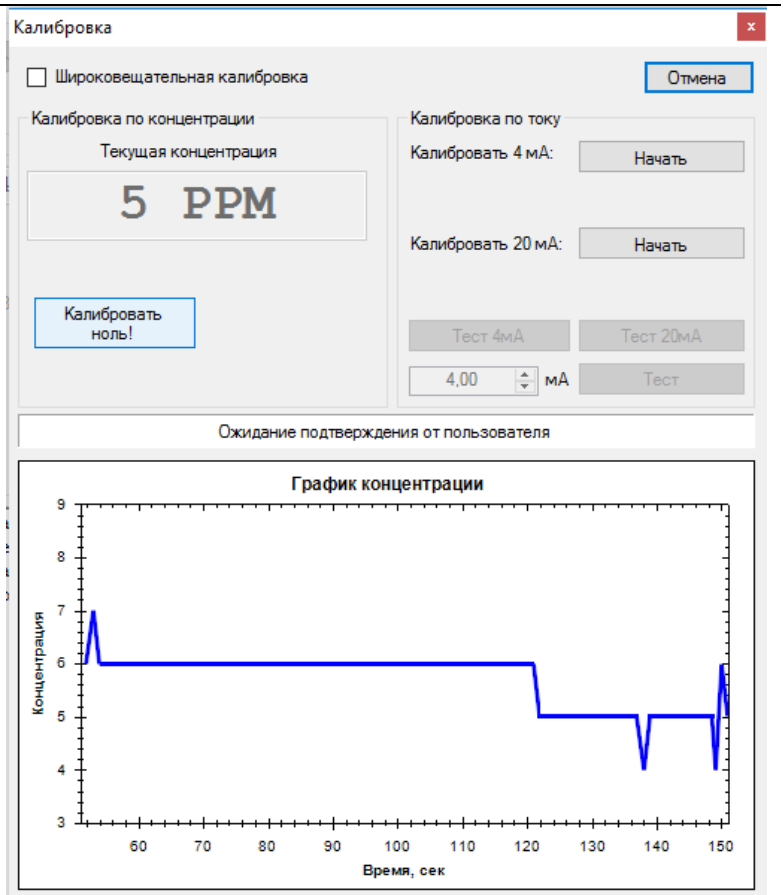
*Serial No. ER0000000**11***

Modbus:11

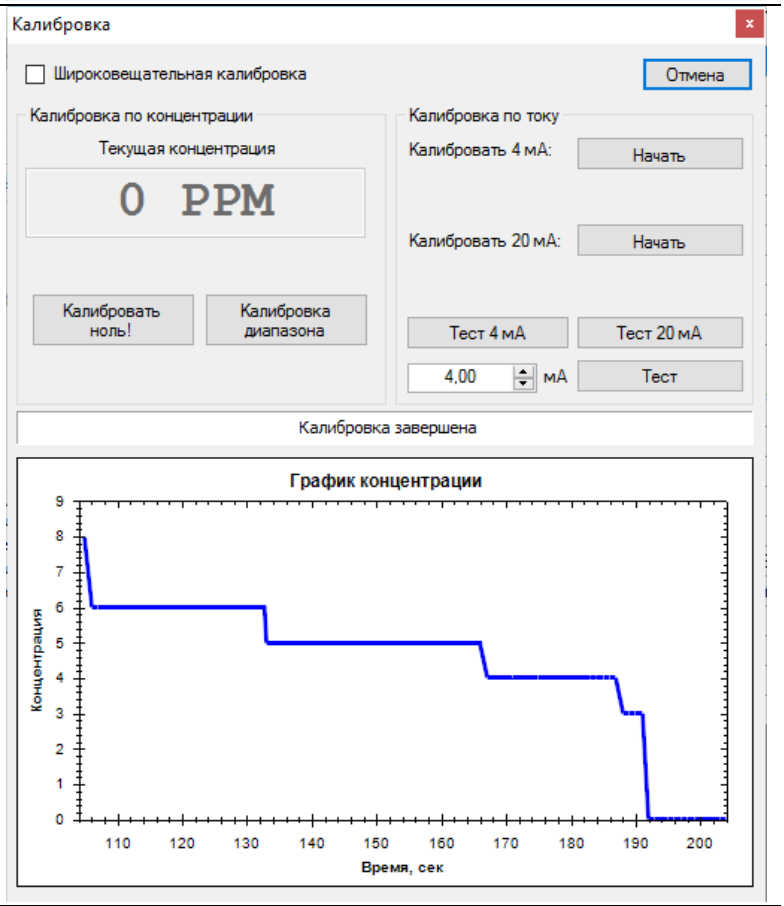


③ Click "Start" button	
④ Click "Calibration" button	
⑤ Calibration window appears. Click "Zero calibration" button	

⑥ Ensure that the gas detector is calibrated in the area without any residual amounts of the measured gas. Otherwise supply zero gas to gas detector DGS ERIS-210.
Click "Zero calibration" button.

