



Warsaw

Oxygen Detector

type

DG-9.E/4

series U5

USER'S MANUAL

edition 1U5en

Read carefully this entire manual BEFORE installation.

The installation can be started after the content of this manual has been fully understood.



Follow the recommendations and warnings provided in this manual to maintain safety when installing and operating the unit.



Keep the manual as reference for the User of the Two-Threshold Gas Detection System.

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1. PURPOSE

The stationary detector DG-9E/4 is designed for continuous control of oxygen concentration in rooms endangered by loss or displacement of atmospheric oxygen from air or endangered by growing oxygen concentration. The control consists in continuous measurement of O₂ concentration in the surrounding air. If concentration drops below the strictly defined thresholds or grows above the specified value, alarm signals are tripped on two control outputs.

It is designed for interaction with MD type control units produced by GAZEX.

It has common structure and can NOT be used in zones with explosion danger classification.

Due to the incorporated thermal compensation system it may be used at variable temperature conditions. It is provided with replaceable, electrochemical oxygen sensor.

DG-9E/4 detector will be called below in this instruction as DG.

CAUTION-IMPORTANT:

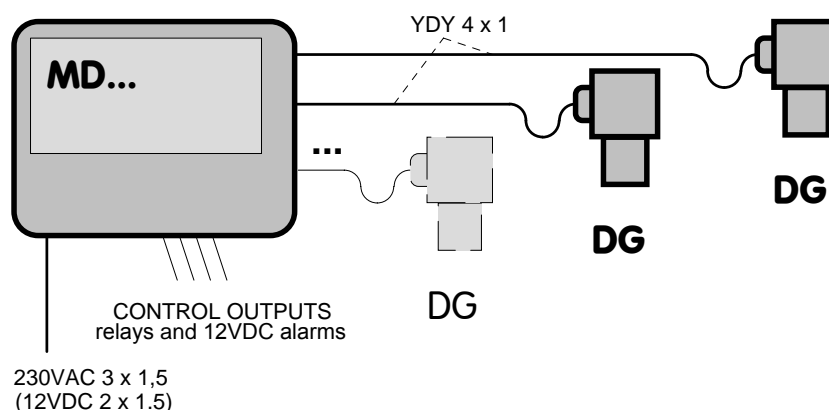


- The electrochemical sensor applied in this detector is resistant to air movement in its vicinity. It is important to avoid impact of strong air stream or its sudden changes.
- The sensor's incorporated thermal compensation system operates correctly only in temperature range indicated below (table 2.1) - exceeding this range or sudden ambient temperature changes may lead to the false indications.
- It is necessary to avoid sudden moisture changes and absolutely avoid moisture condensation on sensor.
- PROTECT detector against violent shocks and impacts => it may result in reduced durability and changes in sensor parameters.
- Protect detector against temperature increase (above +50°C) => it results in irreversible sensor's damage.
- Concentration toxic gas or substance vapors (by item "Resistance to gases and disturbing factors" in table 2.1) on NDSCh level (The Highest Permitted Momentary Concentration by regulation of Minister of Labor and Social Policy) have no impact on sensor operation. Nevertheless, operation of this detector in concentration of gases significantly exceeding such concentrations may result in permanent change in detector measurement parameters, reduce its operation life or total damages of oxygen sensor.
- Absolutely avoid impact of substances indicated as "Disturbing factors" in table 2.1 – their impact may cause wrong measurement of O₂ concentration or permanent, irreversible sensor damage.
- The detector operation in increased oxygen concentration conditions will reduce sensor operation life proportionally to relation of such concentration to the regular level (i.e. 20,9%).

AREA OF APPLICATION

- technical gas warehouses (nitrogen, carbon dioxide, oxygen, etc.).
- breweries
- extinguishing and cosmetic agents bottling plants
- food packing premises
- premises with process consuming oxygen
- the premise with oxygen systems
- production rooms, boiler rooms
- fruit stores

Gas detection system - connection block diagram



2. TECHNICAL PARAMETERS

TABLE 2.1.