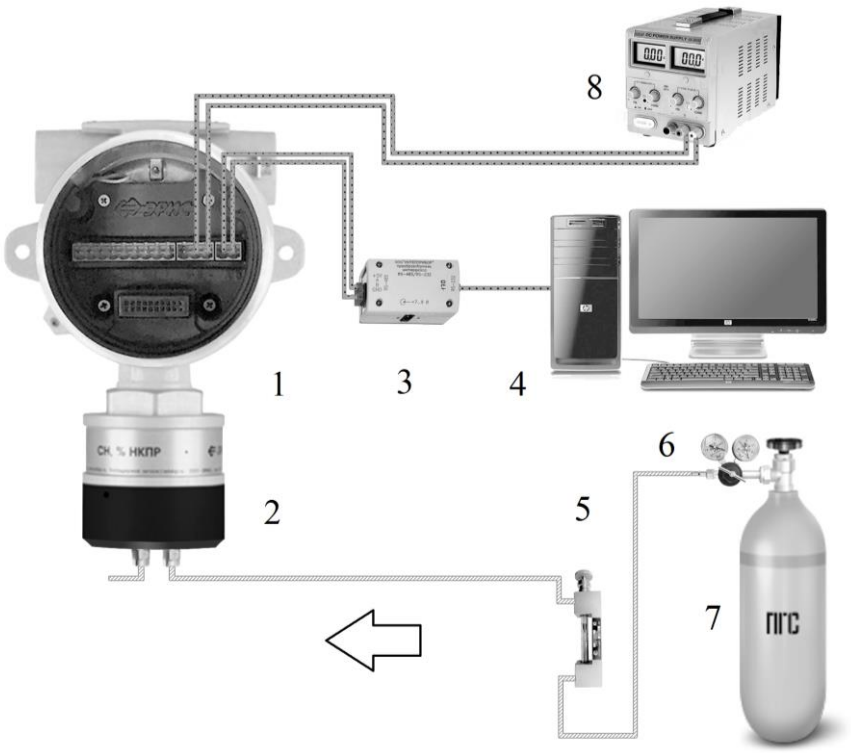


⑦ Wait till the following message will appear: "Calibration is complete". If zero gas is used to set zero, turn off zero gas supply.



16.6 Span calibration using PC with installed software*

**Please refer to www.eriskip.com. for free software and software manual.*



❶Span calibration requires the following equipment:
1 – gas detector DGS ERIS-210;
2 – calibration cap;
3 – RS485/USB transmitter;
4 – PC with installed software;
5 – variable area flow meter;
6 – pressure regulator;
7 – state standard sample of calibration gas mixture
8 – power supply source.

❷ Open the program, set the connection:

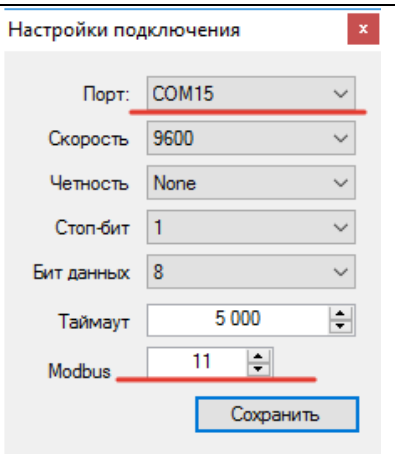
Select the gas detector connection port

Enter the device address in MODBUS line. The device address is two last digits of the serial number.

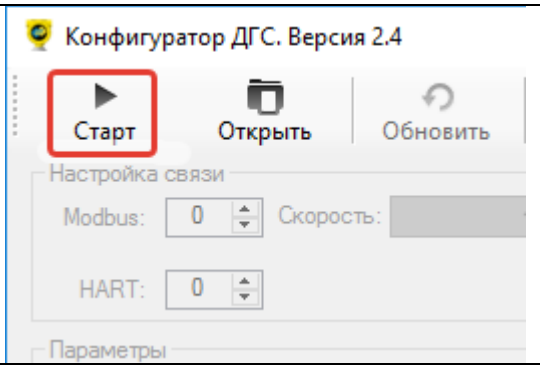
Example: Port: COM15.

*Serial No. ER0000000**11***

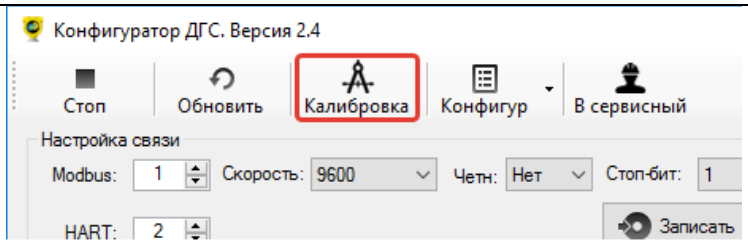
Modbus:11



❸ Click "Start" button

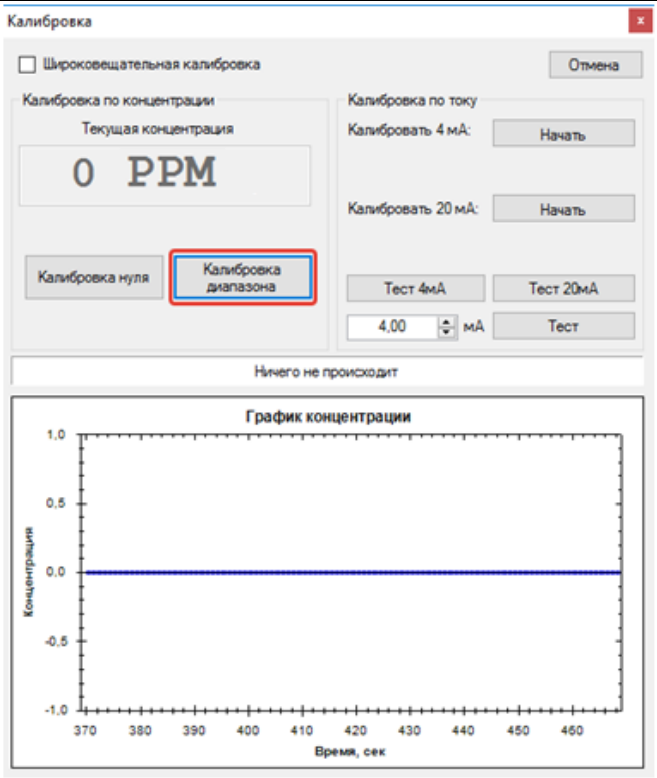


❹ Click "Calibration" button



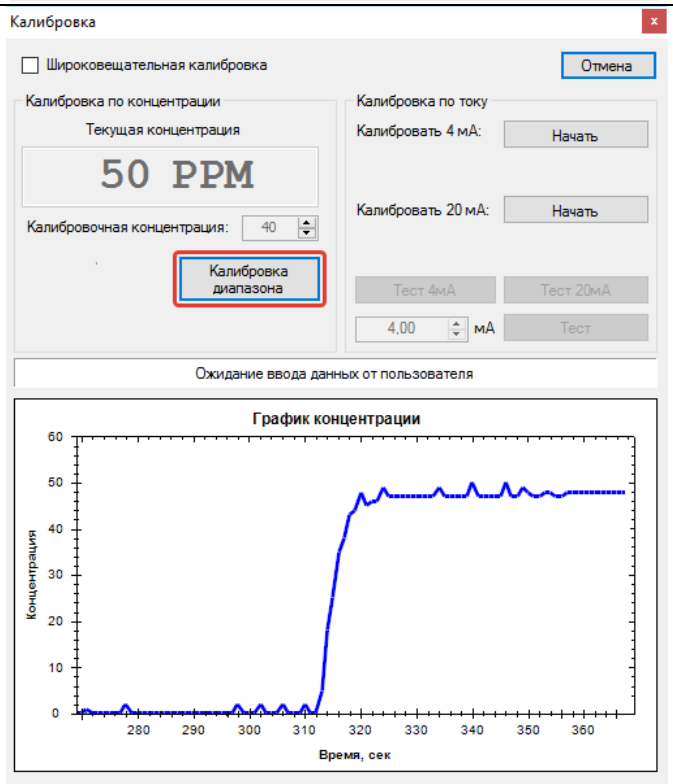
❺ Calibration window appears.

Click "Span calibration" button



❻ Enter the supplied gas concentration into the "Span calibration" input box.
Supply state standard sample of the calibration gas mixture using the calibration cap (the concentration shall be 25–75% of measurement range).

Click "Span calibration" button.

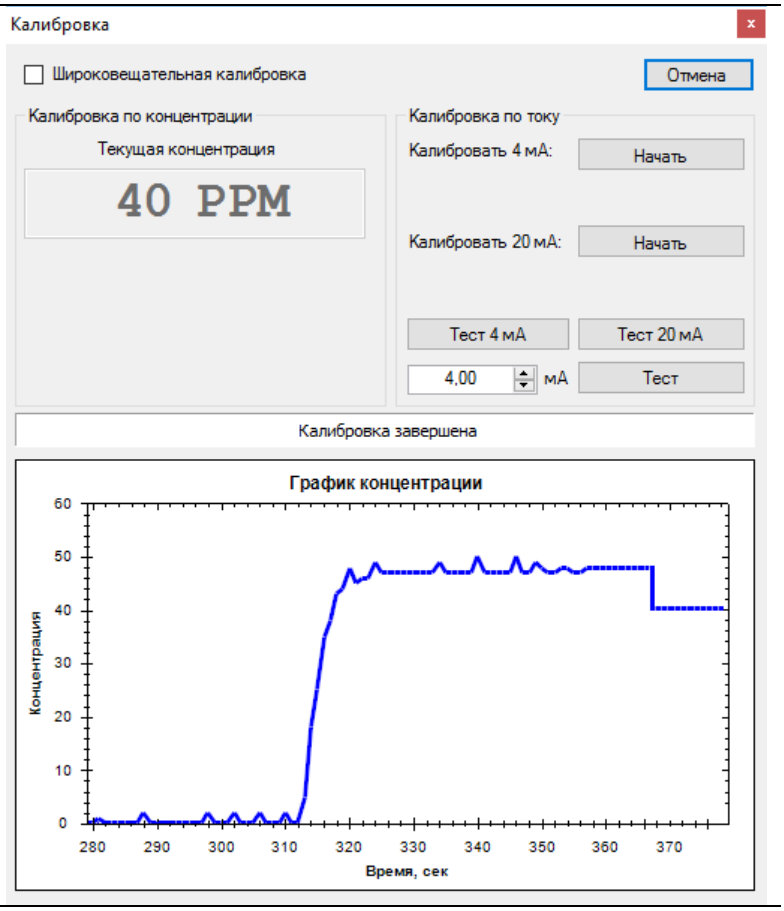


❼ Wait till the following message will appear: "Calibration is complete".

The value in the "Current concentration" window shall correspond to the concentration of applied state standard sample of the calibration gas mixture.

Turn off the gas supply.

Span calibration is completed.



17 Maintenance

Only trained personnel could have access to the internal parts of the gas detector for any kind of works.

The gas detector shall be operated only by personnel acquainted with the present operation manual and having completed the safety training.

Do not operate the gas detector with mechanical damages of the housing or damaged seal.

Do not open the gas detector in an explosion hazard area when power supply is on.

The gas detector housing shall be grounded. Internal and external grounding devices and earth signs according to GOST 21130-75 are envisaged for gas detector ground connection.

Repair of the gas detector shall be carried out by the manufacturer personnel or persons authorised by the manufacturer for repair works performance.

Do not disassemble sensors and interchange sensors parts.

Avoid influence of temperatures out of the specified operation range on the gas detector.

Upon service life expiration the replaceable electrochemical oxygen and toxic gases sensors shall be environment-friendly disposed. Disposal shall be carried out in accordance with the local regulations on waste management and legislation on environmental protection.

Do not burn electrochemical sensors, since the sensor cells may form toxic gases during combustion.

17.1 General guidelines

The maintenance shall be performed to ensure the smooth operation of the gas detector during the service life.

The *maintenance shall be performed only by personnel acquainted with the safety rules for power system operation in the explosion hazard areas, acquainted with the present Operation Manual, certified and authorized to operate such devices***.**

Maintenance types and schedule:

- *visual inspection of gas detector:* once per six months;
- *periodic operability check:* once per six months;
- *cleaning of gas detector sintered metal filter:* once per year;
- *sensor replacement:* as may be required;
- *verification:* once per year (for DGS ERIS-210CT, DGS ERIS-210EC) or once per three years (for DGS ERIS-210IR).

Gas detector visual inspection and periodic operability check shall be performed at operation site. Cleaning of the sintered metal filter and sensor replacement shall be performed in the explosive safe area (the gas detector may be switched on). Verification shall be performed in a laboratory environment.

17.2 Visual inspection

Check the gas detector for mechanical damages and contaminants that could influence the gas detector operability. Use wet cloth and soap to remove contaminants if required.

17.3 Periodic operability check

Zero and span readings of the gas detector shall be periodically checked.