Supply voltage	9VDC= (permitted fluctuations 6,0 ÷ 15,0V)
Current consumption	typical 35mA, max 50mA
Operation temperature	recommended 5°C to +40°C (thermal compensation range) permitted 0°C to +45°C (outside compensation range); at air humidity between 5% and 95% (without moisture condensation on sensor)
Storage temperature	optimum from +5°C to +25°C ; permitted from -15°C to +50°C
Detected gases	oxygen, range 1 ÷ 25% vol. (theoretical – up 100%)
Gas sensor	electrochemical, with thermal compensation, recommended calibration period = 6 months; operation life 4 years = ca. 900.000 [O ₂ % x h] in regular conditions
Measurement method	diffuse response time t ₉₀ = below 15 sec.
Resistance to gases and disturbing factors	no effect: CO, CO ₂ , NO _x , methane, H ₂ S, H ₂ , argon, air movement - no effect; small effect (negligible at NDSC levels): Cl ₂ , CFCs, SO ₂ , NH ₃ , HCl
Disturbing factors	isopropyl alcohol, hexane, CCl ₄ absolutely avoid: NaOH; due to sensor's structure: acetone and methyl ethyl ketone
Effect of atmospheric pressure	proportional (linearity ±2% in range 0,5 - 1,5 atm.)
Effect of moisture (at constant temp and concentration)	< ±1% of concentration level, in temp. range . <+25°C, ca 21% O ₂ ; < ±3% of concentration level, temp. range . +25°C to +40°C, ca 21% O ₂
Alarm thresholds	two, in range 17 ÷ 25% v/v
Threshold concentration levels - typical	ALARM 1 = 19 % v/v ALARM 2 = 18 % v/v; (or in above range); exact setting → see calibration certificate SSW enclosed to each DG-9E/4)
Calibration conditions	20,9% v/v O ₂ , 20(±2)°C, RH 65(±10)%, atmospheric pressure 1013(±30)hPa, >72h continuous power supply
Alarm threshold setting accuracy	± 5% of threshold level, at calibration each 6 months (internal button)
Alarm threshold stability	± 5% of concentration level (within temp. range from +5°C to +40°C) ± 10 % of concentration level - long-term within 3 years
Recalibration	possible local calibration (20,9%), without calibration mixture; calibration button + LED control lamp + potentiometer as standard equipment
Alarm signal outputs	two, transistor type OC (<20VDC=, < 50mA), independent for each threshold; with direct connection to MD unit possibility
Electronic systems	constructed by SMD, technology, incorporated power supply and wire connection effectiveness control system
Dimensions, weight	185 x 110 x 55 mm H x W x D (with cable gland); ca. 0,4kg
Housing	ABS/PC, IP54

CAUTION:

The oxygen sensor is an integral element, in chlorinated polyvinyl chloride (CPVC) housing.