To check the operability, supply zero gas (zero grade air or nitrogen of high purity) and the calibration gas mixture using the calibration cap, the concentration of detected gas shall be 25–75% of measurement range. If the calibration gas mixture containing detected gas is not produced in pressure cylinder, then it is possible to apply equivalent calibration mixture (equivalent gas) with the corresponding correction factor. The actual value of equivalent gas concentration *C*, that corresponds to detected gas value, shall be calculated by formula:

$$C = C_1 \bullet K,$$

where C_1 – concentration value of equivalent gas,
K – correction factor.

Equivalent gas and correction factor are specified in the gas detector datasheet.

Example: The gas detector is configured to measure diesel fuel. Equivalent gas: propane. Correction factor: 3.18. When propane gas mixture of 25% LFL is supplied, the diesel fuel concentration amounts to 25×3.18=79.5% LFL.

The gas detector readings shall be checked using the current loop (4–20) mA in accordance with Section 22. If the readings fall outside the permissible tolerance, perform zero and span calibration in accordance with Section 16.

17.4 Cleaning of sintered metal filter (for gas detector DGS ERIS-210IR)

The cleaning allows to recover filter capacity. Remove the moisture protection cap from the measurement module, unscrew the sensor protective cover (Fig. 26) and blow out the filter mounted in the cover by the compressed air from both sides starting from the inner side. If after the blowing visible contaminants still remain and clog the filter pores, replace the filter. To do so, replace the sensor cover as the filter is an integral part of it.

To order the spare part (sensor cover with sintered metal filter), contact the manufacturing company.

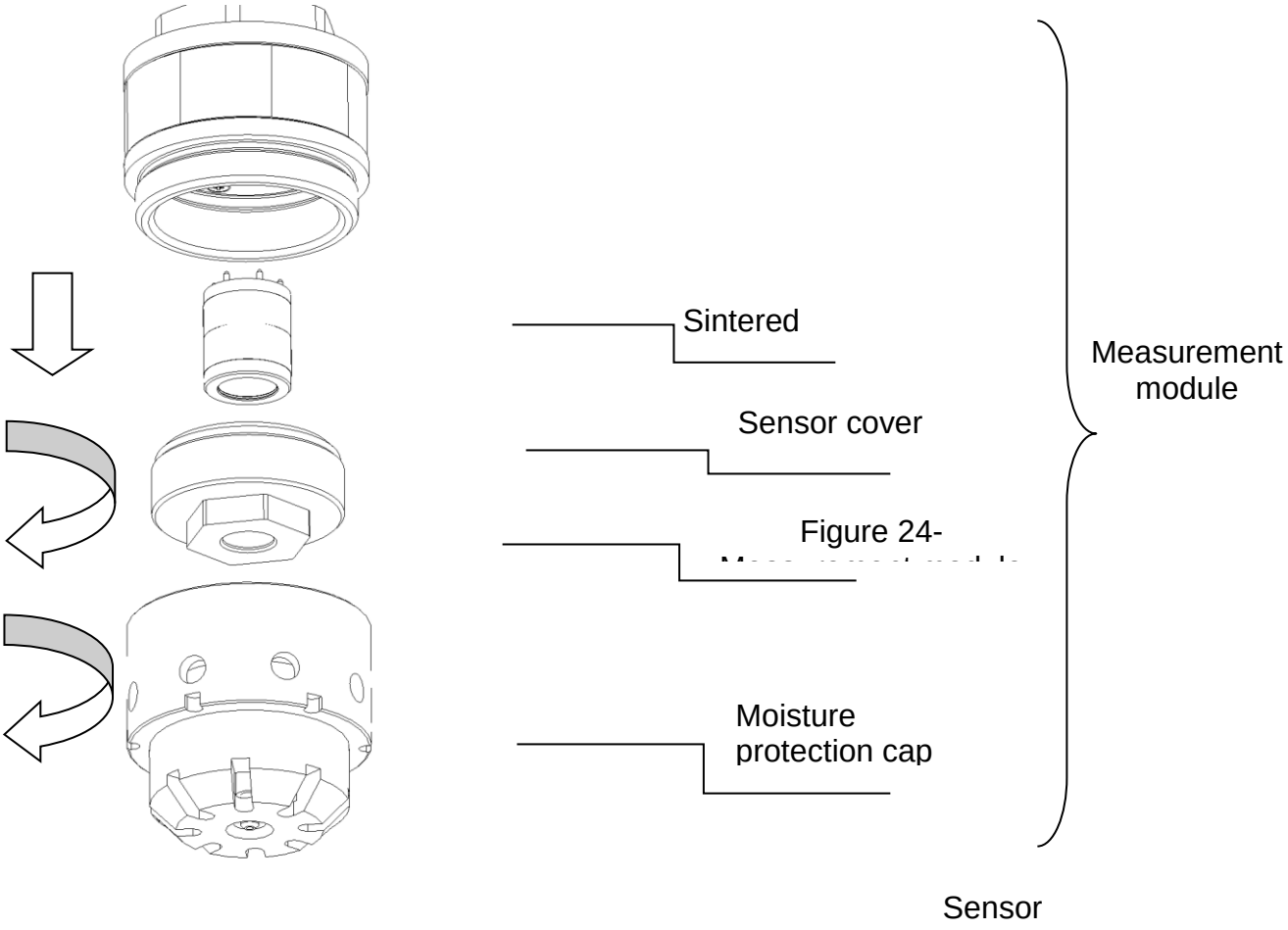


Figure 24-

17.5 Sensor replacement

The sensor shall be replaced if the gas detector readings fall outside the permissible tolerance and the calibration is impossible, or when the sensor got out of order.

The following actions shall be performed for sensor replacement (Fig. 24):

– switch off the gas detector power supply,

– remove the moisture protection cap of the measurement module,

– unscrew the sensor protective cover,

– pull the sensor with care and remove it from the socket,

– install the new sensor into the socket,

– assemble the measurement module in the reverse order.

To order the spare part (sensor), contact the manufacturing company.

After sensor replacement, the primary verification of the gas detector shall be performed in compliance with verification method MP 116-221-2014 with amendment No. 1.

17.6 Verification

The primary verification shall be performed before the gas detector is put in operation and after the repair, and periodic verification shall be performed during the operation life. Verification shall be performed as following: once per year (for DGS ERIS-210CT, DGS ERIS-210EC) or once per three years (for DGS ERIS-20IR). Verification shall be carried out in compliance with verification method MP 116-221-2014 with amendment No. 1.

18 Description and application of the audible and visible alarm

18.1 Description of the audible and visible alarm

The audible and visible alarm (hereinafter referred to as the alarm) is an optional accessory and is supplied under the special order.

The alarm is intended to give visible and audible signals in the explosion hazard areas in order to attract people attention in the event of danger or emergency situations.

Technical specifications:

- The alarm has 1ExdmIICT6X explosion proof marking.
- The alarm is designed for installation in the explosion hazard areas of 1st and 2nd classes according to GOST R 51330.9-99.
- The maximum level of sound pressure is minimum 110 dB at distance of 30 cm and under normal conditions;
- Ambient temperature range permissible for operation is from –60 up to +60°C;
- Ingress protection rating of IP67;
- Electric shock protection of III class;
- Overall dimensions are maximum 116×46×85 mm excluding cable dimensions;
- Maximum mass is 0.35 kg;
- Average service life is minimum 10 years;

The alarm operation statuses are described in Table 4.

18.2 Application of the audible and visible alarm

The warranty period shall comprise 12 months from the date of the alarm commissioning, but not more than 18 months starting from the date of manufacture.

The alarm repairing shall be performed only at the manufacturing company.

Do not open and disassemble the alarm.

Do not use the alarm with the damaged housing parts and seals.

The external view of gas detector DGS ERIS-210 with the audible and visible alarm is shown in Figure 25.

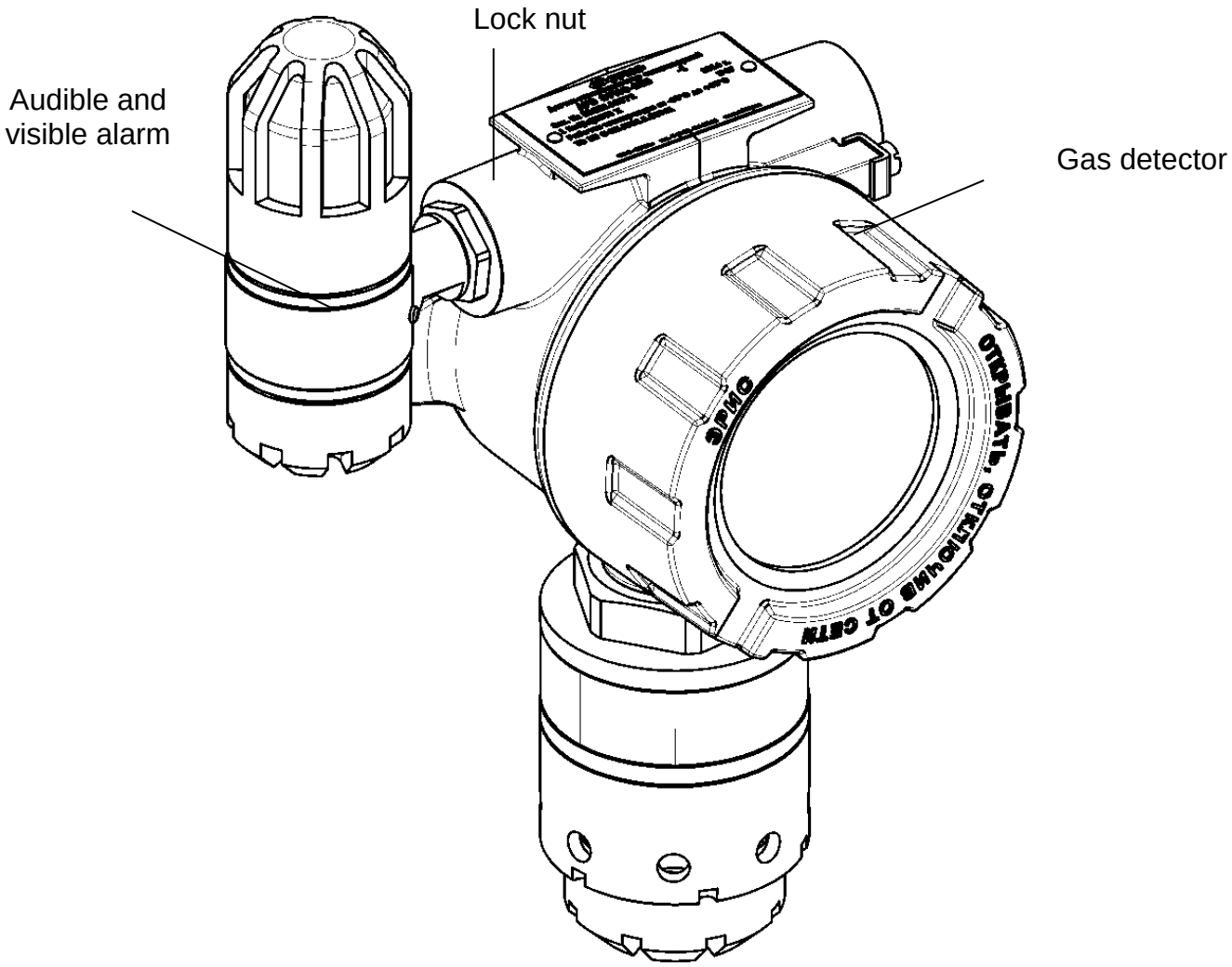


Figure 25.- The external view of the gas detector with the audible and visible alarm

18.3 Operation of the audible and visible alarm

To disable the audible warning, attach the magnetic wand supplied along with the gas detector, to the marked section of the audible and visible alarm , as shown in Figure 26.

To restart the visible and audible alarm, attach and hold the magnetic wand within 30 seconds. The alarm will be switched off with the intermittent beeping.