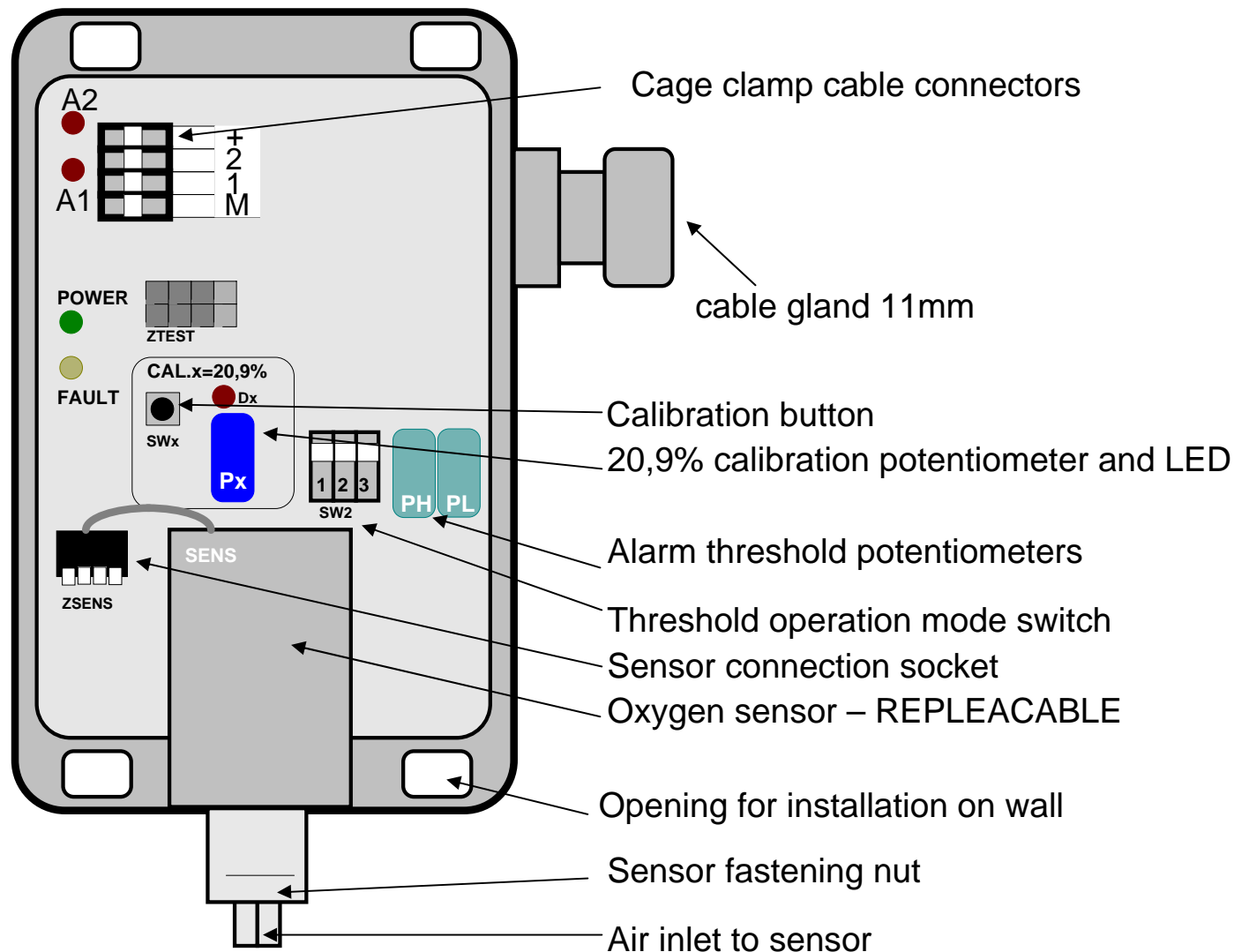
It is filled with electrolyte with weak acid reaction and includes also small amounts of lead and its compounds, and gold. In case of mechanical damage of sensor and contact with electrolyte the exposed area shall be flushed with plenty of water and possibly obtain the medical advice.



The applicable regulations must be observed for utilization.

3. DESCRIPTION

The view without detector cover.



4. INSTALLATION CONDITIONS

The detector's user and INSTALLER must be aware of special structure and specific purpose of DG-9E/4 detector. All installation and service operations must be conducted with the **HIGHEST CARE !!**



4.1. The detector INSTALLATION LOCATION in room endangered by oxygen concentration fluctuations have FUNDAMENTAL impact on correct detector operation from the point of view of safety of personnel. Therefore, installation location shall be trusted to the competent specialist.

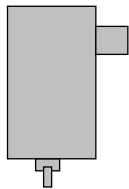
4.1.1. It can be adopted, that the optimum detector installation location is:

- **on the wall or extension arm, on height ca 180-200cm above floor or on the face level of man in working position**
- in place, where employees often reside, not further than 8m from the potential source causing oxygen concentration fluctuations;
- away from ventilation openings, windows;
- away from impact of air directly breathed out by people;
- place not exposed to direct sunlight, away from heat sources;

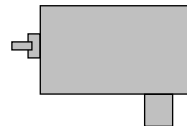
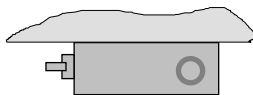
- and in place not exposed to direct impact of outside air, steam, water or other liquids, exhaust gases from furnaces and other disturbing factors from table 2.1, dust. The indicated above distance from absorbing source, displacing or emitting oxygen, applies to the undisturbed diffusion zone, i.e. area with uniform temperature, without mechanical obstacles restricting the gas or vapor flow, without forced air circulation, without gravitational ventilation. All listed factors must be considered in correct arrangement of detectors.

4.2. INSTALLATION POSITION: RECOMMENDED – VERTICAL (inlet to oxygen sensor downward) !
The horizontal installation is allowed – with inlet to the side provided that detector is not exposed on to moisture or other factors, at low dust level in the supervised room.