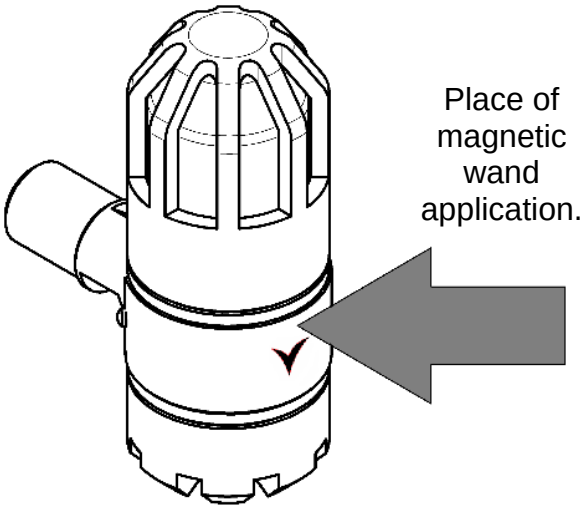


Figure 26.- Place of magnetic wand application

The alarm operation statuses are described in Table 4.

Table 4. The alarm operation statuses

Process, mode		Visible alarm	Audible alarm
Pre-starting procedure	Audible and visible alarm actuation	LEDs glow green around a circle LEDs alternatively blink all colours (white, green, blue, red, yellow, violet)	2 short beeps
	DGS ERIS-210 search	LEDs blink blue on each side around a circle	-
	Audible and visible alarm initialisation	LEDs blink white once per second	-
Standard indication	Operation mode DGS ERIS-210 and audible and visible alarm are functioning properly	LEDs blink green once per second	-
	Configuration mode	LEDs blink white once per second	-
	Magnetic wand is attached	LEDs glow violet	Intermittent beep
Warnings	Maximum volume concentration of detected gas exceeds the set limit of ALARM 1	LEDs blink red one time, once per second	Continuous beep (siren)
	Maximum volume concentration of detected gas exceeds set limit of ALARM 2	LEDs blink red two times, once per second	Continuous beep (siren)
	DGS ERIS-210 measurement range is exceeded	Central LEDs glow yellow LEDs slowly blink red once per second	Continuous beep (siren)
Failures	DGS ERIS-210 fault	Central LEDs glow yellow LEDs slowly blink red once per second	Intermittent beep
	No communication with the sensor / sensor is damaged	Central LEDs glow yellow LEDs shortly blink red three times, once per second	Intermittent beep
	No communication with DGS ERIS-210 via MODBUS	LEDs blink yellow two times, once per second	Intermittent beep

18.4 Marking

The marking of the audible and visible alarm corresponds to the manufacturer drawings and includes the following:

- "Audible and visible alarm" indication
- manufacturer name and trade mark

- serial number of the audible and visible alarm in compliance with the manufacturer numbering system
- 1ExdmIICT6X explosion proof marking
- year of manufacture
- explosion safety sign in accordance with CU TR 012/2011
- conformity certificate No. CU TR 012/2011
- sign  of magnet application area.

18.5 Maintenance of audible and visible alarm

The maintenance of the audible and visible alarm shall include visual inspection and periodic operability check.

The maintenance shall include the visual inspection of the following:

– integrity of alarm housing and inlet fitting;

– secure fixation of alarm;

– integrity of seals;

– presence of explosion-proof marking.

Visual inspection shall be performed once per six months. The visual inspection of the alarm shall be performed simultaneously with gas detector DGS ERIS-210.

Besides, the alarm operability shall be checked once per six months simultaneously with DGS ERIS-210 operability check and shall include testing of audible and visible alarm signals.

19 HART menu

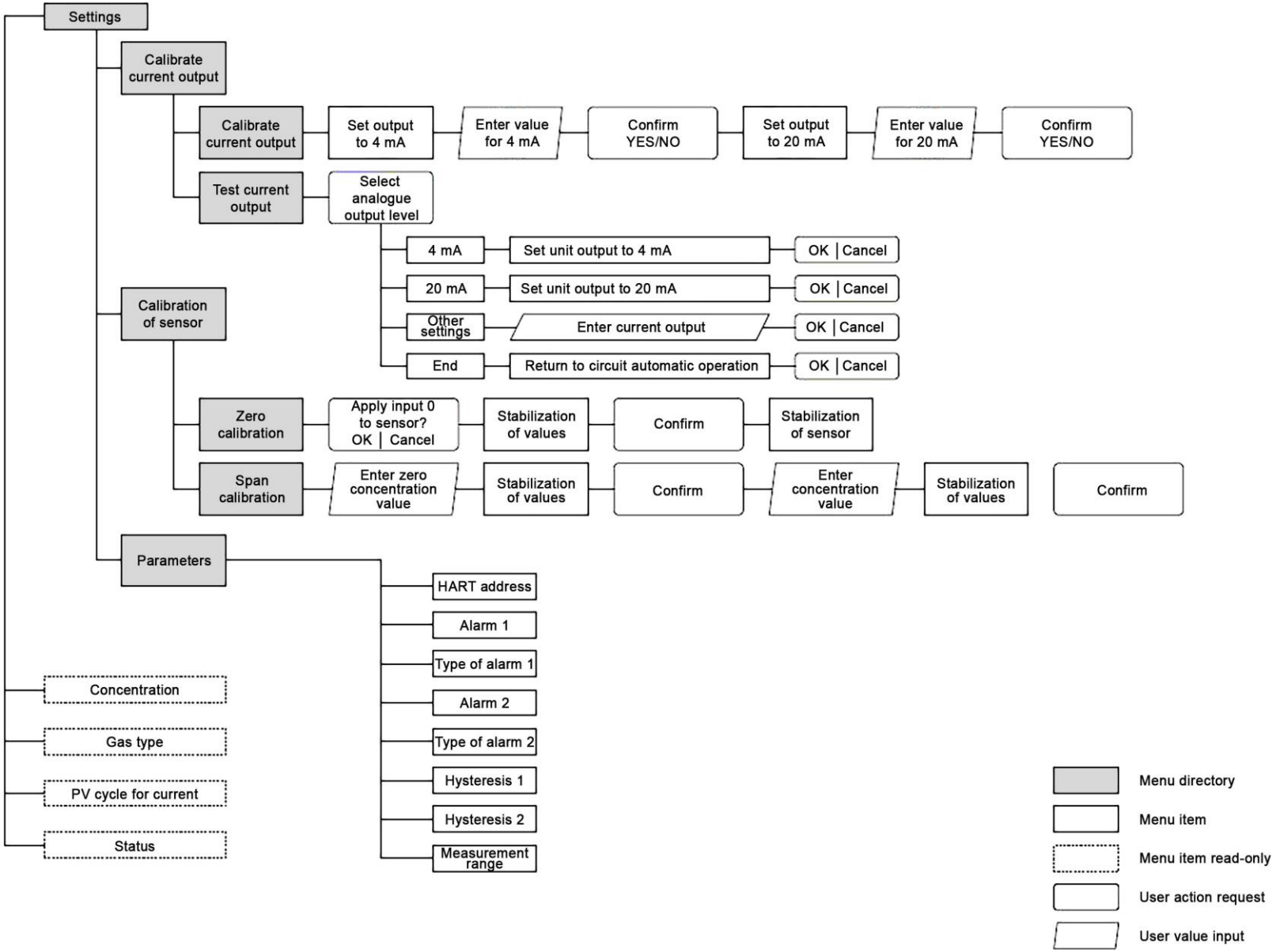
WELCOME SCREEN	
Menu item	Menu item
1 Device Setup	1 Device Setup
2 Gas Concentration	2 Gas Concentration
4 PV Loop current	4 PV Loop current
5 Current Gas	5 Current Gas
7 Loop Current Mode	7 Loop Current Mode

Select Device Setup, then the following menu items appear:

Menu has the following structure:

DEVICE SETTING MENU	
Menu item	Submenu
1 Calibrate current output	1 Calibration of current output 2 Test current output
2 Calibrate sensor	Zero calibration Span calibration
3 Parameters	1 HART address 2 Alarm 1 3 Type of Alarm 1 4 Alarm 2 5 Type of Alarm 2 6 Hysteresis 1 7 Hysteresis 2 8 Measurement range

HART menu structure:



20 RS485 communication protocol

Interface: RS485 (default settings: 9600 bit/s, 8 databits, Nonparity, stop-bit 1; Modbus device address is the last two digits of the serial number).

Holding registers:

0x03 – read holding registers

0x06 – write single register

0x10 – write multiple registers

Address	Description	Range	Access
0x0000	Module ID	210	R/-
0x0001	RS485 speed and network address upper byte - RS485 network address: 1–255 lower byte: Bits 0–3 – Rate: -- 0 – 1200 baud -- 1 – 2400 baud -- 2 – 4800 baud -- 3 – 9600 baud -- 4 – 19200 baud -- 5 – 38400 baud -- 6 – 57600 baud -- 7 – 115200 baud Bits 4, 5 – Parity: -- 0 – no -- 1 – odd -- 2 – even Bit 6 – Stop-bits: -- 0 – 1 stop-bit -- 1 – 2 stop-bits		R/W
0x0002	HART network address	1–15	R/W
0x0003	Status: bit 0 – always 0 bit 1 – alarm 1 bit 2 – alarm 2 bit 3 – sensor is missing or damaged bit 4 – maintenance mode bit 5 – signal excess bit 6 – module initialization is in progress bit 7 – mode 0 – operation, 1 – configuration bit 8 – reserve bit 9 – no communication with the gas detector bit 10 – fault (potential problem with the gas		R/W

	detector) bit 11 – reserve bit 12 – reserve bit 13 – DAC. No communication bit 14 – DAC. The current is not set. Possible open circuit fault bit 15 - presence of magnet		
0x0004	Module settings: - bit 4–7 – Measuring unit -- 0 – % vol. -- 1 – ppm -- 2 – ppb -- 3 – % LFL -- 4 – g/cm^3 -- 5 – mg/m^3 -- 9 – mg/m^3 - bit 8–9 – Discreteness: -- 0 - *1; -- 1 - *10; -- 2 - *100; - bit 10–15 – Reserve:		R/W
0x0005	Lower range value	0–65535	R/W
0x0006	Upper range value: measurable	0–65535	R/W
0x0007	Alarm 1	0–65535	R/W
0x0008	Alarm 2	0–65535	R/W
0x0009	Hysteresises - bit 0–7 – Hysteresis 1 - bit 8–15 – Hysteresis 2		R/W
0x000A	Delays of alarm response - bit 0–7 – Delay of alarm 1 response (seconds) - bit 8–15 – Delay of alarm 2 response (seconds)		R/W
0x000B	Time of automatic alarm reset		R/W
0x000C	Calibration mode *Read*: **0** – operation mode **1** – zero calibration **2** – span calibration **3** – 4 mA point calibration **4** – 20 mA point calibration **5** – current output testing **6** – change of sensor parameters *Write*: **0x0000** – operation mode activation		R/W

	0x185D – Mode. Zero calibration **0x64C4** – Mode. Span calibration **0x5530** – Mode. Calibration of 4 mA point **0x55C3** – Mode. Calibration of 20 mA point **0x3535** – Mode. Current output testing **0x7294** – changes saving		
0x000D	Span gas concentration		R/W
0x000E	Concentration during calibration using magnetic wand		R/W
0x000F	Current for initialization mode, * 100, mA		R/W
0x0010	Current for maintenance mode, * 100, mA		R/W
0x0011	Current for calibration mode, * 100, mA		R/W
0x0012	Dead band		R/W
…			
0x001B	SENSOR. Sensor type		R/-
…			
0x0020	SENSOR. Gas name. Symbol 0 and 1		R/-
0x0021	SENSOR. Gas name. Symbol 2 and 3		R/-
0x0022	SENSOR. Gas name. Symbol 4 and 5		R/-
0x0023	SENSOR. Gas name. Symbol 6 and 7		R/-
0x0024	SENSOR. Gas name. Symbol 8 and 9		R/-
0x0025	SENSOR. Gas name. Symbol 10 and 11		R/-
0x0026	SENSOR. Gas name. Symbol 12 and 13		R/-
0x0027	SENSOR. Gas name. Symbol 14 and 15		R/-
…			
0x0071	Point of range reference to 20 mA Lo		R/W
0x0072	Point of range reference to 20 mA Hi		R/W
0x0073	Upper value: measured in mg/m^3 Lo		R/W
0x0074	Upper value: measured in mg/m^3 Hi		R/W
0x0075	Displayed and applied concentration		R/W
…			
0x0078	SENSOR. Low value		R/-
0x0079	SENSOR. Upper value: displayed		R/-
0x007A	SENSOR. Upper value: measurable		R/-
0x007B	SENSOR Measurement unit and discreteness		R/-