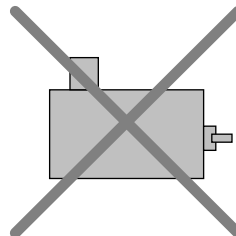
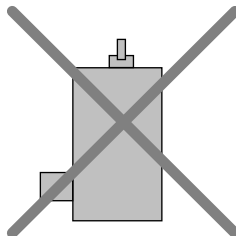
INSTALLATION POSITIONS:



recommended - vertical



or permitted - horizontal



PROHIBITED:

5. DG-9E/4 INSTALLATION

It is necessary to make sure **PRIOR** installation that detector is provided with individual detector calibration certificate (specified alarm threshold values must be consistent with the grey calibration label on cover). This document shall be kept and necessary transfer to the user as this document is the base for any claims.



CAUTION. VERY IMPORTANT !

- DURING INSTALLATION it is necessary to avoid touching the sensor with fingers or using tools which may heat the sensor = it will disturb the sensor's thermal balance and increase the stabilization time to ca 20 minutes.

5.1. Disassemble the detector's cover. Introduce 4-wire round cable through the cable gland and connect it to detector's connectors. The mechanical damage of printed-circuit board will cause **IRREPARABLE** damage of electronic systems = need of replacement and calibration, which is not covered by **WARRANTY!!!**

5.1.1. CABLES: It is permitted to use only one, (-wire, exclusij Y mround cable. The recommended type **YDY, YKSY (or equivalents from other manufacturers); permitted - OWY, OMY;** condition : cable internal diameter can not be smaller than 5 mm and can not be higher than 11 mm; it is condition necessary for correct cable sealing in cable gland.

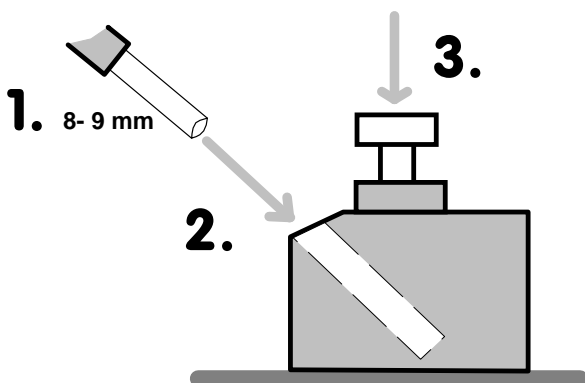
There are no critical values for cross-sections due to very small currents in wires. The practical aspects of mechanical strength of wire, accessibility and distance to module cause that the minimum wire cross-section is recommended:

- 0,5 mm² at distance from MD to ca. 300 m,
- 1,0 mm² " " " " up to 700 m (eg. YDY4x1G offered by GAZEX),
- 1,5 mm² " " " " above 700 m.

But cables with wir cross-section 1.5mm² are NOT recommended due to mechanical problems with wire connection to detector's connectors.

5.1.2. Wire ends: cable end introduced to the detector's connector box shall be so prepared that wires fastened in terminals are not bent inside detector and sealing of cable gland contains the outside coating of the cable.

5.1.3. IMPORTANT:



5.1.3. Introduction of wire to self-gripping type terminal (slant)

1. remove wire isolation on distance exactly 9 to 10 mm (straight) or 8 to 9mm (slant)
2. push (introduce) the bared wire end into the round terminal opening with pliers.

The correctly introduced wire can not be moved out from terminal. Wire can be released and taken out after pushing lever 3 (white or grey, according to arrow 3).

The clamping of wire in cable gland shall be so strong so cable will not move out from detector by hand jerking(and cable can not transfer mechanical forces on detector connection

terminals). This will secure correct detector's sealing.

5.1.4. Screw down the detector's cover. When assembling the cover it is necessary to make sure that the rubber gasket is on its correct position and provides complete cove tightness.

5.2. Detector must be installed with measuring chamber directed downward or aside so inlet to sensor is on the recommended height.

5.2.1. It is necessary to take care that detector is not exposed to mechanical damages or flooding with water, other agents or contamination of sensor inlet.

5.3. The connection cable shall be carry to MD unit installation location or the system control panel. The cable moved out from detector shall be "U"-shaped with "belly" directed downward, directly at detector (it prevents water dripping on connection cable to detector's cable gland and provides the additional length of cable for possible connecting tips corrections in the future).

When cables are run through zones available for the third persons, cable shall be run in plastic pipe casing. This will protect system against accidental or purposeful damages.

It is recommended to use UNIFORM cable between DG and control unit.

If it is necessary to extend the cable ("lengthen"), connecting cables can be joined using the tight box with four terminals with protection class IP54 or higher.

5.3.1. Connect:

- wires from detector outputs "1" and "2" to outputs of control unit or system central panel.
- detector 9V power supply "M" and "+" to relevant terminals in module MD or central panel..

Observe correct POLARIZATION of all wires !



The incorrect polarization of wires from outputs of DG-9E/4 detector will cause MD Alarm condition or improper system operation.

Secure minimum 20 minutes time for equalization of oxygen sensor temperature (after transport/ storage period) and detector installation location – the best in the cardboard package.

5.4. Connect MD control unit power supply, check system correct power supply signaling.

5.4.1.The initial sensor operation stabilization period in DG-9E/4 starts when power supply is turned on.It lasts several seconds (it depends on environment conditions, calibration level). ALARM 1 and/or ALARM 2 can be generated in MD during stabilization.

The unstable sensor operation condition can last even several dozen minutes in case of too high difference of temperatures between oxygen sensor and surrounding air or if leveling of these temperatures is too fast. Detector passes to its regular operation after this initial period (if oxygen concentration in the supervised room does not exceed detector's threshold values ALARM 1 or ALARM 2 !)

5.5. The final check of MD + DG system operation is the final phase of installation :

5.5.1. You must make sure that detector is correctly supplied (only green "POWER" lamp is on) and heating cycle is over (A2 and A1 lamps are off).

5.5.2. Generate detector's alarm conditions:

- for alarm thresholds set below 20,9%:

slowly blow in sensor direction (air breathed out by man has significantly lower oxygen concentration)
Detector's lamp [A2] and/or [A1] shall turn on in this moment (or with few seconds delay).

If there is no effect, repeat blowing with air "detained" in lugs for ca 10 s - it includes more carbon dioxide,
less oxygen. The relevant effects shall be also observed in the connected MD module.

- for threshold level settings above 20,9%:

introduce portion of oxygen (technical, in gaseous form, with ambient temperature (introduce through the thin, long flexible pipe – minimum 1 m) into sensor vicinity – effect similar to described above (or according to alarm threshold operation mode switch); possibly increase the oxygen portion (sensor is resistant to momentary, high, even to 100% by volume, oxygen concentration). The relevant effects shall be also observed in the connected MD control unit.

**Detector DG-9E/4 shall be recognized
as operational and started after successful result of test.**

The date and name of person conducting installation and serial numbers of all units installed in System shall be included in the Periodical Inspection Report. The individual detector's SSW calibration certificate shall be kept with this Report.

In case of any doubts or lack of clarity concerning installation and operation of this DETECTOR, please contact with the Authorized Distributor or MANUFACTURER.

6. MAINTENANCE / OPERATION

6.1. Due to the multi-year durability of sensor in DG-9E/4 detector, maintenance is reduced to:

- A) - periodical elimination of dust from casing and inlet to sensor,
- B) - periodical inspection of system operation according to procedure 5.5 in chapter DG-9E/4 installation

**The recommended frequency of periodical
*inspection at least every 3 months***

C) - in case of high moisture level in the supervised room or if connecting cable or detector was exposed to water splashes, the above procedure shall be supplemented by detector cable gland box tightness test:

- - turn off detector's (system) power supply,
- - disassemble the detector's cover,
- - check if terminal chamber or connecting terminals are moist, covered with deposit or demonstrate traces of corrosion. In such situation it is absolutely NECESSARY to dry the terminal chamber, seal the cable gland (tighten) and secure removal of water drops in front of cable gland (orifices, covers on cable, U-recess or cable loop in front of cable gland, etc.
- - assemble cover according to point 5.1.4.

D) - as oxygen sensor has natural tendency to loss its sensitivity in time (irrespective if it is connected or power supplied), sensor must be calibrated after period not longer than 6 months from production date (in practice from purchase date from manufacturer) or from the last calibration.