INPUT registers

0x04 – read input registers

Address	Description	Range	Access
0x0100	Module ID	210	R/-
0x0101	Serial number. Hi		R/-
0x0102	Serial number. Lo		R/-
0x0103	Software build		R/-
0x0104	Software build		R/-
0x0105	DGS output current * 100		R/-
0x0106	State Lo: bit 0 – always 0 bit 1 – alarm 1 bit 2 – alarm 2 bit 3 – sensor is missing or damaged bit 4 – maintenance mode bit 5 – signal excess bit 6 – module initialization is in progress bit 7 – mode 0 – operation, 1 – configuration bit 8 – reserve bit 9 – no communication with the sensor bit 10 – fault (potential problem with the sensor) bit 11 – reserve bit 12 – reserve bit 13 – DAC. No communication bit 14 – DAC. The current is not set. Possible open circuit fault bit 15 – presence of magnet		R/-
0x0107	State Hi: bit 0 – AT25. Memory faults bit 1 – Current output. Very low resistance, probable short circuit bit 2 – Current output. Very high resistance, probable open circuit fault or long-distance line bit 3 – AT45. Memory faults		R/-
0x0108	Temperature.* 10		R/-
0x0109	SENSOR Temperature.* 10		R/-
0x010A	SENSOR. Type		R/-
0x010B	SENSOR. Concentration * multiplier		R/-
0x010C	SENSOR. Status Sensor status back-up register		R/-
0x010D	SENSOR. Software build		R/-
0x010E	SENSOR. Software build		R/-
0x010F	SENSOR. Communication quality, %		R/-
…			

0x0160	Concentration, mg/m^3 Lo		R/-
0x0161	Molar mass of gas * 100		R/-
0x0162	Concentration, mg/m^3 Hi		R/-
0x0166	Current concentration. Lo		R/-
0x0167	Current concentration. Hi		R/-

The present clause contains only the key registers. The complete communication protocol is available on request.

21 Nominal static conversion function

The concentration value delivered through the current loop is calculated by the nominal static conversion function. The formula shows the relationship between current loop output signal and detected gas concentration:

$$I_{НОМ} = 16 \cdot \frac{C_i}{C_{max}} + 4, \quad (1)$$

where I_{nom} – current output, mA;

C_i – measured concentration, % vol.;

C_{max} – maximum volume concentration of detected gas that corresponds to current output signal of 20 mA.

The measured concentration is calculated by the following formula:

$$C = \frac{|I_i - I_0|}{K}, \quad (2)$$

where I_i – gas detector current output at the control point (mA);

I_0 – gas detector initial current output of 4 mA;

K – conversion coefficient:

$$K = \frac{16\,mA}{C_{max} - C_{min}}, \quad (3)$$

where C_{max} – maximum concentration of measurement range;

C_{min}= 0 – minimal concentration of measurement range.

Annex A
Gases detected by flammable gas sensors (IR/CT)

1. Amylene (isomers, pentenes)
2. Acetylene
3. Acetone
4. Acetaldehyde
5. Diesel fuel according to GOST 305-2013
6. White spirit according to GOST 3134-78
7. Jet fuel according to GOST 10227-86
8. Motor petrol
9. Aviation petrol B-70
10. Rubber solvent petrol
11. Aviation petrol according to GOST 1012-2013
12. Natural-gas condensate
13. Hexane
14. Heptane
15. Unleaded petrol according to GOST 51866-2002
16. Kerosene according to TU 38 71-5810-90
17. Benzene
18. Butane
19. 1,3-butadiene
20. Butylene (isomers)
21. Butanol
22. Hydrogen
23. Water gas
24. Vinyl chloride**
25. Liquefied petroleum gases according to GOST 27578-87
26. Compressed natural fuel gas according to GOST 27577-2000*
27. Divinyl
28. Dioxane
29. Dichloroethane**
30. Diethyl ether
31. Isobutane
32. Isobutanol
33. Isobutylene
34. Isopentane
35. Isopropanol
36. Isoprene

37. Coke gas
38. Xylol
39. 2-methyl-2-propanol
40. Methanol
41. Methane
42. Methyl ethyl ketone, ethyl methyl ketone
43. Propylene oxide
44. Carbon monoxide
45. Acrylonitrile
46. Acetonitrile
47. Carbon dioxide
48. Ethylene oxide
49. Octane
50. Vapours of petroleum and petroleum products
51. Pentane
52. Petroleum ether
53. Associated petroleum gas*
54. Propylene
55. Propyl alcohol
56. Propane
57. Turpentine
58. Styrene
59. Toluene
60. Acetic acid
61. Acetic acid methyl ester, methyl acetate
62. Acetic acid ethyl ester, ethyl acetate
63. Acetic acid butyl ester, butyl acetate
64. Cyclohexane
65. Ethane
66. Ethylene
67. Ethylbenzene
68. Ethanol
69. Formaldehyde

** Controlled substance contains catalyst poisons and/or aggressive substances.*

***Controlled substance is catalyst poison and/or aggressive substance.*

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Revision record sheet

Revision record sheet									
Change	Page No.				Total number of pages	Doc. No.	Reg. No. and date of covering document	Sign.	Date
	amended	replaced	new	cancelled					
1	18,19	-	-	-	55	without No.		Chun	22.08.17
2	-	all	-	-	85	without No.		Rzh	03.10.17
3	14	-	-	-	85	without No.		Rzh	15.11.17

Promyshlennaya street 8/25
Chaikovsky, Perm region 617760
Russia

phone: 8 (34241) 6-55-11
e-mail: info@eriskip.ru
eriskip.com