The above operation may be conducted by the user according to procedure 6.2.



E) CAUTION : IT IS NOT ALLOWED to modify PL and PH potentiometer and SW2 threshold mode switch settings ! Modification of alarm threshold settings requires specialist equipment and can be conducted exclusively by Manufacturer or Authorized Distributor/ Service company.

F) ALL results of periodical inspection or observed incorrectness in System operation must be absolutely introduced to the Periodical Inspection Report under pain of loss of warranty right and release of Manufacturer from any liability from any consequences resulting from gas detection system operation.

6.2. DETECTOR CALIBRATION

The recommended calibration frequency: at least every 6 months

* - after 4 years from production/ purchase (according to SSW detector calibration certificate) it is recommended at least each 3 months.

6.2.1. Make sure that

- there are stable thermal conditions around the detector for at least 20 minutes;
- there is no strong circulation;
- detector has secured supply of **FRESH, CLEAN OUTSIDE AIR** for which we can be sure that it includes 20,9% of oxygen !!! In case there is no such convince – provide artificial air from the bottle, with flow rate not higher than 0,5 l/min
- you must remember that DG-9E/4 outputs are active during calibration = it is necessary to notify the oxygen detection system's user on possibility of false alarms during calibration and to deactivate temporary the system's outputs.

6.2.2. Disassemble the detector's cover. Do not touch the sensor ! DO NOT direct the breathed out into detector's direction !!!

6.2.3. Push "SWx" calibration micro-switch with the finger. Hold the pushed button for entire calibration period. If "Dx" LED (next to SWx) is not turned on = detector is still calibrated correctly

6.2.4. If "Dx" lamp turns on – it means calibration is necessary, i.e.:

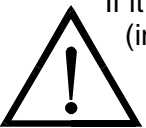
- gently, slowly turn with the small screw-driver the "Px" calibration potentiometer screw, located below "Dx lamp, in both directions, so the "Dx" red lamp turns off;
- set "Px" calibration potentiometer screw in location in the center of area in which "Dx" lamp is turned off;
- CAUTION !!! DO NOT TURN screws of PL, PH potentiometers protected by seal. This will result in loss of alarm threshold settings.



6.2.5. Release micro-switch SWx.

6.2.6. Screw down the detector's cover.

If it not possible to turn off "Dx" lamp during calibration, it is possible that oxygen sensor must be replaced (in particular after 4 years from production date). In case of detector operation in atmosphere with excess of oxygen – sensor operation life will shorten !



The user can replace the oxygen sensor according to the following procedure 6.3.

6.3. OXYGEN SENSOR REPLACEMENT

It is not necessary to switch off the power supply for sensor replacement but you must be very care and gentle inside the detector ! However, you must remember that detector's outputs can be activated during sensor replacement = it is necessary to notify the oxygen detection system's User or to deactivate system outputs for sensor replacement and calibration!



Necessary tools and materials:

- new oxygen sensor type MS-9E4 (delivered exclusively by Manufacturer or authorized representative);
- flat or Phillips screwdriver (for cover disassembly);
- flat, thin screwdriver (for releasing the oxygen sensor connecting inlet lock);
- flat pliers (for assembly/ disassembly of sensor inlet nut).

6.3.1. Disassemble the detector's transparent cover.

6.3.2. Release the lock of sensor's connecting and remove inlet from the socket with the thin screwdriver. The lock is released by minimal levering of socket edge center (insertion of flat tip of screwdriver [1] from upside, on depth ca 1 mm), and plug will remove with simultaneous screwdriver down movement.

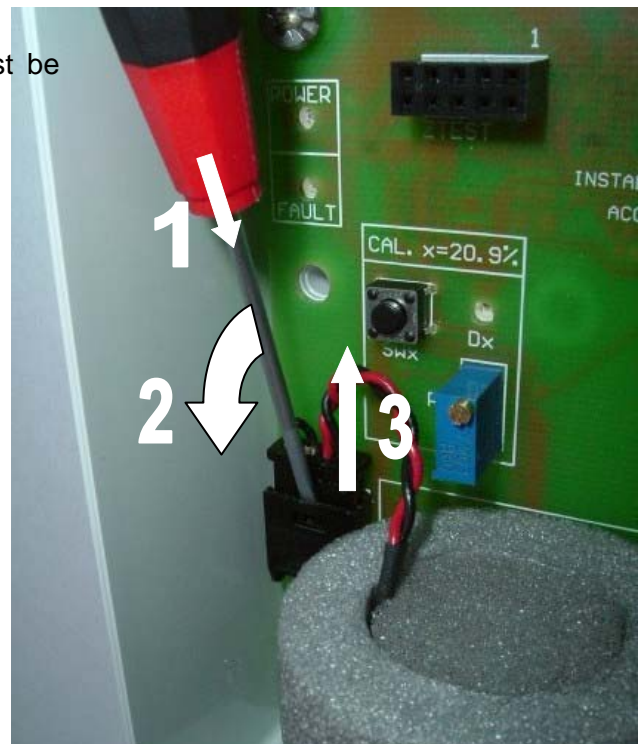


Fig. 6.3.

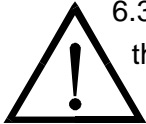
according to arrow [2] on figure 6.3. Remove fully the plug from socket [3] "FAULT" yellow lamp shall turn on then (and these A1/A2 red lamps, which shall indicate oxygen concentration lower than regular 20,9%).

6.3.3. Holding the oxygen sensor by grey insulation, grip the white sensor nut (above inlet) with flat pliers and gently release, turning counterclockwise. Then unscrew the sensor fastening nut with fingers. Remove sensor from opening in casing.

6.3.4. Gently insert the new sensor into opening in detector's casing so the cable with plug is on the connecting socket side.

6.3.5. Holding the sensor for the grey foam insulation, fix it to the casing with the white nut. Gently "tighten" the nut with flat pliers. Sensor must be stiffly and reliably fastened to the casing.

6.3.6. Insert plug with sensor's connecting cable to the socket – insert to hear the socket lock "click" sound. When the sensor is correctly connected, yellow "FAULT" lamp will turn off. The condition of A1 and A2 red lamps shall be ignored until calibration of the new sensor is finished.



6.3.7. It is absolutely necessary to CALIBRATE the new sensor !!! New sensor requires thermal stabilization for ca 20 minutes. After this period, new sensor shall be calibrated according to procedure in point 6.2.

6.3.7. Install the detector's transparent cover, taking care on visibility of detector's control lamps

6.4. DG-9E/4 STORAGE



DG-9E/4 detectors shall be stored in location free of moisture, dust, combustion gases, any chemically active substances (in particular NaOH, acetone, methyl ethyl ketone), in tightly closed polyethylene bag, in position with sensor downward or horizontal.

Protect against strong shocks and vibrations. Storage temperature between -15°C and +50°C.

Detector shall be always stored with attached calibration certificate. After 6 months from production date or more, calibration is required according to procedure 6.2.

6.5. In accordance with the Act on the used electric and electronic equipment dated 29. July 2005 (Journal of Laws 2005 no 180, item 1495), the used MD control unit (classified as equipment group 9.5 under the mentioned above Act) can not be removed with other wastes.

Therefore, it is marked with special symbol.



6.6. **CAUTION:** due to product continuous improvement process and desire to deliver possibly full, detailed information on these products and to provide you knowledge necessary for correct, long-term operation of products based on the current experience of Customers,

GAZEX reserves the right to introduce minor modifications in technical specifications for delivered products and not included in this Operation Manual and to change its content. Therefore we ask to verify and confirm relevance of this Operation Manual edition at the Manufacturer (please provide exactly type/ make and model of the used unit and operation instruction edition number).

7. WARRANTY TERMS

The Manufacturer shall grant GAZEX Warranty for correct operation of this detector for 12 **MONTHS PERIOD from purchase date invoice if separate contract is not entered in this regard**) according to the Standard Warranty GAZEX (SGG) – available on www.gazex.pl website.

SGG warranty shall not cover oxygen electrochemical sensor. The oxygen sensor is covered by the GAZEX Restricted Warranty (OGG3M) – according to OGG3M warranty terms – available on www.gazex.pl website.

This warranty shall not cover mechanical damages and damages resulting from incorrect storage, installation or improper operation conditions, inconsistent with Operation Manual, in particular included in CAUTIONS on page 2.

Delivery of individual calibration report for the given detector is the prerequisite for repairs under this Warranty.